Prepared for:

DRAFT
Programmatic Environmental Impact Statement

Hawaiian Monk Seal Recovery Actions

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4.0 ENVIRONMENTAL CONSEQUENCES

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 describing the Project Area (Section 4.1), defining frequently used terms (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 including the resource-specific criteria used in the evaluation. 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.

4.1 PROJECT AREA AND SCOPE FOR ANALYSIS

The project area for this Programmatic Environmental Impact Statement (PEIS) encompasses the range where Hawaiian monk seals are found throughout the Hawaiian Archipelago (including the Northwestern Hawaiian Islands [NWHI] and Main Hawaiian Islands [MHI]) and Johnston Atoll (Figure 1.3-1).

More specifically, the Project Area includes portions of the open ocean and nearshore environment where monk seals may be found; and, the shorezone of the islands, islets and atolls that make up the Hawaiian Archipelago and Johnston Atoll. For the purposes of this project, the shore zone generally includes those terrestrial areas 5 meters (m) inland from the line where the shore meets the sea. In addition, secondary use areas, such as research field camps in the NWHI, are also considered for inclusion in the analysis.

In the NWHI, monk seals have six main reproductive sites including Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, and French Frigate Shoals. Necker and Nihoa Islands have smaller breeding sub-populations and monk seals have been observed at Gardner Pinnacles and Maro Reef. Monk seals are also found throughout the MHI where the population appears to be increasing (National Marine Fisheries Service [NMFS] 2007).

The time frame for this analysis is defined as 1958 through approximately 2020. As described in more detail in Section 3.3.1, 1958 marks the point in time when the first beach counts of Hawaiian monk seals were conducted in all the primary NWHI. That year is considered a benchmark for the species' known historic high point of abundance. By the year 2020, NMFS will have potentially completed two

more permit cycles for authorizing Hawaiian monk seal research and enhancement activities; in addition, 10 years is considered a reasonable amount of time for the life of an EIS document. Within this 10-year timeframe, NMFS will continue to monitor the Hawaiian monk seal research and enhancement program to evaluate its potential impacts and to comply with NEPA as described in more detail in Chapter 5.

4.2 DEFINITION OF TERMS

The following terms are used throughout this document to discuss potential effects. In this analysis, the terms "effects" and "impacts" are used interchangeably.

- Direct Effects – caused by the action and occurring at the same time and place (40 Code of Federal Regulations [CFR] § 1508.8).

- Indirect Effects – effects "caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. 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).

- Cumulative Effects – "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). 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.

- 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. Based on existing guidance, we can assume that reasonably foreseeable future actions (RFFAs) are those that are likely to occur and are not purely speculative. Typically, they are based on documents such as existing plans, permit applications, or announcements.

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; and
- The agency's evaluation of adverse impacts based on generally accepted scientific methods.

This PEIS identifies those areas where information is unavailable to support a thorough evaluation of the environmental consequences of the alternatives. In particular, as described in more detail in Section 4.9, there are challenges to analyzing potential impacts on fisheries resources (commercial, subsistence and recreational) due to constraints associated with data confidentiality, and also cases where little or no relevant data exist. The initial estimates of direct and indirect effects are based on qualitative discussions of experienced economists who have worked directly with NMFS to determine the best methods for assessing potential effects of the proposed alternatives.

Similarly, the analysis of potential effects on cultural and historic properties is based on known properties listed in the National Register of Historic Places (NRHP) and other data publicly available from the State of Hawai'i Division of Land and Natural Resources (DLNR). While additional cultural and historic properties exist, the assessment presented in this PEIS is based on publicly available information on documented sites and any information available on sites eligible for listing in the National Register. 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

Federal agencies are required under National Environmental Policy Act (NEPA) to prepare an Environmental Impact Statement (EIS) or PEIS 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, indirect, and cumulative effects of the proposed alternatives (40 CFR 1502.16).

- 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 can be referred to as 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.
- 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 effect is the likelihood of its occurrence.

Geographic extent of potential impacts to wildlife may be described using the following terms:

- Species level – change in species or population throughout its range that would likely affect its long-term survival.
- Subpopulation or local level – change in a species age- or size-classes in a limited area of its range. Subpopulations are described in Section 3.3.1.3 Hawaiian Monk Seal Population Status and Trends.
- Individual level – change to a specific animal or small number of animals.

Duration or frequency provides the context of time and may use the following terms:

- Short-term – temporary effect that lasts from a few minutes to a few days, after which the affected animals or resource revert to a "normal" condition.
- Long-term – more permanent effects that may last for years or from which the affected animals or resource never revert to a "normal" condition.
- Intermittent or infrequent effects – effects that only occur a couple times a year or fewer.

- Frequent – effects that occur on a regular or repeated basis each year.

Other species-specific characteristics, such as whether the effects occur during a sensitive or critical part of the year (for example, breeding), are described in the analyses for each species or resource.

The combination of context and intensity is used to determine the level of impact on each type of resource. Analysts follow these steps to accomplish this analysis:

1) Examine the mechanisms by which the proposed action could affect the particular resource.

2) For each type of effect, develop a set of criteria to distinguish between major, moderate, minor, or negligible impacts (defined in Tables 4.4-1 through 4.4-8).

3) Use these impact criteria to rank the expected magnitude, extent, duration, and likelihood of each type of effect under each alternative.

Determining the likelihood of an effect serves to assess whether it is plausible or just speculative. For the purposes of this analysis, "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.

Tables 4.4-1 through 4.4-8 provide guidelines for the analysts to assess the context of a potential effect and serve as tools for comparing the alternatives based on the conclusions drawn from the analysis. The impact criteria tables use terms and thresholds that are both quantitative and qualitative.

Qualitative thresholds are used where resource-specific baseline data may be lacking or potential effects are difficult to predict quantitatively (*e.g.*, quality of life is difficult to measure in quantitative terms). For a qualitative assessment, analysts must use professional judgment about where a particular effect falls in the continuum from "negligible" to "major."

The criteria and definitions of levels of impact provided in Tables 4.4-1 through 4.4-8 are used only in reference to effects projected to occur within 10 years (see Section 4.1 Project Area and Scope for Analysis). Predictions beyond 10 years are challenging due to uncertainty and the number of independent factors that may alter the environment. Thus potential long-term effects are described using more qualitative terms.

4.4.1 Impact Criteria for Hawaiian Monk Seals

Table 4.4-1 presents criteria for analyzing potential effects on Hawaiian monk seals. The effects of various actions on population status through direct and indirect mortality or through improvements in survival can be evaluated by various metrics. The choice of the appropriate metric to be used depends on a suite of factors including the nature of the actions, the mechanism of potential demographic effects, and our confidence in predicting the expected effects.

The quantitative metrics used to compare and contrast the expected outcome associated with the different actions included in the alternatives are:

- Population growth rate;
- Age-specific survival rates and survivorship; and
- Population reproductive value (V_{pop}).

Additionally, the expected benefits associated with certain new interventions for which applicable data are not yet available, are evaluated qualitatively. For each intervention, the approach or metric believed to be most revealing for describing the expected outcome of the action is presented.

The intrinsic growth rate, or lambda (λ) for a subpopulation or group of subpopulations is determined from the demographic rates (age-specific survival and reproductive rates) for that population. When all of the demographic rates are assembled into a single table or matrix, they form the lifetable for that population.

Mathematical analysis of that lifetable allows the calculation of certain lifetable descriptors, including λ, that reveal much information about the expected behavior of the population in the future. The value of λ provides an estimate for the long-term likelihood that a population will grow or decline, with values above 1.0 representing growth and values below 1.0 representing decline. A value of exactly 1.0 would correspond to a stable population that will remain at approximately the same abundance over time.

The actual growth rate of a population will vary from the intrinsic growth rate depending on the age structure of the population. For example, more females that can reproduce in a population than normally expected within the population's lifetable may allow the population to exceed the growth rate predicted by λ. Conversely, fewer reproductive females than normally expected might mean the population would fail to meet λ.. In recent years, all of the subpopulations in the NWHI have had $\lambda < 1.0$ (declining), whereas, in contrast, the MHI have had λ well above 1.0 (growing). Also, as described in Chapter 3, most subpopulations in the NWHI now have poor age structures that are likely to limit their capacity to achieve the growth rate predicted by λ.

Survival rates are often the most direct measure for describing the expected outcomes for an action, or for comparing effects across the alternatives. Age-specific survival (often abbreviated as p_x) indicates the probability that a seal will survive from age x to the next age, or age $x+1$. Similarly, survivorship (abbreviated l_x) gives the probability that a newborn pup will survive to age x. Of particular interest for recovery of the monk seal is survivorship to the subadult stage (approximately age 4yr); shorthand for this measure is l_4. A number of the research and enhancement activities included in Alternatives 1, 3 and 4 are specifically targeted at improving the value of l_4 in the NWHI.

One can think of V_{pop} as analogous to the quantity of potential energy stored in the population, which is likely to translate into future pup production.

The metric population reproductive value (V_{pop}) is used to evaluate the effects of certain actions included in some alternatives. This metric is an extension of a related demographic measure known as *age-specific reproductive value*, or v_x. This measure essentially informs us about the relative value of female seals of different ages in terms of their probable contribution to future population growth.

Females of prime reproductive age have a higher v_x than very young females that might not survive to reproductive maturity, or very old females that are past their prime reproductive years and may not produce many more pups. V_{pop} extends the concept of age-specific reproductive value by incorporating information on the current population size and age/sex composition. This parameter is the sum of the age-specific reproductive values for all of the females currently in the population.

One can think of V_{pop} as analogous to the quantity of potential energy stored in the population, which is likely to translate into future pup production. Thus:

- An action that increases the number of reproductively aged females will result in a higher V_{pop} as compared to a "baseline" scenario without the action.

- An action that results in the loss of reproductively aged females will lower V_{pop} at that site.

V_{pop} is ideally suited for assessing potential affects of the proposed translocations because that activity is focused on augmenting the number of reproductively-aged females within the high v_x age classes, thereby increasing V_{pop} for the treated subpopulation.

For clarity, and because V_{pop} may be an unfamiliar concept to some readers, the effects of some actions may also be expressed as simply the change in number of reproductively-aged females in a subpopulation. This value expresses much the same thing as V_{pop}, but is slightly less informative as it does not account for the

differences in v_x among females of different ages. For this measure, "reproductively aged females" are defined as those of age 5-20, corresponding to the youngest age of first reproduction through the approximate age at which fecundity tapers off in the monk seal.

In addition to evaluating the number of potential mortalities, it is important to understand how sublethal effects may result in changes to the species' status. For the purposes of this analysis, we evaluate sublethal effects in terms of how they could result in changes to reproductive success.

The effects of some actions may also be expressed as simply the change in number of reproductively-aged females in a subpopulation. "Reproductively aged females" are defined as those of age 5-20.

Finally, in order to understand how the proposed research and enhancement activities contribute to conservation of the species more broadly, the proposed actions are compared against specific actions listed in the 2007 Hawaiian Monk Seal Recovery Plan (NMFS 2007). This element of the effects analysis qualitatively discusses how well the scope of research and enhancement represented under each alternative would be able to address information needs for taking management actions that would promote recovery of the species.

The goal of the Recovery Plan is to promote the recovery of Hawaiian monk seals to the point that they 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. Additional information on the 2007 Recovery Plan and its relevance to this PEIS is provided in Section 3.3.1.7.

Table 4.4-1 Impact Criteria for Hawaiian Monk Seals

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Direct and indirect mortality or survival enhancement	Magnitude and Intensity	Sufficient to cause measurable change in population status (*i.e.*, population growth rate, survival rates, V_{pop})	Equivocal change in population status (*i.e.*, population growth rate, survival rates, V_{pop})	Mechanism for effects on population status (*i.e.*, population growth rate, survival rates, V_{pop}), but status indistinguishable from baseline	NA
	Geographic extent/Biological level	Affects entire species throughout range	Effects limited to a single or a few subpopulations	Effects limited to a small number of individuals	NA
	Duration and Frequency	Long-term duration and high frequency	Moderate duration with high frequency or long-term duration with medium frequency	Short-term duration with moderate frequency or moderate duration with low frequency	NA
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely
Direct and indirect reproductive effects	Magnitude and Intensity	Sufficient to cause measurable change in reproductive success	Equivocal change in reproductive success	Mechanisms for effects but reproductive success similar to baseline	No mechanisms for reproductive effects
	Geographic extent/Biological level	Effects entire species throughout range	Effects limited to a single or a few subpopulations	Effects limited to a small number of individuals	No measurable effects
	Duration and Frequency	Long-term duration and high frequency	Moderate duration with high frequency or long-term duration with moderate frequency	Short-term duration with moderate frequency or moderate duration with low frequency	No measurable effects
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Beneficial contribution toward conservation objectives	Magnitude and Intensity	Addresses all conservation objectives in Recovery Plan	Addresses multiple conservation objectives in Recovery Plan	Addresses a few conservation objectives in Recovery Plan	Addresses no conservation objectives in Recovery Plan
	Geographic extent/Biological level	Research and enhancement benefits conservation of species throughout range	Research and enhancement benefits conservation of a single or a few subpopulations	Research and enhancement benefits a small number of individuals	Provides no enhancement benefits or useful information for management
	Duration and Frequency	Provides immediate and long-term enhancement benefits and/or information needs	Provides periodic and long-term enhancement benefits and/or information needs	Provides periodic and short-term enhancement benefits and/or information needs	Provides no enhancement benefits or information for management
	Likelihood[1]	Likely	Likely	Not Likely	Not Likely

[1] - "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%.

4.4.2 Impact Criteria for Other Biological Resources

Tables 4.4-2 through 4.4-5 indicate the types of effects Hawaiian monk seal research and enhancement activities may have on other biological resources (species other than monk seals) that are assessed in this NEPA analysis. These tables summarize the criteria for determining the level of impact based on the magnitude, extent, duration and likelihood of occurrence. Where additional resource-specific information may provide further insight into the rationale behind impact criteria, these details are presented following each table. Sections 4.8.2 through 4.8.6 summarize the anticipated direct, indirect and cumulative effects under each alternative for other biological resources.

Table 4.4-2 Impact Criteria for Sea Turtles

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Reproductive effects	Magnitude or Intensity	Population level changes in reproduction over several breeding seasons.	Population changes in reproduction over one breeding season.	Changes in reproduction at the individual rather than population level.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location (bay or beach)	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Mortality	Magnitude or Intensity	Population-level effects observed	Sub-population or community level effects observed	Individual mortality observed but not sufficient to affect population survival.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "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%.

Table 4.4-3 Impact Criteria for Cetaceans

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Mortality	Magnitude or Intensity	Population-level effects observed	Sub-population or community level effects observed	Individual mortality observed but not sufficient to affect population survival.	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Reproductive effects	Magnitude or Intensity	Population level changes reproduction in several species over several seasons.	Population changes in reproduction over one season.	Changes in reproduction effect a small number of individuals	No measurable effects
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes that are likely to be permanent	Periodic, temporary, or short-term changes in an annual or several season cycle	Periodic, temporary, or short-term changes over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "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%.

