4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Methodology

This chapter describes the predicted consequences, or potential effects, on the physical, biological, and human environment from implementing the alternatives described in Chapter 2. The chapter begins by defining frequently used terms (Section 4.1.1), describes the project area (Section 4.2), and explains how incomplete or unavailable information is dealt with in this document (Section 4.3). Section 4.4 describes the steps used for determining the level of impact and the criteria used to evaluate impacts, Section 4.5 provides an overview of the approach to cumulative effects assessment. Section 4.6 presents resources not carried forward for further analysis, while Section 4.7 characterizes elements common to all alternatives. Sections 4.8 and 4.9 provide analyses of impacts to the biological environment and to the social and economic environment, respectively, from each of the alternatives. Section 4.10 discusses economic impacts from federally funded research on Steller sea lions (SSLs) and Northern fur seals (NFSs).

4.1.1 Definition of Terms

The following terms are used throughout this document to discuss impacts:

- **Direct Impacts** – caused by the action and occurring at the same time and place. (40 CFR § 1508.8).
- **Indirect Impacts** – defined as effects "caused by an action and are later in time or farther removed in distance but are still reasonably likely. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8). Indirect impacts are caused by the project, but do not occur at the same time or place as the direct impacts.
- **Cumulative Impacts** – additive or interactive effects that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). Interactive impacts may be either *countervailing* – where the net cumulative impact is less than the sum of the individual impacts or *synergistic* – where the net cumulative impact is greater than the sum of the individual impacts. Focusing this Environmental Impact Statement (EIS) on reasonably foreseeable cumulative impact issues, rather than on speculative impact relationships, is critical to the success of the analysis. Direct impacts pertain to the proposed action and alternatives only, while cumulative impacts pertain to the additive or interactive effects that would result from the incremental impact of the proposed action and alternatives when added to other past, present, and reasonably foreseeable future actions. Section 4.4 describes steps involved in the cumulative impact assessment.
- **Reasonably Foreseeable Future Actions** – this term is used in concert with the Council on Environmental Quality (CEQ) definitions of indirect and cumulative impacts, but the term itself is not further defined. Most regulations that refer to "reasonably foreseeable" do not define the meaning of the words, but do provide guidance on the term. For this analysis, reasonably foreseeable future actions (RFFAs) or impacts are those that are likely (or reasonably certain) to occur, and although they may be uncertain, they are not purely speculative. Typically, they are based on documents such as existing plans, permit applications, or announcements.

4.2 Project Area and Scope for Analysis

The spatial scope of the effects analysis is the entire geographic range of SSLs and NFSs in the Bering Sea and the North Pacific Ocean off Alaska, Washington, Oregon, and California. When this spatial scope is not applicable to a given resource, a relevant geographic sub-area is defined in the analysis.

Evaluation of cumulative effects requires an analysis of the potential direct and indirect effects of the proposed research alternatives, in combination with other past and present actions and RFFAs. The time frame or temporal scope for the past and present effects analysis was defined as the period over which the populations of SSLs and NFSs began to decline to the present. Although collection of this population trend data began in the 1960s, relevant data may also be available from an earlier time period (i.e., effects of the commercial harvest of NFSs from 1786-1984). For some resources, relevant data may not have been available until more recently. For each resource, the time frame for past/present effects is defined in the Summary of Lingering Past Effects located under the corresponding cumulative effects section. RFFAs considered in the cumulative effects analysis consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur over the next 10 years (from 2007 to 2017) and that are likely to affect the resources described.

4.3 Incomplete and Unavailable Information

The CEQ guidelines require that:

"When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking (40 CFR 1502.22)."

In the event that there is relevant information, but "the overall costs of obtaining it are exorbitant or the means to obtain it are not known" (40 CFR 1502.22), the regulations instruct that the following should be included:

- A statement that such information is unavailable
- A statement of the relevance of such information to evaluate reasonably foreseeable significant adverse impacts
- A summary of existing information that is relevant to evaluating the adverse impacts
- The agency's evaluation of adverse impacts based on generally accepted scientific methods

In the analysis, this EIS identifies those areas where information is unavailable to support a thorough evaluation of the environmental consequences of the alternatives. In particular, the intent of the mortality assessment tables described in more detail in Section 4.8.1, is to provide a framework for assessing the effects of research. The initial estimates of direct and indirect effects are based on the professional judgment of highly experienced researchers at National Marine Mammal Laboratory (NMML) who have worked directly with these species for several decades. Efforts have been made to obtain all relevant information; however, where data gaps still exist, the implication is that these areas qualify for the CEQ guidelines above.

4.4 Steps for Determining Level of Impact

The National Environmental Policy Act (NEPA) requires federal agencies to prepare an EIS for any action that may significantly affect the quality of the human environment. The CEQ regulations implementing NEPA state that an EIS should discuss the significance, or level of impact, of the direct and indirect impacts of the proposed alternatives (40 CFR 1502.16), and that significance is determined by considering both the context in which the action will occur and the intensity of the action (40 CFR 1508.27). Context and intensity are often further broken down into components for impact evaluation. The context is comprised of the extent of the effect (geographic extent or extent within a species, ecosystem, or region) and any special conditions, such as endangered species status or other legal status. The intensity of an impact is the result of its magnitude and duration. Actions may have both adverse and beneficial effects on a particular resource. A component of both the context and the intensity of an impact is the likelihood of its occurrence.

The combination of context and intensity is used to determine the level of impact on each type of resource. The first step is to examine the mechanisms by which the proposed action could affect the particular resource. For each type of effect, the analysts develop a set of criteria to distinguish between major, moderate, minor, or negligible impacts. The analysts then use these impact criteria to rank the expected magnitude, extent, duration, and likelihood of each type of effect under each alternative.

The tables provide a guideline for the analysts to place the effects of the alternatives in an appropriate context and to draw conclusions about the level of impact. However, the distinctions made in the criteria tables may not be completely relevant for each resource and each type of effect, so they should not be seen as a recipe that must be followed precisely in all cases. The criteria used to assess the effects of the alternatives vary for the different types of resources analyzed (Tables 4.4-1 through 4.4-3). The impact criteria tables use terms and thresholds that are quantitative for a few components and qualitative for other components. The terms used in the qualitative thresholds are somewhat vague and relative, necessarily requiring the analyst to make a judgment about where a particular effect falls in the continuum from “negligible” to “major”. The following descriptions of the terms used in the criteria tables are intended to help the reader understand the distinctions made in the analyses.

The magnitude or intensity of effects on biological resources is generally assessed in terms relative to the population rather than the individual. The rationale for using Potential Biological Removal (PBR) as a metric for mortality effects on SSLs and NFSs is described in Section 2.5. In summary, the Marine Mammal Protection Act (MMPA), as reauthorized in 1994, defined PBR as, "...the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." PBR was intended to serve as an upper limit guideline for fishery-related mortality for each species.

The MMPA also provides some rationale for establishing certain numerical thresholds for the magnitude of mortality relative to PBR in the SSL and NFS impact criteria tables (Table 4.4-1). Section 118 of the MMPA requires NMFS to classify fisheries according to their relative levels of mortality for each marine mammal stock (16 U.S.C. 1387 (c)(1)). Fisheries that cause mortality of a marine mammal stock totaling 10 percent of PBR or less are classified as Category III fisheries and are not required to register with NMFS or obtain authorizations for incidental take (50 CFR 229.2). In addition, the MMPA established a requirement that the level of incidental mortality and serious injury of marine mammals in fisheries be reduced to “insignificant levels approaching a zero rate”, which is commonly referred to as the Zero Mortality Rate Goal (ZMRG). To implement the MMPA, NMFS defined the insignificance threshold for fisheries related mortality, the ZMRG, as being 10 percent of PBR for the stock of marine mammals (69 FR 43338). To be consistent with the thresholds in these regulatory criteria, research-related mortality less than or equal to 10 percent of PBR will be considered “negligible” in the following analysis of the alternatives.

Fisheries that cause mortality equal to or exceeding 50 percent of PBR for a marine mammal stock are classified as Category I fisheries and are required to register with NMFS, follow a take reduction plan, and may be required to carry marine mammal observers on board to monitor take. Following the logic of this threshold for fishery related regulations, research related mortality more than or equal to 50 percent of PBR will be considered “major” in the following analysis of the alternatives. There are no comparable thresholds used in the fishery regulations to distinguish between “minor” and “moderate” levels of mortality. For the purposes of this NEPA analysis, these thresholds will be evenly divided between the 10 percent (negligible) and 50 percent (major) thresholds. Thus, research related mortality between 10 percent and 30 percent of PBR will be considered “minor” and mortality equal to or more than 30 percent and less than 50 percent of PBR will be considered “moderate” in the following analysis of the alternatives (Table 4.4-1).

For species other than SSL and NFS, the magnitude of effects on the population is based on the potential mechanisms for effects on reproduction or survival and the spatial overlap of SSL and NFS research activities with the species considered. These species include:

- ESA Listed Species
  - Transient killer whales (Section 4.8.3)
  - Whales (humpback, blue, bowhead, fin, right, Sei, and sperm; Section 4.8.4)
  - Sea otters (Section 4.8.4)

- Marine mammals (Section 4.8.5)
  - California sea lion
- Sea birds (Section 4.8.6)

The geographic extent component is intended to estimate the distribution of effects relative to the population or non-biological resource as a whole. For SSLs, NMFS has defined a number of sub-regions for population census and stock assessment purposes that provide convenient units for analyses (see Section 3.2.1). For eastern Pacific NFS, the breeding population is concentrated in a few locations, so the appropriate geographic distinction is at the rookery level. The breeding population of the San Miguel NFS is restricted to a single island, so any actions in that location could potentially affect the entire population. The appropriate terms for the distribution of effects are further defined relative to the particular species or resource in their respective analyses.

The duration or frequency component provides the context of time. "Short-term" refers to a temporary effect that lasts from a few minutes to a few days and the affected animals or resource revert back to a "normal" condition. "Long-term" refers to more permanent effects that may last for years or from which the affected animals or resource never revert back to a "normal" condition. Moderate is somewhere in between. Intermittent or infrequent effects are those that only occur a couple times a year or less. "Frequent" refers to effects that occur on a regular or repeated basis each year. Other elements of the temporal context of effects, such as whether the effects occur primarily during a sensitive or critical part of the year, are described in the analyses for each species or resource.

The likelihood component serves to assess whether the potential effects are plausible or just speculative. "Likely" effects are those that could arise from reasonable or demonstrated mechanisms and the probability of those mechanisms arising from the alternatives is greater than 50 percent. This does not imply that the analysts will perform a formal probability calculation but, in their professional judgment, the probability of the effect occurring is more likely than not.

4.4.1 Impact Criteria for Steller Sea Lions and Northern Fur Seals

Table 4.4-1 indicates the general types of effects on SSLs and NFSs that are assessed in this NEPA analysis. This table summarizes the criteria for determining the level of impact based on the magnitude, extent, duration and likelihood of occurrence. Sections 4.8.1 and 4.8.2 describe the anticipated direct and indirect effects for each alternative on these species by evaluating each type of risk and the scope of research activity.

It should be noted that there is an important difference between the use of the terms "major", "moderate", "minor", and "negligible" to describe mortality effects in a NEPA context (i.e. to distinguish the differences in impacts among alternatives) and how those terms might be used in a less technical context (i.e. that a "major" impact could cause a population to decline). The NEPA context used in the following analysis is defined in terms of the potential mortality for each alternative relative to PBR. As stated earlier (section 2.5), PBR is a precautionary or conservative measure of human-caused mortality that could be expected to affect a population's ability to recover from a depleted state or to remain at a sustainable level. The PBR calculation contains provisions to account for uncertainty in population estimates and protects a larger fraction of annual productivity for depleted stocks through a recovery factor (Fr). For endangered populations such as the western DPS of SSLs, Fr is set at 0.1, so that 90 percent of the endangered population's annual net production is reserved for recovery of the population. NMFS has calculated that keeping human-caused mortality at or below PBR calculated with a recovery factor of 0.1 would increase the recovery time of endangered marine mammals by no more than 10 percent (Wade 1998). For the threatened eastern DPS of SSLs, Fr is set to 0.75 because the population has been growing consistently for over 20 years. For the depleted Eastern Pacific stock of NFS, Fr is set at 0.5 so that 50 percent of the population's annual net production is reserved for recovery. Because the calculation of PBR contains a recovery factor for these stocks, mortality levels that exceeded PBR would not necessarily cause a population to decline but could slow the rate of recovery. A mortality level above PBR would therefore be considered "major" in this NEPA analysis even though it would not necessarily cause the population to decline.

Table 4.4-1
Criteria for Determining Impact Level for Effects on SSL and NFS

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Direct and indirect mortality due to research (see mortality assessment tables under each alternative)	Magnitude or Intensity	Total mortality assessment equal to or more than 50% of PBR	Total mortality assessment equal to or more than 30% and less than 50% of PBR	Total mortality assessment between 30%-10% of PBR	Total mortality assessment less than or equal to 10% of PBR
	Geographic Extent	Effects distributed across range of population	Effects distributed among several subregions or rookeries	Effects limited to one subregion or rookery	No measurable effects
	Duration or Frequency	Long-term and/or frequent	Moderate and frequent or long-term and intermittent	Short-term or moderate and intermittent or infrequent	No measurable effects
	Likelihood	Likely	Likely	Not likely	Not likely
Direct and indirect sub-lethal effects due to research	Magnitude or Intensity	Enough to cause measurable change in reproductive success	Equivocal change in reproductive success	Mechanisms for effects but productivity similar to baseline	No mechanisms for reproductive effects
	Geographic Extent	Effects distributed across range of stock	Effects distributed among several subregions or rookeries	Effects limited to one subregion or rookery	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderately frequent or intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood	Likely	Likely	Not likely	Not likely
Beneficial contribution toward conservation objectives	Magnitude or Intensity	Addresses all conservation objectives in Recovery or Conservation Plan	Addresses most conservation objectives in Recovery or Conservation Plan	Addresses a few conservation objectives in Recovery or Conservation Plan	Addresses no conservation objectives in Recovery or Conservation Plan
	Geographic Extent	Research pertinent for local and population-wide management needs	Research pertinent for local and subregion management needs	Research pertinent for local management needs only	Provides no information for management
	Duration or Frequency	Provides immediate and long-term information needs	Provides periodic and long-term information needs	Provides periodic and short-term information needs	Provides no information for management
	Likelihood	Likely	Likely	Not likely	Not likely

4.4.2 Impact Criteria for Other Biological Resources

Table 4.4-2 indicates the types of effects of SSL and NFS research and grant-related activities on other biological resources (other than SSLs or NFSs) that are assessed in this NEPA analysis. These effects are primarily related to disturbance associated with research activities, although some habitat damage can also occur. This table summarizes the criteria for determining the level of impact based on the magnitude, extent, duration and likelihood of occurrence. Sections 4.8.3 through 4.8.6 summarize the anticipated direct and indirect effects under each alternative for other biological resources.

Table 4.4-2
Criteria for Determining Impact Level for Effects on Fish and Wildlife

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Reduced survival or reproductive success	Magnitude or Intensity	Causes population change in most of project area	Causes population change in part of project area	No measurable population change	No mechanisms for population change
	Geographic Extent	Affects less than 25% of population in project area	Affects 25% - 10% of population in project area	Affects less than 10% of population in project area	No measurable effects
	Duration or Frequency	Long-term and/or frequent	Moderate and frequent or long-term and intermittent	Short-term or moderate and intermittent or infrequent	No measurable effects
	Likelihood	Likely	Likely	Not likely	Not likely
Disturbance	Magnitude or Intensity	Enough to cause shift in regional distribution	Noticeable change in localized distribution	Distribution similar to baseline	No measurable effects
	Geographic Extent	Affects less than 25% of population in project area	Affects 25% - 10% of population in project area	Affects less than 10% of population in project area	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderately frequent or intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood	Likely	Likely	Not likely	Not likely

4.4.3 Impact Criteria for Socioeconomic Resources

Table 4.4-3 summarizes the mechanisms by which effects of SSL and NFS research and grant-related activities on the social and economic environment can be measured, and the criteria for determining the level of impact based on the magnitude, extent, duration and likelihood of occurrence. These effects are primarily related to subsistence characteristics, commercial fishing activities, coastal communities, research institutions and independent researchers, and public interest in the protection of SSLs and NFSs. Section 4.9 summarizes the anticipated direct and indirect effects under each alternative for these resources.

Table 4.4-3
Criteria for Determining Impact Level for Effects on Socioeconomic Resources

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Effects on subsistence	Magnitude or Intensity	Year-round change in subsistence use patterns	Seasonal change in subsistence use patterns	Shift within seasonal subsistence use patterns	No measurable effects
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood	Likely	Likely	Not likely	Not likely
Effects on coastal communities	Magnitude or Intensity	Less than 10% increase or decrease in employment, population, or tourism levels	5% - 10% increase or decrease in employment, population, or tourism levels	No changes in employment, population, or tourism levels	No measurable effect
	Geographic Extent	Affects state employment, population, or tourism levels	Affects regional employment, population, or tourism levels	Affects local employment, population, or tourism levels	No measurable effect
	Duration or Frequency	Long-term and/or frequent	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effect
	Likelihood	Likely	Likely	Not likely	Not likely
Effects on research institutions and independent researchers	Magnitude or Intensity	Less than 25% increase or decrease in funding, employment, or ability to support management obligations	5% - 25% increase or decrease in funding, employment, or ability to support management obligations	No changes in funding, employment, or ability to support management obligations	No measurable effects
	Geographic Extent	Affects researchers throughout project area	Affects researchers regionally or in limited numbers of institutions	Affects researchers in only one institution	No measurable effects
	Duration or Frequency	Long-term and/or frequent	Moderately frequent or intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood	Likely	Somewhat likely	Not likely	Not likely
Effects on members of the public who value the protection of the SSL and NFS	Magnitude or Intensity	Major increase or decrease in welfare	Moderate increase or decrease in welfare	Minor changes in welfare	No measurable effects
	Geographic Extent	Affects some members of the public throughout project area	Affects some members of the public in a specific region	Affects a small, localized segment of the public	No measurable effects
	Duration or Frequency	Long-term and/or frequent	Moderately frequent or intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood	Likely	Somewhat likely	Not likely	Not likely

4.5 Steps for Identifying Cumulative Effects

To meet the requirements of NEPA, an EIS must include an analysis of the potential cumulative effects of a proposed action and its alternatives and consider those cumulative effects when determining environmental impacts. The CEQ guidelines for evaluating cumulative effects state that "…the most devastating environmental effects may result not from the direct effects of a particular action but from the combination of individually minor effects of multiple actions over time" (CEQ 1997).

The CEQ regulations for implementing NEPA define cumulative effects as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

For this Draft EIS (DEIS), assessment of cumulative effects requires an analysis of the potential direct and indirect effects of the proposed research alternatives, in combination with other past, present, or RFFAs potentially affecting SSLs, NFSs, and other biological, physical, and socioeconomic resources. The intent of this analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually, and to assess the relative contribution of the proposed action and its alternatives to cumulative effects. The cumulative effects assessment then describes the additive and synergistic result of the research alternatives as they potentially interact with actions external to the proposed actions. The ultimate goal of identifying potential cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the research alternatives.

The methodology used for cumulative effects analysis in this DEIS is similar to that followed in the Alaska Groundfish Fisheries Programmatic Supplemental EIS (PSEIS) (NMFS 2004a), the SSL Protection Measures SEIS (NMFS 2001a), and the Setting the Annual Subsistence Harvest of NFS on the Pribilof Islands EIS (NMFS 2005a). It consists of the following steps:

- *Identify issues, characteristics, and trends within the affected environment that are relevant to assessing cumulative effects of the research alternatives* – include lingering effects from past activities, and demonstrate how they have contributed to the current baseline for each resource. This information is summarized in Chapter 3.
- *Describe the potential direct and indirect effects of the research alternatives.* This information is presented in detail in Chapter 4, and is summarized in Section 4.11.
- *Define the spatial (geographic) and temporal (time) frame for the analysis*. This timeframe may vary between resources depending on the historical data available and the relevance of past events to the current baseline. The "reasonably foreseeable future" has been established as the next 10 years (through 2017) for the purposes of this DEIS.
- *Identify past, present, and reasonably foreseeable external actions such as other types of human activities and natural phenomena that could have additive or synergistic effects* – summarize past and present actions, within the defined temporal and spatial timeframes, and also identify any RFFAs that could have additive or synergistic effects on identified resources. The cumulative effects analysis uses the specific direct and indirect effects of each resource alternative and combines them with these identified past, present, and reasonably foreseeable effects of the identified external actions.
- *Use cumulative effects tables to screen all of the direct indirect effects, when combined with the effects of external actions, to capture those synergistic and incremental effects that are potentially cumulative in nature* – both adverse and beneficial effects of external factors are assessed and then evaluated in combination with the direct and indirect effects to determine if there are cumulative effects.

- *Evaluate the impact of the potential cumulative effects using the criteria established for direct and indirect effects and assess the relative contribution of the action alternatives to cumulative effects.*
- *Discuss rationale for determining the impact rating, citing evidence from the peer-reviewed literature, and quantitative information where available* – the term unknown can be used where there is not enough information to determine an impact level.

The advantages of this approach are that it closely follows 1997 CEQ guidance, employs an orderly and explicit procedure, and provides the reader with the information necessary to make an informed and independent judgment concerning the validity of the conclusions.

4.5.1 Relevant Past and Present Actions within the Project Area

Relevant past and present actions are those that have influenced the current condition of the resource. For the purposes of this DEIS, past and present actions include both human-controlled events, such as subsistence harvest and commercial fisheries, and natural events, such as predation and climate change.

The past actions applicable to the cumulative effect analysis have been either presented in Chapter 3 or previously reviewed in Chapter 4 of the Alaska Groundfish Draft Programmatic SEIS (NMFS 2004a), SSL Protection Measures SEIS (NMFS 2001a), and the Setting the Annual Subsistence Harvest of NFS on the Pribilof Islands EIS (NMFS 2005a). The cumulative effects analysis relies heavily on the descriptions presented in those documents. Additional past actions were identified using agency documentation, NEPA documentation, reports and resource studies, peer-reviewed literature, and best professional judgment. Table 4.5-1 lists relevant past and present actions, and where descriptions of those actions can be located.

4.5.2 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions (RFFAs) are those that have already been or are in the process of being funded, permitted, described in fishery or coastal zone management plans, included as priorities in government planning documents, or are likely to occur or continue based on traditional or past patterns of activity. Judgments concerning the probability of future impacts must be informed rather than based on speculation. RFFAs to be considered must also fall into the temporal and geographic scope described in Section 4.2.

Reasonably foreseeable future human-controlled and natural actions were screened for their relevance to the alternatives proposed in this DEIS. Due to the large geographic scope of this analysis, the identification of RFFAs was conducted on a broad scale, although some specific RFFAs were considered where applicable. The following list presents the actions to be considered in the cumulative effects analysis, and Table 4.5-1 compares those actions with past and present actions:

- *Commercial fisheries:* Federal and state (AK, WA, OR, and CA) fisheries operate according to the designated Fishery Management Plan (FMP). State and federally regulated fisheries in the project area are administered by the North Pacific fishery Management Council (NPFMC) and the Pacific Fishery Management Council (PFMC). The NPFMC oversees management of groundfish in the U.S. Exclusive Economic Zone (EEZ) off Alaska; however, the State of Alaska primarily manages the state's salmon, crab and herring fisheries. The PFMC has developed FMPs for salmon, groundfish and coastal pelagic species in the U.S. EEZ off the coasts of California, Oregon, and Washington. The NPFMC and PFMC also make recommendations for Pacific halibut harvest regulations to the International Pacific Halibut Commission (IPHC).
- *Scientific research:* Activities related to the scientific research of other marine mammals, fish, birds, marine predator-prey relationships, and the physical environment are likely to continue.
- *Global and industrial pollutants:* Oil pollution in the marine environment can occur from road runoff, bilge cleaning and ship maintenance, natural seeps, oil tanker spills, and offshore drilling. High-volume seafood processing could result in the discharge of oil and grease. Other marine pollution and debris can

occur due to industrial activities, waste disposal, and atmospheric deposition. Marine species may accumulate ocean contaminants, such as polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs).

- *Subsistence activities:* Subsistence harvest activities of both SSLs and NFSs by Alaska Natives who dwell on the North Pacific Ocean or Arctic Ocean coasts of Alaska are likely to continue at present levels as described in Chapter 3. Subsistence harvest of SSLs and NFSs in the Pribilof Islands will remain consistent with the co-management agreements between NMFS and the tribal governments of St. Paul (2000) and St. George (2001).
- *Commercial shipping:* The west coast supports a large commercial shipping industry, which results in regular vessel traffic through coastal marine environments.
- *Invasive species:* The introduction of non-native species into the marine environment can occur through ballast water transfer and could potentially disrupt the marine food web structure. Introduction of non-native terrestrial species, such as rats and fox, on islands is a continuing problem in many areas. Eradication programs for these species have been conducted in some areas and there are plans to expand these programs in the Aleutian Islands (AI).
- *Other economic development:* Cruises, whale and wildlife viewing tours, and fishing charters are likely to continue. Military activity, such as the Kodiak Launch Complex, is likely to continue. The Kodiak Launch Complex is located at Narrow Cape, Kodiak Island, Alaska, and provides launch facilities for private and government organizations. Coastal development including port expansions and the construction of docks and facilities within the project area are likely to occur as needs for marine support services and shipping capacity increase. The development of on-land infrastructure on the Pribilof Islands has been proposed to create economic opportunities, including boat harbors, airports, dock facilities, and multi-species seafood processing plants.
- *Climate variability:* Short-term changes in the ocean climate are likely to continue on a scale similar to those presently occurring, as described in Chapter 3. Evidence is emerging that human-induced global climate change is linked to the warming of air and ocean temperatures and shifts in global and regional weather patterns. Other relevant physical and chemical effects of climate change include alteration of deep-ocean circulation patterns, ocean stratification and chemical composition, the frequency and duration of naturally occurring El Niño – Southern Oscillation (ENSO) events, and ocean biodiversity and ecosystems.
- *Mortality:* Disease, parasites and predation will continue to result in mortality of marine mammals, fish, and birds. Factors such as exposure to contaminants, decreased genetic diversity, and increased stress can lead to reduced fitness and increase susceptibility to mortality from disease and predation.

Table 4.5-1
Past, Present, and RFFAs Considered in the Impact Analyses

	Past and Present	Reference (within this DEIS, unless otherwise noted)	Reasonably foreseeable
Human-Caused Events			
Commercial fisheries	• Foreign groundfish fisheries • Joint venture fisheries • International Pacific Halibut Commission (IPHC) halibut longline fishery • Federal groundfish fisheries • Federal crab fishery • State (AK, WA, OR, and CA) nearshore fisheries (including salmon and herring)	• Sections 3.2.1.6; 3.2.2.5; 3.2.8	• IPHC halibut longline fishery • Fishery Management Plans (FMPs) for federal groundfish, swordfish, and halibut/angle shark fisheries • FMPs for federal crab fishery • FMP for state (AK, WA, OR, and CA) fisheries
Scientific research	• Biological (including other marine species) • Oceanographic • Geophysical/chemical	• Section 3.2	• Biological (other marine species) • Oceanographic • Geophysical/chemical
Global and industrial pollutants	• Marine spills and pollution • Marine debris • Bioaccumulation	• Sections 3.2.1.8; 3.2.2.7	• Marine spills and pollution • Marine debris • Bioaccumulation
Subsistence activities	• Marine mammal harvest	• Sections 3.2.1.6; 3.2.2.5; 3.4.1	• Marine mammal harvest
Commercial harvest	• Commercial whaling • Commercial sealing	• Sections 3.2.2.5; 3.2.8	None
Commercial shipping	• Vessel traffic and fuel	• Section 3.2.1.9	• Vessel traffic and fuel
Invasive species	• Introduction of non-native species	• Section G.8.2, Draft Conservation Plan for the Eastern Pacific Stock of NFS (NMFS 2006)	• Introduction of non-native species • Eradication programs
Other development	• Military activity • Coastal and infrastructure development • Tourism	• Section 3.2.1.9	• Military activity • Coastal and infrastructure development • Tourism
Natural Events			
Climate variability	• Regime shift/Pacific decadal oscillation/ENSO • Global warming	• Sections 3.2.8; 3.3.5; 3.3.6	• Pacific decadal oscillation/ENSO • Global warming
Mortality	• Predation • Disease and parasites	• Sections 3.2.1.7; 3.2.1.8; 3.2.2.6; 3.2.2.7; 3.2.3	• Predation • Disease and parasites

4.6 Resources and Characteristics Not Carried Forward for Analysis Under Environmental Consequences

CEQ regulations require NMFS to focus attention on important issues and avoid extraneous material in this impact statement (40 CFR 1502.15). The CEQ regulations for implementing NEPA define "direct effects" as effects that are caused by the action and occur at the same time and place (40 CFR 1508.8(a)). The CEQ regulations for implementing NEPA define "indirect effects" as effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8(b)). Agencies must consider only those indirect effects that are "reasonably foreseeable." They need not consider potential effects that are highly speculative or indefinite (*Kleppe v. Sierra Club*, 427 U.S. 390, 402 (1976)). The First Circuit Court set a three-part test to determine whether a particular set of indirect effects was too indefinite or speculative to be considered: 1) With what confidence can one say that the impacts are likely to occur?; 2) Can one describe them “now” with sufficient specificity to make their consideration useful?; and 3) If the decision maker does not take them into account “now,” will the decision maker be able to take account of them before the agency is so firmly committed to the project that further environmental knowledge, as a practical matter, will prove irrelevant to the government's decision? (*Sierra Club v. Marsh,* 729 F.2d 868 [1st Cir. 1985]). Based on these three criteria, several of the resources and factors described in Chapter 3 may contribute to cumulative effects, but would themselves not be affected measurably by any of the alternatives for SSL and NFS research, and thus additional analysis would not be useful to the decision makers or public. As described in Section 2.6, SSL and NFS research activities could be categorized as follows: aerial surveys; vessel surveys; ground surveys; scat collection; behavioral and demographic observations and remote monitoring; capture and restraint; morphometric/ physiological measurements and tissue sampling; permanent and temporary marking; external attachment of instruments; insertion/implantation of instruments; transport and temporary captivity; and incidental mortality. None of these activities would have a measurable affect on the resources described below. The following subsections present each resource or factor not carried forward for detailed analysis.

4.6.1 Fish and Essential Fish Habitat

As described in Chapter 3, the fish resource includes Essential Fish Habitat (EFH) and fish species. Research activities using vessels can disturb EFH while anchoring or beaching small landing craft, although the habitat would be expected to recover. This potential effect would be localized, temporary, and therefore negligible across all alternatives. While the information obtained from SSL research has been used in the past to develop fisheries management measures to limit total allowable catch (TAC) in SSL critical habitat and exclusion areas round SSL rookeries, the research activities on SSL and NFS themselves do not affect fish or EFH. Because there would be negligible impact from access and no mechanisms for potential impacts of the research alternatives on EFH and fish species, further detailed analysis under each alternative would not be expected to influence the decision to be made, and therefore fish and EFH are not carried forward.

4.6.2 Invertebrates and Sea Turtles

Invertebrates and sea turtles are included with other marine species described in Chapter 3. Research activities on SSLs and NFSs are not expected to have any effect on invertebrates and have not been identified as an ongoing problem for sea turtles. Because impacts to other marine species are not expected, and if any were to occur, would not differ among alternatives, other marine species are not carried forward for detailed analysis.

4.6.3 Special Coastal Lands and Waters Designations

Some existing and proposed research would occur on or near lands and waters under special designations. This would include the Alaska Maritime National Wildlife Refuge (AMNWR), Aleut archeological sites, World War II historical sites, Channel Islands National Park, Channel Islands National Marine Sanctuary, and critical habitat for SSLs and several salmon and steelhead species. Because of the designations, certain research activities would require permits and/or approvals for access to these areas. However, none of the proposed research activities, for any of the alternatives, would be expected to affect the designations. Therefore, these designations are not carried forward for detailed analysis.

4.6.4 North Pacific Ocean, Bering Sea, and Gulf of Alaska Ecosystems, Substrate, Temperature and Nutrient Regimes, Climatic Regime Shifts and Distant Forcing Parameters

None of the research alternatives would be expected to have any measurable effects on the substrate, temperature and nutrient regimes, or overall ecosystems of the North Pacific Ocean, Bering Sea, or Gulf of Alaska. Similarly, no measurable effects on climatic regime shifts or ENSO events (distant forcing parameters) are anticipated from any of the alternatives. None of the activities described under any of the alternative policies would have any measurable affects on these resources. Therefore, detailed analysis under each alternative is not warranted.

4.6.5 Commercial Fishing

As discussed in Chapter 3, much federally funded research on SSLs and NFSs has, in the past, been directly or indirectly associated with management of commercial fisheries in Alaska. The measures proposed and analyzed in the *2001 Steller Sea Lion Protection Measures Final Supplemental Environmental Impact Statement,* prepared by NMFS Alaska Region, involved direct changes in the management of the Alaska groundfish fisheries, with an aim to avoid or minimize impacts of the fisheries on SSLs based on information from research on SSLs.

However, none of the alternative policies for continuing SSL and NFS research would have a direct, indirect, or cumulative effect on commercial fisheries. The possible additional scientific information on SSLs and NFSs resulting from the issuance of new grants, permits, or authorizations, or the possible lack of scientific information resulting from the absence of new grants, permits, or authorizations, would in itself have no direct effect on commercial fisheries. Rather, future regulatory actions or protective measures to alter commercial fishing in order to further protect SSLs or NFSs could directly affect commercial fishing activities and would require a separate NEPA analysis.

The indirect effects on commercial fishing of the alternative policies for continuing SSL and NFS research are too speculative for inclusion in this EIS. Under any of the alternative policies for continuing SSL and NFS research, the probability that additional regulations or protective measures for SSLs or NFSs that could affect commercial fisheries will be implemented in the future is unknown. Future regulations or protective measures for SSLs or NFSs and their effects on commercial fisheries cannot be sufficiently described and specified at this time to allow for useful evaluation. Again, potential effects of new policies for protecting SSLs and NFSs on commercial fisheries would be evaluated in a separate Environmental Assessment (EA) or EIS as they would constitute a change in fisheries management, not SSL or NFS research.

According to NMFS cumulative effects guidance, if there are no direct or indirect impacts from alternatives to some or all of the resources in the affected environment, a cumulative effects analysis for those resources would not be necessary. It has been determined above that none of the alternative policies for continuing SSL and NFS research would have direct or indirect effects on commercial fisheries; therefore, analysis of cumulative effects on commercial fisheries is unnecessary.

4.7 Elements Common to All Alternatives

4.7.1 Duration of Permits

The maximum period of any permit issued for scientific research on SSLs and NFSs, or any major amendment to an existing permit, is five years from the effective date of the permit issuance or major amendment. This five-year period may be extended by a minor amendment up to 12 months beyond that established in the original permit (50 CFR part 216.39).

4.7.2 Coordination

4.7.2.1 Coordination between Grants Office and Permits Division

NMFS administers a research program that awards research grants and issues permits pursuant to the MMPA and ESA for the purpose of facilitating research on SSLs and NFSs. The grants program is administered through the Grants Program Office of the NMFS, Alaska Region, and permits are issued by the Office of Protected Resources, Permits Division, in Silver Spring, Maryland. Each office has its own application, review, and decision process, which function independently. A discussion of these processes is provided in Section 3.7. The overlap between these two offices, regarding granting and permitting SSL and NFS research, is limited to a requirement of the Grants Program Office that the grantee provide proof that the necessary permits have been obtained. This proof must be provided to the Grants Program Office prior to grant expenditure.

4.7.2.2 Coordination among Researchers and with NMFS

The increased interest in SSL and NFS research, and the substantial increase in funding of SSL research, has highlighted the need to coordinate research projects in order to reduce both complications in the field and the duplication of efforts. The strategies used by researchers and NMFS to coordinate SSL and NFS research are described in Section 3.2.1.12 and include various meetings, workshops, and symposia used to facilitate the exchange of information necessary to improve research methods, management techniques and/or species recovery plans. These coordination efforts are likely to continue under all alternatives.

Coordination between NMFS and individual researchers also occurs, and will continue to occur under all alternatives, upon NMFS receipt of grant and permit applications. The Grants Program Office and the Office of Protected Resources, Permits Division, review their respective applications for completeness and communicate with applicants regarding needed changes to the applications. Incomplete applications are determined via internal technical reviews, and a review of consistency with application requirements. For SSL and NFS research permits, applications must be consistent with the ESA and MMPA. Permits for the research of any ESA-listed marine mammal must be justified by the likelihood of contributing to the species' recovery and must be reasonably likely to achieve the objectives of the MMPA. Through regulations, NMFS requires that applications for permits for research on marine mammals listed as depleted, threatened, or endangered show how the results of the proposed research would directly benefit that species, or would fulfill a critically important research need, by demonstrating how research would contribute to fulfilling a research need or recovery objective identified in the species' recovery or conservation plan.

4.7.2.3 Coordination Required Under Co-Management Agreements

NMFS entered into co-management agreements with the St. George Traditional Council and the Traditional Council of St. Paul for the purpose of coordinating the efforts to conserve SSL and NFS populations, maintain a sustainable harvest for traditional uses, and promote and continue specific NFS and SSL research. Co-Management Councils were established to meet regularly and develop annual management plans, monitoring programs, and research programs for St. George Island; to annually review the contents, performance, and responsibilities in the agreement; to review and assess progress towards implementation of the agreement; to identify challenges to achieving the purpose of the agreement; to recommend solutions to any identified challenges; to identify future courses of action; and to review applicable laws and regulations governing the subsistence take and use of fur seals and sea lions for the purpose of making recommendations for appropriate change to NMFS.

NMFS and each traditional council will also assist each other in seeking funding from a variety of sources to support research and management projects of mutual benefit regarding NFSs and SSLs. Each traditional council will submit a yearly budget to NMFS to fulfill specific responsibilities stated in the corresponding Co-Management Agreement, for each fiscal year the Agreement is in effect.

4.7.2.4 Coordination between Researchers and Rural Communities

Much of the coordination between rural communities and researchers occurs as a result of research activities where subsistence-harvested animal tissues are shared with researchers who have specific permits to use such samples. There is currently one active permit (a second was vacated by the May 2006 court order [*The Humane Society of the United States v. Department of Commerce*, 05-1392-ESH, D.D.C.]) to use tissue samples from subsistence-harvested SSLs. Subpart G of MMPA (50 CFR 216.74) states:

> Pribilovians who engage in the harvest of seals are required to cooperate with scientists engaged in fur seal research on the Pribilof Islands who may need assistance in recording tag or other data and collecting tissue or other fur seal samples for research purposes. In addition, Pribilovians who take fur seals for subsistence uses must, consistent with 5 CFR 1320.7(k)(3), cooperate with the NMFS representatives on the Pribilof Islands who are responsible for compiling the following

information on a daily basis: (a) The number of seals taken each day in the subsistence harvest, (b) The extent of the utilization of fur seals taken, and (c) Other information determined by the Assistant Administrator to be necessary for determining the subsistence needs of the Pribilovians or for making determinations under §215.32(e).

Thus, Pribilof Islands community residents who engage in the harvest of seals cooperate with scientists engaged in fur seal research. Subsistence hunters report to NMFS when there is evidence that a harvested animal may have been one that was tagged or marked for research. This helps researchers track the life history of animals that have been taken through subsistence. Some researchers may also hire local residents to assist them with animal counts.

4.7.3 Reporting Requirements

4.7.3.1 Grants Office Reporting Requirements

Grantees are required to complete programmatic reports, which are for semi-annual reporting periods, as well as a final report. Reports are due 30 days after the end of each reporting period, with the exception of final reports, which are due 90 days after the grant ends. The financial reports include the SF-269 or SF-269a, Financial Status Report, and the SF-272, Federal Cash Transactions Report. The Financial Status Reports are due 30 days after the end of each reporting period, with the exception of final reports, which are due 90 days after the project expires. The Federal Cash Transaction Reports may be required monthly if the grant or cooperative agreement is for more than $1,000,000. Those reports are due 15 days after the reporting period, semi-annual reports are due 30 days after the end of the reporting period, and the final reports are due 90 days from the end of the project period. If funds are not being expended, the grantee is required to complete a financial report with explanation.

4.7.3.2 Permits Division Reporting Requirements

A requirement of MMPA permits for research, as stated in 50 CFR part 216.38, is that permit holders must submit to NMFS annual, final, and special reports in accordance with the requirements established in the permit, and any reporting format established by the Office Director. Researchers operating under NMFS grants and permits may be required to allow NMFS or NOAA personnel to observe their activities and inspect any facilities or records related to permitted or funded activities. Annual and final reports for permits shall include a summary of all research or enhancement objectives, hypotheses, and testing (including methodology); a summary of the results and the manner in which such results relate to the research or enhancement objectives; an assessment of whether or not and how the scientific research or enhancement activity contributed to the achievement of any recovery objectives established for the species or stock; an indication of where and when the research findings will be published or otherwise made available to the public or scientific community, or a description of the contribution of the enhancement program and future recommendations; and a description of the disposition of any marine mammal parts, including an identification of the part as required in 50 CFR part 216.37(a)(4) and the manner of disposition.

Annual permit reports are due 90 days from completion of the last field season during the calendar year or, if the research is not conducted during a defined field season, 90 days after the anniversary date of issuance of the permit. Final permit reports are due 180 days from the date of permit expiration. Requirements for special reports vary, but all SSL and NFS research permits require the holder to submit “serious injury and mortality incident” reports that must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional research-related mortality. These special reports are due within two weeks of the incident. Failure to submit complete and accurate reports required under a permit may result in suspension, revocation, or modification of the subject permit, as well as delays in processing future permit applications.

4.7.4 Mitigation and Conditions of Grants, Permits, and Authorizations

Researchers who apply to take protected species (i.e., threatened or endangered under ESA and MMPA) for scientific and/or enhancement purposes must abide by certain general terms and conditions. These terms and conditions are based on the requirements necessitated by the statutes. Explanations and descriptions of how mitigation measures would be incorporated into the research plans must be included in the permit applications. Incorporation of permit terms and conditions helps to mitigate possible adverse impacts precipitated by research. Not complying with terms and conditions constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action. All permits for research on marine mammals contain the following types of permit terms and conditions, which must be complied with 1) duration of permit; 2) number and kind(s) of protected species, location(s) and manner of taking; (3) qualifications, responsibilities, and designation of personnel; (4) possession of permit; (5) reports; (6) notification and coordination; (7) observers and inspections; (8) modification, suspension, and revocation; (9) penalties and permit sanctions; and (10) acceptance of permit.

There are also a number of special conditions specific to research on SSLs and NFSs, which must be adhered to. These special conditions for SSL and NFS research permits are contained within the terms associated with condition number two: number and kind(s) of protected species, location(s) and manner of taking. The following will further detail both the general and special terms and conditions for all SSL and NFS research permits.

Duration of Permit

- The permit expires on the date indicated (not to exceed five years past the date of issuance), is non-renewable, and may only be extended by the Director of NMFS Office of Protected Resources.
- All permitted activities must be suspended in the event of a serious injury or mortality and the permit holder must contact the Chief of NMFS Permits, Conservation and Education Division (Permits Division), by phone within two business days. Activities may be authorized to resume after a review of the incident report.
- If the authorized take (which under the MMPA means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal) is exceeded, research activities must cease and the Permits Division Chief must be notified by phone as soon as possible, but not later than two business days. The permit holder must submit a written incident report, and resumption of permitted activities is contingent upon review of the report and compliance with permit terms and conditions.

Number and Kind(s) of Protected Species, Location(s) and Manner of Taking

- A table outlining the number of protected species authorized to be taken and the locations, manner, and time period in which they may be taken, must be included in the permit application and will be included in the permit. The actual number of takes must be provided in the annual report.
- Visual images of or related to the research may be collected as needed, provided that collection of images does not result in takes of protected species.
- Nonessential images or audio recordings may be allowed, but only with permission of the Permits Division Chief.
- Researchers must comply with specific restrictions related to taking (i.e., time, location, and manner), as specified in special conditions for SSL and NFS research permits. These special conditions are:
  - Except where disturbance during pupping season is expressly authorized, researchers must not conduct any rookery activities until after peak pupping season, and use personnel (i.e., biologists, veterinarians, or physiologists) experienced in sampling techniques in order to complete work as quickly as possible;

- Cease all research-related procedures if an animal is showing signs of acute or protracted alarm (i.e., constant muscle tensions or abnormal respiration) that may lead to serious injury or death;
- Use disposable instruments (i.e., needles or biopsy punches) to the maximum extent practicable;
- For blood sampling, do not exceed three attempts (needle insertions) per site per animal, and not more than 1.0 ml blood per kg body mass per capture event;
- Responsible steps will be taken by researchers to identify pups of lactating females before attempting to immobilize a lactating female;
- If research activities result in an orphaned pup, or one with a seriously injured mother, the orphaned pup will be humanely provided for (i.e., placed in a rehabilitation facility or, if necessary, euthanized); and
- To the maximum extent practicable, without further disturbance of the rookery/haulout, researchers shall conduct post-handling monitoring of animals captured or sampled, for signs or injury or stress.

Qualifications, Responsibilities, and Designation of Personnel

- All researchers must be listed and categorized as either Principal Investigator, Co-Investigator, Research Assistant, or Permit Holder.
- Only personnel identified in the permit may perform activities, which must be commensurate with their qualifications and responsibilities.
- Research Assistants cannot conduct permitted activities in the absence of the Principal Investigator or a Co-Investigator.
- Personnel who require a state or federal license in order to conduct certain activities authorized under the permit (i.e., veterinarians or pilots) must be licensed when undertaking said activities.
- Any changes to the list of personnel described in the permit must be detailed in a written request to the Permits Division Chief. These changes will then be formally approved or denied.

Possession of Permit

- The permit cannot be transferred or assigned to any other person or institution.
- The permit holder, and any other persons operating under the permit, must possess a copy of the permit when: engaged in a permitted activity; a protected species is in transit; and during any other time when any protected species is taken or imported under the auspices of the permit.
- A duplicate of the permit must be attached to any container, package, enclosure, or other means of containment that contains a protected species, or part(s) of, for storage, transit, supervision, or care.

Reports

- The permit holder must submit annual, final, and incident reports, as well as any papers or publications that result from the research, to the Permits Division Chief.
- Written incident reports related to serious injury and/or mortality events, or an exceedance of authorized takes, must be submitted to the Permits Division Chief. These reports must describe the events that occurred, as well as what measures are being taken to prevent the occurrence of similar incidents in the future.
- An annual report must be submitted to the Permits Division Chief at an agreed upon date for each year the permit is valid. Also, a final report must be submitted to the Permits Division Chief within 180 days of the permit expiration date, or if research finishes prior to permit expiration, within 180 days of completion of research.
- The annual report must include the species, activities, numbers, age class/gender, number of times each activity was performed, and locations of takes in tabular form, as well as a narrative of the results of research.

- Research results must be published, or otherwise made available to the scientific community, in a reasonable period of time.

Notification and Coordination

- The permit holder must provide written notification of planned field activities to the appropriate NMFS Assistant Regional Administrator(s) for Protected Resources. This notification must occur at least two weeks before commencement of any field work and should include the intended locations of work and/or survey routes, estimated dates, and names and roles of all participants.
- To the maximum extent practicable, the permit holder should coordinate the spatial and temporal characteristics of the study with those that have similar plans, in order to minimize and possibly avoid unnecessary disturbance to animals.

Observers and Inspections

- Permitted activities may be reviewed by NMFS. Upon request by NMFS, the permit holder must cooperate with any review by allowing any employee of NOAA, or other individual designated by the Director of NMFS Office of Protected Resources, to observe permitted activities, or by providing any documents or other data relating to the permitted activities.

Modification, Suspension, and Revocation

- Any and all permits are subject to suspension, revocation, modification, and denial. The Director of NMFS Office of Protected Resources may modify, suspend, or revoke the permit in its entirety, or in part, for several reasons: in order to make the permit consistent with any change made after the date of permit issuance; in any case in which a violation of the terms and conditions of the permit is found; in response to a written request from the permit holder; if NMFS determines the application or other pertinent information is false; and if NMFS determines the activities authorized under the permit to be to the disadvantage of threatened or endangered species or to be no longer consistent with the ESA (only applicable to ESA-listed species).

Penalties and Permit Sanctions

- Any individual who violates any provision of a permit, MMPA, ESA, or regulations at 50 CFR 216 and 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture.
- NMFS shall be the sole arbiter of whether or not a given activity is within the scope and limits of the authorization granted in the permit. It is the responsibility of the permit holder to verify whether an activity is within the scope of the permit. If verification is not performed and NMFS subsequently determines that an activity was outside the scope of the permit, this failure to verify may be used as evidence of a violation of the permit, the MMPA, the ESA, and other applicable regulations in any enforcement actions.

Acceptance of Permit

- Upon signing the permit, the permit holder and principal investigator agree(s) to all terms and conditions explained in the permit; understand(s) that the authority to conduct certain activities detailed in the permit is conditional and continued use of said permit is contingent upon compliance with annual reporting requirements; and acknowledge(s) that a NMFS permit does not absolve the permit holder of the responsibility of obtaining any other applicable permits (i.e., federal, state, local, or international).

Although no set of measures can fully prevent all adverse effects of research on SSLs and NFSs, the previously described, and requisite, permit terms and conditions do assist with both the documentation and minimization of effects of research activities on these animals.

4.7.5 Monitoring

All NMFS permits for research on SSLs and NFSs require permit holders to conduct post-activity monitoring to the maximum extent practical without causing further disturbance of the animals. Specifically, permit holders are required to conduct post-handling monitoring of captured or sampled animals for signs of acute stress or injury, and to monitor rookeries/haulouts following any disturbance (e.g., aerial surveys, capture activities, or scat collections) to determine if any animals have been injured or pups abandoned. The results of such observations are to be included in annual and final reports submitted as required under the permit.

4.8 Biological Environment

4.8.1 Steller Sea Lion

This section presents the analyses of the effects of the four different research alternatives on SSLs. The general methodology for performing this assessment is introduced in Section 4.4. However, a description of the SSL-specific analysis is presented here in more detail. The alternatives represent different levels of research effort, each with a range of research techniques and intensities that could be authorized by NMFS F/PR1. The intent of conducting research on endangered, threatened, and depleted species is to collect information useful in making management decisions to promote recovery of the species. However, any research activity that has the potential to disturb animals has some risk of adverse effect for animals exposed. Animals disturbed by research may exhibit a variety of behavioral and physiological responses that can result in injury, reduced fitness, or mortality. Similarly, animals' behavioral and physiological responses to capture, chemical or physical restraint, tissue sampling, attachment of tags or instruments, and exposure to various other marking or sampling procedures can result in injury, infection, reduced fitness, and mortality. For each type of research activity there are one or more possible responses from the animals. For some research activities (e.g., aerial surveys) many animals may exhibit no observable response, although they may have elevated adrenaline levels or other internal stress responses. For research activities that require the presence of researchers on a rookery or haulout, some animals will enter the water and others may hold their ground or move away on land. Animals targeted for capture and handling will be subject to additional types of stress and risks compared to animals that are not captured or handled.

The intensity and probability of potential responses is a function of a variety of factors including the sex/age class of the animal, the tendency of the individual animal to respond in certain ways, the intent and behavior of the researchers (how they approach animals), timing and location of the research, and environmental factors such as sea conditions and weather. Each research activity therefore has specific inherent risks of injury to an individual as determined by potential response, which could result in potential impacts on a population as measured by a combination of the intensity of individual responses and the number of animals exposed. The effect of exposure to a variety of research procedures may be additive or synergistic (i.e., the effect of the interaction of two or more procedures combined is greater than simply adding them together). Likewise, the combined effect of all the research activities authorized at any one time on a stock or population can be estimated based on the combined intensity of responses and scope of the permitted activities (e.g., number of individuals exposed). For all of the procedures analyzed, it is assumed that all researchers are experienced and qualified to fill their assigned roles and that all procedures are carried out under "best practices" conditions, including all mitigation measures specified in the relevant permits.

The analysis of the direct and indirect effects of research activities is divided into three major components: an assessment of research-related injuries that lead to serious injury or mortality; an assessment of research-related effects on reproductive success; and an assessment of how well each alternative research strategy would address recovery and conservation objectives for the species. Potential positive effects of research are evaluated based on the project's likelihood of contributing information that can be used to promote species recovery or conservation, in consideration of the potential adverse effects. The criteria for determining the impact level of each component are summarized in Table 4.4-1.

<u>Assessment of Direct and Indirect Mortality Due to Research</u>

There are many potential mechanisms for research-related injuries to occur, some of which may lead directly or indirectly to the death of individual animals. Some injuries may affect the ability of an animal to forage or behave normally but are not directly fatal (i.e., sub-lethal effects). The thresholds for sub-lethal effects (i.e., when they start to affect an animal's ability to survive) are not well known. There are many other natural and anthropogenic factors that also affect survival of individual animals and to attribute the fate of an animal to a particular factor can be difficult, especially for species that are difficult to track and observe over long periods of time. The key question for this impact assessment is whether or not effects on individuals translate into a population-level effect (i.e., reduced population growth or fitness). Population growth must be increasing, with an age/sex structure that promotes population stability, to lead to recovery of the species. In addition, a significant number of individuals within the population need to be robust to disease, free of deleterious genetic mutations, and resistant to environmental or anthropogenic changes or stresses. The population must also be distributed widely enough to withstand acute environmental or manmade disasters such as disease outbreak or an oil spill.

Mortality Assessment Process

The mortality assessment tables presented for each alternative summarize a multi-step process for determining the magnitude or intensity of direct and indirect mortality risks associated with each type of research activity:

Step 1. The potential responses to different types of research activities are categorized according to the intensity of an animal's response. Different responses can lead to mortality through a variety of known or suspected mechanisms for potential injury.

Step 2. The proportion of animals that typically respond in the different ways is estimated based on observed responses in different locations and under different environmental conditions. This estimate is an "average" response, incorporating the range of responses observed at different rookeries/haulouts over the years (see "Basis for estimates" later in this section).

Step 3. An estimation is made of the percentage of animals that would be injured and die as a result of various research activities, either while researchers are still present or sometime in the future after they have left. These estimates include sub-lethal injuries that require some time to heal, may involve some pain or discomfort, and may affect the ability of animals to move or behave normally for a period of time. It also includes estimates of individuals that may actually die as a result of infections, tissue damage, or impaired ability to forage successfully because of their injuries. These estimates do not include animals that would be injured and die due to natural causes.

Step 4. For each type of research activity, potential mortality has been calculated as a function of the mortality risk associated with an individual animal's response. This risk factor is then multiplied by the number of animals exposed to specific types of research under each alternative. The result of each risk calculation for a particular activity and age class of animal usually includes a fraction of one mortality. This is not meant to suggest that animals would only partly die or that every year a given activity would result in a consistent number of mortalities. The approach is probabilistic and should be considered in terms of an estimated average mortality rate that could occur over time and as a result of many different animals being exposed to the same type of activity or disturbance. The estimated number of mortalities for each activity and age class within a table (including fractional results) are totaled to get an overall estimate of the lethal risks to animals for a given scope and type of research activity.

Step 5. Total mortality is then calculated for all types of research activities for each alternative by adding the estimates from each activity table. Mortalities associated with conducting a suite of activities on an animal may be calculated by adding risk factors for specific research procedures from different tables. For example, activities that require handling of animals also involve:

- Incidental disturbance of animals as researchers approach ("researcher presence in view of animals").
- Incidental disturbance of animals as they move about on the rookery or haulout ("researcher presence among animals").
- Disturbance and stress for animals that are captured ("capture and restraint").
- Risks associated with each sampling procedure ("handling").

Step 6. A summary table (Table 4.8-49) shows the estimated number of animals that potentially might die from the specified scope of research defined for each alternative. These totals may include fractions of mortalities, which the reader could round up to the nearest whole number if they choose. Again, these are estimated probabilities that will fluctuate over time and should not be considered hard predictions for any given year. These totals are then used to evaluate the magnitude and intensity of the direct and indirect effects of research on mortality, which is one aspect of the overall impact assessment for each alternative. Sections 4.4 and 4.5 describe the other steps involved in the overall impact analysis.

Mechanisms of Injury from Disturbance

The extent to which human activities may have adverse effects on wildlife has recently become a source of conservation interest. Human disturbance causes a deviation in an animal's behavior from patterns occurring without human influence. There are numerous potential responses to different disturbances that could affect an individual's chance of survival and reproductive success. If the disturbance is severe and/or frequent enough to affect the fitness of many individuals, it may affect overall population size.

One type of response to disturbance is an animal's decision to move away from disturbed areas. This decision is typically determined by factors such as quality of the site being occupied, distance and quality to other suitable sites, relative risk of predation, density of competitors, and the investment the individual has made onsite (Gill *et al.* 2001a). The decisions made by animals in response to human disturbance, and the consequences thereof, have been compared to the decisions they make in response to predation risk (Frid and Dill 2002). Animals with suitable habitat nearby may move away from a disturbance simply because there is an alternative site. Conversely, animals with no suitable habitat nearby may remain despite disturbance and regardless of the survival or reproductive consequences (Gill *et al.* 2001b).

Knowledge of population and individual responses to disruptions of daily activities is necessary to assess viability of populations exposed to human activities. A review of available literature on responses of numerous species to a variety of human activities suggests that the responses of individuals and their effects are highly variable and dependent on multiple factors. For example, Anderson *et al.* (1996) found that there were no long-term effects of military activities on moose, and Englehard *et al.* (2002) concluded there were no long-term effects on elephant seals from human disturbance. However, Kerley *et al.* (2002) found that roads and traffic did affect the reproductive success and survivorship on Amur tigers, and Blackmer *et al.* (2004) found that human disturbance affected hatching success and nest-site fidelity of Leach's storm petrel.

In addition to behavioral responses, animals' responses to disturbance may also be physiological. For example, when an animal is exposed to a stressful stimulus, it may respond with the release of adrenocorticosteriods or other neurochemical changes. Stress has been identified as a factor in the development of pathological conditions in humans including ulcers, hypertension, arteriosclerosis, and immunodeficient conditions (Gorizontov *et al.* 1989). While studies on humans may not be directly applicable to marine mammals, an understanding of the processes for effects may be relevant (Fair and Becker 2000). Results of studies on a wide range of terrestrial birds and mammals suggest that differences in stress hormone concentrations pre- and post-disturbance are valid measures of response to disturbance. Stress hormone concentrations in fecal samples from northern spotted owls (Wasser *et al.* 1997), elk, and wolves (Creel *et al.* 2002) have been used to measure responses to disturbance. Other studies have measured short-term physiological responses, such as elevated heart rates measured via radio telemetry, in bighorn sheep and white-tailed deer (MacArthur *et al.* 1979; Moen *et al.* 1982).

Researchers have used fecal assays to examine the hormonal responses of captive SSLs and California sea lions to various stressors, including tissue contaminant levels, changes in diet, surgical procedures, and handling procedures such as isoflurane anesthesia and hot-branding (Bozza and Atkinson 2005; Mashburn and Atkinson 2005; Petrauskas *et al.* 2005). The results indicate that, for a given type of stressor, there are large variations in the response of individuals, as measured by concentrations of fecal glucocorticoids (cortisol and corticosterone). Responses to handling procedures included sharp increases in glucocorticoid concentrations that typically returned to background levels within days. While the techniques have been useful for monitoring physiological responses to stress under controlled conditions, their usefulness for explaining physiological stress in wild animals will require a better understanding of the natural variability in fecal glucocorticoids among individuals in the population, especially in relation to nutritional status, seasonal reproductive cycles, and territorial behavior (Bozza and Atkinson 2005). Furthermore, stress responses during capture and handling may not be a good indicator of subsequent survival. Serum cortisol concentrations did not vary among groups of deer that died at capture, within 14 days of release, or those surviving longer than 14 days post-release (DelGiudice *et al*. 2005).

Measures of the physiological responses of dolphins to the stress of capture include indicators such as decreased eosinophil counts, imbalances of thyroid hormones, glucocorticoids, and elevations of other blood constituents such as glucose, iron, and potassium (reviewed in Fair and Becker 2000). However, information is not available on responses to repeated captures in other marine mammal species.

Recent studies on pinnipeds have focused on two types of disturbance (reviewed in Kucey and Trites 2005): anthropogenic (e.g., noise, vessel and aircraft traffic, research, recreational, industrial, and development) and non-anthropogenic (e.g., environmental changes, storms, birds, other pinnipeds, or predators). To assess whether or not there is an effect of disturbance on pinniped haulout behavior, it is important to understand the measurement of post-disturbance recovery (i.e., what constitutes a return to "normal" conditions). Some studies have considered post-disturbance recovery to be attained when a certain percentage of the animals present at the time of the disturbance return to shore (i.e., Allen *et al.* 1984) or by applying statistical approaches that consider average densities and daily variation in numbers onshore (i.e., Kucey 2005). In the case of SSLs, disruptions often affect entire haulout sites and rookeries (Lewis 1987). Kucey (2005) documented the number of SSLs hauled out before (one to two weeks), during, and after (one to two weeks) directed research disturbance and found that the assessment of recovery depended on the criteria used. This type of study is useful in assessing short-term effects of disturbance, but cannot evaluate long-term consequences, thus indicating the need for additional methods for long-term studies. One study (McMahon *et al.* 2005) tracked the survival of endangered southern elephant seal pups (*Mirounga leonina*) that had been handled repeatedly and subjected to intrusive research procedures in their first six weeks of life and found no short-term (24 day nursing period) or long-term (first year of life and beyond) effects on survival. As indicated earlier, the results from studies of stress on one species may not apply to the responses of another species.

Understanding the effects of human disturbance on wildlife populations is critical to conservation efforts. Conservation measures will only be effective when we understand how disturbance affects the animals, physiologically or behaviorally. The insights gained by assessing effects of disturbance may help guide management of research activities, air and boat operations, and other forms of human disturbance.

Mechanisms of Injury from Presence of Researchers on or Near Rookeries and Haulouts
It is not always possible to detect animal responses to disturbance. Some responses go unnoticed for various reasons including cryptic behavior of the animal or limitations in methods used to observe or measure responses. For those species or circumstances where responses may be detected, the type and intensity of response can vary greatly. For SSLs, researchers have observed a variety of behaviors and measured various physiological indicators of stress in response to research activities.

In response to some research activities (e.g., "researcher presence in view of animals" or "researcher presence among animals"), some animals exhibit no obvious behavioral response although they may have physiological responses associated with stress. Other animals are "alerted" and show a noticeable increase in awareness of the researchers (e.g., head up, vocalization, etc.). Others may move away from the researcher or toward the water without actually entering the water. Others may enter the water either in an "orderly" fashion or in a stampede. Some mechanisms for direct and indirect adverse effects, including injury and mortality, during a stampede or flight into the water include:

- Increased corticosteroid levels or other physiological stress responses, especially from prolonged or repeated exposure to disturbance.
- Increased energy expenditure with the potential for hyperthermia (excessively high body temperature which could lead to muscle rigidity, brain damage, or death) for those animals involved in strenuous or prolonged activity.

- Hypothermia (characterized by abnormally low body temperature and associated with rapid, progressive mental and physical collapse which could be life-threatening) for those animals forced into the water, particularly animals undernourished or in poor health.
- Injury to pups from being trampled by adults or other pups.
- Injury to adults and pups from landing on sharp rocks when jumping or falling off cliffs or rocks.
- Injury to pups from aspirating water.
- Death of pups by drowning.
- Increased risk of predation for those animals forced into water, especially pups and juveniles with limited mobility.
- Increased conspecific aggression (e.g., biting and pushing) among adults and from adults toward pups as animals try to reestablish or access territories on the rookery or reunite with their pups.
- Delay in return of nursing females to the rookery/haulout, leading to a malnourished or weakened pup, or slower pup growth.
- Failure of pups and mothers to reunite after separation resulting in pup death by starvation or exposure.
- Stress reactions that produce psychological and physiological responses, especially if disturbance is chronic or frequent.

Mechanisms of Injury from Capture and Restraint

For research activities that require capture and restraint of animals, there are risks of injury in addition to those listed above. Capture and restraint methods include both land-based and at-sea techniques (see Appendix B). The following are mechanisms by which animals may be injured during capture:

- Efforts to avoid or escape capture can lead to contusions, lacerations, hematomas, nerve injuries, concussions, and fractures, as well as hyperthermia and myopathy from increased muscle activity.
- Pups herded into large groups for processing or that pile up in response to disturbance on rookeries may be injured or suffocated under the weight of other pups.
- Pups attempting to reunite with their mothers after researchers leave may encounter lactating females who may aggressively displace and injure them.
- Capture myopathy is associated with prolonged or repeated stress reactions in many mammals (but it is uncertain if it occurs in pinnipeds) and characterized by degeneration and necrosis of striated and cardiac muscles. Capture myopathy may be fatal and may not develop until 7-14 days after capture and handling.

Mechanisms of Injury from Sedation or Anesthesia

There are several types of drugs used to capture, sedate, or immobilize animals for marking, instrument attachment/insertion, hot-branding, or tissue sampling procedures. Technical descriptions of these procedures are presented in Appendix B. Some of the factors that contribute to adverse effects of anesthesia or sedation include:

- Chemical immobilization for sedation or anesthesia requires an accurate assessment of an animal's weight and condition to determine the appropriate dosage. Miscalculation can lead to an overdose that may result in death.
- A dart-injected animal may be injured if it enters the water after being darted and later aspirates water or drowns as the drug begins to take effect.
- Dart injection of anesthetic into blubber rather than muscle tissue can lead to aseptic necrosis and large abscesses.
- Dart injections into the abdominal or chest regions can result in puncture of the stomach or lungs, which may be fatal.
- Darts may hit an animal smaller than intended, leading to an inadvertent overdose.

- Animals under sedation can develop hyperthermia (over-heating) or hypothermia (reduced body temperature) due to stress reactions and the effects of some drugs on thermoregulation. Both conditions can influence the physiological response of the animal to drugs or exacerbate existing health problems.
- Immobilizing drugs can result in respiratory depression or apnea (stopped breathing); muscle spasms; increased salivation, which can lead to choking; and complications for animals that already have kidney or liver diseases.

Mechanisms of Injury from Tissue Sampling, Marking, and Other Research Procedures

There are numerous types of research procedures involving the handling of animals, including collection of various tissue samples, attaching tags or scientific instruments, and applying marks such as hot-brands. Technical descriptions of these procedures and their specific potential effects on animals are presented in Appendix B. In addition to the following risks associated with these procedures, all of the handled animals are exposed to the risks of researcher disturbance and capture listed previously.

- Blood collection can cause pain, stress, damage to the vein, abscesses, and clotting, particularly when multiple attempts are made on the same animal.
- Biopsy punches for skin and blubber samples produce a small wound that has the potential for infection, especially when considering the unsanitary conditions of the environment. Muscle biopsy produces a small-diameter deep wound that can bleed excessively and tends to heal at the surface prior to deep tissue healing, thereby increasing the chances of abscess formation.
- Hazards of remote biopsy sampling include inadvertently striking vulnerable areas such as the head or abdomen, darts that penetrate too deeply and cause excessive bleeding or tissue damage, stuck darts or broken tips remaining attached to the animals, causing irritation and possibly abscess and infection, and inadvertent repeated sampling of the same individual, thereby compounding the effects on that animal. Depending on the depth of penetration and force of impact, biopsy darts can damage internal organs if they strike the abdominal area, resulting in a fatal wound that may not be detected by researchers at the time of sampling. Animals can also be severely injured if darts strike them in the head (Gemmell and Majluf 1997).
- Tooth extraction can result in infection and cause more than momentary pain, which could temporarily interfere with foraging behavior.
- Flipper tags create puncture wounds that produce more than momentary pain, include chances of infection, and may also pull out over time, creating a rip in the flipper.
- Hot-brands are the permanent marking method currently used for SSLs and can lead to stress, more than momentary pain, wounds that remain open for prolonged periods, and infection.
- Use of dyes, bleach, paint, or other chemicals to temporarily mark the pelage of SSLs or NFSs can potentially cause irritation, and some of the chemicals can be toxic if ingested, and, if they get into an animal's eye can result in blindness. Additional physiological or behavioral effects of temporary pelage marking are unknown, but potentially could alter thermoregulation or grooming behavior.
- External attachment of instruments to the fur or skin with epoxy can cause irritation and lead to increases in grooming behavior with reductions in foraging behavior and other normal behavior. The hydrodynamic drag created by the instrument can hinder swimming performance and result in increased energetic costs of swimming, potentially affecting foraging efficiency.
- The potential long-term effects of injecting SSLs with substances for research purposes, such as isotope-labeled water and Evan's blue dye, and collecting serial blood samples have not been well studied. Also, these procedures necessitate the extended restraint of animals, which may increase the risk of stress-related effects and behavioral changes when the animals are released. All procedures that require insertion of needles carry the risk of infection and abscesses that may affect an animal's general health.
- Stomach intubation carries the risk of introducing fluids into the trachea and lungs, which may lead to pneumonia.

- Enemas and fecal loops carry the risk of perforating the rectum, which may lead to peritonitis.
- Surgical implantation of instruments is performed under anesthesia, which eliminates pain during surgery, but there may be complications from the anesthesia, as well as considerable pain during healing, which may take weeks or months and could inhibit normal foraging behavior, reproductive behavior (including lactation and mating), and the ability to escape predators. There is also a substantial risk of infection associated with exposing deep tissues or penetrating the abdominal cavity.

Number of Animals Affected by Research under Each Alternative

The permits that were active at the time this EIS was initiated constitute the Status Quo level of research (Alternative 3). The numbers of takes for different research activities under these permits are listed in Appendix A (Take by Permit Number and Research Activity). These Status Quo numbers were modified according to the policies stated for Alternatives 2 and 4 to derive proxy numbers of takes used in the analysis of Alternatives 2 and 4.

Alternative 1 – No Action: No New Permits or Authorizations

Alternative 1, the No Action Alternative, would allow continuation of research that is currently authorized until the existing permits expire. However, for the purposes of analysis, the effects of the No Action Alternative will be based on what would be allowed after all current permits expire. Because no new research permits or authorizations would be issued after that time, no activities that required a permit would be allowed, which would limit research to those methods that do not result in "takes" of marine mammals, such as remote surveys and observations and analysis of existing data and samples. No animals in the wild would be exposed to researcher activity under this alternative.

Alternative 2 – Research Program without Capture or Handling

Alternative 2 would prohibit any research activities that require capturing and handling of animals or researcher presence on rookeries during the breeding season. If these particular activities were not authorized, researchers might choose to expand their efforts with non-intrusive techniques or, alternatively, may elect not to pursue research on SSLs because they would not be able to address issues that interested them or fit their research and funding objectives. In other words, the level of non-intrusive research authorized could be more or less than the Status Quo, depending on the response of individual researchers and agencies to the policy represented in this alternative. For the purposes of analysis, the number of takes under each research activity will be defined as the numbers of animals affected by non-intrusive research activities under the Status Quo for those activities (see mortality assessment Tables 4.8-1, -2, -13, and -14).

Alternative 3 – Status Quo Research Program

For Alternative 3, the Status Quo alternative, the numbers of animals exposed to different research activities is taken directly from the permits that were valid on January 1, 2006, including those permits that were subsequently vacated by court order on May 26, 2006 (Civil Action No. 05-1392 [see mortality assessment Tables 4.8-3 through 4.8-7 and 4.8-15 through 4.8-19]). The alternative does not include activities that had been applied for (permits or amendments) but not yet authorized at the time this EIS was initiated. No new permits for research on SSLs in the wild have been issued since initiation of this EIS.

For survey and monitoring types of activities, the number of animals that would be exposed to potential disturbance depends on how many animals will be in a particular place at a particular time. To account for potential interannual variation in the distribution and abundance of animals within a survey area, researchers are encouraged to estimate the maximum number of animals that would be exposed (surveyed). Researchers generally estimate this number based on information in Stock Assessment Reports (SARs) and previous experience. When applying for permits, researchers may add a "buffer" to this maximum number of animals to make sure they do not exceed their permit allowance should the actual number of animals encountered be greater than predicted. The numbers of authorized takes for incidental disturbance are therefore less than the numbers reported after fieldwork is complete (see Table 3.7-1).

For some activities, such as capture of juveniles at sea, researchers have applied for and received permits to capture a specific number of animals. However, due to financial constraints or the logistical difficulty of capturing animals, the actual sample size has been less than the number authorized (see Table 3.7-1). For procedures that are intended to test specific hypotheses or provide statistically robust data for modeling or other applications, the number of animals requested to be captured or sampled may be based on a "power analysis" determination of sample size. Such statistical power calculations depend on the level of statistical resolution needed to either test the hypothesis or detect an environmental pattern (the effect). In all cases, the analysis of effects will be based on the number of takes authorized in the permits rather than the number of actual takes reported after the field season.

Alternative 4 – The Preferred Alternative – Research Program with Full Implementation of Conservation Goals

Alternative 4 includes all research activities that would be needed to address all information objectives identified in the Draft Recovery Plan for SSL (NMFS 2006a). While such a program would likely require a substantial increase in future funding levels and the sources of that funding have not yet been established, it will be assumed for the purposes of this EIS analysis that sufficient funding would be secured to implement an expanded research program under Alternative 4. This alternative would include the same types of research as described in the Status Quo plus activities that have not been authorized under the Status Quo, including new permits and permit amendments that were pending as of January 2006. It could also include some types of techniques and activities that have not been previously requested or authorized, including intentional lethal take.

The Draft Recovery Plan does not offer specific targets for the future scope or frequency of particular research activities but presents broad suggestions of research direction. All of the suggestions for new research are oriented toward the western DPS so the scope of research on the eastern DPS under Alternative 4 will be assumed to be the same as the Status Quo (Alternative 3). Two objectives that have been emphasized for the western DPS are the need for improved information on vital rates and foraging behavior. Increased effort towards these goals would be expected to increase the numbers of animals captured and marked (and hence takes associated with researcher presence among animals), and to increase the amounts of observational effort. Another objective would be to improve knowledge about the health and reproductive cycles of mature females and this could be addressed by development of capture techniques to allow handling of larger and older sea lions. In general, the numbers of takes for different research activities have been increased over the Alternative 3 levels with input on potential future research from agency experts. These increases have not been assessed with power analyses of sample sizes or with respect to testing specific hypotheses because such detail would depend on the particular objectives of future research proposals. The estimates of takes under each research category are therefore considered to be proxies for the scope of proposals that would arise from many sources under a favorable funding environment. These estimates will be used in the analysis of effects for Alternative 4 (see mortality assessment Tables 4.8-8 through 4.8-12 and 4.8-20 through 4.8-24).

Mortality Assessment Tables

The mortality assessment tables address the likelihood that animals exposed to various research activities could be injured and die as a result of those activities, either immediately or some time in the future. Note that effects of research related to reproduction are considered in the sections on sub-lethal effects. There are a total of five tables that are organized according to the nature of the research activity as follows:

- Table 4.8-1 – Estimated Mortality Due to Researcher Presence in View of Animals
  - aerial surveys
  - vessel surveys
  - remote observations on land
- Table 4.8-2 – Estimated Mortality Due to Researcher Presence among Animals
  - on rookeries during breeding season (disturbance during ground counts, scat collections, captures)

- on haulouts at any time or rookeries during non-breeding-season (disturbance during scat collections, brand or tag resights, captures)

- Table 4.8-3 – Estimated Mortality Due to Capture and Restraint Activities
  - capture/physical restraint
  - capture/chemical restraint (inhalant anesthesia)
  - capture/chemical restraint (injected anesthesia)
  - capture/chemical restraint (injected sedative)
  - intentional lethal take or permanent removal
- Table 4.8-4 – Estimated Mortality Due to Handling and Sampling Procedures
  - permanent mark/hot-brand
  - relatively low-risk procedures (e.g., ultrasound; pulling whiskers; applying paint/bleach/dye marks; instruments attached externally with epoxy/neoprene cement/harnesses; blood samples; flipper tags; isotopes; BIA; injections; enemas; stomach intubation; fecal loops; stomach pill telemeters; metabolic chambers)
  - relatively medium-risk procedures (e.g., tooth pull; biopsies; remote biopsies; local anesthesia)
  - relatively high-risk procedures (e.g., activities that require surgical procedures or otherwise expose a body cavity such as implanting transmitters sub-cutaneously or intraperitoneal or performing other surgeries)
  - Note that there are some procedures that do not pose any additional risk of mortality (e.g., external swabs/scrapings; clipping hair, nails, or whiskers; external physical exam; morphometric measurements
- Table 4.8-5 – Estimated Mortality Due to Capture, Temporary Captivity, and Release
  - capture/transport/holding/release
  - permanent mark/hot-brand
  - relatively low risk procedures as above
  - relatively medium risk procedures as above
  - relatively high risk procedures as above

Tables 4.8-1 and 4.8-2 are analyzed according to the following criteria as shown in the columns in each table:

- **Activity:** The tables assess different types of activities based on differences in risk associated with each activity and also by when those activities occur (breeding season or non-breeding-season), based on differences in risk associated with the presence of small pups.
- **Age Class:** Two age classes are evaluated: pups (less than 3 months old) and non-pups (adults and juveniles). For survey activities and incidental disturbance takes, researchers do not attempt to distinguish or report numbers of animals affected by different sex/age classes other than pups and non-pups. For research activities involving capture, researchers also distinguish between juveniles (3 months to 4 years old) and adults (> 4 years old).
- **Animals Potentially Exposed:** The number of animals exposed to the activity is the number of authorized takes for that activity as listed in the permits under the Status Quo (Alternative 3) or the predicted number of takes (proxies for analysis) as defined for Alternatives 2 and 4. This is generally the number of animals estimated to be present when the research activity is conducted, or the number of animals authorized to be captured or sampled.
- **Type of Response:** The types of responses include observed mortality during the activity, "alert" responses (e.g., head up, watching researchers, or moving away from the disturbance), entering the water, and injuries that occur during the disturbance either on land or as SSLs enter the water. Physiological responses are inferred from behavioral responses, as discussed under the various mechanisms of injury.

For example, the physiological response associated with entering the water is expected to range from mild to moderate changes in circulating stress hormones, to hyper- or hypothermia, myopathy, and death.

- **Estimated Proportion of Animals Affected:** For each age class (pups and non-pups), an estimate is given for the proportion of the population likely to be affected by being exposed to various research activities.
- **Predicted Numbers of Animals Affected:** Multiplying the proportion of the population likely to be affected by the number of animals exposed to a research activity yields the predicted total number of animals affected.
- **Estimated Mortality Rate per Affected Animal:** The next step is an estimation of the mortality rate associated with the different types of effects (i.e., the percentage of animals that is affected during a particular procedure that would immediately or eventually die as a result of the research).
- **Predicted Mortalities:** Multiplying the estimated mortality rate for a given research activity by the predicted number of animals affected by that activity yields the estimated number of mortalities within each age class. The injuries and mortalities may occur from different mechanisms related to the disturbance.

Tables 4.8-3, 4.8-4, and 4.8-5 are based on the number of animals captured in different ways and the number of procedures conducted. All animals captured are assumed to have the potential for injury (through stress or other mechanisms), so these tables do not list a separate number of "animals affected" as is done in the first two tables. Although some permits specify finer divisions in age classes for captured and handled animals, there are no standard age divisions used by all researchers, so the numbers of takes for all animals over 3 months of age have been combined into the non-pup category. The calculation of estimated mortalities is similar to that in the first two tables except that the calculation is divided into immediate mortalities (observed while researchers are present) and eventual or future mortalities that are estimated to occur after researchers leave. The number of handling procedures assessed in Tables 4.8-4 and 4.8-5 are greater than the number of animals captured because most animals are subjected to more than one procedure per capture event. For each animal, the number of times a given procedure is authorized is tallied in the appropriate row, independent of the number of other procedures conducted or the number of times the animal is captured (the risks of which are calculated separately in Table 4.8-3).

Basis for Estimates of Animals Affected, Injury Rates, and Mortality Rates

Although few studies dedicated to detecting effects of research on SSLs have been completed, the reactions of animals to research activities have been observed and recorded in numerous locations over the years by the researchers conducting the activities and, in some cases, by observers or remote cameras positioned well away from the animals. These data provide a basis for response estimates considering the mechanisms for injury or death described above. Serious injuries and deaths observed during research activities are recorded in the annual reports filed with NMFS F/PR1 and are the basis of some estimates as described below. However, we do not have quantitative information on the effects of research activities that may occur after researchers have left the area. We have therefore relied on estimates of the proportions and rates of animals experiencing injury through different mechanisms, based on the professional opinion of highly experienced researchers at NMML. Unless otherwise stated, estimates for proportions of animals responding and mortality rates are applied to both western and eastern populations of SSLs. This framework allows consideration of different risk elements, provides for maximum use of existing injury and mortality rate data, provides flexibility in estimating uncertain risks, and can assist with guiding priorities for future studies.

Aerial Surveys

Because permit applicants request takes based on the numbers expected to be counted during a survey (reflecting the maximum potential take) rather than an estimate of the number of sea lions likely to be disturbed, the actual number of takes of sea lions resulting from aerial surveys will likely be less than the number exposed. For the purposes of this analysis, the proportions of animals affected by research activities were derived from the NMML final report for permit number 782-1532 for the years 2000-2004 (Final Report MMPA/ESA Permit No. 782-

1532-02 NMFS 2004). Based on this summary report, 2,797 SSLs were observed to be disturbed (or 'alerted') out of 216,821 counted during monthly aerial surveys in both western and eastern populations, a rate of 0.013 SSLs alerted per counted animal. Observations made during these counts indicate it was very rare for SSLs to actually go into the water. The NMML final report for permit number 782-1532 also reported that <10 percent (0.10) of SSLs counted during breeding-season aerial surveys were observed to respond, and that few animals left a site. Observers at field camps in 2002 and 2004 observed little response to survey aircraft, but reported "mild spooks" (animals becoming alert and moving toward the water but remaining on the beach) at Ugamak Island.

Responses of animals to aerial survey aircraft may differ depending on the acoustics of the site (B.Fadely, L. Fritz, NMML, pers. comm). A response similar to that observed at Ugamak Island is more likely at rookeries or haulouts located at the base of a cliff or in an embayment. Little or no response of animals has been observed at sites on flat offshore islands. Given the range of alert response rates with no age-class specificity (0.013 - <0.10), 0.05 was selected as an estimate of the proportion of animals effected for the "alert" response rate for both pups and non-pups. Because no pups were observed entering the water in response to aerial surveys, their "enter water" rate was set to 0.0. For non-pups the "enter water" rate was set to 0.01 (likely an overestimate based on field camp reports and the proportion of sites on flat offshore islands). Estimated "injury" rates were set to 0.001 (1/1,000) for pups and 0.0001 (1/10,000) for non-pups. Pups were assumed to be more at risk than non-pups because pups are more prone to trampling or getting bitten by larger animals.

The NMML final report for permit number 782-1532 reported no observed mortalities during aerial survey activities. It is estimated that no individuals that are just alerted to aerial surveys are likely to subsequently die as a consequence. For non-pups that enter the water, the subsequent mortality rate is estimated at 0.0001 (1/10,000). For individuals injured during a survey, the subsequent mortality rate is estimated to be 0.05 (5/100) mortalities per injured animal for pups and 0.02 (2/100) mortalities for non-pups. Pups are assumed to be at greater risk than non-pups due to their smaller size and dependence on their mothers.

Vessel Surveys

In contrast to aerial and on-land surveys, researchers request incidental disturbance takes for vessel surveys as the number of sea lions that are likely to be affected (which may be less than the number of animals present), and thus all of this group of animals will be alerted (a proportion of 1.0). Proportions of SSLs entering the water during vessel surveys depend on age class and season. ADF&G estimated that the highest mean proportion of animals entering the water during their studies (primarily during breeding season) is 10-13% (0.10-0.13), but may be as low as 3% (0.03). NMML surveys for marked animals in the GOA and AI during May of 2004-2006 found 30% (0.30) of non-pups entered the water. Thus, the enter water rates for breeding season non-pups was estimated at 0.10, non-breeding season non-pups at 0.30, and breeding season pups at 0.0 (consistent with aerial surveys and on land presence). Potential mechanisms for injury and mortality are the same as in response to aerial surveys but the estimated rate of injury for pups is set at 0.01 (10 times as great as the rate for aerial surveys) because of a greater injury risk associated with the greater number of non-pups reacting and entering the water. The estimated rate of injury for non-pups is 0.0001 (the same rate used for non-pups being injured during aerial surveys). There were no observed mortalities during vessel surveys in 2000-2004, according to the NMML final report for permit numbers 782-1532 and 782-1768. Estimated unobserved mortality rates for sea lions responding by becoming alert, entering the water, or getting injured were the same as those described for aerial surveys.

On-Land Surveys

For survey activities conducted on land where researchers are positioned some distance from the animals for observation purposes (i.e., they are in view of animals but not moving among them), the proportions of animals affected by being alerted, entering the water or being injured were estimated to be the same as described for aerial surveys. The estimated indirect mortality rates for animals affected by this activity were the same as those described for aerial surveys.

Disturbance from Researcher Presence among Animals

Because these activities occur among animals on haulouts or rookeries, and most researchers request takes for incidental disturbance as the number that are likely to be affected, it is assumed that all animals listed as potentially exposed would be at least alerted by the presence of researchers on a rookery or haulout. During the breeding season (June and July), it is estimated that only a small proportion of pups (0.01) enter the water while most of the non-pups enter the water (0.9). These proportions are based on the estimates of the NMML researchers who have conducted the field research for permit number 782-1532 during the years 2000-2004. The current procedures used for accessing rookeries and separating pups from non-pups greatly reduce the chances of animals "stampeding" into the water compared to past procedures as documented by Lewis (1987) and Snyder (1998). Based on current procedures (described in Appendix B), the estimated rates of injury and mortality subsequent to these responses are the same as those estimated for the aerial, vessel, or land survey disturbances described above.

The tables distinguish between the mortality risks associated with the herding of animals (roundups) for branding versus roundups for taking morphometric measurements or other procedures, based on the observed mortality rates recorded by NMML and ADF&G. The NMML final report for permit 782-1532 and 782-1768 indicate there were no observed mortalities of pups or non-pups occurring incidental to counting, scat collection, or capture activities not related to branding on rookeries during the breeding season, so the observed mortality rate for these activities is set at 0.

During roundups for branding, a larger number of pups are collected for processing and pups may tend to climb on top of each other. Occasionally a pup will get trapped in a pool of water or in a crevice in the rocks and die before it is handled for branding. Pups have also suffocated or been crushed under the weight of these pup piles. This type of mortality is directly associated with the branding activity but not a consequence of the brand itself and has therefore been calculated separately from the mortality risks of the actual branding procedure. For the western DPS, NMML data for 2000-2005 indicate an observed rate of mortality associated with roundups for branding of 0.001 per pup branded based on 2 mortalities associated with rounding-up 1,449 pups that received brands during 16 rookery visits (Final Report MMPA/ESA Permit No. 782-1532-02 NMFS 2004, and 2006 782-1768 report). For the eastern DPS, data from ADF&G and NMML trip reports (summarized in NMML 2006 permit application) during the period 2001-2005 indicate that the observed mortality rate is 0.007 per pup branded. This higher mortality rate appears to be primarily due to differences in rookery substrate and topography between the geographic areas. No mortalities of non-pups have been observed during roundups for branding.

During the non-breeding-season (August through May) or on haulouts at any time, the presence of researchers among animals is assumed to cause alert behavior in all animals that become aware of the researchers presence. There are very few animals less than 3 months old (pups) at haulouts. Young-of-the-year at haulouts during the non-breeding season are older, larger, and similar to juveniles and adults in their ability to maneuver on land. Because the mechanisms of injury are related to the agility of the animal, the rates of entering the water or being injured as a consequence of the disturbance are therefore assumed to be equivalent for all non-pup age classes. The estimated proportion of animals that enter the water is 0.9 and the rate of injury is 0.0001, the same estimates as for non-pups during the breeding season. Any potential sub-lethal effects related to interruption of suckling bouts are considered in Section 4.6.1.2. The NMML final report for permit 782-1532 (for the years 2000-2004) and for 782-1768 (for 2005) indicate no observed mortalities incidental to counting, scat collecting, or capture activities during any season on haulouts, or on rookeries during the non-breeding-season. The estimated rates of future or eventual mortality (after the researchers have left) for animals that are alerted, enter the water, or are injured are the same as those estimated for the aerial, vessel, or land survey disturbances described above.

Capture and Restraint of Animals

The following estimates are all based on the number of animals captured and do not include the number of animals incidentally exposed to researcher disturbance during captures. It is assumed that all of the captured animals have the potential to be injured or die during capture procedures and will experience some degree of stress associated with capture; and these rates may vary by age-class. Injury or mortality may occur during capture, restraint, or handling procedures and is observable and reported by researchers. Expected rates can be calculated based on numbers of injuries or mortalities as a proportion of the total animals subjected to the specific activity, which is defined as "observed during activity." It is recognized that there is some possibility that mortality may also occur as a result of the capture, restraint, and handling process but not occur until after the animal is released, may not be observed by researchers, and hence is defined as "unobserved/post-capture." The sum of both risks is the total mortality risk associated with a specific technique or procedure. Any potential sub-lethal effects of capture, restraint, or handling are discussed in Section 4.6.1.2.

Capture and physical restraint of 1,725 western stock pups for measurement and sampling by NMML during 2000-2005 resulted in no observed mortalities during the activities (NMML 2006 permit application, NMML permit report for 782-1768). Of 464 animals (juveniles and adults) captured by ADF&G and NMML during 24 capture events from 2000 through 2005, no mortalities of juveniles captured and physically restrained were observed, one non-pup died during a hoop net capture, and no non-pups died during underwater noose captures for a combined expected rate of 0.002 mortalities per sea lion. For this analysis, the observed mortality rate for capture and physical restraint methods is set to 0.0 for pups and 0.002 for non-pups based on the prevalent capture technique. The estimated mortality rates after researchers leave are set to 0.001 for pups and 0.0001 for non-pups, based on NMML's professional judgment.

During 2000-2005, no mortalities occurred due to capture, chemical restraint with inhalable anesthesia (e.g., isoflurane) or handling for measurements, sampling and hot-iron branding of 4,231 pups from eastern and western stocks by NMML, ADF&G, ASLC and ODF&W researchers (summarized in Appendix 1 of NMML's 2006 permit application), for an estimated observed pup mortality rate of 0.0 mortalities per pups handled. Based on the same ADFG and NMML capture data reported above, observed mortality rates for juveniles captured and chemically restrained with inhalable anesthesia (e.g., isoflurane), were 2 anesthesia-related deaths out of 463 animals (yielding a rate of 0.004 for non-pups). The estimated mortality rates after researchers leave (i.e., after all animals recover from anesthesia) are set to the same indirect rates as above, 0.001 for pups and 0.0001 for non-pups.

Juvenile and adult SSLs (non-pups) have also been captured in the past by darting with injectable anesthetics (e.g., Telazol). Based on data summarized from NMML trip reports and data books from 1990-1996 (summarized in NMML 2005 and 2006 permit applications), the observed mortality rate for darting non-pups is 0.034 mortalities per capture attempt. The estimated mortality rate for this technique after researchers leave is estimated at 0.011 based on the finding of one dead non-pup on the beach the week after 88 animals were darted. Some non-pups that are captured may be injected with a sedative (e.g., valium) to assist with physical restraint. The observed mortality rate for use of valium on non-pups is 0.0 and the unobserved mortality rate is estimated to be 0.0001, the same value estimated for physical restraint.

The last row in the capture and restraint table is for intentional lethal takes (for scientific purposes) or capture for permanent captivity. Either procedure results in a removal from the population; therefore, the mortality rate is 1.

Handling, Testing, and Sampling Procedures

With the exception of hot-branding and tooth pulling, which are done only once per animal, the following predicted rates of injury or mortality are based on the number of procedures done regardless of how many animals are actually involved. These risks are estimates of the additional risk of mortality beyond the risk posed (and already accounted for in another table) by initial capture, handling, and restraint (using anesthetics, for example). It is suitably precautionary to separate several categories based on potential handling effects, though pinniped studies published thus far suggest no measurable effects on subsequent survival over a range of handling intensities (Baker and Johanos 2002; McMahon *et al.* 2005). Groupings for the relative additional mortality risk of research procedures were based on a combination of: a) level of invasiveness, b) whether the procedure is routinely used in wildlife and veterinary practice or is an ordinary diagnostic test, and c) potential mechanisms for mortality. These groupings and risk estimates assume that the procedures are conducted by qualified personnel and follow the mitigation practices as described in their permits.

According to ADF&G and NMML permit reports for 2000-2005, there were no observed mortalities of pups or non-pups during branding procedures (although there were mortalities associated with pup roundups for branding, which are considered separately in Table 4.8-2) and thus observed mortality rates for branding are 0.0 for pups and non-pups. A draft manuscript by Hastings *et al.* (2006) estimated the maximum potential mortality related to pup branding disturbance was 0.005-0.006 per pup branded at Lowrie Island, in southeast Alaska. Their estimate includes the combined mortality risk attributable to branding, capture/anesthesia, and incidental to the activity. In this EIS assessment, observed mortality associated with roundups during the breeding season is included in Table 4.8-2 and the observed mortality associated with capture/anesthesia is included in Table 4.8-3. Combined, they have an estimated rate of 0.003 mortalities/branded pup based on observed mortalities. The estimate for unobserved mortalities for the branding procedure in this table is therefore set to a rate of 0.002 mortalities per branded pup to be consistent with the overall mortality estimated by Hastings *et al*. (2006). Rates estimated by Hastings *et al.* (2006) are likely applicable to other sites in Alaska, given similar estimates in total survival over an extended period of time post-disturbance: estimates of pup survival through 11 weeks post-branding disturbance were similar between sites in Southeast Alaska (0.868; Hastings *et al*. 2006) and Ugamak Island (0.829-0.864, based on NMML data from 2005). The estimated mortality rate for non-pups is set to 0.0001 based on NMML's professional judgment.

Several procedures are considered to add negligible additional risk of mortality during or after the procedure, including: bacteriology/virology swabs, hair or nail clipping, temporary external marks such as hair dye or paint, morphological measurements, milk samples, and external physical exams.

Examples of procedures considered to have relatively low risks of post-procedure mortality include blood sampling, flipper tagging, whisker pulling, injections of isotopic or other relatively inert chemical substances (such as deuterated water, tritiated water, Evan's Blue dye), BIA, ultrasound measurements/imaging, stomach intubation, enemas, fecal collection with loops, and insertion of stomach telemeter "pills." These are routine procedures in marine mammal husbandry and rehabilitation and, given best-practices, an anesthetized animal (where appropriate), and a qualified practitioner, these procedures have a low likelihood of creating a condition that may subsequently result in death. Because no directed studies have been conducted to measure post-procedure mortality rates, they are estimated at 0.0001 mortalities per procedure for pups and non-pups based on NMML's professional judgment.

Examples of procedures considered to have relatively medium risks of post-procedure mortality include tooth removal under general anesthesia, biopsies (local and remote), and use of local anesthesia. Because no directed studies have been conducted to measure post-procedure mortality rates, they are estimated at 0.0002 mortalities per procedure for pups and non-pups, double the estimated low-risk procedure rate.

Examples of procedures considered to have relatively high risks of post-procedure mortality include transmitter implantation and other surgeries. Because no directed studies have been conducted to measure post-procedure mortality rates so they are estimated at 0.001 mortalities per procedure for both pups and non-pups, 10 times the estimated low-risk procedure rate.

Animals Taken into Temporary Captivity

The risk of mortality for animals taken into temporary captivity for research purposes contains components from all of the assessment tables described previously (e.g., capture, physical and chemical restraint, and numerous handling/sampling procedures). Temporary captivity also involves risks associated with transport of animals to and from the wild, and the stresses and other risks associated with living in an artificial environment and being chronically exposed to novel stimuli. One research method/risk unique to animals in captivity is dietary manipulations designed to study animals' responses to varying levels of nutrition and caloric content. The types of dietary manipulations performed are described in Appendix B, along with the suite of potential responses from the animals. Another factor unique to research on animals in captivity is that they can be monitored more closely and for longer periods of time post exposure to a risk or stressor than is practical for animals in the wild. As part of this additional monitoring, animals in captivity may receive veterinary care to resolve adverse effects (e.g., injuries, infections) associated with the research more readily and consistently than animals subject to the same or similar research activities in the wild. This may mitigate some of the adverse impacts associated with being in captivity.

The Animal Welfare Act (AWA), administered by the USDA APHIS, specifies requirements for ensuring the general health and welfare of captive marine mammals. APHIS is responsible for ensuring that research facilities adhere to these requirements. Because the AWA is not administered by NMFS, permits issued by NMFS do not include terms and conditions related to compliance with the AWA. However, NMFS permits can and do specify terms and conditions intended to ensure that the research conducted on captive marine mammals is consistent with the humane standards of the MMPA. Thus, NMFS permits require that these animals be monitored during and after experimental procedures and that mitigation measures are followed to minimize the potential for adverse impacts from the research. Permits allowing research on captive SSLs require that no animal be released back into the wild until passing a rigorous health assessment, both to ensure that the animal is capable of surviving in the wild and to minimize the potential for introducing disease into the wild population.

In acknowledgement of the different nature of risks associated with research on captive animals compared to that on wild animals, the mortality risks for temporarily captive animals will be calculated separately. Although much of the risk associated with research on captive animals is mitigated, the estimated mortality risks for all procedures will be assumed to be the same as for wild animals, as described previously.

Assessment of Sub-Lethal Effects Due to Research

This element of the direct and indirect effects analysis discusses the ways the scope of research activities represented by each alternative may affect animals in ways that do not lead to mortality, particularly the effects of research on the reproductive success of animals. As is the case for mortality, sub-lethal effects could occur as a direct result of the research activity itself or indirectly due to other contributing factors. The longer an animal takes to fully recover from the disturbance or injury, the greater the chance that other complicating factors could contribute to the overall effect. For example, a painful injury may make it more difficult for an animal to forage efficiently. If food is plentiful the animal may be able to compensate for the decrease in efficiency by foraging a little longer than usual and may not suffer an overall loss of nutrition. But if the prey population is at a low density or of low quality, a decrease in foraging efficiency could affect an animal's nutritional state. This could lead to a reduced rate of growth or loss of weight that could contribute to reproductive failure of the animal.

There have been efforts to analyze the effects of some research activities on the subsequent growth rates of SSLs. Appendix 1 (on the effects of branding on SSLs) in the NMML and ADFG 2006 permit applications contains the following relevant report. These data suggest that there was no measurable effect of capture, handling, and branding on the growth rate of pups through two years of age.

> "In unpublished studies to assess the effects of branding on Steller sea lion growth, ADFG and NMFS examined 371 juvenile Steller sea lions captured with hoop net or underwater noose techniques during 2000-2003; 27 of these had been branded as pups on natal rookeries. The pups did not differ in mass or length compared to non-branded sea lions of similar age up to 2 years of age (Figures 1 and 2), suggesting there was no effect of branding on subsequent growth. This conclusion was further supported by examination of the distribution of residuals from an analysis of covariance of mass (log-transformed) by sex, branding status (yes/no), and region (natal region for branded pups, region of capture for non-branded pups) with age (log transformed) as a covariate (Figure 3). Though there were significant effects of sex, region and age and the overall model accounted for 71% of variance in mass, there was no significant effect of branding (ANCOVA $F_{(1,370)}$=0.008, *P*=0.931)."

Other researchers have used marked animals to study the effects of various handling procedures on the survival, growth, and birth rates of other species (e.g., endangered Hawaiian monk seals, Baker and Johanos 2002; Antarctic fur seals, Goebel *et al.* 2003). Although these studies found no significant differences between handled and non-handled animals, the same results can not be inferred for SSLs. Additional analysis for these types of effects should be possible in the future if sample sizes for marked and recaptured individuals become large enough to make statistical comparisons.

While sub-lethal effects can result in changes in an individual's body condition, immune response, etc., the analysis of sub-lethal effects in this EIS focuses on reproductive success because of the potential for effects on the population.

The consequences of research-related effects depend on a number of environmental conditions that change seasonally, among years, and among locations. While the result of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect.

Part of the risk assessment includes estimates of the number of animals that are injured but do not die (sub-lethal effects). These estimates will be used as the basis for evaluating the potential effects on the reproductive success of animals exposed to research.

The potential mechanisms established or postulated for effects on reproductive success include:

- Physiological responses to stress that cause failure of embryonic implantation or reabsorption of fetuses.
- Injury to the reproductive organs or damage to hormonal regulation that leads to temporary or permanent sterility.
- Changes in maternal behavior that reduces feeding of pups, affecting growth rates.
- Delayed sexual maturation due to slow growth or poor health.
- Loss or shrinkage of territory, and therefore access to mates.

As noted for the mortality assessment, monitoring designed to specifically measure the effects of research techniques on reproductive success has not been conducted for most activities. There is a great deal of uncertainty regarding not only the intensity of effects but also the mechanisms of effects. The analysis of sub-lethal effects is therefore qualitative in nature and draws on studies of other species where pertinent.

In many cases, the mechanisms or means for potential sub-lethal effects are inferred from studies on the reactions of other species or humans to various types of stress. Direct evidence for the occurrence of most of these mechanisms in SSLs is weak or lacking altogether. Research designed to specifically measure the sub-lethal effects of different research techniques have not been conducted for most activities considered in this EIS. Acquiring comprehensive data on the long-term effects on survival and reproductive success would require an extensive monitoring program and would probably include intrusive research techniques, such as permanent marking and telemetry. Although the information would be useful to have, not only for this EIS assessment but for interpretation of the research data, there is a level of uncertainty regarding the collection of this kind of information. It is not possible to design studies to investigate every potential effect of research without also affecting the animals. It would also likely be difficult to differentiate sub-lethal effects of decreased growth or reproductive output potentially caused by research activities from other potential sources (for example disease, contaminants, nutritional limitation due to fisheries competition or environmental variation, disturbance due to tourism), in addition to the variability of individual behavior. Chapter 5 discusses issues related to post-research monitoring.

Assessment of Beneficial Contributions toward Conservation Objectives

This element of the direct and indirect effects analysis discusses how well the scope of research represented under each alternative would be able to address information needs for taking management actions that would promote recovery and conservation of the species. The evaluation of the alternatives against recovery and conservation goals is founded on the information needs identified in the Draft SSL Recovery Plan (hereafter referred to as the Draft Recovery Plan) (NMFS 2006a). The Draft Recovery Plan was released in 2006 for public review and comments. NMFS is currently incorporating those comments and expects to release a Final Revised Recovery Plan in the fall of 2007. Although there may be substantial differences between the draft and final revised Recovery Plans, this EIS along with current research permits and research permit applications currently under consideration are all based on the conservation objectives and research priorities as described in the 1992 Recovery Plan and the 2006 Draft Recovery Plan.

The goal of the Draft Recovery Plan is to promote the recovery of the western population of SSLs to the point that it could be down-listed from "endangered" to "threatened" and ultimately to the point that it could be removed from the list of threatened and endangered species under the ESA. Although there have been substantial efforts to understand the causes of the population decline in the 1980s and 1990s, the Draft Recovery Plan focuses on factors that are potentially impeding recovery of the population and the actions necessary to promote recovery. The Draft Recovery Plan recommends three broadly defined actions that are necessary for the population to recover:

- Maintain current fishery conservation measures.
- Design and implement an adaptive management program to evaluate fishery conservation measures.
- Continue population monitoring and research on the key threats potentially impeding sea lion recovery.

The first two actions are concerned with fishery management but would rely heavily on SSL field research to monitor the spatial/temporal effects of the fisheries. The last action effectively describes the overall objective of most current SSL research. The Draft Recovery Plan refines these and other conservation objectives into a series of recommended actions that are all directly or indirectly dependent on SSL research.

1. Baseline Population Monitoring
   - 1.1 Continue to estimate population-trends for pups and non-pups.
   - 1.2 Estimate vital rates.
   - 1.3 Monitor health, body condition, and reproductive status.
   - 1.4 Develop and implement live capture methods and non-lethal sampling techniques.
   - 1.5 Develop an implementation plan (for research).
2. Insure Adequate Habitat and Range for Recovery
   - 2.1 Maintain, and modify as needed, critical habitat designations.
   - 2.2 Redefine and catalog rookery and haulout sites and ensure their protection.
   - 2.3 Estimate prey consumption and essential characteristics of marine habitat.
   - 2.4 Determine the environmental factors influencing sea lion foraging and survival.
   - 2.5 Investigate sea lion bioenergetics.
   - 2.6 Assess and protect important prey resources for sea lions.
3. Protect from Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes
   - 3.1 Minimize threat of incidental take in fisheries.
   - 3.2 Minimize threat of intentional killing in fisheries.
   - 3.3 Minimize frequency and severity of sea lion-human interactions in ports and harbors.
   - 3.4 Minimize take by recreational and commercial viewing operations.
   - 3.5 Evaluate and reduce the direct and indirect impacts of research activities.
4. Protect from Diseases, Contaminants, and Predation
   - 4.1 Protect Steller sea lions from disease.
   - 4.2 Protect sea lions from contaminants.
   - 4.3 Predation.
5. Protect from Other Natural or Manmade Factors and Administer the Recovery Program
   - 5.1 Reduce damage to sea lions and their habitat from discharges of pollutants by developing preventive measures.

5.2 Reduce the potential for sea lion entanglement by improving and continuing programs aimed at reducing marine debris.

5.3 Monitor causes of sea lion mortality and use data to direct management actions.

5.4 Effectively administer the Steller sea lion recovery program by continuing to provide a recovery coordinator staff position.

5.5 Improve sea lion conservation by consulting with the State of Alaska on actions that are likely to adversely impact Steller sea lions.

5.6 Conduct an effective outreach program to inform the public about Steller sea lion biology, habitat utilization, and conservation issues.

5.7 Co-manage Steller sea lion subsistence harvests in Alaska by developing co-management agreements as appropriate with Alaska tribes and tribally authorized Alaska Native Organizations (ANOs).

5.8 Improve the effectiveness of research for Steller sea lion recovery by instituting a "fast track" process for expediting NMFS research permits for Steller sea lions.

Regarding the eastern population of SSLs, the Draft Recovery Plan recommended the initiation of a status review to consider removing the eastern DPS from the ESA's List of Threatened and Endangered Wildlife. Given the long-term increasing population-trend and lack of significant conservation threats, the Draft Recovery Plan concludes the primary recovery goal is to develop a post-delisting monitoring plan to ensure that re-listing is not necessary after removal. Key components of this plan relative to research activities have not been prioritized in the Draft Recovery Plan, but would be likely to include population-trend monitoring, genetics research to refine population structure, monitoring terrestrial habitat threats, monitoring for unusual mortality events that may be related to contaminants or other human factors, and monitoring fisheries management plans to ensure that these remain consistent with SSL requirements.

4.8.1.1 Western DPS - Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

<u>Direct and Indirect Mortality Due to Research</u>

There would be no research activities that would affect SSLs in the wild under this alternative; therefore, there would be no mechanism for research-related injury or mortality.

<u>Sub-Lethal Effects Due to Research</u>

There would be no mechanism for research-related injury under this alternative; therefore, there would be no sub-lethal effects on SSLs.

<u>Contribution to Conservation Objectives</u>

Although no research involving interactions with live SSLs in the wild would occur under this alternative, research on captive animals and surrogate species could continue, as could any remote monitoring, observations, and censusing conducted far enough away from SSLs to avoid take. In addition, analyses of data and tissue samples that have already been collected could continue. Research not directed at SSLs, but related to investigating the causes of decline or failure to recover, such as oceanographic studies, could continue under this alternative.

Considering the volume of research that has been conducted on SSLs in the past, there could be a number of new analyses and syntheses conducted from existing data and samples that could address some conservation objectives from the Recovery Plan. However, the usefulness of existing data would be likely to decrease over time as environmental conditions and the status of the population changes.

Past research on SSLs has been used to establish critical habitat boundaries, regulations about what types of activities would be allowed inside critical habitat, and a complex system of fisheries management regulations designed to mitigate potentially adverse effects on SSLs. Under Alternative 1, the level of scientific uncertainty regarding the efficacy of these critical habitat and fishery regulations would likely increase over time as the original data become outdated. Decisions about whether or how to modify regulations to either improve conservation of the species or ease the regulatory burden on the fishing industry would therefore have to rely more on data from other scientific studies and disciplines, including oceanographic and climatological studies, and research on other marine species in the ecosystem.

Conclusion for Conservation Objectives

Research conducted under Alternative 1 could provide a limited amount of information and is therefore considered to have a minor effect in support of the Recovery Plan conservation objectives. It is not clear whether researchers could develop techniques that would provide data comparable to previous census data or make observations in enough areas without causing takes of SSLs to collect information useful for other management decisions. Research conducted under Alternative 1 is unlikely to contribute useful data other than in very limited locations and times.

4.8.1.2 Western DPS - Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

All research activities authorized under Alternative 2 would meet the statutory and regulatory requirements of the permit process (see Section 3.7.1), including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and implementation of permit conditions to mitigate potentially adverse effects. The resulting research program is therefore assumed to be conducted under conditions that minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 2. As described earlier, the mortality estimates are reported with fractions of mortalities as a result of the risk assessment methodology used. This is not meant to suggest that animals would only partly die. The reader may prefer to round these fractions to the nearest whole number but the estimates are intended to reflect probabilities that may occur over time and as a result of many different animals being exposed to the same type of activity or disturbance.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality are described in Section 4.8.1.1 and Appendix B. It is important to note here a distinction between "cause and effect" relationships and "effects" as defined under NEPA. Research can cause injury and mortality directly and indirectly. As stated in Section 4.1, under NEPA "direct effects" are those that occur at the same time and place as the action, whereas "indirect effects" are those that occur at times or places removed from the action. Thus, for the purpose of this analysis, direct effects are those injuries and mortalities occurring while the researchers are present (i.e., at the time of the action). We assume that all of these "direct" mortalities are observed by the researchers. Indirect effects are those injuries and mortalities occurring after researchers have left (removed in time from the action) or the animals have left the site (removed in place from the action). We assume that all of these "indirect" mortalities are unobserved by the researchers. However, this distinction in no way diminishes the "cause and effect" relationship between the research activity and the mortality. The mortality assessment tables estimate mortality due to research regardless of when or where it takes place and the following discussion addresses the combined direct and indirect effects of mortality.

Under this alternative, authorized research could include aerial surveys, vessel surveys, land surveys, scat collection from haulouts or rookeries during the non-breeding-season, as well as other activities that do not involve the capture or handling of animals or the presence of researchers on rookeries during the breeding season. The estimated number of takes and mortality assessments for these activities are described in Tables 4.8-1 and 4.8-2 below.

The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* is 0.9 SSLs per year from the western DPS (Table 4.8-1). Most of this estimated mortality is due to disturbance from aerial surveys (0.8 animals per year). The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 2.5 SSLs per year from the western DPS (Table 4.8-2).

Conclusion for Mortality Effects

The combined estimated direct and indirect mortality from research under Alternative 2 is therefore 3.4 SSLs per year from the western DPS, which is 1.5 percent of PBR for this population (234 animals). The magnitude and intensity of the effects from mortality is therefore considered negligible at the population-level (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects). While the intensity of the predicted mortality would be negligible, the research would be conducted across the geographic range of the population, and the effects would be distributed across the population. Disturbance effects are considered likely given current research techniques, but would only affect individual animals intermittently or infrequently and are therefore considered to be minor in duration.

Table 4.8-1
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Western DPS - Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	10,000	Observed mortality during activity			0	0.0	
			Alert	0.05	500	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	10	0.05	0.5	
	adults and juveniles (non-pups)	98,250	Observed mortality during activity			0	0.0	
			Alert response	0.05	4,913	0.0	0.0	
			Enter water	0.01	983	0.0001	0.098	
			Injured during disturbance	0.0001	9.8	0.02	0.197	0.8
Vessel surveys[3]	pups	0	Observed mortality during activity			0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	0	0.05	0.00	
	non-pups (breeding season)	0	Observed mortality during activity			0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.1	0	0.0001	0.0	
			Injury during disturbance	0.0001	0	0.02	0.0	0.0
	non-pups (non-breeding season)	2200	Observed mortality during activity			0	0.0	
			Alert response	1	110	0.0	0.0	
			Enter water	0.3	660	0.0001	0.07	
			Injury during disturbance	0.0001	0.2	0.02	0.004	0.1
On land[2]	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.05	0	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	0	0.05	0	
	non-pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.05	0	0.0	0.0	
			Enter water	0.01	0	0.0001	0	
			Injured during disturbance	0.0001	0	0.02	0	0.0
Subtotal for estimated mortality due to researcher presence in view of animals								**0.9**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-2
Estimated Mortality Due to Researcher Presence Among Animals. SSL Western DPS Alternative 2

Activity	Age class	Animals exposed[2]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Haul-outs, rookeries non-breeding (scat collection, re-sights, ground counts)	All	27,000	Observed mortality during activity			0	0.0	
			Alert response	1	27,000	0.0	0.0	
			Enter water	0.9	24,300	0.0001	2.4	
			Injured during disturbance	0.0001	2.7	0.02	0.1	
Subtotal for estimated mortality due to researcher presence among animals								**2.5**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to react to researcher presence.

Direct and Indirect Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 2 could potentially affect, most if not all, animals in the population through disturbance from aerial surveys and other activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during a research-related disturbance. Most animals that are exposed to research activities do not die as a result; however, they may experience other effects ranging in intensity from a temporary alteration of their normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

Although research-related injuries under Alternative 2 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is how those injuries might contribute to a population-level effect. Not all sex/age classes are equally susceptible to sub-lethal effects that could alter the productivity of the population. Mature bulls that sustain a substantial injury may have difficulty establishing or reestablishing their breeding territory and could therefore lose potential mates. Although this would reduce individual reproductive success, one or more other bulls would be likely to take their places. All breeding females would still find mates, and the overall productivity of the rookery would remain unchanged. Pups and juveniles that are injured but do not die are likely to recover well before they approach reproductive-age (i.e., 4-5 years for females and 8-9 years for males). Their future survival and reproductive success is therefore much more likely to be determined by the many environmental variables that affect foraging success and growth rate, such as the abundance and distribution of forage fish and changes in ocean regimes.

The sex/age class most susceptible to effects that might decrease overall productivity is breeding-age females. Research-related disturbance could cause a lactating female to abandon her pup or disrupt her normal maternal care to the point that the pup dies. This loss of a pup is considered under the mortality assessment tables. However, a potential mechanism for sub-lethal effects on reproduction in breeding-age females not considered under the mortality assessment tables, is through physiological reactions to stress that cause reabsorption or abortion of fetuses or failure of fertilized embryos to implant. A female that reacts in any of these ways would lose the opportunity to raise a pup the following summer, but not necessarily in subsequent seasons. If these types of injuries occur to a relatively large number of females each year, overall pup production would decrease and hinder population recovery. The relevant question for the analysis is how many breeding-age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Table 4.8-1 indicates that there would be an estimated 10 non-pups injured each year during aerial surveys, with approximately 980 non-pups entering the water. About 660 non-pups per year are predicted to enter the water during vessel surveys, with less than one injury during the disturbances. Table 4.8-2 indicates that about 24,300 animals per year would be predicted to enter the water during scat collection and other non-breeding-season activities, with three non-pups being injured during the disturbances. The mortality tables estimate that about three non-pups would be expected to die each year as a result of this level of disturbance. Unfortunately, we cannot make an equivalent estimate for how many failed pregnancies this level of disturbance would be likely to cause due to several factors:

- Uncertainty about what proportion of these disturbed animals would be reproductive-age females or gestating females.
- Uncertainty about the proportions of animals that are likely to respond in different ways.
- Uncertainty about the mechanisms of effect, particularly prior to implantation, which is several months after mating.
- Uncertainty about the environmental conditions that would strongly influence the ultimate effect on the individual.

Conclusion for Sub-lethal Effects

The magnitude of sub-lethal effects as they relate to population-level changes in productivity under Alternative 2 is unknown. The geographic extent of the research under Alternative 2 is likely to distribute sub-lethal effects across the range of the population. Disturbance effects are considered likely given current research techniques, but they would only affect individual animals intermittently or infrequently and are therefore considered to be minor in duration.

Contribution to Conservation Objectives

The non-intrusive research activities that could be authorized under Alternative 2 could contribute to some of the Draft Recovery Plan objectives. Aerial, vessel, and land-based surveys could be used to support all of the objectives listed under Recovery Plan Action 1, "Baseline Population Monitoring," except for 1.4 – develop capture methods and non-lethal sampling techniques. The ability to track population-trends for pups and non-pups would be consistent with past efforts. Information on vital rates could be collected through resighting of previously branded animals. However, the efficacy of these efforts would decline over time as the number of branded animals declined through mortality. Vital rate information derived from past brand/resight data and new observations would gradually become outdated. Health and body condition monitoring would be limited to visual assessments and scat analysis. Development of an implementation plan for an overall research program could take place under Alternative 2.

Past research on SSLs has been used to catalog important rookery and haulout sites, establish critical habitat boundaries, regulate what types of activities would be allowed inside critical habitat, and to develop a complex system of fishery management regulations designed to mitigate potentially adverse effects on SSLs. Under Alternative 2, the objectives listed under Recovery Plan Action 2, "Insure Adequate Habitat and Range for Recovery," would mostly be supported by data that have already been collected rather than by new field work. The level of scientific uncertainty regarding the efficacy of critical habitat and fishery regulations would be likely to increase over time as the original data become outdated. Efforts to modify the regulations to either improve conservation of the species or to ease the regulatory burden on the fishing industry would therefore have to rely more on data from other scientific studies and disciplines, including oceanographic and climatological studies, and research on other marine species in the ecosystem.

Most of the objectives under Recovery Plan Action 3, "Protect from Over-Utilization for Commercial, Recreational, Scientific, or Educational Purposes," are related to management regulations on fisheries and tourism operations and are not directly related to research on the species. The exception is Objective 3.5 – Evaluate and reduce the direct and indirect impacts of research activities, which is addressed in part through this EIS and the construction of Alternative 2 to eliminate the risk of capture and handling procedures.

Research under Alternative 2 would provide only limited support for the objectives under Recovery Plan Action 4, "Protect from Diseases, Contaminants, and Predation." While work on killer whales could proceed at a high level without intrusive work on SSLs, the ability of researchers to monitor disease and contaminant levels in SSLs would be limited to assays from found carcasses, tissue samples donated by subsistence hunters, and scat and fur samples collected from haulouts. Currently this type of work is reinforced and supplemented by histological and physiological research on captured animals that would not be possible under Alternative 2.

The objectives under Recovery Plan Action 5, "Protect from Other Natural or Manmade Factors and Administer the Recovery Program," are primarily related to management and administrative functions that are not directly dependent on new field research on SSLs. These objectives could be sufficiently supported by research under Alternative 2.

Conclusion for Conservation Objectives

Research conducted under Alternative 2 could provide information to support many of the conservation objectives listed in the Recovery Plan and the effect is therefore considered to be moderate in magnitude. Research conducted under Alternative 2 would be likely to address conservation issues across the range of the population, and to address both long-term and immediate information needs.

4.8.1.3 Western DPS - Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

All research activities authorized under Alternative 3 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and implementation of permit conditions to mitigate potentially adverse effects. The resulting research program is therefore assumed to be conducted under conditions that would minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 3. As described earlier, the mortality estimates are reported with fractions of mortalities as a result of the risk assessment methodology used. This is not meant to suggest that animals would only partly die. The reader may prefer to round these fractions to the nearest whole number but the estimates are intended to reflect probabilities that may occur over time and as a result of many different animals being exposed to the same type of activity or disturbance.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality that result from a variety of research activities are described in Section 4.8.1.1 and Appendix B. The mortality assessment tables estimate mortality due to research regardless of when or where it takes place, and the following discussion addresses the combined direct and indirect effects of mortality.

Under this alternative, authorized research could include:

- Activities with *Researchers in View of Animals* (Table 4.8-3 – aerial, vessel, and land surveys).
- Activities with *Researcher Presence Among Animals* (Table 4.8-4 – on rookeries and haulouts for ground counts, scat collection, captures).
- *Capture and Restraint activities* (Table 4.8-5 – various sex/age classes by various physical and chemical methods).
- *Handling and Sampling Procedures* on animals in the wild (Table 4.8-6 – various procedures, primarily on captured animals, plus remote sampling).
- *Capture, Temporary Captivity, and Release* back into the wild (Table 4.8-7 – non-pups taken to approved facilities for up to three months).

Each table lists the number of takes, estimated injuries, and estimated mortalities of western DPS SSLs for the given activities under Alternative 3, the Status Quo conditions.

The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* is 0.9 SSLs per year (Table 4.8-3). Most of this estimated mortality is due to disturbance from aerial surveys (0.8 animals per year). The number of takes under aerial surveys is several times the total number of animals in this population. This reflects the fact that some existing permits authorize researchers to conduct more than one aerial survey per year for scientific purposes and each animal has the potential to be exposed to research disturbance more than once per year. In some cases, multi-year permits specify a greater survey effort in some years than others, corresponding to a larger number of takes. The numbers of takes used in the tables are the largest number of takes for any given year during the permit period; therefore the number of takes is a "maximum" value for the set of permits considered. This maximum effort, and therefore maximum estimated mortality risk, would only pertain to one or two years within the five-year permit period.

The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 5.8 SSLs per year (Table 4.8-4). The majority of this estimated mortality (3.4 animals per year) would be from non-pups that entered the water during ground counts, scat collection, and brand resight efforts on haulouts and rookeries during the non-breeding-season. The next highest estimated mortality (1.6 animals per year) would be from non-pups entering the water during ground counts, scat collection, and capture activities on rookeries during the breeding season. As described for aerial surveys, the number of takes in this table is greater than the number of animals in the population and reflects the authorization of multiple visits to the same rookeries/haulouts within a year. Under the Status Quo permits, takes by disturbance incidental to a variety of research activities are grouped into a general "incidental disturbance during research activities" category. Thus, Table 4.8-4 does not distinguish among takes for some activities such as roundups of pups for branding, disturbance during scat collection, disturbance of not-target animals during capture activities, etc.

The estimated total direct and indirect mortality from *Capture and Restraint activities* is 5.6 SSLs per year out of the total capture effort of 1,260 pups and 1,165 non-pups (Table 4.8-5). As with other activities, some permits authorize different numbers of captures in different years. The numbers of takes used in the table are the maximum authorized in any given year and therefore represent the maximum estimated mortality risk under the Status Quo permits. The majority of these estimated mortalities (4.9 animals per year) would result from capture and use of an inhalable anesthesia (e.g., isoflurane), with most of those estimated mortalities involving non-pups (4.3 animals per year) rather than pups (0.6 animals per year). Most of the remaining estimated mortality (0.7 animals per year) would be from pups captured with physical restraint methods.