Table 4.4-4 Impact Criteria for Fish

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Mortality	Magnitude or Intensity	Mortality to large numbers of fish.	Mortality to individual fish; no population level effects.	Mortality to very small numbers of fish.	No measurable effects
	Geographic Extent	Effects realized in multiple locations	Effects realized in multiple locations	Effects realized at few locations	No measurable effects
	Duration or Frequency	Chronic and long-term changes that are likely to be permanent	Periodic, temporary, or short-term changes in an annual or several season cycle	Periodic, temporary, or short-term changes over one or two seasons	No measurable effect
	Likelihood	Likely	Likely	Not likely	Not likely

[1] - "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%.

Table 4.4-5 provides criteria for analyzing the potential direct, indirect and cumulative impacts to birds based on their nesting, brood-rearing, and seasonal use patterns within the terrestrial portion of the Project Area. This area includes beach habitat up to 5 m inland from the upper reaches of the wash of the waves, as described in Section 1.3 Project Area Description, and areas where seasonal field camps at French Frigate Shoals, Pearl and Hermes Reef, Midway and Kure Atolls, and Laysan and Lisianski Islands are located (see Section 3.3.1.9).

Impact levels for the endangered Laysan finch were based on the Incidental Take Statement in the USFWS 2009 Biological Opinion for the Issuance of a Permit to Conduct Field Research on Hawaiian monk seals (USFWS 2009c).

Table 4.4-5 Impact Criteria for Birds

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Altered survival or reproduction (other than Laysan finch)	Magnitude or Intensity	Changes in survival or productivity in one or more avian species over several years.	Changes in survival or productivity in one avian species over several years.	Changes in survival or productivity in one avian species during one year.	No measurable effects
	Geographic Extent	Regional effects observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effects
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely
Habitat loss or alteration	Magnitude or Intensity	Population level changes in one or more avian species over several years.	Sub-population or level changes in one avian species over one or two years.	Impacts to individuals observed during one year.	No measurable effect
	Geographic Extent	Regional impacts observed throughout the islands	Effects realized in multiple locations over several islands	Effects realized at one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Altered survival or reproduction of Laysan Finch	Magnitude or Intensity	Disturbance of more than 200 Laysan finch and/or more than 2 Laysan finch are incidentally injured per year.	Disturbance of 200 Laysan finch and/or incidental injury or mortality of two Laysan finch per year.	Disturbance of less than 200 Laysan finch and/or incidental injury or mortality of less than two Laysan finch.	No measurable effect
	Geographic Extent	Effects realized at Laysan Island and Pearl & Hermes Reef	Effects realized at Laysan Island and Pearl & Hermes Reef	Effects realized in one location	No measurable effect
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons	Periodic, temporary, or short-term changes that could be reversed in an annual or several season cycle	Periodic, temporary, or short-term changes that are reversed over one or two seasons	No measurable effect
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "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%.

4.4.3 *Impact Criteria for Socioeconomic Resources*

Table 4.4-6 presents a summary of mechanisms used to measure the effects that Hawaiian monk seal research and enhancement actions would have on the social and economic environment, 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 commercial fishing, subsistence fishing, recreational fishing, and recreation and tourism activities. Section 4.9 summarizes the anticipated direct and indirect effects under each alternative for these resources.

This analysis takes into account the economic and distributional effects of the various alternatives and their associated elements. The criteria in Table 4.4-6 specify the impact level in the context of existing socioeconomic activity. The impacts identified are translated into measures of overall expected changes in jobs, income, and quality of life in MHI.

The analysis of socioeconomic effects also discusses the distribution of effects of the proposed action – *e.g.*, what human populations are likely to be affected and

how, where the effects will occur, and what businesses or industries will be advantaged or disadvantaged.

Specifically, the analysis considers how certain elements of the alternatives would affect fishing and recreation/tourism in the MHI in terms of income and employment. It further looks into the specific populations that could be affected, such as commercial fishermen, residents involved in subsistence fishing, and residents and tourists recreating in the MHI. Social and economic effects are related to effects of an action or alternatives on human populations. Given that the NWHI is designated as the Papahānaumokuākea Marine National Monument (Monument), the only human presence relates to research. There are no recognized communities on these islands. Further, there are restrictions on commercial fishing in the NWHI. Therefore, social and economic effects of the Alternatives are unlikely in the NWHI, and this analysis focuses on the MHI.

For commercial fishing, the key indicator for measuring effects is the value of commercial landings, whereas effects on recreation/tourism and recreational fishing are largely based on the number of tourists or residents recreating in the MHI. Finally, effects on subsistence fishing are evaluated by looking at potential changes in the quantity of fish consumed for subsistence purposes and how that might vary across alternatives.

Table 4.4-6 Impact Criteria for Socioeconomics

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Effects on commercial fishing	Magnitude or Intensity	More than 10% increase or decrease in quantity and/or value of commercial landings	3% - 10% increase or decrease in quantity and/or value of commercial landings	Less than 3% increase or decrease in quantity and/or value of commercial landings	No measurable effects
	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood[1]	Likely	Likely	Somewhat unlikely	Unlikely
Effects on	~~Magnitude or~~	~~More than 10%~~	~~3% - 10%~~	~~Less than 3%~~	~~No~~

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
subsistence fishing	Intensity	change in quantity of fish consumed for subsistence	change in quantity of fish consumed for subsistence	change in quantity of fish consumed for subsistence	measurable effects
	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years)and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood	Likely	Likely	Somewhat unlikely	Unlikely
Effects on recreational fishing	Magnitude or Intensity	More than 10% change in number of recreational fishing trips	3% - 10% change in number of recreational fishing trips	Less than 3% change in number of recreational fishing trips	No measurable effects
	Geographic Extent	Effects realized in most of the MHI (over 50% of the MHI)	Effects realized in numerous locations in the MHI (10% - 50% of MHI)	Effects realized at few locations in the MHI (2% - 10% of MHI)	Effects realized at less than 2% of locations in MHI
	Duration or Frequency	Long-term (over 10 years) and/or frequent	Moderate (1 - 10 years) and/or intermittent	Short-term (1 month - 1 year) and/or periodic	Less than 1 month
	Likelihood[1]	Likely	Likely	Somewhat unlikely	Unlikely

[1] - "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%.

Impacts to cultural resources, including historic structures, archaeological sites, and traditional cultural properties, would be considered significant if they result in adverse effects to historic properties that are eligible for listing on the NRHP. Once a cultural resource is identified, the historic significance of the property must be evaluated in terms of its ability to meet the National Register criteria (36 CFR 800.4 [c][1]).

A cultural resource that meets the criteria is considered an historic property entitled to the consideration afforded by Section 106 of the NHPA, as outlined in the Advisory Council on Historic Preservation's implementing regulations (36 CFR 800). Impact to a traditional cultural property would be evaluated in terms

of the specific significance of the resource, and the potential for the proposed project to detract from that significance.

Table 4.4-7 Impact Criteria for Cultural and Historic Resources

Type of Effect	Impact Component	Impact Level			
		Major	**Moderate**	**Minor**	**Negligible**
Effects on Archaeological Sites	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility	Site is affected, but not adversely	Possible contact with site, but no effect	No measurable effects
	Geographic Extent	Effects realized throughout the project area	Effects realized in numerous locations	Effects realized 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[1]	Likely	Likely	Not likely	Not likely
Effects on Historic Structures	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility	Site is affected, but not adversely	Possible contact with site, but no effect	No contact with site
	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[1]	Likely	Likely	Not likely	Not likely
Effects on Traditional Cultural Properties	Magnitude or Intensity	Adversely affects the qualities that contribute to NRHP eligibility or that significantly impede traditional cultural practices	Property is affected, but not adversely; traditional cultural practices not significantly impeded	Possible contact with property, but no effect; no effect on traditional cultural practices	No contact with property

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
	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[1]	Likely	Likely	Not likely	Not likely

[1] - "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%.

Impact Criteria for Environmental Justice

According to 1997 CEQ guidelines, federal agencies must evaluate whether a proposed action would have a disproportionately high adverse impact on low income populations, minority populations or Indian tribes due to a proposed action (CEQ 1997a). Analysis of potential impacts may rely on available demographic data from credible sources such as the U.S. Census.

The criteria presented in Table 4.4-8 provide a scale on which to measure potential impacts of the proposed alternatives on military activities. Specific details and results of the analysis are presented in Section 4.9.7.

Table 4.4-8 Impact Criteria for Military Activities

Type of Effect	Impact Component	Impact Level			
		Major	Moderate	Minor	Negligible
Effects on military training and operational activities	Magnitude or Intensity	Year-round change in military use or operations	Seasonal change in military use or operations	Slight change of military use or operations	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	Long-term or permanent	Moderate and frequent or long-term and intermittent	Periodic, temporary, or short-term	No measurable effects
	Likelihood[1]	Likely	Likely	Not likely	Not likely

[1] - "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%.

4.5 STEPS FOR IDENTIFYING CUMULATIVE EFFECTS

To meet the requirements of NEPA, an EIS must include an analysis of the 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 greatest 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 follows:

> *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 non-federal) 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 PEIS, assessment of cumulative effects requires an analysis of the direct and indirect effects of the proposed research and enhancement alternatives, in combination with other past, present, and RFFAs potentially affecting monk seals 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.

Another purpose of this analysis is to assess the relative contribution the proposed action and its alternatives have on cumulative effects. The cumulative effects assessment then describes the additive and synergistic result of the research and enhancement alternatives as they are reasonably likely to interact with actions external to the proposed actions. The ultimate goal of identifying cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the alternatives.

The methodology used for cumulative effects analysis includes the steps outlined below. 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.

- *Identify issues, characteristics, and trends within the affected environment that are relevant to assessing cumulative effects of the 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 direct and indirect effects of the research and enhancement alternatives.* This information is presented in Chapter 4.

- *Define the spatial (geographic) and temporal (time) frame for the analysis.* This timeframe may vary between resources depending on 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 2021) for the purposes of this PEIS.

- *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 and 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 reasonably likely 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.

4.5.1 Relevant Past and Present Actions within the Project Area

Relevant past and present actions (federal and non-federal) and events are those that have influenced the current condition of a resource. For the purposes of this PEIS, past and present actions/events include both human controlled events (such as shipping or commercial fisheries), and natural events, such as predation. Table 4.5-1 provides a list of past actions and events considered in the cumulative effects analysis in this PEIS.

Table 4.5-1 Relevant Past and Present Actions within the Project Area

Action / Event	Region	Status	Source
Natural Events (Tsunami, Volcano, Earthquake, Hurricane)	Entire Project Area	Ongoing	NOAA
Climate Change	Entire Project Area	Ongoing	Hare and Mantua 2000; Friedlander *et al.* 2009; Minobe 1997; etc.
Research, enhancement and public display permits issued since 2000 (HMS only)	Entire Project Area	Ongoing	NMFS (APPS)
Research, enhancement and public display permits issued since 2000 (All species)	Entire Project Area	Ongoing	NMFS (APPS)
Whaling	Entire Project Area	19th Century	DLNR 2005
Guano mining	NWHI	19th and 20th Century	Rauzon 2001
Building islands using dredge and fill	NWHI	Mid 20th Century	Rauzon 2001
Feather poaching	NWHI	20th Century	Rauzon 2001
Military activities	Entire Project Area	Ongoing	DLNR 2005
LORAN station	NWHI	Mid 20th Century	DLNR 2005
Whale watching (tour boats)	MHI	On going	USN
Makaha 242-foot Reservoir No. 2	Wai`anae	Completed	HRC FEIS/OEIS 2008
Nānākuli 242-foot Reservoir	Wai`anae	Unknown	HRC FEIS/OEIS 2008
Wai`anae Wastewater Treatment Plan Modification	Wai`anae	Completed	HRC FEIS/OEIS 2008
Wailupe Stream Flood Control	East Honolulu	Underway as of 2008	HRC FEIS/OEIS 2008
Advanced Wastewater Treatment Upgrade	SBMR	2005	HRC FEIS/OEIS 2008

Action / Event	Region	Status	Source
Lā`ie Wastewater Collection System Expansion Phase II – Lā`ie	Lā`ie (adjacent to KTA)	2004	HRC FEIS/OEIS 2008
Kamehameha Highway Bridge Replacements	Kawela Camp Road, Kaukonahua Road (near SBMR)	Funded Through 2004	HRC FEIS/OEIS 2008
Waimanalo Treatment and Disposal System	Koolaupoko	Underway as of 2008	HRC FEIS/OEIS 2008
P-302 Dry Dock Ship Support Services	Dry docks 1 and 2, Bravo piers 1 and 2	2012	HRC FEIS/OEIS 2008
P-639 Construct Advanced SEAL Delivery System/SEAL Delivery Vehicle (ASDS/SDV) Operations Wharf	Wharf Victor 2	2013	HRC FEIS/OEIS 2008
FY09 MCON P-422 Advanced Radar Detection Laboratory (ARDEL)	PMRF	2009 and beyond	HRC FEIS/OEIS 2008
Rim of the Pacific (RIMPAC) Exercise	HRC	Ongoing	HRC FEIS/OEIS 2008
Long-range missile tests	HRC Temporary Operating Area, Department of Defense Test Ranges	Ongoing	HRC FEIS/OEIS 2008
Undersea Warfare Exercise (USWEX)	HRC	2007	HRC FEIS/OEIS 2008
Overseas Environmental Assessment (OEA) for MK 48 Advanced Capability Torpedo Service Weapons Tests in Hawaii	Hawaii	September 2008	HRC FEIS/OEIS 2008
Kailua Beach Park Improvements	Koolaupoko	Unknown	HRC FEIS/OEIS 2008
Queen's Beach Park	East Waikiki	Completed	HRC FEIS/OEIS 2008
Ka Iwi Shoreline Park	East Honolulu	Land acquisition complete	HRC FEIS/OEIS 2008
Banzai Rock Beach Support Park	North Shore	Underway as of 2008	HRC FEIS/OEIS 2008
Kaunala Beach Park	North Shore	Underway as of 2008	HRC FEIS/OEIS 2008
Kahawai Beach Support Park (including	North Shore	Underway	HRC FEIS/OEIS

Action / Event	Region	Status	Source
Sunset Beach Recreation Center)		as of 2008	2008
Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA)	Authorized (NOAA) for 6 missions within HRC	August 16 2008 - August 15, 2009	SURTASS
Introduction of Invasive species	Ongoing	Ongoing	HISC
Entanglement of Hawaiian monk seals in marine debris or fishing gear	Hawaiian Archipelago	Ongoing	NMFS
Intentional shooting, maiming, injury or other harm of Hawaiian monk seals	MHI	Ongoing	NMFS
National Historic Preservation Act	United States	1966	U.S. Government
A Bill for an Act Relating to Environmental Impact Statements (Act 50; "Hawai`i Cultural Impact Assessment Bill"; House Bill 2895; 20th Legislature; 2000)	Hawai`i	HB 402 (26th legislature) to take effect January 1, 2012	State of Hawai`i
A Bill for an Act Relating to the Environment (Act 294; "Hawai`i Environmental Justice Bill"; Senate Bill 2145; 23rd Legislature; July 10, 2006)	Hawai`i	2006	State of Hawai`i
Hawai`i Environmental Policy Act (HRS 343)	Hawai`i	1974	State of Hawai`i
EO 12898, Environmental Justice	United States	1994	U.S. Government

4.5.2 Reasonably Foreseeable Future Actions

RFFAs (federal and non-federal human-controlled actions and natural events) are those that:

- Have already been or are in the process of being funded, permitted, or described in coastal zone management plans;
- Are included as priorities in government planning documents; or
- Are likely to occur or continue based on environmental data, or historical patterns.