The estimated total direct and indirect mortality from *Handling and Sampling Procedures* on animals in the wild is 2.4 SSLs per year (Table 4.8-6). This estimate does not include the risks associated with capture and restraint of the animals, calculated separately above, and therefore represents the estimated additional mortality from the handling and sampling procedures themselves. The total number of takes (expressed in units of "procedure-animals" in the table) is greater than the number of animals captured because many captured animals are subject to multiple procedures. Captured pups and non-pups are often subjected to various combinations of procedures to address the specific scientific objectives of one or more research programs. Not all captured animals are hot-branded and hot-brands are applied only once per animal in its lifetime. Under the Status Quo alternative, 400 of the 1,260 pups captured would be hot-branded. In addition, those 1,260 captured pups are subject to an average of 3.1 relatively low-risk procedures and 0.6 relatively medium-risk procedures each. Out of the 1,165 non-pups that would be captured per year by various means, 180 would be branded. In addition, those 1,165 non-pups would be subject to an average of 5.5 relatively low-risk procedures and 1.6 relatively medium-risk procedures each. The largest contribution to the estimated mortality in Table 4.8-6 is from relatively low-risk procedures (0.6 non-pups and 0.4 pups per year) due to the large numbers of these procedures that are authorized. Hot-branding contributes an estimated 0.8 mortalities per year, essentially all of which would be pups. Relatively medium-risk procedures account for about 0.5 mortalities per year (0.4 non-pups and 0.1 pups per year).

The estimated total direct and indirect mortality from *Capture, Temporary Captivity, and Release* back into the wild is 0.1 SSLs per year out of 16 taken per year in the existing program (Table 4.8-7). The estimated mortality risk is primarily associated with the numerous procedures done on each animal. However, these animals are monitored constantly throughout these procedures by experienced veterinarians and marine mammal experts. This estimated risk of mortality therefore likely represents a "worst-case scenario."

Conclusion for Mortality Effects

The combined estimated direct and indirect mortality from research under Alternative 3 is 14.8 SSLs per year from the western DPS, which is 6.3 percent of PBR for this population (234 animals). The magnitude and intensity of the effects from mortality is therefore considered negligible on the population-level (see Table 4.4-1 for the impact criteria and Section 2.5 for a description of PBR as a metric for population-level effects). While the intensity of the predicted mortality would be negligible, the research would be conducted across the geographic range of the population, and the effects would be distributed across the population. Disturbance effects that lead to mortality are considered likely given current research techniques. Although each exposure may be brief, individual animals could be affected by different research activities more than four times per year; they are therefore considered to be moderate in frequency.

Table 4.8-3
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Western DPS - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	10,000	Observed mortality during activity			0	0.0	
			Alert	0.05	500	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	10	0.05	0.5	
	adults and juveniles (non-pups)	98,250	Observed mortality during activity			0	0.0	
			Alert response	0.05	4,913	0.0	0.0	
			Enter water	0.01	983	0.0001	0.10	
			Injured during disturbance	0.0001	9.8	0.02	0.20	0.8
Vessel surveys[3]	pups	0	Observed mortality during activity			0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	0	0.05	0.00	
	non-pups (breeding season)	0	Observed mortality during activity			0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.1	0	0.0001	0.0	
			Injury during disturbance	0.0001	0	0.02	0.00	
	non-pups (non-breeding season)	2,200	Observed mortality during activity			0	0.0	
			Alert response	1	110	0.0	0.0	
			Enter water	0.3	660	0.0001	0.07	
			Injury during disturbance	0.0001	0.2	0.02	0.004	0.1
On land[2]	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.05	0	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	0	0.05	0	
	non-pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.05	0	0.0	0.0	
			Enter water	0.01	0	0.0001	0	
			Injured during disturbance	0.0001	0	0.02	0	0.0
Subtotal for estimated mortality due to researcher presence in view of animals								**0.9**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-4
Estimated Mortality Due to Researcher Presence among Animals. SSL Western DPS - Alternative 3

Activity	Age class	Animals exposed[3]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
On rookeries during breeding season[4] (ground counts, scats, captures)	pups	6,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	6,000	0.0	0.0	
			Enter water	0.01	60	0.001	0.06	
			Injured during disturbance	0.001	6	0.05	0.3	
Roundups for branding[2]		400	Observed mortality during activity	1	400	0.001	0.4	0.8
On rookeries during breeding season[4] (ground counts, scats, captures)	adults and juveniles (non-pups)	18,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	18,000	0.0	0.0	
			Enter water	0.9	16,200	0.0001	1.6	
			Injured during disturbance	0.0001	1.8	0.02	0.04	1.6
On haulouts or rookeries during non-breeding season (scats, resights, captures)	pups	0	Observed mortality during activity			0.0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.9	0	0.0001	0.0	
			Injured during disturbance	0.0001	0	0.02	0.0	
	non-pups	37,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	37,000	0.0	0.0	
			Enter water	0.9	33,300	0.0001	3.3	
			Injured during disturbance	0.0001	3.7	0.02	0.07	3.4
Subtotal for estimated mortality due to researcher presence among animals								**5.8**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Number exposed are based on numbers of pups handled or branded, and are a subset of the number exposed to the activity.
[3]Estimate based on the number of animals expected to react to researcher presence.
[4]Breeding season is June/and July.

Table 4.8-5
Estimated Mortality Due to Capture and Restraint Activities. SSL Western DPS - Alternative 3

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	700	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.7	
	adults and juveniles (non-pups)	0	Observed during activity	0.002	0	
			Unobserved/post-capture	0.0001	00	0.7
Capture/chemical anesthesia (inhalable agent-isoflurane)	pups	560	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.56	
	non-pups	1,060	Observed during activity	0.004	4.24	
			Unobserved/post-capture	0.0001	0.106	4.9
Capture/chemical anesthesia (injectable)	non-pups	0	Observed during activity	0.034	0	
			Unobserved/post-capture	0.011	0	0
Capture/chemical sedation (injectable-eg valium)	non-pups	105	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.01	0.0
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**5.6**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-6
Estimated Mortality Due to Handling and Sampling Procedures. SSL Western DPS - Alternative 3

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-branding	pups	400	Observed during activity	0	0	
			Unobserved/post-capture	0.002	0.8	
	adults and juveniles (non-pups)	180	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.018	0.8
Relatively low risk procedures	pups	3,860	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.386	
	non-pups	6,433	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.643	1.0
Relatively medium risk procedures	pups	695	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.139	
	non-pups	1,918	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.384	0.5
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**2.4**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-7
Estimated Mortality Due to Temporary Captivity for Experimentation. SSL Western DPS - Alternative 3

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed during activity			
			Unobserved/post-capture			
	non-pups	16	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.0016	0.0
Chemical sedation (injectable-e.g., valium)	non-pups	208	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.0208	0.0
Permanent mark/hot-branding	non-pups	16	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.0016	0.0
Relatively low risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	
	non-pups	1,104	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.1104	0.1
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	84	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.0168	0.0
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	16	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.016	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.1**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 3 could potentially affect most, if not all, animals in the population through disturbance and capture/handling activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during a research-related disturbance. Most animals exposed to research activities do not die as a result; however, they may experience other effects, ranging in intensity from a temporary alteration of normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

As described under Alternative 2, sub-lethal effects could occur as a direct result of the research activity itself or indirectly due to other contributing factors, but this is difficult to determine as no specific studies on this topic have been conducted. Research activities could cause disturbance or injury to animals that could affect their ability to function normally. The consequences of such research-related effects will depend on a number of factors, including environmental conditions that change seasonally, among years, and among locations. While the effect of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect. Although research-related injuries under Alternative 3 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is how those injuries contribute to a population-level effect. The sex/age class most susceptible to effects that might decrease overall productivity of the population is breeding-age females, primarily through physiological reactions to stress that cause reabsorption or abortion of fetuses, or failure of fertilized embryos to implant. The relevant question for the analysis is how many breeding-age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Table 4.8-3 indicates that there would be an estimated 10 non-pups injured each year during aerial surveys, with approximately 980 non-pups entering the water. About 660 non-pups are predicted to enter the water during vessel surveys, with less than one injury during the disturbances.

Table 4.8-4 indicates that research activities on rookeries during the breeding season could cause about 16,200 non-pups to enter the water and result in injury of about two animals. Research activities on rookeries during the non-breeding-season and on haulouts at any time could cause about 33,300 non-pups to enter the water and result in injury of about four animals.

The animals represented by the takes in Tables 4.8-3 through 4.8-7 are assumed to have responses to capture that are more stressful than entering the water, and they are all considered to have the potential for injury through several mechanisms. There are a total of 1,165 non-pup captures/recaptures authorized each year by various methods under Alternative 3. However, most of the animals involved are juveniles and sub-adults less than three years old. A total of 115 adult female captures are authorized. Considering authorized recaptures, these adult females account for 285 out of the 1,165 takes.

The combined mortality tables for Alternative 3 estimate that 14.8 animals per year would die as a result of research activities, including 11 non-pups per year. The research activities would create enough disturbance to cause about 58,000 non-pups to enter the water per year. Because this number of takes is more than the number of animals in the population, the average animal in the population could be chased into the water by research activities more than once per year. However, we cannot make an estimate for how many reproductive failures this level of disturbance would be likely to cause due to several factors:

- uncertainty about what proportion of these disturbed animals would be reproductive-age females or gestating females;
- uncertainty about the proportions of animals that are likely to respond in different ways;
- uncertainty about the mechanisms of effect; and

- uncertainty about the environmental conditions that could strongly influence the ultimate effect on the individual.

Conclusion for Sub-lethal Effects

The magnitude of sub-lethal effects as they relate to population-level changes in productivity under Alternative 3 is therefore unknown (see Table 4.4.1). The geographic extent of the research permitted under Alternative 3 includes the entire range of the population in the U.S. However, many permittees do not specify which specific rookeries/haulouts their research would affect until a month or two before they begin fieldwork. It is therefore not known at the time of permit issuance how permittees would distribute their activities within a large area. Activities could range from being widely dispersed across the range of the species to being concentrated in a few locations. Disturbance and sub-lethal effects are likely to occur, given the current understanding of how existing research techniques affect SSLs. Although each exposure may be brief, individual animals could be affected by different research activities more than four times per year. Disturbance from research activities is therefore considered to be moderate in frequency.

Contribution to Conservation Objectives

The range of research activities authorized under the Status Quo, Alternative 3, provides the means to address essentially all basic information needs about SSL that are identified in the Draft Recovery Plan. However, there are some sex/age classes underrepresented in the current data sets that address particular issues. Some of these data gaps are due to a lack of interest by researchers (i.e., behavior of mature males) and others are due to inadequate techniques for safely capturing and recapturing larger animals that researchers would like to study more closely (e.g., mature females). Although the following sub-objectives of the Draft Recovery Plan have been addressed to some extent, the limited ability of researchers to recapture specific reproductive females with currently authorized techniques has made it difficult to adequately address these:

- Develop methods and determine reproductive rates including pregnancy and parturition rates (objective 1.2.4).
- Examine the effects of season, age, and sex on body condition (objective 1.3.1).
- Deploy instruments to obtain fine scale data on sea lion foraging habitat (objective 2.3.3).
- Assess the relationships between oceanographic profiles or features and sea lion foraging ecology (objective 2.4.1).
- Determine the physiological diving capabilities and evaluate how this limits the ability to forage successfully (objective 2.5.1).
- Determine the energetic costs to foraging sea lions (objective 2.5.2).
- Develop an energetics model to investigate the interrelationships between prey availability and sea lion growth, condition, and vital rates (objective 2.5.4).

All basic objectives under the Action Plan are currently being addressed except for Objective 1.5 - develop an implementation plan. The intent of this objective is to develop a “comprehensive ecological and conceptual framework that integrates and further prioritizes the numerous recovery actions provided in this plan” (NMFS 2006a). There is currently no coordinated effort to develop an overall research plan that could be part of the recovery implementation plan for the species. Such an overall research plan could refine research priorities, determine an overall strategy for where, when, and how research efforts should be conducted, and specify how research results should be evaluated and used for management decisions. Developing an implementation plan could be pursued under this or any alternative.

Conclusion for Conservation Objectives

Research conducted under Alternative 3 could provide information to support all of the conservation objectives listed in the Recovery Plan, at least for some sex/age classes, and the effect is therefore considered to be major in magnitude. Research conducted under Alternative 3 would be likely to address conservation issues across the range of the population, and address both long-term and immediate information needs.

4.8.1.4 Western DPS - Direct and Indirect Effects of Alternative 4 – The Preferred Alternative – Research Program with Full Implementation of Conservation Goals

All research activities authorized under Alternative 4 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and implementation of permit conditions to mitigate potentially adverse effects. The resulting research program is therefore assumed to be conducted under conditions that minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 4. As described earlier, the mortality estimates are reported with fractions of mortalities as a result of the risk assessment methodology used. This is not meant to suggest that animals would only partly die. The reader may prefer to round these fractions to the nearest whole number but the estimates are intended to reflect probabilities that may occur over time and as a result of many different animals being exposed to the same type of activity or disturbance.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality from a variety of research activities are described in Section 4.8.1.1 and Appendix B. The mortality assessment tables estimate mortality due to research regardless of when or where it takes place so the following discussion addresses the combined direct and indirect effects of mortality.

Under this alternative, authorized research could include:

- *Activities with Researcher Presence in View of Animals* (Table 4.8-8 - aerial, vessel, and land surveys).
- *Activities with Researcher Presence Among Animals* (Table 4.8-9 – on rookeries and haulouts for ground counts, scat collection, captures, etc.).
- *Capture and Restraint Activities* (Table 4.8-10 – various sex/age classes by various physical and chemical methods).
- *Handling and Sampling Procedures* on animals in the wild (Table 4.8-11 – various procedures, primarily on captured animals plus remote sampling).
- *Capture, Temporary Captivity, and Release* back into the wild (Table 4.8-12 – non-pups taken to approved facilities for up to three months).

Each table lists the number of takes, estimated injuries, and estimated mortalities for the given activities under Alternative 4 for the western DPS of SSLs.

The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* is 4.1 SSLs per year (Table 4.8-8). Most of this estimated mortality (2.9 animals per year) is due to disturbance from vessel surveys. Under Alternative 4, vessel surveys are expected to expand from Status Quo conditions to accommodate an increased brand resight effort intended to improve vital rate models. Aerial surveys could expand to include a complete winter survey and could result in an estimated 0.9 mortalities per year. Land-based surveys could also expand under Alternative 4, but could account for less than one mortality per year. As was the case under Alternative 3, the number of takes that could be authorized per year is greater than the number of animals in the population, indicating that the average animal is likely to be exposed to research activities multiple times per year. Also, survey effort, and therefore the number of takes per year, is expected to vary among years under Alternative 4. The numbers used in the mortality tables represent a "maximum effort" year and therefore the maximum estimated mortality risk per year. Because each year within the five-year permit period may have varying levels of take (some years less than others), this maximum number of takes is not expected to occur every year within the permit period.

The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 9.8 SSLs per year (Table 4.8-9). Under Alternative 4, it is assumed that capture activities would increase for both pups and non-pups to support an expanded brand resight effort and other work. Scat collection efforts are also assumed to expand considerably, with monthly collection efforts in some locations. Ground count efforts are assumed to remain the same as under the Status Quo because these are considered adequate. The majority of the estimated mortality (6.8 animals per year) could result from non-pups entering the water during ground counts, scat collection, capture efforts, and brand resight efforts on haulouts and rookeries during the non-breeding-season. The next highest estimated mortality (1.8 animals per year) could result from non-pups entering the water during ground counts, scat collection, and capture activities on rookeries during the breeding season. The next highest estimated mortality (0.7 pups per year) could be expected during pup roundups for branding. These mortalities would be related to the pups piling on top of each other during the roundup with the potential for suffocation or drowning in pools, rather than the branding activity itself, which is calculated separately. As described for activities in Table 4.8-9, the number of takes in this table is greater than the number of animals in the population and reflects multiple visits to the same rookeries/haulouts per year, at least during some years of the five-year permit period.

The estimated total direct and indirect mortality from *Capture and Restraint activities* is 12.4 SSLs per year, out of the total capture effort of 1,560 pups and 1,285 non-pups per year (Table 4.8-10). This total includes five intentional lethal takes described below. As with other activities, capture efforts, and therefore the number of takes per year, are expected to vary between years under Alternative 4. The numbers used in the mortality tables represent a “maximum effort” year, and therefore the maximum estimated mortality risk per year, which may only pertain to a few years within the five-year permit period. The majority of estimated mortalities (5.3 animals per year) could result from capture and use of an inhalable anesthesia (e.g., isoflurane), with most of those estimated mortalities involving non-pups (4.4 animals per year) rather than pups (0.9 animals per year). The next highest estimated mortality (1.3 animals per year) could be from non-pups captured with injectable agents (darts). Most of the remaining estimated mortality (0.7 animals per year) could result from capture and physical restraint of pups.

Under Alternative 4, it is assumed that there would be an increased effort to capture and recapture breeding-age females in order to attach satellite transmitters and for other sampling/testing purposes. Current permits prohibit the use of the available injectable anesthetic (i.e., Telazol) on females potentially lactating or pregnant (essentially all mature females) due to concerns about potentially adverse effects of Telazol on fetal development and nursing pups. Because darting with Telazol is the most efficient means of capturing and recapturing specific large animals, this restriction limits the ability of researchers to work with breeding-age females. In order to expand research efforts with breeding-age females under Alternative 4, either studies would need to be conducted that demonstrated the safety of Telazol sufficient to allow its use, or new techniques/drugs would need to be developed for capture of this sex/age class. It is assumed that new, experimental drugs and procedures would be safety-tested and refined on surrogate species first (e.g., California sea lions or other non-ESA listed species) but that the new techniques would eventually be authorized for use on the western DPS SSLs. Permit conditions would contain mitigation measures to minimize the risk to individual animals, but the initial transition to use on SSLs could still be considered experimental and potentially lethal to a targeted female and her dependent pup. One way to conservatively estimate the risk of a potentially dangerous procedure in the mortality assessment tables is to assume that a new procedure will be lethal until the actual risk values are established by experience. Table 4.8-10 includes a small number of “intentional lethal takes” to illustrate the policy that intentional mortalities could be authorized under Alternative 4. The number of intentional mortalities under Alternative 4 has been set to five in this EIS assessment only as an example of how requests for intentional mortality (e.g., euthanasia of moribund animals) and/or potentially lethal experimental procedures (as described above) could be addressed in the risk assessment tables as part of an overall risk assessment for a given scope of research. It is important to note that, as is the case for all the other take numbers assessed under Alternative 4 for particular research activities, NMFS would be under no obligation to authorize five lethal takes or limit the number of lethal takes to five in the future. The numbers used in this assessment are proxies for the numbers and types of takes that researchers may request in permit applications in the future.

The estimated total direct and indirect mortality from *Handling and Sampling Procedures* on animals in the wild is 3.3 SSLs per year (Table 4.8-11). This estimate does not include the risks associated with *Capture and Restraint* of the animals, calculated separately, and therefore represents the estimated additional mortality from the handling and sampling procedures themselves. Under Alternative 4, it is assumed that there will be an increase in the number of pups and non-pups captured and an increase in the number of procedures done on captured individuals to address conservation objectives. As with Alternative 3, the total number of takes permitted for *Handling and Sampling Procedures* (expressed in units of “procedure-animals” in the table) would be greater than the number of animals captured because many captured animals are subject to multiple procedures. Under Alternative 4, 700 of the 1,560 pups captured per year would be hot-branded. In addition, those 1,560 captured pups would be subject to an average of 3.0 relatively low-risk procedures and 0.5 relatively medium-risk procedures. Out of the 1,285 non-pups that would be captured per year by various means, 300 would be hot-branded. In addition, those 1,285 non-pups would be subject to an average of 6.0 relatively low-risk procedures and 1.8 relatively medium-risk procedures each. The largest contribution to the estimated mortality in this table is from relatively low-risk procedures (0.8 non-pups and 0.5 pups per year). Hot-branding contributes an estimated 1.4 mortalities per year, essentially all pups. Relatively medium-risk procedures account for about 0.6 mortalities per year (0.5 non-pups and 0.2 pups per year). Under Alternative 4, it is assumed that 30 non-pups would be subject to relatively high-risk procedures, but this is expected to account for less than one mortality per year.

It is assumed that the number of animals taken into temporary captivity for experimentation would increase to 26 non-pups per year under Alternative 4. The estimated total direct and indirect mortality from *Capture, Temporary Captivity, and Release* is 0.2 SSLs per year (Table 4.8-12). The estimated mortality risk is primarily associated with the numerous procedures done on each animal. However, as under the Status Quo conditions, these animals would be monitored constantly throughout these procedures by experienced veterinarians and marine mammal experts, and this estimated risk of mortality likely represents a “worst-case scenario.”

<u>*Conclusion for Mortality Effects*</u>

The combined estimated direct and indirect mortality from research under Alternative 4 is 29.8 SSLs per year from the western DPS, which is 12.7 percent of PBR for this population (234 animals). Based on the impact criteria presented in Table 4.4-1, the magnitude and intensity of the effects from mortality is therefore considered minor on the population level. The research would be conducted across the geographic range of the population. However, some of the specific rookeries/haulouts where research would take place each year under Alternative 4 would likely not be known until a month or two before fieldwork began (as under the Status Quo). It would therefore not be known at the time of permit issuance how permittees would distribute their activities within a large area. These could range from being widely dispersed across the range of the species to being concentrated in a few locations. Disturbance effects that lead to mortality are likely to occur given the current research techniques used. Although each exposure may be brief, individual animals could be affected by different research activities more than five or six times per year; thus disturbance effects are considered moderate in frequency.

Table 4.8-8
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Western DPS Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	10,000	Observed mortality during activity			0	0.0	
			Alert	0.05	500	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	10	0.05	0.5	
	adults and juveniles (non-pups)	128,250	Observed mortality during activity			0	0.0	
			Alert response	0.05	6413	0.0	0.0	
			Enter water	0.01	1283	0.0001	0.128	
			Injured during disturbance	0.0001	12.8	0.02	0.257	0.9
Vessel surveys[3]	pups	5,000	Observed mortality during activity			0	0.0	
			Alert response	1	250	0.0	0.0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	50	0.05	2.5	
	non-pups (breeding season)	7,500	Observed mortality during activity			0	0	
			Alert response	1	375	0	0	
			Enter water	0.1	750	0.0001	0.075	
			Injury during disturbance	0.0001	0.75	0.02	0.015	
	non-pups (non breeding season)	9,700	Observed mortality during activity			0	0.0	
			Alert response	1	485	0.0	0.0	
			Enter water	0.3	2,910	0.0001	0.29	
			Injury during disturbance	0.0001	1.0	0.02	0.02	2.9
On land[2]	pups	5,000	Observed mortality during activity			0	0.0	
			Alert response	0.05	250	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	5	0.05	0.25	
	non-pups	15,000	Observed mortality during activity			0	0.0	
			Alert response	0.05	750	0.0	0.0	
			Enter water	0.01	150	0.0001	0.015	
			Injured during disturbance	0.0001	1.5	0.02	0.03	0.3
Subtotal for Table 1 - Estimated mortality due to researcher presence in view of animals								**4.1**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-9
Estimated Mortality Due to Researcher Presence among Animals. SSL Western DPS - Alternative 4

Activity	Age class	Animals exposed[3]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
On rookeries during breeding season [4] (ground counts, scats, captures)	pups	7,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	7,000	0.0	0.0	
			Enter water	0.01	70	0.001	0.07	
			Injured during disturbance	0.001	7	0.05	0.4	
Roundups for branding[2]		700	Observed mortality during activity	1	700	0.001	0.7	1.2
On rookeries during breeding season [4] (ground counts, scats, captures)	adults and juveniles (non-pups)	20,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	20,000	0.0	0.0	
			Enter water	0.9	18,000	0.0001	1.8	
			Injured during disturbance	0.0001	2	0.02	0.04	1.8
On haulouts or rookeries during non-breeding season (scats, resights, captures)	pups	0	Observed mortality during activity			0.0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.9	0	0.0001	0.0	
			Injured during disturbance	0.0001	0	0.02	0.0	
	non-pups	74,000	Observed mortality during activity			0.0	0.0	
			Alert response	1	74,000	0.0	0.0	
			Enter water	0.9	66,600	0.0001	6.7	
			Injured during disturbance	0.0001	7.4	0.02	0.1	6.8
Subtotal for estimated mortality due to researcher presence among animals								**9.8**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Number exposed are based on numbers of pups handled or branded, and are a subset of the number exposed to the activity..
[3]Estimate based on the number of animals expected to react to researcher presence.
[4]Breeding season is June and/July.

Table 4.8-10
Estimated Mortality Due to Capture and Restraint Activities. SSL Western DPS Alternative 4

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	700	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.7	
	adults and juveniles (non-pups)	30	Observed during activity	0.002	0.06	
			Unobserved/post-capture	0.0001	0.003	0.8
Capture/chemical anesthesia (inhalable agent-isoflurane)	pups	860	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.86	
	non-pups	1,090	Observed during activity	0.004	4.36	
			Unobserved/post-capture	0.0001	0.109	5.3
Capture/chemical anesthesia (injectable)	non-pups	30	Observed during activity	0.034	1.02	
			Unobserved/post-capture	0.011	0.33	1.3
Capture/chemical sedation (injectable-eg valium)	non-pups	135	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.014	0.0
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	5	Unobserved/post-capture	1	5	5
Subtotal for estimated mortality due to capture and restraint activities						**12.4**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-11
Estimated Mortality Due to Handling and Sampling Procedures. SSL Western DPS Alternative 4

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-branding	pups	700	Observed during activity	0	0	
			Unobserved/post-capture	0.002	1.4	
	adults and juveniles (non-pups)	300	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.03	1.4
Relatively low risk procedures	pups	4,630	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.463	
	non-pups	7,720	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.772	1.2
Relatively medium risk procedures	pups	830	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.166	
	non-pups	2,300	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0. 46	0.6
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	30	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.03	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**3.3**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-12
Estimated Mortality Due to Temporary Captivity for Experimentation. SSL Western DPS Alternative 4

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/transport/holding/release	pups	0	Observed during activity			
			Unobserved/post-capture			
	non-pups	26	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.003	0.0
Chemical sedation (injectable-e.g., valium)	non-pups	338	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.034	0.0
Permanent mark/hot-branding	non-pups	26	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.003	0.0
Relatively low risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	
	non-pups	1,794	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.18	0.2
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	136	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.03	0.0
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	26	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0.03	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.2**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 4 could potentially affect all animals in the population through exposure to disturbance and capture/handling activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during research-related disturbance. Most animals exposed to research activities do not die as a result; however, they may experience other effects, ranging in intensity from a temporary alteration of normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

As described under Alternative 2, sub-lethal effects could occur as a direct result of the research activity itself or indirectly, due to other contributing factors; however, this is difficult to determine as no specific studies on this topic have been conducted. Research activities could cause disturbance of or injury to animals that could affect ability to function normally. The consequences of such research-related effects would depend on a number of factors including environmental conditions that vary seasonally, among years, and among locations. While the effect of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect. Although research-related injuries under Alternative 4 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is on how those injuries contribute to a population-level effect. The sex/age class most susceptible to effects that might decrease overall productivity of the population is breeding-age females, primarily through physiological stress reactions that cause reabsorption or abortion of fetuses, or failure of fertilized embryos to implant. The relevant question for the analysis is how many breeding-age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Table 4.8-8 indicates that there would be an estimated 13 non-pups injured each year during aerial surveys, with approximately 1,280 non-pups entering the water each year. About 3,660 non-pups are predicted to enter the water each year during vessel surveys, with two non-pups injured during the disturbances. During land surveys, 150 non-pups are estimated to enter the water each year with two non-pups injured during the disturbances.

Table 4.8-9 indicates that research activities on rookeries during the breeding season would be predicted to cause about 18,000 non-pups to enter the water each year and to injure about two animals. Research activities on rookeries during the non-breeding-season and on haulouts at any time would be predicted to cause about 66,600 non-pups to enter the water each year and to injure about eight animals annually.

The animals represented by the takes in Tables 4.8-8 through 4.8-12 are assumed to have responses to capture that are more stressful than entering the water, and all are considered to have the potential for injury through several mechanisms. Under Alternative 4, a total of 1,285 non-pup captures/recaptures authorized each year by various methods is assumed. Under the Status Quo, most of the non-pups captured are juveniles and sub-adults less than three years old. While this is still likely to be true under Alternative 4, there would be an increased effort to capture breeding-age females to monitor their foraging behavior and for other purposes. It is therefore assumed that the non-pup captures under Alternative 4 would include up to 200 adult females. Considering authorized recaptures, these adult females would account for an estimated 400 out of the 1,285 takes.

The combined mortality tables for Alternative 4 estimate that 29.8 animals per year would die as a result of research activities, including 22 non-pups per year, and that the research activities would create enough disturbance to cause about 90,000 non-pups to enter the water each year. Because this number of permitted takes is more than the number of animals in the population, the average animal in the population would likely be chased into the water by research activities several times per year. However, we cannot make an estimate for how many reproductive failures this level of disturbance would be likely to cause due to several factors:

- Uncertainty about what proportion of these disturbed animals would be reproductive-age females or gestating females.

- Uncertainty about the proportions of animals likely to respond in different ways.
- Uncertainty about the mechanisms of effect.
- Uncertainty about the environmental conditions that would strongly influence the ultimate effect on individuals.

Conclusion for Sub-lethal Effects

The magnitude of sub-lethal effects as they relate to population-level changes in productivity under Alternative 4 is therefore unknown (see Table 4.4.1). The geographic extent of the research under Alternative 4 is likely to distribute sub-lethal effects across the range of the population. Disturbance and sub-lethal effects are considered likely given current research techniques. Although each exposure may be brief, individual animals could be affected by different research activities four or five times per year; disturbances they are therefore considered to be moderate in frequency.

Contribution to Conservation Objectives

Alternative 4 is designed to allow researchers to address all objectives and sub-objectives of the Draft Recovery Plan (see Section 4.8.1.4). The implementation of the alternative would require an increased level of funding and other resources compared to the Status Quo. Although such funding levels have not been appropriated by Congress or secured through other sources, Alternative 4 assumes that the full scope of research analyzed above could be authorized if funding were available. This means that researchers would be able to develop new capture techniques and drugs that would allow capture/recapture of mature animals to address sex/age class data gaps. In addition, procedures that present a greater risk of injury to individual animals could be permitted if they addressed essential data needs and had a reasonable chance of succeeding.

The expanded research efforts under Alternative 4 would highlight the need to address Objective 1.5 of the Draft Recovery Plan - develop an implementation plan. This implementation plan would be a "comprehensive ecological and conceptual framework that integrates and further prioritizes the numerous recovery actions provided in this plan" (NMFS 2006a). Development of an overall research plan as part of this effort would be essential for coordinating and maximizing the benefits of the expanded research efforts under Alternative 4. Such an overall research plan would refine research priorities, determine an overall strategy for where, when, and how research efforts should be conducted, and specify how research results should be evaluated and used for management decisions. Development of such a plan would require a substantial and coordinated commitment from NMFS and other federal and state agencies, Alaska Native organizations, academic institutions, environmental groups, the fishing industry, and other interested parties.

Conclusion for Conservation Objectives

Research conducted under Alternative 4 could provide information to support all of the conservation objectives listed in the Recovery Plan and the effect is therefore considered to be major in magnitude. Research conducted under Alternative 4 would be likely to address conservation issues across the range of the population and address both long-term and immediate information needs.

4.8.1.5 Western DPS - Cumulative Effects

Summary of Direct and Indirect Effects

Direct and indirect mortality and sub-lethal effects of research activities may result from disturbance, capture, and handling. The alternatives vary in the estimated amount of mortality that would occur under a given scope of research (Sections 4.8.1.1 through 4.8.1.4). For Alternatives 1, 2, and 3, the estimated mortality is less than 10 percent of PBR and is considered negligible on a population-level. The estimated mortality under Alternative 4 is about 13 percent of PBR and is considered minor on a population level. The magnitude of sub-lethal effects would be negligible for Alternative 1 and unknown for Alternatives 2, 3, and 4 because of uncertainty factors listed above. Alternative 1 would address few conservation objectives described in the Draft SSL Recovery Plan. Alternative 2 would address many but not all conservation objectives. Alternative 3 would address most conservation objectives, and Alternative 4 would address all conservation objectives.

Summary of Lingering Past Effects

The western DPS of SSLs has experienced a rapid population decline in the past 30 years and has not recovered. The causes of the decline and lack of recovery are still under investigation, but likely factors include competition with commercial fisheries, changes in the ocean climate and environment, predation by killer whales, environmental contamination, and anthropogenic mortality (NMFS 2006a). The role of these and other potential factors in the past decline, and their lingering effects on the current population status, are described in Section 3.1 of this document, and in other recent EIS documents (NMFS 2001a; NMFS 2004a).

The annual stock assessment reports (Angliss and Outlaw 2007) list as the past sources of anthropogenic mortality: incidental take in commercial fisheries, subsistence harvests, and illegal shooting. Commercial fisheries from different areas within the range of the western DPS of SSLs had a mean incidental mortality of 24.6 SSLs per year from 1990-2004 (Angliss and Outlaw 2007). Subsistence harvest from all areas within the range of the western DPS averaged 191 SSLs per year from 2000-2004 (Wolfe *et al.* 2002; Wolfe *et al.* 2004; Zavadil *et al.* 2004). Prior to passage of the MMPA in 1972, an estimated 45,000 SSLs were killed in Alaska by commercial harvest and predator-control programs. These activities became illegal after passage of the MMPA, but fishermen were still allowed to shoot SSLs to protect their fishing efforts. A large but unknown number of SSLs were as killed (NMFS 2006). This provision was repealed in 1990 when the species was listed as threatened under the ESA, and the level of illegal shooting is now believed to be minimal. NMFS enforcement records state that there were two cases of illegal shootings of SSLs in the Kodiak area in 1998, both of which were successfully prosecuted (Angliss and Outlaw 2007).

Other sources of disturbance of SSLs that are similar to the types of disturbance from research include researchers studying other nearshore and island-dwelling species such as sea otters, seabirds, and fish. These types of disturbances can lead to similar mechanisms for mortality and sub-lethal effects on reproduction as described in the direct/indirect effects sections. However, because these types of research activities generally take place on the periphery of SSL concentrations, the intensity of disturbances is likely to be much less than research activities designed to get close to SSLs. Most, if not all, of this type of research takes place within designated SSL critical habitat or on AMNWR lands that require specific permits, which stipulate that researchers must avoid SSLs to the greatest extent possible.

Analysis of Reasonably Foreseeable Future Actions (RFFAs)

The following is an analysis of impacts on SSLs based on the RFFA groups described in Table 4.4-2. Much of this analysis is summarized from the threats analysis in the Draft SSL Recovery Plan (NMFS 2006a).

Commercial fisheries: Potential future effects of commercial fishing can be divided into two major subgroups: 1) competition with fisheries and 2) incidental take due to interactions with active fishing gear.

Competition with fisheries recognizes that there is a substantial overlap between the size of fish and species targeted by commercial fisheries and those consumed by SSLs. The current system of fishery regulations designed to mitigate potential adverse effects on SSLs is based on the concept of distributing fishing effort over time and space to minimize localized depletion of prey for SSLs. The potential adverse impact of competition with fisheries is ranked "high" in the future threats analysis of the Draft Recovery Plan based on the concern that the aggregate effects of seasonal fishing in SSL foraging areas have resulted in alterations to the location, density, distribution, availability, and quality of SSL prey.

The potential impact from incidental take associated with active fishing gear is based on past assessments of incidental take from fishery observer data, self-reported fisheries data, and data on stranded animals. The average number of lethal entanglements in active U.S. fishing gear from 1990 to 2001 was 31 SSLs per a year (NOAA

2006). Because large segments of the fishing industry do not have observer coverage and do not self-report, incidental take in commercial fisheries is ranked as “medium” in the future threats analysis of the Draft Recovery Plan.

Ocean climate variability: The effects of climate change or regime shifts (i.e., Pacific decadal oscillations) on SSLs are not clearly understood. Regime shifts have altered the quality and availability of SSL prey in the past and are likely to do so in the future, which could lead to nutritional stress and possibly other unforeseen effects. These effects could interact synergistically with competition for prey with commercial fisheries. Due to the unpredictable dynamics of future climate changes and their potential for significant effects on SSL prey, the potential impact of ocean climate change is ranked as “high” in the future threats analysis of the Draft Recovery Plan.

Predation: The primary predator of SSLs is killer whales. However, there is substantial scientific disagreement and uncertainty about the relative importance of killer whale predation in the decline of the western population and the extent to which it may be impeding recovery of the population. Due primarily to a high degree of uncertainty, the potential impact of predation is ranked as “high” in the future threats analysis of the Draft Recovery Plan.

Scientific research: Although scientific research does result in disturbance to SSLs, these disturbances are monitored and attempts are made to minimize impacts. Moreover, as previously described, most research activities associated with other marine species, such as USFWS research on birds and sea otters, are on the periphery of SSL concentrations. As a result these researchers are not in close proximity to SSLs. Also, as much of the research on other marine species takes place in protected areas or SSL critical habitat, where permits declaring and outlining impact mitigation measures are necessary and help to minimize future potential impacts. For example, when USFWS personnel are performing bird surveys and are in an area where there are SSLs, they will avoid direct confrontation, which means they will not land on rookeries and move between the animals. Due to the relatively low volume of research-related SSL encounters and their ability to be mitigated, the potential impacts associated with scientific research activities on other marine species besides SSL are ranked as “low” in the future threats analysis of the Draft Recovery Plan.

Toxic pollutants: SSL tissue samples have shown relatively low levels of pollutants, and these substances are not believed to have caused high levels of mortality or reproductive problems. However, there have not been any studies on the effects of pollutants at the population-level to determine potential impacts on vital rates and population-trends. Long-term exposure to and bioaccumulation of pollutants such as DDT and PCB can result in damage to DNA, RNA, and cellular proteins (Matkin 2001). Therefore, due to the various unknowns associated with the effects of pollutants on SSLs and the risk of an oil spill in SSL critical habitat, the potential impacts of toxic pollutants are ranked as “medium” in the future threats analysis of the Draft Recovery Plan.

Subsistence activities: The ESA and the MMPA have provisions to allow coastal Alaska Natives to harvest threatened, endangered, or depleted species for subsistence purposes. The past annual number of takes (including struck and lost) from 1997-2004 was between 165 and 215 SSLs from the western DPS, down from about 550 SSLs in 1992 (NOAA 2006). Because estimates of subsistence take numbers are fairly accurate and the relative impacts of harvest can be mitigated, the overall potential impact is ranked as “low” in the future threats analysis of the Draft Recovery Plan.

Disease and Parasitism: Serological data indicate a prevalence of antibodies in SSLs for several endemic disease agents that could impede recovery of the population. However, the potential for those agents to cause disease has not been documented. Parasites may have little impact on otherwise healthy animals, but their effects could become substantial if combined with other stresses. Overall, due to the relatively low frequency of occurrence, the potential impacts of disease and parasitism are ranked as “low” in the future threats analysis of the Draft Recovery Plan.

Commercial shipping: The potential disturbance impacts of commercial and recreational vessel traffic vary depending on the speed and size of the vessels, season, and reproductive stage of the animal. Chronic or severe disturbances could cause animals to abandon traditional haulouts and rookeries. Commercial shipping also contributes to the potential for oil spills. Overall, due to the relatively modest volume of vessel traffic and the high degree of possible mitigation, the potential impacts from commercial shipping are ranked as "low" in the future threats analysis of the Draft Recovery Plan.

Invasive species: The presence of vessels, which could be rat-infested, poses the threat of releasing disease carrying rodents on islands (e.g., the Pribilof Islands). Efforts to eradicate invasive species (e.g., rats and foxes) will likely cause some disturbance of SSLs. However, USFWS personnel who conduct eradication programs in SSL habitats avoid direct confrontation (i.e., they do not land on rookeries and move discreetly around the outside of hauled-out animals) (Personal communication Vernon Byrd, USFWS). Also, non-native marine species could be introduced into SSL habitat through ballast water transfers, but long-term effects on the food web are unknown. The potential impact from invasive species and related eradication activities is ranked as "medium" in the future threats analysis of the Draft Recovery Plan.

Other economic development: RFFAs concerning economic development include: 1) military activity; 2) infrastructure development; and 3) tourism.

The main military activities that could potentially disturb SSLs include vessel operation and missile defense system launches. Impacts from vessels were discussed under the commercial shipping RFFA. Concerning missile defense, NMFS recently authorized the take of up to 900 SSLs per year for a five-year period at the Kodiak Launch Complex. However, that many takes is not expected to occur based on observed disturbances during past launches. Therefore, due to the modest degree of harassment associated with military activity, the potential future impact of military activity is considered minor.

Infrastructure development could include such things as sewer outfalls, port and harbor operations, and offshore oil and gas production. NMFS has processed applications for future Level B harassment of SSLs in the northwest portion of Upper Cook Inlet. These activities will take place in areas that are not typical SSL habitat and no SSLs were sighted in this area during recent beluga whale surveys, thus the potential future impact from infrastructure development is considered minor.

The majority of tourist activities relate to vessel traffic on wildlife sightseeing cruises. The potential impacts of vessel traffic were ranked low and previously described under the commercial shipping RFFA. Flight-seeing tours could also affect SSLs, but regulations concerning critical habitat air space would minimize the potential impacts. As a result of relatively infrequent tourism-based interactions and the ability to mitigate, the potential future impact of tourism is considered minor.

Cumulative Effects

Mortality

The primary contributors to cumulative anthropogenic mortality listed in the stock assessment reports (Angliss and Outlaw 2007) are subsistence harvest (191 animals per year) and incidental take in fishing gear (25 animals per year). This totals 216 animals per year, which is 92 percent of PBR for this population (234 animals). Alternative 1 would contribute no mortalities to this total and would therefore have no cumulative effect on mortality. Alternative 2 would contribute an estimated 3.4 mortalities per year, raising the overall total to about 220 animals, which is 94 percent of PBR. Alternative 3 would contribute an estimated 14.8 mortalities per year, raising the overall total to about 231 animals, which is 99 percent of PBR. Alternative 4 would contribute an estimated 29.8 mortalities per year, raising the overall total to about 246 animals, which is 105 percent of PBR. Under the criteria developed to assess the impacts of the alternatives (Table 4.4-1), the cumulative level of mortality for this population as a percentage of PBR would be considered "major" under all alternatives.

As explained in Section 2.5, the formula for PBR is defined in the MMPA and is a precautionary or conservative measure of human-caused mortality that could be expected to affect a marine mammal population's ability to recover from a depleted state. For endangered marine mammals the formula reserves 90 percent of the population's annual net production for recovery of the stock. This means that human-caused mortalities that exceeded PBR would not necessarily cause the population to decline (unless human-caused mortality accounted for all of the annual net production, [i.e., 1,000 percent of PBR]), but could slow the rate at which the population recovers. Through a series of extensive simulation modeling, NMFS has calculated that keeping human-caused mortality at or below PBR would increase the recovery time of endangered marine mammals by no more than 10 percent (Wade 1998). Total cumulative human-caused mortalities approaching or slightly above 100 percent of PBR, as occur under all of the alternatives, would therefore be unlikely to cause the population to decline but could slow its recovery.

Sub-Lethal Effects

Disturbance from research activities, marine vessel traffic, air traffic, fishing operations, tourism, and other sources can cause physical responses and physiological effects in SSLs ranging from temporary alterations of behavior and abandonment of haulout sites, to painful injuries, inability to forage normally, or reproductive failure. The intensity of response to a particular disturbance and the ultimate effect on individual animals depends on many factors, including the nutritional and reproductive status of the animal at the time of the disturbance. It is likely that animals in good condition and with access to adequate food supplies are able to tolerate more disturbance than animals in poor condition. The effects of disturbance therefore likely vary substantially from place to place and over time. Despite years of research on individual components of SSL ecology, the synergistic relationships between environmental conditions and the effects of human disturbance on SSL reproductive success are essentially unknown.

The alternatives vary in the amount of research-related disturbance and potential injuries, and thus in amounts of cumulative sub-lethal effects. Alternative 1 would result in no disturbance and would therefore make no contribution to cumulative sub-lethal effects. The other three alternatives would result in incremental increases in the scope and intensity of disturbance. However, because the population-level effect of disturbance and handling procedures from all of these alternatives is unknown, their contribution to the cumulative sub-lethal effects is also unknown.

Conservation Objectives

The Draft Recovery Plan (NMFS 2006a) describes numerous factors that contribute to the population dynamics of SSLs and many types of management actions that are likely to be necessary to promote the recovery of the population. These include, among other things, regulations on commercial and recreational fisheries, co-management agreements with Alaska Native organizations, planning and mitigation for coastal resource development, and efforts to control marine pollution. Information from scientific research on SSLs and other components of the marine environment plays a crucial role in making informed decisions about these regulations and management actions.

Research under the alternatives would contribute varying amounts of information in support of these conservation objectives. Alternative 1 would contribute no new field work involving takes of SSLs and its contribution to the cumulative conservation efforts would be minimal. The other alternatives can be ranked in increasing scope and intensity of contributed research from Alternative 2 to Alternative 3 to Alternative 4. While each of these alternatives could contribute to the scientific basis for management decisions to various extents, the use of these data to implement meaningful conservation measures is largely a political decision that is beyond the scope of this EIS.

4.8.1.6 Eastern DPS - Direct and Indirect Effects of Alternative 1 – No Action: No New Permits of Authorizations

Direct and Indirect Mortality Due to Research

There would be no research activities that affect SSLs in the wild under this alternative so there would be no mechanism for research-related injury or mortality on wild SSLs. A small number of SSLs are maintained in captivity and would still be affected by research, but potential impacts on these captive animals would have no direct effect on the wild population.

Sub-Lethal Effects Due to Research

There would be no mechanism for research-related injury under this alternative and therefore there would be no sub-lethal effects on wild SSLs.

Contribution to Conservation Objectives

Although no research involving interactions with live SSLs in the wild would occur under this alternative, research on captive animals and surrogate species could continue, as could any remote monitoring, observations, and censusing conducted far enough away from SSLs to avoid take. In addition, analyses of data and tissue samples that have already been collected could continue. Research not directed at SSLs, but related to investigating the causes of decline or failure to recover, such as oceanographic studies, could continue under this alternative.

Considering the volume of research that has been conducted in the past, there could be a number of new analyses and syntheses conducted from existing data that could address conservation objectives from the recovery plan. However, the usefulness of existing data would be likely to decrease over time as environmental conditions and the status of the population changed.

Past research on SSLs has been used to establish critical habitat boundaries, regulations about what types of activities would be allowed inside critical habitat, and a complex system of fishery management regulations designed to mitigate potentially adverse effects on SSLs. Under Alternative 1, the level of scientific uncertainty regarding the efficacy of these critical habitat and fishery regulations would be likely to increase over time as the original data become outdated. Decisions about whether or how to modify the regulations to either improve conservation of the species or ease the regulatory burden on the fishing industry would therefore have to rely more on data from other scientific studies and disciplines, including oceanographic and climatological studies, and research on other marine species in the ecosystem.

Conclusion for Conservation Objectives

Research conducted under Alternative 1 could provide a limited amount of information and is therefore considered to have a minor effect on support of the Recovery Plan conservation objectives. It is not clear whether researchers could develop techniques that would provide data comparable to previous census data, or make observations in enough areas, without causing takes of SSLs, to collect information useful for other management decisions. Research conducted under Alternative 1 is unlikely to contribute useful data other than in very limited locations and times.

4.8.1.7 Eastern DPS - Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

All research activities authorized under Alternative 2 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures that would minimize pain and suffering, and implementation of permit conditions that would mitigate potentially adverse effects. The resulting research program is therefore assumed to be conducted under conditions that minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 2. As described earlier, the mortality estimates are reported with fractions of mortalities as a result of the risk assessment methodology used. This is not meant to suggest that animals would only partly die. The reader may prefer to round these fractions to the nearest whole number but the estimates are intended to reflect probabilities that may occur over time and as a result of many different animals being exposed to the same type of activity or disturbance.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality are described in Section 4.8.1.1 and Appendix B. Some injuries could lead to rapid mortalities that take place while researchers are still present, and have the potential to be observed. These mortalities would take place at the same time and place as the research activity and be considered "direct" effects under the NEPA definition of effects (Section 4.1). Other injuries could result in mortalities that do not occur for some time after researchers leave (hours or days or weeks) or take place after animals have moved to other locations. These mortalities could be direct, resulting from research activities, or indirect, resulting from impairment and mortality resulting from other causes. However, this distinction in no way diminishes the responsibility of the research activity for the injury and mortality. The mortality assessment tables estimate mortality due to research regardless of when or where it takes place, so the following discussion addresses the combined direct and indirect effects of mortality.

Under this alternative, authorized research could include aerial surveys, vessel surveys, land surveys, scat collection from haulouts or rookeries during the non-breeding-season, and other activities that do not involve the capture or handling of animals or the presence of researchers on rookeries during the breeding season. The estimated number of takes and mortality assessments for these activities are described in Tables 4.8-13 and 4.8-14 below.

The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* is 1.9 SSLs per year from the eastern DPS (Table 4.8-13). Most of this estimated mortality is due to disturbance from aerial surveys (1.7 animals per year). The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 1.3 SSLs per year from the eastern DPS (Table 4.8-14).

Conclusion for Mortality Effects

The combined estimated direct and indirect mortality from research under Alternative 2 is therefore 3.2 SSLs per year from the eastern DPS, which is 0.2 percent of PBR for this population (2,000 animals). The magnitude and intensity of the effects from mortality is therefore considered negligible on the population level (see Table 4.4.1 for the impact criteria and Section 2.5 for a description of PBR as a metric for population-level effects). While the intensity of the predicted mortality would be negligible, the research would be conducted across the geographic range of the population and the effects would be distributed across the population. Disturbance effects are considered likely given current research techniques; however, they would only affect individual animals intermittently or infrequently and are therefore considered to be minor in duration.

Table 4.8-13
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Eastern DPS - Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	21,000	Observed mortality during activity			0	0	
			Alert	0.05	1050	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.001	21	0.05	1.05	
	non-pups	225,000	Observed mortality during activity			0	0	
			Alert	0.05	11250	0	0	
			Enter water	0.01	2250	0.0001	0.225	
			Injured during disturbance	0.0001	22.5	0.02	0.45	1.7
Vessel surveys[3]	pups	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	0	0.05	0	
	non-pups (breeding season)	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0.1	0	0.0001	0	
			Injured during disturbance	0.0001	0	0.02	0	
	non-pups (non-breeding season)	4,600	Observed mortality during activity			0	0	
			Alert	1	230	0	0	
			Enter water	0.3	1,380	0.0001	0.14	
			Injured during disturbance	0.0001	0.5	0.02	0.0	0.1
On land[2]	pups	0	Observed mortality during activity			0.0000	0	
			Alert	0.05	0	0.0000	0	
			Enter water	0	0	0.0010	0	
			Injured during disturbance	0.001	0	0.0500	0	
	non-pups	1,500	Observed mortality during activity			0	0	
			Alert	0.05	75	0	0	
			Enter water	0.01	15	0.0001	0.002	
			Injured during disturbance	0.0001	0.15	0.02	0.003	0.0
Subtotal mortality for incidental effects of researcher presence in view of animals:								**1.9**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-14
Estimated Mortality Due to Researcher Presence among Animals. SSL Eastern DPS Alternative 2

Activity	Age class	Animals exposed[2]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Haulouts, rookeries non-breeding (scat collection, resights, ground counts)	All	14,500	Observed mortality during activity			0	0	
			Alert response	1	14,500	0.0	0.0	
			Enter water	0.9	13,050	0.0001	1.3	
			Injured during disturbance	0.0001	1.45	0.02	0.0	
Subtotal for estimated mortality due to researcher presence among animals								**1.3**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to react to researcher presence.

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 2 could potentially affect all animals in the population through disturbance from aerial surveys and other activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during a research-related disturbance. Most animals exposed to research activities do not die as a result but may experience other effects ranging in intensity from a temporary alteration of their normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1.1 and Appendix B.

Although research-related injuries under Alternative 2 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is how those injuries might contribute to a population-level effect. Not all sex/age classes are equally susceptible to sub-lethal effects that could alter the productivity of the population. Mature bulls that sustain a substantial injury may have difficulty establishing or reestablishing their breeding territory and could therefore lose potential mates. Although this would reduce individual reproductive success, one or more other bulls would likely take the place of a displaced bull. All breeding females would still find mates, and the overall productivity of the rookery would remain unchanged. Pups and juveniles that are injured but do not die are likely to recover well before they approach reproductive-age (i.e., 4-5 years for females and 8-9 years for males). Their future survival and reproductive success is therefore much more likely to be determined by the many environmental variables that affect foraging success and growth rate, such as the abundance and distribution of forage fish and changes in ocean regimes.

The sex/age class most susceptible to effects that might decrease overall productivity is breeding-age females. Research-related disturbance could cause a lactating female to abandon her pup or disrupt her normal maternal care to the point that the pup dies. This loss of a pup is considered under the mortality assessment tables. However, a potential mechanism for sub-lethal effects on reproduction in breeding-age females not considered under the mortality assessment tables is through physiological reactions to stress that cause reabsorption or abortion of fetuses or failure of fertilized embryos to implant. A female that reacts in any of these ways would lose the opportunity to raise a pup the following summer, but not necessarily in subsequent seasons. If these types of injuries occur to a relatively large number of females each year, overall pup production would decrease and hinder the ability of the population to recover. The relevant question for the analysis is how many breeding-age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Table 4.8-13 indicates that there would be an estimated 23 non-pups injured each year during aerial surveys, with approximately 2,250 non-pups entering the water. About 1,380 non-pups are predicted to enter the water each year during vessel surveys, with one injured during the disturbances. About 15 non-pups are predicted to enter the water each year during land-based surveys, with perhaps one injured during the disturbances. Table 4.8-14 indicates that about 13,050 animals per year would be predicted to enter the water during scat collection and other non-breeding-season activities, with two non-pups being injured during the disturbances. The mortality tables estimate that about two non-pups per year would be expected to die as a result of this level of disturbance. Unfortunately, we cannot make an equivalent estimate for how many failed pregnancies this level of disturbance would likely cause due to several factors:

- Uncertainty about what proportion of these disturbed animals would be reproductive-age females or gestating females.
- Uncertainty about the proportions of animals likely to respond in different ways.
- Uncertainty about the mechanisms of effect.
- Uncertainty about the environmental conditions that would strongly influence the ultimate effect on individuals.

Conclusion for Sub-lethal Effects

The magnitude of sub-lethal effects as they relate to population-level changes in productivity under Alternative 2 is therefore unknown (see Table 4.4.1). The geographic extent of the research under Alternative 2 is likely to distribute sub-lethal effects across the range of the population. Disturbance effects are considered likely given current research techniques but would only affect individual animals intermittently or infrequently and are therefore considered to be minor in duration.

Contribution to Conservation Objectives

Regarding the eastern population of SSLs, the Draft Recovery Plan (NMFS 2006a) concludes that the primary recovery goal is to develop a post-delisting monitoring plan should a status review conclude that de-listing was warranted; however, it does not prioritize research activities required to do this. The Draft Recovery Plan suggests that such an effort would be likely to include population-trend monitoring, genetics research to refine understanding of population structure, monitoring terrestrial habitat threats, monitoring for unusual mortality events that may be related to contaminants or other human factors, and monitoring fishery management plans to ensure that these stay consistent with SSL requirements.

The scope and type of research activities described under Alternative 2 would be sufficient to address all of these conservation objectives, except perhaps for the genetics component. Genetic analysis can be done on numerous types of tissue. Hair samples would likely be available from haulouts and rookeries during the non-breeding-season under the conditions of this alternative. However, whether or not these would be sufficient for the types of analyses that could be specified at a later date is not clear.

Conclusion for Conservation Objectives

Research conducted under Alternative 2 could provide information to support most of the conservation objectives outlined in the Recovery Plan for the eastern DPS, and the effect is therefore considered to be moderate in magnitude. Research conducted under Alternative 2 would be likely to address conservation issues across the range of the population and to address long-term information needs. There may be some immediate information needs concerning potential acute threats to the population (e.g., disease outbreaks) that would be difficult to address under Alternative 2.

4.8.1.8 Eastern DPS - Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

All research activities authorized under Alternative 3 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of “humane” procedures to minimize pain and suffering, and implementation of permit conditions to mitigate potentially adverse effects. The resulting research program is therefore assumed to be conducted under conditions that would minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 3. As described earlier, the mortality estimates are reported with fractions of mortalities as a result of the risk assessment methodology used. This is not meant to suggest that animals would only partly die. The reader may prefer to round these fractions to the nearest whole number but the estimates are intended to reflect probabilities that may occur over time and as a result of many different animals being exposed to the same type of activity or disturbance.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality that result from a variety of research activities are described in Section 4.8.1.1 and Appendix B. The mortality assessment tables estimate mortality due to research regardless of when or where it takes place, and the following discussion addresses the combined direct and indirect effects of mortality.

Under this alternative, authorized research could include:

- Activities with *Researchers in View of Animals* (Table 4.8-15 – aerial, vessel, and land surveys).
- Activities with *Researcher Presence Among Animals* (Table 4.8-16 – on rookeries and haulouts for ground counts, scat collection, captures).
- *Capture and Restraint activities* (Table 4.8-17 – various sex/age classes by various physical and chemical methods).
- *Handling and Sampling Procedures* on animals in the wild (Table 4.8-18 – various procedures, primarily on captured animals plus, remote sampling).
- *Capture, Temporary Captivity, and Release* back into the wild (Table 4.8-19 – non-pups taken to approved facilities for up to 3 months).

Each table lists the number of takes, estimated injuries, and estimated mortalities for the given activities under Alternative 3, the Status Quo conditions for the eastern DPS of SSLs.

The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* is 1.9 SSLs per year (Table 4.8-15). Most of this estimated mortality is due to disturbance from aerial surveys (1.7 animals per year) and vessel surveys (0.2 animals per year). The total number of takes under aerial, vessel, and land-based surveys is many times the total number of animals in this population. This is because some existing permits authorize researchers to conduct multiple surveys per year for scientific purposes and each animal has the potential to be exposed to research disturbance more than once per year. In some cases, multi-year permits specify a greater survey effort in some years than others, corresponding to a larger number of takes. The numbers of takes used in the mortality assessment tables are the largest number of takes for any given year during the permit period. The number of takes therefore, is a "maximum" value for the set of permits considered. This maximum effort, and therefore maximum estimated mortality risk, would pertain to only one or two years within the five-year permit period.

The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 11.5 SSLs per year (Table 4.8-16). The majority of this estimated mortality (6.3 pups and 1.8 non-pups per year) would result from animals that enter the water or are injured during ground counts, scat collection, and capture activities on rookeries during the breeding season. An estimated mortality of 3.3 animals per year would result from non-pups that enter the water during ground counts, scat collection, and brand resight efforts on haulouts and rookeries during the non-breeding-season. As described for surveys in Table 4.8-15, the total number of takes in Table 4.8-16 is greater than the number of animals in the population and reflects the authorization of multiple visits to the same rookeries/haulouts within a year. Under the Status Quo permits, takes by disturbance incidental to a variety of research activities are grouped into a general "incidental disturbance during research activities" category. Thus, Table 4.8-16 does not distinguish among takes for some activities such as roundups of pups for branding, disturbance during scat collection, disturbance of not-target animals during capture activities, etc.

The estimated total direct and indirect mortality from *Capture and Restraint activities* is 8.6 SSLs per year out of the total capture effort of 900 pups and 1,302 non-pups (Table 4.8-17). As with other activities, some permits authorize different numbers of captures in different years. The numbers of takes used in the table are the maximum authorized in any given year and therefore represent the maximum estimated mortality risk under the Status Quo permits. The majority of these estimated mortalities (5.9 animals per year) would result from capture and use of an inhalable anesthesia (e.g., isoflurane), with most of those estimated mortalities involving non-pups (5.0 animals per year) rather than pups (0.9 animals per year). Most of the remaining estimated mortality (2.7 non-pups per year) would be through capture with injectable chemical methods.

The estimated total direct and indirect mortality from *Handling and Sampling Procedures* on animals in the wild is 3.5 SSLs per year (Table 4.8-18). This estimate does not include the risks associated with capture and restraint of the animals, but rather represents the estimated additional mortality from the handling and sampling procedures themselves. The total number of takes (expressed in units of "procedure-animals" in the table) would be greater than the number of animals captured because many captured animals are subject to multiple procedures. Captured pups and non-pups are often subjected to various combinations of procedures to address the specific scientific objectives of one or more research programs. Not all captured animals are hot-branded and hot-brands are applied only once per animal in its lifetime. Under the Status Quo alternative, 800 of the 900 captured pups would be hot-branded. In addition, those 900 captured pups would be subject to an average of 4.6 "relatively low-risk" procedures each, and 20 pups would be subject to a "relatively medium-risk" procedure. Out of the 1,302 non-pups that would be captured by various means, 906 would be branded. In addition, those 1,302 non-pups would be subject to an average of 7.3 "relatively low-risk" procedures and 1.6 "relatively medium-risk" procedures each. The highest contribution to the estimated mortality in this table is from hot-branding (1.6 pups and 0.1 non-pups per year). The estimated mortality from "relatively low-risk" procedures is 0.9 non-pups and 0.4 pups per year. "Relatively medium-risk" procedures would account for about 0.4 mortalities of non-pups per year.