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 1.2 (Project Area Description).

Reasonably foreseeable future human controlled actions and natural events were screened for their relevance to the alternatives proposed in this PEIS. Because the regulations in 40 CFR 1508.8 state that the actions and events must be considered probable, not just possible, only those actions with an occurrence probability of high or medium have been included for analysis and shown in Table 4.5-2. Due to the large geographic scope of the Project Area, the identification of RFFAs was conducted on a broad scale, although some specific RFFAs were considered where applicable. Table 4.5-2 provides a list of RFFAs considered in the cumulative effects analysis in this PEIS. Also included in the following table is a list of resources that may potentially be affected (beneficially or adversely) by the activity. The resources listed are limited to only those that have been carried forward for analysis in this PEIS.

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Table 4.5-2 Reasonably Foreseeable Future Actions Within the Project Area

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Commercial							
Grid Upgrades	MHI (Oʻahu, Molokaʻi, Lānaʻi, Maui)	Planning	Scoping (PEIS)	NA	Medium	9, 11	HIREP
Undersea transmission cables	MHI (Oʻahu, Molokaʻi, Lānaʻi, Maui)	Planning	Scoping (PEIS)	NA	Medium	1, 2, 3, 4, 5, 6, 8, 9, 10	HIREP
Wind farm	MHI (Oʻahu, Molokaʻi, Lānaʻi, Maui)	Planning	Scoping (PEIS)	NA	Medium	7, 12	HIREP
Hawaiʻi Superferry	Interisland (MHI)	Suspended	Unknown	NA	Low	2, 3, 4, 10, 12	Hawaiʻi Department of Transportation
Kalaupapa NHP General Management Plan and EIS	Molokaʻi	In development	Draft	NA	High	11, 12	NPS
Pilot Aquaculture Project (Tuna cultivation)	In state marine waters off N. Kohala, Big island	Under review	Permitting	5 years after permitted	High	2, 6, 10	USACE
Permit to Authorize the Culture	Island of Hawaiʻi	Recently	Permitting	5 years	High	10	NMFS

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
and Harvest of a Managed Coral Reef Fish Species (Seriola rivolialla) in Federal Waters off the West Coast of the Island of Hawaii		permitted					
Residential & Commercial construction (beach, near shore)	Various	Ongoing		NA	High	1, 2, 3, 9, 10, 11, 12	DBED (Hawai`i) CIP List
Whale watching (Tour boats)	MHI	Ongoing		NA	High	1, 3, 4, 12	
Other Government Actions							
Draft Supplemental Environmental Impact Statement: Measures to End Bottomfish Overfishing in the Hawaiian Archipelago - March 30, 2006	Hawaiian Archipelago	Complete		Current	High	6, 8, 10	WPRFMC
Final Environmental Impact Statement Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (2005).		Complete	FEIS, ROD	Current	High	6, 8, 10	WPRFMC
Fishery Ecosystem Plan for the Hawai`i Archipelago	Hawaiian Archipelago	Complete	FEP	Current	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14	WPRFMC
Hawaiian Islands Humpback Whale National Marine Sanctuary Management Plan Revisions	Hawaiian Archipelago		Development of Draft Revisions	2010 - 2014	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Hawaiian Spinner Dolphin Human Interaction	MHI	Ongoing	DEIS/Proposed Rule	Current	High	1, 3, 4, 12	NOAA
Hawaiian Monk Seal Critical Habitat Revisions	Throughout Hawaiian monk seal range	Ongoing	Proposed Draft Rule	Current	High	1	NOAA
Maritime Heritage Conservation and Management Activities	NWHI (Monument)	Ongoing		Summer/Fall 2011	High	11	PMNM
State of Hawai`i DLNR. Clearing of rivers, streams, beach areas	Various	Ongoing		Ongoing	High	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12	USACE
Military Activities							
15806 MMPA Small Take Letter of Authorization: U.S. Navy Training in the Hawai`i Range Complex	Pacific Ocean; State/Territory: HI; Pacific (235,000 nm2 around the Main Hawaiian Islands	Current		Jan. 2011-Jan. 2012	High	4, 14	USN
Hawaii-Southern California Training and Testing EIS/OEIS	Within Hawai`i Range Complex	ongoing NOI July 2010	DEIS	2011	High	1, 2, 3, 4, 5, 6, 9, 10, 12, 14	SURTASS
Joint High Speed Vessel (JHSV)	Proposed home port: Pearl Harbor	Planning	EIS	NA	Medium	1, 3, 4, 10, 12, 14	USAEC, Sierra Club
Supplemental EIS Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA)	NA	NOI January 2009	DEIS	Current	High	4, 5, 14	USN

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
US PAC COM naval exercises (RIMPAC)	Hawai'i	Ongoing	NA	Biennially even numbered years (June - July)	High	1, 2, 3, 4, 5, 6, 9, 10, 12, 14	USN
Natural Events							
Climate Change	Entire Project area	Ongoing		Ongoing	High	All	Various
Natural Events (Tsunami, Volcanic eruption, Earthquake, Hurricane)	Entire Project area	Ongoing		NA	Medium	All	Various
Introduction of Invasive species		Ongoing		Ongoing	Medium	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	HISC
UNESCO World Heritage Site Monument	NWHI (Monument)	Ongoing		Designated 2010	High	11	UNESCO
Scientific Research							
10653 Measuring the hearing of stranded cetaceans in U.S. waters, beaches and rehabilitation centers using the evoked auditory potential procedure	U.S. beaches and rehabilitation centers; primary location is Hawaii	Permit Application		FR notice published May 17, 2011; will replace Permit No. 978-1791	High	4	NOAA
15330 Studies of population size, population structure, habitat use, movements, behavior and ecology of cetaceans in the Pacific Ocean	Pacific Ocean including U.S. states (AK, WA, OR, CA, HI), territories (*e.g.,* Palmyra, American	Permit Application		Application in process; FR pub. 2/25/11 will replace Permit No. 731-1774 (exp. 8/31/11)	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	Samoa, Guam, Wake), and International waters)						
15409 MMPA General Authorization for Scientific Research: Population and photo-id studies of small cetaceans in the Pacific Islands	Pacific Ocean; States/Territories: AS, HI (Nearshore waters of HI islands EEZ and American Samoa)	Permit		June 2010 - June 2015	High	4	NOAA
15453 Scientific Research Relating to Enhancing the Survival of the Hawaiian monk seal (*Monachus schauinslandi*) under the Marine Mammal Protection Act and the Endangered Species Act.	Waikiki Aquarium, University of Hawai`i 2777 Kalakaua Avenue Honolulu, HI 96815	Permit Application		Application in process; FR published 1/27/11; will replace Permit No. 455-1760 (exp. 5/31/11)	High	1, 3, 7, 12	NOAA
15685 Ocean capture research of green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles in the Hawaiian Islands to determine growth rates, health status, stock and population structure, foraging ecology, habitat use, and movements.	Coastal waters (bays, reefs, canals, etc.). Most of the study sites are accessed by land, the exception being Kaneohe Bay, which is accessed by boat. Public beach accesses, private residences,	Permit Application		Application in process; FR notice published 2/14/11; will replace Permit No. 1581 (exp. 12/31/11)	High	3	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	hotel and resort beaches, and State and National Parks are used.						
16163 Studies of movements, habitat use, ecology, behavior, and risk factors of cetaceans in the Pacific Ocean	Pacific Ocean: WA, OR, CA, HI, AK, High Seas North Pacific Ocean	Permit Application		Application in process; received 1/25/11 (FR notice not published yet)	High	4	NOAA
Activities to Enhance Understanding of Hawaiian Monk Seal Foraging Ecology at Nihoa Island	Nihoa Island	Permit Application		2011-2012	High	1, 3, 6	PMNM
Amendment 14 and Final Supplemental Environmental Impact Statement; Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region (Dec 2007)		Permit Application		Current	High	6, 8, 10	NOAA
Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems	NWHI (Monument)	Permit Application		July-August 2011	High	2	PMNM

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
Analysis of Carbonate Chemical Make-up of Waters Surrounding Atoll Systems	NWHI (Monument)	Permit Application		July- Aug 2011	High	2	PMNM
Application for a Permit for Scientific Research or to enhance the survival or recovery of a stock *(sic: whales and dolphins)* under the Marine Mammal Protection Act and the Endangered Species Act	Off the western end of O'ahu, and in the Au Au Channel, in the Four-Island Region of the Hawaiian Main Islands.	Permit Application		2010-2015	High	4	NOAA
Assessing distribution and abundance of marine mammals on Navy operational area A, instrumented ranges and adjacent waters using surface vessel surveys, photo identification, videography, and acoustic recording	Federal and state waters around the main Hawaiian Islands and Northwest Hawaiian Islands, including the Hawaiian Islands Humpback Whale National Marine Sanctuary and Monument	Permit Application		2010-2015	High	1, 3, 4, 5	NOAA
Bathymetric Mapping of the Intersection of Necker Ridge with the Hawaiian Ridge	Necker Ridge to Hawaiian Ridge	Permit Application		Scheduled to end early summer 2011	High	3, 4, 5, 6	PMNM
Behavior and biology of humpback whales in the Pacific Ocean,	Hawaiian Islands Exclusive	Permit Application		2010-2015	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
primarily off Hawai`i and Alaska	Economic Zone; waters off Hawai`i (main study area						
Behavior, social organization and communication in humpback and gray whales in Hawaii, Alaska and Washington	Coastal waters of the main Hawaiian Islands	Permit Application		2010-2014	High	4	NOAA
Comparison Study of the Biological Community Structure and Diversity of Maritime Heritage Resource Sites	NWHI (Monument) (Exact itinerary not set)	Permit Application		June- Aug 2011	High	11	PMNM
Coral Reef Bioerosion Rates as Indicators of Community Response to Ocean Acidification	Shallow water reefs with NWHI / Monument - exact locations not set	Permit Application		May 2011 - Nov 2011	High	8	PMNM
Determine prevelance of disease on coral reefs in shallow waters	Shallow waters throughout NWHI (Monument)	Permit Application		May - Sept 2011	High	8	PMNM
Efforts to Increase Juvenile Monk Seal Survival	NWHI (Monument)	Permit Application		2011-2012	High	1, 3, 7, 12	PMNM
Genetic Surveys to Address the Level of Isolation Between Shallow and Deep Reef Ecosystems	NWHI (Monument)	Permit Application		May-Oct 2011	High	1, 2, 3, 4, 5, 6, 7, 8	PMNM
Humpback whale research	Maui, Molokai, Lanai, and	Permit		2008-2013	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	Kahoolawe.	Application					
Incidence and Effects of Coral and Fish Disease within Shallow Water Reefs	Shallow water reefs throughout NWHI (Monument)	Permit Application		May-Sept 2011	High	6, 8	PMNM
Installation and maintenance of four infrasound elements on Midway Atoll National Wildlife Refuge to monitor the Comprehensive Test Ban Treaty	Sand island Midway Atoll	Permit Application		Sept 2009 - Sept 2014	High	7, 9	PMNM
Long term monitoring Laysan & black footed albatross	Midway, French Frigate, Laysan	Permit Application	renewal	2011-2012	High	7	NOAA
Monitoring of Red-footed, Brown, and Masked Boobies from Midway Atoll and French Frigate Shoals	Tern Island, FFS, Eastern Island, Midway Atoll NWR	Permit Application		Dec 2010 - Dec 2015	High	7	PMNM
Monitoring shark activity on selected monk seal pupping sites	French Frigate Shoals	Permit Application	renewal	Spring/Summer 2011	High	1, 5	PMNM
Pacific Reef Assessment and Monitoring Program	NWHI (Monument) - shallow water	Permit Application		July-Aug 2011	High	8	PMNM
Permit to conduct level B harassment and biopsy sampling of cetaceans in Hawaiian waters	leeward coast of the island of Hawai`i	Ongoing		2007-2012	High	4	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
PR 1 Permit #1071-1770 Long-term population studies of cetacean species in the Eastern, Western and Central North Pacific Ocean	Main study area is Hawai`i; permit includes waters along the rim of the Pacific from CA northward to southeast AK, westward through the Gulf of AK, Aleutian Islands and regions of the upper Pacific.	Ongoing		2/9/2006 - 2/28/12; will be replaced by File No. 16053	High	4	NOAA
PR 1 Permit #731-1774 Baird - cetacean scientific research	Pacific Ocean (Hawai`i, California, Oregon, Washington, Alaska, other U.S. territories and international waters of the Pacific Ocean)	Ongoing		Expires 8/31/2011 (will be replaced by File No. 15330)	High	4	NOAA
PR 1 Permit #932-1905 research/enhancement	Beaches, coastal waters of the US, waters within the US EEZ, and international waters; world-wide import/export; U.S. rehabilitation and captive	Ongoing		6/30/2009 - 6/30/2014	High	1	NOAA

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
	facilities						
PR 1 Permit #978-1791 Auditory research on stranded and rehabilitating cetaceans	U.S. waters and rehabilitation facilities; primary location is Hawai`i	Ongoing		2/9/2006 - 2/28/12; will be replaced by File No. 16053	High	4	NOAA
PR1 Permit #587-1767 scientific research (To continue studies of long-term social affiliations among humpback whales)	Alaska/ Hawai`i	Ongoing		2005-2011	High	4	NOAA
PR1 Permit #978-1857 scientific research: examination of basic hearing and echolocation processes in odontocete cetaceans	Hawai`i; floating pens on the leeward side of Coconut Island in Kaneohe Bay at the Hawai`i Institute of Marine Biology, O`ahu Hawaii	Ongoing		2007 - 2012	High	4	NOAA
Quantify movement & ecology of top predators (sharks & large fishes)	NWHI (Monument)	Ongoing		May - Oct 2011	High	5, 6	PMNM
Relative Role of Terrestrial Sources of Nutrients for Algae and Bivalve Product.	NWHI (Monument)	Permit application		Permit applied for (2010); still under review by	High		PMNM

RFFA	Region	Status	Phase (if applicable)	Time Frame	Probability	Relevant Resource(s) Potentially Affected	Source
				co trustees			
Retrieval of Ecological Acoustic Recorders (EARs) in Deep Marine Areas	Kure, Lisianski, FFs, Nihoa	Ongoing		NA	High	1, 3, 4, 5	PMNM
Tuna Tagging	Primarily around NOAA Weather monitoring buoys in MHI	Ongoing		Ongoing	High	6	PFRP (SOEST)

Resource Key:

1 – Hawaiian monk seals	2 – Water Quality	3 – Sea Turtles	4 – Cetaceans	5 – Sharks
6 – Other Fish Species	7 – Birds	8 – Coral	9 – Invasive Species	10 – Fishing (Commercial, Recreational & Subsistence)
11 – Cultural & Historical	12 – Recreation & Tourism	13 – Environmental Justice	14 – Military Activities	NA - Not available

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). Under CEQ regulations for implementing NEPA:

- "Direct effects" are effects that are caused by the action and occur at the same time and place (40 CFR 1508.8[a]).
- "Indirect effects" are 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 only consider indirect effects that are "reasonably foreseeable." Several of the resources and characteristics described in Chapter 3 may contribute to cumulative effects but would not be affected measurably by any of the alternatives for Hawaiian monk seal research and enhancement measures. Thus, additional analysis of these resources would not be useful to the decision makers or public.