No SSLs from the eastern DPS would be brought into temporary captivity for experimentation under the Status Quo permits. The mortality risk table for *Capture, Temporary Captivity, and Release* therefore has no mortality associated with it for the population (Table 4.8-19).

Conclusion for Mortality Effects

The combined estimated direct and indirect mortality from research under Alternative 3 is 25.5 SSLs per year from the eastern DPS, which is 1.3 percent of PBR for this population (2,000 animals). The magnitude and intensity of the effects from mortality is therefore considered negligible on the population level (see Table 4.4-1 for the impact criteria and Section 2.5 for a description of PBR as a metric for population-level effects). While the intensity of the predicted mortality would be negligible, the research would be conducted across the geographic range of the population and the effects would be distributed across the population. Disturbance effects that lead to mortality are considered likely given current research techniques. Although each exposure may be brief, individual animals could be affected by different research activities several times per year. They are therefore considered to be moderate in frequency.

Table 4.8-15
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Eastern DPS - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	21,000	Observed mortality during activity			0	0.0	
			Alert	0.05	1,050	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	21	0.05	1.05	
	non-pups	225,000	Observed mortality during activity			0	0	
			Alert	0.05	11,250	0	0	
			Enter water	0.01	2,250	0.0001	0.225	
			Injured during disturbance	0.0001	22.5	0.02	0.45	1.7
Vessel surveys[3]	pups	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	0	0.05	0	
	non-pups (breeding season)	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0.1	0	0.0001	0	
			Injured during disturbance	0.0001	0	0.02	0	
	non-pups (non-breeding season)	4,600	Observed mortality during activity			0	0	
			Alert	1	230	0	0	
			Enter water	0.3	1,380	0.0001	0.138	
			Injured during disturbance	0.0001	0.46	0.02	0.009	0.1
On land[2]	pups	0	Observed mortality during activity			0	0	
			Alert	0.05	0	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.001	0	0.05	0	
	non-pups	1,500	Observed mortality during activity			0	0	
			Alert	0.05	75	0.0	0.0	
			Enter water	0.01	15	0.0001	0.002	
			Injured during disturbance	0.0001	0.15	0.02	0.003	0.0
Subtotal mortality for incidental effects of researcher presence in view of animals:								**1.9**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-16
Estimated Mortality Due to Researcher Presence among Animals. SSL Eastern DPS - Alternative 3

Activity	Age class	Animals exposed[3]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
On rookeries during breeding season[4] (ground counts, scats, captures)	pups	12,000	Observed mortality during activity			0	0	
			Alert response	1	12,000	0.0	0.0	
			Enter water	0.01	120	0.001	0.12	
			Injured during disturbance	0.001	12	0.05	0.6	
Roundups for branding[2]		800	Observed mortality during activity	1	800	0.007	5.6	6.3
On rookeries during breeding season[4] (ground counts, scats, captures)	adults and juveniles (non-pups)	20,000	Observed mortality during activity			0	0	
			Alert response	1	20,000	0.0	0.0	
			Enter water	0.9	18,000	0.0001	1.8	
			Injured during disturbance	0.0001	2	0.02	0.04	1.8
On haulouts or rookeries during non-breeding season (scats, resights, captures)	pups	0	Observed mortality during activity			0	0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.9	0	0.0001	0.0	
			Injured during disturbance	0.0001	0	0.02	0.0	
	non-pups	36,750	Observed mortality during activity			0.0	0.0	
			Alert response	1	36,750	0.0	0.0	
			Enter water	0.9	33,075	0.0001	3.3	
			Injured during disturbance	0.0001	3.7	0.02	0.07	3.4
Subtotal for estimated mortality due to researcher presence among animals								**11.5**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Number exposed are based on numbers of pups handled or branded, and are a subset of the number exposed to the activity..
[3]Estimate based on the number of animals expected to react to researcher presence.
[4]Breeding season is June and/July.

Table 4.8-17
Estimated Mortality Due to Capture and Restraint Activities. SSL Eastern DPS - Alternative 3

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	Adults and juveniles (non-pups)	0	Observed during activity	0.002	0	
			Unobserved/post-capture	0.0001	0	0
Capture/chemical anesthesia (inhalable agent-isoflurane)	pups	900	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	0.9	
	non-pups	1,230	Observed during activity	0.004	4.92	
			Unobserved/post-capture	0.0001	0.123	5.9
Capture/chemical anesthesia (injectable)	non-pups	60	Observed during activity	0.034	2.04	
			Unobserved/post-capture	0.011	0.66	2.7
Capture/chemical sedation (injectable -e.g., valium)	non-pups	12	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.001	0.0
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**8.6**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-18
Estimated Mortality Due to Handling and Sampling Procedures. SSL Eastern DPS - Alternative 3

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-branding	pups	800	Observed during activity	0	0	
			Unobserved/post-capture	0.002	1.6	
	non-pups	906	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.091	1.7
Relatively low risk procedures	pups	4,180	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.418	
	non-pups	9,490	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.949	1.4
Relatively medium risk procedures	pups	20	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.004	
	non-pups	2,052	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.410	0.4
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**3.5**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-19
Estimated Mortality Due to Temporary Captivity for Experimentation. SSL Eastern DPS - Alternative 3

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed during activity			
			Unobserved/post-capture			
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Chemical sedation (injectable - e.g., valium)	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Permanent mark/hot-branding	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Relatively low risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	0
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 3 could potentially affect most, if not all, animals in the population through disturbance and capture/handling activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during a research-related disturbance. Most animals exposed to research activities do not die as a result; however, may experience other effects, ranging in intensity from a temporary alteration of their normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1.1 and Appendix B.

As described under Alternative 2, sub-lethal effects could occur as a direct result of the research activity itself or indirectly due to other contributing factors; however, this is difficult to determine because no specific studies on this topic have been conducted. Research activities could cause disturbance or injury to animals that affect ability to function normally. The consequences of such research-related effects will depend on a number of factors, including environmental conditions that vary seasonally, among years, and among locations. While the result of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect. Although research-related injuries under Alternative 3 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is on how those injuries contribute to a population-level effect. The sex/age class most susceptible to effects that might decrease overall productivity of the population is breeding-age females, primarily through physiological reactions to stress that cause reabsorption or abortion of fetuses, or failure of fertilized embryos to implant. The relevant question for the analysis is how many breeding-age females are likely to be affected each year because of research activities to the extent that they fail to reproduce.

Table 4.8-15 indicates that there would be an estimated 23 non-pups injured each year during aerial surveys, with approximately 2,250 non-pups entering the water. About 1,380 non-pups are predicted to enter the water during vessel surveys, with one injured during the disturbances. About 15 non-pups are predicted to enter the water during land-based surveys, with one injured during the disturbances.

Table 4.8-16 indicates that research activities on rookeries during the breeding season would cause about 18,000 non-pups to enter the water and would injure about two animals. Research activities on rookeries during the non-breeding-season and on haulouts at any time would be predicted to cause about 33,000 non-pups to enter the water and to injure about four animals.

All animals represented by the takes in Tables 4.8-17 and 4.8-18 are assumed to have responses to capture that are more stressful than entering the water, and all are considered to have the potential for injury through several mechanisms. A total of 1,302 non-pup captures/recaptures are authorized each year by various methods under Alternative 3. However, most of the animals involved are juveniles and sub-adults less than three years old. A total of 30 adult females are authorized for capture. Considering authorized recaptures, these adult females account for 60 out of the 1,302 takes.

The combined mortality tables for Alternative 3 estimate that 25.5 SSLs per year from the eastern DPS would die because of research activities, including about 15 non-pups per year. Research activities would also create enough disturbance to cause about 55,000 non-pups per year to enter the water. Because this number of takes is more than the number of animals in the population, the average animal in the population would be likely to be chased into the water by research activities multiple times per year. However, an estimate of how many reproductive failures this level of disturbance would likely cause is not possible due to several factors:

- Uncertainty about what proportion of these disturbed animals would be reproductive-age females or gestating females.
- Uncertainty about the proportions of animals likely to respond in different ways.
- Uncertainty about the mechanisms of effect.

- Uncertainty about the environmental conditions that would strongly influence the ultimate effect on individuals.

Conclusion for Sub-lethal Effects

The magnitude of sub-lethal effects as they relate to population-level changes in productivity under Alternative 3 is considered unknown (see Table 4.4-1). The geographic extent of the research under Alternative 3 includes the entire range of the population. However, many permittees do not specify which specific rookeries/haulouts their research would affect until a month or two before they begin their fieldwork. It is therefore not known at the time of permit issuance how permittees would distribute their activities within a large area. These could range from being widely dispersed across the range of the species to concentrated in a few locations. Disturbance and sub-lethal effects are considered likely given current research techniques. Although each exposure may be brief, individual animals could be affected by different research activities more than four times per year. Disturbance from research activities is therefore considered to be moderate in frequency.

Contribution to Conservation Objectives

Regarding the eastern population of SSLs, the Draft Recovery Plan (NMFS 2006a) concludes that the primary recovery goal is to develop a post-delisting monitoring plan; however, it does not prioritize research activities required to do this. The Draft Recovery Plan suggests that such an effort would be likely to include population trend monitoring, genetics research to refine understanding of population structure, monitoring terrestrial habitat threats, monitoring for unusual mortality events that may be related to contaminants or other human factors, and monitoring fishery management plans to ensure these stay consistent with SSL requirements.

All of these recovery objectives could be addressed sufficiently with the scope of research described under Alternative 3. There would likely be modifications to research objectives or locations over time to address conservation issues as they arise, but the overall numbers of takes and types of research techniques described under Alternative 3 should be sufficient to accomplish future conservation objectives for this population.

Conclusion for Conservation Objectives

Research conducted under Alternative 3 could provide information to support all of the conservation objectives outlined in the Recovery Plan for the eastern DPS and the effect is therefore considered to be major in magnitude. Research conducted under Alternative 3 would be likely to address conservation issues across the range of the population and to address both long-term and immediate information needs.

4.8.1.9 Eastern DPS - Direct and Indirect Effects of Alternative 4 – The Preferred Alternative – Research Program with Full Implementation of Conservation Goals

The Draft SSL Recovery Plan (NMFS 2006a) recommended the initiation of a status review to consider removing the eastern DPS from the ESA’s List of Threatened and Endangered Wildlife. Given the long-term increasing population trend and lack of significant conservation threats, the Draft Recovery Plan concludes that, if the DPS is de-listed, the primary recovery goal is to develop a post-delisting monitoring plan to ensure relisting is not necessary after removal. Key components of this plan, relative to research activities, have not been prioritized in the Draft Recovery Plan but would be likely to include population trend monitoring, genetics research to refine understanding of population structure, monitoring terrestrial habitat threats, monitoring for unusual mortality events that may be related to contaminants or other human factors, and monitoring fishery management plans to ensure these stay consistent with SSL requirements.

All of these recovery and conservation objectives could be addressed sufficiently within the scope of research described under Alternative 3. It is therefore assumed that no additional takes or procedures would be warranted under Alternative 4 for this population. The numbers of takes and types of procedures under Alternative 4 are therefore defined as the same as under the Status Quo conditions (see mortality assessment Tables 4.8-20 through 4.8-24). The assessment and conclusions of Alternative 4 on the eastern DPS of SSLs for mortality effects, sub-lethal effects, and the contribution to conservation objectives are the same as described above for Alternative 3.

Table 4.8-20
Estimated Mortality Due to Researcher Presence in View of Animals. SSL Eastern DPS - Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey[2]	pups	21,000	Observed mortality during activity			0	0.0	
			Alert	0.05	1,050	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0.001	21	0.05	1.05	
	non-pups	225,000	Observed mortality during activity			0	0	
			Alert	0.05	11,250	0	0	
			Enter water	0.01	2,250	0.0001	0.225	
			Injured during disturbance	0.0001	22.5	0.02	0.45	1.7
Vessel surveys[3]	pups	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.01	0	0.05	0	
	non-pups (breeding season)	0	Observed mortality during activity			0	0	
			Alert	1	0	0	0	
			Enter water	0.1	0	0.0001	0	
			Injured during disturbance	0.0001	0	0.02	0	
	non-pups (non-breeding season)	4,600	Observed mortality during activity			0	0	
			Alert	1	230	0	0	
			Enter water	0.3	1,380	0.0001	0.138	
			Injured during disturbance	0.0001	0.46	0.02	0.009	0.1
On land[2]	pups	0	Observed mortality during activity			0	0	
			Alert	0.05	0	0	0	
			Enter water	0	0	0.001	0	
			Injured during disturbance	0.001	0	0.05	0	
	non-pups	1,500	Observed mortality during activity			0	0	
			Alert	0.05	75	0.0	0.0	
			Enter water	0.01	15	0.0001	0.002	
			Injured during disturbance	0.0001	0.15	0.02	0.003	0.0
Subtotal mortality for incidental effects of researcher presence in view of animals:								**1.9**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Estimate based on the number of animals expected to be present during survey.
[3]Estimate based on the number of animals expected to react to researcher presence.

Table 4.8-21
Estimated Mortality Due to Researcher Presence among Animals. SSL Eastern DPS - Alternative 4

Activity	Age class	Animals exposed[3]	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
On rookeries during breeding season [4] (ground counts, scats, captures)	pups	12,000	Observed mortality during activity			0	0	
			Alert response	1	12,000	0.0	0.0	
			Enter water	0.01	120	0.001	0.12	
			Injured during disturbance	0.001	12	0.05	0.6	
Roundups for branding[2]		800	Observed mortality during activity	1	800	0.007	5.6	6.3
On rookeries during breeding season [4] (ground counts, scats, captures)	adults and juveniles (non-pups)	20,000	Observed mortality during activity			0	0	
			Alert response	1	20,000	0.0	0.0	
			Enter water	0.9	18,000	0.0001	1.8	
			Injured during disturbance	0.0001	2	0.02	0.04	1.8
On haulouts or rookeries during non-breeding season (scats, resights, captures)	pups	0	Observed mortality during activity			0	0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.9	0	0.0001	0.0	
			Injured during disturbance	0.0001	0	0.02	0.0	
	non-pups	36,750	Observed mortality during activity			0.0	0.0	
			Alert response	1	36,750	0.0	0.0	
			Enter water	0.9	33,075	0.0001	3.3	
			Injured during disturbance	0.0001	3.7	0.02	0.07	3.4
Subtotal for estimated mortality due to researcher presence among animals								**11.5**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Number exposed are based on numbers of pups handled or branded, and are a subset of the number exposed to the activity..
[3]Estimate based on the number of animals expected to react to researcher presence.
[4]Breeding season is June and/July.

Table 4.8-22
Estimated Mortality Due to Capture and Restraint Activities. SSL Eastern DPS - Alternative 4

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	Adults and juveniles (non-pups)	0	Observed during activity	0.002	0	
			Unobserved/post-capture	0.0001	0	0
Capture/chemical anesthesia (inhalable agent-isoflurane)	pups	900	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	0.9	
	non-pups	1,230	Observed during activity	0.004	4.92	
			Unobserved/post-capture	0.0001	0.123	5.9
Capture/chemical anesthesia (injectable)	non-pups	60	Observed during activity	0.034	2.04	
			Unobserved/post-capture	0.011	0.66	2.7
Capture/chemical sedation (injectable -e.g., valium)	non-pups	12	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.001	0.0
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**8.6**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-23
Estimated Mortality Due to Handling and Sampling Procedures. SSL Eastern DPS - Alternative 4

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-branding	pups	800	Observed during activity	0	0	
			Unobserved/post-capture	0.002	1.6	
	non-pups	906	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.091	1.7
Relatively low risk procedures	pups	4,180	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.418	
	non-pups	9,490	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.949	1.4
Relatively medium risk procedures	pups	20	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.004	
	non-pups	2,052	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.410	0.4
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**3.5**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-24
Estimated Mortality Due to Temporary Captivity for Experimentation. SSL Eastern DPS - Alternative 4

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed during activity			
			Unobserved/post-capture			
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Chemical sedation (injectable - e.g., valium)	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Permanent mark/hot-branding	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Relatively low risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	0
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters/metabolic chamber
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

4.8.1.10 Eastern DPS - Cumulative Effects

Summary of Direct and Indirect Effects

Direct and indirect mortality and sub-lethal effects of research activities may result from disturbance, capture, and handling. The alternatives vary in the estimated amount of mortality that would occur under a given scope of research, but the estimated mortality for all alternatives is less than 10 percent of PBR and is considered negligible on a population level. (Sections 4.8.1.6 through 4.8.1.9). The magnitude of sub-lethal effects would be negligible for Alternative 1 and are unknown for Alternatives 2, 3, and 4 because of uncertainty factors listed above. In regard to ability to provide research support for the conservation objectives described in the Draft Recovery Plan; Alternative 1 would address few conservation objectives, Alternative 2 would address all conservation objectives except serological monitoring of disease and genetic refinement of the population structure, and Alternatives 3 and 4 would be sufficient to address all conservation objectives.

Summary of Lingering Past Effects

The population trend over the past 30 years has been very different for the eastern DPS of SSLs than it has been for the western DPS. In contrast to the population decline in the western DPS, the eastern DPS has increased steadily over the past 20 years (Angliss and Outlaw 2007). However, the factors that influence injury and mortality in the western DPS are similar to those that affect the eastern DPS, just often to lesser degrees. These include competition with commercial fisheries, changes in the ocean climate and environment, predation by killer whales, environmental contamination, and human-caused mortality (NMFS 2006a).

The annual stock assessment reports (Angliss and Outlaw 2007) list as the past sources of anthropogenic mortality; incidental take in commercial fisheries, subsistence harvests, and illegal shooting. Commercial fisheries from different areas within the range of the eastern DPS of SSLs had a mean incidental mortality of 2.6 SSLs per year from 1990-2004 (Angliss and Outlaw 2007). The mean subsistence harvest for 16 Alaskan coastal communities within the range of the eastern DPS was six animals per year between 2000-2004, based on hunter interviews (Wolfe *et al.* 2004). An unknown number of SSLs from the eastern DPS were taken by Canadian subsistence hunters, but this number is believed to be small (Angliss and Outlaw 2007). There were no commercial harvests of SSLs in the range of the eastern DPS in the U.S. but an unknown number of SSLs were killed by fishermen before passage of the MMPA in 1972. Thousands of animals were also killed during predator-control programs in British Columbia prior to 1970 (NMFS 2006a). The MMPA provision allowing fishermen to kill SSLs to protect their gear was repealed in 1990 when the species was listed as threatened under the ESA. The level of illegal shooting is now believed to be minimal. NMFS enforcement records state that there were two cases of illegal shootings of SSLs in southeast Alaska: one near Sitka, where one animal was shot, and one in Petersberg, where three animals were shot. Both of these cases were successfully prosecuted (Angliss and Outlaw 2007).

Analysis of RFFAs

The types of RFFAs for the eastern DPS are similar to those presented for the western DPS in Section 4.8.1.5, although their scope and intensity vary. For example, commercial fishing activities in southeast Alaska and in the states of Washington, Oregon, and California have been and will likely continue to be quite different from those that occur in the BSAI/GOA, in the quantity and method of fish being harvested and in the numbers of SSLs killed in fishing gear. Incidental take for fisheries in the range of the eastern DPS has averaged less than four SSLs per year and are likely to remain at low levels.

Given the increasing population trend for the eastern DPS, the Draft Recovery Plan does not consider any of the RFFAs listed in Section 4.8.1.5 to be a serious threat to the population in the future.

Cumulative Effects

Mortality

The primary contributors to cumulative human-caused mortality listed in the stock assessment reports (Angliss and Outlaw 2007) are subsistence harvest (six animals per year) and incidental take in fishing gear (three animals per year). Nine animals per year is about 0.4 percent of PBR for this population (2,000 animals). Alternative 1 would contribute no mortalities to this total and would therefore have no cumulative effect on mortality. Alternative 2 would contribute an estimated 3.2 mortalities per year, raising the overall total to about 13 animals, which is 0.7 percent of PBR. Alternatives 3 and 4 would contribute an estimated 25.5 mortalities per year, raising the overall total to about 36 animals, which is 1.8 percent of PBR. Under the criteria developed to assess the impacts of the alternatives (Table 4.4-1), the cumulative level of mortality for this population as a percentage of PBR would be considered negligible under all alternatives.

Sub-Lethal Effects

Disturbance from research activities, marine vessel traffic, air traffic, fishing operations, tourism, and other sources can cause physical responses and physiological effects in SSLs ranging from temporary alterations of behavior and abandonment of haulout sites, to painful injuries, inability to forage normally, or reproductive failure. The intensity of a response to a particular disturbance and the ultimate effect on individual animals depends on many factors, including the nutritional and reproductive status of the animal at the time of the disturbance. It is likely that animals in good condition and with access to adequate food supplies could tolerate more disturbance than animals in poor condition. The effects of disturbance, therefore, likely vary substantially from place to place and over time. Despite years of research on individual components of SSL ecology, the synergistic relationships between environmental conditions and the effects of human disturbance on SSL reproductive success are essentially unknown.

The alternatives vary in the amount of research-related disturbance and potential injuries that they would contribute to the cumulative sub-lethal effects. Alternative 1 would contribute no disturbance and would therefore make no contribution to cumulative sub-lethal effects. Alternative 2 would contribute a relatively small amount of disturbance compared to Alternatives 3 and 4. However, because the population-level effects of disturbance and handling procedures from Alternatives 2, 3, and 4 are unknown, their contributions to the cumulative sub-lethal effects are also unknown.

Conservation Objectives

The Draft Recovery Plan (NMFS 2006a) concludes that the primary recovery goal for the eastern DPS is to develop a post-delisting monitoring plan. This plan would likely include both research components and regulation/management components related to fisheries, tourism, coastal development, marine pollution, and other sources of human interactions with SSLs. Information from scientific research on SSLs and other components of the marine environment play a crucial role in making informed decisions about these regulations and management actions.

The alternatives would contribute varying amounts of information in support of a post-delisting monitoring plan. Alternative 1 would contribute no new field work; its contribution to the cumulative conservation effort would therefore be minimal. Alternative 2 would contribute to all conservation objectives, except perhaps serological monitoring of disease and genetic refinement of the population structure. Alternatives 3 and 4 would be sufficient to address all conservation objectives. While each of these alternatives could contribute to the scientific basis for management decisions to varying extents, the use of these data to implement meaningful conservation measures is largely a political decision that is beyond the scope of this EIS.

4.8.2 Northern Fur Seal

This section presents the analyses of the effects of the four different research alternatives on the eastern Pacific and San Miguel stocks of NFSs. The general methodology for this assessment is introduced in Section 4.4 and is the same methodology used for SSLs in Section 4.8.1. The alternatives represent different levels of research effort on NFSs, each with a range of research techniques and intensities that could be authorized by NMFS F/PR1. The intent of conducting research on a depleted species is to collect information that is useful in making management decisions to conserve and restore the species to its optimum sustainable population (OSP).

As discussed under Section 4.8.1, any research activity that has the potential to disturb animals has some risk of adverse effect for animals exposed. For each type of NFS research activity there are one or more possible responses from the animals. For some research activities (e.g., aerial surveys) many animals may exhibit no observable response although they may have elevated adrenaline levels or other internal stress responses. For research activities that require the presence of researchers on a rookery, some NFSs will enter the water and others may hold their ground or move away on land. NFSs targeted for capture and handling will be subject to additional types of stress and risks compared to animals that are disturbed by researches but not captured or handled.

The intensity and probability of potential responses is a function of a variety of factors including the sex/age class of the animal, the tendency of the individual animals to respond in certain ways, the intent and behavior of the researchers (how they approach animals), timing and location of the research, and environmental factors such as sea conditions and weather (see in Section 4.8.1). Each research activity therefore has specific inherent risks of injury to an individual as determined by a particular response, which could result in potential impacts on a population as measured by a combination of the intensity of individual responses and the number of animals exposed.

The effect of exposure to a variety of research procedures may be additive or synergistic. Also, the cumulative effect of all research activities on a stock during one season can be estimated based on the cumulative intensity of responses (i.e., the number of animals exposed) and scope of the research.

For all of the procedures analyzed, it is assumed that all researchers are experienced and qualified to fill their assigned roles and that all procedures are carried out under "best practices" conditions, including all mitigation measures specified in the relevant permits. Standard mitigation measures common to all alternatives are described in Section 4.7.4.

Similar to the effects analysis for SSLs in Section 4.8.1, the analysis of the direct and indirect effects of research activities on NFSs is divided into three major components: an assessment of research-related injuries that lead to serious injury or mortality; an assessment of research-related effects on reproductive success; and an assessment of how well each alternative research strategy would address conservation objectives in the 2006 Draft Conservation Plan (hereafter referred to as the Draft Conservation Plan) (NMFS 2006b). Potential beneficial effects of research are evaluated based on the likelihood of contributing information that can be used to promote the conservation of the species, in comparison to the potential adverse effects of the research activities. The criteria for determining the impact level of each component are summarized in Table 4.4-1.

<u>Assessment of Direct and Indirect Mortality Due to Research</u>

There are many potential mechanisms for research-related injuries to occur, some of which may lead directly or indirectly to the death of individual NFSs. Some injuries may affect the ability of individuals to forage or behave normally but are not directly fatal (i.e., sub-lethal effects). The thresholds for sub-lethal effects (i.e., when they start to affect an animal's ability to survive) are not well known. There are many other natural and anthropogenic factors that also affect survival of individual animals and it can be difficult to attribute the fate of an animal to one particular factor, especially for species that are difficult to track and observe over long periods of time. The primary concern for this impact assessment is whether effects on individuals results in a population-level effect (i.e. reduced population growth or fitness). Population growth must be increasing, with an age/sex structure that promotes population stability, to lead to recovery of the species.

In addition, a significant number of individuals within the population need to be robust to disease, deleterious genetic mutations, and environmental or anthropogenic changes or stresses. The population must also be distributed widely enough to withstand acute environmental or manmade disasters such as disease outbreak or an oil spill.

Mortality Assessment Process

The mortality assessment tables presented for each alternative follow the same process as described under Section 4.8.1 for SSLs for determining the magnitude or intensity of direct and indirect mortality risks associated with each type of research activity.

A summary table (Table 4.8-49) shows the estimated number of NFSs that may sustain lethal effects from the specified scope of research defined for each alternative. These totals are then used to evaluate the magnitude or intensity of the direct and indirect effects of research on mortality, which is one aspect of the overall impact assessment for each alternative. Sections 4.4 and 4.5 describe the other steps involved in the overall impact analysis.

Mechanisms of Injury from Disturbance

Human presence at breeding and resting areas harasses NFSs (NMFS 2006b). Such presence includes research activities, ecotourism, and activities of residents of St. Paul and St. George. The presence and activities of humans near or in fur seal rookeries/haul-outs can cause major disturbances. As a result regulatory closures (50 CFR 216, subpart J) preclude human access to fur seal breeding and resting areas from 15 May until 15 October without prior authorization.

The mechanisms for injury to NFSs from human disturbance would be generally the same as discussed under SSLs in Section 4.8.1. Knowledge of population and individual responses to disruptions of daily activities is necessary to assess viability of populations exposed to human activities. A review of available literature on responses of numerous species to a variety of human activities suggests that the response, and the effect, may be variable and dependent on multiple factors. For a discussion on the mechanism of injury from disturbance, presence of researchers (in view of or among animals) on or near rookeries, capture and restraint of individual animals, and handling of animals for conducting invasive procedures, see Section 4.8.1.1.

Mechanisms of Injury from Presence of Researchers on or near rookeries

It is not always possible to detect animal responses to disturbance. Some responses go unnoticed for various reasons including cryptic behavior of the animal, or limitations in methods used to observe or measure responses. For those species or circumstances where responses may be detected, the type and intensity of response can vary greatly. For NFSs, researchers have documented a variety of behaviors and measured various physiological indicators of stress in response to research activities. Many of the responses are similar to those of SSLs.

The biological effects of disturbance are strongly related to the season, type of disturbance, and frequency. During the peak of the breeding season, NFSs are reluctant to leave the breeding areas (NMFS 2006b). NFSs seem to tolerate disturbances in the breeding areas during the peak of the breeding season and studies have indicated that NFSs are resilient to extreme disturbances during the breeding season Gentry (1998).

Mechanisms of Injury from Capture and Restraint

For research activities that require capture and restraint of animals, there are risks of injury in addition to those listed above. Capture and restraint methods include both land-based and at-sea techniques (see Appendix B). Mechanisms by which NFSs can be injured during captured or incidental to capture include:

- Efforts to avoid or escape capture can lead to contusions, lacerations, hematomas, nerve injuries, concussions, and fractures, as well as hyperthermia and myopathy from increased muscle activity.
- Pups herded into large groups for processing or that pile up in response to disturbance on rookeries may be injured or suffocated under the weight of other pups.
- Pups attempting to reunite with their mothers after researchers leave may encounter lactating females who may aggressively displace and injure them.
- Capture myopathy is associated with prolonged or repeated stress reactions and is characterized by degeneration and necrosis of striated and cardiac muscles, which may be fatal and may not develop until 7-14 days after capture and handling.

Mechanisms of Injury from Sedation or Anesthesia

There are several types of drugs used to capture, sedate, or immobilize animals for marking, instrument attachment/insertion, or tissue sampling procedures. Technical descriptions of these procedures are presented in Appendix B. Some of the factors that contribute to adverse effects of anesthesia or sedation are discussed for SSLs in Section 4.8.1.1.

Mechanisms of Injury from Tissue Sampling, Marking, and Other Research Procedures

There are numerous types of research procedures involving the handling of NFSs, including collection of various tissue samples, attaching tags or scientific instruments, and applying temporary or permanent marks to animals. Technical descriptions of these procedures and their specific potential effects on animals are presented in Appendix B. Additional risks of procedures described for SSLs would also apply to NFSs. Risks associated with these other handling procedures on NFS are in addition to the risks of researcher disturbance and capture.

Attachment of instruments on NFSs have shown some negative effects. Gentry and Kooyman (1986) found that lactating females who were outfitted with to secure dive recording instruments had significantly longer foraging trips than those that were flipper tagged but not carrying instruments. However, this method is not currently in use.

Number of Animals Affected by Research under Each Alternative

The permits that were active at the time this EIS was initiated constitute the Status Quo level of research (Alternative 3). The numbers of takes for different research activities under these permits are listed in Appendix A (Take by Permit Number and Research Activity). These Status Quo numbers were modified according to the policies stated for Alternatives 2 and 4 to derive proxy numbers of takes used in the analysis of Alternatives 2 and 4.

Alternative 1 – No Action: No New Permits or Authorizations

Alternative 1, the no action alternative, would allow continuation of research that is currently authorized until the existing permits expire. However, for the purposes of analysis, the effects of the no action alternative will be based on what would be allowed after all current permits expire. Because no new research permits or authorizations would be issued after that time, no activities that required a permit would be allowed, which would limit research to those methods that do not result in "takes" of marine mammals such as remote surveys and observations and analysis of existing data and samples. No NFSs in the wild would be exposed to researcher activity under this alternative.

Aerial surveys of NFS rookeries could occur, but only at elevations above 1,000 ft. to avoid disturbing NFSs. Limited census activities, including pup and adult male counts, would be allowed if there were conducted from a distance and in way that causes no animals to respond to the activities. NFSs could also be monitored through use of time-lapse and remote video cameras mounted on cliffs overlooking rookeries. Tissue collection, use of collected materials, and measurements from animals taken for subsistence by Alaska Natives would be allowed to continue. This alternative would allow continued disentanglement programs for NFSs on the Pribilof Islands authorized by Marine Mammal Stranding Agreement with the NMFS and Scientific Research Permit No. 481-623 for Level B harassment. Collection of scat samples would be allowed at vacant haulouts and rookeries.

Alternative 2 - Research Program without Capture or Handling

Alternative 2 would prohibit any research activities that require capturing and handling of NFSs or researcher presence on rookeries during the breeding season. If these specific activities were not authorized, researchers could choose to expand their efforts with non-intrusive techniques or, alternatively, might elect not to pursue research on NFSs because they would not be able to address issues of interest or fit their research and funding objectives. Therefore, the level of non-intrusive research authorized could be similar the Status Quo, depending on the response of individual researchers and agencies to the policy represented in this alternative. For the purposes of analysis, the number of takes under each research activity will be defined as the numbers of animals affected by non-intrusive research activities under the Status Quo for those activities (see mortality assessment Tables 4.8-25 and 4.8.26).

This alternative would essentially limit research to census activity and behavioral observations that are not expected to cause injury to animals. Activities allowed under this alternative would include any aerial, vessel, and land-based survey activities that would result in only minor, short-term disturbance of NFSs. Marine mammal observers on resting areas or rookeries would be positioned at locations that would avoid disturbing the animals. Any remote sensing equipment would be placed at times and in such a manner as to avoid disturbing animals. Researchers could obtain permits for receipt and use of tissue samples from animals collected by Alaska Natives in the subsistence harvest or from animals that have been found dead. Scat collection would be allowed but only from haulouts and rookeries during the non-breeding season. No activities involving capture, restraint, or disturbance of animals on rookeries during the breeding season would be permitted, but disturbance on haulouts for resighting efforts and scat collection could be authorized.

Alternative 3 – Status Quo Research Program

For Alternative 3, the Status Quo, the numbers of animals exposed to different research activities is taken directly from the permits that were valid on January 1, 2006. For survey and monitoring types of activities, the number of animals that would be exposed to potential disturbance depends on how many animals will be in a particular place at a particular time. To account for potential interannual variation in the distribution and abundance of animals at the rookeries, researchers are encouraged to estimate the maximum number of animals that would be exposed (surveyed). Researchers generally estimate this number based on information in Stock Assessment Reports (SAR) and previous experience. When applying for permits, researchers may add a "buffer" to this maximum number of animals to make sure they do not exceed the permit allowance should the actual number of animals encountered be greater than predicted. The numbers of authorized takes for incidental disturbance are therefore often greater than the numbers reported after field work is complete (see Table 4.8-27 through 4.8-31).

For some activities, researchers have applied for and received permits to capture a specific number of animals. However, the actual sample size has been less than the number authorized. For procedures that are intended to test specific hypotheses or provide statistically robust data for modeling or other applications, the number of animals requested to be captured or sampled may be based on a "power analysis" determination of sample size. In all cases, the analysis of effects is based on the number of takes authorized in the permits rather than the number of actual takes reported after the field season.

Alternative 4 – Research Program with Full Implementation of Conservation Goals

Alternative 4 includes all research activities that would be needed to address all information objectives identified in the Draft Conservation Plan for NFS (NMFS 2006b). While such a program would likely require a substantial increase in future funding levels and the sources of that funding have not yet been established, it will be assumed for the purposes of this EIS analysis that sufficient funding would be secured to implement an expanded research program under Alternative 4. This alternative would include the same types of research as described in the Status Quo plus activities that have not been authorized under the Status Quo, including new permits and permit amendments that were pending as of January 2006. It could also include some types of techniques and activities that have not been previously requested or authorized, including temporary or permanent removal of animals from the wild and intentional lethal take.

The Draft Conservation Plan does not offer specific targets for the future scope or frequency of particular research activities but presents broad suggestions of research direction. All of the suggestions for new research are oriented toward the Eastern Pacific stock so the scope of research on the San Miguel Island stock under Alternative 4 will be assumed to be the same as the Status Quo (Alternative 3). Research objectives that have been emphasized for the Eastern Pacific stock are the need for improved information on vital rates, foraging behavior, habitat use, and the potential role of disease in the population decline. Increased effort towards these goals would be expected to increase the numbers of animals captured and marked (and hence takes associated with researcher presence among animals), and to increase the amounts of observational effort. New efforts to monitor reproductive success and the incidence of disease in the population would likely increase captures of mature females and involve an increase in handling procedures (e.g., blood samples) from captured animals. In general, the numbers of takes for different research activities have been increased over the Alternative 3 levels with input on potential future research from agency experts. These increases have not been assessed with power analyses of sample sizes or with respect to testing specific hypotheses because such detail would depend on the particular objectives of future research proposals. The estimates of takes under each research category are therefore considered to be proxies for the scope of proposals that would arise from many sources under a favorable funding environment. These estimates will be used in the analysis of effects for Alternative 4 (see mortality assessment Tables 4.8-32 through 4.8-36).

Because the San Miguel Island stock is not listed as depleted, and therefore has no Conservation Plan, the scope of research would be the same as under Alternative 3 (see mortality assessment tables 4.8-39 through 4.8-48).

Basis for Estimates of Animals Affected, Injury Rates, and Mortality Rates

Although few studies dedicated to detecting effects of research on NFSs have been conducted, the reactions of animals to research activities have been observed and recorded in numerous locations over the years by the researchers conducting the activities and, in some cases, by observers positioned well away from the animals. These data provide a basis for response estimates. Serious injuries and deaths that are observed during research activities are recorded in the annual reports filed with NMFS F/PR1 and are the basis of some estimates. However, quantitative information on the effects of research activities that may occur after researchers have left the area is not readily available. Therefore, this analysis relies on estimates of the proportions and rates of animals experiencing injury through different mechanisms, based on the professional opinion of highly experienced researchers at NMML. Except where noted, estimated reaction and mortality rates are applied to both NFS stocks.

Disturbance from Researcher Presence in View of Animals

Disturbance from research activities may result in a proportion of animals reacting to a research activity. *Researcher Presence in View of Animals* includes aircraft, vessel, and land observational platforms. Expected reactions of exposed NFSs include: 1) becoming alerted (includes physiological reactions that may not be externally expressed); 2) entering water; or 3) sustaining an injury because of the activity (e.g., being trampled, or having an elevated physiological stress reaction).

The mortality rate is the proportion of the animals reacting to the research activity (in the ways defined above) that might be expected to die as a result of the research activity either during the activity (and therefore directly observable), or as a direct result of the activity but expressed as an unobserved mortality occurring after the researchers have left the area. Differential mortality rates depending upon the response type (alerted, entered water, or injured) are estimated. The mortality rate estimated for NFSs is the same as described for SSLs (Section 4.8.1), except that no vessel survey category is included as it is not a technique utilized in NFS studies.

Incidental disturbance of NFSs may occur during surveys of other marine mammal species. Because takes of NFSs resulting from aerial surveys are requested based on the numbers expected to be exposed incidental to other marine mammal surveys, the number of NFSs actually reacting to this survey activity will potentially be less than the number of NFS exposed. An objective of aerial surveys is to not disturb NFSs while surveying for other animals.

Because takes resulting from aerial surveys are requested based on the numbers expected to be counted during a survey, the number of NFSs actually reacting to this activity will potentially be less than exposed. Observations at San Miguel Island found no observable reactions by NFSs in response to aerial surveys (R. Delong, NMML, personal communications 2006). Aerial surveys are rarely conducted on NFSs in Alaska. Insley (1992, 1993) suggested that aircraft activity could cause disturbance of NFSs because sound spectra of aircraft noise and airborne vocalizations are similar and noted that some NFSs oriented towards aircraft noise during overflights. However, due to the infrequency of the use of aerial surveys and based on observations from San Miguel Island responses in Alaska are likely to be rare, and thus estimated reaction rates are less than those estimated for SSLs, and assuming that non-pups are more likely to enter the water, but are less likely to be injured, than pups.

For aerial surveys and *Researcher Presence in View of Animals*, no pups are assumed to enter the water as a response based on their age. However, to account for uncertainty, a small proportion of the total number of pups potentially affected was used to estimate the number alerted and entering the water. The proportion of non-pups alerted and entering the water in response to aerial surveys was estimated from the SSL estimates; based on behavioral differences between these two species and the time of year of the surveys, NFSs were estimated to exhibit this response at a proportion half that of SSLs. The proportions of pups and non-pups potentially exposed and estimated to be injured were based on the NMML final report for permit number 782-1532 for the years 2000-2004. This estimate accounts for the type of activity as well as the time of year. In general, pups were assumed to be more at risk than non-pups.

No mortalities were observed to occur as a result of aerial surveys at San Miguel Island. Potential unobserved mortality rates have been estimated using the same approach used for aerial surveys of SSLs.

Disturbance from Researcher Presence among Animals

A proportion of 1.0 alerted animals of the total animals potentially exposed (all animals) was selected for the number of animals becoming alert in response to researcher presence among animals assuming the total number of individuals potentially and estimated to be actually affected are the same. This reflects how takes are requested by researchers for these activities. Proportion of animals that enter water in response to researcher presence among animals was based on NMML researcher experience on rookeries and resting areas, and accounts for different types of activities as well as the time of year (related to behavioral changes as the rookery structure breaks down). The proportions of pups and non-pups potentially exposed that were estimated to be injured were based on NMML professional opinion, and accounts for the type of activity as well as the time of year. In general, pups were assumed to be more at risk than non-pups.

For all listed activities except incidental takes of pups for *Researchers Present Among Animals*, no mortalities have been observed to occur based on the NMML final report for permit number 782-1532 for the years 2000-2004. When researchers are present among animals for pup round-ups and clearing of rookeries, the proportion of pups estimated to die (of the total number of pups incidentally taken during these activities) is 0.00001. This proportion was calculated based on 1998-2005 NMML permit reports documenting mortalities for these activities. It is likely that none of the individuals alerted incidental to these activities are likely to subsequently die. Pups were assumed to be more at risk than non-pups. According to NMML professional judgment, proportions of animals estimated to subsequently die as a result of sustaining injuries in response to activities are 0.05 (5/100) mortalities per injured animal for pups and 0.02 (2/100) mortalities per injured animal for non-pups, assuming pups are at greater risk than non-pups. These values are equivalent to the unknown mortality risks associated with similar activities anticipated for SSLs (Section 4.8.1).

Capture and Restraint of Animals

Mortality rates observed during the activity for capture/physical restraint and capture/chemical sedation were obtained from review of permit and trip reports for NMML NFS activities. Estimated rates for capture/chemical anesthesia were based on SSL data. Post-handling mortality rates are unknown, and estimates are as described for SSLs (Section 4.8.1). For this analysis, the observed mortality rate for capture and physical restraint methods is set to 0.0 for pups and 0.004 for non-pups. The estimated mortality rates after researchers leave are set to 0.001 for pups and 0.0001 for non-pups, based on NMML's professional judgment.

Handling, Testing, and Sampling Procedures

No mortalities have been reported by NMML resulting from any procedures performed on NFSs. All unobserved/post-capture mortality estimates are as described for SSLs. Several procedures are considered to add negligible additional risk of mortality during or after the procedure, including; bacteriology/virology swabs, hair or nail clipping, temporary external marks such as hair dye or paint, morphological measurements, milk samples, and external physical exams.

Examples of procedures considered to have relatively low risks of post-procedure mortality include blood sampling, flipper tagging, whisker pulling, injections of isotopic or other relatively inert chemical substances (such as deuterated water, tritiated water, Evan's Blue dye), BIA, ultrasound measurements/imaging, stomach intubation, enemas, fecal collection with loops, and insertion of stomach telemeter "pills." Because no directed studies have been conducted to measure post-procedure mortality rates, unobserved mortality is estimated at 0.0001 mortalities per procedure for pups and non-pups based on NMML's professional judgment.

Examples of procedures considered to have relatively medium risks of post-procedure mortality include tooth removal under general anesthesia, biopsies (local and remote), and use of local anesthesia. Because no directed studies have been conducted to measure post-procedure mortality rates, they are estimated at 0.0002 mortalities per procedure for pups and non-pups, double the estimated relatively low-risk procedure rate.

Examples of procedures considered to have relatively high risks of post-procedure mortality include transmitter implantation and other surgeries. Because no directed studies have been conducted to measure post-procedure mortality rates so they are estimated at 0.001 mortalities per procedure for both pups and non-pups, 10 times the estimated relatively low-risk procedure rate.

Animals Taken into Temporary Captivity

Historically, NFSs have rarely been taken into temporary captivity for research. However for the purposes of this EIS, this risk of these activities have been included as reasonably foreseeable future actions. The risk of mortality for animals taken into temporary captivity for research purposes contains components from all of the assessment tables described previously (e.g., capture, physical and chemical restraint, and numerous handling/sampling procedures). Temporary captivity also involves risks associated with transport of animals to and from the wild, and the stresses and other risks associated with living in an artificial environment and being chronically exposed to novel stimuli. One research method/risk unique to animals in captivity is dietary manipulations designed to study animals' responses to varying levels of nutrition and caloric content. The types of dietary manipulations performed are described in Appendix B, along with the suite of potential responses from the animals. Another factor unique to research on animals in captivity is that they can be monitored more closely and for longer periods of time post exposure to a risk or stressor than is practical for animals in the wild. As part of this additional monitoring, animals in captivity may receive veterinary care to resolve adverse effects (e.g., injuries, infections) associated with the research more readily and consistently than animals subject to the same or similar research activities in the wild. This may mitigate some of the adverse impacts associated with being in captivity.

The Animal Welfare Act (AWA), administered by the USDA APHIS, specifies requirements for ensuring the general health and welfare of captive marine mammals. APHIS is responsible for ensuring that research facilities adhere to these requirements. Because the AWA is not administered by NMFS, permits issued by NMFS do not include terms and conditions related to compliance with the AWA. However, NMFS permits can and do specify terms and conditions intended to ensure that the research conducted on captive marine mammals is consistent with the humane standards of the MMPA. Thus, NMFS permits require that these animals be monitored during and after experimental procedures and that mitigation measures are followed to minimize the potential for adverse impacts from the research. Permits allowing research on captive NFSs require that no animals be released back into the wild until passing a rigorous health assessment both to ensure the animal is capable of surviving in the wild and to minimize the potential for introducing disease into the wild population.

Assessment of Sub-lethal Effects Due to Research

As discussed for SSLs under Section 4.8.1, this element of the direct and indirect effects analysis addresses the ways the scope of research activities represented by each alternative may affect animals in ways other than those that lead to mortality, particularly the effects of research on the reproductive success of animals. As was the case for mortality, sub-lethal effects could occur as a direct result of the research activity itself or indirectly due to other contributing factors. While sub-lethal effects can result in changes in body condition, immune response, etc., our analysis of sub-lethal effects focuses on reproductive success and assumes these other responses ultimately affect reproductive capacity of adults or survival of offspring in some manner.

The consequences of research-related effects depend on a number of environmental conditions that vary seasonally, among years, and among locations. While the result of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect.

Part of the risk assessment for mortality includes estimates of the number of animals that are injured but do not die (sub-lethal effects). These estimates will be used as the basis for evaluating the potential effects on the reproductive success of animals exposed to research.

In many cases, the mechanisms or means for potential sub-lethal effects are inferred from studies on the reactions of other species or humans to various types of stress. Direct evidence for the occurrence of most of these mechanisms in NFSs is weak or lacking altogether. Although the information would be useful to have, not only for this EIS assessment but for interpretation of the research data, there is a level of uncertainty regarding the collection of this kind of information. It is not possible to design studies to investigate every potential effect of research without also affecting the animals. Chapter 5 discusses issues related to post research monitoring.

Assessment of Contributions towards Conservation Objectives

The direct and indirect effects analysis for the contributions towards conservation objectives discusses the degree to which the scope of research represented under each alternative would be able to address information needs for taking management actions that would promote recovery and conservation of the species. The evaluation of the alternatives against recovery and conservation goals is founded on the objectives and information needs identified in the Draft NFS Conservation Plan (NMFS 2006b).

The goal of the Draft Conservation Plan for NFS (NMFS 2006b) is to promote the recovery of the eastern Pacific NFS stock to a level appropriate to justify removal from MMPA depleted listing. NMFS will focus management using a science-based ecosystem approach to determine how and when to implement and monitor the conservation actions identified in the plan. NMFS noted that as of the writing of the Draft Conservation Plan, the stock was declining, and stopping the decline was of paramount importance. Meeting the goal of recovery to an OSP level and reclassification as not depleted may take many decades. The Draft Conservation Plan proposes four objectives aimed at restoring and maintaining the eastern Pacific stock of NFSs to its OSP level.

1. Identify and eliminate or mitigate the cause or causes of human-related mortality of the eastern Pacific stock of NFSs.
2. Assess and avoid or mitigate adverse effects of human-related activities on or near the Pribilof Islands and other habitat essential to the survival and recovery of the eastern Pacific stock of NFSs.
3. Continue and, as necessary, expand research or management programs to monitor trends and to detect natural or human-related causes of change in the NFS population and habitats essential to NFS survival and recovery.
4. Coordinate and assess the implementation of the conservation plan, based on the implementation of conservation actions and the completion of high-priority studies.

The first two objectives are concerned with human-related mortality in regards to marine debris and commercial fishing, but would rely on NFS field research to monitor effects. The third objective is the continuation of research to monitor the population trends and their causes. The last objective focuses on coordination associated with implementing the conservation plan and the conservation actions, but also monitors vital research. Under each of these objectives is a series of recommended conservation actions that would assist in achieving the stated objective:

1. Identify and eliminate or mitigate the cause or causes of human-related mortality of the eastern Pacific stock of NFSs
   - 1.1 Improve understanding of the sources, fates, and effects of marine debris.
   - 1.2 Improve assessments of incidental take of NFSs in commercial fishing operations.
   - 1.3 Evaluate harvests and harvest practices.
2. Assess and avoid or mitigate adverse effects of human-related activities on or near the Pribilof Islands and other habitat essential to the survival and recovery of the eastern Pacific stock of NFSs
   - 2.1 Work with the Tribal governments under co-management agreements.
   - 2.2 Advise and consult with the relevant action agencies and industries.
   - 2.3 Review and make recommendations on proposed activities and actions that have the potential for adversely affecting NFSs.
   - 2.4 Conduct studies to quantify effects of human activities (e.g., research, hunting, tourism, vehicles, discharges, facilities) at or near breeding and resting areas.
   - 2.5 Undertake conservation or management measures as necessary to eliminate or minimize deleterious impacts to NFSs.
   - 2.6 Assess and monitor pollutants.
3. Continue and, as necessary, expand research or management programs to monitor trends and to detect natural or human-related causes of change in the NFS population and habitats essential to NFS survival and recovery
   - 3.1 Monitor and study changes in the NFS population.
   - 3.2 Improve assessment of the effects of disease.

3.3 Describe and monitor essential NFS habitats.

3.4 Identify and evaluate natural ecosystem changes.

4. Coordinate and assess the implementation of the conservation plan, based on the implementation of conservation actions and the completion of high-priority studies

   4.1 Establish conservation plan coordinator position.

   4.2 Develop and implement education and outreach programs.

   4.3 Develop and promote international conservation efforts.

   4.4 Enforce existing regulations.

This section presents the analyses of the effects of the four different research alternatives on NFSs. The general methodology for performing this assessment is introduced in Section 4.4, and a more detailed description of the approach to analyzing mortality and sub-lethal effects in SSLs is presented in Section 4.8.1. The same approach used for SSLs applies to NFSs.

4.8.2.1 Eastern Pacific Stock – Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

Because there would be no research-related takes of NFSs on the Pribilof Islands and Bogoslof Island under Alternative 1, there would be no mechanism for research-related injury or mortality.

Direct and Indirect Mortality Due to Research

Because there would be no research-related takes of NFSs on the Pribilof Islands and Bogoslof Island under Alternative 1, there would be no mechanism for research-related injury or mortality. Direct and indirect effects of the authorized research would be negligible.

Sub-Lethal Effects Due to Research

There would be no mechanism for research-related injury under this alternative; therefore, there would be no sub-lethal effects on NFSs. Direct and indirect effects of the authorized research would be negligible.

Contribution to Conservation Objectives

Alternative 1 - research program would continue to pursue the identified actions under Objectives 1 and 2. NMFS and the Tribal groups would be able to conduct marine debris studies, disentanglement programs, and programs to improve the assessment of incidental take in commercial fisheries; to monitor and evaluate subsistence harvest and collect tissue from the animals harvested; and to analyze previously collected samples and other data. Programs under Objective 2 would address potential adverse human-caused effects on NFSs in the Pribilof Islands. With the exception of 2.4, neither of these objectives relies directly on NFS research.

Most of the programs and actions under Objective 3 would not be able to be pursued under Alternative 1. Some census activity could take place using high-altitude aerial surveys and observations from distant vantage points. To ensure that animals are not disturbed, these activities would be restricted only to specific research projects that can be conducted in a manner and distance that eliminates any potential for animal response. However, these data would be of questionable quality and value, would not be comparable to previous years, and would not provide a continuous time-series record of population levels. Without census information on the population, efforts to upgrade this stock from a depleted status would likely be unsuccessful; use of existing data or data collected from subsistence-harvested animals, as allowed by Alternative 1, would not provide the appropriate metrics of time frame to address the critical scientific needs related to the recovery of the stock.

Under Alternative 1, Objective 4, Conservation Action 4.1 - Establish conservation plan coordinator position, would not be warranted to monitor for such minimal conservation actions. The other three conservation actions under Objective 4 could be supported without field research and include 4.2 - Develop and implement education and outreach programs, 4.3 - Develop and promote international conservation efforts, and 4.4 - Enforce existing regulations.

Conclusion for Conservation Objectives
Because of the limited magnitude or intensity of the research program under Alternative 1, the beneficial contribution towards the conservation objectives in the 2006 Draft Conservation Plan is primarily analysis of information already collected and cursory field observations and is therefore considered minor.

4.8.2.2 Eastern Pacific Stock - Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

All research activities authorized under Alternative 2 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and permit conditions to mitigate potentially adverse effects. It is assumed that the resulting research program would be conducted under "best practice" conditions that would minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects that would remain even after all reasonable precautions are taken for the scope of research defined under Alternative 2.

Alternative 2 would include research methods that would not involve capture, restraint, tissue sampling, or intentionally causing animals to leave rookeries during the breeding season. This alternative would essentially limit research to census activity and behavioral observations that are not expected to cause injury to animals.

Direct and Indirect Mortality Due to Research

The potential mechanisms for injury and mortality are described in Section 4.8.1 and Appendix B. Under Alternative 2, the majority of research would consist of aerial and ground-based surveys. Disturbance from aerial survey activity would be incidental to surveys for other marine mammals. Mortality as a result of incidental overflights would likely be extremely small (an estimated 0.1 animals per year). Land-based surveys of rookeries during the breeding season would be limited to observations from blinds, catwalks, and cliffs, and in such a manner as to avoid disturbing them. No mortality is anticipated from these activities. Thus, an estimation of the risk of mortality associated with *Researcher Presence in View of Animals* is approximately 0.1 animal per year (Table 4.8-25).

After the breeding season, researchers would be authorized to enter the rookery to collect scat samples, look for tagged animals, and ground count animals remaining. Therefore, some animals still present at a rookery would be affected from these disturbances. Mortality from *Researcher Presence Among Animals* is estimated to be 1.1 animals per year.

Conclusion for mortality effects

Total mortality for all research activities on eastern Pacific NFSs under Alternative 2 is estimated at 1.2 animals per year. This represents substantially less than 0.1 percent of PBR (15,262 animals). The magnitude and intensity of the effects from mortality is therefore considered negligible at the population-level (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects).

Table 4.8-25
Estimated Mortality Due to Researcher Presence in View of Animals. NFS Eastern Pacific Stock - Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.01	0	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	30,500	Observed mortality during activity			0	0.0	
			Alert response	0.01	305	0.0	0.0	
			Enter water	0.005	153	0.0001	0.02	
			Injury during disturbance	0.00001	0.3	0.02	0.0	0.0
On land catwalks, tripods, cliffs	pups	6,500	Observed mortality during activity			0	0.0	
			Alert response	0.05	325	0.0	0.0	
			Enter water	0.0001	1	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	38,450	Observed mortality during activity			0	0.0	
			Alert response	0.05	1,923	0.0	0.0	
			Enter water	0.005	192	0.0001	0.02	
			Injured during disturbance	0.00001	0.4	0.02	0.01	0.0
Subtotal for estimated mortality due to researcher presence in view of animals								**0.1**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-26
Estimated Mortality Due to Researcher Presence among Animals. NFS Eastern Pacific Stock - Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Haulouts, rookeries non-breeding (scat collection, resights, ground counts)	pups	1,000	Observed mortality during activity			0.00001	0.0	
			Alert response	1	1,000	0.0	0.0	
			Enter water	0.05	50	0.0001	0.0	
			Injured during disturbance	0.0005	1	0.05	0.0	
	non-pups and "all"	11,500	Observed mortality during activity			0.0	0.0	
			Alert response	1	11,500	0.0	0.0	
			Enter water	0.9	10,350	0.0001	1.04	
			Injured during disturbance	0.0001	1	0.02	0.0	1.1
Subtotal for estimated mortality due to researcher presence among animals								**1.1**
Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.								

Sub-Lethal Effects due to Research

The estimated scope of research conducted under Alternative 2 could potentially affect many animals in the population through disturbance from aerial surveys and other activities. The mortality assessment tables indicate that a very small percentage of animals could die as a result of entering the water and/or being injured during a research-related disturbance. Most animals exposed to research activities do not die as a result but may experience other effects ranging in intensity from a temporary alteration of normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

Although research-related injuries under Alternative 2 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is how those injuries contribute to a population-level effect. Not all sex/age classes are equally susceptible to sub-lethal effects that could alter the productivity of the population. Mature bulls that sustain a substantial injury may have difficulty establishing or reestablishing breeding territories and could therefore lose potential mates. Although this would reduce individual reproductive success, one or more other bulls would be likely to take the place of displaced bulls. All breeding females would still find mates, and the overall productivity of the rookery would remain unchanged. Pups and juveniles that are injured but that do not die are likely to recover well before they approach reproductive age (i.e., 5-7 years for females and 8-10 years for males). Their future survival and reproductive success is therefore much more likely to be determined by the many environmental variables that affect foraging success and growth rate, such as the abundance and distribution of forage fish and changes in ocean regimes.

The sex/age class most susceptible to effects that might decrease overall productivity is breeding-age females, primarily through physiological reactions to stress that may cause re-absorption or abortion of fetuses, or failure of fertilized embryos to implant. A female that reacts in any of these ways would lose the opportunity to raise a pup the following summer, but not necessarily in subsequent seasons. Another potential mechanism for sub-lethal reproductive effect would be if an injury was sustained somewhere in the reproductive tract or hormonal regulatory system that led to permanent sterility. If these types of injuries occur to a relatively large number of females each year, overall pup production would decrease and hinder the ability of the population to recover. The relevant question for the analysis is how many breeding age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Sub-lethal effects of *Researcher Presence in View of Animals* can range from avoidance of the disturbance (little or no adverse effect) to pain and suffering resulting in serious injury. During aerial survey activity, sub-lethal effects are caused by an animal's flight response from the disturbance. Injury can result from stampedes where pups get trampled or chased into the water, or from aggressive interaction between adults. For NFSs, it is anticipated that only 1 percent of the exposed animals would respond by an alert reaction, and half of those animals would enter the water to escape. Therefore, under Alternative 2, if 30,500 NFSs were overflown during aerial surveys (incidental to surveys of other marine mammals), disturbance would be sufficient to drive approximately 153 into the water.

Because these aerial surveys are focused on other marine mammals and are incidental to NFS-specific research, they would likely be flown at an elevation greater than 600 feet, which would more than likely not result in flight response in NFSs. There is little information on the effect of aerial surveys on NFSs, but impacts are likely to be similar to those on SSLs. Disturbance from aircraft traffic has been observed to have highly variable effects on hauled-out SSLs, ranging from no reaction to complete departure from the site (Calkins and Pitcher 1982; Johnson *et al.* 1989; Williams 2001). Because of the low intensity of this disturbance, and the short-term duration, effects of these types of aerial surveys are expected to be negligible.

Disturbance caused by *Researcher Presence Among Animals* results from researchers coming in close contact with animals on the rookeries. The only types of activities in this category under Alternative 2 are scat collections, looking for tags, and general animal counts after the breeding season. There could potentially be some disturbance to an estimated 12,500 animals still present at the rookeries. However, no mortality is expected due to these activities.

Conclusion for sub-lethal effects

Sub-lethal effect on reproductive success is unknown; however, based on the estimated low number of animals responding to this type of disturbance, effects on the population are expected to be negligible. The duration of research activities affecting the animals would be relatively short-term, occurring for a short period at the time of the survey. Therefore, the degree to which this portion of the research program would contribute to direct and indirect mortality would be negligible.

Contribution to Conservation Objectives

Under Alternative 2, the non-intrusive research activities that could be authorized could contribute to some of the Draft Conservation Plan objectives that address research (see Section 4.8.2). However, aerial and land-based surveys would do little to support two of the conservation activities listed under Objective 3: 3.1 - Continue monitoring and study changes in the NFS population and 3.2 - Improve assessment of the effects of disease. The other two conservation actions under Objective 3 do not rely on intrusive field research and could be conducted without intrusive activities: 3.3 - Describe and monitor essential NFS habitats and 3.4 - Identify and evaluate natural ecosystem changes. The conservation actions would be limited to descriptions of historical NSF distributions and collection of environmental data and would, therefore, not provide for direct evaluation of causal relationships to changes in the NFS population.

Under the Alternative 2 research program, the standard mark/recapture technique (shear-sampling) used in the past to estimate pup production (York and Kozloff 1987) would not be authorized. Data from any new census methods would not be comparable with past results and monitoring population trends would be compromised.

Some biological samples could be collected from male NFSs during the subsistence harvest in the Pribilof Islands. Health and body condition monitoring would be limited to visual assessments and scat analysis.

Under Alternative 2, Objective 4, Conservation Action 4.1 - Establish conservation plan coordinator position, no position would be warranted because there would be minimal conservation actions. The other three conservation actions under Objective 4 could be supported without field research. These are 4.2 - Develop and implement education and outreach programs, 4.3 - Develop and promote international conservation efforts, and 4.4 - Enforce existing regulations.

Conclusion for Conservation Objectives

Because the magnitude or intensity of the research program under Alternative 2 would allow for some low-level field research activities and non-field-related research, the beneficial contribution towards the conservation objectives in the Draft Conservation Plan is considered minor.

4.8.2.3 Eastern Pacific Stock - Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

All research activities authorized under Alternative 3 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and implementation of permit conditions to mitigate potentially adverse effects. It is assumed that the resulting research program would be conducted under conditions that would minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects for the scope of research defined under Alternative 3. The existing grant and permit process is relatively flexible in that it can accommodate minor changes in the level of funding, management priorities, scientific interests, research techniques, population status, and it addresses threats to the recovery of the NFSs. The scope of research activities conducted under this alternative depends substantially on the amount of funding that is available, which can often limit the amount of research that can be done. The number, types, and distribution of takes allowed by all permits approved by January 2006 will be used for the analysis of effects under this alternative.

Direct and Indirect Mortality Due to Research

Under Alternative 3, the Status Quo alternative, new permits would be issued for the same type and scope of research as occurred before January 1, 2006. New permits would be issued to replace permits as they expire, such that the levels and types of research activities would continue to the extent that funding allowed. Under Alternative 3, the combined permits and authorizations for incidental mortality would not exceed 10 percent of PBR (i.e., 1,526).

New requests for permits and amendments to existing permits would be considered on a case-by-case basis and would be granted as long as the researchers were qualified to do the work, the research was bona fide and justified through reference to the Draft Conservation Plan objectives, the project had a reasonable chance of succeeding, the authorizations for incidental mortality would not exceed 10 percent of PBR, and it was consistent with all other permit issuance criteria. Under this alternative, authorized research could include:

- Activities with *Researcher Presence in View of Animals* (Table 4.8-27 - aerial and land surveys).
- Activities with *Researcher Presence Among Animals* (Table 4.8-28 – on rookeries and haulouts for ground counts, scat collection, captures).
- *Capture and Restraint Activities* (Table 4.8-29 – various sex/age classes by various physical and chemical methods).
- *Handling and Sampling Procedures* on animals in the wild (Table 4.8-30 – various procedures, primarily on captured animals, plus remote sampling. Pups and juveniles captured for invasive procedure may be injected with valium if necessary to reduce stress levels).
- *Capture, Temporary Captivity for Experimentation, and Release* back into the wild (Table 4.2-31 – non-pups taken to approved facilities for up to 3 months).

Each table lists the number of takes, estimated injuries, and estimated mortalities of eastern Pacific stock NFSs for the given activities under Alternative 3.

The estimated total direct and indirect mortality from aerial surveys is the same as under Alternative 2. Aerial surveys could be flown at a similar elevation (600 feet) or lower, depending on the survey conditions. Effects from land-based observations taken at a distance by either researchers or remote camera would also be similar to effects under Alternative 2. Additionally, NFSs would be disturbed from *Researcher Presence in View of Animals* during ground-based census activity in the Pribilof Islands and Bogoslof Island. Approximately 45,000 animals would be exposed to the activity. The estimated total direct and indirect mortality from *Researcher Presence in View of Animals* approaches zero (0.1 animals per year) under Alternative 3 (Table 4.8-27).

The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 20.7 NFSs per year (Table 4.8-28). Census activity on the Pribilof Islands under Alternative 3 would include pup production estimates on a biennial basis, and adult males would be counted annually. Census activity of Bogoslof and Sea Lion Rocks would be less frequent. These mortalities would result from physical trauma, such as trampling of pups or aggressive interaction with other animals, separation of pups from their mothers, pups entering the water prematurely, and overheating from stress. A majority of this mortality would be from activities involving rookery clearing (18.3 animals per year), primarily because of the large number of animals exposed to this disturbance (up to 321,250). Most, if not all, of the predicted mortality would be unobserved (occurring after the researchers leave).

Capture and restraint of individual animals for marking or other procedures is analyzed by four sub-categories of this activity: capture and physical restraint, capture and anesthesia (inhalation agent – isoflurane gas), capture and chemical sedation (injectable valium), and intentional lethal take or permanent removal. The specific effects of individual procedures on animals are discussed in Appendix B. Mortality can occur at the time the animals are being captured and treated (observed mortality), or animals can succumb sometime after release (unobserved mortality).

Based on the authorized number of animals that could be captured and restrained or permanently removed under this alternative and the predicted mortality rate of each activity, the estimated total direct and indirect mortality from *Capture and Restraint activities* is approximately 26.4 animals per year, most of which would be pups. Over 99 percent of this mortality would be due to capture and physical restraint of the animals. Capture and chemical sedation would result in mortality of <0.1 animal per year.

Handling of the animals and conducting sampling procedures after animals have been captured and restrained is also a potential source of mortality. The handling and sampling procedures allowed under this alternative include:

- Relatively low-risk procedures—sampling blood, hair, nails and vibrissae, flipper tag, external instrument attachments, enemas, stomach intubation, fecal loop, stomach pill telemeters; and
- Relatively medium-risk procedures —teeth pull, biopsies, remote biopsies (includes local anesthesia).

The estimated total direct and indirect mortality from *Handling and Sampling Procedures* on animals in the wild would be approximately 0.6 animals per year, primarily from relatively low-risk procedures. A total of over 6,000 procedures could occur because multiple procedures could be performed on each animal. By comparison, only 70 relatively medium-risk procedures are performed on all animals being handled and sampled, which contribute to approximately 0.01 animal mortalities per year. No relatively high-risk procedures are proposed under Alternative 3. Overall, the intensity of the effects of handling and sampling procedures would be considered negligible based on the very low mortality rate. The geographic extent of this activity would be considered moderate because the sampling would be distributed throughout several of the major rookeries.

The estimated total direct and indirect mortality from *Capture*, *Temporary Captivity for Experimentation, and Release* back into the wild is typically very low, and once an animal is captured and sedated, mortality is very low. However, there are no current permits or authorizations for temporary capture of NFSs under this alternative. A mortality rate similar to that of SSLs (0.1 animals per year for 16 animals taken) is assumed.

Total mortality for all research activities on eastern Pacific NFSs under Alternative 3 is estimated at 47.8 animals per year. This represents approximately 0.3 percent of PBR (15,262 animals). Therefore, the magnitude or intensity of the overall effect is considered negligible (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects). This effect would be considered likely and would be spread over several rookeries within the major breeding area for this stock, therefore the geographic extent and likelihood would be considered moderate.

Table 4.8-27
Estimated Mortality Due to Researcher Presence in View of Animals. NFS Eastern Pacific Stock - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.01	0	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	30500	Observed mortality during activity			0	0.0	
			Alert response	0.01	305	0.0	0.0	
			Enter water	0.005	153	0.0001	0.02	
			Injury during disturbance	0.00001	0.3	0.02	0.0	0.0
On land catwalks, tripods, cliff	pups	6500	Observed mortality during activity			0	0.0	
			Alert response	0.05	325	0.0	0.0	
			Enter water	0.0001	1	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	38450	Observed mortality during activity			0	0.0	
			Alert response	0.05	1923	0.0	0.0	
			Enter water	0.005	192	0.0001	0.02	
			Injured during disturbance	0.00001	0.4	0.02	0.01	0.0
Subtotal for estimated mortality due to researcher presence in view of animals								**0.1**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-28
Estimated Mortality Due to Researcher Presence among Animals. NFS Eastern Pacific Stock - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Activities involving pup roundups	pups	7,010	Observed mortality during activity			0.00001	0.1	
			Alert response	1	7,010	0.0	0.0	
			Enter water	0.01	70	0.001	0.07	
			Injured during disturbance	0.001	7	0.05	0.4	
	non-pups	3,465	Observed mortality during activity			0.0	0.0	
			Alert response	1	3,465	0.0	0.0	
			Enter water	0.8	2,772	0.0001	0.3	
			Injury during disturbance	0.0005	2	0.02	0.03	0.8
Activities involving clearing rookery/haulout	pups	217,275	Observed mortality during activity			0.00001	2.2	
			Alert response	1	217,275	0.0	0.0	
			Enter water	0.05	10,864	0.0001	1.09	
			Injured during disturbance	0.0005	109	0.05	5.4	
	non-pups	103,975	Observed mortality during activity			0.0	0.0	
			Alert response	1	103,975	0.0	0.0	
			Enter water	0.9	93,578	0.0001	9.4	
			Injured during disturbance	0.0001	11	0.02	0.21	18.3
Incidental disturbance during captures in breeding season[2]	pups	8,420	Observed mortality during activity			0.0	0.1	
			Alert response	1	8,420	0.0	0.0	
			Enter water	0.001	8	0.001	0.01	
			Injured during disturbance	0.001	8.4	0.05	0.4	
	non-pups	20,165	Observed mortality during activity			0.0	0.0	
			Alert response	1	20,165	0.0	0.0	
			Enter water	0.01	202	0.0001	0.0	
			Injury during disturbance	0.001	20	0.02	0.4	0.9
Incidental disturbance during captures outside of breeding season	pups	11,890	Observed mortality during activity			0.0	0.1	
			Alert response	1	11,890	0.0	0.0	
			Enter water	0.05	595	0.0001	0.06	
			Injured during disturbance	0.0005	6	0.05	0.3	
	non-pups	9,905	Observed mortality during activity			0.0	0.0	
			Alert response	1	9,905	0.0	0.0	
			Enter water	0.2	1981	0.0001	0.2	
			Injured during disturbance	0.0001	1.0	0.02	0.02	0.7
Subtotal for estimated mortality due to researcher presence among animals								**20.7**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Breeding season: SM prior to 1 August; EP prior to 08 August

Table 4.8-29
Estimated Mortality Due to Capture and Restraint Activities. NFS Eastern Pacific Stock - Alternative 3

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	25,535	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	25.535	
	non-pups	190	Observed during activity	0.004	0.76	
			Unobserved/post-capture	0.0001	0.019	26.3
Capture/chemical anesthesia ' (inhalable agent-isoflurane)	non-pups	0	Observed during activity	0.004	0	
			Unobserved/post-capture	0.0001	0	0.0
Capture/chemical anesthesia '(injectable)	non-pups	0	Observed during activity	0.01	0	
			Unobserved/post-capture	0.001	0	0.0
Capture/chemical sedation (injectable-e.g. valium)	non-pups	660	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.066	0.066
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**26.4**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-30
Estimated Mortality Due to Handling and Sampling Procedures. NFS Eastern Pacific Stock - Alternative 3

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-cold branding	pups	0	Observed during activity	0.000	0	
			Unobserved/post-capture	0.002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0.0
Relatively low risk procedures	pups	3,620	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.362	
	non-pups	2,620	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.262	0.6
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	70	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.014	0.014
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**0.6**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-31
Estimated Mortality Due to Temporary Captivity for Experimentation. NFS Eastern Pacific Stock - Alternative 3

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed mortality during activity			
			Unobserved/post-capture mortality			
	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Chemical sedation (injectable - e.g. valium)	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Permanent mark/hot branding	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0.0
Relatively low risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0
Relatively medium risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	0
Relatively high risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.0**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

Most animals exposed to research activities do not die as a result; however, they may experience other effects, ranging in intensity from a temporary alteration of normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

As described under Alternative 2, sub-lethal effects could occur as a direct result of the research activity itself or indirectly, due to other contributing factors. The cause is difficult to determine, however, because no specific studies on this topic have been conducted. Research activities could cause disturbance or injury to animals that affect their ability to function normally. The consequences of such research-related effects will depend on a number of environmental conditions that vary seasonally, between years, and among locations. While the result of a disturbance or injury is difficult to predict because of the many complicating factors, the initial disturbance caused by research does play a role in the ultimate effect. Although research-related injuries under Alternative 3 could cause more than momentary pain or discomfort for individual animals, the focus of the analysis is how those injuries contribute to a population-level effect. The sex/age class most susceptible to effects that might decrease overall productivity of the population is breeding-age females, primarily through physiological reactions to stress that cause re-absorption or abortion of fetuses, failure of fertilized embryos to implant, or sterilization. The relevant question for the analysis is how many breeding age females are likely to be affected each year to the extent that they fail to reproduce as a result of research activities.

Total takes of NFSs, from *Researcher Presence in View of Animals* is not likely to affect reproductive success of the population (Table 4.8-27). Of the approximately 30,500 non-pups that would be exposed to aerial survey activity, approximately 450 would be expected to react to the disturbance. However, a smaller portion of these reactions would likely result in some degree of stress, pain, and suffering, and an even smaller number would include physical injuries. Because this type of disturbance would be very short in duration and very limited in frequency, responses would be unlikely to result in effects to reproductive success.

Land-based census activities from cat walks, cliffs, or tripods under this alternative would expose approximately 38,450 adults and juveniles, of which approximately 2,000 would respond to the disturbance in some manner. These responses could include an alert response, a change in behavior, or animals entering the water. These responses could elicit aggressive interactions between animals of neighboring territories. The magnitude or intensity of these reactions would be minor based on numbers. Although the sub-lethal effects on reproduction are unknown, the potential exists for some mechanism that could affect reproductive success or decrease the reproductive life of some individual animals. Responses, however, would be unlikely to result in effects to reproductive success at the population level. Effects are therefore considered minor.

The primary research activity associated with *Researcher Presence Among Animals* includes ground-based census activities. Approximately 382,000 pups and non-pups would be exposed to land or vessel-based activities, including captures. There is some potential for this level of disturbance to have an effect on reproductive success of individual animals. Magnitude or intensity therefore is considered minor; however, the actual intensity of that effect is unknown. Responses would be unlikely to result in effects to reproductive success at the population level.

Outside of the breeding season, captures at rookeries and haulouts could potentially disturb an estimated 21,795 animals (both pups and non-pups). Of the 21,795 NFSs, approximately 2,576 could be driven to the water, and about 7 would be expected to be injured (Table 4.8-28).

Capture and Restraint procedures constitute one of the most stressful incidents in the life of an animal, and intense or prolonged stimulation can induce detrimental responses (Fowler 1986). With NFSs, the primary subjects for capture and restraint are pups. Approximately 25,500 pups would be captured and physically restrained under Alternative 3 (Table 4.8-29). Sub-lethal effects on NFS pups have not been well studied. Because most of the sub-lethal effects in this category is associated with capture and restraint, it is assumed that the greatest amount of sub-lethal effects would occur from capture and restraint. All NFSs captured and restrained would be expected to experience some degree of stress associated with the capture or attempted escape from restraint. Physical injury could also occur. Restraint of the animals for marking or other procedures can result in overexertion, hyperthermia, and breathing problems (Appendix B). Capture myopathy (striated and cardiac muscle damage) is a possible consequence of the stress associated with chase, capture, and handling in numerous mammal species (Fowler 1986). The magnitude or intensity of the effects at the population level is unknown. However, because most of the captured animals would be pups, effects on reproductive success are unlikely by the time they enter the breeding population as adults. Chemical restraint, in the form of anesthesia or sedation, is used by researchers to minimize adverse effects or physical pain on the subject animals and to ensure success of the procedure. Sub-lethal effects of chemical restraint depend on the specific drugs used, and success of the drug is highly dependant on dosage (Appendix B). Adverse reactions and side effects from the range of drugs used for these procedures are not expected to be long-term. However, the effect on reproductive success or length of reproductive life in subsequent years is unknown.

The effects of *Handling and Sampling Procedures* are highly dependent on the experience and knowledge of the technicians performing the procedures and the health and physical condition of the subject animals. Sterile techniques and hygiene at the work site minimize injury to captured animals.

Approximately 6,240 relatively low-risk procedures would be performed on NFSs, about 58% of which would be pups. Collection of physical data on captured NFSs such as weight, length, girth, and use of ultrasound are not expected to have long-term effects on the animals. Collection of biological samples such as hair, nails, vibrissae, blood, fecal loops, enemas, swabs, and intubations result in either no pain or momentary pain.

Few (70) relatively medium-risk procedures would be done on adult NFSs. These procedures would include activities that break the skin in some manner and have a greater potential for adverse effects, in comparison to the relatively low-risk procedures. These procedures would be expected to cause more than momentary pain and have the potential for infection, especially given the unsanitary conditions of the rookeries. Muscle biopsies require a deeper incision and abscess can form in the deep tissue. Other relatively medium-risk procedures include blubber biopsies, skin biopsies, and surgical implantation of instruments. Relatively few of these procedures would be done on adult NFSs (70) under Alternative 3, but would yield valuable information on the condition of the NFS (Table 4.8-30).

It is difficult to estimate how many reproductive failures this level of disturbance would be likely to cause due to uncertainty about several factors:

- The proportion of these disturbed animals that would be reproductive age females.
- The proportions of animals likely to respond in different ways.
- The mechanisms of effect.
- The environmental conditions that would strongly influence the ultimate effect on individual animals.

<u>*Conclusion for sub-lethal effects*</u>

The magnitude of the total direct and indirect effect of mortality on NFSs under the scope of research under Alternative 3, the Status Quo, is approximately 47.8 animals per year, and would be considered negligible at the population level based on the percent of PBR affected. The geographic extent of this effect would be distributed among several rookeries, but within the major breeding area of this stock, and considered moderate. The magnitude of sub-lethal effects as they relate to population-level changes in reproductive success under Alternative 3 is unknown. Mortality and sub-lethal effects are considered likely with current research techniques, but the geographic extent of the research under Alternative 3 is likely to distribute sub-lethal effects across the range of the population. Frequency of research activities and exposure to this level of disturbance could occur several times during the breeding season and considered moderate.

Contribution to Conservation Objectives

The range of research activities authorized under Alternative 3, the Status Quo, provides the means to address essentially all basic information needs for NFSs that are identified in the Draft Conservation Plan. However, there are some sex/age classes that are underrepresented in the current data sets addressing particular issues. Consistent funding of research activities has been identified as a problem in fulfilling recommendations of the Draft Conservation Plan. Some of these data gaps may also be due to lack of techniques for safely capturing adult animals that researchers are interested in studying, such as pregnant or lactating females. Particular conservation actions recommended by the Draft Conservation Plan under Objective 3 that would be difficult to address adequately for all age/sex classes with currently authorized techniques include:

Conservation Action 3.1.5 – Study Vital Rates

- An expanded tagging and re-sighting program is recommended to obtain improved estimate of age-specific female survival and reproductive rates (once a better tag is tested).
- A study of the long-term survival and reproduction of individually identified females is recommended.
- A study of trends in age structure, age-specific reproductive rates, prey taken by fur seals during the breeding season and in other parts of the range is recommended.

Conclusion for Conservation Objectives

The Alternative 3, Status Quo, research program addresses most priority issues and long-term information needs for the eastern Pacific NFS stock. Based of the magnitude/intensity, long-term nature, and frequency of sampling under the Alternative 3 research program and the data thereby collected, the beneficial contribution towards the conservation objectives in the Draft Conservation Plan is considered moderate.

4.8.2.4 Eastern Pacific Stock - Direct and Indirect Effects of Alternative 4 – Preferred Alternative - Research Program with Full Implementation of Conservation Goals

All research activities authorized under Alternative 4 would meet the statutory and regulatory requirements of the permit process, including criteria for experienced research personnel, the use of "humane" procedures to minimize pain and suffering, and permit conditions to mitigate potentially adverse effects. It is assumed that the resulting research program would be conducted under conditions that would minimize disturbance and the chance of harm to the animals. The following assessment provides an estimate of the effects that would remain even after all reasonable precautions were taken for the scope of research defined under Alternative 4. This alternative would include not only those specific activities currently or previously permitted but any additional research activities or methods that would be needed to implement the Draft NFS Conservation Plan (NMFS 2006b).

Under Alternative 4, NMFS would consider proposals for research that posed a higher risk of injury to individual animals, including intentional mortality of moribund animals or other specified individuals, if the research was bona fide, and had a reasonable chance of providing important data relevant to conservation of the species. Permit issuance criteria would still prohibit research from putting the species at a disadvantage.

Permits and authorizations for incidental and intentional mortality under Alternative 4 would not exceed 15 percent of PBR for the eastern Pacific NFS (i.e., 2,289). The methods and procedures authorized under this research program would include all of those discussed under Alternative 3, plus additional methods as deemed appropriate.

Alternative 4 represents an extensive research program that would be able to address multiple issues over a large geographical area. For the purposes of this EIS, it is assumed that the grants and permits processes will be essentially the same as under the Status Quo. However, if adequate funding were available to implement this expanded research program, it is likely that NMFS would adopt one or more of the measures discussed in Chapter 5 of this document. These measures would expedite the review process and improve communication and coordination, not only between researchers but also between the various branches of NMFS involved in the research program, the Alaska Native communities affected by research, other federal and state agencies, and the public.

Direct and Indirect Mortality Due to Research

Under Alternative 4, there is the potential for use of aerial surveys (new methodology for NFSs) for abundance estimation in NFSs; however, because this is not currently used, this assumption is speculative. If the current takes for aerial surveys incidental to other marine mammal research remain the same as Status Quo, the takes for *Researcher Presence in View of Animals* would be similar to Alternative 3 (Table 4.8-32). Morality would remain at an estimate of 0.1 animals per year. Increased efforts with land-based surveys and direct observations on vital rates of NFSs under Alternative 4 would be likely to double; however, the predicted mortality from these low-intensity methods would be similar to the Status Quo (0.1 animals per year).

Population counts involving researchers among animals would be similar to the Status Quo. The estimated total direct and indirect mortality from *Researcher Presence Among Animals* is 21.7 animals per year (Table 4.8-33). Disturbances associated with recovery of tags and/or reading of tags would likely increase. The take associated with these activities would be expected to double over the Status Quo. Therefore, mortality estimates would increase from 0.9 to 1.9 animals per year. Overall, mortality for this category would increase over the Status Quo by approximately 1 animal per year.

Capture and Restraint of pups and non-pups could be expected to greatly increase compared to the Status Quo. New programs for tagging and pregnancy monitoring are anticipated, as is an increased effort for disease surveillance. Recaptures of animals with implantable passive integrated transponder (PIT) or flipper tags would be necessary if this technology is used. At-sea captures of animals could also be attempted for monitoring the health and condition of the population during the winter migration. As the numbers of animals captured and recaptured increases, the predicted mortality would also be expected to increase by 63 percent, from 26.4 to 42.0 animals per year (Table 4.8-34). Most of the increase would be directly related to capturing and restraining more animals. Six of the animals would be retained permanently for experimentation, which is considered as mortality because the animals are removed from the population.

Handling and Sampling Procedures performed on captured reproductive-age females would substantially increase in number under Alternative 4. The greatest increase would be for relatively medium-risk procedures, increasing from 70 under the Status Quo to 2,180 under Alternative 4 (Table 4.8-35). To monitor natality, an initial assessment could be made in October or November by evaluating circulation of hormone levels, and performing ultrasounds to determine pregnancy rates. The number of procedures per animal would also be likely to increase. For example, the addition of tooth removal of reproductive-age females could occur. Studies to assess the role of disease in pup survival may also be conducted (as described for SSLs). With the increase in numbers of animals handled and number of procedures performed, mortality would increase for handling and sampling from 0.6 under the Status Quo to 3.2 animals per year under Alternative 4.

The estimated total direct and indirect mortality from *Capture, Temporary Captivity for Experimentation, and Release* back into the wild is estimated at <0.1 animals per year (Table 4.8-36). Up to 10 non-pups would likely be taken from the wild for temporary captive research. Approximately 900 procedures would be performed on these animals while in captivity. The low rate of mortality would be due primarily to the controlled environment in which the animals are kept. As with all NMFS permits for research on pinnipeds used in captive experiments, NFSs must be maintained only in APHIS USDA-certified research facilities.

Conclusion for Mortality Effects

Total mortality for all research activities on eastern Pacific NFSs under Alternative 4 is estimated at 67.0 animals per year (Table 4.8-49). This represents 0.4 percent of PBR, and is therefore considered negligible (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects). This effect would be considered likely and would be spread over several rookeries within the major breeding area for this stock, therefore the geographic extent and likelihood would be considered moderate.

Table 4.8-32
Estimated Mortality Due to Researcher Presence in View of Animals. NFS Eastern Pacific Stock - Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0.01	0	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	30,500	Observed mortality during activity			0	0.0	
			Alert response	0.01	305	0.0	0.0	
			Enter water	0.005	153	0.0001	0.02	
			Injury during disturbance	0.00001	0.3	0.02	0.0	0.0
On land, catwalks, tripods, cliffs	pups	13,000	Observed mortality during activity			0	0.0	
			Alert response	0.05	650	0.0	0.0	
			Enter water	0.0001	1	0.001	0.0	
			Injured during disturbance	0.00005	1	0.05	0.0	
	non-pups	76,900	Observed mortality during activity			0	0.0	
			Alert response	0.05	3,845	0.0	0.0	
			Enter water	0.005	385	0.0001	0.04	
			Injured during disturbance	0.00001	0.8	0.02	0.02	0.1
Subtotal for estimated mortality due to researcher presence in view of animals								**0.1**
Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.								

Table 4.8-33
Estimated Mortality Due to Researcher Presence among Animals. NFS Eastern Pacific Stock - Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Activities involving pup roundups	pups	7,010	Observed mortality during activity			0.00001	0.1	
Assume unchanged from Status Quo (Alternative 3) because these are related to censusing, which will be unchanged.			Alert response	1	7,010	0.0	0.0	
			Enter water	0.01	70	0.001	0.07	
			Injured during disturbance	0.001	7	0.05	0.4	
	non-pups	3,465	Observed mortality during activity			0.0	0.0	
			Alert response	1	3,465	0.0	0.0	
			Enter water	0.8	2,772	0.0001	0.3	
			Injury during disturbance	0.0005	2	0.02	0.03	0.8
Activities involving clearing rookery/haulout	pups	217,275	Observed mortality during activity			0.00001	2.2	
			Alert response	1	217,275	0.0	0.0	
			Enter water	0.05	10,864	0.0001	1.09	
			Injured during disturbance	0.0005	109	0.05	5.4	
Assume unchanged from Status Quo (Alternative 3) because these are related to censusing, which will be unchanged.	non-pups	103,975	Observed mortality during activity			0.0	0.0	
			Alert response	1	103,975	0.0	0.0	
			Enter water	0.9	93,578	0.0001	9.4	
			Injured during disturbance	0.0001	10	0.02	0.21	18.3
Incidental disturbance during captures in breeding season[2]	pups	16,840	Observed mortality during activity			0.0	0.2	
			Alert response	1	16,840	0.0	0.0	
			Enter water	0.001	17	0.001	0.02	
			Injured during disturbance	0.001	16.8	0.05	0.8	
	non-pups	40,330	Observed mortality during activity			0.0	0.0	
			Alert response	1	40,330	0.0	0.0	
			Enter water	0.01	403	0.0001	0.0	
			Injury during disturbance	0.001	40	0.02	0.81	1.9
Incidental disturbance during captures outside of breeding season	pups	12,890	Observed mortality during activity			0.0	0.1	
			Alert response	1	12,890	0.0	0.0	
			Enter water	0.05	645	0.0001	0.06	
			Injured during disturbance	0.0005	6	0.05	0.3	
	non-pups	10,905	Observed mortality during activity			0.0	0.0	
			Alert response	1	10,905	0.0	0.0	
			Enter water	0.2	2181	0.0001	0.2	
			Injured during disturbance	0.0001	1.1	0.02	0.02	0.8
Subtotal for estimated mortality due to researcher presence among animals								**21.7**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Breeding season: San Miguel stock prior to 1 August; eastern Pacific prior to 08 August

Table 4.8-34
Estimated Mortality Due to Capture and Restraint Activities. NFS Eastern Pacific Stock - Alternative 4

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	32,735	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	32.735	
	non-pups	380	Observed during activity	0.004	1.52	
			Unobserved/post-capture	0.0001	0.038	34.3
Capture/chemical anesthesia (inhalable agent-isoflurane)	non-pups	100	Observed during activity	0.004	0.4	
			Unobserved/post-capture	0.0001	0.01	0.4
Capture/chemical anesthesia (injectable)	non-pups	100	Observed during activity	0.01	1	
			Unobserved/post-capture	0.001	0.1	1.1
Capture/chemical sedation (injectable - e.g. valium)	non-pups	1,520	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.152	0.152
Intentional lethal take or permanent removal	pups	6	Observed during activity	1	6	
	non-pups	0	Unobserved/post-capture	1	0	6
Subtotal for estimated mortality due to capture and restraint activities						**42.0**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-35
Estimated Mortality Due to Handling and Sampling Procedures. NFS Eastern Pacific Stock - Alternative 4

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-cold branding	pups	0	Observed during activity	0.000	0	
			Unobserved/post-capture	0.002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0.0
Relatively low risk procedures	pups	14,400	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	1.44	
	non-pups	13,080	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	1.308	2.7
Relatively medium risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0	
	non-pups	2,180	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.436	0.436
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**3.2**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/bia/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-36
Estimated Mortality Due to Temporary Captivity for Experimentation. NFS Eastern Pacific Stock - Alternative 4

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed mortality during activity			
			Unobserved/post-capture mortality			
	non-pups	10	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.001	0.001
Chemical sedation (injectable - e.g. valium)	non-pups	130	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.013	0.013
Permanent mark/hot branding	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0.0
Relatively low risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	
	non-pups	690	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0.069	0.069
Relatively medium risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	
	non-pups	52	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0.0104	0.0104
Relatively high risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	
	non-pups	10	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0.01	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.1**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 4 could potentially affect many animals in the population through disturbance and capture/handling activities. The mortality assessment tables indicate that a small percentage of animals could die as a result of entering the water and/or being injured during research-related disturbance. Most animals exposed to research activities do not die as a result; however, they may experience other effects, ranging in intensity from a temporary alteration of normal behavior to a reduction in foraging efficiency due to a painful injury or, at the extreme, to reproductive failure. The mechanisms for this range of potential sub-lethal effects are described in Section 4.8.1 and Appendix B.

Sub-lethal effects of aerial surveys would be similar to those discussed under Alternative 3. For land-based surveys and observations (*Researcher Presence in View of Animals*), approximately 90,000 NFSs would be exposed to disturbance during these activities, but only 386 are predicted to respond to the point of entering the water (Table 4.8-32). Physical injury is predicted to affect less than 2 individuals.

Sub-lethal effects of *Researcher Presence Among Animals* resulting from the roundup of pups for census work would be similar to Alternative 3 (Table 4.8-33). The program would continue at the same intensity as under Alternative 3, the Status Quo. Capture during the breeding season would result in disturbance of other animals on the rookery. Approximately 57,000 animals would be exposed to this activity, with 420 potentially suffering some level of sub-lethal effect by escaping to the water. Physical injuries would affect approximately 57 of these animals. After the breeding season, scat collection and other activities would potentially expose approximately 23,800 animals to disturbance. Potentially 2,826 would suffer some level of sub-lethal effects, but physical injury is expected to affect only 7 NFSs.

Effects of *Capture and Restraint* of approximately 32,700 pups for capture/physical restraint are expected to contribute substantially to sub-lethal effects (Table 4.8-34). By comparison, other procedures performed after capture, such as sedation and anesthesia, are done on relatively few animals. Thus, the sub-lethal effect is primarily due to capture and physical restraint of animals. Sub-lethal effects from these activities on reproductive success or the duration of the reproductive life of females as they come into the breeding population are unknown. Sub-lethal effects of chemical restraint, such as anesthesia and sedation, on reproduction are also unknown, but the number of animals affected is relatively small.

Sub-lethal effects of *Handling and Sampling Procedures* would primarily be from relatively low-risk procedures performed on 27,480 pups and non-pups, and relatively medium-risk procedures performed on 2,180 non-pups (Table 4.8-35). This would be a three-fold increase over Status Quo levels; therefore, sub-lethal effects are also expected to be greater. Again, the primary risk to NFSs occurs during capture and restraint; therefore, subsequent procedures are not expected to cause additional risk to the animals.

The estimated total direct and indirect mortality from *Capture, Temporary Captivity for Experimentation, and Release* back into the wild is estimated at 0.1 animals per year (Table 4.8-36). Once NFSs are captured and transported to a facility for further experimentation, sub-lethal effects of subsequent procedures are not as risky as the initial capture. Although the numbers of procedures (approximately 800) may seem high, these procedures are performed on the same small number of animals, and are closely observed and monitored for signs of adverse effects. Magnitude or intensity of these effects is expected to be minor.

Conclusion for sub-lethal effects

The magnitude of the sub-lethal effects on reproduction at the population level is unknown, but would be proportionally higher than Status Quo. Geographic extent of these effects would be the same as under Alternative 3 and considered moderate. Frequency of research activities and exposure to this level of disturbance could occur several times during the breeding season, and is therefore considered moderate.

Contribution to Conservation Objectives

Alternative 4 is designed to allow researchers to address all objectives and conservation actions of the Draft NFS Conservation Plan. The implementation of the alternative would require an increased level of funding compared to the Status Quo. Although such funding levels have not been appropriated through Congress or secured through other sources, Alternative 4 assumes that the full scope of research analyzed previously could be authorized if funding was available. Researchers would be able to develop new capture techniques and drugs that would allow capture/recapture of mature animals to address sex/age class data gaps. In addition, procedures that present a greater risk of injury to individual animals could be permitted if they address essential data needs and have a reasonable chance of succeeding.

The expanded research efforts under Alternative 4 would contribute substantially to the goals and objectives of the NFS Conservation Plan (NMFS 2006b). Development of an overall research plan as part of this effort would be essential for coordinating and maximizing the benefits of the expanded research efforts under Alternative 4. Such an overall research plan would refine research priorities, determine an overall strategy for where, when, and how research efforts should be conducted, and specify how research results should be evaluated and used for management decisions. Development of such a plan would require a substantial and coordinated commitment from NMFS, other federal and state agencies, Alaska Native organizations, academic institutions, environmental groups, the fishing industry, and other interested parties.

Conclusion for conservation objectives

The Alternative 4 research program is focused on full implementation of the Draft Conservation Plan. Because of the magnitude/intensity, duration, long-term nature, and frequency of sampling, and data collected thereby, under this alternative research program, the beneficial contribution towards the conservation objectives in the Draft Conservation Plan is considered major. However, the actual contribution would be highly dependent on funding.

4.8.2.5 Eastern Pacific Stock - Cumulative Effects

Summary of Direct and Indirect Effects

Direct and indirect effects of research activities include disturbance, capture, and handling that could lead to mortality and sub-lethal effects. The alternatives vary in the estimated amount of mortality that would occur under a given scope of research (Sections 4.8.2.1 through 4.8.2.4). For Alternatives 1, 2, and 3, the estimated mortality is less than 10 percent of the PBR and is considered negligible on a population level. The estimated mortality under Alternative 4 is under the target of 15 percent of PBR and is also considered negligible on a population level. For all alternatives (1-4), the estimated mortality represents less than 0.5% of PBR. The magnitude of sub-lethal effects would be negligible for Alternative 1 and is considered unknown for Alternatives 2, 3, and 4 because of several uncertainty factors. In regard to ability to provide research support for the conservation objectives described in the Draft Conservation Plan, Alternative 1 would address very few conservation objectives. Alternative 2 would address only a few additional conservation objectives. Alternative 3 would address a high degree of the important conservation objectives; and Alternative 4 would address all conservation objectives.

Summary of Lingering Past Effects

Commercial harvest of NFSs was a major source of human-induced mortality for over 200 years, and the abundance of NFSs fluctuated greatly in the past largely due to this commercial harvest (NMFS 2006b). Commercial harvest of NFSs peaked in 1961 with over 126,000 animals harvested. The harvest was halted in 1985. Commercial harvests of females from 1956 through 1968, only about two generations ago, probably contributed to the decline of the population from the 1950s to the 1970s, and may have had lingering effects after its cessation (York and Hartley 1981). The population increased slightly in the early 1970s, however, and declines since then are difficult to explain. The level of commercial juvenile male harvests on the Pribilof Islands in the 1970s and 1980s was not believed to have had a deleterious affect on the population. It is therefore unlikely that the present NFS population is now influenced by any residual effects from the past commercial (or subsistence) harvest (NMFS 2006b).

At present, the PBR for this population is 15,262 animals per year (Angliss and Outlaw 2007). Alaska Natives are allowed to harvest NFSs for subsistence purposes, with a range of take determined by annual household surveys. From 1999 to 2003, the average annual subsistence take was 869 from St. Paul and St. George in the Pribilof Islands. This represents less than 6 percent of PBR. Only juvenile males are taken in the subsistence hunt, which minimizes the impact of the hunt on population growth. Subsistence take in other areas besides the Pribilofs is known to occur, but is thought to be minimal (Angliss and Outlaw 2005). Intentional killing of NFSs by commercial fishermen, sport fishermen, and others probably occurs, but the magnitude of this mortality is not known. Intentional take is illegal under the MMPA except for subsistence uses of Alaska Natives or bona fide research.

Incidental take of NFSs from the foreign and joint venture groundfish fisheries averaged 22 animals per year from 1978 to 1988 (Perez and Loughlin 1991). The high seas driftnet fisheries killed thousands of NFSs every year, including an estimated 5,200 NFSs in 1991, the last year before these fisheries were outlawed by United Nations Resolution (46/215) (Hill and DeMaster 1999). Illegal driftnet fishing apparently continues at low levels, but no quantitative information is available on incidental take. Based on self-reported mortalities, state-managed salmon fisheries took an average of 15 NFSs per year from 1990 to 1998. Most of these mortalities came from the Bristol Bay salmon drift gillnet fishery.

Commercial fisheries may have affected NFSs indirectly by affecting the quality of their marine habitat and the availability of their prey species. The removal of large numbers of fish and other marine species from NFS marine habitat may have changed the composition of the fish community, thereby altering the abundance and distribution of prey available for NFSs (NMFS 2006 unpublished).

Another mechanism for incidental take of NFSs is through entanglement with fishing gear, packing bands, and other debris lost or ejected from fishing vessels, shipping vessels, and shoreside sources (Angliss and Outlaw 2005). Some gear may continue to circulate in the environment for many years. The numbers of animals entangled at sea that never make it back to land are not known, but this issue has been cited as making a significant contribution to the decline of the population in the 1970s and early 1980s (Fowler 1987). Surveys of NFSs on St. Paul indicated that the proportion of animals with debris wrapped around part of their bodies decreased from 0.4 percent in 1976-1985 to 0.2 percent in 1988-1992 and 1995-1997, and increased to 2.8 in 1998-2002 (Angliss *et al.* 2001; Angliss and Outlaw 2005). Between 1995 and 2000, responsibility for entanglement studies of NFSs shifted gradually from NMML to the Tribal Government of St. Paul's Ecosystem Conservation Office (ECO). ECO has managed the entanglement studies under a co-management agreement with NOAA for NFSs since 2000.

Analysis of Reasonably Foreseeable Future Actions

Many of the lingering past effects are expected to continue in the foreseeable future. These effects include incidental take from foreign fisheries outside the U.S. EEZ, where NFSs are widely dispersed. State-managed fisheries take small numbers of NFSs (approximately 15 per year) including the Prince William Sound drift gillnet fishery, Alaska Peninsula and Aleutian Island salmon gillnet fisheries, and the Bristol Bay salmon fisheries (Angliss and Outlaw 2007). Subsistence will continue to be a major source of mortality in the future but is limited to the Pribilof Islands. Levels of take are expected to be well below 10 percent of PBR for this species. The effects of global climate change or long-term regime shifts on NFSs are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. The future spatial/temporal concentration of commercial fisheries could affect the abundance and distribution of important prey species for NFSs, specifically pollock and cod, and potentially contribute to their nutritional stress. Vessel traffic associated with commercial shipping and tourism could increase as these industries expand, but outside of the breeding season, NFSs are generally dispersed over a large area and this effect is likely to be minimal.

Cumulative Effects

A number of internal and external factors have been identified that could contribute to overall mortality and a range of sub-lethal effects, primarily through disturbance. Mortality from research activities under Alternatives 1 and 2 is very small and approaches zero. Therefore, there would be no cumulative effects expected under these alternatives. Under Alternatives 3 and 4, research activities would likely contribute approximately 48 to 67 animals per year, respectively, to the overall cumulative mortality. Sub-lethal effects from research activities are identified for Alternatives 2, 3, and 4. These effects are difficult to quantify but if reproductive success were to be affected, the effect would be a very small contribution to the overall cumulative effect.

Mortality Effects

The population of the eastern Pacific stock of NFSs has been in decline in recent years (Angliss and Outlaw 2007). The most recent estimate for the number of NFSs in the eastern Pacific stock, based on the pup counts from 2002 on Sea Lion Rock, from 2004 on the Pribilof islands, and from 2005 on Bogoslof Island is 721,395 (Angliss and Outlaw 2007). The cumulative effect of human-caused mortality from internal and external factors is considered negligible based on the large size of the NFS populations and existing levels of human-caused mortality (below the PBR of 15,262). The contribution of research, under all of the alternatives, to the cumulative effect of mortality is considered negligible.

Sub-Lethal Effects

Disturbance from research activities, marine vessel traffic, air traffic, fishing operations, tourism, and other sources can cause physical and physiological effects in NFSs that may range from temporary alterations of behavior, abandonment of haulout sites, painful injuries, inability to forage normally, or reproductive failure. The intensity of response to disturbance can vary according to numerous physical factors and individual condition of the animals. The alternatives vary in the amount of research-related disturbance and potential injuries that they would contribute to the cumulative sub-lethal effects. Alternative 1 would contribute to no disturbance and, therefore, there would be no cumulative effect on sub-lethal effects. The other alternatives represent an increasing scope and intensity of contributed disturbance from Alternative 2 to Alternative 4. However, because the population-level effect of disturbance and handling procedures from all of these alternatives is unknown, their contribution to the cumulative sub-lethal effects is also unknown.

Conservation Objectives

Alternatives 1 through 4 would contribute varying amounts of research effort in support of the objectives in the Draft Conservation Plan. Alternative 1 would contribute no new field work; its contribution to the cumulative conservation efforts would therefore be very minimal. The other alternatives can be ranked in increasing scope and intensity of contributed research from Alternative 2 to Alternative 4. While each of these alternatives could contribute to the scientific basis for management decisions to varying extents, the use of these data to implement meaningful conservation measures would depend on many factors, such as funding, scientific interest, and socioeconomic factors.

4.8.2.6 San Miguel Island Stock – Direct and Indirect Effects of Alternative 1 - No Action: No New Permits or Authorizations

Under Alternative 1, No Action, the scope of research on the San Miguel Island would be limited to analysis of existing data and samples collected in the past, behavioral observations from distant vantage points that would not result in any disturbance of the animals, and aerial surveys at an elevation that would not elicit a response from individuals at the rookery.

Direct and Indirect Mortality Due to Research

Because there would be no research-related takes of NFSs from the San Miguel Island NFS stock, there would be no mechanism for research-related injury or mortality.

Sub-Lethal Effects Due to Research

Because there would be no research-related takes of NFSs from the San Miguel Island NFS stock, there would be no mechanism for research-related injury or mortality.

Conclusion for sub-lethal effects

Lacking a mechanism for research-related mortality or sub-lethal effect on San Miguel Island NFSs, effects of the Alternative 1 research program would be negligible.

Contribution to Conservation Objectives

Because the San Miguel Island stock of the NFS is not listed as threatened or endangered under the ESA or listed as depleted under the MMPA, there is currently no recovery plan or conservation plan for this stock. However, NMFS must still fulfill MMPA requirements to determine the status of this stock. Based on currently available data, the estimated annual level of total human-caused mortality and serious injury is zero. Therefore, human-caused mortality does not exceed the PBR of 219 for this stock, and the San Miguel Island stock of the NFS is not classified as a strategic stock (NMFS 2003).

4.8.2.7 San Miguel Island Stock - Alternative 2 – Research Program without Capture or Handling

Under Alternative 2, the scope of research on the San Miguel Island stock of NFSs would be limited to survey activities (>1,000 feet elevation), land-based census activities from a distance, behavioral observations, scat samples from the rookery during the non-breeding season, and other activities that would not involve the capture or handling of animals or the presence of researchers on rookeries during the breeding season.

Direct and Indirect Mortality Due to Research

The estimated number of takes and mortality assessments for these activities are described in Tables 4.8-37 and 4.8-38. Permits would be issued for incidental disturbance during aerial survey activity on this stock and incidental disturbance from survey activity on other species. The mortality assessment table indicates that the effects of *Researcher Presence in View of Animals* would be relatively low (350) and the estimated mortality from this type of research activity would be zero.

Land-based and vessel-based census activity on this stock could be conducted as long as no disturbance occurs on the rookeries. Scat collections would be allowed during the non-breeding season. Total take would be approximately 3,750 (approximately half of which would be pups), but the predicted mortality from research under this alternative is also expected to be zero (Table 4.8-38).

Conclusion for mortality effects

Based on the low-level of research activity under Alternative 2, mortality from research activities is unlikely and considered negligible.

Table 4.8-37
Estimated Mortality Due to Researcher Presence in View of Animals. NFS San Miguel Stock - Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal1	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0	0	0.05	0.0	
	non-pups	350	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.0001	0.00	
			Injury during disturbance	0	0	0.02	0.0	0.0
On land, catwalks, tripods, cliffs	pups	1,300	Observed mortality during activity			0	0.0	
			Alert response	0.05	65	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	2,450	Observed mortality during activity			0	0.0	
			Alert response	0.05	123	0.0	0.0	
			Enter water	0.005	12	0.0001	0.00	
			Injured during disturbance	0.00001	0	0.02	0.00	0.0
Subtotal for estimated mortality due to researcher presence in view of animals								**0.0**
Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.								

Table 4.8-38
Estimated Mortality Due to Researcher Presence among Animals. NFS San Miguel Alternative 2

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Haulouts, rookeries non-breeding (scat collection, resights, ground counts)	pups	0	Observed mortality during activity			0.00001	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.05	0	0.0001	0.0	
			Injured during disturbance	0.0005	0	0.05	0.0	
	non-pups	0	Observed mortality during activity			0	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.9	0	0.0001	0.00	
			Injured during disturbance	0.0001	0	0.02	0.0	0.0
Subtotal for estimated mortality due to researcher presence among animals								**0.0**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Sub-Lethal Effects Due to Research

Sub-lethal Effects from *Researcher Presence in View of Animals* under this alternative are expected to range from a mild alert response and vocalization to being forced into the water. Neither of these responses would be expected to result in any long-term effects on reproductive success of females.

Research of NFSs on San Miguel Island reports little if any disturbance effect from aerial or vessel-based surveys (Bengston *et al.* 2005). No mortalities are predicted for this scope of work under Alternative 2. The sub-lethal effects of the low level of research activities allowed under Alternative 2 are expected to have a negligible effect on reproductive success.

Conclusion for sub-lethal effects

The geographic extent of research activities would be considered major in that it would potentially affect much of the breeding population on San Miguel Island. Although there would be some mechanism for sub-lethal effects to occur, the magnitude or intensity of these effects is unknown. However, considered the limited research activity under Alternative 2, effects are unlikely to result in reduced reproductive success and are considered negligible.

Contribution to Conservation Objectives

Because the San Miguel Island stock of NFSs is not listed as threatened or endangered under the ESA or listed as depleted under the MMPA, there are currently no conservation objectives.

4.8.2.8 San Miguel Island Stock - Direct and Indirect Effects of Alternative 3 - Status Quo Research Program

Under Alternative 3, the Status Quo, the scope of research on the San Miguel Island stock of NFSs depends substantially on the amount of available funding. The level of NFS take authorized by January 2006 is used as a proxy for the level and types of research programs under this alternative. Under Alternative 3, new permits would replace old permits, such that the levels and types of research activities would continue to the extent that funding would allow.

Direct and Indirect Mortality Due to Research

The estimated number of takes and mortality assessments for research activities under Alternative 3 is approximately 5 animals per year (Tables 4.8-49). For *Researcher Presence in View of Animals,* the number of animals exposed to an aerial survey activity on the San Miguel Island stock of NFSs would be essentially the same as under Alternative 2 (Table 4.8-39). Effects of researcher presence in view of animals would be considered negligible.

Effects of the land-based research program, *Researcher Presence Among Animals*, on San Miguel Island under Alternative 3, would be associated with pup roundups, rookery-clearing activities, and animals incidentally disturbed during captures of other individual animals (Table 4.8-40). This level of activity is predicted to result in mortality of approximately 0.6 animals per year. These mortalities would be the result of physical trauma, such as trampling of pups or aggressive interaction between other animals on the rookery.

Of the 2,165 takes permitted for *Capture and Restraint* under Alternative 3, there would be an estimated mortality of 3.7 animals per year (Table 4.8-41). Mortality of 1.4 animals is predicted for capture and anesthesia using injectable agents (used on less than 6 percent of the subject animals), and this typically occurs during the procedure. With injectable anesthetic the proper dosage is vital. Determining the proper dosage, primarily a function of age, weight, and health, is often difficult in the field and could result in increased risk of mortality. Actual capture and physical restraint of the animals would contribute the highest mortality (2.3 animals per year), and this mortality is predicted to occur during the post-capture period (unobserved mortality).

Potential multiple captures of a single animal are treated as separate captures but could increase the risk of mortality to individual animals. Some pups may be recaptured up to five separate times for some procedures, which can contribute to the overall mortality.

The primary source of mortality for *Handling and Sampling Procedures* would be the relatively low-risk procedures, which would be performed on over 6,000 animals (Table 4.8-42). Total mortality is estimated at 0.6 animals per year. By comparison, relatively medium-risk procedures would be performed on only 550 animals, with an approximate mortality of 0.1 animals per year. No high-risk procedures are proposed under Alternative 3. Total estimated mortality for these research procedures is very low and projected to be less than one animal per year (0.7 animals per year).

Temporary Capture for Experimentation includes capture of individual animals for transport to a research facility for an extended period of time. The number of animals captured for these purposes is typically very low and once captured and sedated, mortality is very low. However, there are no current permits which authorize the temporary capture of San Miguel Island NFS stock (Table 4.8-43).

<u>*Conclusion for mortality effects*</u>

Total mortality for all research activities on San Miguel Island NFSs under Alternative 3 is estimated at 5 animals per year (Table 4.8-49). This represents 2.3 percent of PBR, and is therefore considered negligible (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects).

Table 4.8-39
Estimated Mortality Due to Researcher Presence in View of Animals. NFS San Miguel Stock - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0	0	0.05	0.0	
	non-pups	350	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.0001	0.00	
			Injury during disturbance	0	0	0.02	0.0	0.0
On land catwalks, tripods, cliffs	pups	1,300	Observed mortality during activity			0	0.0	
			Alert response	0.05	65	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	2,450	Observed mortality during activity			0	0.0	
			Alert response	0.05	123	0.0	0.0	
			Enter water	0.005	12	0.0001	0.00	
			Injured during disturbance	0.00001	0	0.02	0.00	0.0
Subtotal for estimated mortality due to researcher presence in view of animals:								**0.0**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-40
Estimated Mortality Due to Researcher Presence among Animals. NFS San Miguel Stock - Alternative 3

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Activities involving pup roundups	pups	3,000	Observed mortality during activity			0.00001	0.0	
			Alert response	1	3,000	0.0	0.0	
			Enter water	0.01	30	0.001	0.03	
			Injured during disturbance	0.001	3	0.05	0.2	
	non-pups	1,575	Observed mortality during activity			0.0	0.0	
			Alert response	1	1,575	0.0	0.0	
			Enter water	0.8	1,260	0.0001	0.1	
			Injury during disturbance	0.0005	0.7875	0.02	0.02	0.4
Activities involving clearing rookery/haulout	pups	0	Observed mortality during activity			0.00001	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.05	0	0.0001	0.00	
			Injured during disturbance	0.0005	0	0.05	0.0	
	non-pups	500	Observed mortality during activity			0.0	0.0	
			Alert response	1	500	0.0	0.0	
			Enter water	0.9	450	0.0001	0.0	
			Injured during disturbance	0.0001	0.05	0.02	0.00	0.0
Incidental disturbance during captures in breeding season	pups	1,630	Observed mortality during activity			0.0	0.0	
			Alert response	1	1,630	0.0	0.0	
			Enter water	0.001	1.63	0.001	0.00	
			Injured during disturbance	0.001	1.63	0.05	0.1	
	non-pups	2,260	Observed mortality during activity			0.0	0.0	
			Alert response	1	2,260	0.0	0.0	
			Enter water	0.01	22.6	0.0001	0.0	
			Injury during disturbance	0.001	2.26	0.02	0.05	0.1
Incidental disturbance during captures outside of breeding season	pups	710	Observed mortality during activity			0.0	0.0	
			Alert response	1	710	0.0	0.0	
			Enter water	0.05	35.5	0.0001	0.0	
			Injured during disturbance	0.0005	0.355	0.05	0.0	
	non-pups	595	Observed mortality during activity			0.0	0.0	
			Alert response	1	595	0.0	0.0	
			Enter water	0.2	119	0.0001	0.0	
			Injured during disturbance	0.0001	0.0595	0.02	0.00	0.0
Subtotal for estimated mortality due to researcher presence among animals								**0.6**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-41
Estimated Mortality Due to Capture and Restraint Activities. NFS San Miguel Stock - Alternative 3

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	1,900	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	1.9	
	non-pups	100	Observed during activity	0.004	0.4	
			Unobserved/post-capture	0.0001	0.01	2.3
Capture/chemical anesthesia '(inhalable agent-isoflurane)	pups	0	Observed during activity	0.004	0	
			Unobserved/post-capture	0.0001	0	0.0
Capture/chemical anesthesia (injectable)	non-pups	125	Observed during activity	0.01	1.25	
			Unobserved/post-capture	0.001	0.125	1.4
Capture/chemical sedation (injectable-e.g. valium)	non-pups	40	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.004	0.004
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**3.7**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-42
Estimated Mortality Due to Handling and Sampling Procedures. NFS San Miguel Stock - Alternative 3

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-cold branding	pups	0	Observed during activity	0.000	0	
			Unobserved/post-capture	0.002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0.0
Relatively low risk procedures	pups	4225	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.4225	
	non-pups	1795	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.1795	0.6
Relatively medium risk procedures	pups	100	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.02	
	non-pups	450	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.09	0.11
Relatively procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**0.7**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-43
Estimated Mortality Due to Temporary Captivity for Experimentation. NFS San Miguel Stock - Alternative 3

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture, transport, holding, release	pups	0	Observed mortality during activity			
			Unobserved/post-capture mortality			
	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Chemical sedation (injectable-e.g. valium)	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Permanent mark/hot branding	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0.0
Relatively low risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0
Relatively medium risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	0
Relatively high risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.0**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

The estimated scope of research conducted under Alternative 3 could potentially affect most, if not all, of the San Miguel Island stock of NFSs, due to disturbance from vessel-based and land-based surveys and other research activities. In addition to the small rate of mortality from these research procedures, the vast majority of animals would experience other sub-lethal effects, ranging in intensity from alarm, to temporary alteration of normal behavior, to a reduction in foraging efficiency or, at the extreme, to reproductive failure. From a population-level perspective, the most important effects are those that could decrease overall productivity.

Sub-lethal effects of *Researcher Presence in View of Animals* due to land-based surveys under Alternative 3, the Status Quo, would potentially expose approximately 3,750 animals to this short-term or intermittent disturbance (Table 4.8-39). Effects are expected to include a mild alert response and vocalization (123 non-pups), being forced into the water (12 animals) or sub-lethal injuries (<0.1 animal). There would be some potential for effects on reproductive success of individual animals, but the magnitude of the effect is unknown. Because of the low response and injury rate, sub-lethal effects are expected to be negligible and would not be likely to affect reproductive success.

Rookery clearing, pup counts in the rookeries, and incidental disturbance during capture of NFSs for marking or sampling can result in a range of sub-lethal effects on both pups and non-pups. For *Researcher Presence among Animals,* approximately 9,000 animals would be exposed to these disturbances during the breeding season and approximately 1,764 of these (mostly non-pups) would be disturbed enough to enter the water (Table 4.8-40). Physical injury would be expected for about 8 animals. Another 1,300 would be disturbed after the breeding season during scat collections. The extent of any long-term effects of these responses on reproduction in subsequent years is unknown. Sub-lethal effects on pups would not be expected to influence reproductive success due to the 4-5 years required to reach maturity.

Approximately 1,900 pups and 265 non-pups would be captured and restrained for various procedures (Table 4.8-41). Anesthesia and sedations would be used on some of these animals. Effects of these activities on subsequent reproductive success are unknown. Sub-lethal effects on pups would not be expected to influence reproductive success due to the 4-5 years required to reach maturity. Sub-lethal effects on the relatively low number of adults captured would not be expected to affect reproductive success of the rookery.

For *Handling and Sampling Procedures,* once the animals are captured, approximately 5,100 relatively low-risk procedures and 550 relatively medium-risk procedures would be performed (Table 4.8-42). Most of the relatively low-risk procedures would be performed on pups, whereas most of the relatively medium-risk procedures would be on non-pups. No Relatively high-risk procedures, such as surgical implantations, are anticipated. Some of these animals would suffer some degree of sub-lethal effects as a result of the procedures in addition to the effects of capture; however long-term effects on later reproductive success are unknown. Sub-lethal effects on the relatively low number of adults captured would not be expected to affect reproductive success of the stock.

Temporary Capture for Experimentation includes capture of individual animals for transport to a research facility for an extended period of time. The numbers of animals captured for these purposes is typically very low, and once captured and sedated, mortality is very low. However, there are no current permits that authorize the temporary capture of NFSs from the San Miguel Island stock (Table 4.8-43).

Conclusion for sub-lethal effects

Although there are mechanisms for sub-lethal effects to occur from research activities under Alternative 3, the magnitude and intensity of these effects on reproductive success are unknown. The geographic extent would be major in that it is concentrated at one site: San Miguel Island, the only breeding area for this stock. The duration and frequency of effects would be considered relatively minor. Effects of research activities on reproductive success of this stock are considered unknown.

Contribution to Conservation Objectives

Because the San Miguel Island stock of NFS is not listed as threatened or endangered under the ESA or listed as depleted under the MMPA, there are currently no conservation objectives.

4.8.2.9 San Miguel Island Stock - Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

The scope of research under the Alternative 4 research program for the San Miguel Island stock of NFSs would be essentially the same as under Alternative 3, the Status Quo. Because this stock is not listed under the ESA or considered depleted under the MMPA, there are no recovery or conservation plans for this species.

Mortality

Total mortality for all research activities on San Miguel Island NFSs under Alternative 4 is estimated at 5 animals per year (Table 4.8-49). This represents 2.3 percent of PBR (219 animals), and is therefore considered negligible (see Table 4.4-1 for the impact criteria, and Section 2.5 for a description of PBR as a metric for population-level effects).