As described in Section 2.6 Alternatives Carried Forward for Analysis, the range of Hawaiian monk seal research and enhancement activities proposed could include:

- Conducting land-based, vessel, and aerial surveys and observations;
- Mitigating infectious disease, and fishery and human/domestic animal interactions;
- Translocating seals to improve survival;
- Translocating seals to alleviate male aggression, and mitigating adult male aggression using chemical intervention;
- De-worming seals and providing supplemental feeding; and
- Capturing, restraining and handling seals for marking and attaching scientific instruments, measuring, and sampling (*e.g.,* for health and genetics).

None of these activities would have a measurable effect on the resources described below. The following subsections present each resource or factor not carried forward for detailed analysis.

4.6.1 *Physical Environment - Circulation Patterns, Water Temperatures and Nutrient Regimes, Air Quality, Climate Change*

None of the research and enhancement alternatives would be expected to have any effects on the circulation patterns in the Pacific Ocean, water temperatures and nutrient regimes, or air quality. Therefore, detailed analysis for these parameters under the alternatives is not warranted. In addition none of the proposed project alternatives would be expected to induce measurable effects on climate change. However, climate change is being considered from the perspective of cumulative effects. The potential effects of climate change generated by other sources are evaluated as part of the cumulative effects analyses for each resource evaluated in Chapter 4.

4.6.2 *Sharks*

As described in Section 3.3.4, approximately 40 species of sharks are found in Hawaiian waters. None of the proposed Hawaiian monk seal research and enhancement alternatives covered by this PEIS and that would occur in the coastal waters surrounding the Hawaiian Islands is likely to have direct or indirect effects on sharks. Researchers accessing beaches and inshore areas by small boat to observe, capture, handle or transport Hawaiian monk seal would not be likely to disturb pelagic sharks. Research vessels might encounter sharks while traveling in small or large vessels between islands to areas where Hawaiian monk seal are located, but any encounters are not expected to impact sharks. In addition it is not expected that the small increase in numbers of monk seal pups that could be realized in the MHI under Alternative 4 would attract additional large numbers of sharks.

As described in Table 1.6-1, NMFS currently has a permit for "Decreasing or Eliminating Predation of Pre-weaned Hawaiian Monk Seal Pups by Galapagos Sharks in the NWHI" (NMFS Permit PMNM-2010-014). This activity is not part of the proposed research and enhancement actions covered by this PEIS, and it has been documented under a separate NEPA process (Section 1.6).

4.6.3 *ESA-Listed Plants*

Proposed Hawaiian monk seal research and enhancement activities would have no effect on any of the endangered plants that occur in the NWHI or MHI (NMFS Permit File No. 10137 - Effects to USFWS Species). The proposed activities would be located in coastal waters on the beach or within 5 m inland of the splash zone. Field research camps in the NWHI are located further inland than this immediate shoreline area.

Some listed plants may occur near field camps or trail paths leading to beaches where monk seals haul out. These species are threatened by human disturbance and are known to exist in areas where humans access beaches. Monument Permit

PMNM 2011-001 (Appendix G) allows NMFS researchers to enter the Monument to conduct research and enhancement activities, and covers field camp support and supply activities. Although the permit does not specifically identify procedures for protecting ESA-listed plants, NMFS would take all precautions necessary to avoid contact with these plants. This includes training biologists on the identification and locations of such plants and working with the USFWS to develop a training protocol to implement for work in the MHI (similar to that implemented for work in the NWHI). When accessing beaches by foot, researchers would stay on the path where no vegetation occurs. When accessing beaches by boat, they would only land on sandy beaches below the vegetation line. It would be highly unlikely that research biologists would encounter coastal ESA-listed plant species, or they would be easily avoidable.

4.6.4 Sanctuaries, Monuments, and Refuges

As described in Section 3.4.11 Sanctuaries Monument and Refuges, the State of Hawai`i has a system of conservation areas that include wildlife and marine sanctuaries, monuments, parks, refuges, natural area reserves, and marine life conservation districts (MLCDs). The jurisdictional authorities for these public lands are described in Section 3.4.11. The majority of these areas are federally managed; however the MLCDs are managed by the state. Some of the proposed research and enhancement activities could occur on or near Hawaiian shorelines and waters that fall under one or several of these special designations.

Whether under state or federal jurisdiction, these areas are protected; therefore, research and enhancement activities that would access coastal or refuge lands would require permits and/or approvals for access to these areas. For example, research scientists wishing to work within the Monument are required to obtain a Research Monument Permit (PMNM 2011-001 see Appendix G). The permit allows the permit holder to conduct their permitted activities within the Monument. For work within the state protect areas, a Special Activity Permit for Scientific, Educational or Propagation Purposes is required under HRS 187A-6. The permit allows any person with a bona fide scientific, educational or propagation purpose to legally take certain aquatic life, use certain gear, and gain entrance into certain areas otherwise prohibited.

The permit applications required in sanctuaries, monuments and refuges must go through a public process as well as regulatory and agency reviews. Thus, impacts to protected lands and waters from research and enhancement activities are not expected because of imposed requirements such as mitigation to avoid adverse effects to these areas. Also, none of the proposed alternatives would be expected to affect or change the designations of these protected areas in any way. Therefore, sanctuaries, monuments and refuges are not carried forward for detailed analysis.

4.7 ELEMENTS COMMON TO ALL ALTERNATIVES

This section presents requirements of Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) permits that are common to all alternatives and includes information on the duration of permits, reporting requirements, mitigation and permit conditions, and monitoring.

4.7.1 Duration of Permits

Scientific research and enhancement permits may be issued for a maximum of five years from the date of issuance (50 CFR 216.35[b]). The five-year period may be extended by a minor amendment up to 12 months beyond that established in the original permit, but such extension by a minor amendment may not authorize an increase in the number of animals taken, or changes to the geographic locations or species (50 CFR 216.39).

4.7.2 Reporting Requirements

Permit Holders must submit annual, final, and special reports in accordance with requirements established in the permit and any reporting format established by the Director, NMFS Office of Protected Resources (50 CFR 216.38).

Annual reports must be submitted to the Chief, Permits, Conservation and Education Division (hereinafter "Permits Division"), Office of Protected Resources at the conclusion of each year for which a permit is valid. Annual reports are due 90 days after the end of each reporting period (either a calendar year or a 12-month period determined by field seasons). Each annual report must include the following information:

- A table reporting the actual number of animals taken for research and enhancement purposes, by activity and location;
- The number and type of non-permitted species caught, harassed, or otherwise taken, and the observed effects of such taking;
- Any problems or unforeseen effects encountered during the permitted activities and steps taken or proposed to resolve such problems;
- Measures taken to minimize effects of permitted activities on animals and the effectiveness of these measures;
- Circumstances surrounding unintentional injuries or deaths of animals, and a description of how the animals were disposed of if not in the way described in the permit;
- The physical condition of animals taken and used in the permitted activities;

- The effects permitted activities had on animals, including any unforeseen responses or effects;

- Steps taken to coordinate the permitted activities with other permit holders;

- Preliminary findings and an indication as to whether the goals of the permitted activities were accomplished;

- Titles of reports, publications, etc. resulting from the reporting period with copies of all final documents and publications submitted as available.

- Any incidental (non-research related) use of photographs, film, or other images (*e.g.*, on websites, in commercial publications or documentaries).

Special or "incident" reports are required for events such as serious injury, mortality, and exceeding authorized take. Incident reports must be submitted to the Chief, Permits Division within two weeks of the incident. Such reports must include a description of the events and identification of steps that will be taken to reduce the potential for additional research-related mortality or exceeding authorized take.

Final reports must be submitted within 180 days after conclusion of research or expiration of the permit. Final reports must include the following information:

- Findings relative to the hypothesis, questions, or objectives in the permit application; this includes a description of how project goals were accomplished or an explanation of why they were not accomplished;

- A description of how the research or enhancement benefited the species, promoted recovery, or conserved the target species and fulfilled objectives listed in the Recovery Plan;

- Any problems or unexpected outcomes with the authorized methodologies or gear; and if permitted to use different methods, which worked best and why;

- A qualitative and quantitative description of the types of reactions target and non-target animals had as a result of researcher's actions, and whether the permitted activities had any effects on habitat;

- Whether the mitigation measures employed during permitted activities were successful in minimizing or avoiding adverse impacts to target and non-target species, and any additional measures that might further minimize reactions;

- Efforts made to share data or collaborate with other researchers during the course of the permit and a description of how the collaborations occurred;
- Publications or reports not listed in annual reports;
- Any new directions for future studies identified as a result of the research or enhancement;
- Any new or emerging technologies that could be used to further the research or enhancement; and
- An explanation of any permit conditions that were difficult to comply with or were unclear; and whether the take numbers requested in the permit application were accurate and realistic.

4.7.3 Mitigation and Conditions of Permits and Authorizations

Scientific research and enhancement permits issued under the MMPA and ESA require researchers to abide by certain general terms and conditions based on requirements of the statutes and regulations. Activities authorized in a permit must occur by the means, in the areas, and for the purposes set forth in each permit application, and as limited by the terms and conditions specified in a permit. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

All research and enhancement permits contain the following types of permit terms and conditions: duration of permit; number and kinds of protected species, locations and manner of taking; qualifications, responsibilities, and designation of personnel; possession of permit; reports; notification and coordination; observers and inspections; permit modification, suspension, and revocation; penalties and permit sanctions; and acceptance of permit.

Descriptions of how mitigation measures would be incorporated into the research and enhancement programs must be included in the permit applications and are presented in Section 2.6 for the various alternatives. Incorporation of terms and conditions in a permit also helps to mitigate possible adverse impacts to animals from the permitted activities.

In addition to general terms and conditions common to all research and enhancement permits, there are a number of special conditions for activities conducted on pinnipeds, and specifically on Hawaiian monk seals. These are found within the conditions pertaining to the manner of taking. The section below details both the general and special terms and conditions common to permits issued under each alternative.

4.7.3.1 *Duration of Permit*

Permits expire on the date specified in the permit (not more than five years after issuance) and are non-renewable. As described in Section 4.7.1, the Director, NMFS Office of Protected Resources, may extend the permit by one year via a minor amendment.

Researchers are required to suspend permitted activities if serious injury or mortality of protected species reaches that allowed in the permit, or if authorized take is exceeded; in any case, an incident report must be submitted to the Permits Division. Authorization to resume activities is based on review of the report and in consideration of the terms and conditions of the permit.

4.7.3.2 *Number and Kinds of Protected Species, Locations and Manner of Taking*

Each permit contains a table outlining the number of animals authorized to be taken (by species and stock), and the locations, manner, and time period in which they may be taken.

Researchers working under a permit may take photographs and video to document the permitted activities, provided it does not result in takes of protected species. Photos and other media may be used in printed materials (including commercial or scientific publications) and presentations; a statement citing the permit number under which the media was collected must accompany the images.

The Chief, Permits Division may authorize photography, filming, or audio recording activities not essential to achieving the objectives of the permitted activities (*e.g.*, a documentary film crew may accompany researchers to film seals). These activities must not influence the research or enhancement or result in takes of protected species. The Permit Holder and researchers cannot require compensation in return for allowing non-essential personnel to accompany researchers.

Researchers must comply with the following special conditions related to the manner of taking Hawaiian monk seals. These conditions pertain to the current research and enhancement permit (10137) and would apply to future permits:

- Carry out permitted activities efficiently and use biologists experienced in capture and sampling techniques to minimize handling time and disturbance.

- Whenever feasible, only take target animals when no other seals are in the immediate vicinity, particularly mother/pup pairs; move carcasses to a secure area during necropsies to avoid disturbance to seals; and not retrieve carcasses or samples (*e.g.*, scat, spew, molt) when other seals are in the immediate vicinity.

- Immediately cease activities if there is any evidence that the actions may be life threatening to a seal, including but not limited to, a seal showing signs of acute stress or protracted alarm reaction that may lead to serious injury, capture myopathy, other disease conditions, or death. In the event a seal has an adverse reaction, researchers must monitor and/or treat the animal as determined appropriate by the attending veterinarian, principal investigator (PI) or a co-investigator (CI).

- Researchers must minimize disturbance when approaching seals, particularly mother/pup pairs, and an approach or other activity must be stopped if there is evidence that the activity may be interfering with the mother/pup behavior, nursing, or other vital functions of any animal.

- If a pup is orphaned as a result of permitted activities, the pup must be humanely provided for (*i.e.*, placed in a Stranding facility for rehabilitation or humanely euthanized). Any rehabilitation of pups must be done in consultation with the Marine Mammal Health and Stranding Response Program (MMHSRP) and under the authority of the MMHSRP permit. Pups that are euthanized count against the total number of animals authorized for accidental mortality in the permit.

- Only experienced, well-trained personnel may perform intrusive procedures. For activities involving the use of sedatives, an experienced marine mammal veterinarian must be present.

- Researchers must use sterile disposable needles, biopsy punches, and other sampling tools to the maximum extent practicable and clean and disinfect all non-disposable equipment.

- Researchers must monitor seals that have been captured, treated, or are recovering from immobilizing drugs to ensure they resume normal behavior and have an opportunity to recover without risk of drowning or injury from other animals.

- Without causing further disturbance of seals and whenever possible, researchers must monitor seals following any disturbance.

- In the event any seal is seriously injured, dies or is euthanized, an incident report must be submitted to the Chief, Permits Division.

The following conditions pertain to conducting de-worming treatments:

- The Permit Holder must provide information to the Permits Division on how the treatments proceeded; any logistical problems encountered; observed short-term effects of the drugs and any follow-up observations; and any observed impacts to non-target species.

- If there is any indication that handling, treatments, or any other artifact of the de-worming study has compromised the health and welfare of seals, researchers must halt treatments, contact the Chief, Permits Division, and submit an incident report. Authorization to resume treatments is based on review of the incident report and in consideration of the terms and conditions of the permit.

- Prior to initiating full-scale de-worming treatments of up to 200 animals annually, the Permit Holder must provide evidence that treatments administered during the experimental phase are beneficial and have no significant adverse effects to seals and non-target species.

The following conditions pertain to conducting permitted euthanasia of moribund seals or aggressive adult male seals:

- Over the five-year period, up to 10 moribund seals may be humanely euthanized if an experienced on-site veterinarian determines that there is a high probability of the death of the animal due its condition.

- As a last resort to remove adult males known to seriously injure or kill other seals, up to 10 adult male seals may be humanely euthanized over the five-year period of the permit.

- In all cases, an experienced veterinarian must conduct the euthanasia and after necropsy, all parts not retained must be collected for environmentally safe disposal.

The following conditions pertain to translocations of Hawaiian monk seals within the Northwestern Hawaiian Islands:

- The Permit Holder must submit a written incident report in the event a seal dies, is seriously injured, or experiences health problems during the translocation process.

- The Permit Holder must submit information with the annual report regarding the number of seals translocated, their health and disease status, and a summary of post-release survival and behavior.

All disentanglements and necropsies, and any relocations of seals within the Main Hawaiian Islands, must be conducted in coordination with the NMFS Pacific Islands Regional Office Stranding Coordinator.

For health assessment sampling and instrumentation captures, annually up to 10 animals may be captured, released/not fully processed, and recaptured for full processing (to account for failed capture/processing attempts).