Table 4.8-44
Estimated Mortality Due to Researcher Presence in View of Animals. NFS San Miguel Stock - Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Aerial survey	pups	0	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.001	0.0	
			Injured during disturbance	0	0	0.05	0.0	
	non-pups	350	Observed mortality during activity			0	0.0	
			Alert response	0	0	0.0	0.0	
			Enter water	0	0	0.0001	0.00	
			Injury during disturbance	0	0	0.02	0.0	0.0
On land, catwalks, tripods, cliff	pups	1300	Observed mortality during activity			0	0.0	
			Alert response	0.05	65	0.0	0.0	
			Enter water	0.0001	0	0.001	0.0	
			Injured during disturbance	0.00005	0	0.05	0.0	
	non-pups	2450	Observed mortality during activity			0	0.0	
			Alert response	0.05	123	0.0	0.0	
			Enter water	0.005	12	0.0001	0.00	
			Injured during disturbance	0.00001	0	0.02	0.00	0.0
Subtotal for Table 1 - Estimated mortality due to researcher presence in view of animals								**0.0**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-45
Estimated Mortality Due to Researcher Presence among Animals. NFS San Miguel Stock - Alternative 4

Activity	Age class	Animals potentially exposed	Type of effect	Estimated proportion of animals affected	Predicted number of animals affected	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Activities involving pup roundups	pups	3,000	Observed mortality during activity			0.00001	0.0	
			Alert response	1	3,000	0.0	0.0	
			Enter water	0.01	30	0.001	0.03	
			Injured during disturbance	0.001	3	0.05	0.2	
	non-pups	1575	Observed mortality during activity			0.0	0.0	
			Alert response	1	1,575	0.0	0.0	
			Enter water	0.8	1,260	0.0001	0.1	
			Injury during disturbance	0.0005	0.7875	0.02	0.02	0.4
Activities involving clearing rookery/haulout	pups	0	Observed mortality during activity			0.00001	0.0	
			Alert response	1	0	0.0	0.0	
			Enter water	0.05	0	0.0001	0.00	
			Injured during disturbance	0.0005	0	0.05	0.0	
	non-pups	500	Observed mortality during activity			0.0	0.0	
			Alert response	1	500	0.0	0.0	
			Enter water	0.9	450	0.0001	0.0	
			Injured during disturbance	0.0001	0.05	0.02	0.00	0.0
Incidental disturbance during captures in breeding season[2]	pups	1,630	Observed mortality during activity			0.0	0.0	
			Alert response	1	1,630	0.0	0.0	
			Enter water	0.001	1.63	0.001	0.00	
			Injured during disturbance	0.001	1.63	0.05	0.1	
	non-pups	2,260	Observed mortality during activity			0.0	0.0	
			Alert response	1	2,260	0.0	0.0	
			Enter water	0.01	22.6	0.0001	0.0	
			Injury during disturbance	0.001	2.26	0.02	0.05	0.1
Incidental disturbance during captures outside of breeding season	pups	710	Observed mortality during activity			0.0	0.0	
			Alert response	1	710	0.0	0.0	
			Enter water	0.05	35.5	0.0001	0.00	
			Injured during disturbance	0.0005	0.355	0.05	0.0	
	non-pups	595	Observed mortality during activity			0.0	0.0	
			Alert response	1	595	0.0	0.0	
			Enter water	0.2	119	0.0001	0.0	
			Injured during disturbance	0.0001	0.0595	0.02	0.00	0.0
Subtotal for Table 2 - Estimated mortality due to researcher presence among animals								**0.6**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.
[2]Breeding season: San Miguel stock prior to 1 August; eastern Pacific prior to 08 August

Table 4.8-46
Estimated Mortality Due to Capture and Restraint Activities. NFS San Miguel Stock - Alternative 4

Activity	Age class	Number of animals captured	When mortality occurs	Estimated mortality rate per affected animal[1]	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/physical restraint	pups	1900	Observed during activity	0.000	0	
			Unobserved/post-capture	0.001	1.9	
	non-pups	100	Observed during activity	0.004	0.4	
			Unobserved/post-capture	0.0001	0.01	2.3
Capture/chemical anesthesia (inhalable agent-isoflurane)	non-pups	0	Observed during activity	0.004	0	
			Unobserved/post-capture	0.0001	0	0.0
Capture/chemical anesthesia (injectable)	non-pups	125	Observed during activity	0.01	1.25	
			Unobserved/post-capture	0.001	0.125	1.4
Capture/chemical sedation (injectable - e.g. valium)	non-pups	40	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.004	0.004
Intentional lethal take or permanent removal	pups	0	Observed during activity	1	0	
	non-pups	0	Unobserved/post-capture	1	0	0
Subtotal for estimated mortality due to capture and restraint activities						**3.7**

Notes: [1]Mortality rates associated with alert, enter water, and injured reactions account for unobserved or subsequent mortalities attributable to the activity.

Table 4.8-47
Estimated Mortality Due to Handling and Sampling Procedures. NFS San Miguel Stock - Alternative 4

Activity	Age class	Number of procedure-animals	When mortality occurs	Estimated mortality rate per procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Permanent mark/hot-cold branding	pups	0	Observed during activity	0.000	0	
			Unobserved/post-capture	0.002	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0.0
Relatively low risk procedures	pups	4225	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.4225	
	non-pups	1,795	Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0.1795	0.6
Relatively medium risk procedures	pups	100	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.02	
	non-pups	450	Observed during activity	0	0	
			Unobserved/post-capture	0.0002	0.09	0.11
Relatively high risk procedures	pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	
	non-pups	0	Observed during activity	0	0	
			Unobserved/post-capture	0.001	0	0.0
Subtotal for estimated mortality due to handling and sampling procedures						**0.7**

Notes: Low risk - blood/flipper tag/whisker pull/isotopes/eb/bia/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Table 4.8-48
Estimated Mortality Due to Temporary Captivity for Experimentation. NFS San Miguel Stock - Alternative 4

Activity	Age class	Number of animals or procedure-animals	When mortality occurs	Estimated mortality rate per affected animal or procedure	Predicted mortalities (number of animals)	Mortality subtotal for activity
Capture/transport/holding/release	pups	0	Observed mortality during activity			
			Unobserved/post-capture mortality			
	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
chemical sedation (injectable-e.g. valium)	non-pups		Observed during activity	0	0	
			Unobserved/post-capture	0.0001	0	0
Permanent mark/hot branding	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0.0
Relatively low risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0001	0	0
Relatively medium risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.0002	0	0
Relatively high risk procedures	pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	
	non-pups	0	Observed mortality during activity	0	0	
			Unobserved/post-capture mortality	0.001	0	0.0
Subtotal for estimated mortality due to temporary captivity for experimentation						**0.0**

Notes: Lowrisk - blood/flipper tag/whisker pull/isotopes/eb/BIA/injections/ultrasound/external instruments/enemas/stomach intubate/fecal loop/stomach pill telemeters
Medium risk - teeth pull/biopsies/remote biopsies/(includes local anesthesia)
High risk - implant transmitters, surgeries
No risk - swabs/hair or nail clipping, temp marks, morph measurements, milk sample, external physical exam

Sub-Lethal Effects Due to Research

Under Alternative 4, the research program would be essentially the same as under Alternative 3; therefore, direct and indirect sub-lethal effects are expected to be similar to those discussed under Alternative 3. Additional methods and procedures could be authorized as appropriate but protocols are not known at this time.

The direct and indirect effects of the scope of research under Alternative 4 would be the same as under Alternative 3. The magnitude or intensity of these effects are considered unknown.

Contribution to Conservation Objectives

Because the San Miguel Island stock of NFSs is not listed as threatened or endangered under the ESA or listed as depleted under the MMPA, there are currently no recovery objectives.

4.8.2.10 San Miguel Island Stock - Cumulative Effects

Summary of Direct and Indirect Effects

Direct and indirect effects of research activities include disturbance, capture, and handling that could lead to mortality and sub-lethal effects. The alternatives vary in the estimated amount of mortality that would occur under a given scope of research (Sections 4.8.2.6 through 4.8.2.9). For all the alternatives, the estimated mortality is less than 10 percent of PBR for Alternatives 1, 2, and 3 and less than 15 percent of PBR under Alternative 4. Mortality is considered negligible on a population level for all alternatives. The magnitude of sub-lethal effects would be negligible for Alternative 1 and is considered unknown for Alternatives 2, 3, and 4 because of several uncertainty factors.

Lingering Past Effects

El Niño events, which occur periodically along the California coast, affect population growth of NFSs at San Miguel Island and are an important regulatory mechanism for this population (DeLong and Antonelis 1991; Melin and DeLong 1994, 2000; Melin *et al.* 1996). The El Niño events in 1982-1983, 1992-1993, and 1997-1998 (largest) resulted in both short-term and longer-term reductions in the population. Recovery from the 1998 decline has been slowed by the adult female mortality that occurred, in addition to the high pup mortality in 1997 and 1998 (Melin and DeLong 2000).

NMFS considers any takes of NFSs by commercial fisheries in waters off California, Oregon, and Washington as being from the San Miguel Island stock (NMFS 2003). The three observed fisheries that may have interacted with NFSs include the thrasher shark and swordfish drift gill net fisheries, the halibut/angel shark set net fishery, and the Washington, Oregon, or California groundfish fisheries. There were no reported mortalities of NFSs in any observed fishery along the west coast of the continental U.S. during the period from 1990-1996. However, reporting requirements have been scaled back, so the information on actual mortality is incomplete (NMFS 2003). Based on currently available data, the estimated annual total of human-caused mortality and serious injury is 1 animal per year. This amount, therefore, does not exceed the PBR (219).

Analysis of Reasonably Foreseeable Future Actions

Potential mortality of the San Miguel Island stock from future foreseeable factors is likely to occur from commercial fisheries, continuing recreational boating and vessel traffic, and marine pollution. The effects of global climate change or long-term regime shifts on San Miguel Island NFSs are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. Future El Niño events are likely to continue to adversely affect NFSs reproduction and overall numbers. Vessel traffic associated with commercial shipping and tourism with its underwater noise could increase with increased industrial activity, but the effect on NFS mortality is likely to be minimal.

Cumulative Effects

Mortality

Direct and indirect affects of NFS research and external factors have been identified that could cause disturbance and mortality to San Miguel Island NFSs. The population of this stock is on the increase and is currently at 63.4 percent of the 1997 levels (NMFS 2003). The cumulative effects for this stock do not appear to include any adverse population-level effects and are therefore considered to be minor. Because there are no direct or indirect effects associated with Alternative 1, there would be no cumulative effect. The direct and indirect effects associated with Alternatives 2, 3, and 4 are considered negligible. Overall human-caused mortality is well below 10 percent of PBR, so the contribution of research activities to mortality of the San Miguel Island stock of the NFSs is considered negligible.

Sub-Lethal Effects

Disturbance from research activities, as well as other human-caused disturbance, can cause physical and physiological effects that may include temporary alterations of behavior, physical injuries, decreased ability to forage, or reproductive failure. Research alternatives under Alternatives 1 through 4 vary in the amount of research-related disturbance and potential injuries that they would contribute to the cumulative sub-lethal effects. Alternative 1 would contribute to no disturbance and therefore there would be no cumulative effect. The other alternatives represent an increasing scope and intensity of contributed disturbance from Alternative 2, 3, and 4. However, because the population-level effect of disturbance and handling procedures from these alternatives is unknown, their contributions to the cumulative sub-lethal effects are also unknown.

Table 4.8-49
Summary of Estimated Mortality - All Alternatives

Source of mortality	Alternative 1	Alternative 2	Alternative 3	Alternative 4
SSL - Western DPS				
Researcher presence in view of animals		0.9	0.9	4.1
Researcher presence among animals		2.5	5.8	9.8
Capture and restraint			5.6	12.4
Handling and sampling procedures			2.4	3.3
Temporary captivity for experimentation			0.1	0.2
Total estimated mortality for SSL WDPS (animals)	**0**	**3.4**	**14.8**	**29.8**
Estimated mortality as a percent of PBR (234)	**0**	**1.45%**	**6.32%**	**12.74%**
SSL - Eastern DPS				
Researcher presence in view of animals		1.9	1.9	1.9
Researcher presence among animals		1.3	11.5	11.5
Capture and restraint			8.6	8.6
Handling and sampling procedures			3.5	3.5
Temporary captivity for experimentation			0	0
Total estimated mortality for SSL EDPS (animals)	**0**	**3.2**	**25.5**	**25.5**
Estimated mortality as a percent of PBR (2000)	**0**	**0.16%**	**1.27%**	**1.27%**
NFS - Eastern Pacific stock				
Researcher presence in view of animals		0.1	0.1	0.1
Researcher presence among animals		1.1	20.7	21.7
Capture and restraint			26.4	42
Handling and sampling procedures			0.6	3.2
Temporary captivity for experimentation			0	0.1
Total estimated mortality for NFS EP (animals)	**0**	**1.2**	**47.8**	**67**
Estimated mortality as a percent of PBR (15,262)	**0**	**<< 1%**	**< 1%**	**0.44%**
NFS - Sam Miguel stock				
Researcher presence in view of animals		0	0	0
Researcher presence among animals		0	0.6	0.6
Capture and restraint			3.7	3.7
Handling and sampling procedures			0.7	0.7
Temporary captivity for experimentation			0	0
Total estimated mortality for NFS SM (animals)	**0**	**0**	**5**	**5**
Estimated mortality as a percent of PBR (219)	**0**	**0**	**2.28%**	**2.28%**

4.8.3 Killer Whales

Under all of the alternatives, no apparent mechanisms of effect have been identified for resident killer whales; therefore, resident killer whales are not included in the effects analysis. Resident killer whales do not feed on marine mammals as transient killer whales do, and other than the southern resident stock, resident whale populations are neither depleted nor appear to be adversely affected by human disturbance. As for the endangered southern resident stock, it inhabits inland waterways of Puget Sound, outside of important SSL and NFS habitat. Because transient killer whales feed on marine mammals and are implicated in the decline of SSLs and NFSs, they are included in the effects analysis. The current status of killer whale stocks are described in Section 3.2.3, and the predicted direct and indirect effects of research activities under the alternative research programs are discussed below. The intent of this analysis is to provide an overall assessment of the species' population-level response to its environment as it is influenced by SSL and NFS research activities. Representative direct and indirect effects used in this analysis include reduced survival or reproductive success, and disturbance (Table 4.4-2). Past, present, and future actions external to the project alternatives described in this analysis are also presented in detail in the Alaska Groundfish Fisheries Final Programmatic Supplemental Environmental Impact Statement (SEIS) (NMFS 2004a).

4.8.3.1 Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Since there would be no research-related take or disturbance of SSLs and NFSs under Alternative 1, there would be no research-related disturbance of killer whales incidental to studies on SSLs and NFSs. However, research on the role of killer whales in the population dynamics of SSLs and NFSs, which does not require authorization for incidental take or disturbance of SSLs and NFSs, would occur under this alternative. This research would involve documenting killer whale feeding behavior via witness accounts, observer data, or surveys conducted from marine vessels. Marine vessels could potentially strike and cause injury or death to individual killer whales. However, vessel strikes on killer whales and other marine mammals are rare, and few research vessels would approach killer whales under this alternative. Marine vessels can also produce discharges and increased turbidity; however, the result is generally localized short-term changes in water quality that are unlikely to affect the survival and reproductive success of killer whales. Because vessel strikes on killer whales would be rare, it is unlikely that there would be a measurable reduction in the overall survival or reproductive success of killer whales.

The diet of transient killer whales consists of marine mammals. Since there would be no research-related take or disturbance of SSLs or NFSs under Alternative 1, the abundance and distribution of killer whale prey species would not be affected. The effects of Alternative 1 on the survival and reproductive success of killer whales are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

As described above, research on the role of killer whales in the population dynamics of SSLs and NFSs would be permitted under this alternative, although this would not include authorizations for incidental take or disturbance of SSLs or NFSs. This type of research generally involves researchers documenting killer whale feeding behavior via witness accounts, observer data, or surveys conducted from marine vessels. Marine vessels that closely approach killer whales could potentially cause disturbance through visual cues and noise pollution. The effects of this disturbance could include avoidance behavior and displacement. Noise pollution could also interfere with whale communication and echolocation used to detect prey (Barrett-Lennard *et al.* 1996). Because the effects would depend on vessels passing very close to killer whales, the geographic extent of the effects would be in the vicinity of the marine vessel. Given that few research vessels would approach killer whales under this alternative and would do so for only short periods of time, the effects of disturbance would be short-term and there would be no measurable effects on the overall population or distribution of killer whales. Therefore, the effects of disturbance on killer whales under Alternative 1 are considered negligible.

Conclusions

Direct and indirect effects of research directed at killer whales and their role in the population dynamics of SSLs and NFSs, as permitted under Alternative 1, would be associated with short-term disturbance of killer whales from marine vessels. However, the low level of research activity under Alternative 1 would result in very little or no disturbance of killer whales. Vessel strikes of killer whales are also unlikely. Overall, the effects of disturbance and reduced survival and reproductive success of killer whales under Alternative 1 are considered negligible.

4.8.3.2 Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

As described under Alternative 1, research on the role of killer whales in the population dynamics of SSLs and NFSs would involve researchers documenting killer whale feeding behavior from marine vessels. However, the level of this type of research under Alternative 2 would potentially increase in magnitude and frequency because authorizations for incidental take or disturbance of SSLs and NFSs would be permitted. Vessel surveys of SSLs and NFSs would also be permitted under Alternative 2, which could increase the presence of marine vessels in the vicinity of killer whales.

Marine vessels used in research on killer whales, as well as research on SSLs and NFSs, could potentially cause vessel strikes and result in injury or death to individual killer whales. However, vessel strikes on killer whales and other marine mammals are rare, and few research vessels would approach killer whales under this alternative. Marine vessels can also produce discharges and increase turbidity; however, the result is generally localized, short-term changes in water quality that are unlikely to affect the survival and reproductive success of killer whales. Because vessel strikes on killer whales would be rare, it is unlikely that there would be a measurable reduction in the overall survival or reproductive success of killer whales.

Aerial, vessel, and land-based survey activities associated with research on SSLs and NFSs would result in minor, short-term disturbance of SSLs and NFSs under this alternative. This could temporarily increase the availability of these animals as prey for killer whales if SSLs and NFSs were to enter the water in response to research activities. Although killer whales can occur in areas of high marine mammal density, such as SSL and NFS haulouts and rookeries, killer whales forage over vast areas and prey on many species other than SSLs and NFSs. In addition, with respect to SSLs, the number and distribution of rookeries affected by research compared to the total number of rookeries for the population is small; therefore, an incremental change in the numbers of SSLs in the water at a particular time and rookery is unlikely to affect the overall foraging success of killer whales. The overall effects on the survival and reproductive success of killer whales are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

As described above, research on the role of killer whales in the population dynamics of SSLs and NFSs under Alternative 2 would involve researchers documenting killer whale feeding behavior from marine vessels. Vessel surveys of SSLs and NFSs would also be permitted under Alternative 2.

Marine vessels that closely approach killer whales could potentially cause disturbance through visual cues and noise pollution. The effects of this disturbance could include avoidance behavior and displacement. Noise pollution could also interfere with whale communication and echolocation used to detect prey (Barrett-Lennard *et al.* 1996). Because the effects would depend on vessels passing very close to killer whales, the geographic extent of the effects would be in the vicinity of the marine vessel. Given that few research vessels would approach killer whales under this alternative and would do so for only short periods of time, the effects of disturbance would be short-term and would produce no measurable effects on the overall population or distribution of killer whales. The overall effects of disturbance on killer whales are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and killer whales would be associated with short-term disturbance of killer whales from marine vessels. Because these effects would be infrequent and limited in geographical extent, it is unlikely that there would be a measurable effect on the abundance and distribution of killer whales. Vessel strikes on killer whales are unlikely, and SSL and NFS research activities causing animals to enter the water is unlikely to increase the killer whale predation on SSLs or NFSs. Overall, the effects of disturbance and reduced survival and reproductive success of killer whales under Alternative 2 are considered negligible.

4.8.3.3 Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Research on the role of killer whales in the population dynamics of SSLs and NFSs would continue under the Status Quo and could increase in magnitude and frequency, including authorizations for incidental disturbance of SSLs and NFSs. Vessel surveys of SSLs and NFSs would also be permitted under Alternative 3 and are likely to increase in magnitude and frequency. Marine vessels used in this type of research could potentially cause vessel strikes and result in injury or death to individual killer whales. However, vessel strikes on killer whales and other marine mammals are rare, and few research vessels would approach killer whales under this alternative. Marine vessels can also produce discharges and increase turbidity; however, the result is generally localized, short-term changes in water quality that is unlikely to affect the survival and reproductive success of killer whales. Because vessel strikes on killer whales would be rare, it is unlikely that there would be a measurable reduction in the overall survival or reproductive success of killer whales.

Research activities under the Status Quo would result in numerous short-term disturbances of SSLs and NFSs that would intentionally and incidentally cause many animals to enter the water. Some of these animals could be injured incidental to research activities and, therefore, would be less able to avoid killer whale predation. This could temporarily increase the availability of these animals as prey for killer whales around rookeries and haulouts, especially at sites where intrusive research activities occur. Although killer whales can occur in areas of high marine mammal density, such as SSL and NFS rookeries, killer whales forage over vast areas and prey on many species other than SSLs and NFSs. In addition, with respect to SSLs, the number and distribution of rookeries affected by research compared to the total number of rookeries for the population is small; therefore, an incremental change in the numbers of SSLs in the water at a particular time and rookery is unlikely to affect the overall foraging success of killer whales. Research under this alternative is assumed to be unlikely to affect the foraging success of killer whales. The overall effects of Alternative 3 on the survival and reproductive success of killer whales are negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

As described above, research on SSLs, NFSs, and killer whales would continue under the Status Quo and could increase in magnitude and frequency. Marine vessels that closely approach killer whales could potentially cause disturbance through visual cues and noise pollution. The effects of this disturbance could include avoidance behavior and displacement. Noise pollution could also interfere with whale communication and echolocation used to detect prey (Barrett-Lennard *et al.* 1996). Because the effects would depend on vessels passing very close to killer whales, the geographic extent of the effects would be in the vicinity of the marine vessel. Given that few research vessels would approach killer whales under this alternative and would do so for only short periods of time, the effects of disturbance would be short-term and would produce no measurable effects on the overall population or distribution of killer whales. Therefore, the effects of disturbance on killer whales under Alternative 3 are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and killer whales would be associated with short-term disturbance of killer whales from marine vessels. Because these effects would be infrequent and limited in geographical extent, it is unlikely that there would be a measurable effect on the abundance and distribution of killer whales. Vessel strikes on killer whales are unlikely and SSL and NFS research activities causing animals to enter the water is unlikely to increase killer whale predation on SSLs or NFSs. Overall, the effects of disturbance and reduced survival and reproductive success of killer whales under Alternative 3 are considered negligible.

4.8.3.4 Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Although the level of research on SSLs and NFSs and research directed at killer whales under Alternative 4 would increase from current levels, the effects of vessel strikes on the survival and reproductive success of killer whales would be similar in nature to those described under Alternative 3. The effects of Alternative 4 on killer whales are considered negligible.

Under Alternative 4, the effects of disturbance and injury on SSLs and NFSs would increase over current levels. However, this incremental change is unlikely to affect the foraging success of killer whales and would, therefore, have negligible effects on their chance of survival or their reproductive success.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Although the level of research on SSLs and NFSs and research directed at killer whales under Alternative 4 would increase from current levels, the effects of disturbance on killer whales from marine vessels would be similar in nature to those described under Alternative 3. The effects of disturbance on killer whales under Alternative 4 are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and killer whales would be associated with short-term disturbance of killer whales from marine vessels. Because these effects would be infrequent and limited in geographical extent, it is unlikely that there would be a measurable effect on the abundance and distribution of killer whales. Vessel strikes on killer whales are unlikely and SSL and NFS research activities causing animals to enter the water is unlikely to increase killer whale predation on SSLs or NFSs. Overall, the effects of disturbance and reduced survival and reproductive success of killer whales under Alternative 4 are considered negligible.

4.8.3.5 Cumulative Effects

The cumulative effects on killer whales are dominated by factors external to research activities on SSLs and NFSs. The following analysis of lingering past and present effects and RFFAs is the same for all alternatives.

Summary of Direct and Indirect Effects

The effects of disturbance and reduced survival and reproductive success due to research on SSLs and NFSs, or research directed at killer whales, are expected to have a negligible effect on the killer whale population under all alternatives.

Summary of Lingering Past Effects

Marine vessel traffic associated with commercial fisheries, commercial shipping, private recreation, tourism, and scientific research have disturbed killer whales in the past but the lingering effects, if any, are unknown. Injury and mortality of killer whales has been documented in several federal and state-managed commercial fisheries and there is evidence of intentional shootings (Angliss and Outlaw 2005). There has been no determination about whether or not these animals were from resident or transient stocks, but it is likely that most, if not all, were resident types foraging on fish. Resident killer whales are well documented to prey on fish being brought up by commercial fishing boats (Angliss and Outlaw 2005), and these interactions are a source of concern for fishery managers. Killer whales are also susceptible to injury or mortality through vessel strikes. One killer whale was reported killed when struck by the propeller of a Bering Sea/Aleutian Island (BSAI) groundfish trawl vessel in 1998 (Angliss and Lodge 2002). The Exxon Valdez Oil Spill (EVOS) resulted in the loss of half of the individual killer whales from the AT1 transient group in Prince William Sound (PWS) (Matkin *et al.* 1999). This group of killer whales has been designated as "depleted" under the Marine Mammal Protection Act (MMPA).

Results of modeling exercises suggest that the removal of great whales from the Bering Sea-GOA ecosystem during commercial whaling has resulted in a shift in the diet of transient killer whales, which has played a role in the decline of SSL populations and other marine mammals consumed by killer whales (Springer *et al.* 2003). Because marine mammals are the primary prey of transient killer whales, the factors identified as having affected the abundance or distribution of cetaceans, pinnipeds, and sea otters could indirectly affect these killer whales. Such factors include: competition with commercial fisheries, commercial and subsistence harvest, intentional shootings, incidental take in all fisheries, marine pollution, climate change, and regime shifts. Declines in harbor seals in PWS after the EVOS could have affected the AT1 group of transient killer whales through the food supply (Matkin *et al.* 1999).

Analysis of RFFAs

Injury and mortality to transient killer whales from RFFAs is likely, including from commercial fisheries, intentional shooting, vessel traffic, and marine pollution, particularly bioaccumulating pollutants such as DDT and PCBs (Matkin *et al.* 1999). The effects of global climate change or long-term regime shifts on transient killer whales are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. The future spatial/temporal concentration of commercial fisheries could affect the abundance and distribution of important prey species for transient killer whales. Vessel traffic associated with commercial shipping and tourism could increase as these industries expand. Disturbance and underwater noise pollution from many types of marine vessels could potentially interfere with communication and echolocation, which could affect the whales' foraging behavior.

Information from scientific research on killer whale physiology and behavior could beneficially affect the survival and reproductive success of killer whales, if it contributes to identifying or resolving conservation problems.

Cumulative Effects

A number of factors have been identified that could cause disturbance and/or affect the survival and reproductive success of killer whales. The population trends of transient killer whale stocks appear to be increasing, with the exception of the AT1 transient stock which is considered depleted. Cumulative effects for the GOA and West Coast transient stocks do not appear to be adverse at the population level, and are, therefore, considered to be minor. The cumulative effects for the AT1 stock are dominated by the EVOS, and are considered major. The direct and indirect effects associated with all alternatives are considered negligible; therefore, the contribution of research activities on SSLs and NFSs to overall cumulative effects on killer whales would be negligible.

4.8.4 Other ESA-Listed Species

The current status of the ESA-listed San Miguel Island fox, Guadalupe fur seal, sea otter, and great whales are described in Section 3.2.4. ESA-listed whales include humpback, blue, bowhead, fin, right, Sei, and sperm whales. Under the alternatives, no apparent mechanisms have been identified for affecting the San Miguel Island fox and the Guadalupe fur seal, and therefore those species are not included in the effects analysis. The southern resident stock of killer whales is also listed under the ESA (Section 3.2.3) and not included in the effects analysis because there are no apparent mechanisms of effect identified for resident killer whales. The status of all killer whale stocks are described in Section 3.2.3 and the direct, indirect, and cumulative effects analysis of transient killer whales is presented in Section 4.8.3. ESA-listed bird species are described in Section 3.2.7.3 and the corresponding direct, indirect, and cumulative effects analysis is presented in Section 4.8.6.

ESA-listed whales and sea otter stocks are carried forward in the effects analysis because of their potential presence in the vicinity of SSL and NFS research activities. Although the southwest Alaska and California (or southern) sea otter stocks have been designated under the ESA, this effects analysis can be applied broadly to all sea otter stocks in the project area. The intent of this analysis is to provide an overall assessment of the species' population-level response to its environment as it is influenced by SSL and NFS research activities. Representative direct and indirect effects used in this analysis include reduced survival or reproductive success and disturbance. Past, present, and future actions external to the project alternatives that are described in this analysis are also presented in detail in the Alaska Groundfish Fisheries Final Programmatic Supplemental Environmental Impact Statement (SEIS) (NMFS 2004a).

4.8.4.1 Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

No apparent mechanisms that could affect the survival or reproductive success of ESA-listed whale or sea otter populations have been identified under this alternative; therefore, the direct and indirect effects of Alternative 1 are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

No apparent mechanisms of disturbance to ESA-listed whale or sea otter populations have been identified under this alternative; therefore, the direct and indirect effects of Alternative 1 are considered negligible.

Conclusions

Because no apparent mechanisms for population change have been identified, there are no measurable effects associated with Alternative 1. The direct and indirect effects of Alternative 1 are considered negligible.

4.8.4.2 Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Marine vessels used for conducting research on SSLs and NFSs could cause vessel strikes, particularly during high-speed transit to and from survey locations, and result in injury or mortality to individual animals. Of the ESA-listed whales, humpback whales are most often seen in nearshore habitats, and therefore are more likely to encounter research vessels. Vessel strikes on marine mammals, however, are rare and it is also unlikely that vessels associated with SSL and NFS research would intentionally approach whales or sea otters. Any contact between marine research vessels and other marine mammals would be incidental to the research activity. Therefore, it is unlikely that vessel strikes would cause a measurable reduction in the overall survival or reproductive success of any species. Marine vessels can also produce discharges and increased turbidity; however the result is generally localized, short-term changes in water quality unlikely to affect the survival and reproductive success of whales and sea otters.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Marine vessels used for conducting research on SSLs and NFSs could potentially cause disturbance of ESA-listed whales if any are in the vicinity. Of the ESA-listed whales, humpback whales are most often seen in nearshore habitats, and therefore are more likely to be disturbed by research vessels. Marine vessels can generate underwater noise pollution that can interfere with whale communication and echolocation used by whales to locate prey. Other behavior changes associated with disturbance from marine vessels include avoidance and modifications to surfacing, respiration, and diving cycles, all of which can be accompanied by stress. The effects of disturbance on these whales, however, would depend on vessels passing very close to the animals.

Although ESA-listed whales are not targeted during aerial surveys of SSLs and NFSs, opportunistic sighting surveys could be conducted. Low altitude aerial surveys could cause behavioral changes to a few individual whales, including avoidance and modifications to surfacing, respiration, and diving cycles. Because overflights of whales during SSL and NFS research would be infrequent and cause minimal disturbance, the effects of disturbance are considered negligible.

Sea otters could be visually disturbed by aerial surveys and marine research vessels in the immediate area of haulouts and rookeries where SSL and NFS research is concentrated. Because sea otters could be in the vicinity of haulouts and rookeries, some animals could be potentially disturbed by SSL and NFS research activities. However, duration of these events would be short-term and would be unlikely to have any measurable effects on local sea otter populations. Therefore, the effects of disturbance on sea otters under Alternative 2 are considered negligible.

Conclusions

Direct and indirect effects of research activities under Alternative 2 would be associated with short-term disturbance of ESA-listed whales and sea otters from marine vessels or aircraft used to conduct research on SSLs and NFSs, and potential injury or mortality from vessel strikes. Because marine research vessels or aircraft are unlikely to intentionally approach whales, and few individual sea otters would be disturbed by human presence, there would be no measurable effects on the abundance and distribution of whales and sea otters. Overall, reduced survival and reproductive success and the effects of disturbance on ESA-listed whales and sea otters under Alternative 3 are considered negligible.

4.8.4.3 Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

The frequency and geographic extent of marine vessel use for the purposes of researching SSLs an NFSs could increase. Although more research vessels could increase the potential for vessel strikes on whales and sea otters, vessels strikes on marine mammals are uncommon, and it is not likely that research vessels would approach these animals. Therefore, Alternative 3 would be similar to Alternative 2 with regard to effects on the survival or reproductive success of whales and sea otters. The effects of Alternative 3 on the survival and reproductive success of whales and sea otters are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

The scope of research activities under the status quo would be greater than that under Alternative 2, and therefore the frequency and geographic extent of marine vessel and aircraft use for the purposes of researching SSLs and NFSs could increase. However, because little or no marine vessels or aircraft would seek out or occur in the vicinity of whales under this alternative, there would be no measurable effects of disturbance. Therefore, the effects of disturbance on whales under Alternative 3 are considered negligible.

Because site access and subsequent shoreline disturbance would increase under Alternative 3, there could potentially be an increase in the level of and the geographic extent of disturbance on sea otters. However, few sea otters are likely to occupy areas where research activities occur, and therefore there would be no measurable effects of disturbance on the population. Therefore, the effects of disturbance on sea otters under Alternative 3 are considered negligible.

Conclusions

Direct and indirect effects of research activities under Alternative 3 would be associated with short-term disturbance of whales and sea otters from marine vessels or aircraft used to conduct research on SSLs and NFSs, and potential injury or mortality from vessel strikes. Because marine research vessels or aircraft are unlikely to intentionally approach whales, and few individual sea otters would be disturbed by human presence, there would be no measurable effects on the abundance and distribution of whales and sea otters. Overall, reduced survival and reproductive success and the effects of disturbance on ESA-listed whales and sea otters under Alternative 3 are considered negligible.

4.8.4.4 Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

The frequency and magnitude of research activities under Alternative 4 would be greater than current levels, but would be similar in nature with regard to the effects on the survival and reproductive success of ESA-listed whales and sea otters, to those described for Alternative 3. The effects of Alternative 4 on the survival and reproductive success of ESA-listed whales and sea otters are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

The frequency and magnitude of research activities under Alternative 4 would be greater than current levels, but would be similar in nature with regard to the effects of disturbance on ESA-listed whales and sea otters, to those described for Alternative 3. The effects of disturbance on ESA-listed whales and sea otters under Alternative 4 are considered negligible.

Conclusions

Direct and indirect effects of research activities under Alternative 4 would be associated with short-term disturbance of whales and sea otters from marine vessels or aircraft used to conduct research on SSLs and NFSs, and potential injury or mortality from vessel strikes. Because marine research vessels or aircraft are unlikely to intentionally approach whales, and few individual sea otters would be disturbed by human presence, there would be no measurable effects on the abundance and distribution of whales and sea otters. Overall, reduced survival and reproductive success and the effects of disturbance on ESA-listed whales and sea otters under Alternative 4 are considered negligible.

4.8.4.5 Cumulative Effects

The cumulative effects on whales and sea otters are dominated by factors external to research activities on SSLs and NFSs. The following analysis of lingering past effects and RFFAs is the same for all alternatives.

Summary of Direct and Indirect Effects

The effects of disturbance and reduced survival and reproductive success of whales and sea otters are expected to be negligible to the populations under all alternatives.

Summary of Lingering Past Effects

Past effects on great whales included commercial whaling; incidental take and entanglement in foreign, Joint Venture, and federal and state-managed fisheries; and ship strikes. Commercial whaling in the 1900s severely depleted the populations of blue, fin, Sei, humpback, and right whales, and the effects continue to linger. A discussion of the effects of commercial whaling on baleen whales is presented in Section 3.8.9 of the Alaska Groundfish Fisheries Final Programmatic SEIS (NMFS 2004a). In the past, subsistence whaling has resulted in disturbance and mortality of the bowhead whales, which are now harvested under International Whaling Commission quotas and co-managed by NOAA Fisheries and the Alaska Eskimo Whaling Commission. The current quota allows the landing of up to 255 bowhead whales between 2003 and 2007. Ship strike injuries of fin whales, humpback whales, and bowhead whales have also been reported, but appear to be rare.

Commercial harvest of sea otter pelts dating from the mid-1700s to the late-1800s had a major impact on the population and nearly resulted in extinction (Bancroft 1959; Lensink 1962). Although protective measures instituted in 1911 have helped to reestablish sea otters, residual effects from this early harvest likely persist in several areas. The subsistence harvest of sea otters for pelts and meat by Alaska Natives has occurred throughout history. Current harvest from southwest Alaska villages averages fewer than 100 otters per year. Sea otters have been incidentally taken by commercial fisheries, particularly by the Aleutian Island Black Cod Pot Fishery. The 1971 Cannikin nuclear test explosion at Amchitka Island in the Aleutian Islands, Alaska, killed thousands of sea otters. The Exxon Valdez Oil Spill (EVOS) resulted in the death of an estimated 2,800 sea otters, and many more probably died and were not recovered (Garrott *et al.* 1993; Loughlin *et al.* 1996). Infectious diseases caused from streptococcus bovis/equinus, vibrio parahaemolyticus, domoic acid, and toxoplasmosis have also resulted in sea otter mortality. Additionally, it has been suggested that the declining sea otter population is due to increased predation by killer whales (Estes *et al.* 1998). This shift in predator-prey relationships could be linked to the decline in killer whale prey species, including great whales and SSLs.

Analysis of Reasonable Foreseeable Future Actions

Potential future sources of injury and mortality to ESA-listed whales include commercial fisheries, vessel traffic, and subsistence harvest of bowhead whales. The effects of global climate change or long-term regime shifts on ESA-listed whales are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. The future spatial/temporal concentration of commercial fisheries could affect the abundance and distribution of important prey species for ESA-listed whales. Vessel traffic associated with commercial shipping and tourism could increase as these industries expand. Disturbance and underwater noise pollution from many types of marine vessels could potentially interfere with communication and echolocation, which could affect the whales' foraging behavior.

Potential future sources of injury and mortality to sea otters include subsistence harvest, marine pollutants, and disease. Similar to the case of great whales, the effects of global climate change or long-term regime shifts on sea otters are difficult to predict and could result in either a beneficial or adverse effect on survival and reproductive success. Subsistence harvest of sea otters is likely to continue at current harvest levels. Marine pollutants, such as oil from oil spills, can soil otter fur and lower its ability to insulate, resulting in hypothermia and death. The number of oil spills and volume of oil spilled in the project area is likely to be similar to that of the present. The concentrated dumping of fish offal and sewage could attract sea otters and result in the transmission of diseases and parasites. Although it is unknown whether or not mortality caused by infectious diseases will increase, the current levels of disease transmission are likely to continue in future population-level effects.

Scientific research on ESA-listed whale and sea otter physiology and behavior could beneficially affect the survival and reproductive success of the animals by identification of potential threats and protection measures. In addition, the establishment of critical habitat for ESA-listed species (e.g., northern right whale critical habitat designation in July 2006) could provide protection from potential anthropogenic sources of injury and mortality.

Cumulative Effects

Few internal factors, and a number of external factors, have been identified that could cause disturbance and affect the survival and reproductive success of both ESA-listed whales and sea otters. It is believed that lingering effects from past actions have caused the decline of and/or are preventing de-listing of these species. Therefore, the cumulative effects for the ESA-listed whales and sea otters are dominated by these past actions and are considered major. Because there would be no direct or indirect effects associated with Alternative 1, this alternative would not contribute to cumulative effects on great whales or sea otters. The direct and indirect effects associated with Alternatives 2, 3, and 4 are considered negligible; therefore, the contribution of research activities on SSLs and NFSs to the overall cumulative effect on ESA-listed whales and sea otters is negligible.

4.8.5 Other Marine Mammals (Cetaceans, Pinnipeds)

Under all of the alternatives, no apparent mechanisms have been identified for affecting the marine mammal species listed in Section 3.2.5, other than the California sea lion, because of their overall abundance and distribution. Therefore, these marine mammals are not included in the effects analysis. The California sea lion, however, competes with the SSL for food and habitat in areas where their ranges overlap. Breeding areas of the California sea lion for example, can occur in the vicinity of SSL and NFS haul-outs and rookeries off California, Oregon, and Washington. The California sea lion is also of particular importance because it has been used as a surrogate species for SSLs in the past for testing new instrumentation devices and procedures. The predicted direct and indirect effects of SSL and NFS research activities on the California sea lion under the alternative research programs are discussed below. The intent of this analysis is to provide an overall assessment of the species' population-level response to its environment as it is influenced by SSL and NFS research activities. Representative direct and indirect effects used in this analysis include reduced survival or reproductive success and disturbance.

4.8.5.1 Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Because there would be no research-related take of SSLs under Alternative 1, it would be considered practical under these circumstances to conduct research on California sea lions as a surrogate species for SSLs. At this point, it is not known exactly what research would be conducted on California sea lions as surrogate species, but it would be likely to involve many of the procedures currently conducted on SSLs, as described in Section 3.2.1. In general, it is assumed that California sea lions would be removed from the wild and held in short-term captivity during experimentation and data collection. It is also assumed that the number of California sea lions captured would be limited because of the high costs associated with caring for the animals. Marine mammals used in captive experiments must be held in APHIS, USDA-certified research facilities, and all research protocols must be IACUC approved. Capture techniques would vary with location, but in all cases, previously permitted methods would be used. Chemical immobilization would be used when necessary to ensure the safety of both the sea lions and the human handlers.

It is unlikely that captive experiments on California sea lions would result in mortality, although there is some risk associated with procedures conducted on these animals, including anesthesia, sedations, and invasive procedures (Appendix B). Because this research would be performed by qualified personnel who would minimize disturbance and cease activity on acutely stressed animals, the potential for injuries is minimal.

The capture of California sea lions in the wild could result in short-term disturbance to other sea lions in the immediate vicinity. At rookeries, this disturbance can cause a stampede as sea lions rush to the water, potentially resulting in injury and death to pups. However, because California sea lion haulouts and rest areas are widely distributed, it is unlikely that capture of a California sea lion would occur on a rookery. Animals that enter the water to escape could also be subjected to killer whale predation, although predation by killer whales is unlikely to result in a measurable effect on the population of California sea lions. Therefore, the effects of Alternative 1 on the survival and reproductive success of California sea lions are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Capture of California sea lions in the wild could result in short-term disturbance to other sea lions in the immediate vicinity (animals in view of researchers). The direct and indirect effects of this disturbance include changes in behavior and injury. Behavioral changes associated with disturbance are flight, increased vigilance, cessation of an activity, or changes in swimming behavior. Physiological responses associated with stress are also likely. Animals that are stressed can also incur injuries in their attempts to avoid capture. Given that few California sea lions would be captured and used in captive experiments, disturbance from capture and release would be periodic and the geographic extent of the effects would be limited to the immediate vicinity of the activity. This activity would have no measurable effect on the abundance or distribution of the California sea lion, and therefore is considered negligible.

Conclusions

Direct and indirect effects of research on California sea lions as a surrogate species for SSLs would be associated with short-term disturbance of other animals during capture activities, injuries to animals incurred during capture, potential morality or injury to pups from stampede, and increased risk of predation by killer whales. The effects of capture and restraint are unlikely to result in a measurable effect on the population of California sea lions. Overall, the effects of disturbance and reduced survival and reproductive success of California sea lions under Alternative 1 are considered negligible.

4.8.5.2 Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Because of the restrictions on research involving the capture and handling of SSLs under Alternative 2, the research of California sea lions as a surrogate species for SSLs would be considered. Similar to that described under Alternative 1, the direct and indirect mortality associated with this research is unlikely to result in a measurable effect on the survival of the California sea lion.

Aerial, vessel, and land-based survey activities associated with SSL and NFS research could result in short-term disturbances to California sea lions. At rookeries, this disturbance can cause a stampede as sea lions rush to the water, potentially resulting in injury and death to pups. However, because California sea lion haulouts and rest areas are widely distributed, it is unlikely that capture of a California sea lion would occur on a rookery. Animals that enter the water to escape could also be subjected to killer whale predation, although California sea lions are abundant and predation by killer whales is unlikely to result in a measurable effect on the population of California sea lions. Therefore, the effects of Alternative 2 on the survival and reproductive success of California sea lions are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Research of California sea lions as a surrogate species for SSLs would continue under Alternative 2, and the effects of disturbance associated with this research would be similar to Alternative 1. Short-term disturbance to California sea lions would also occur from the aerial, vessel, and land-based survey activities associated with SSL and NFS research. The direct and indirect effects of this disturbance include changes in behavior and injury. Behavioral changes associated with disturbance are flight, increased vigilance, cessation of an activity, or changes in swimming behavior. Physiological responses associated with stress are also likely. Animals that are stressed can also incur injuries in their attempts to avoid capture. Given that California sea lions are abundant and widely distributed, the effects of disturbance on California sea lions under Alternative 2 would produce no measurable effects on the population and are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and capture of California sea lions as a surrogate species for SSLs, would be associated with short-term disturbance of other animals during research activities, injuries to animals incurred during capture, potential morality or injury to pups from stampede, and increased risk of predation by killer whales. The direct and indirect effects of Alternative 2 are unlikely to result in a measurable effect on the population of California sea lions. Overall, the effects of disturbance and reduced survival and reproductive success on California sea lions under Alternative 2 are considered negligible.

4.8.5.3 Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Because captive experimentation could be performed on SSLs under the Status Quo, use of California sea lions as a surrogate to SSLs would be likely to be limited to testing new monitoring instrumentation and associated procedures. This research would require capture and removal of the animal from the wild, using previously permitted capture methods, and short-term APHIS and IACUC-approved captivity during experimentation. The direct and indirect mortality associated with this research is similar to that described for Alternatives 1 and 2, and is unlikely to result in a measurable effect on the survival of the California sea lion.

The aerial, vessel, and land-based survey activities associated with SSL and NFS research would increase in frequency and magnitude under the Status Quo, but the potential for injury and mortality to California sea lions would be similar in nature to that described for Alternative 2. The overall effects on the survival and reproductive success of California sea lions under Alternative 3 are considered negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Because captive experimentation could be performed on SSLs under the Status Quo, use of California sea lions as a surrogate to SSLs would likely be limited to testing new monitoring instrumentation and associated procedures. This research would require capture and removal of the animal from the wild, using previously permitted capture methods, and short-term APHIS and IACUC-approved captivity during experimentation. Given that few California sea lions would be captured and used in captive experiments, disturbance from capture and release would be periodic and the geographic extent of the effects would be limited to the immediate vicinity of the activity. This disturbance would have no measurable effect on the abundance or distribution of the California sea lion.

The aerial, vessel, and land-based survey activities associated with SSL and NFS research would increase in frequency and magnitude under the Status Quo, but the effects of disturbance on California sea lions would be similar in nature to that described for Alternative 2. The overall effects of disturbance on California sea lions under Alternative 3 are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and capture of California sea lions as a surrogate species for SSLs, would be associated with short-term disturbance of other animals during research activities, injuries to animals incurred during capture, potential morality or injury to pups from stampede, and increased risk of predation by killer whales. The direct and indirect effects of Alternative 3 are unlikely to result in a measurable effect on the population of California sea lions. Overall, the effects of disturbance and reduced survival and reproductive success of California sea lions under Alternative 3 are considered negligible.

4.8.5.4 Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

The frequency and magnitude of research activities under Alternative 4 would be greater than current levels, but would be similar in nature with regard to the effects on the survival and reproductive success of California sea lions as described for Alternative 3. The effects of Alternative 4 on the survival and reproductive success of California sea lions are negligible.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

The frequency and magnitude of research activities under Alternative 4 would be greater than current levels, but would be similar in nature with regard to the effects of disturbance on California sea lions as described for Alternative 3. The effects of disturbance on California sea lions under Alternative 4 are considered negligible.

Conclusions

Direct and indirect effects of research on SSLs, NFSs, and capture of California sea lions as a surrogate species for SSLs, would be associated with short-term disturbance of other animals during research activities, injuries to animals incurred during capture, potential morality or injury to pups from stampede, and increased risk of predation by killer whales. The direct and indirect effects of Alternative 4 are unlikely to result in a measurable effect on the population of California sea lions. Overall, the effects of disturbance and reduced survival and reproductive success of California sea lions under Alternative 4 are considered negligible.

4.8.5.5 Cumulative Effects

The following analysis of lingering past effects and RFFAs is the same for all alternatives.

Summary of Direct and Indirect Effects

The effects of disturbance, injury, or mortality to California sea lions from SSL and NFS research activities or the use of California sea lions as a surrogate species to SSLs, are expected to be negligible on the population under all alternatives.

Summary of Lingering Past Effects

With the current population of California sea lions estimated at 240,000 animals and a minimum population estimate of 138,881 animals, it does not appear that present external actions have had any lingering effect on the population. However, relevant historical depletions of the California sea lion population are described below in order to fully assess potential cumulative effects.

California sea lions were commercially harvested for blubber, hides, and oil in the 1800s and early 1900s, and until the latter half of the 1900s in parts of California for pet food and other uses. Lowry *et al.* (1992) stated that there were few historical records to document the effects of such exploitation on sea lion abundance. Because prey species of the California sea lion are commercially fished, there have been interactions between sea lions and fisheries, including documented cases of sea lion injury and mortality. The largest number of California sea lions are killed incidentally in set and drift gillnet fisheries, particularly the California set gillnet fishery for halibut and angel shark, which kills an average of 1,267 sea lions each year (Carretta *et al.* 2004). The California driftnet fishery for sharks and swordfish and the Washington and Oregon salmon net pen fishery kill an average of 81 and 11 California sea lions each year, respectively (Carretta *et al.* 2004). Entanglement in troll, purse seine, trawl, commercial passenger fishing vessel hook and line fisheries, and other man-made debris have also resulted in injury and mortality to California sea lions. Commercial fishermen were permitted, up until 1995, to injure or kill a sea lion that was in the act of damaging their fishing gear and catch. Although it is now illegal to intentionally kill a sea lion, illegal shootings of California sea lions are reported. Subsistence harvest, collision with marine vessels, and entrainment in power plants are other sources of sea lion mortality.

California sea lions are preyed upon by killer whales, as well as great white, hammerhead, and blue sharks, and succumb to diseases such as pneumonia and leptospirosis. High pup mortality has been observed on San Miguel Island, and is associated with a high incidence of hookworm infections. Consumption of domoic acid toxin produced by a harmful algal bloom has been linked to many sea lion deaths along the central California coast (Carretta *et al.* 2004; Scholin *et al.* 2000). Environmental pollutants, such as DDT, and changes in the food supply as a result of El Niño events could also have had adverse effects on the sea lions. Documented characteristics of El Niños are decreased pup production, higher pup and juvenile mortality rates, and fewer females being recruited into the adult population (Carretta *et al.* 2004).

NMFS has issued permits for the scientific research of California sea lions. Hundreds of thousands of California sea lions have been harassed incidental to this research, and to a lesser degree, from research on cetaceans and other pinnipeds.

Analysis of Reasonably Foreseeable Future Actions

Injury and mortality of California sea lions from RFFAs is likely to continue, including from commercial fisheries, vessel traffic, intentional shooting, marine pollution, and disease. The future spatial/temporal concentration of commercial fisheries could result in increased interactions with California sea lions. These interactions could increase illegal shootings if the animals destroy nets or fish or increase injury or mortality from entanglement in nets. Disturbance from vessel traffic and injury and mortality from vessel strikes associated with commercial shipping and tourism could increase as these industries expand. The effects of global climate change or long-term regime shifts on California sea lions are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. Because short-term regime shifts such as El Niño have decreased the California sea lions net productivity, future El Niño events could affect the growth rate of the sea lion population.

Scientific research on California sea lions will result in disturbance to the species, but information from scientific research on California sea lion physiology and behavior could beneficially affect the survival and reproductive success of California sea lions if it contributes to identifying or resolving conservation problems.

Cumulative Effects

A number of internal and future external factors have been identified that could cause disturbance, injury, or mortality. The current population of California sea lions, estimated at around 240,000 animals (minimum population estimate of 138,881 animals), does not appear to be affected by past or present actions, including the disturbance of hundreds to thousands of California sea lions incidental to research on the species. The disturbance to California sea lions associated with the research activities under all alternatives would be negligible, comparatively. In addition, the number of California sea lions removed from the wild for research as a surrogate to SSLs would not approach the species' PBR of 8,333 sea lions per year. Therefore, the contribution of SSL and NFS research activities under all alternatives to the overall cumulative effect on California sea lions would be considered negligible.

4.8.6 Seabirds

The scope of research activities under the following research alternatives would include several activities that would potentially affect seabirds. These include observations from distant vantage points adjacent to SSL and NFS rookeries or haul-outs, aerial surveys; vessel-based surveys and support-vessel landings; and human activity on rookeries or haul-outs before, during, and after the breeding season. During the breeding season, potentially the most disruptive activities would be those that require clearing of the rookeries for pup counts; pup roundup; and capture and restraint of pups, juveniles, and adults for marking, measurements, and collection of biological samples. Activities after the breeding season, such as scat collections, would be expected to be less disruptive to birds.

Potential effects on birds would primarily be to the many seabird species that nest on the same remote offshore rocks and islands that provide habitat to SSL and NFS for breeding rookeries and haul-outs. Seabird colonies are associated with SSL (both DPS) rookeries and haul-outs through their range from the Aleutian Islands to Port Orford and Rogue Reefs in Oregon and Cape St. George in Northern California (Sowls et al. 1978, Varoujean, 1979). Very large seabird colonies are associated with the NFS rookeries in the Pribilof Islands and Bogoslof Island (Sowls et al 1978). The time period when seabirds are most vulnerable is during the seabird nesting season, May through August.

SSL and NFS researchers who operate on Alaska Maritime Refuge lands in Alaska must get a special use permit from USFWS, which contains stipulations to avoid and minimize disturbance of bird colonies and marine mammals. The USFWS's research vessel, *R/V Tiglax*, often provides logistical support to marine mammal researchers in Alaska and provides some guidance to researchers for avoiding disruptive activities near nesting seabirds.

Some vessel activity is required in most locations for support of research or is sometimes used for SSL or NFS census activity. These activities could also potentially result in direct and indirect effects on breeding seabirds that nest in close proximity to these research sites.

4.8.6.1 Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Under Alternative 1, direct and indirect effect of the limited research program would most likely be from individual observers gaining access to high ground above the SSL and NFS rookeries for behavioral observation or installation/maintenance of remote sensing equipment.

This response would not be expected to reduce survival of nestlings or adult seabirds of any species. These effects would not be expected to result in mortality of eggs or chicks and would not affect reproductive success.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

If access near the SSL or NFS rookery would require a vessel, small numbers of bird could be displaced from nearshore foraging areas, depending on the proximity of the individual landing locations to nesting areas. Effects would be short-term, but would not be expected to influence foraging success or feeding of nestlings.

Aerial surveys would be conducted at elevations high enough to not disturb marine mammals; therefore, effects on seabirds would be unlikely. Helicopter activity near the colony could occur during the nesting season for maintenance of remote camera or electronic equipment or to re-supply remote camps for observers. Helicopter would have to land in areas where SSL would not be disturbed. Helicopters are noisy and produce a variety of sounds that are disturbing to seabirds and can cause panic flight and egg loss (Fjeld et al. 1988).

Scat collection at vacated rookeries and haul-outs after the breeding season would potentially disturb roosting or loafing birds. Disturbance and displacement of non-breeding seabirds or seabirds foraging near a sample site would be expected to be of very short duration and considered negligible.

Conclusions

Overall, the low level of research activity under Alternative 1 would result in very little or no disturbance to nesting seabirds. Some potential disturbance would be associated with remote observations of SSL or NFS, depending on the routes taken to their observation sites or blinds. Avoidance of areas with nesting seabirds by researchers would greatly minimize effects of this disturbance.

Installation and maintenance of remote camera equipment could also cause some disturbance to nesting seabirds if they occur in the area, especially if the use of helicopters is required.

4.8.6.2 Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Direct and indirect impact on seabirds would primarily be from aerial surveys of trend sites for both western and eastern DPS SSLs, as aerial surveys are typically not used for NFSs. Survey planes are required to approach the rookery or haul-out from a kilometer or more offshore at slow air speeds (100-150 knots) without banking, maintain altitudes greater than 150 m, so they are within hearing range of the plane for 1-2 minutes (NMFS 2005e). This also reduces the disturbance to nesting seabirds in areas around the rookeries or haul-out.

These aerial surveys have the potential to cause panic flights at seabird colonies near the rookeries and haul-outs (Anderson and Keith, 1980; Chardine and Mendenhall 1998). Panic flights can result in and can lead to egg or young chicks being dislodged from the nests or ledges and lost, particularly in murres, which do not build a nest (Carney and Sydeman 1999, Chardin and Mendenhall, 2001). Panic flight can also lead to premature fledging of young birds and resulting in injury or potential mortality (Dixon 1997). Unattended nest after adults leave are subject to nest predation by gulls and ravens (Carney and Sydeman 1999, Chardin and Mendenhall, 2001).

Surveys outside the breeding season in the late fall or early spring could potentially result in momentary disturbance to wintering flock of Steller's eiders in their nearshore winter habitat on the Alaska Peninsula and Aleutian Islands. However, the surveys would be conducted at an elevation (150 meters) that would be unlikely to adversely affect behavior or foraging. Spectacled eiders and short-tailed albatross would not be affected by aerial surveys of SSLs due to the lack of overlap in their distribution.

Bald eagles commonly occur in coastal areas throughout the range of the SSL. Aerial survey could potential elicit some response from nesting eagles that are overflown during these surveys but the elevation of the surveys is relatively high and any adverse response is unlikely. Marbled, Kitlitz's and the Xantus' murrelets (crevice nesters), all special status species, are solitary nesters and would not likely be adversely affected by higher altitude aerial surveys near SSL rookeries and haul-outs or NFS rookeries of either the eastern Pacific or San Miguel Island stocks.

California brown pelicans, an endangered species, nest on San Miguel Island and are known to be sensitive to human disturbance near these colonies (Anderson 1988). Aerial surveys would need to avoid areas of nesting pelicans to minimize disturbance. Land-based surveys would not be in the vicinity of nesting pelicans, although these birds occur throughout the area. Disturbance effects on nesting pelicans are anticipated. Effects on California brown pelicans are considered negligible.

Land-based observations from distant cliffs or blinds would be permitted under Alternative 2, as long as SSLs or NFS are not disturbed. In some cases, gaining access to these observation sites would involve walking close to nesting seabirds and potentially would require frequent trips to the site. Responses to these disturbances by researchers from the nesting birds could range from temporary changes in behavior, such as alert or alarm postures and alarm calling, to changes in their internal state, such as increased heart rate/breathing rate (Wilson et al. 1991, Nimon et al. 1995, Carney and Sydeman 1999). Flushing or panic flights could also result in temporary abandonment of nest sites and reduced attendance by adults (Olsson and Gabrielsen 1990). However, the likelihood of these adverse effects from people walking near a seabird colony is very low.

Disturbance of colonial ground nesting species, such as gulls and terns, can result in chicks wandering into adjacent territories, where they are often attacked by neighbors and potentially injured or killed (Chardine and Mendenhall 1998).

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Adding to the general disturbance from the intermittent presence of researchers at the SSL and NFS rookeries during the breeding season, scat collections and associated vessel support at vacated rookeries and haul-outs after the breeding season would also potentially result in short-term disturbance/displacement of feeding, roosting or loafing seabirds. At sites in Alaska, these birds would typically be cormorants, several species of gulls, and possibly bald eagles. At rookeries and haul-outs in the southern portions of the study area, common birds would be cormorants, brown pelicans, California brown pelicans (at San Miguel), and several species of gulls. Disturbance of non-breeding seabirds at roosts had not been shown to have more than short-term effects (Carney and Sydeman 1999). Because these birds would be non-breeders at this time of the year, there would be no impact on reproduction. Magnitude/intensity and duration of disturbance, if any, would be negligible. The duration of any disturbance effects associated with scat collection would be short-term and considered negligible.

Conclusions

Direct and indirect effects of the scope of research under Alternative 2 on seabirds would be primarily associated with short-term disturbance from aerial survey overflights and land-based observations. There is a potential for some small loss of eggs or chicks from panic flights but this is highly dependent on factors such as timing of the surveys, elevation of the aircraft, locations of the seabird colonies in reference to the rookeries and haul-outs, past habituation to human disturbance (ground, vessel or aircraft), and proximity of researcher to colonies. Effects on reproductive success would be negligible. Adverse effects are unlikely for any seabird species. Overall effects are considered negligible.

4.8.6.3 Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Effects on seabirds from aerial surveys would be the same as under Alternative 2, although the intensity, frequency and locations of surveys would vary to some degree. The increase in aerial surveys at trend sites and additional non-trend sites for western DPS SSLs in the Bering Sea/Aleutian Islands would increase the level of disturbance at nesting colonies of several species of cliff-nesting and crevice-nesting seabirds. Aerial surveys of rookeries and hauls in Oregon and California would continue at the current level of effort and frequency.

There would be little risk of mortality for adult seabirds or young-of-the-year that have already fledged. The geographic scope of potential effects would be considerable in that it affects seabird colonies over the range of the SSL, and at the breeding areas of both stocks of NFS would be affected.

Vessel activity near rookeries during the research activities would be within close proximity to a rookery or haul-outs for more than two to three days at a time. Vessel operation would be expected to have a negligible effect on breeding seabirds in nearby colonies

Land-based census activities or intensive sampling would potentially increase general disturbance to nesting seabirds in adjacent areas. The degrees of disturbance would depend on many site factors, such as the distance from researcher to nesting seabirds, species affected, time of season, and level of disturbance for the activity. The duration of effects would depend on the number of time the birds are disturbed and would range from a one-time momentary event to a protracted period of intermittent disturbance (over several day) during intensive sampling or census activities. The likelihood of adverse effects to reproductive success from land-based activities would be very low. Effects of disturbance from research activity on seabirds would be negligible to minor.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Adding to the general disturbance from the intermittent presence of researchers at the SSL and NFS rookeries during the breeding season, scat collections and associated vessel support at vacated rookeries and haul-outs after the breeding season would also potentially result in short-term disturbance/displacement of feeding, roosting or loafing seabirds. At sites in Alaska, these birds would typically be cormorants, several species of gulls, and possibly bald eagles. At rookeries and haul-outs in the southern portions of the study area, common birds would be cormorants, brown pelicans (California brown pelicans at San Miguel), and several species of gulls. Disturbance of non-breeding seabirds at roosts has not been shown to have adverse effects (Carney and Sydeman 1999). Because these birds would be non-breeders at this time of the year, there would be no impact on reproduction. Magnitude/intensity and duration of disturbance, if any, would be negligible. The duration of any disturbance effects associated with scat collection would be short-term and is considered negligible.

Conclusions

Direct and indirect effects of the scope of research under Alternative 3 on seabirds would be primarily associated with short-term disturbance from aerial survey overflights, vessel based surveys, and land-based census activities and intensive sampling activities. Effects on survival or reproductive success would be negligible to minor. For disturbance, effects on breeding birds would be considered minor for geographic extend and frequency of occurrence. For non-breeding birds at roosts, effects would be negligible. Adverse effects are unlikely for any seabird species. Overall effects are considered negligible to minor.

4.8.6.4 Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

Direct and Indirect Reduced Survival or Reproductive Success Due to SSL and NFS Research

Effects on seabirds from aerial surveys would be the same as under Alternatives 2 and 3, although the intensity, frequency and locations of surveys would vary to some degree. The increase in aerial surveys at trend sites and additional non-trend sites for western DPS SSL in the Bering Sea/Aleutian Islands would increase the level of disturbance at nesting colonies of several species of cliff-nesting and crevice-nesting seabirds. Aerial survey of rookeries and haul-outs in Oregon and California would continue at the current level of effort and frequency.

Direct and Indirect Effects of Disturbance Due to SSL and NFS Research

Any increase in ground-based census activities or intensive sampling could potentially increase general disturbance to nesting seabirds in adjacent areas. The degrees of disturbance would depend on many site factors: the distance from researcher to nesting seabirds, species affected, time of year, and level of disturbance for the activity. The geographic scope of the disturbance would be considerable in that it would affect birds over the range of both SSL stocks and the breeding areas of both the eastern Pacific NFS stock and the San Miguel Islands stock. The duration of effects would depend on the number of time the birds are disturbed and would range from a one-time momentary event to protracted periods of intermittent disturbance (over several days) during intensive sampling or census activities. The likelihood of adverse effects from land-based activities would be negligible.

Conclusions

Direct and indirect effects of the scope of research under Alternative 4 on seabirds would be similar to Alternative 3 with a potential increase in ground-based and intensive sampling. Adverse effects are unlikely for any seabird species. The overall effects on survival and reproductions and effects of disturbance would be negligible to minor.

4.8.6.5 Cumulative Effects

Summary of Direct and Indirect Effects.

Because research activities allowed under Alternative 1 would be limited to observations on SSLs and NFLs behavior at a distance, the likelihood of affecting the survival or reproductive success of nesting seabirds as a result of these activities would be negligible. Any unscheduled maintenance to remote camera equipment would be infrequent and would not be likely to affect survival or reproductive success. Alternative 2 would result in disturbance of nesting seabirds from aerial surveys, but the overall effect on seabird survival would be negligible. Alternatives 3 and 4 would result in disturbance of nesting seabirds from both aerial and ground-based research activities, but the overall effect on seabird survival would be negligible.

Summary of Lingering Past Effects.

Past sources of reduced survival that may continue to have an effect on these species include subsistence hunting and egging in Alaska, incidental take in a variety of foreign and U.S. federal and state-managed fisheries, oil spills and other pollution, and introduced species such as the Norway rat in the Aleutian Islands (Ebbert and Byrd 2002), black rats on San Miguel Island, or fox farming ventures in Alaska (Bailey 1993, Williams, et al 2003). Oceanographic and climatic events (e.g., El Niño Southern Oscillation [ENSO], Pacific Decadal Oscillation [PDO]) have also caused intermittent episodes of mass starvation (Napp and Hunt 2001, Banduini et al. 2001). Disturbance from research activities appears to have contributed relatively little to the mortality of these species in the past. Eggshell thinning and/or elevated levels of DDT were documented in eggs of ashy storm-petrels, Cassin’s auklets, Xantus’ murrelets, and other seabird species in the Southern California Bight (Fry 1994). Brown pelican populations have decreased in the past as a result of eggshell thinning (USFWS 1995).

Analysis of Reasonably Foreseeable Future Actions

Mortality or reduced survival/reproductive success from RFFAs is identified for the continuing federal and state-managed commercial fisheries, subsistence harvest in Alaska (including egging), tourism and recreation, boat traffic near rookeries, eradication programs for introduced fox and rats (Aleutian Islands, Pribilof Islands, San Miguel Island), and marine pollution. All of the mortality factors identified in the previous section are likely to continue in the future. There are active efforts to keep rats off of the Pribilof Islands (USFWS 2006). While these potentially catastrophic events could happen at any time, several laws and programs are in place to mitigate the likelihood of their occurrence.

The greatest sources of human-caused mortality from the past include oil spills and incidental take in longline and drift net fisheries. These are likely to remain the largest factors in the future.

The effects of global climate change or long-term regime shifts on sea birds are difficult to predict, but could potentially have either a beneficial or adverse effect on survival and reproductive success. El Nino events can result in very large die-offs of sea birds in both Alaska and the west coast.

Cumulative Effects

The seabird groups in this analysis represent a wide diversity of niches, all of which have experienced infrequent mortality events in the recent past. All are also susceptible to future human-caused mortality factors. Contribution from activities associated with SSL and NFS research, however, is considered negligible. Because the direct and indirect effects associated with Alternative 1 approach zero, it would not contribute to the overall cumulative effects on any species. Alternatives 2, 3 and 4 would involve additional disturbance to a large geographic area from aerial surveys. The magnitude/intensity and duration of these effects are considered negligible. Overall, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9 Social and Economic Environment

While the proposed alternatives are largely focused on the potential methods and strategies employed by SSL and NFS researchers under a variety of conditions, there may be social and economic effects associated with any one of these alternatives. These effects may be felt in the local Alaskan communities where regular interactions between residents and research staff take place or in other contexts where interactions between SSL and NFS research and other activities, such as commercial fishing, may take place. In the case of commercial fisheries, this could involve entities based in Alaska and beyond. In terms of potential localized community effects, Chapter 3 discussed the existing conditions surrounding the interactions between research efforts and communities, outlining the economic, non-economic, and sociocultural dimensions of these interactions. This section analyzes how community members would be affected by each alternative through the interpretation of how different SSL and NFS research methodologies would alter existing interactions or result in new levels or types of interactions between visiting research staff and local residents. This includes a discussion dealing with the effects each proposed alternative may have on subsistence harvesters. Also included is a discussion concerning direct community interactions as they relate to the local economy, education, and sociocultural environment. Finally, an Environmental Justice section is included; it discusses the potential for effects that may be disproportionately experienced by minority populations and/or low-income populations.

4.9.1 Subsistence Harvesting

The analysis in this section is based upon existing-conditions information presented in Chapter 3, which includes discussion of ADF&G surveys concerning SSL and NFS subsistence harvest levels and regional variation, as well as detailed narratives from academic publications that outline hunting strategies. Because SSL and NFS subsistence harvesting varies greatly in region, scope, and method, it is appropriate for the purpose of this analysis to deal with SSL and NFS subsistence separately. Because discussions concerning different SSL and NFS stocks weigh little in the analysis of how the proposed alternatives might potentially affect subsistence harvesting, information concerning different stocks will not be included in this analysis.

In the context of subsistence harvesting, effects include any actions that would (1) decrease the number of potential SSLs or NFSs for subsistence hunting; (2) threaten the geographic availability of SSLs or NFSs available for subsistence hunting; (3) threaten the success of traditional methods used to procure SSLs or NFSs during subsistence hunting; or (4) threaten the usability of SSLs or NFSs for the purposes of subsistence or traditional handicrafts. Any of these possible effects could become major if the magnitude of the effect is great enough to threaten the viability of subsistence harvesting as a general practice or to affect the specific cultural contexts surrounding the subsistence harvest in any specific local community.

4.9.1.1 SSL Subsistence Harvesting

The geographic range of SSL subsistence harvesting spans approximately 2,000 miles of coastal Alaska, ranging from western AI communities to southeast panhandle communities. Generally, subsistence harvests are greatest in the AI, the North Pacific Rim, and the Pribilof Islands regions. Methods, however, vary by region, with hunting in the AI and the North Pacific Rim being typically done by two to three individual hunters operating from skiffs in open water. In contrast, hunters in the Pribilof Islands typically hunt from land, targeting mid-size SSL males swimming near shore in a system that eventually results in the wind and sea bringing the SSL carcass to shore, precluding the need to use a skiff under what may be difficult conditions. A more detailed account of the methods used by SSL subsistence hunters can be found in Section 3.4.1.

<u>Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorization</u>

Under Alternative 1, the No Action Alternative, no new permits would be issued, nor could existing permits be extended to allow for modifications. For a complete description of permitted research methodologies under Alternative 1, please refer to Section 2.6.

It is unlikely that there would be any direct effects on the subsistence harvest related to the research methods possible under Alternative 1. The analysis of existing data and samples would not directly affect subsistence hunters. Bio-sampling agreements under co-management would necessarily include subsistence hunters, but participation in any donation agreement is voluntary and can be withdrawn at any time. Remote sensing techniques (including aerial surveys) would be done in a manner that would not directly affect the behavior of the SSL population being studied and therefore would not affect the subsistence harvest. Behavioral observations, too, would take place from a remote location such that the SSL population would not be affected. Finally, scat collection from empty haulouts and rookeries would not directly affect the practice of hunting from land (particularly in the Pribilof Islands) because scat collection and subsistence harvesting would be done at different times. None of the research methods permitted under Alternative 1 would directly affect the four criteria outlined in Section 4.9.1 substantially. Therefore, direct effects associated with the implementation of Alternative 1 are considered to be negligible.

Indirect effects, however, may be minor. Scientific research would still be done on SSL populations under Alternative 1, but it is doubtful that the same types of research questions could be addressed under this alternative that could be addressed under existing conditions (or under Alternatives 2, 3, and 4). With SSL populations in decline, scientific investigation is designed, in part, to play a key role in explaining the cause of this phenomenon and suggesting strategies for SSL recovery. As discussed briefly in Section 2.8, it is unlikely that research conducted under Alternative 1 would provide answers to these research questions in an expedited manner, potentially compromising the ability of NMFS to meet their obligation under the ESA to manage the resource for recovery. As the contribution to SSL conservation objectives are described in Section 4.8.1.1, what research could be done from existing data would become increasingly outdated as environmental conditions and status of population change, and arguments other than scientific research results would be considered for the conservation of the species. To the extent that the implementation of Alternative 1 plays a role in failing to stop or reverse a decrease in the number of potential SSLs available for subsistence hunting on a general or localized basis, indirect effects associated with the implementation of Alternative 1 would be minor, depending on the ultimate biological consequences of the lack of research. Section 4.8.1.1 describes the contribution of Alternative 1 to SSL conservation objectives.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 1 would directly affect the subsistence harvesting of SSLs. Direct effects are likely to be negligible. Depending on the ultimate biological consequences of the research permitted under Alternative 1, however, the indirect effects associated with its implementation could be minor.

Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

Under Alternative 2, which would result in a research program without the capture or handling of SSLs, permits would be issued to researchers whose methods do not involve capture, restraint, tissue sampling, or intentionally forcing SSLs to leave rookeries during the breeding season. For a complete description of permitted research methodologies under Alternative 2, please refer to Section 2.6.

It is unlikely that there would be any direct effects on the subsistence harvest related to the research methods possible under Alternative 2. The methods permitted under Alternative 2 include those permitted under Alternative 1, which have been determined to not directly affect the subsistence harvest of SSLs in a substantial way. The additional methods of closer aerial, vessel-based, and land-based surveys allowed under Alternative 2 could directly affect subsistence harvesting methods and strategies through a disturbance to the animals, but these disturbances would be unlikely to affect subsistence harvesting for an extended period of time. Permits issued for the maintenance and husbandry of captive animals would not directly affect the subsistence harvest. Like the analysis of existing data and samples, the maintenance and husbandry of captive animals is likely to be done miles away from any subsistence harvesting and could, in no way, directly affect the hunt. Additionally, incidental mortality at or below 5 percent of PBR for each stock would not reduce SSL stocks to a point that would directly affect subsistence hunting. None of the research methods permitted under Alternative 2 would directly affect the four criteria related to subsistence hunting outlined in Section 4.9.1 substantially. Therefore, direct effects associated with the implementation of Alternative 2 are considered to be negligible.

Indirect effects, however, may be minor. Scientific research would still be done on SSL populations under Alternative 2, but it is unclear that the same types of research questions could be addressed under this alternative that could be addressed under existing conditions (or under Alternatives 3 and 4). With SSL populations in decline, scientific investigation is, in part, designed to play a key role in explaining the cause of this phenomenon and suggesting strategies for SSL recovery. It is more likely that research conducted under Alternative 2 would provide answers to these research questions in a manner more productive than under Alternative 1, but less productive than research done under Alternatives 3 and 4. As discussed in Section 4.8.1.2, it is unlikely that the methods permitted under Alternative 2 would contribute to all of the conservation objectives under the Draft Recovery Plan although its implementation would be considered to have a moderate effect on the ability to provide relevant information to support these objectives. Some research under Alternative 2 would become outdated as environmental conditions and status of population change, while other research would not be reinforced or supplemented by histological or physiological research. To the extent that the implementation of Alternative 2 plays a role in failing to stop or reverse a decrease in the number of potential SSLs available for subsistence hunting on a general or localized basis, indirect effects associated with the implementation of Alternative 2 would be minor, depending on the ultimate biological consequences of the reduced scope of research. Section 4.8.1.2 describes the contribution of Alternative 2 to SSL conservation objectives.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 2 would directly affect the subsistence harvesting of SSLs. Direct effects are likely to be negligible. Depending on the ultimate biological consequences of the research permitted under Alternative 2, however, the indirect effects associated with its implementation could be minor.

Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Under Alternative 3, which would reinstate the Status Quo research program, permits would be issued to researchers in the same way that existed before the court order vacated them in May 2006. For a complete description of permitted research methodologies under Alternative 3, please refer to Section 2.6.

Under Alternative 3, a variety of methods could be potentially employed, including those permitted under Alternatives 1 and 2, which have been determined to not have a substantial direct affect on the subsistence harvest of SSLs. The additional methods available under Alternative 3 involving the capture and restraint of SSLs vary in their effect on subsistence hunting activities. Among the methods not considered to directly affect the subsistence harvest are the collection of morphometric measurements, body composition measurements, and tissue samples. Additionally, incidental mortality at or below 10 percent of PBR for each stock would not reduce SSL stocks to a point that would directly affect subsistence hunting. Other methods permitted under Alternative 3, however, do directly affect the usability of SSLs for the purposes of subsistence or traditional handicrafts. These methods include chemical and drug injections, the application of permanent markings, and the application of various scientific instruments. The injection of chemicals and the application of scientific instruments (specifically the injection of subdermal transmitters) impact the physical body of the SSL in ways potentially adverse to humans who use SSLs in a subsistence capacity. Additionally, permanent markings to the skin of SSLs can affect traditional craftsmen/women who rely on an unmarred, natural animal for their traditional handicrafts. In short, Alternative 3 theoretically has the potential to substantially affect the usability of SSLs for the purposes of subsistence or traditional handicrafts. In practical terms, however, it is likely that few, if any, of the same individual SSLs used for research would be included in the subsistence harvest due to the wide geographic dispersion of both SSL research efforts and subsistence hunting efforts and because of the relatively small number of animals taken for either research or subsistence. In practice, the level of effect is dependent on the level of overlap between SSL subsistence populations and those studied by researchers. Thus, it is likely that direct effects associated with the implementation of Alternative 3 would be negligible.

The types of scientific research done on SSL populations under Alternative 3 would be similar to those conducted before the court order in May 2006. With SSL populations in decline, scientific investigation is, in part, designed to play a key role in explaining the cause of this phenomenon and suggesting strategies for SSL recovery. Previous research done with the methods permitted under Alternative 3 have provided productive answers to the problems surrounding SSLs. Section 4.8.1.3 describes the contribution of Alternative 3 to SSL conservation objectives and suggests that it is likely that continued research of this type would essentially meet the basic information needs outlined in the Draft Recovery Plan, ostensibly providing scientists and lawmakers an appropriate course of action for the preservation and recovery of SSLs as a species. Research results developed under Alternative 3 could provide a way to preserve SSL numbers for the subsistence harvest similar to what is occurring under existing conditions and in a timelier manner than would be the case under Alternatives 1 and 2. Alternative 3 may result in positive minor indirect effects to the four criteria outlined in Section 4.9.1. Therefore, indirect effects associated with the implementation of Alternative 3 are considered positive and minor.

Conclusion for Direct and Indirect Effects

While Alternative 3 could theoretically affect subsistence, it is likely that only a few, if any, of the same individual SSLs used for research would be included in the subsistence harvest. Thus, direct effects related to the implementation of Alternative 3 are considered to be negligible. Because the methods under Alternative 3 would address the basic information needs outlined in the Draft Recovery Plan, and would likely result in minor positive indirect effects.

Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

Alternative 4 would fully implement conservation goals and permits would be issued to researchers engaged in activities working toward the 78 substantive actions outlined in the Draft SSL Recovery Plan. For a complete description of permitted research methodologies under Alternative 4, please refer to Section 2.6.

Under Alternative 4, a variety of methods could be potentially employed, including those permitted under Alternatives 1, 2, and 3 that have been determined to have no substantial direct affect on the subsistence harvest of SSLs. Additionally, incidental mortality at or below 15 percent of PBR for each stock would not reduce SSL stocks to a point that would directly affect subsistence hunting. However, because Alternative 4 is similar to Alternative 3 in methodology, but greater in intensity, the same methods that could result in effects under Alternative 3 are of concern under Alternative 4. These methods include chemical and drug injections, the application of permanent markings, and the application of various scientific instruments.

Interviews conducted with local community members and subsistence hunters (discussed in detail in Section 3.5), specifically suggested that the injection of chemicals affect the physical body of the SSL in ways potentially adverse to humans who use SSLs in a subsistence capacity. It is also possible that the application of scientific instruments (specifically the injection of subdermal transmitters) would have similar effects. Finally, permanent markings to the skin of SSLs can theoretically affect traditional craftsmen/women who rely on an unmarred, natural animal for their traditional handicrafts. Practically, however, it is unlikely that the same individual SSLs used for research would be included in the subsistence harvest.

In correspondence (Appendix H), NMML suggested that SSL research would be geographically spread throughout the range of the SSL western stock, involving an aerial survey of the entire western stock, expanded vessel surveys, and the addition of new branding of animals from the rookeries in the central-western AI. Other permitted researchers might conduct research in this geographic area as well, as it is largely seen as the place where research on SSLs is needed the most, but expansion of effort in other areas is also possible. Due to the wide geographic nature of both SSL research and subsistence hunting, the level of significance is ultimately dependent on the level of overlap between SSL subsistence populations and those studied by researchers. Increased use of aerial and vessel-based surveys could directly affect the process of hunting to a point depending on volume and frequency of disturbance. These surveys may affect movement patterns of SSLs, potentially driving them from rookeries important to subsistence harvesters or away from areas utilized by hunters. To the extent that Alternative 4 has the potential to directly threaten the success of traditional methods used to procure SSLs during subsistence hunting, effects could result, depending on the degree of disturbance. Therefore, direct effects associated with the implementation of Alternative 4 could be moderate.

The types of scientific research done on SSL populations under Alternative 4 would be similar to those conducted before the court order in May 2006, but greater in intensity and scope. Research activity under Alternative 4 would be an aggressive implementation of the Draft SSL Recovery Plan. With SSL populations in decline, scientific investigation is designed, in part, to play a key role in explaining the cause of this phenomenon and suggesting strategies for SSL recovery. Previous research done with the methods permitted under Alternative 4 have provided productive answers to the problems surrounding SSLs. It is likely that continued research of this type would contribute to the formulation of an appropriate course of action for the preservation and recovery of the SSL as a species. As suggested in Section 4.8.1.4, Alternative 4 would have a major positive effect in terms of its potential contribution of meeting research goals. Further, Alternative 4 could provide a way to preserve SSL numbers for the subsistence harvest in a timelier manner than could Alternatives 1, 2, or 3. As a result, indirect effects associated with the implementation of Alternative 4 are considered positive and minor with respect to the four criteria outlined in Section 4.9.1.

Conclusion for Direct and Indirect Effects

The projected intensity and wide geographic nature of permitted research under Alternative 4 have the possibility to affect the subsistence harvest in a direct and moderate manner, depending on the level of overlap between SSL subsistence populations and those studied by researchers. Because the methods permitted under Alternative 4 would directly address the needs outlined under the Draft Recovery Plan, however, indirect effects are considered positive and minor in magnitude.

SSL Subsistence Harvesting Cumulative Effects

Summary of Direct and Indirect Effects

Depending on the alternative implemented, there are a number of potentially substantial direct and indirect effects to the subsistence harvest of SSLs. Under Alternatives 1 and 2, while there are no direct effects related to the research methods permitted, there is a minor indirect effect related to the decreased ability to conduct scientific research that speaks to environmental and population concerns over time.

Alternatives 3 and 4 do not entail the indirect effects associated with Alternatives 1 and 2, because the research methodologies under both alternatives would satisfy the research needs of the Draft Recovery Plan. The increased intensity and geographic reach of the proposed research agenda under Alternative 4, however, have the possibility of disturbing the subsistence harvest, but the level of disturbance is ultimately dependent on the level of overlap between SSL subsistence populations and those studied by researchers.

Summary of Lingering Past Effects

While a number of past effects tied to various management actions, such as the MMPA, have continued to shape subsistence hunting of SSLs in Alaska, lingering past effects regarding subsistence use of SSLs are largely tied to the biological vitality, and thus the availability of, stocks for subsistence use. As noted elsewhere (Section 4.10.5.2), the complexity, indirect nature, and cumulative effects of the factors negatively affecting the western population segment of SSLs have made it difficult to determine which factors were responsible for the population decline and which are primary threats to recovery. Additionally, despite impetus for further research funding based on pressure to mitigate potential negative consequences to commercial fisheries from unduly restrictive

SSL protection measures, federal appropriation for SSL research and management has shown an overall declining trend.

Analysis of Reasonably Foreseeable Future Actions

The following is an analysis of direct effects to the subsistence harvest of SSLs based on the RFFAs described in Section 4.5.2. Because the success of SSL subsistence harvest is directly related to the number of SSLs available in the wild, it is understood that any RFFA that would directly affect the general population of SSLs and their historical distribution would indirectly affect the subsistence harvest. For an analysis of how RFFAs would affect SSL populations in these ways, please refer to Section 4.8.1.5. This analysis, instead, will concentrate on how RFFAs would directly affect the act of subsistence harvesting.

Many of the RFFAs described have the potential to affect SSL numbers, migration patterns, or physiology. As such, the RFFAs have the potential to substantially affect the subsistence harvest. This is because a successful subsistence harvest relies on the presence of a healthy number of available SSLs, migrating in historically similar patterns, and exhibiting a non-diseased physiology. These considerations are discussed in Section 4.8.1. Beyond these factors, however, it is possible that increased commercial fishing, shipping, and other economic development could affect the subsistence harvest by disrupting traditional hunting areas or by increasing employment available to subsistence harvesters during the harvest season, resulting in a reduced number of people who harvest in the local community and potentially endangering the continued viability of the cultural practice.

Cumulative Effects

Alternative 1 – No Action: No New Permits or Authorization

For subsistence hunters living in small communities, the implementation of Alternative 1 has the potential to create minor cumulative effects. Local business owners would lose a minor amount of business as a direct effect under Alternative 1. While this loss of revenue would not be of substantial magnitude in larger communities, a drop in economic interaction in smaller communities would be of greater magnitude. It is possible, however, that this minor direct effect could be offset by growth of tourism and other industries, as mentioned in Section 4.5.2. Paradoxically, increases in economic activity can have the effect of making the subsistence harvest more productive (through making access to more expensive, more productive technologies financially more accessible), but it can also decrease the level of participation (as more people have employment conflicts during the harvest season). How individual hunters or communities articulate greater or lesser degrees of economic success with the subsistence harvest is quite variable. Thus, it is unknown to what specific degree economic effects will have on subsistence in any particular community, but they are likely to be minor overall.

Regardless, economic activity will accumulate with the foreseeable continuation of the subsistence harvest and the subsistence-related indirect effects of Alternative 1, which would potentially result in research that would become outdated as environmental conditions and the status of SSL populations change. A decrease in the number of potential SSLs available for the subsistence harvest on a general or localized basis could have a minor affect on subsistence depending on the ultimate biological consequences of the lack of research. Depending on how economic change is negotiated, for small communities that rely heavily on the SSL subsistence harvest, the minor direct and indirect effects related to the implementation of Alternative 1 could result in cumulative effects of minor magnitude to subsistence.

Alternative 2 – Research Program without Capture or Handling

For all communities within the study area, the implementation of Alternative 2 has the potential to create minor cumulative effects related to the subsistence harvest. Local business owners are expected to lose a negligible amount of business as a direct effect under Alternative 1. It is possible, however, that Alternative 2 will indirectly result in a minor increase in economic interaction between research staff and local community members. Coupled with a foreseeable growth in tourism and other industries (as described in Section 4.5.2), local communities may experience minor cumulative economic effects. Paradoxically, increases in economic activity can have the effect of making the subsistence harvest more productive (through making access to more expensive, more productive technologies financially more accessible), but it can also decrease the level of participation (as more people have employment conflicts during the harvest season). How individual hunters or communities articulate greater or lesser degrees of economic success with the subsistence harvest is quite variable. Thus, it is unknown to what specific degree economic effects will have on subsistence in any particular community, but they are likely to be minor overall.

Regardless, Alternative 2 has the potential to affect the subsistence harvest because its implementation would potentially result in research that would become outdated as factors change over time or that would not be supported by other types of more direct research on SSLs. A minor decrease in the number of potential SSLs available for the subsistence harvest on a general or localized basis could have a minor effect on subsistence depending on the ultimate biological consequences of the lack of research. An increased use of aerial surveys could also disturb the act of the harvest in a minor way. If this minor effect is combined with a decrease in number of SSLs, then it is somewhat likely that the subsistence harvest could be threatened. Depending on how economic change is negotiated, for small communities that rely heavily on the SSL subsistence harvest, the minor effects related to the implementation of Alternative 2 could result in cumulative effects of minor magnitude to subsistence.

Alternative 3 – Status Quo Research Program

For all communities within the study area, the implementation of Alternative 3 is considered to result in negligible cumulative effects. As Alternative 3 would reinstate the activities permitted before the court order, it is generally assumed that subsistence activities and community interactions would return to levels present before the permits were vacated. As such, there would not likely be a change from the existing conditions outlined in Chapter 3. Thus, the implementation of Alternative 3 is considered to result in negligible cumulative effects to subsistence.

Alternative 4 – Research Program with Full Implementation of Conservation Goals

For smaller communities within the study area, the implementation of Alternative 4 has the potential to create cumulative subsistence effects that may range from minor to major in magnitude depending on community type. Major effects are more likely for smaller, rural communities and other communities that, under Alternative 4, would experience interactions with research staff for the first time. Interactions with research staff would include economic interactions, which are considered to be minor in magnitude. However, depending on the level of other economic growth (in the form of tourism or the growth of other industries as described in Section 4.5.2), local communities may experience minor cumulative economic effects. Economic activity can have the effect of making the subsistence harvest more productive (through the use of more expensive, more productive technologies now within the financial range of subsistence hunters), but it can also threaten the level of participation (as more people are employed during the harvest season). How members of each community negotiate economic success (or lack thereof) with the subsistence harvest is unique. Thus, it is unknown to what degree minor economic effects will have on subsistence.

Regardless, subsistence harvesters of SSLs could be affected directly in ways ultimately dependent on the level of overlap between SSL subsistence populations and those studied by researchers. These direct moderate effects related to subsistence would combine with the increased economic interactions that are possible under Alternative 4, which could create a range of effects, from moderate to major, with major effects being of higher probability for smaller, more rural communities. These effects are combined with the positive, indirectly minor effects related to subsistence. These effects accumulate, regardless of their perceived negative or positive outcomes, in communities that play host to SSL research. Thus, the implementation of Alternative 4 is considered to have the potential to result in moderate to major cumulative effects to subsistence, with major cumulative effects being more possible in small communities.

4.9.1.2 Northern Fur Seal Subsistence Harvesting

The geographic range of NFS subsistence harvesting is relatively constrained to the Pribilof Islands and the communities of St. George and St. Paul. Only three other communities (Akutan, Nikolski, and Unalaska) show any level of harvest for any ADF&G survey year. The numbers in these three communities are low, however, accounting for 1 percent or less of the total community subsistence take.

As discussed in Chapter 3, hunting of NFSs in the Pribilof Islands is a direct outgrowth of the commercial harvest that began in historic times and has continued for generations. In contrast to the SSL harvesting strategies outlined in Chapter 3, NFS subsistence harvesting in the Pribilof Islands is an organized, land-based, group activity. The subsistence harvest usually begins with a harvest crew entering the haulout under the direction of a harvest foreman. This foreman directs the harvest crew in a strategy to isolate a number of two- to four-year-old male NFSs from the rest of the pod. A certified veterinarian acts as a Humane Observer during this process. Once the Humane Observer determines that the seals are sufficiently rested and cooled, experienced harvesters deliver a swift blow to the back of the head to render the animal unconscious and others subsequently humanely disable the heart of the seal. The meat is processed, distributed, and frozen for future use as soon as possible to prevent spoilage. Subsistence harvests take place throughout the authorized season to meet subsistence demands.

Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

The research methods that would be permitted for NFSs under Alternative 1 are the same as would be permitted for SSL research. Thus, it is unlikely that any direct effects on the subsistence harvest of NFSs would occur related to the methods possible under Alternative 1. The analysis of existing data and samples, bio-sampling, remote sensing, behavioral observations, and scat collection would be conducted in a manner that would not interfere with subsistence harvesting. Therefore, direct effects associated with the implementation of Alternative 1 are considered negligible.

In contrast to SSLs, NFS numbers are not drastically declining and there is less concern for rebuilding NFS numbers in the Pribilof Islands than for the recovery of SSLs in western Alaska. Therefore, restricted scientific inquiry is not likely to result in a threatened NFS population. Thus, indirect effects associated with the implementation of Alternative 1 are negligible.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 1 would directly or indirectly affect the subsistence harvesting of NFSs. All effects, direct or indirect, are considered to be negligible under Alternative 1.

Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

The research methods that would be permitted for NFSs under Alternative 2 are the same as would be permitted for SSL research. Thus, it is likely that negligible direct effects on the subsistence harvest of NFSs would occur related to the methods possible under Alternative 2. These methods include closer aerial and vessel-based surveys, closer land-based observations, and the husbandry of captive NFSs. Even with consideration of an incidental mortality at or below 5 percent of PBR, Alternative 2 would only directly affect the four criteria related to subsistence hunting outlined in Section 4.9.1 to a negligible degree. Therefore, direct effects associated with the implementation of Alternative 2 are considered negligible.

In contrast to SSLs, NFS numbers are not drastically declining and there is less concern for rebuilding NFS numbers in the Pribilof Islands than for the recovery of SSLs in western Alaska. Therefore, restricted scientific inquiry is not likely to result in a threatened NFS population. Thus, indirect effects associated with the implementation of Alternative 2 are considered negligible.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 2 would directly or indirectly affect the subsistence harvest of NFSs. All effects, direct or indirect, are considered to be negligible under Alternative 1.

Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

The research methods that would be permitted for NFSs under Alternative 3 are the same as would be permitted for SSL research. Thus, it is unlikely that there would be any direct effects on the subsistence harvest of NFSs related to the methods possible under Alternative 3. Additionally, incidental mortality at or below 10 percent of PBR for each stock would not reduce NFS stocks to a point that would directly affect subsistence hunting. As with SSLs, other methods permitted under Alternative 3, however, would theoretically directly affect the usability of NFSs for the purposes of subsistence or traditional handicrafts. These methods include chemical and drug injections, the application of permanent markings, and the application of various scientific instruments. In practice, however, it is unlikely that the same individual NFSs used for research would be included in the subsistence harvest due to the cooperative nature of in-place co-management agreements, the proportionately small number of NFSs affected by the research methods, and a specific subsistence harvesting methodology that would presumably allow the harvesters to more easily identify and avoid the taking of research animals. Thus, direct effects associated with the implementation of Alternative 3 are considered negligible.

In contrast to SSLs, NFS numbers are not drastically declining and there is less concern for rebuilding NFS numbers in the Pribilof Islands than for the recovery of SSLs in western Alaska. Therefore, scientific inquiry similar to that done under the Status Quo is not likely to indirectly result in any substantial change in NFS stock populations. Thus, positive or negative indirect effects associated with the implementation of Alternative 3 are considered negligible.

Conclusion for Direct and Indirect Effects

Although Alternative 3 could theoretically affect subsistence, it is likely that few, if any, of the same individual NFSs used for research would be included in the subsistence harvest. This is especially true if cooperative co-management agreements continue into the future. Thus, direct effects and indirect effects related to the implementation of Alternative 3 are considered negligible.

Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

The research methods permitted for NFSs under Alternative 4 are the same as would be permitted for SSL research as is described previously. Whereas Alternative 4 resulted in direct effect of moderate magnitude for SSL, it is unlikely that there would be any direct effects on the subsistence harvest of NFSs related to the methods possible under Alternative 4. Additionally, incidental mortality at or below 15 percent of PBR for each stock would not reduce NFS stocks to a point that would directly affect subsistence hunting. As is the case with SSLs, however, other methods permitted under Alternative 3 could theoretically directly affect the usability of NFSs for the purposes of subsistence or traditional handicrafts. These methods include chemical and drug injections, the application of permanent markings, and the application of various scientific instruments. In practice, however, it is unlikely that the same individual NFSs used for research would be included in the subsistence harvest due to the cooperative nature of in-place co-management agreements, the proportionately small number of NFSs affected by the research methods, and a specific subsistence harvesting methodology that would presumably allow the harvesters to more easily identify and avoid the taking of research animals. These same considerations would also minimize any effect increased aerial or vessel-based observations may have. Chemical injections, permanent markings, and more intrusive surveying techniques could potentially result in minor effects if left unchecked; however, these effects would most likely be mitigated with continued cooperation between research staff and co-management authorities. Therefore, direct effects associated with the implementation of Alternative 4 are considered negligible.

In contrast to SSLs, NFS numbers are not drastically declining and there is less concern for rebuilding NFS numbers in the Pribilof Islands than for the recovery of SSLs in western Alaska. Therefore, scientific inquiry similar to that done under the Status Quo is not likely to indirectly result in any substantial difference in NFS stock populations. Thus, indirect effects associated with the implementation of Alternative 4 are considered negligible.

Conclusion for Direct and Indirect Effects

Although Alternative 4 could theoretically affect subsistence, it is likely that few, if any, of the same individual NFSs used for research would be included in the subsistence harvest. This is especially true if cooperative co-management agreements continue into the future. Thus, direct effects related to the implementation of Alternative 4 are considered negligible. Additionally, Alternative 4 would have a negligible indirect effect on the subsistence harvest of NFSs.

Northern Fur Seal Subsistence Harvesting Cumulative Effects

Summary of Direct and Indirect Effects

There are negligible direct and indirect effects associated with any of the proposed alternatives in reference to the NFS subsistence harvest.

Summary of Lingering Past Effects

While a number of past effects tied to various management actions, such as the MMPA, have continued to shape subsistence hunting of NFSs in Alaska, lingering past effects regarding subsistence use of NFSs are largely tied to the biological vitality, and thus the availability of, stocks for subsistence use. Although the structure of the current NFS subsistence harvest can be traced back to Russian times, with the forced relocation of indigenous residents of the Aleutian Chain to the Pribilof Islands, the harvest today remains most directly shaped by changes seen in the transition away from a commercially oriented harvest, which began in the early 1980s with the lapse of the Fur Seal Convention. While availability of NFSs for subsistence has not historically been a problem in the Pribilof Islands where this activity has been centered, NFS research funding was substantially reduced after the lapse of the Fur Seal Convention, as noted in Section 4.10.5.2, Recently, however, there has been an increase in funding due, at least in part, to the fact that NFS populations in the Pribilof Islands show no signs of recovery from recent declines.

Analysis of Reasonably Foreseeable Future Actions

The analysis of RFFAs for NFS subsistence harvesting is similar to that previously outlined for SSL subsistence harvesting. Please refer to Section 4.9.1.1 for this discussion.

Cumulative Effects

Alternative 1 – No Action: No New Permits or Authorization

For subsistence hunters living in small communities, the implementation of Alternative 1 has the potential to create minor cumulative effects. Local business owners would lose a minor amount of business as a direct effect under Alternative 1. While this loss of revenue would be of negligible magnitude in larger communities, a drop in economic interaction in smaller communities would be of greater magnitude. It is possible, however, that this minor direct effect would be offset by a growth of tourism and other industries, as mentioned in Section 4.5.2. Paradoxically, increases in economic activity can have the effect of making the subsistence harvest more productive (through making access to more expensive, more productive technologies financially more accessible), but it can also decrease the level of participation (as more people have employment conflicts during the harvest season). How individual hunters or communities articulate greater or lesser degrees of economic success with the subsistence harvest is quite variable. Thus, it is unknown to what specific degree economic effects will have on subsistence in any particular community, but they are likely to be minor overall.

Regardless, economic activity will accumulate with the foreseeable continuation of the subsistence harvest and the NFS subsistence-related direct and indirect effects of Alternative 1, which are considered negligible in magnitude. Depending on how economic change is negotiated, for small communities that rely heavily on the NFS subsistence harvest, the minor direct and indirect economic effects and RFFAs related to economic growth and the negligible effects related to the implementation of Alternative 1 could be synergistic and result in minor cumulative effects to subsistence.

Alternative 2 – Research Program without Capture or Handling

For all communities within the study area, the implementation of Alternative 2 has the potential to create minor cumulative effects to the subsistence harvest. Local business owners are expected to lose a negligible amount of business as a direct effect under Alternative 2. It is possible, however, that Alternative 2 will indirectly result in a minor increase in economic interaction between research staff and local community members. Coupled with a foreseeable growth in tourism and other industries (as described in Section 4.5.2), local communities may experience minor cumulative economic effects. Paradoxically, increases in economic activity can have the effect of making the subsistence harvest more productive (through making access to more expensive, more productive technologies financially more accessible), but it can also decrease the level of participation (as more people have employment conflicts during the harvest season). How individual hunters or communities articulate greater or lesser degrees of economic success with the subsistence harvest is quite variable. Thus, it is unknown to what specific degree economic effects will have on subsistence in any particular community, but they are likely to be minor overall.

Regardless, economic activity will accumulate with the foreseeable continuation of the subsistence harvest and the NFS subsistence-related direct and indirect effects of Alternative 2, which are considered negligible in magnitude. Depending on how economic change is negotiated, for small communities that rely heavily on the NFS subsistence harvest, the interaction between minor indirect economic effects and RFFAs related to economic growth and the negligible effects related to the implementation of Alternative 2 could be synergistic and result in cumulative effects of minor magnitude for the subsistence harvest.

Alternative 3 – Status Quo Research Program

For all communities within the study area, the implementation of Alternative 3 is considered to result in negligible cumulative effects. As Alternative 3 would reinstate the activities permitted before the court order, it is generally assumed that subsistence activities and community interactions would return to levels present before the permits were vacated. As such, there would not likely be a change from the existing conditions outlined in Chapter 3. Thus, the implementation of Alternative 3 is considered to result in negligible cumulative effects to subsistence.

Alternative 4 – Research Program with Full Implementation of Conservation Goals

For smaller communities within the study area, the implementation of Alternative 4 has the potential to create cumulative effects related to direct interactions that may range from minor to major in magnitude depending on community type. Major effects are more likely for smaller, rural communities and other communities that, under Alternative 4, would experience interactions with research staff for the first time. Interactions with research staff would include economic interactions, which are considered to be moderate in magnitude. Depending on the level of other economic growth (in the form of tourism or the growth of other industries as described in Section 4.5.2), local communities may experience major cumulative economic effects. Economic activity can have the effect of making the subsistence harvest more productive (through the use of more efficient technologies now within the financial range of subsistence hunters), but it can also potentially decrease the level of participation (as more people may experience employment conflicts during the harvest season). How members of each community negotiate economic success (or lack thereof) with the subsistence harvest is variable. Thus, it is unknown to what degree these economic effects will have on subsistence.

Regardless, subsistence harvesters of NFSs could theoretically be affected directly in ways that are ultimately dependent on the level of overlap between NFS subsistence populations and those studied by researchers. This possibility, however, could be minimized through co-management agreements and harvesting methodologies to a point of negligibility. These direct effects related to subsistence, which are considered to be negligible in magnitude, would combine with the increased economic interactions that are possible under Alternative 4, which could create a range of effects, from moderate to major, with major effects being of higher probability for smaller, more rural communities. These effects are combined with the positive, indirect minor effects related to subsistence. These effects accumulate, regardless of their perceived negative or positive outcomes, in communities that play host to NFS research. Thus, the implementation of Alternative 4 is considered to have the potential to result in moderate to major cumulative effects to subsistence, with major cumulative effects being more possible in small communities.

4.9.2 Direct Interactions with Communities during Research-Related Activities

The analysis in this section is based upon information in Chapter 3, which includes a general summary of a series of interviews conducted with SSL- and NFS-permitted scientists and their staff. Through these interviews, it became clear that direct interactions between local community members and SSL/NFS researchers manifested in three distinct ways: economic interactions, educational/training interactions, and general sociocultural interactions. It also became clear through these interviews that the general nature of SSL research is markedly different from NFS research. Thus, the community interactions surrounding these different types of research are varied. Due to this difference, it is appropriate to deal with the community interactions surrounding primarily SSL research separately from the community interactions surrounding primarily NFS research. Because discussions concerning different SSL and NFS stocks weigh little in the analysis of how the proposed alternatives might potentially affect general community interaction, discourse concerning different stocks will not be included in this analysis.

Effects, in the context of community interaction between research staff and local community members, are related to the three distinct interaction types previously mentioned: economic, educational/training, and sociocultural. For economic interactions, a major effect would be seen by individual business entities if there was a substantial decrease (>10 percent) in revenue. From that, major effects would be seen at the community level if there was a substantial decrease in public revenue. For educational/training interactions, major effects would include any substantial decline in community members engaged in assisting or learning from visiting research staff or a substantial decline in the quality of this interaction. Sociocultural interactions and related possible major effects are difficult to quantify, however, because sociocultural interactions can encompass positive and negative events, often take place in informal settings, and are typically not well documented, if they are documented at all. That these types of interactions are of concern to the communities, however, may be gleaned from input given during the public participation process for this EIS and from the August 2006 focus group meetings in particular. As an example, various attendees at those meetings commented on the need for better coordination with communities, analysis of social and cross-cultural effects to communities, and development of a protocol for researchers interacting with rural communities to promote culturally appropriate behavior and to ensure local tribes and organizations are adequately informed of research and are given the opportunity to benefit from research results. Beyond these specific comments, it was also noted that not all potentially affected communities have the opportunities provided by co-management agreements and that there is, in general, an overarching need for upfront involvement and communication with Alaska Native communities. For the purposes of this analysis, effects are expected to increase if there is a substantial increase in research programs without accompanying input from the local community or some other community involvement program.

Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorizations

It is unknown what precise effect Alternative 1 would directly have on the volume of researchers visiting local communities, the frequency local communities may experience visiting researchers, or the duration visiting researchers may stay in each community during field research. It is generally assumed, however, that volume, frequency, and duration of SSL and NFS research would be substantially less than was experienced under the research permitting process in place prior to the court order. If this is indeed the case, then interaction between research team members and local community residents would be reduced. For all communities that experience visiting researchers, whether or not they are related primarily to SSL or NFS research, the commercial interactions outlined in Chapter 3 would decrease. As aerial and vessel-based surveys are allowed under Alternative 1 (with the caveat that these surveys would be conducted in a manner that did not result in takes), occasional airplane and vessel charters would be likely, but not in the numbers present before the court order. For the relatively economically diversified communities largely associated with SSL research, this decrease in economic interaction is not likely to result in any major loss of revenue due to the proportionately small amount of money brought in by visiting researchers compared to other economic sectors, such as the fishing and, in some cases, the tourism industry. Smaller communities, such as St. George and St. Paul, may experience a greater effect from a decrease in economic interaction, but even this decrease would be minor in comparison to the larger economic sphere present in these communities. Thus, direct economic effects associated with the implementation of Alternative 1 are considered minor.

Similar to economic interactions, it is generally assumed that the frequency and quality of educational interactions would decrease under Alternative 1. For all communities that experience visiting researchers, whether they are related primarily to SSL or NFS research, the educational interactions outlined in Chapter 3 would decrease. This would include the decrease in formal presentations and may also include a decrease in media presence by researchers. Alternative 1 would also likely decrease the number of informal conversations between local community members and research staff. For the larger communities associated largely with SSL research, the loss of formal presentations, informal meetings, and other non-economic interactions outlined in Chapter 3 is negligible due to the relatively small proportion of the local population affected by these interactions in the first place. In the smaller communities of St. George and St. Paul, however, these informal meetings and exchanges of information are more socially significant due to the relatively small population of the communities. Additionally, researchers regularly take on volunteers, including children, in a conscious effort to educate young people about biology, ecology, and the general principles of science. As described in Chapter 3, this educational outreach gives children (many of whom are Alaska Native) the opportunity to engage with wildlife in a way that complements the traditional understanding of nature passed down by their ancestors. Even though these volunteer opportunities are relatively short-lived and infrequent, researchers stressed the importance of providing education to local children in a conscious effort to instill in future generations an understanding and interest in science, so that one day local community members could conduct research on their own. Under Alternative 1, it is likely that this educational outreach would decrease. Therefore, direct educational effects associated with the implementation of Alternative 1 are considered to be moderate for people living in the communities of St. George and St. Paul.

Like economic and educational interactions, it is generally assumed that sociocultural interactions would decrease under Alternative 1. For all communities that experience visiting researchers, whether or not they are related primarily to SSL or NFS research, the potential for positive and negative sociocultural interactions would decrease due to the decrease in research staff directly interacting with local community members in any capacity. By reducing some of the negative sociocultural effects, Alternative 1 may actually benefit local community members. As noted in Chapter 3, however, effects derived from culturally inappropriate behaviors have been decreasing in recent years under existing conditions, so the magnitude of this gain is likely small. Thus, direct sociocultural effects associated with the implementation of Alternative 1 are considered negligible.

An indirect effect of Alternative 1, which may not decrease the number of researchers in local communities, might manifest as a redirection of research funds into more aerial or vessel-based surveying, longer stays in local communities in order to collect a wide range of tissue samples from animals found dead of natural causes, an increased cooperation between research staff and Alaska Natives in order to secure tissue samples from subsistence takes for science, or even a shift by researchers into studying marine mammals not affected by the SSL or NFS permit process. These scenarios could result in increased economic and educational interaction between research staff and local community members, and this increase in interaction would most likely be minor in magnitude.

Additionally, the overall number of researchers in the local communities would likely stay the same as those experienced before the court order, resulting in indirect sociocultural effects similar to those previously experienced by local community members. Thus, indirect sociocultural effects associated with the implementation of Alternative 1 are considered negligible.

Conclusion for Direct and Indirect Effects

There would be a decrease in economic interaction between research staff and local community members under Alternative 1, and it is likely that this decrease would result in a direct effect of minor magnitude. Additionally, as interaction would decrease generally under Alternative 1, sociocultural effects are not likely to be substantially positive or negative. Educational opportunities would likely decline under Alternative 1, however, potentially creating a moderate effect in at least some small, rural communities. Indirect effects associated with the implementation of Alternative 1 are considered to range from minor to negligible.

Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

It is unknown what precise effect Alternative 2 would have directly on the volume of researchers visiting local communities, the frequency local communities may experience visiting researchers, or the duration visiting researchers may stay in each community during field research. The limitations in methods under Alternative 2 are similar to those put in place by the court order, however, so it is likely that the nature of interactions between research staff and local community members would be similar to what is being experienced at present. Therefore, it is generally assumed that volume, frequency, and duration of SSL and NFS research would be less than was experienced under the research permitting process in place prior to the court order, but greater than what would be experienced under Alternative 1. If this is the case, interaction between research team members and local community residents would experience a minor reduction. As close-proximity aerial and vessel-based observations would be allowed, the economic interaction surrounding these industries in the larger, more economically diverse communities regularly associated with SSL research would not be substantially affected by Alternative 2. Similarly, the land-based observational methods prevalent in both SSL and NFS research would be allowed under Alternative 2, resulting in researchers largely able to continue their research in the smaller communities. As is interpreted under Alternative 1, whatever economic effects may happen as a result of decreased research in local communities, the effect is not likely to be substantial due to the relatively negligible importance money from research has in the local community compared to other locally represented economic sectors, such as the fishing industry and, in come cases, the tourism industry. Thus, direct economic effects associated with the implementation of Alternative 2 are considered negligible.

Similar to economic interactions, it is generally assumed that the frequency and quality of educational interactions would decrease under Alternative 2 to a level between what would exist under Alternative 1 and what was experienced before the court order. Because a measurable amount of SSL and NFS research would still take place in local communities (even if capture or handling were not permitted), formal presentations, media appearances, and informal meetings would likely continue to take place between research staff and local community members. For the larger communities associated largely with SSL research, a continuation of educational outreach, even at a slightly depressed level, is not likely to result in any substantial effects. In the smaller communities of St. George and St. Paul, and elsewhere where local volunteers were regularly hired to assist in research before the court order, this practice would likely continue. While not as immediately tactile as animal handling, activities permitted under Alternative 2 (e.g., brand resight, behavioral observation, scat collection, operation of remote sensing equipment) would continue to provide volunteers, including children, an opportunity to learn about biology and ecology from professional scientists. Thus, while not as engaging as the opportunities available under the Status Quo, educational opportunities would continue under Alternative 2. The direct educational effects associated with the implementation of Alternative 2 are considered negligible.

Like economic and educational interactions, it is generally assumed that sociocultural interactions would decrease under Alternative 2 to a place between Alternative 1 and the level experienced before the court order. Because a measurable amount of SSL and NFS research would still take place in local communities, there would be a substantial amount of interaction between research staff and local community members. However, as there would be ostensibly fewer researchers, there would be fewer chances for both positive interactions and sociocultural missteps. By reducing sociocultural effects, Alternative 2 may actually benefit local community members in this regard. As noted under Alternative 1, however, culturally inappropriate behaviors associated with research under existing conditions appears to be on the decline. Therefore, any gains in incrementally reducing these behaviors would likely be negligible. Thus, direct sociocultural effects associated with implementation of Alternative 2 are considered negligible.

It is unknown, however, how the implementation of Alternative 2 would indirectly affect researchers. Indirect effects of Alternative 2 may not decrease the number of researchers in local communities. Indirect effects could manifest themselves as a redirection of research funds into increased observational and/or remote sensing methods, longer stays in local communities in order to facilitate greater observational detail, an increased cooperation between research staff and Alaska Natives in order to secure tissue samples from subsistence takes for science, or even a shift by researchers into studying marine mammals not affected by the SSL or NFS permit process. These scenarios could result in increased economic and educational interaction between research staff and local community members. These would be potentially minor effects. However, the overall number of researchers in the local communities would likely stay the same as those experienced before the court order, resulting in negligible sociocultural effects similar to those previously experienced by local community members. Thus, indirect sociocultural effects associated with the implementation of Alternative 2 are considered to range from minor to negligible.

Conclusion for Direct and Indirect Effects

Although there would be a decrease in economic interaction between research staff and local community members under Alternative 2, it is unlikely that this decrease would result in any direct effect beyond a negligible magnitude. Additionally, as interaction would decrease generally under Alternative 2, sociocultural effects are not likely to be anything more than negligible. Educational opportunities would likely continue under Alternative 2, albeit in a limited fashion, in a manner unlikely to directly affect the community. All direct effects are considered to be negligible. It is unknown, however, exactly how the implementation of Alternative 2 would affect the research methods of individual research teams. It is entirely possible that an indirect effect of Alternative 2 would be longer stays by research staff in local communities. If this happens, economic and educational interaction may increase. Thus, indirect effects associated with the implementation of Alternative 2 are considered to range from minor to negligible.

Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

Because Alternative 3 would reinstate the research program in place before the court order, the volume of researchers visiting local communities, the frequency with which local communities may experience visiting researchers, and the duration visiting researchers may stay in each community during field research would be generally similar to that experienced before the court order. If this is the case, then interaction between research team members and local community residents would experience neither a substantial reduction nor growth. As all research methodologies would be available to researchers that were previously available before the court order, aerial and vessel-based research work would continue, resulting in continued economic interactions surrounding these services. Similarly, land-based work, including observation, capturing, and handling, would be done under Alternative 3 at levels similar to those prior to the court order. This research would result in a frequency and scale of economic interactions similar to those described in Chapter 3. Because Alternative 3 would reinstate the Status Quo, direct economic effects associated with the implementation of Alternative 3 are considered negligible.

As with economic interactions, Alternative 3 would generally result in educational interactions similar to those present before the court order. The educational interactions described in Chapter 3 (i.e., formal presentations, media appearances, informal conversations) would continue to take place between research staff and local community members. For the larger communities associated largely with SSL research, this continuation of educational outreach is likely to result in negligible effects. In the smaller communities of St. George and St. Paul, and elsewhere where local volunteers regularly assisted with research activities, Alternative 3 would maintain the types of opportunities for volunteers present before the court order, including the direct interaction with the animal for purposes of tissue collection, weighing, and marking. Thus, direct educational effects associated with the implementation of Alternative 3 are considered negligible.

Like economic and educational interactions, it is generally assumed that sociocultural interactions under Alternative 3 would be similar to those experienced before the court order. Because a substantial amount of interaction associated with SSL and NFS research would continue to take place in local communities, there would continue to be opportunities for sociocultural misunderstandings. As mentioned in Chapter 3, however, sociocultural missteps were becoming relatively rare under existing conditions and it is likely that this same level of sociocultural understanding would continue under Alternative 3. Thus, direct sociocultural effects associated with the implementation of Alternative 3 are considered negligible.

The implementation of Alternative 3 would be likely to result in the same kinds of indirect effects as those experienced by communities under the Status Quo. Economic, educational, and sociocultural effects are unlikely to increase or decrease based on the assumption that research agendas and methodologies would not drastically change under this alternative. Thus, indirect effects associated with the implementation of Alternative 3 are considered negligible.

Conclusion for Direct and Indirect Effects

As Alternative 3 would reinstate the Status Quo, community interactions would continue in the manner present before the court order. Therefore, economic, educational, and sociocultural interactions are not likely to be directly or indirectly affected by the implementation of Alternative 3. Effects, direct and indirect, are considered negligible under this alternative.

Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

It is unknown what precise effect Alternative 4 would have directly on the volume of researchers visiting local communities, the frequency with which local communities may experience visiting researchers, or the duration visiting researchers may stay in each community during field research. The methods available under Alternative 4 are similar to those available under Alternative 3, so it is likely that the nature of interactions between research staff and local community members would be similar to what is being experienced at present. It is generally assumed, however, that volume, frequency, and duration of SSL and NFS research would be slightly more than was experienced under the research permitting process in place prior to the court order. NMML suggests (Appendix H) that aerial and vessel-based surveying would be likely to increase, as would the frequency of research trips throughout the year. Additionally, observations, captures, and morphometric collections would expand to new areas in an attempt to gather a larger geographic sample. The number of captures would also increase, ostensibly necessitating lengthier stays aboard vessels or in local communities. These actions would most likely result in an increase in economic interaction between research team members and local community residents. Because Alternative 4 is primarily focused on SSL recovery, this increase would be particularly experienced in larger communities largely related to SSL research activities. Smaller communities, such as St. George and St. Paul, would experience a moderate increase in economic interaction as well, but probably not to the same degree. This potential increase in economic interaction would be considered positive, but it is unknown if it would rise to a major level of magnitude at either the individual business level or the community level, given the uncertainty in forecasting the magnitude of increased activity. Positive effects would be potentially most obvious in communities that have never experienced research-related interactions but, under the increased scope of Alternative 4, would host research throughout the year. Therefore, direct economic effects associated with the implementation of Alternative 4 are considered to be positive, and may range from minor to major at the individual community level.

As with economic interactions, it is generally assumed that the frequency and quality of educational interactions would increase under Alternative 4. Because an increased amount of SSL and NFS research would take place in and around local communities, formal presentations, media appearances, and informal meetings would be likely to take place more frequently between research staff and local community members. For the larger communities generally associated with SSL research, this increase in educational outreach is not likely to result in any effects due to the large population of these communities and the relatively low level of interest demonstrated by community members (compared to the level of interest in smaller, more rural communities). In the smaller communities of St. George and St. Paul, and elsewhere where local volunteers regularly assist in research, a more vigorous research agenda may provide locals with more opportunities to assist directly with biological and ecological research. These opportunities may even include assisting with experimental and cutting-edge methodologies, which would be more prevalent under Alternative 4. Educational outreach would also be likely to be welcome in communities that have never experienced research-related interactions but which, under Alternative 4, would fall within the sphere of inquiry. Therefore, direct educational effects associated with the implementation of Alternative 4 are seen as positive and may range from negligible to major in their magnitude but are only likely to be major for people living in smaller, rural communities.

Like economic and educational interactions, it is generally assumed that sociocultural interactions would increase under Alternative 4. Because an increased amount of SSL and NFS research would take place in and around local communities, there would be a parallel increase in the level of interaction between research staff and local community members. It is likely that Alternative 4 would increase the number of researchers in the community, even drawing new researchers into studying SSL and NFS issues. Coupled with the possibility that research-related interactions would be taking place more frequently and in more places, the opportunity for sociocultural misunderstandings is greatest under Alternative 4. If left unchecked, sociocultural effects could be moderate in magnitude. However, as sociocultural missteps were becoming relatively rare under existing conditions, it is altogether unlikely that a substantial number of research programs would be started without the inclusion of a community collaboration component under Alternative 4. These programs help avoid or minimize cross-cultural interaction based effects. Thus, direct sociocultural effects associated with the implementation of Alternative 4 are considered negligible.

As stated previously, it is generally assumed that Alternative 4 would result in more researchers visiting local communities throughout the year. This may not be the case, however, as the implementation of Alternative 4 could instead result in a number of different scenarios. These include a possible redirection of research funds into experimental remote sensing methods, or the same number of researchers in more geographic areas (resulting in a net loss in research-related interactions for a single community). It is also unclear whether or not implementation of Alternative 4 would be met with a governmental funding increase above that of the Status Quo, which would be necessary to support the research agenda put forth by the SSL Draft Recovery Plan. These scenarios would most likely result in economic, educational, and sociocultural effects similar to those under Alternative 3 and the Status Quo. Thus, indirect effects associated with the implementation of Alternative 4 are considered negligible.

Conclusion for Direct and Indirect Effects

Due to the proposed intensity and wide geographic range of research under Alternative 4, direct effects related to the increased economic interaction are considered to range between minor and major, at least on a localized basis in some communities. Educational opportunities would be likely to increase under Alternative 4, creating a range of effects from negligible, in large communities, to major for some small, rural communities. It is likely, however, that sociocultural effects would be negligible. This is especially true if community collaboration is continued under this alternative. The indirect effects would be most like those experienced under Alternative 3. Therefore, indirect effects associated with the implementation of Alternative 4 are also considered negligible.

Direct Interactions with Communities during Research-Related Activities Cumulative Effects

Summary of Direct and Indirect Effects

Depending on the alternative implemented, there are a number of potentially substantial direct and indirect effects to interactions between SSL and NFS research staff and local community members. Under Alternative 1, while educational and sociocultural interactions are considered to be negligibly affected, economic interactions would be likely to experience a minor decline. Indirect effects under Alternative 1 are considered to be minor for educational and economic interactions, but negligible for sociocultural effects. Alternative 2 also exhibits a decline in educational interaction, but this effect is smaller in scale and all interaction-related effects, direct or indirect, are considered to be negligible.

Because Alternative 3 would reinstate the Status Quo, there are no foreseeable direct or indirect effects related to its implementation. All effects, direct and indirect, are considered to be negligible. Alternative 4, however, would be likely to create a positive economic effect due to an increased number of interactions between staff and local residents, potentially ranging from minor to major depending on community specifics. The number of educational opportunities also has the potential to increase in degrees from negligible (in large communities) to major (in small communities). All indirect effects associated with Alternative 4 are considered negligible.

Summary of Lingering Past Effects

Lingering past effects that influence direct interactions with communities during research-related activities may be tied to multiple causes; however, level of research funding is thought to be the primary factor. Section 4.10.5.2 provides a more detailed summary of the history of research funding. In general, despite impetus for further research funding based on pressure to mitigate potential negative consequences to commercial fisheries from unduly restrictive SSL protection measures, federal appropriation for SSL research and management has shown an overall declining trend. In the case of NFSs, research funding was substantially reduced with the lapse of the Fur Seal Convention in the mid-1980s, but there has recently been an increase in funding due, at least in part, to the fact that NFS populations in the Pribilof Islands show no signs of recovery from recent declines.

Analysis of Reasonably Foreseeable Future Actions

The following is an analysis of direct effects to the subsistence harvest of SSLs and NFSs based on the RFFA groups described in Section 4.5.2. Although the RFFAs were originally drawn to analyze how each would affect SSLs and NFSs, some of them can be interpreted as having effects on interactions between research staff and local community members. For example, increased commercial fishing, shipping, and other economic development may change local communities that have been historically linked to NFS research. These activities could produce a more diversified economy in these small, rural communities, decreasing the relative importance of research-related economic, educational, and sociocultural interactions.

Cumulative Effects

For the purposes of this analysis, the cumulative effects related to the alternatives include possible effects related to small-scale economic activity (e.g., shopping at stores, hiring crew, purchasing repairs), educational outreach and training, sociocultural interactions, and, where appropriate, subsistence activities. Given their identification in individual issue area analyses, the rural, largely Alaska Native communities of St. George and St. Paul are considered likely to experience the greatest cumulative effects related to direct interactions. The following section analyzes how the direct and indirect effects outlined previously would accumulate under each of the proposed alternatives.

Alternative 1 – No Action: No New Permits or Authorizations

For the largely Alaska Native communities of St. George and St. Paul, the implementation of Alternative 1 has the potential to create minor cumulative effects related to direct interactions. The direct effects potentially experienced by these communities include a moderate decrease in educational outreach by visiting research staff. There is also a possibility that local business owners would lose a minor amount of business from an absence of regularly visiting research staff. Of course, the foreseeable economic growth mentioned in Section 4.5.2 may outweigh this minor effect.