Up to 500 spinner dolphins may be taken annually by Level B harassment incidental to research and enhancement activities in the Northwestern Hawaiian Islands.

The following are U. S. Fish and Wildlife Service (USFWS) conditions for researchers working in the NWHI:

- Walking is prohibited on all beaches, from dusk to dawn, where adult sea turtles rest.
- All field camps must use maximum light control (shading, minimum wattage, etc.).
- All field camps must avoid disorienting hatchling turtles.

Researchers must comply with the following conditions related to methods of captive care and transportation of seals, as applicable:

- Hawaiian monk seals must be maintained in captivity and transported in compliance with the provisions of the Animal Welfare Act (AWA) and AWA implementing regulations.
- Contingency plans must be in place to prevent escape from temporary pens (*e.g.*, during extreme weather events) and to respond to escape (*e.g.*, search surveys).
- Prior to removing adult male seals from the wild into permanent captivity, a facility to permanently house the seal(s) must be identified,, and plans for temporary care of the animals prior to transfer to the permanent facility, if needed, must be submitted.

All research and enhancement permits authorizing sample collection have requirements for the disposition of marine mammal parts/biological samples, outlined in Appendix H.

4.7.3.3 Qualifications, Responsibilities, and Designation of Personnel

All research and enhancement permits identify by name the researchers (PI and CIs) authorized to participate in the permitted activities. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under a permit are as follows:

- The Permit Holder is ultimately responsible for activities of individuals operating under the authority of a permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the

institution/facility who is responsible for the supervision of the Principal Investigator.

- The PI is the individual primarily responsible for the taking, import, export and related activities conducted under the permit. The PI must be on site during activities conducted under this permit unless a CI is present to act in place of the PI.

- CIs are individuals who are qualified to conduct activities authorized by the permit without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.

- Research Assistants (RAs) are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI and are not named in the permit.

Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to:

- Individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of vessels or aircraft);

- Individuals included as backup for essential personnel; and

- Individuals included for training purposes.

Persons who require state or Federal licenses to conduct activities authorized under a permit (*e.g.*, veterinarians, pilots) must be duly licensed when undertaking such activities.

Permitted activities may be conducted aboard vessels or aircraft or in cooperation with individuals engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities, except with written approval of the Chief, Permits Division (*e.g.*, for documentary film making).

The Permit Holder cannot require or receive direct or indirect compensation from persons requesting to conduct activities under the permit. The Permit Holder or PI may designate additional CIs and must provide a copy of the letter designating the individual to the Permits Division on the day of designation.

4.7.3.4 Possession of Permit

Permits cannot be transferred or assigned to any other person. The Permit Holder and persons operating under the authority of a permit must possess a copy of the permit when engaged in a permitted activity. A duplicate copy of the permit must be attached to any container, package, enclosure, or other means of

containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

4.7.3.5 Reports

As described in Section 4.7.2 above, Permit Holders must submit annual, final, and incident reports, and papers or publications resulting from the activities authorized by a permit. Incident reports are due within two weeks of the incident. Annual reports are due 90 days after the end of each permit year, and final reports are due 180 days after the expiration of the permit or conclusion of research or enhancement. Section 4.7.2 presents information required in permit reports.

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

4.7.3.6 Notification and Coordination

Permit Holders must provide written notification of planned fieldwork to the Pacific Islands Assistant Regional Administrator for Protected Resources at least two weeks prior to initiation of a field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

Permit Holders must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals.

4.7.3.7 Observers and Inspections

At the request of NMFS, the Permit Holder must allow an employee of NOAA or another designated other person to observe permitted activities. The Permit Holder must; provide documents or other information relating to the permitted activities upon request.

4.7.3.8 Modification, Suspension, and Revocation

Permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

The Director, NMFS Office of Protected Resources may modify, suspend, or revoke a permit in whole or in part:

- To make the permit consistent with a change in the regulations prescribed under section 103 of the MMPA and section 4 of the ESA;
- In a 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 that the application or other information pertaining to the permitted activities includes false information; and
- If NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

Issuance of a permit does not guarantee or imply that NMFS will issue or approve subsequent permits or amendments for the same or similar activities requested by a Permit Holder, including those of a continuing nature.

4.7.3.9 Penalties and Permit Sanctions

A person who violates a provision of a permit, the MMPA, ESA, or the regulations at 50 CFR 216 and 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA, ESA, and 15 CFR part 904.

NMFS is the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in a permit. The Permit Holder must contact the Permits Division for verification before conducting an activity if they are unsure whether an activity is within the scope of the permit. Failure to verify, where NMFS subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

4.7.3.10 Acceptance of Permit

When a permit is issued by signature of the Director, Office of Protected Resources, the Permit Holder must date and sign the permit, and return a copy of the original signature to the Office Director. The permit is effective upon the Permit Holder's signing of the permit.

In signing a permit, the Permit Holder:

- Agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 216, and 222-226, and all restrictions and requirements under the MMPA, and the ESA;

- Acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and

- Acknowledges that the permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with other Federal, State, local, or international laws or regulations.

4.7.4 Monitoring

All NMFS permits for research on pinnipeds require permit holders to conduct post-activity monitoring without causing further disturbance. As indicated above, Permit Holders conducting research on Hawaiian monk seals are required to monitor captured or sampled animals for signs of acute stress or injury, monitor the effects of administering drugs, and to monitor haulouts following any disturbance. The results of such observations are to be included in reports submitted to the Permits Division. Monitoring protocols designed for the proposed research and enhancement activities are presented in Chapter 5 and Appendix E.

4.8 BIOLOGICAL ENVIRONMENT

4.8.1 Hawaiian Monk Seals

This section presents the analyses of the effects of the four different research and enhancement alternatives on Hawaiian monk seals. The general methodology for performing this assessment is introduced in Section 4.4. However, a description of the Hawaiian monk seal-specific analysis is presented here in more detail. The alternatives represent discrete sets of research and enhancement activities varying in scope, each with a range of research and enhancement techniques and intensities that could be authorized by NMFS F/PR1.

Research and enhancement activities on endangered species are intended to determine factors limiting recovery, design intervention measures and execute those measures, evaluate their efficacy and repeat the process as warranted. However, any research and enhancement activity that has the potential to disturb animals has some risk of adverse effect for animals exposed. Animals disturbed by research and enhancement may exhibit a variety of behavioral and physiological responses that could result in injury, reduced reproductive success, 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 and enhancement activity there are one or more possible responses from the animals. For some research and enhancement activities (*e.g.,* aerial surveys) most monk seals exhibit no observable response, although it is possible they may have elevated adrenaline levels or other internal stress responses. For research and enhancement activities that require the presence of researchers on land near monk seals, most animals will remain sleeping undisturbed, others will simply watch researchers, and others may move their bodies, vocalize or enter the water.

Seals that are captured and handled will be subject to additional types of stress and risks compared to those that are simply observed. 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 approach and handling technique of the researchers, timing and location of the research or enhancement activity, and environmental factors such as sea conditions and weather. Each research and enhancement activity therefore has inherent potential risks, which are influenced by all the above factors.

Potential population- or species-level impacts could result depending on the nature of all individual responses and the number of animals involved. The effect of exposure to a variety of research and enhancement procedures may be additive or synergistic (*i.e.,* the effect of two or more procedures combined could be greater than simply adding them together). 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 program protocols and the relevant permits.

The analysis of the direct and indirect effects of research and enhancement activities is divided into three major components:

- An assessment of research- and enhancement-related injuries that lead to serious injury or mortality;
- An assessment of research and enhancement-related effects on reproductive success; and
- An assessment of how well each alternative research and enhancement strategy would address recovery and conservation objectives for the species.

Potential positive effects of research and enhancement are evaluated based on the project's likelihood of contributing to the 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.

4.8.1.1 *Assessment of Direct and Indirect Mortality Due to Research and Enhancement*

There are many potential mechanisms for research and enhancement-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, so attributing the fate of an animal to a particular factor is often highly uncertain. The key question for this impact assessment is whether or not effects on individuals translate into population-level effects such as population growth rate.

The following begins with an extensive narrative describing the potential or hypothetical ways that the research and enhancement activities represented in the various PEIS alternatives (see Chapter 2) might effect survival of individual seals. Following that, available information from published studies, publications in development and unpublished data are brought to bear to guide the quantitative and qualitative analysis of potential effects of research and enhancement activities on monk seal mortality.

4.8.1.2 *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 normal patterns that occur 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 have population-level effects.

One type of response to disturbance is an animal's decision to move away from disturbed areas. This decision may be influenced, other than by the disturbance itself, 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).

A review of available literature on responses of numerous species to a variety of human activities suggests that the behavioral and physiological responses of individuals and their consequences are highly variable and influenced by

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 affected the reproductive success and survivorship of 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 assessing behavioral responses and population parameters, a frequently measured indicator of the vertebrate stress response is stress hormones: glucocorticoids (GCs), typically cortisol and corticosterone (Wingfield *et al.* 1997). Research on drivers influencing hypothalamic-pituitary-adrenal (HPA) activation, GC release and related physiological and behavioral processes are also numerous (Keay *et al.* 2006). A short-term stress response to an acute, ephemeral stressor represents an adaptive ability to cope with the stimulus, focusing on the immediate survival of the animal while suspending future processes such as energy storage as fat, production of gametes and growth (Reeder & Kramer 2005). A chronic stress response to a persistent stressor, however, can be detrimental to the organism and result in cell death, immunodeficiency, muscle wasting, reproductive suppression, and memory impairment (Reeder & Kramer 2005).

Studies on a wide range of vertebrates indicate that physiological stress responses can be reliably and repeatedly characterized by measuring GCs pre- and post-disturbance or among population subsets that vary in their exposure to a disturbance (Baker *et al.* in review, Busch & Hayward 2009). Assessing adrenal activity through GC measurement in blood and fecal samples has become increasingly popular in recent decades, however, other physiological measures, such as cardiac response and immuno-competence are also common (MacArthur *et al.* 1979; Moen *et al.* 1982; Tarlow and Blumstein 2007).

In a review of 290 studies on stress responses of wildlife to ten disturbances, the effect of capture and handling was mostly frequently examined, followed by land use and alteration, human presence (*e.g.* tourism, number of people in an area, human-flushing, human interaction) and husbandry activities (*e.g.* confinement, herding, hot-branding, stocking, feeding) (Baker *et al.* in review). An increase in GCs was consistently associated with capture and handling (significant in 80% of tests) and land use and alteration (significant in 100% of tests) across species tested; whereas the effects of human presence and husbandry were more variable (significant in 62-65% of tests) (Baker *et al.* in review).

GCs have been measured in a number of marine mammals in association with disturbances. For example, GCs were increased with toxin exposure, predators, capture, and entanglement, but not significantly influenced by isoflurane anesthesia and hot-branding; other correlates were also influential (pregnancy,

lactation, other hormones, age, season, time of day, gender) (Gulland *et al.* 1999, Ortiz *et al.* 2000; Oki & Atkinson 2004, Bozza & Atkinson 2005; Petrauskas *et al.* 2005; Hunt *et al.* 2006; Mashburn and Atkinson 2007; Mellish *et al.* 2007). Most of these studies focused on captive animals.

For wild marine mammal populations, identifying, monitoring and analyzing covariates demonstrated to be relevant to stress physiology in other vertebrates (*e.g.,* age, reproductive state, social status) may aid in accurate characterization and interpretation of results (*e.g.* Goyman *et al.* 2001 and Gobush *et al.* 2008). A failure to account for a sufficient number of relevant variables may preclude an adequate context for sound evaluation. For example, significant GC patterns may be masked by noise from other biological factors and a particular disturbance may incorrectly be deemed to have no effect on stress physiology, contributing to some inconsistent trends between vertebrate stress responses and disturbances that are apparent across studies and species.

A measured temporary rise in GCs in response to capture or disturbance might have consequences on individual fitness if it became chronic. However, though baseline GC measures can predict the relative fitness of individuals and populations, the relationship is not always consistent or present for a particular population or species (Bonier *et al.* 2009). For example, increased GCs were associated with increased probability of death (of individuals) or diminished viability (of offspring) in 73% of tests across 42 vertebrate studies (Baker *et al.* in review).

Behavioral indices can provide a useful complement to GC measures and can help determine the risks of their activities to populations. For example, 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). Alternatively, long-term population assessment, which can determine relationships between disturbances such as handling events and individual condition and survival, offer considerable insight.

In the case of Hawaiian monk seal research and enhancement activities, great pains are taken to avoid disturbance. In the cases when it does occur, it typically involves only a single or at most a few animals at once. Disturbances that occur during activities that do not involve capture or handling monk seals, usually amount to the seal simply looking at the researcher, perhaps swinging its head and lying back down. The most dramatic response is that a seal may move down the beach, enter the water and swim some distance away. Even in these cases, the seals rarely exhibit what would be interpreted as a panic flight response.

Thus, observable monk seal response to disturbance is entirely distinct from research on other types of pinnipeds which congregate in dense colonies, where

hundreds to thousands of animals can be disturbed in a single event, leading to stampedes to the water (Lewis 1987). 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. The results from studies of stress on one species may not apply to the responses of another species. No physiological studies of Hawaiian monk seal response to disturbance alone (*i.e.*, not involving capture and handling) have been conducted.

The most common scenario for disturbance of Hawaiian monk seals is during research activities that involve the presence of researchers on NWHI beaches where seals are resting. The seals tend to be distributed around the islands in singles or small clusters usually fewer than a dozen in number. Perhaps because most Hawaiian monk seals are rarely captured following a brief tagging event soon after they wean as pups, they are typically not particularly wary of human presence.

However, it is thought that past circumstances, especially those involving prolonged, frequent and intense harassment and disturbance associated with military and USCG activities on NWHI beaches, caused Hawaiian monk seals to avoid certain important beach habitats (Ragen 1999).

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In response to researcher presence, seals often simply return to sleep, or watch the researcher until they are no longer visible. Sometimes, however, the seals do get agitated and move a few body lengths down the beach before settling down.

While the above describes the most common disturbance scenario, not all seals exhibit the same response to the same disturbance, nor does an individual seal necessarily exhibit the same response on any given day. Hawaiian monk seal researchers have noted that juvenile seals tend to be more wary and likely to respond to researchers.

Thermoregulation may also play a role in seals' responses. Commonly, seals that have slept on land overnight spend the morning resting as well. As the temperature rises during the day they often slowly make their way to the water to cool off. This transit from the beach berm to the water may take several hours, with the seals sleeping for periods on the way. However, if a seal is feeling hot and is on the way to the water, seeing a researcher may hasten their entering the sea. Finally, seals that have recently been captured and handled understandably tend to be more likely to go to the water the next time they see a researcher. At

the other extreme, there are individual seals that seem to have no concern about human presence. For example, when field camps are established on NWHI, it is common that one or more seals will habitually haul out and sleep in camp.

In the MHI, seals have been exposed to the large resident and transient human populations. Many seals have become extremely habituated to people and choose to rest on beaches with hundreds of humans in proximity.

However, Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people.

This suggests that beach habitat selection of MHI Hawaiian monk seals may be influenced by human disturbance. A similar avoidance of the vastly smaller scale of human presence in the NWHI has not been detected.

Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people.

Despite the fact that outwardly, Hawaiian monk seals do not usually exhibit strong disturbance responses, it is not possible to rule out that there may be unobserved deleterious responses. Indeed, human disturbance has long been considered a threat to monk seal conservation, due mostly to population declines and local extinctions associated with the long history of first persecution and hunting by people up to the early 20th Century, and subsequent intensive prolonged harassment by military personnel and others visiting the NWHI prior to the seals receiving protection (Ragen 1999). As noted above, the frequency and intensity of research and enhancement related disturbance is vastly less than the seals' historical treatment.

Thus, while there is reason to believe that the level of disturbance associated with human disturbance from research and enhancement activities that do not involve capture and restraint are benign, we must consider the potential that disturbance could cause injury or harm. The following is a list of conceivable potential mechanisms for such harm:

- Increased corticosteroid levels or other physiological stress responses;
- Seals sustaining scrapes or cuts while fleeing over abrasive substrates (*e.g.*, coral);
- Increased risk of shark predation to seals that enter water when they would otherwise be on the beach;
- Increased risk of pups being subjected to adult male seal aggression if they enter the water in proximity to an aggressive male seal; and

- Disruption of nursing of mother/pup pairs leading to lower energy and nutrient intake by the pup.

4.8.1.3 Mechanisms of Injury from Capture and Restraint

In contrast to simple disturbance described above, seals that are captured and restrained during research and enhancement activities are subject to additional risks. As described in Chapter 2, capture and restraint can involve a range from brief procedures for tagging to longer procedures involving sedation, attachment of instruments, biomedical sampling, etc. Upon release from capture and restraint, most seals immediately flee to the water. The exception is that recently weaned pups often remain on land after being captured, tagged and measured. The following are mechanisms by which animals may be injured during capture and restraint without sedation:

- Efforts to avoid or escape capture could lead to contusions, lacerations, abrasions, hematomas, concussions, and fractures, as well as hyperthermia and myopathy from increased muscle activity;

- 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; and

- Capture myopathy is associated with prolonged or repeated stress responses in many mammals (though whether it occurs in pinnipeds is uncertain) and is characterized by degeneration and necrosis of striated and cardiac muscles (Fowler 1986). Capture myopathy may be fatal and may not develop until many days after capture and handling.

4.8.1.4 Mechanisms of Injury from Sedation or Anesthesia

Diazepam (valium) is the drug used for field sedation of Hawaiian monk seals. Midazolam may also be used for sedation in some cases. Gas anesthesia (*e.g.*, isoflurane) has also been successfully used in clinical settings, for example, surgeries to remove embedded fish hooks from seals. However, these latter cases involve stranding response and are not covered by this PEIS. Thus, this discussion is limited to risks associated with diazepam and midazolam sedation. These include:

- Miscalculation of dosage could lead to overdose and consequently death;

- Administration of IV diazepam could cause pain, stress, and damage to the extradural vein or surrounding tissue;

- Administration of IM midazolam could cause pain, stress, and damage to surrounding tissue; and

- Possible side effects include bradycardia (slowed heart rate), respiratory depression, tremor, confusion, blurred vision, nausea, vomiting, depressed gag reflex, lethargy, and ataxia (inability to coordinate muscle activity during voluntary movement) (NMFS 2005).

4.8.1.5 *Mechanisms of Injury from Biomedical Sampling, Marking, Attachment of Telemetry Instruments, De-worming, Disentanglement and Other Research and Enhancement Procedures*

Numerous research and enhancement procedures involve the handling of animals, including collection of various tissues as biomedical samples, weighing, measuring, attaching flipper tags, applying pelage (fur) bleach marks, attaching various telemetry (*e.g.*, satellite or GPS tracking) devices, and administering de-worming medications. 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/restraint presented above.

- Blood collection can cause pain, stress, damage to the extradural vein or surrounding tissue, and potentially infection;

- Biopsy punches for skin and blubber samples can cause pain and stress, and produce a small wound that has the potential for infection;

- Swab sampling of orifices could cause pain or irritation. Fecal sampling with a fecal loop could also cause pain and irritation; additionally, perforation of the rectum is a possibility. In female seals, accidental insertion of a fecal loop into the vagina could result in discomfort or possibly introduction of pathogens;

- Flipper tags involve creating a small hole in the flipper, through which plastic tags are threaded. This can cause temporary pain, stress, and possibility of infection. The tag might tear out over time, causing additional wounding to the flipper;

- Use of hair bleach to temporarily mark the pelage of Hawaiian monk seals can awaken the seal, causing a disturbance response. Bleach could cause irritation to areas it might come into contact with (eyes, nose or skin surfaces);

- Attachment of instruments to the fur with epoxy can cause irritation and in some cases minor skin wounds at the margins of the attachment area. The hydrodynamic drag created by the instrument might hinder swimming performance and result in increased energetic costs of swimming and diving, potentially affecting foraging efficiency;

- Administration of de-worming medications can occur by various routes, each with some potential risk. Injections (intra-muscular or subcutaneous) can cause pain, stress, swelling, and the risk of infection at the injection site. Oral intubation also can cause pain and stress, and carries the risk of introducing fluids into the trachea and lungs, which may lead to pneumonia. Topical application of de-worming medication has a potential to disturb or stress seals if they awaken during the application;

- It is possible that de-worming a seal that has a sufficiently heavy parasite burden could result in a bolus of dead worms causing an intestinal blockage and death; and

- During disentanglement of seals caught in marine debris, removal of debris from severe wounds or from seals which have become very compromised by their entanglement, can pose a risk of causing excessive bleeding and other complications, potentially leading to death.

4.8.1.6 Mechanisms For Injury From Translocation

A number of enhancement activities involve translocation of Hawaiian monk seals. The seals involved include nursing pups that have been abandoned or separated from their mothers, weaned pups, juveniles and adult males. The details of translocations are presented in Chapter 2 and Appendix E (Two-Stage Translocation: A Proposal for Endangered Hawaiian Monk Seals). The procedures associated with these actions vary with the logistics of each case and to some degree, the age of the animals involved. However, all translocations will entail some portion or all of the following elements:

- Capture;

- Restraint;

- Holding in a cage or other enclosure;

- Transport via small boat, automobile, ship or aircraft;

- Sedation;

- De-worming;

- Health and disease screening (*i.e.*, biomedical sampling);

- Pre-release quarantine;

- Attachment of telemetry devices; and

- Release at a destination site.

Risks of many of these procedures have been identified in the foregoing sections and are applicable to translocation to the extent that they occur as part of a translocation action. The following is a list of risks specific to procedures involved only in translocation:

- Temporary holding and transport may cause stress, leading to any number of related ailments, including immuno-suppression, and potentially death.
- Some monk seals in captivity have developed eye problems that make them non-viable for release into the wild.
- Seals could be harmed if an accident occurs during transport.
- Seals released in a new area may encounter risks that they were unaccustomed to in their previous location (*e.g.,* increased shark predation or competition for prey, increased human disturbance, and potential harm by humans).
- Seals released in a new area may forage less efficiently, either because the new site has less available prey, or because the seal is unfamiliar with the novel foraging landscape.
- Seals may be exposed to new diseases either through contact with other seals being translocated at the same time, or through contact with seals at the release location.
- Translocated seals themselves may pose a risk to other seals if they carry communicable disease.

4.8.1.7 Mechanisms of Injury from Behavioral Modification

Research to determine the safest and most effective methods for modifying undesirable behavior of seals that, for example, become habituated to humans in the MHI, will potentially involve a number of techniques. These would include methods such as capture, restraint, sedation, biomedical sampling, instrumentation, translocation, and temporary holding. Seals may also be hazed using visual, audible and tactile means. They may be guided or have their movements impeded by temporary barriers. Some of these actions have already been described and would entail the same risks identified above. Risks of actions unique to behavioral modification include:

- Hazing and use of barriers to movement may cause stress;
- Tactile means might involve momentary, minor pain or discomfort, though the techniques would not involve any type of intentional infliction of injury;

- Visual and audible hazing could cause stress; and

- In cases where the objective of behavioral modification is to move seals away from a specific area where they are, for example, interacting with people, achieving this objective could also displace the seal from resources (*i.e.*, foraging or resting areas) that are important for maintenance and growth.

Behavioral modification of aggressive male Hawaiian monk seals that harm other seals could involve experimental use of gonadotropin-releasing hormone (GnRH) agonist (*e.g.*, decapeptyl or deslorelin), to lower testosterone levels and, ideally, aggressive behavior. Decapeptyl has been used safely with no ill effects in HMS (Atkinson *et al.* 1993; Atkinson *et al.* 1998). The effects of deslorelin have proven safe in other mammals (Bertschinger *et al.* 2001; Trigg *et al.* 2006). The drugs would be given via injection after capture and restraint, and would therefore entail the same risks described above for these procedures. Potential harm or injury that could result from treatment with these drugs include:

- An initial relatively brief rise in testosterone levels prior to their suppression (as shown in other mammals injected with GnRH agonists). During this period there is a risk that male seals could exhibit elevated levels of aggression, posing a risk of harm to other seals;

- Treatment might cause the subjects to be attacked or harmed by other males;

- If effective in reducing testosterone, subject males would be temporarily "chemically castrated," such that they potentially have lower reproductive success; and

- GnRH agonists may have side effects.

4.8.1.8 Mechanisms of Injury from Vaccination

Vaccines currently used for prevention of viral diseases in domestic animals can be divided into three types: those based on a dead inactivated virus; those using live attenuated virus; and vaccines consisting of recombinant viruses. Recombinant viruses use a vector virus that does not typically infect the target host but expresses antigen from the pathogen of interest, stimulating an immune response against it (Griffin and Oldstone 2009). Vaccines using a dead virus are considered the safest as the virus cannot replicate in the host or cause disease; however, this lack of replication often means that the immune response generated following vaccination is short lived and may not be protective. Live vaccines typically generate the most effective immune response, but present the risk (when used in species other than the one for which the vaccine was developed) of the virus replicating in the host and either causing disease in the

vaccinated animal, or being shed in secretions and becoming infective to other contacted animals. Numerous carnivores, especially mustelids (weasel family) and procyonids (*e.g.*, raccoons), have died in zoological collections following vaccination with live canine distemper virus (CDV) vaccine (Deem *et al.* 2000). To overcome this risk of live vaccine use, recombinant vaccines to CDV are now used extensively in zoological collections (Brunson *et al.* 2007).

Vaccines currently being considered for Hawaiian monk seal include a recombinant canary pox (Purevax, Meriel) vaccine against morbillivius and an inactivated West Nile Virus (WNV) (Innovator, Fort Dodge). The canary pox vaccine has been safely used on a wide range of non-domestic carnivores including pinnipeds. It has not been associated with live virus shedding and is likely to stimulate higher immunity than a dead vaccine. The canary pox is also commercially available in the U.S. and is recommended by the American Association of Zoo Veterinarians for use in non-domestic carnivores. The Fort Dodge WNV vaccine has been used to date on Hawaiian monk seals in captivity in San Antonio, Texas, with no adverse reactions observed (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005).

Vaccines would most likely be administered to Hawaiian monk seals through injections which could involve capture and restraint. Vaccination would thus entail the risk associated with disturbance, injection and potentially capture/restraint. Other specific risks of vaccination may include an immune response, which can rarely result in a local reaction at the site of injection characterized by heat and swelling that resolves in 5-7 days, or febrile response (*i.e.*, fever).

4.8.1.9 Number of Animals Affected by Research and Enhancement under Each Alternative

Sections 1.8 and 2.6 describe in detail the different research and enhancement "take" activities that may occur under the various alternatives. Permits must specify the number of seals that could potentially be affected by research and enhancement take activities. Thus, each alternative may involve different numbers of animals. The take numbers indicate the maximum number of animals that may be affected by each take category under each alternative.

When applying for MMPA/ESA marine mammal research and enhancement permits, applicants request the maximum number of takes that they believe might potentially occur during their permitted activities. Exceeding these take levels would amount to a permit violation. In the case of the Hawaiian monk seal, NMFS historically has not reached the total level of takes authorized for research and enhancement. Nevertheless, these maximum levels will be analyzed here. The numbers of takes for different research and enhancement activities under the following alternatives are presented in Appendix I (Take Tables) and support the analysis of the alternatives presented herein.

- Alternative 1 (Status Quo) is based on the current Hawaiian monk seal research and enhancement permit (10137). Permit 10137 expires in 2014 and Alternative 1 assumes that the same levels of take would be authorized in the future with no changes.

- Alternative 2 (No Action) assumes that no further research and enhancement permits would be authorized once the current permit (10137) expires in 2014;

- Alternative 3 (Limited Translocation) includes a suite of additional research and enhancement activities with their associated number of takes, as well as some additional takes for existing (Status Quo) actions; and

- Alternative 4 (Enhanced Implementation) has identical take levels as Alternative 3, but is distinguished by the added potential to translocate weaned seals from the NWHI to the MHI.

Implementation of any alternative will depend on the availability of sufficient funding, which is not guaranteed. Alternatives 3 and 4 would likely require a substantial increase in future funding levels compared to the current funding available for implementing Status Quo (Alternative 1). However, for the purposes of this analysis, it is assumed that sufficient funding would be secured to fully implement each alternative.

4.8.1.10 Assessment of Mortality Due to Research and Enhancement

Analysis of mortality effects associated with research and enhancement activities will be primarily based on up to three sources of lethal takes presented in Appendix I (Take Tables). These include:

- Adult male removals. These involve either lethal removal or permanent captivity of adult male seals that have harmed or killed other seals. Because permanent captivity is equivalent to mortality from the perspective of the wild populations, captivity is treated as a mortality in the analysis of alternatives;

- Accidental mortality (research). This includes any unintentional deaths of seals that may occur as a result of research; and

- Accidental mortality (enhancement). This includes any unintentional deaths of seals that may occur as a result of enhancement activities.

These sources of mortality are considered to be entirely observable. NMFS has a long history of evaluating the potential effects of research and enhancement on Hawaiian monk seals as evidenced by numerous published reports and papers showing that Hawaiian monk seals subjected to specific research and

enhancement activities do not subsequently exhibit higher mortality than seals not subjected to the activities (Baker and Johanos 2002; Littnan *et al.* 2004; Baker *et al.* in review). Moreover, these studies have often sought to detect sub-lethal effects (for example, on behavior, movement, body condition, etc.) of research and enhancement activities, but have failed to find evidence of any such deleterious effects. Based on these publications, coupled with the fact that most Hawaiian monk seals are uniquely identifiable and closely monitored, it is assumed that there are no unobserved mortalities associated with research and enhancement activities.

Thus, NMFS concludes that the accidental or intentional (in the case of aggressive adult male seals) mortalities that are observed as an immediate result of research or enhancement constitute the totality of mortality associated with these activities. It is important to note that this is not a claim that research and enhancement have no associated mortality; rather it asserts that such mortality will be entirely observable and documentable.

4.8.1.11 Research and Enhancement Activities That Involve Take

Below is a discussion of each type of activity involving take that is proposed under various alternatives and the evidence supporting the above conclusion.