These educational and economic concerns interact with the indirect effects of Alternative 1 related to the subsistence harvest of SSLs in the Pribilofs, which were outlined previously. These indirect effects would potentially result in research becoming outdated as environmental conditions and the status of SSL populations change. While members of a community negotiate economic growth (or lack thereof) uniquely, if a downturn in the local economy places more importance on a successful subsistence harvest, these minor effects related to subsistence may have a synergistic effect on community interaction effects, intensifying them. Together, the interaction of these effects would be likely to create a minor cumulative effect related to direct interactions.

Alternative 2 – Research Program without Capture or Handling

For St. George and St. Paul, the implementation of Alternative 2 has the potential to create minor cumulative effects related to direct interactions. In contrast to the effects under Alternative 1, direct moderate educational effects are not likely under Alternative 2. Additionally, the direct effects of economic interactions are expected to be negligible. Coupled with the economic development related to tourism and other industries (mentioned in Section 4.5.2), there may be minor cumulative economic effects. Indirect effects related to economic and educational interactions are considered minor, as well. As discussed above, the types of economic interactions that would result from the implementation of Alternative 2 are unknown; a direct effect could be a decrease, while an indirect effect could be an increase. Thus, economic activity in the form of tourism or other industrial growth could have a countervailing or synergistic effect, depending on how individual communities are affected by the proposed alternative.

Regardless, Alternative 2 is somewhat likely to affect the subsistence harvest, as its implementation would potentially result in research becoming outdated as factors change over time, or being incongruent with more direct types of research on SSLs. Again, depending on how members of a community negotiate economic growth (or lack thereof), if a downturn in the economy places more importance on a successful subsistence harvest, these minor effects related to subsistence may have a synergistic effect on community interaction effects, intensifying them. Together, the interaction of these effects would be likely to create a minor cumulative effect related to direct interactions.

Alternative 3 – Status Quo Research Program

For all communities within the study area, the implementation of Alternative 3 is considered to result in negligible cumulative effects. As Alternative 3 would reinstate the activities permitted before the court order, it is generally assumed that subsistence activities and community interactions would return to levels present before the permits were vacated. As such, there would not likely be a change from the existing conditions outlined in Chapter 3. Thus, the implementation of Alternative 3 is considered to result in negligible cumulative effects related to direct interactions.

Alternative 4 – Research Program with Full Implementation of Conservation Goals

The implementation of Alternative 4 has the potential to create cumulative community effects ranging from minor to major in scope, depending on the nature of the local community. The direct effects potentially experienced by individual communities would be likely to include between a minor and major increase in the amount of money spent by visiting researchers on minor supplies and repairs to equipment, depending on the size of the community.

This is compounded by the foreseeable economic growth mentioned in Section 4.5.2. With more researchers also comes the possibility of an increase in the amount of educational outreach and volunteer opportunities for young people in these communities. These direct effects related to education would be negligible in large communities, but have the potential to be major in small communities. Increased economic activity (in an area historically constrained) and increased educational opportunities, taken together, could accumulate into major effects related to direct interaction for local community members in small, rural communities like St. George and St. Paul.

The increased geographic range and higher intensity of research on SSLs are somewhat likely to create a moderate effect on subsistence harvesters in the Pribilof Islands, depending on the amount of overlap between SSLs used for research and subsistence. This is despite the indirect, minor, positive gains to subsistence garnered through meeting contributing to research goals. As NFS subsistence harvesting is paramount in these communities, a decline in SSL subsistence harvesting would not be as substantial as would be a decline in NFS harvesting, but SSL subsistence is still important. Although it is most likely that research would be conducted through strong coordination with local co-management groups, if left unchecked, this moderate direct effect on the subsistence harvest has the potential to temper any sort of positive cumulative effects gained through increased direct economic and educational interaction by creating a moderate sociocultural effect. A threat to the subsistence harvest perceived to be at the hands of researchers could produce a moderate sociocultural effect for subsistence hunters living in small, rural communities, regardless of whatever community collaboration is in place. The accumulation of these effects has the potential to result in major cumulative effects related to direct interactions in smaller, rural communities like St. Paul and St. George. Larger communities would experience minor to moderate cumulative effects related to direct interactions.

4.9.3 Environmental Justice

As noted in previous sections, under the alternatives likely to have effects, a greater number and higher level of social and economic effects are likely to accrue to the communities of St. George and St. Paul than to other communities. As described in Section 3.5.4, there is a substantial minority population present in the communities of St. George and St. Paul. The proportions of minority populations in St. George and St. Paul are 92.1 percent and 87.0 percent, respectively. These proportions are substantially higher than in the state of Alaska as a whole, which has a minority population of 32.4 percent. St. George and St. Paul exhibit a meaningfully greater percentage of minority residents when compared to the general population of Alaska. Therefore, disproportionately high effects to the populations of these two communities, if any, would be of concern for Environmental Justice analysis purposes.

Table 3.5-2 illustrates the proportion of people with income considered below poverty in the potentially affected communities of St. George and St. Paul, as well as in Alaska as a whole. The proportions of people with income below poverty in St. George and St. Paul are 7.9 and 11.9 percent, respectively. Within the larger general population of Alaska, the proportion of the population with income below poverty level for the same base year was 9.4 percent. In other words, the low-income portion of the population in St. George was smaller than that of the state as a whole, but the opposite is true in St. Paul. Therefore, depending on the specific community, Environmental Justice based on low-income population thresholds may apply to the Pribilof Islands communities, but in any event, the islands have already been shown to have minority population levels that would trigger Environmental Justice concerns, if any.

<u>Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorization</u>

As described previously, Alternative 1 would not directly affect the subsistence harvest of SSLs or NFSs. Educational outreach (specifically outreach aimed toward children), however, would be likely to decrease substantially in St. George and St. Paul under Alternative 1. This would result in Environmental Justice concerns in those communities.

Indirect effects related to a less robust scientific agenda for the formulation of a recovery strategy are possible but would be considered minor under Alternative 1. Outside of any specific community, this effect would disproportionately accrue to Alaska Native populations in general, as the only population allowed to harvest SSLs for subsistence purposes. On a localized basis, SSL harvests in the Pribilof Islands have declined in recent years, with estimated combined total harvests for St. George and St. Paul ranging between 34 and 43 animals annually for the period 2000-2004. While SSLs remain an important subsistence resource for local residents, they are not the most important marine mammal subsistence resource in terms of overall dependency. Islanders are more heavily dependent on NFSs than on SSLs, with annual NFS subsistence takes ranging between 522 and 754 animals on St. Paul and between 121 and 203 animals on St. George over the period 2000-2003. Local residents could potentially offset some level of SSL subsistence harvest decline with increased NFS take, but overall loss of SSL harvest would be a substantial Environmental Justice concern for Alaska Native hunters themselves, as well as for those who benefit from the harvest (from extended families to virtually entire Alaska Native communities that participate in the regular, informal sharing of subsistence resources). This is true of quite a few coastal Alaska communities in general and of the Pribilof Islands in particular. The minor indirect effects associated with the implementation of Alternative 1 would result in Environmental Justice concerns in these communities, as would the minor cumulative effects related to direct interaction and the subsistence harvest.

Conclusion for Direct, Indirect, and Cumulative Effects

Environmental Justice concerns are present in the Pribilof Islands and potentially in other small, coastal Alaska communities due to both moderate and minor direct effects, minor indirect effects, and minor cumulative effects.

Direct and Indirect Effects of Alternative 2– Research Program without Capture or Handling

Environmental Justice concerns under Alternative 2 would be similar to those that would be seen under Alternative 1. Alternative 2 would not directly affect the subsistence harvest of SSLs or NFSs. Educational outreach is not expected to substantially decline under Alternative 2. Researchers would be likely to remain in the communities of St. George and St. Paul, engaging in remote research and collecting tissue samples through passive means. Volunteer opportunities and educational outreach would continue, negating potential loss of these opportunities as an Environmental Justice concern.

Indirect effects related to a less robust scientific agenda for the formulation of a recovery strategy are possible but would be considered minor under Alternative 2. As noted under Alternative 1, outside of any specific community, this effect would disproportionately accrue to Alaska Native populations because they are the only population allowed to harvest SSLs for subsistence purposes, and thereby result in Environmental Justice concerns. Localized Environmental Justice concerns related to potential SSL harvest decline in the Pribilof Islands would be similar to those described under Alternative 1. Cumulative effects related to direct interactions and the subsistence harvest may also have a minor effect.

Conclusion for Direct, Indirect, and Cumulative Effects

Environmental Justice concerns are present in the Pribilof Islands and other small, coastal Alaska communities due to minor indirect effects and minor cumulative effects.

Direct and Indirect Effects of Alternative 3– Status Quo Research Program

There is a theoretical possibility that the continued practice of chemical and drug injections, the application of permanent markings, and the application of various scientific instruments into SSLs and NFSs could result in effects to Alaska Native subsistence use of these animals, which, in turn, would raise Environmental Justice concerns. In reality, however, this is unlikely to rise to a level of significance due to the wide distribution of SSL harvest and research efforts, to the conscientious practices of NFS co-management, and especially to the traditional harvesting methodologies employed for NFSs whereby research animals could likely be efficiently avoided. Other direct aspects of researcher-related interaction, such as economic gain, educational opportunities, and sociocultural interactions, are also considered to be negligible under this alternative. The minor, indirect effect associated with Alternative 3 is not considered to be adverse. As a result, Environmental Justice concerns are not anticipated under Alternative 3.

Conclusion for Direct, Indirect, and Cumulative Effects

Environmental Justice concerns are not present in the Pribilof Islands and other small, coastal Alaska communities due to negligible adverse effects.

Direct and Indirect Effects of Alternative 4– Research Program with Full Implementation of Conservation Goals

In ways similar to Alternative 3, there is a theoretical possibility that the continued practice of chemical and drug injections, the application of permanent markings, and the application of various instruments into SSLs and NFSs could result in a substantial effect to Alaska Native subsistence use of these animals. With potentially more researchers engaging in these methods, there is a danger that these actions could produce a moderate effect if not counterbalanced by co-management agreements (for a detailed discussion of co-management, see Section 4.6.2.3 and Appendix F). A part of this moderate effect is the increased use of aerial and vessel-based observation, which may affect SSL and NFS behavior in ways that could reduce the number of animals available for the subsistence harvest, depending on the actual level of disturbance. This could raise Environmental Justice concerns regarding the Alaska Native population engaged in the subsistence harvest and use of these animals in general and on a localized basis in a number of communities, including the Pribilof Islands. There are minor indirect effects under Alternative 4 and there are moderate cumulative effects under Alternative 4. However, the indirect and cumulative effects are not interpreted to be especially adverse, and are not used to determine Environmental Justice concerns. Regardless, the moderate direct effects anticipated under Alternative 3 would result in Environmental Justice concerns for small, rural communities like St. Paul and St. George.

Conclusion for Direct, Indirect, and Cumulative Effects

Environmental Justice concerns are present in the Pribilof Islands and potentially in other small, coastal Alaska communities due to moderate direct effects.

4.10 Economic Effects of Federal Funding for SSL and NFS Research

As described in Chapter 3, federally funded research on SSLs and NFSs results in a variety of economic effects. Research-related spending not only generates jobs and income in the entities that are recipients of the research funds, it can have a "ripple" economic effect throughout a region. In addition, scientific and technological advances from basic and applied research can produce economic benefits for society that may not be readily translated into dollar values. This section examines criteria for evaluating the potential economic effects of each alternative considered in terms of changes in both research expenditures and the output of SSL and NFS research activities.

The varying level of research effort represented by each of the alternatives could potentially result in a difference in the amount and distribution of funds for SSL and NFS research and management. These funding differences, in turn, have employment and income implications for the entities that are recipients of the funds and, because of the multiplier effect described in Chapter 3, for the broader regional economy. However, it is difficult to quantify the predicted amount and distribution of funds for SSL and NFS research and management under each alternative because of the fiscal, political, institutional and other factors that affect research funding; to at least some extent these complex and unpredictable factors exist apart from the specific types of SSL and NFS research techniques and level of research effort permitted. Nevertheless, it is possible to present a qualitative discussion of the effects of the selected alternatives on the amount and distribution of funds for SSL and NFS research and management based on the informed judgment of individuals engaged in this research. This qualitative analysis will include a determination of which institutions would be affected, the nature of the economic effects (e.g., changes in research positions or purchases), how likely any economic effects would be and whether the economic effects would be temporary or long-term.

As discussed in Section 3.6, the economic effects of changes in research output are related to public preferences for providing protection to SSL and NFS populations. This expressed willingness to pay exists because the protection of SSL contributes to human welfare, where "welfare" is broadly defined to reflect the overall happiness or satisfaction of an individual or group of individuals (National Research Council, 2004). Due to data limitations, it is not possible to quantify the extent to which alternative research policies affect the welfare of individuals; however, the likely direction and magnitude of change in human welfare can be estimated for each alternative if expected changes in SSL and NFS recovery and conservation are used as a proxy for this non-market value. The anticipated changes in SSL and NFS recovery and conservation are described for each alternative in Sections 4.8.1 and 4.8.2. In general, it is assumed that an alternative that has a beneficial effect on SSL and NFS protection enhances the welfare of those individuals who value this protection.

Section 3.6 noted that it may not be necessary that a given research policy have negative or positive implications for the survival of a SSL or NFS population in order for a segment of the American public to be affected. For example, if a given research policy causes the death of some individual animals within a SSL or NFS population, it is likely that some members of the general public would experience a loss of welfare or feel moral unease even if the SSL or NFS population as a whole is unharmed. Consequently, if a research policy both results in the death of some animals and potentially contributes to the protection of the overall population, there would be a trade-off between the social welfare losses from research-related mortality and the social welfare gains from the possibility of increased protection. Additional in-depth surveys are needed before we can better understand the nature and magnitude of these trade-offs among members of the American public.

4.10.1 Direct and Indirect Effects of Alternative 1 – No Action: No New Permits or Authorization

4.10.1.1 Economic Effects of Changes in Research Expenditures

Under this alternative, the level of SSL and NFS research funding is expected to be less than that under the Status Quo. This is because the research that can be conducted under the grant and permitting restrictions of Alternative 1 is of limited value in terms of creating new knowledge that will lead to the identification of key factors for the recovery of SSLs and conservation of NFSs (DeMaster, 2006; Bengtson, 2006; Wilson, 2006). In the words of one scientist, the research would be "spending a lot of money to find out very little" (Lee, 2006).

If the SSL research conducted has little potential to increase our understanding of the cause of the decline of the SSL and to develop conservation and protective measures to ensure recovery of the species, Congress is likely to question the point of continuing its appropriation for this research (DeMaster, 2006; Bengtson, 2006). Moreover, the ability of researchers to offset possible reductions in Congressional appropriations with funds from other sources may be limited under Alternative 1. Through their systems of merit review, the National Science Foundation and other non-appropriation funding sources direct funds to research that has the greatest potential to lead to significant scientific advances. In the case of SSL research, achieving this standard generally requires the use of aerial and vessel-based surveys, tagging and marking procedures, attachment of scientific instruments, collection of tissue samples and other techniques that are prohibited under the ESA and MMPA except where allowed by permit (DeMaster, 2006; Bengtson, 2006). For example, the use of satellite transmitters attached to SSLs provide information on location, dive characteristics, time on land and at sea and other data critical to revealing the relationship between the foraging ecology of SSL and recent population declines (Wilson, 2006).

The grant and permitting restrictions under Alternative 1 would also constrain the ability of some entities to use existing research resources to attract additional research funding. For example, prior to permits being vacated by the 26 May 2006 court order, free-ranging juvenile sea lions were captured and transported to the $2 million specialized Steller South Beach holding facility at the ASLC to conduct health assessments. Since the court order the facility has been idle—all captive animals were released following the court order (Atkinson, 2006). Under Alternative 1, the ASLC facility would continue to be disallowed from holding SSL at the facility, effectively preventing the ASLC from fully capitalizing on a major research investment already made. Further, the absence of SSLs may reduce the popularity of the ASLC as a tourist attraction; a reduction in income from visitor admission fees and gift shop purchases would have an additional negative economic effect on the ASLC.

A substantial reduction in the funding for SSL and NFS research would be likely to have long-term negative economic consequences for those entities that have been the recipients of those funds. These entities and their SSL research funding levels are described in Chapter 3. Job losses would occur in these entities, including the universities and federal agencies with "soft money" positions supported by SSL and NFS research funds. In addition, a decrease in research funds will lead to a reduction in purchases of capital items and expendable items by these entities and may affect their ability to meet overhead costs.

Another likely effect of the policy direction under Alternative 1 is that SSL research fund recipients would direct a larger portion of their research monies to projects outside of the United States; for example, to projects studying SSL populations in Russia and Canada (Atkinson, 2006). Both NMFS and the ASLC have programs to monitor population trends (non-pup and pup counts), estimate vital rates (branding and re-sighting), collect food habits data and conduct other research on SSLs in Russia (NMFS, 2006).

An overall decrease in research expenditures in combination with a diversion of funds to research activities outside of the United States would have a broader negative effect on the local economy because of the spending/income multiplier effect discussed in Chapter 3. However, the effect is unlikely to be substantial due to the relatively minor role SSL and NFS research funding plays in generating economic activity in regions within the project area.

Not all recipients of SSL research and management funds would experience a reduction in funding under Alternative 1. For example, the amount of SSL research and management funds received by the NPFMC may not decrease relative to the Status Quo because NPFMC primarily uses those funds for management rather than research (Wilson, 2006). Most management activities, such as meetings to implement regulations, independent reviews of actions and analyses of the effects of actions, would be unaffected under Alternative 1.

Conclusion

Under Alternative 1, research institutions and independent researchers would likely experience a major reduction in funding for SSL and NFS research relative to the Status Quo because the research that can be conducted under the grant and permitting restrictions of this alternative would be of limited value in the recovery of SSL and conservation of NFS populations. The lower level of funding would likely continue as long as the grant and permitting restrictions are in place. However, entities that receive funds for SSL and NFS management activities are unlikely to experience a lower amount of funding under Alternative 1 in comparison to the Status Quo.

4.10.1.2 Economic Effects of Changes in Research Output

According to the analysis of direct/indirect effects of Alternative 1 on SSLs in Section 4.8.1, the usefulness of existing data in terms of addressing the conservation objectives from the SSL Recovery Plan would be likely to decrease over time as environmental conditions and the status of the population change. Further, Section 4.8.1 states that under Alternative 1, the level of scientific uncertainty regarding the efficacy of these critical habitat and fishery regulations would be likely to increase over time as the original data becomes outdated. With respect to the contribution of Alternative 1 to NFS conservation objectives, Section 4.8.2 states that, because of the limited magnitude and intensity of the research program under Alternative 1, the beneficial contribution towards the objectives in the NFS Conservation Plan is considered negligible. To the extent that the implementation of Alternative 1 plays a role in a possible failure to stop or reverse a decline of SSL or NFS populations, the loss of welfare among that segment of the American public who value SSL and NFS protection would be potentially substantial, depending on the ultimate biological consequences of the lack of research.

According to Sections 4.8.1 and 4.8.2, the estimated direct and indirect mortality of SSLs and NFSs from research is less under Alternative 1 than under any other alternative. Consequently, the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be lowest under Alternative 1.

Conclusion

To the extent that the implementation of Alternative 1 plays a role in a possible failure to stop or reverse a decline of SSL or NFS populations, the loss of welfare among that segment of the American public who value the protection of SSL and NFS populations as a whole would be potentially major, depending on the ultimate biological consequences of the lack of research. The members of the American public that would potentially be affected are widely distributed geographically; it is likely that they are dispersed throughout the United States.

A comparison of the estimated number of animals that would die from the specified scope of research defined for each alternative suggests that the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be lowest under Alternative 1.

4.10.2 Direct and Indirect Effects of Alternative 2 – Research Program without Capture or Handling

4.10.2.1 Economic Effects of Changes in Research Expenditures

Alternative 2 is similar to Alternative 1 in that no grants, permits or authorizations would be issued for research activities that require capture, handling, and/or invasive procedures on wild animals. As noted in the assessment of the effects of Alternative 1, the inability of researchers to engage in these research activities could have negative implications for research funding. However, researchers may choose to seek funding to expand their efforts with non-intrusive techniques. In that event, the effect of Alternative 2 on the level of funding for SSL and NFS research would be less negative than under Alternative 1.

Conclusion

To the extent that funding for non-intrusive research activities could be secured, the impact of Alternative 2 on research institutions and independent researchers would likely be moderate or minor.

4.10.2.2 Economic Effects of Changes in Research Output

As discussed in Section 4.8.1, the non-intrusive research activities that could be authorized under Alternative 2 would address many but not all of the conservation objectives listed in the SSL Recovery Plan. As under Alternative 1, the level of scientific uncertainty regarding the efficacy of these critical habitat and fishery regulations would be likely to increase over time as the original data becomes outdated. With respect to contributing to NFS conservation objectives, Section 4.8.2 states that, because the magnitude/intensity of the research program under Alternative 2 does allow for some low-level field research activities and non-field related research, the beneficial contribution towards the conservation objectives in the Draft NFS Conservation Plan is considered minor. These assessments of the contributions of Alternative 2 to SSL and NFS conservation objectives suggest that the probability of Alternative 2 leading to a gain in welfare among that segment of the American public who value the protection of SSL and NFS would be higher than under Alternative 1, but lower than that probability under Alternatives 3 or 4.

According to Sections 4.8.1 and 4.8.2, the estimated direct and indirect mortality of SSL and NFS from research under Alternative 2 is less than that under the Status Quo, due to the decreased scope of the research program under Alternative 2. Consequently, the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be lower under Alternative 2 relative to the Status Quo.

Conclusion

Assessments of the contributions of Alternative 2 to SSL and NFS conservation objectives suggest that the likelihood that Alternative 2 would lead to a gain in welfare among that segment of the American public who value the protection of SSL and NFS populations as a whole would likely be higher than the likelihood under Alternative 1, but may be lower than the likelihood under Alternatives 3 or 4, as Alternative 2 would address many but not all conservation objectives.

4.10.3 Direct and Indirect Effects of Alternative 3 – Status Quo Research Program

4.10.3.1 Economic Effects of Changes in Research Expenditures

The policy direction of this alternative would have no effect on research funding because grants and permits would be issued for the same type and scope of research as occurred under SSL grants and permits prior to the May 26, 2006 court order.

Conclusion

The impact of Alternative 3 on SSL and NFS funding for research institutions and independent researchers would likely be negligible, as all Status Quo grants and permits would be issued.

4.10.3.2 Economic Effects of Changes in Research Output

Section 4.8.1 states that the range of research activities that are authorized under Alternative 3 provide the means to address essentially all basic information needs about SSLs that are identified in the Recovery Plan. The section further states that, because of the magnitude/intensity, long-term nature, and frequency of sampling under the

Alternative 3 research program, the beneficial contribution towards the conservation objectives in the NFS Conservation Plan is considered moderate. Given the contribution of research results developed under Alternative 3 to the recovery and conservation of SSLs and NFSs, the likelihood that individuals who value the protection of these species would incur a welfare loss is less than would be the case under Alternatives 1 and 2.

According to Sections 4.8.1 and 4.8.2, the estimated direct and indirect mortality of SSL and NFS from research would be higher under Alternative 3 than under Alternative 1 or Alternative 2 due to the increased scope of the research program under Alternative 3. Consequently, the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be higher under Alternative 3 than under Alternative 1 or Alternative 2.

Conclusion

Given the contribution of research results developed under Alternative 3 to the recovery and conservation of SSL and NFS, the likelihood that individuals who value the protection of SSL and NFS populations as a whole would incur a welfare loss is less than would be the case under Alternatives 1 and 2. The likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be higher under Alternative 3 than under Alternative 1 or Alternative 2.

4.10.4 Direct and Indirect Effects of Alternative 4 – Research Program with Full Implementation of Conservation Goals

4.10.4.1 Economic Effects of Changes in Research Expenditures

This alternative would include not only those specific activities currently or previously permitted but any additional research activities or methods that are needed to implement the Draft SSL Recovery Plan and Draft NFS Conservation Plan. Alternative 4 represents an extensive research program for SSLs and NFSs that is able to simultaneously address multiple issues over a large geographical space. To be fully implemented, such a program would require a much larger research budget than is currently allocated to these species.

It is uncertain whether a proposal for an extensive research program would, in fact, lead to higher funding levels. Both the Draft SSL Recovery Plan (NMFS 2006a:ii) and Draft NFS Conservation Plan (NMFS 2006b:iv) include this disclaimer:

> *Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Nothing in this plan should be construed as a commitment or requirement that any federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.*

On the other hand, Alternative 4 may help remove some of the "budgetary and other constraints affecting the parties involved" by making SSL and NFS research more attractive to both researchers and sources of research funding. For example, an expanded research program would create more opportunities to conduct "cutting-edge" marine mammal science.

Conclusion

It is uncertain whether a proposal for an extensive research program would lead to higher funding levels. However, Alternative 4 may make SSL and NFS research more attractive to both researchers and sources of research funding by creating opportunities for more advanced marine mammal studies.

4.10.4.2 Economic Effects of Changes in Research Output

Sections 4.8.1 states that Alternative 4 is designed to allow researchers to address all objectives and sub-objectives of the Draft SSL Recovery Plan, while Section 4.8.2 states that the alternative is focused toward full implementation of the Draft NFS Conservation Plan. Given the beneficial contribution towards the recovery and conservation of SSLs and NFSs, the likelihood that individuals who value the protection of these species would experience a welfare gain is similar to that of Alternative 3 and higher than would be the case under Alternatives 1 and 2.

According to Sections 4.8.1 and 4.8.2, the estimated direct and indirect mortality of SSL and NFS from research would be higher under Alternative 4 than under any other alternative due to the increased scope of the research program under Alternative 4. Consequently, the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be highest under Alternative 4.

Conclusion

Given that Alternative 4 could provide information to support all of the conservation objectives listed in the SSL Recovery Plan and NFS Conservation Plan, the effect of Alternative 4 on that segment of the American public that values the protection of SSL and NFS populations as a whole would be similar to the effect of Alternative 3. A comparison of the estimated number of animals that would die from the specified scope of research defined for each alternative suggests that the likelihood of a loss of human welfare resulting from the deaths of individual animals due to research would be highest under Alternative 4.

4.10.5 Cumulative Effects Analysis

4.10.5.1 Summary of Direct and Indirect Effects

The restrictions on research under Alternative 1 would be likely to result in less funding for SSL and NFS research relative to the other alternatives. The lower funding level would have an immediate and major negative economic effect on entities that have been recipients of those funds. There would also be a broader negative effect on the local economy because of the spending/income multiplier effect, but this effect would be minimal due to the relatively minor role SSL and NFS research funding plays in generating economic activity in regions within the project area.

According to Section 4.8.1 and Section 4.8.2, the alternatives differ with respect to improving understanding of the reasons for the unfavorable condition of SSL and NFS populations and determining the most effective management and policy actions—Alternative 1 contributes the least to SSL and NFS conservation objectives and Alternative 4 contributes the most. Alternatives 2 and 3 lie in between Alternatives 1 and 4. Accordingly, the alternatives can be ranked in terms of their likelihood that they would lead to a gain in welfare among that segment of the American public who value the protection of SSLs and NFSs, with the likelihood being lowest under Alternative 1 and highest under Alternative 4.

4.10.5.2 Summary of Lingering Past Effects

The complexity, indirectness and cumulative effects of the factors negatively affecting the western population segment of SSLs have made it difficult to determine which factors were responsible for the population decline and which are primary threats to recovery (Holmes *et al.*, 2006). The negative consequences of this scientific uncertainty for the recovery of the western population segment of SSLs, together with the possibility that Alaskan groundfish fisheries might face costly restrictions as a result of this uncertainty, continue to provide an impetus to fund SSL research. However, as discussed in Chapter 3, the Congressional appropriation for SSL research and management has shown an overall declining trend, and a sharp decrease occurred in FY 2006 due to federal budget constraints. These federal budget constraints are likely to continue. In addition, a large amount of federal research funds has already been devoted to reducing uncertainty about the factors negatively affecting the SSL population. The budget for SSL research since 2001 has been the largest for a U.S. endangered species (Holmes *et al.*, 2006). It has been argued that this investment in SSL research and management is prudent given the economic importance of the commercial fisheries potentially at stake (e.g., Hogarth, 2005); however, some researchers have expressed concern about the high level of federal funding for research on a single species at a time when the availability of research funds for many other endangered species is low or absent (Dalton, 2005).

As noted in Chapter 3, the lapse of the Fur Seal Convention in 1985 substantially reduced research funding into the causes of the fur seal decline and limited the subsequent scope of that broad fur seal research program. However, funding levels for NFS research have recently increased due, at least in part, to the fact that NFS populations in the Pribilof Islands show no signs of recovery from recent declines.

With respect to impacts on individuals who express a positive preference for the continued survival of SSLs and NFSs, that segment of the American public has experienced a welfare loss due the decline of the western DPS of SSLs and the population of the eastern Pacific stock of NFSs. Human-caused mortality associated with fishing, subsistence hunting and other actions have contributed to the decline. The increasing population trend for the eastern DPS of SSLs and San Miguel Island stock of NFSs has resulted in a welfare gain among those who value the protection of SSL and NFS populations. However, human actions result in the deaths of individual animals in those populations, causing a decrease in the welfare of those who wish to protect individual animals, as well as the populations as a whole.

4.10.5.3 Analysis of RFFAs

Given on-going federal budget constraints due to the record-high federal deficit, possible proposals to end the widespread use of Congressional appropriation earmarks and other factors, it is doubtful that there will be an increase in the Congressional appropriation for SSL research and management in the foreseeable future, and it is possible that there could be a substantial reduction. Moreover, non-defense federal agencies are projected to see dramatic reductions in their research and development (R&D) portfolios over the next five years; NOAA is expected to experience a 19 percent real reduction in R&D by 2011 (Koizumi, 2006). On the other hand, there is a possibility that other funding sources would step in to cover any shortfalls in research funding should the Congressional appropriation for SSL research and management decrease (DeMaster, 2006; Bengtson, 2006). There are opportunities for funding SSL research from other federal sources (e.g., National Science Foundation and North Pacific Research Board) and private research centers and foundations (e.g., Pollock Conservation Cooperative Research Center, Alfred P. Sloan Foundation and Doris Duke Charitable Foundation) (Atkinson, 2006).

With specific regard to NFS research, research funding for this species may increase, depending on factors such as its future population trend and speculation about the contribution of commercial fisheries and other factors to its population status and prospects. NFS populations in the Pribilof Islands show no signs of recovery from recent declines. Commercial fisheries operate in NFS habitat and target some of the same fish species that it preys upon. However, it is unclear whether this is an important cause of the population decline, or whether it is caused primarily by non-anthropogenic factors such as changing ocean conditions. In any case, there is increasing concern that an ESA listing petition for NFSs could be on the horizon. This situation invites comparison to that of the SSL (Hershman, 2005). Since the SSLs gained ESA protection in the 1990s, fishery management decisions affecting the SSL have been extremely controversial and litigious largely due to ongoing scientific uncertainty regarding whether commercial fisheries are responsible for the population decline. To avoid a similar situation for NFSs it is likely that funding to investigate factors affecting survival of NFS will increase.

4.10.5.4 Cumulative Effects

The on-going federal budget constraints in combination with the reduction in research funding likely to occur under Alternative 1 would have an additive cumulative effect on SSL and NFS research funding. The highly restrictive research environment under Alternative 1 offers little justification or incentive for federal investments in SSL and NFS research, especially in the face of a tight federal budget and declining federal R&D funding.

Further, the research restrictions would hamper the ability of entities to secure research funding from non-federal sources. The rapid and substantial decline in research funding expected to occur under Alternative 1 would have negative employment and income generation effects both on the entities that have been the recipients of these funds and on the broader local economy due the multiplier effect.

In comparison to Alternative 1, the ability of researchers to offset possible reductions in federal funding for SSL and NFS research with funds from other sources would be greater under Alternatives 2, 3 and Alternative 4 because of the higher potential to acquire new knowledge that will lead to the identification of key factors for the recovery of SSLs and conservation of NFSs. Consequently, the potential to generate positive effects on the economy in terms of jobs created and purchases of goods and services is higher under Alternatives 2, 3 and Alternative 4 than under Alternative 1.

In the cumulative effects analysis, Section 4.8.1 and Section 4.8.2 state that the contribution of Alternative 1 to the cumulative SSL and NFS conservation efforts would be minimal. To the extent that the implementation of Alternative 1 plays a role in failing to stop or reverse a decline of SSL or NFS populations, the loss of welfare among that segment of the American public who value the protection of SSL and NFS populations as a whole would be potentially major, depending on the ultimate biological consequences of the lack of research. Sections 4.8.1 and 4.8.2 indicate that the other alternatives can be ranked in increasing scope and intensity of contributed research from Alternative 2 to Alternative 3 to Alternative 4. Accordingly, these three alternatives can be ranked in terms of likelihood that they would lead to a gain in welfare among that segment of the American public who value the protection of SSL and NFS populations, with the likelihood being lowest under Alternative 2 and highest under Alternatives 3 or 4. A comparison of the estimated number of animals that would die from the specified scope of research defined for each alternative suggests that the likelihood of a loss of human welfare resulting from the deaths of individual animals would be lowest under Alternative 1 and highest under Alternative 4. As discussed above, there may be trade-offs in welfare if a research policy results in the deaths of individual animals but possibly contributes to the protection of the population as a whole. Additional in-depth surveys are needed before we can better understand the nature and magnitude of these trade-offs among members of the American public.

4.11 Summary of Effects

As presented in Chapter 2 of this document, there are four alternatives analyzed in this PEIS. Under Alternative 1, the No Action Alternative, no new permits would be issued to replace existing permits as they expire, nor could existing permits be amended to allow modifications in research activities, sample sizes, or objectives. Further, no grants would be awarded for research that requires a permit, except for those activities authorized under existing permits. When the existing permits expire, all research activities that require a permit would have to cease, or researchers would risk violation of the MMPA, ESA, and NMFS regulations. Under Alternative 1, no incidental or intentional mortality due to research activities would be acceptable or authorized.

The policy direction of Alternative 2 would be to issue permits and to provide grant support to qualified individuals and institutions to conduct research on SSLs and NFSs using methods that would not involve capture, restraint, tissue sampling, or that would not risk causing animals to leave rookeries during the breeding season. This restriction on intrusive activities would essentially limit research to censusing surveys and behavioral observations that have a very small potential to cause injury to animals. Under Alternative 2, the total amount of incidental mortality allowed under all permits and authorizations would not exceed 5 percent of PBR for each stock (western SSL is 12 animals, eastern SSL is 100, eastern Pacific NFS is 763, San Miguel Island NFS is 11). No intentional lethal take would be authorized under Alternative 2.

Alternative 3, Status Quo, represents the existing grant and permit process and is somewhat flexible in that it can accommodate changes in funding level, management priorities, scientific interests, research techniques, population status, and threats to the populations' recovery. Under the Status Quo process, permits are issued to qualified individuals and institutions to conduct research according to the scope and methods requested in their applications, with permit restrictions and mitigation measures required by the MMPA, ESA, and NMFS implementing regulations. In addition to these statutory and regulatory permit restrictions, the proposed research programs for SSLs must have impacts at a level below that which would jeopardize the continued existence of the species or result in adverse modification of critical habitat, as required by Section 7 of the ESA. For NFSs, funding levels have recently increased; therefore, the number, types, and distribution of takes allowed by all permits approved by January 2006 are used for the analysis of effects under this alternative. This may not represent a peak research effort for NFSs, depending on future funding opportunities and interest among the research community, both of which are linked to factors such as population trends and speculation about the contribution of commercial fisheries and other factors to population status and prospects. Under Alternative 3, the total amount of incidental mortality allowed under all permits and authorizations would not exceed 10 percent of PBR for each stock (western SSL is 23 animals, eastern SSL is 200, eastern Pacific NFS is 1,526, San Miguel Island NFS is 22).

Alternative 4 represents an extensive research program that would be able to simultaneously address multiple issues over a huge geographical space. This alternative would include not only those specific activities currently or previously permitted but any additional research activities or methods that are needed to implement the new Draft SSL Recovery Plan (NMFS 2006a) and the new Draft NFS Conservation Plan (NMFS 2006b), assuming they are consistent with the MMPA, ESA, and NMFS implementing regulations. To be fully implemented, such a program would require a much larger research budget than is currently allocated to these species. It would also require greater administrative support for the Grants, Permits, and Regional Offices of NMFS in order to efficiently process the large number of projects. For the purposes of this EIS, it is assumed that the grants and permits processes will be essentially the same as under the Status Quo. Under Alternative 4, the total amount of incidental mortality allowed under all permits and authorizations would not exceed 15 percent of PBR for each stock (western SSL is 35 animals, eastern SSL is 300, eastern Pacific NFS is 2,289, San Miguel Island NFS is 33).

The following tables (Tables 4.11-1 through 4.11-8) summarize the direct, indirect, and cumulative effects under each alternative for all resources where environmental consequences were evaluated and found to be possible. More detailed discussions of direct, indirect, and cumulative effects can be found in Sections 4.8 through 4.10.

Table 4.11-1
Summary Of Direct/Indirect And Cumulative Effects –Steller Sea Lions– Section 4.8.1

	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
WESTERN DPS STELLER SEA LIONS				
DIRECT / INDIRECT EFFECTS				
Mortality	• No mechanism for mortality.	• Mortality 3.4 SSLs/yr (1.5% of PBR[1]); negligible on population level. • Disturbance effects minor.	• Mortality 14.8 SSLs/yr (6.3% of PBR[1]); negligible on population level. • Individuals could be disturbed >4x/yr; moderate effect.	• Mortality 29.8 SSLs/yr (12.7% of PBR[1]); minor on population level. • Individuals could be disturbed >5-6x/yr; moderate effect.
Sub-Lethal Effects	• No mechanism for sub-lethal effects.	• Magnitude of sub-lethal effects to productivity unknown. • Disturbance effects minor.	• Magnitude of sub-lethal effects to productivity unknown. • Individuals disturbed >4x/yr; moderate effect.	• Magnitude of sub-lethal effects to productivity unknown. • Individuals disturbed >5-6x/yr; moderate effect.
Contribution to Conservation Objectives	• Increased level of scientific uncertainty over time.	• Increased level of scientific uncertainty over time.	• Major contribution to conservation efforts. • Contributes to both immediate and long-term needs.	• Major contribution to conservation efforts. • Contributes to both immediate and long-term needs; highly dependant on funding.
CUMULATIVE EFFECTS				
	• No additional anthropogenic mortalities. • No additional sub-lethal effects. • Contribution to conservation efforts minimal.	• Contributes 3.4 SSL mortalities/yr. • Total mortality[2] 219/yr (93.6% of PBR[1]); major cumulative effect. • Cumulative effects of disturbance and sub-lethal effects unknown. • Contributes more data to conservation objectives than Alt. 1.	• Contributes 14.8 SSL mortalities/yr. • Total mortality[2] 230/yr (98.5% of PBR[1]); major cumulative effect. • Cumulative effects of disturbance and handling, and sub-lethal effects unknown. • Contributes more data to conservation objectives than Alts. 1 and 2.	• Contributes 29.8 SSL mortalities/yr. • Total mortality[2] 245/yr (104.9% of PBR[1]); major cumulative effect. • Cumulative effects of disturbance and handling, and sub-lethal effects unknown. • Contributes more data to conservation objectives than Alts. 1, 2 and 3.

Table 4.11-1 (continued)
Summary Of Direct/Indirect And Cumulative Effects –Steller Sea Lions– Section 4.8.1

	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
EASTERN DPS STELLER SEA LIONS				
DIRECT / INDIRECT EFFECTS				
Mortality	• No mechanism for mortality.	• Mortality 3.2 SSLs/yr (0.2% of PBR[1]); minor on population level. • Disturbance effects minor.	• Mortality 25.5 SSLs/yr (1.3% of PBR[1]); negligible on population level. • Individuals could be disturbed >4x/yr; moderate effect.	• Same as Alt. 3.
Sub-Lethal Effects	• No mechanism for sub-lethal effects.	• Magnitude of sub-lethal effects to productivity unknown. • Disturbance effects minor.	• Magnitude of sub-lethal effects to productivity unknown. • Individuals disturbed >4x/yr; moderate effect.	• Same as Alt. 3.
Contribution to Conservation Objectives	• New analyses and syntheses from existing data but increased scientific uncertainty over time.	• Contributes to most conservation objectives except perhaps genetics.	• Major contribution to conservation efforts. • Contributes to conservation objectives.	• Same as Alt. 3.
CUMULATIVE EFFECTS				
	• No additional anthropogenic mortalities. • No additional sub-lethal effects. • Contribution to conservation efforts minimal.	• Contributes 3.2 SSL mortalities/yr. • Total mortality[2] 13/yr (0.7% of PBR[1]); negligible cumulative effect. • Cumulative effects of disturbance and sub-lethal effects unknown. • Contributes to all conservation objectives except perhaps monitoring disease and genetic refinement.	• Contributes 25.5 SSL mortalities/yr. • Total mortality[2] 36/yr or 1.8% of PBR[1]); negligible cumulative effect. • Cumulative effects of disturbance and handling, and sub-lethal effects unknown. • Contributes to all conservation objectives.	• Same as Alt. 3.

[1] - PBR = potential biological removal
[2] - Total mortality = total human-caused mortality (i.e., research, subsistence, commercial fishing, etc.)
Note: For more detail on effects please see Chapter 4 of the EIS.

Table 4.11-2
Summary Of Direct/Indirect And Cumulative Effects –Northern Fur Seals– Section 4.8.2

	Alternative 1: No Action; No New Permits or Authorizations	**Alternative 2: Research Program Without Capture or Handling**	**Alternative 3: Status Quo Research Program**	**Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals**
EASTERN PACIFIC STOCK NORTHERN FUR SEALS				
DIRECT / INDIRECT EFFECTS				
Mortality	• No mechanism for mortality.	• Mortality 1.2 NFSs/yr (<0.1% of PBR[1]); negligible on population level.	• Mortality 47.8 NFSs/yr (0.3% of PBR[1]); negligible on population level.	• Mortality 67 NFSs/yr (0.4% of PBR[1]); negligible on population level.
Sub-Lethal Effects	• No mechanism for sub-lethal effects.	• Duration of activities short-term. • Effects of disturbance and sub-lethal effects negligible.	• Magnitude of sub-lethal effects to productivity unknown; large number of animals disturbed. • Geographic extent and frequency/duration of disturbance moderate.	• Magnitude of sub-lethal effects to productivity unknown; large number of animals disturbed. • Geographic extent and frequency/duration of disturbance moderate.
Contribution to Conservation Objectives	• Contribution to conservation objectives minor.	• Contribution to conservation objectives minor.	• Addresses many immediate and long-term needs. • Moderate contribution to conservation efforts.	• Addresses most immediate and long-term needs. • Major contribution to conservation efforts; highly dependant on funding.
CUMULATIVE EFFECTS				
	• Mortality negligible; (< PBR of 14,546). • No cumulative sub-lethal effects. • Contribution to conservation efforts minimal.	• Contributes 1.2 NFS mortalities/. • Total mortality[2] 757/yr (5.0% of PBR[1]); negligible cumulative effect. • Cumulative effects of disturbance and sub-lethal effects unknown; contribution of research considered negligible. • Contributes more data to conservation objectives than Alt. 1.	• Contributes 47.8 NFS mortalities/yr • Total mortality[2] 804/yr (5.3% of PBR[1]); negligible cumulative effect. • Cumulative effects of disturbance and handling, and sub-lethal effects unknown. • Moderate contribution to conservation objectives; contributes more than Alts. 1 and 2.	• Contributes 67 NFS mortalities/yr • Total mortality[2] 823/yr (5.4% of PBR[1]); minor cumulative effect. • Cumulative effects of disturbance and handling, and sub-lethal effects unknown. • Major contribution to conservation objectives; contributes more than Alts. 1, 2 and 3.

Table 4.11-2 (continued)
Summary Of Direct/Indirect And Cumulative Effects –Northern Fur Seals– Section 4.8.2

	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
SAN MIGUEL ISLAND STOCK NORTHERN FUR SEALS				
DIRECT / INDIRECT EFFECTS				
Mortality	• No mechanism for mortality.	• Mortality 0; negligible on population level.	• Mortality 5.0 NFSs/yr (2.3% of PBR[1]); negligible on population level.	• Same as Alt. 3.
Sub-Lethal Effects	• No mechanism for sub-lethal effects.	• Duration of activities short-term. • Effects of disturbance and sub-lethal effects negligible.	• Magnitude of sub-lethal effects to productivity unknown. • Geographic extent of disturbance is major (concentrated on San Miguel Island). Duration and frequency is minor	• Same as Alt. 3. Additional methods/ procedures could be authorized but are unknown at this time.
Contribution to Conservation Objectives	• Not listed as threatened or endangered; no conservation objectives.	• Not listed as threatened or endangered; no conservation objectives.	• Not listed as threatened or endangered; no conservation objectives.	• Not listed as threatened or endangered; no conservation objectives.
CUMULATIVE EFFECTS				
	• No additional anthropogenic mortalities. • No additional sub-lethal effects. • Not listed as threatened or endangered; no conservation objectives.	• Population is increasing; no population-level effects expected therefore, cumulative effect negligible. • Cumulative effects of disturbance and sub-lethal effects unknown; contribution of research considered negligible. • Not listed as threatened or endangered; no conservation objectives.	• Contributes 5.0 NFS mortalities/yr • Total mortality[2] 5.7/yr (2.7% of PBR[1]); negligible cumulative effect. • Effects of disturbance and handling, and sub-lethal effects unknown. • Not listed as threatened or endangered; no conservation objectives.	• Same as Alt. 3. • Additional methods/ procedures could be authorized but are unknown at this time.

[1] - PBR = potential biological removal
[2] – Total mortality = total human-caused mortality (i.e., research, subsistence, commercial fishing, etc.)
Note: For more detail on effects please see Chapter 4 of the EIS.

Table 4.11-3
Summary Of Direct/Indirect And Cumulative Effects – Killer Whales, Other ESA-Listed Species, And Other Marine Mammals (Cetaceans, Pinnipeds)– Sections 4.8.3 through 4.8.6

Effect		Alternative 1 No Action: No New Permits or Authorizations	Alternative 2 Research Program without Capture or Handling	Alternative 3 Status Quo Research Program	Alternative 4 (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
KILLER WHALES, OTHER ESA-LISTED SPECIES, AND OTHER MARINE MAMMALS (CETACEANS, PINNIPEDS)					
Direct/Indirect	Effects on survival or reproductive success due to SSL and NFS research	• Research vessels investigating the role of killer whale in SSL and NFS population dynamics not requiring authorization for incidental take or disturbance could result in rare injury or death from strikes, as well as short-term discharges and increased turbidity. • Effects of research on California sea lions as a surrogate species for SSLs would be short-term and negligible. • Overall effects considered negligible.	• Likely increase in marine vessel research due to permitted incidental take or disturbance of SSL and NFS; potential effects resulting mortality, injury, and disturbance considered negligible. • Potential local increase in available killer whale prey around rookeries and haulouts. • Overall effects considered negligible.	• The frequency and geographic extent of marine vessel use for the purposes of research could increase; potential effects resulting mortality, injury, and disturbance considered negligible. • Overall effects considered negligible.	• Similar to Alternative 3, effects considered negligible.
	Disturbance due to SSL and NFS research	• Marine research vessel disturbance from visual cues and noise pollution could result in stress and avoidance behavior, displacement, interference with whale communication and echolocation, modifications to whale surfacing, respiration, and diving cycles. • Short-term disturbance of other animals during California sea lion research activities is considered negligible. • Overall effects considered short-term and negligible.	• Marine research vessel disturbance would result in the same effects as Alternative 1. • Opportunistic sightings during SSL and NFS low-altitude aerial surveys could cause negligible behavioral changes in a few individuals. • Sea otters concentrated in the vicinity of SSL and NFS haulouts could potentially be disturbed, effects considered negligible. • Overall effects considered negligible.	• Few or no marine vessels or aircraft would seek out or occur in the vicinity of whales under this alternative, there would be no measurable effects of disturbance. • Few sea otters are likely to occupy areas where research activities occur. • Overall effects considered negligible.	• Similar to Alternative 3, effects considered negligible.

Table 4.11-3 (continued)
Summary Of Direct/Indirect And Cumulative Effects – Killer Whales, Other ESA-Listed Species, And Other Marine Mammals (Cetaceans, Pinnipeds)– Sections 4.8.3 through 4.8.6

Effect		Alternative 1 No Action: No New Permits or Authorizations	Alternative 2 Research Program without Capture or Handling	Alternative 3 Status Quo Research Program	Alternative 4 (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
KILLER WHALES, OTHER ESA-LISTED SPECIES, AND OTHER MARINE MAMMALS (CETACEANS, PINNIPEDS)					
Cumulative		• Potential killer whale cumulative effects difficult to predict (commercial fisheries, intentional shooting, vessel traffic, and marine pollution, global climate change, long-term regime shifts). • Internal (few) and external (numerous) factors could affect survival and reproductive success of other ESA species. De-listing likely prevented as a result of past actions. • There has been no apparent affect on California sea lions from past or present actions, including incidental research. • California sea lions removed from the wild for research as a surrogate to SSLs would not approach the species' PBR. • Negligible contribution to overall cumulative effects from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution to overall cumulative effects from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution to overall cumulative effects from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution to overall cumulative effects from SSLs and NFSs research activities.

Table 4.11-4
Summary of Direct/Indirect and Cumulative Effects – Seabirds - Section 4.8.6

Effect		Alternative 1 No Action: No New Permits or Authorizations	Alternative 2 Research Program without Capture or Handling	Alternative 3 Status Quo Research Program	Alternative 4 (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
SEABIRDS					
Direct/Indirect	Effects on survival or reproductive success due to SSL and NFS research	• Potential effects when accessing high ground above the SSL and NFS rookeries for behavioral observation or installation/maintenance of remote sensing equipment. • Negligible affect on survival and reproductive success.	• Aerial surveys not anticipated to affect nesting seabird ESA-listed bird species. Mortality of adults or chicks unlikely based on aircraft elevation. • Effect of research activity considered negligible.	• Potential disturbance increase to adjacent nesting seabirds from land-based census activities and intensive sampling. • Effects to reproductive success from land-based activities would be very low. • Effects of disturbance from research activity on seabird survival or productivity would be negligible. • Effects on ESA-listed species are unlikely and are considered negligible.	• Same as Alternative 3, effects considered negligible.
	Disturbance due to SSL and NFS research	• Potential nesting disturbance associated with remote observations of SSL or NFS, installation and maintenance of remote camera equipment, especially if helicopters use is required. • Effects are considered negligible.	• Potential effects from short-term aerial survey overflights and land-based observations. Potential for small loss of eggs or chicks from panic flights. • Effects considered negligible.	• Potential effects from short-term aerial survey overflights and land-based observations would be the same as Alternative 2. Effects from scat collection or other survey activity would be negligible. • Effects considered negligible.	• Potential effects from short-term aerial survey overflights and land-based observations would be the same as Alternative 2. • Effects considered negligible.
Cumulative		• All seabird groups have experienced infrequent mortality events in the recent past, and all are susceptible to future human-caused mortality factors. • Negligible contribution from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution from SSLs and NFSs research activities.	• Same as Alternative 1. • Negligible contribution from SSLs and NFSs research activities.

Table 4.11-5
Summary Of Direct/Indirect And Cumulative Effects – Subsistence Harvest – Section 4.9

Effect	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
SUBSISTENCE HARVEST				
Direct/Indirect	• None of the research methods would directly affect the subsistence harvest of SSLs or NFSs, therefore direct effects are considered to be negligible. • Depending on the ultimate biological consequences of the reduced scope of research, the indirect effects could be minor.	• It is unlikely that any of the research methods would directly affect the subsistence harvest of SSLs or NFSs, therefore direct effects are considered to be negligible. • Depending on the ultimate biological consequences of the reduced scope of research, the indirect effects could be minor.	• It is likely that only a few, if any, of the same individual SSLs or NFSs used for research would be included in the subsistence harvest, therefore direct effects are considered to be negligible. • Because basic informational needs outlined in the Plans would be addressed, indirect effects are considered positive and minor.	• The possible intensity and wide geographic area of permitted research has the potential to affect SSL subsistence harvest, therefore direct impacts are considered to be moderate. • Because research would directly address the needs outlined under the Plans, indirect effects to SSL are considered positive and minor. • It is likely that only a few, if any, of the same individual NFSs used for research would be included in the subsistence harvest, therefore direct and indirect effects are considered to be negligible.
Cumulative	• Depending on how economic change is negotiated, small communities that rely heavily on SSL and NFS subsistence harvest may result in a minor cumulative effect.	• Depending on how economic change is negotiated, small communities that rely heavily on SSL and NFS subsistence harvest may result in a minor cumulative effect.	• Subsistence activities of SSLs and NFSs would return to level prior to vacation of permits, resulting in negligible cumulative effects.	• The extent of the effect on harvesters is unknown and is ultimately dependent on the level of overlap between SSL and NFS subsistence populations and those studied by researchers. • Cumulative effects are considered moderate to major, with major effects being more possible in small communities.

Table 4.11-6
Summary Of Direct/Indirect And Cumulative Effects – Interactions with Communities – Section 4.9

Effect		Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
INTERACTIONS WITH COMMUNITIES					
Direct/ Indirect	Economic	• For larger and more economically diversified communities, the decrease in revenue associated with less research is likely to result in negligible direct impacts. • Smaller communities, such as St. George and St. Paul, could experience minor direct impacts. • A redirection of research funds could result in minor indirect effects.	• For both small and large communities, the potential decrease (but possible maintenance) in revenue associated with different research methods is likely to result in negligible direct impacts. • A redirection of research funds could result in minor indirect effects.	• As research practices would be the same as those prior to the court order, direct and indirect effects are considered negligible.	• The proposed intensity and wide geographic range of research, direct effects are considered to range between minor and major, on a localized basis in some communities. • The possible intensity and wide geographic area of permitted research would result in moderate direct impacts. • Indirect effects considered negligible.
	Educational	• For more populous communities, the decrease in education opportunities is likely to result in negligible direct impacts. • Communities such as St. George and St. Paul, where research related education opportunities are important to a higher proportion of the population, could experience minor indirect impacts. • A redirection of research funds could result in minor indirect effects.	• The educational opportunities that remain would be less engaging than the Status Quo, but still available, therefore the direct educational effects are considered negligible. • A redirection of research funds could result in negligible indirect effects.	• As research practices would be the same as those prior to the court order, direct and indirect effects are considered negligible.	• Educational opportunities would likely increase, therefore direct effects would range from negligible in large communities to major in small communities. • Indirect effects are considered negligible.

Table 4.11-6 (continued)
Summary Of Direct/Indirect And Cumulative Effects – Interactions with Communities – Section 4.9

Effect		Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
Direct/ Indirect	Sociocultural	• The potential for positive and/or negative sociocultural interactions would decrease, therefore direct effects are considered negligible. • A redirection of research funds could result in negligible indirect effects.	• The potential for positive and/or negative sociocultural interactions would decrease, therefore direct effects are considered negligible. • A redirection of research funds could result in longer stays in local communities to collect data, therefore indirect effects range from minor to negligible.	• As research practices would be the same as those prior to the court order, direct and indirect effects are considered negligible.	• The proposed intensity and wide geographic range of research would result in some direct sociocultural interactions. Therefore effects are considered to be negligible (especially if community collaboration continues). • Indirect effects are considered negligible.
Cumulative		• Cumulative effects would be considered minor, depending of how members of the community negotiate economic growth or recession.	• Cumulative effects would be considered minor, depending of how members of the community negotiate economic growth or recession.	• Cumulative effects would be considered negligible, depending of how members of the community negotiate economic growth or recession.	• The proposed intensity and wide geographic range of research has the potential to result in major cumulative effects in smaller communities and minor to moderate cumulative effects in larger communities

Table 4.11-7
Summary Of Direct/Indirect And Cumulative Effects – Environmental Justice – Section 4.9

Effect	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
ENVIRONMENTAL JUSTICE				
Direct/Indirect	• No direct effects on subsistence harvest. Educational outreach would likely decrease. Therefore, direct effects are considered minor. • Permitting restrictions and lack of research may potentially contribute to a failure to stop or reverse population declines which may influence subsistence harvesting in some small communities. Therefore, indirect effects are considered minor.	• No direct effects on subsistence harvest. Educational outreach and volunteer opportunities would likely continue. Therefore, direct effects are considered negligible. • Permitting restrictions and lack of research may potentially contribute to a failure to stop or reverse population declines which may influence subsistence harvesting in some small communities. Therefore, indirect effects are considered minor.	• As research practices would be the same as those prior to the court order, direct and indirect effects are considered negligible.	• Due to increased research scope and intensity, some of the research practices (i.e., chemical and drug injections and aerial surveys) could influence Alaska Native subsistence use of SSL and/or NFS in small coastal communities. Therefore, direct effects are considered moderate. • Indirect effects are considered negligible.
Cumulative	• Lower research levels could lead to a decrease in educational interaction opportunities and lower numbers of animals available for subsistence. Therefore, cumulative effects are considered minor.	• Lower research levels could lead to a decrease in educational interaction opportunities and lower numbers of animals available for subsistence. Therefore, cumulative effects are considered minor.	• As research practices would be the same as those prior to the court order, direct and indirect effects are considered negligible.	• Due to increased research scope and intensity, some of the research practices (i.e., chemical and drug injections and aerial surveys) could influence some subsistence animals used by small communities. Therefore, cumulative effects are considered minor.

Table 4.11-8

Summary Of Direct/Indirect And Cumulative Effects –Economic Effects of Funding for Research– Section 4.10

Effect	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
ECONOMIC EFFECTS OF FEDERAL FUNDING FOR SSL AND NFS RESEARCH				
DIRECT/INDIRECT EFFECTS				
Economic Effects of Changes in Research Expenditures	• Due to permitting restrictions, research would be of limited value, which would likely lead to less available research funding. Reduced funding would likely have major negative direct and indirect effects to both institutional and independent researchers.	• Depending on the amount of funding for non-intrusive research that could be procured, direct and indirect negative effects would be considered minor to both institutional and independent researchers.	• Because funding would maintain at about Status Quo levels, direct and indirect effects would be considered negligible to both institutional and independent researchers.	• Because it is unclear whether a more extensive research program would actually lead to greater funding levels, direct and indirect positive effects would be range from minor to moderate to both institutional and independent researchers.
Economic Effects of Changes in Research Output	• Permitting restrictions and a lack of research might contribute to a failure to stop or reverse population declines. Therefore, negative direct and indirect effects would be considered major to the concerned public. • The direct and indirect effects among the public concerned about research-associated mortality would be negligible.	• To the extent that conservation objectives would be addressed, direct and indirect positive effects to the concerned public could be minor to major, depending on the ultimate biological outcome of the research. • The direct and indirect effects among the public concerned about research-associated deaths would be minor.	• To the extent that conservation objectives would be addressed, direct and indirect positive effects to the concerned public could be minor to major, depending on the ultimate biological outcome of the research. • The direct and indirect effects among the public concerned about research-associated deaths would be moderate.	• To the extent that conservation objectives would be addressed, direct and indirect positive effects to the concerned public could be minor to major, depending on the ultimate biological outcome of the research. • The direct and indirect effects among the public concerned about research-associated deaths would be moderate to major.
CUMULATIVE				
Economic Effects of Changes in Research Expenditures	• The highly restrictive research environment (and lack of new scientific contributions) would offer the least incentive for federal research investments. Therefore, cumulative effects would be considered major.	• The moderately restrictive research environment would offer moderate incentive for federal research investments. Therefore, cumulative effects would be considered minor.	• The permissive research environment (and possibility of new scientific contributions) would offer researchers a greater ability to offset federal funding losses with other sources. Therefore, cumulative effects would be considered minor.	• The highly permissive research environment (and possibility of new scientific contributions) would offer researchers the greatest ability to offset federal funding losses with other sources. Therefore, cumulative effects would be considered moderate.

Table 4.11-8 (continued)
Summary Of Direct/Indirect And Cumulative Effects –Economic Effects of Funding for Research– Section 4.10

Effect	Alternative 1: No Action; No New Permits or Authorizations	Alternative 2: Research Program Without Capture or Handling	Alternative 3: Status Quo Research Program	Alternative 4: (Preferred Alternative) Research Program with Full Implementation of Conservation Goals
CUMULATIVE				
Economic Effects of Changes in Research Output	• The highly restrictive research environment might contribute to a failure to stop or reverse population declines. Therefore, cumulative effects on public welfare loss associated with extinction of populations are considered major. • Cumulative effects on public welfare loss due to research-associated mortality are considered negligible.	• The moderately restrictive research environment might help to stop or reverse population declines. Therefore, cumulative effects on public welfare gain associated with survival of populations are considered minor. • Cumulative effects on public welfare loss due to research-associated mortality are considered minor.	• The permissive research environment might help to stop or reverse population declines. Therefore, cumulative effects on public welfare gain associated with survival of populations are considered moderate to major. • Cumulative effects on public welfare loss due to research-associated mortality are considered moderate. •	• The highly permissive research environment might help to stop or reverse population declines. Therefore, cumulative effects on public welfare gain associated with survival of populations are considered moderate to major. • Cumulative effects on public welfare loss due to research-associated mortality are considered moderate to major.