Tagging – Since the early 1980s, nearly all Hawaiian monk seals have been captured, restrained and tagged with plastic flipper tags as soon as possible after weaning. To ensure that this practice did not have negative effects, Henderson and Johanos (1988) conducted a study at Lisianski Island to compare the early survival, behavior and movements of tagged and untagged weaned pups. They found no differences in any of these metrics. For most Hawaiian monk seals, this initial tagging at weaning is the only time in their lives they are handled by humans. However, some seals may be captured, restrained and retagged at an older age if they have lost, worn or broken flipper tags. Baker and Johanos (2002) compared the survival, migration and condition of 437 seals during the year subsequent to retagging to an equal number of matched controls with pre-existing tags. It was important to choose control seals that were already tagged so that probability of resighting would not be biased between the two groups. No differences in survival, migration or condition were found between the retagged and control groups.

Bleach Marking – Seals are marked with hair dye, providing marks that last until the seal's next molt. While no directed study of the effects of bleach marking has been conducted on Hawaiian monk seals, it is reasonable to assume that since the more intensive activity of capture, restraint and tagging has no detectable negative effect, bleach marking is even less likely to cause mortality. Most seals do not even awaken during bleaching so that there is no disturbance effect. Field staff is instructed not to place bleach in areas where the seal could sweep it with their flippers into their eyes, nose or mouth. Further, despite many

thousands of bleach markings of monk seals, no negative effect of this procedure other than minor disturbance has ever been observed (NMFS PIFSC Annual Permit Reports for Permits No. 10137 and 848-1695-). Bleach marking aids in detection of a seal's identity from a greater distance than would be possible with flipper tags alone, thereby reducing the necessary approach distance and consequently the chances of disturbance.

Health Screening and Foraging Studies – Although these two activities have distinct goals and involve different procedures, in practice they quite often occur simultaneously and are therefore discussed together here. For example, almost every time a seal is captured to attach a telemetry instrument (to study foraging behavior) a health screening is conducted at the same time. Baker and Johanos (2002) evaluated the same metrics (survival, migration and condition) of seals that were instrumented and/or health screened compared to matched controls and found no difference. The number of cases of health screening was small (N = 19), however the sample for foraging instrumentation was much larger (N=93) and many in this latter group were also health screened, lending confidence to the conclusion that neither procedure had negative effects.

Further Littnan *et al.* (2004) evaluated a suite of diving and foraging-related parameters of juvenile Hawaiian monk seals fitted with the largest type of foraging instrument used in this species, a seal-mounted video camera (*i.e.,* "Crittercam"). The foraging behavior parameters of seven seals were compared while they had both the Crittercam and a much smaller dive recorder attached versus a period when they carried the dive recorder alone. No statistically significant differences were detected in the seals' behavior during the two periods.

De-worming – Although treatment for gastrointestinal parasites has long been a somewhat routine procedure for captive monk seals and other pinnipeds brought into captivity for rehabilitation, there has been relatively little experience with field treatment of free-ranging seals for parasites to reduce worm burden and improve body condition and survival. However, such a study was implemented at Laysan Island in 2009-2010 (Gobush *et al.* in review). A pilot trial using orally administered de-wormers proved unsuccessful in that it was too difficult to administer a reliable dose orally in field conditions. Subsequently, an injectable medication trial was conducted. This involved 43 juvenile seals which were captured, weighed, measured, feces sampled and either given an intra-muscular injection of the anti-helmintic (Praziquantel), or served as controls three times on an 8-16 week interval.

The effect of treatment on survivorship, egg presence and gain in mass was evaluated. Survivorship of the subset of the three cohorts included in the study was 100% for the 2007 and 2008 cohorts, and 85.2% for the 2009 cohorts. There was no difference in survival of the treatment and control seals. Nearly all collected fecal samples had cestode eggs; there were no significant differences in

egg presence between control and treated seals. Percent mass change differed with season and by age. Mass gain was greatest in the period from March to May. Percent mass gain was significantly greater for treated than control seals during March to May, but not during December to March or over the entire treatment period (December to May). The above study was designed to both evaluate potential beneficial effects of de-worming and also detect any potential negative effects. The fact that there was no difference in survival and a suggestion of higher growth rates in treated seals during a portion of the study indicates that there was no negative effect on survival or condition.

The following describes additional observations relevant to potential negative de-worming effects (Permit No. 10137, *Hawaiian Monk Seal Deworming Project: Year One Summary*). Typically, seals entered the water within minutes of being released from treatment with no indication of adverse effects of capture or treatment. However, adverse conditions for two seals treated during the course of the study were observed. One seal displayed signs of respiratory distress and another developed an abscess at the injection site. The respiratory distress case was reviewed by veterinarians and it was deemed unlikely that this symptom could be attributed to de-worming.

The seal with the abscess was captured, the abscess lanced and flushed. The wound healed and the seal survived and gained a large amount of mass by the next capture. Three other seals developed minor swellings near their injection sites within days of treatment; these swellings subsided on their own within 1-3 weeks. One seal that had a swelling was re-injected at the next treatment period and did not develop another swelling.

As a precaution against further swellings, protocols for cleaning the injection site were reviewed and standardized, improved restraining techniques were implemented, and the Praziquantel dose was split into two injections for half of the treated seals to test whether reducing the injected volume might mitigate swelling. The dose was divided between two bilateral intramuscular injections, each with a volume of 5 milliliters (ml) or less for five treated seals in August. The maximum injection volume for the split dose group was 3.7ml for an 85 kilogram (kg) seal, and for the single dose group it was 6.2ml for a 71kg seal. Subsequently, no injection site swellings occurred in any of the seals treated.

Due to apparently weak efficacy, lack of compelling benefits and the minor risk of potential negative effects (abscess at injection) of Praziquantel injection, the de-worming study was suspended (Permit No. 10137, *Hawaiian monk seal Deworming Project: Year One Summary*). Future studies will consider other routes of drug administration or other drugs. In such cases as above, researchers will be closely monitoring individuals to detect both negative and positive effects, and in cases of the former (as with the abscess described above) be prepared to mitigate negative effects. Thus, it is very unlikely that any mortalities or injuries associated with future de-wormer studies will go undetected.

Translocation – Baker *et al.* (in review) summarized and analyzed an extensive history of experience involving translocation of 247 Hawaiian monk seals to achieve a variety of objectives, including mitigating shark predation and male seal aggression, reducing human-seal interactions, and taking advantage of favorable foraging habitats to improve survival. A total of three mortalities (two adult male seals and one weaned pup) occurred during either capture or temporary captivity for translocation. While cause of death could not be determined in any of these cases, it is conservatively assumed that the deaths were attributable to the translocation action.

For all cases with data available to analyze, survival and dispersal behavior of translocated seals was statistically indistinguishable from comparable seals native to the release sites. This study indicates that, like other research and enhancement activities, mortalities associated with translocation are observable and quantifiable. However, as noted above, because two-stage translocation has some novel and yet untested aspects, negative and positive impacts of this activity will be assessed using simulation modeling as described in the Quantitative Approach section below and in Appendix J (Description of Monk Seal Stochastic Simulation Model) .

Adult male removal – Aggressive adult male Hawaiian monk seals may be removed from their subpopulation either via translocation to another subpopulation, permanent captivity, or by lethal removal (euthanasia). As noted above, captivity will be treated the same as mortality for evaluation of impacts on populations. Baker *et al.* (in review) found that aggressive males translocated from Laysan Island to the MHI in 1994 had high survival rates commensurate with those of native born adults. However, while data were very sparse, it seems that post-release survival of seals taken to Johnston Atoll was likely poor. In the future, translocations to Johnston Atoll are possible but unlikely; and, if they should occur, the fate of those translocatees would be closely monitored. Any that died or disappeared after release at Johnston Atoll would be considered mortalities in the context of the permit.

Nearly 300 Hawaiian monk seals have been observed entangled in marine debris and over 60 have been observed with embedded hooks (Carretta et al. draft 2011 SAR).

Disentanglement and De-hooking – When Hawaiian monk seals are entangled in marine debris or are observed with an embedded fishing hook, they may be captured to remove the offending items. In some cases, debris is cut away from seals while they are asleep and no disturbance occurs. Marine debris and hooking are known sources of serious injury and mortality. As such, the risks associated with disentanglement/dehooking are weighed against the risks of leaving the debris or hooks in place. Nearly 300 Hawaiian monk seals have been observed entangled in marine debris and over 60 have been observed with embedded hooks (Carretta *et al.* draft 2011 SAR). Many of these animals have

been captured and disentangled or dehooked and none have subsequently died from causes attributable to this enhancement activity.

Behavioral modification – As described above, behavioral modification research will involve a variety of techniques that entail some risk of mortality. Though experience to date with these techniques is limited to a few seals hazed or subjected to temporary barriers to movement, there have been no injuries or mortalities as a result (Baker et al in press). Further, any seals that are subject to behavioral modification in the MHI in the future will be monitored very closely to determine the efficacy of the treatments as well as to detect any adverse effects on the seal. It is therefore very unlikely that any mortality associated with behavioral modification would go undetected.

Chemical behavior modification of adult males through the use of GnRH agonists has been the subject of some experimentation in captivity and the wild in the past (Atkinson *et al.* 1993, Atkinson *et al.* 1998). While the efficacy of this approach to mitigate aggressive male behavior is undetermined, there were no deaths associated with the administration procedures or from effects of the drug itself. As with other behavior modification research, study subjects in the future would be closely monitored so that any resulting mortalities could be detected and quantified.

Vaccination –To date, there have been no vaccination programs for wild pinnipeds, though some captive seals, including Hawaiian monk seals, have been vaccinated against morbillivirus and WNV (Appendix D, vaccination review and plan from TMMC). Under Alternatives 3 and 4, vaccine research would occur and potentially vaccination would be used for enhancement as needed. These research and enhancement projects would involve either inactivated dead virus or recombinant virus vaccines.

No adverse reactions have been reported following use of the recombinant canary pox vaccine in marine mammals to date (Steller sea lions, sea otters, harbor seals, and one Hawaiian monk seal). The only data on vaccination of pinnipeds against WNV are from SeaWorld, San Antonio, where captive Hawaiian monk seals have been vaccinated with an inactivated WNV vaccine from Fort Dodge following an outbreak of WNV in the park and the loss of one monk seal to WNV infection. The vaccinated seals have sero-converted following vaccination with no adverse reactions (Workshop to Evaluate the Potential for Use of Morbillivirus Vaccination in Hawaiian Monk Seals, Final Report 2005).

Any future vaccination programs with monk seals would proceed cautiously, testing safety and sero-conversion first on surrogate species, then on captive monk seals prior to use in the wild. Careful monitoring would ensure that any resulting mortalities would be detected.

Disturbance – In this section, we consider mortality due to disturbance alone (that is, seals that are disturbed by research and enhancement but not captured

or handled in any way). This may occur in two ways. First, seals may be disturbed during monitoring activities (aerial, vessel or land-based) where they are approached for identification, photographic documentation, etc. Second, seals may be incidentally disturbed when they are present near other seals that are approached for monitoring, capture, handling or any other research or enhancement activity. In either case, there is no indication that the level of disturbance proposed in any of the alternatives would be likely to cause any mortality.

As noted above, prolonged, repeated and intensive harassment and disturbance (not associated with research or enhancement) has been thought to have contributed to habitat avoidance and decline in monk seal populations in the past. However, as described above, the intensity and frequency of disturbances related to past Hawaiian monk seal research and enhancement has been very low.

The proposed alternatives allow for at most 5 disturbances per seal in any given year, though the average for any seal will be far less. More importantly, because all disturbances are recorded, it is even less likely that should such a disturbance-related mortality occur it would go undetected. The primary potential mechanisms for disturbance-related mortality in Hawaiian monk seals would be avoidance of habitat critical for survival, or stress-induced mortality.

While there have been no studies specifically quantifying and evaluating the potential impacts of disturbance on Hawaiian monk seals, it stands to reason that disturbance alone would elicit far less impact than much more intensive activities such as capture, restraint, tagging, health screening, instrumentation, etc. The fact that these activities have been shown not to change survival, migration or body condition compared to seals that did not undergo such procedures (Baker and Johanos 2002), is compelling evidence that the low levels of disturbance proposed in the alternatives would be even less likely to induce harm. It is further worth noting that no harm or mortality due to simply disturbing a Hawaiian monk seal during research or enhancement has been documented in over 30 years (Permit No. 10137, *Hawaiian monk seal Deworming Project: Year One Summary*).

4.8.1.12 Separation of Positive and Negative Effects in Subsequent Analysis

To compare effects of various alternatives, it is important to explicitly identify both negative effects (such as mortalities) from positive effects, or benefits (such as lives saved). The overall balance of these opposing effects leads to conclusions about the relative merits of each Alternative. In order to distinguish and explicitly present negative and positive effects, the following approach is applied in the subsequent Alternatives analyses.

All ***negative*** effects are analyzed in sections entitled:

- "Direct and Indirect Mortality Due to Research and Enhancement", and
- "Direct and Indirect Reproductive Effects Due to Research and Enhancement"

All ***positive*** effects are analyzed in sections entitled:

- "Contributions to Conservation Objectives"

In this way the positive and negative effects are readily identifiable in their respective sections.

4.8.1.13 Quantitative Approach to Analyze the Effects of the Lethal Take

The monk seal simulation model (Appendix J) was used to assess the population level effects of the lethal take levels allowed in the alternatives. In general terms, a simulation model combines all of the important data for a population and, starting with the current population size and composition, projects the population forward to predict what the probable future state will be under various scenarios. Details of the model structure are provided in Appendix J with additional details available in Harting (2002).

For these simulations, each of the seven subpopulations was initialized at its current status (age/sex composition) and projected forward for 10 years, using the most recent estimates for the vital rates (survival and reproduction) at each subpopulation. To better represent the way in which the population behaves in the real world, the vital rates varied year-to-year with the amount of annual variation conforming to that which has been historically observed. In the projections, seals were allowed to move among subpopulations in accordance with the movement rates observed in the wild.

As stipulated in the descriptions of the alternatives, the takes due to accidental mortality from research can apply to any age or sex class. This means that the consequences of the mortality to the welfare of the population can vary depending on exactly which individuals are lost. In general, the loss of females is of much greater consequence to the population than is the loss of males because the population forfeits not just that individual female but also any pups she was likely to produce in the future. Further, females at or near prime reproductive age are especially important to the population because they comprise the age class likely to produce the most pups and thereby promote future population growth (refer to the discussion of age-specific reproductive value, Section 4.4). For these reasons, an exceptionally high-impact simulation scenario was used to represent the allowable take in each alternative, in which all of the take mortality was applied to females with high age-specific reproductive value (age 4 years). The maximum number of seals removed and the number allowed each year conformed to the provisions specified in the take tables (Appendix I). For

example, to simulate the four accidental takes during research allowed under Alternative 1, two females were removed during the first year of the simulation and two additional females were removed in the following year.

As with the research-related takes, the allowable take for the loss of weaned pups and juveniles during enhancement activities (Alternatives 3-4) can apply to either sex. As with the research take, a hypothetical exceptionally high-impact scenario was specified by assuming that all of this mortality would apply to females.

Because the simulated takes might occur at any subpopulation, the outcome was evaluated in terms of the effects on abundance and realized growth rate (from first to last year of the simulations) for the total population (that is, all subpopulations combined).

4.8.1.14 Assessment of Reproductive Effects Due to Research and Enhancement

Even if research and enhancement activities do not lead to mortality, it is possible that the activities could reduce the probability that seals produce viable offspring. Thus, effects on individual and population-level reproduction are possible from research and enhancement activities. This element of the direct and indirect effects analysis discusses the ways in which the scope of research and enhancement activities represented by each alternative may affect reproductive success.

The potential mechanisms for effects on reproductive success could happen to either gender; however, effects on females are naturally far more plausible and of greater concern. If research and enhancement activities were to impact the ability of some male seals to reproduce (*i.e.*, compete for or encounter mates, produce viable sperm or through any other mechanism), it is unlikely to translate into population level effects. The monk seal mating system is not well known but is probably promiscuous (Stirling 1983). Multiple male seals seek access to mate with females in estrous, such that if one or more males were unavailable due to some reproductive harm, other males would almost certainly ensure that any available female would be mated. For this reason, the remainder of this discussion focuses on reproductive effects on females. Possible mechanisms for reproductive effects on females include:

- Injury to the reproductive organs or damage to hormonal regulation that leads to temporary or permanent sterility.
- Physiological responses to stress that cause reproductive failure at any stage (ovulation, fertilization of ova, embryonic implantation, embryonic or fetal development).
- Changes in maternal behavior that reduces feeding of pups, consequently reducing their growth and survival rates.

- Delayed sexual maturation due to slow growth or poor health.

As noted in Chapter 2, NMFS has a long-standing conservative approach to disturbance or capture of adult female seals. For example, no adult female is captured that appears to be pregnant or is otherwise thought likely to be well into a pregnancy even if it is not visually apparent. The only exception is for a life-threatening situation such as a severe entanglement. Also, great efforts are made to minimize the disturbance of mother-pup pairs. Because of these precautionary policies, the risks to reproductive females are minimized, but at the same time risk-averse procedures complicate any analysis to evaluate whether any effects are occurring. For example, in the Baker and Johanos (2002) study on effects of research handling, reproductive effects could not be evaluated. Because pregnant females were actively avoided in the study, there were no control seals to compare subsequent reproduction of the adult females that were handled (i.e. the adult female treatment group was biased).

There has never been a reported or documented case where research or enhancement related disturbance has caused a female to abandon a pup.

Despite the complications with quantitative evaluation of reproductive effects based on actual research and enhancement activities in the past, it is possible to qualitatively infer the likelihood of such effects. For example, many of the hypothetical mechanisms for reproductive effects are mediated through reduced growth or body condition of female seals. Avoiding handling pregnant females reduces this risk. Also, the lack of any indication that actions such as tagging, health screening, instrumentation, and de-worming have had any negative effects on growth or body condition (Baker and Johanos 2002; Gobush *et al.* in prep.), suggests that growth-related effects on reproduction are highly unlikely. Likewise, the strict avoidance of disturbance to mother-pup pairs and the prohibition on capturing either a mother or her offspring during the period between birth and weaning, means that effects on the nursing process are also very unlikely.

There has never been a reported or documented case where research or enhancement related disturbance has caused a female to abandon a pup.

It is difficult to evaluate the remaining mechanisms: stress-related reproductive failure or damage to reproductive organs. Again, by avoiding handling pregnant female seals (or those who could be pregnant) the potential for stress-related effects is minimized. Goebel *et al.* (2003) evaluated the birth rates of female Antarctic fur seals the year following capture, restraint, anesthesia, and post-canine tooth extraction (for age determination) to a control group of females that was not captured. There were no differences detected in birth rates of these two groups. The procedures these fur seals were subjected to were arguably far more intense than any procedure proposed for Hawaiian monk seals. While one cannot assume that results from another species are applicable to Hawaiian

monk seals, this information is encouraging. We cannot rule out that handling could damage reproductive organs. On the other hand, if organ damage of any kind did occur, one would expect vital organs important to survival would be as likely, or more likely, to be involved than specific reproductive organs. The lack of any detectable effects on survival described in the preceding sections suggests that vital organ damage, and by inference, reproductive organ damage, is unlikely.

In summary, directly evaluating reproductive effects is far more complex than is the case for effects on survival. While we cannot rule out the potential for reproductive effects of proposed research and enhancement activities, several lines of evidence, including years of monitoring data for Hawaiian monk seals, suggest that this is a minor concern for Hawaiian monk seals.

4.8.1.15 Assessment of Beneficial Contributions toward Conservation Objectives

This element of the direct and indirect effects analysis discusses how well the scope of research and enhancement represented under each alternative would promote recovery and conservation of the species. The evaluation of the alternatives will be conducted with reference to the 2007 Recovery Plan for the Hawaiian Monk Seal (NMFS 2007, hereafter referred to as the Recovery Plan) (see Section 3.3.1.8). The goal of the Recovery Plan is to promote the recovery of the Hawaiian monk seal 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. The Draft Recovery Plan focuses on factors impeding recovery of the population and the actions necessary to promote recovery. The following is an excerpt from the Executive Summary of the Recovery Plan:

RECOVERY STRATEGY: While recommendations within this report are many and detailed, there are four key actions required to alter the trajectory of the Hawaiian monk seal population and to move the species towards recovery:

1. Improve the survivorship of females, particularly juveniles, in sub-populations of the NWHI. To do this requires the following:

- *maintaining and enhancing existing protection and conservation of habitat and prey base;*
- *targeting research to better understand the factors that result in poor juvenile survival;*
- *intervening where appropriate to ensure higher survival of juvenile and adult females;*
- *continuing actions to protect females from individual and multiple male aggression and to prevent excessive shark predation;*

- *and continuing actions to remove marine debris and reduce mortality of seals due to entanglement.*

2. Maintain the extensive field presence during the breeding season in the NWHI. Field presence is critical not just to the monitoring and research efforts, but also to carry out the active management and conservation of Hawaiian monk seal subpopulations in these areas.

3. Ensure the continued natural growth of the Hawaiian monk seal in the MHI by reducing threats including interactions with recreational fisheries, disturbance of mother-pup pairs, disturbance of hauled out seals, and exposure to human and domestic animal diseases. This should be accomplished with coordination of all federal, state, local and non-government parties, volunteer networks, and increased outreach and education in order to develop a culture of co-existence between humans and seals in the MHI.

4. Reduce the probability of the introduction of infectious diseases into the Hawaiian monk seal population.

The various alternatives will be qualitatively analyzed with reference to how well they address the Recovery Plan's Recovery Strategy.

4.8.1.16 *Methodology Used to Evaluate Two-Stage Translocation Effects*

The option to conduct two-stage translocation to enhance juvenile survival is included in Alternatives 3 and 4. The conservation benefits of two-stage translocation are evaluated independently from the effects of other activities. The methods used for this evaluation rely on simulation modeling and are described in detail in Appendix E (Two-Stage Translocation: A Proposal for Enhancement of the Endangered Hawaiian Monk Seal). Key aspects of the methodology are summarized below and in Appendix F. Because this is a new type of intervention, there are limited existing data with which to formulate predictions about its expected benefits or risks. In such cases, it is often beneficial to employ simulation modeling to provide quantitative analysis of the expected outcomes.

For this evaluation, the monk seal stochastic simulation model (Appendix J) was used to compare the expected outcomes from a representative set of translocation scenarios as permitted under each alternative. In practice, the specific two-stage translocation plan to be undertaken in a given year will be determined according to the most recent data available for each subpopulation in accordance with the decision framework described in Appendix E and summarized in Chapter 5. Results from preceding translocation efforts, logistics to accomplish the translocation, funding, and other considerations will be important factors in that determination. Based on that assessment, the translocation plan implemented in a given year might involve either single or multiple donor and nursery sites, provided that the site selection is consistent with the provisions of the operative alternative (no NWHI to MHI translocations are allowed for Alternative 3).

Further, the number of seals collected and translocated to each site can vary and will be determined following the provisions of the decision framework (Appendix E).

The allowance for flexibility in site selection and number of handled seals means that no single simulation scenario can fully represent all of the possible combinations and outcomes that might be undertaken pursuant to the translocation strategy. The simulation scenarios used for this evaluation are hypothetical and were selected to illustrate the salient aspects of the two-stage translocation concept as permitted under each alternative. In practice, prior to initiating an action, additional simulations and ancillary analyses will be undertaken to inform NMFS about the relative benefits that might accrue from various translocation scenarios under consideration in a given year.

For all simulation scenarios presented here, French Frigate Shoals was chosen to represent the "donor" site because this site has consistently had the poorest juvenile survival of any site (recent year's survivorship to age 3 and age 4 is 0.137 and 0.123, respectively). The simulations modeled the collection of 10 female pups annually for 5 years at French Frigate Shoals, with subsequent release at the nursery site. Simulations were run with and without a first-year survival decrement ("nursery site decrement") for translocatees as compared to survival of the native born seals at the release site. This decrement was primarily intended to represent a survival penalty that might result from smaller weaning girth as compared to native born seals at the nursery site.

The survival decrement, or penalty, represents a proportionate reduction in the survival rate for the translocated seals relative to other, non-managed seals of the same age at the nursery or return site. For example, if the survival rate for age 1 seals is normally 0.60 and the survival decrement is 0.90, the translocated seals will have a survival rate = 0.54 (0.90 * 0.60). As described in Appendix E, a decrement value of 0.90 (10% survival penalty) was used in those simulations that included the decrement. For the next two simulation years subsequent to the first year after release, translocated seals shared the same survival rate as native-born seals.

For all of the simulated translocations described here, seals were returned to their birth site at age 3 years. At this second stage of the simulated translocations, another survival decrement ("return decrement") was optionally applied to represent differential survival relative to non-translocated seals left at the original site. This decrement was primarily intended to represent the survival penalty that might result from translocated seals being unfamiliar with their new environment. As with the previous "nursery site survival decrement", the "return decrement" applied only to the first year after release. In the simulations that included this decrement, the value was set to 0.71 (29% survival penalty relative to non-treatment seals) to indicate the worst performance expected from

the second stage of the translocation. The derivation of this value is described in Appendix E.

The metrics used to evaluate the outcome of the translocation simulations were:

- Mean final abundance (N) at the original donor site;
- Population reproductive value (V_{pop});
- Number of mature females (Nf_{mature});
- Realized growth rate ($\lambda_{realized}$) for the donor subpopulation from year 1 to year 10 of the simulation;
- Survivorship of the translocated seals (l_x to age 3); and
- Intrinsic growth rate (λ_{trans})[1] for the lifetable representing the translocated seals.

All results are compared to results of a baseline simulation scenario of the same duration in which no translocation occurred. The baseline scenario projected that in 10 years, the mean number of monk seals in the total population would be 898.

4.8.1.17 *Direct and Indirect Effects of Alternative 1 – Status Quo*

Direct and Indirect Mortality Due to Research and Enhancement

Alternative 1 allows for the following lethal takes for both research and enhancement combined (see Table 4.8-3 and Appendix I Alternative 1 Take Table):

- Adult male removal: 10 males can be removed from the population over a five-year period. These seals can be taken for permanent captive care or by euthanasia, and may be removed in one or multiple years.

[1] There are some subtleties associated with computing λ_{trans}, which make this a somewhat conservative value. First, it is assumed that the observed reproductive schedule for the translocated seals will match the estimated rates for the non-translocated French Frigate Shoals, which grew up at that subpopulation. However, if as expected, the translocated seals returned to French Frigate Shoals are in better condition than the non-translocated seals, their reproductive patterns may be closer to the nursery sites, (Laysan Island or the MHI) which have more favorable reproductive curves (see Figure 3 of Appendix E, Translocation Paper). Further, the lifetable from which λ_{trans} is calculated contains a pre-weaning survival value (0.77) equal to that observed at French Frigate Shoals in recent years. In fact, translocated seals would be selected *after* weaning, so that their actual pre-weaning survival value would be 1.0, which if used instead, would yield higher estimates of λ_{trans}. However, because these seals' survival to weaning was not attributable to the two-stage translocation, using a pre-weaning survival value of 1.0 might suggest the translocation would yield more favorable results than is actually the case. Using either value (1.0 or 0.77) is imperfect, but the latter was chosen as it more conservatively characterized the benefits to conservation.

- Accidental mortality: Four seals may be unintentionally killed over a five-year period, with no more than two seals taken per year. These seals can be of any size and of either sex. As noted previously, to model an exceptionally high-impact scenario, it is assumed that all these mortalities involve 4-year-old female seals. Note that in Alternative 1, these lethal takes could result either from research or enhancement activities, or both.

- Humane euthanasia: 10 moribund or seriously injured seals may be euthanized. These takes are not simulated in the model. By definition, this would involve seals that would definitely have died without euthanasia, so that there would be no additional mortality attributable to research or enhancement associated with this activity.

In the 10-year projection of Alternative 1 (Status Quo), the simulated loss of four 4-year old females reduced the total abundance from 898 seals (Baseline: scenario 1 of Table 4.8-3) to 889 seals (scenario 2). That difference (9 fewer seals) is attributable both to the lost female seals and the offspring they were likely to produce during the 10-year projection. The additional loss of 10 males over 5 years (scenario 3) reduced the mean abundance by an additional 3 seals. This reduction is less than the number of males removed because the losses were randomly allocated to individual males present in the subpopulation and many of those males were older individuals likely to die sometime within the 10-year projection. These losses reduced the realized population growth rate ($\lambda_{realized}$) from 0.985 to 0.983, when both types of loss (accidental mortality and male removals) were incorporated into the simulations.

Conclusions for Mortality Effects

Under the exceptionally high-impact scenario modeled, Alternative 1 could result in a reduction of total abundance of 9 seals, representing a 1% decline compared to baseline projections without these takes. This can also be viewed as a reduction in realized growth rate of 0.002. While possible, it is unlikely that all the lethal takes due to research or enhancement would occur, or that they would all involve female seals at peak reproductive value. Thus, the research and enhancement impacts will likely be less than those simulated above.

These very small changes in the population may not be detectable compared to baseline values, so the magnitude and intensity of mortality effects would be minor. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would also be minor. The frequency of allowable lethal takes is expected to be low given that they could at most average 0.8 accidental deaths per year, and would occur with moderate (over a 5–year permit cycle) duration, such that the duration and frequency would be minor. Overall, Alternative 1 would likely result in minor adverse effects on mortality, especially when considered with positive benefits of

enhancement actions that directly or indirectly improve survival as described below.

Direct and Indirect Reproductive Effects of Research and Enhancement

As described above, it is difficult to reliably quantify the degree, if any, of negative reproductive effects from research and enhancement activities. To assess a more severe case than would occur by random chance, the simulations assumed that all lethal takes involved females with high reproductive value and also accounted for the loss of the offspring they would have produced, had they not been killed. Mortality effects were all determined to be minor, thus we would assume reproductive effects on the same number of females would be even less consequential.

If reproductive effects extended to a larger number of female seals, they could result in greater impacts but it is unlikely they would be detectable. Thus, mechanisms for possible adverse reproductive effects as a result of research or enhancement exist, but are likely indistinguishable from other natural stresses, so that their magnitude and intensity would be minor. Any such effects would not be measurable, so that their geographic extent/biological level and duration and frequency would be negligible. Overall, as described more in detail in Section 4.8.1 (Assessment of Reproductive Effects Due to Research and Enhancement), the direct and indirect effects from research and enhancement would likely result in negligible reproductive effects given the applicable precautionary measures (no adult female is captured that appears to be pregnant or is otherwise thought likely to be well into a pregnancy even if it is not visually apparent).

Contribution to Conservation Objectives

Alternative 1 represents the Status Quo, representative of current research and enhancement activities under the existing permit. Close monitoring of Hawaiian monk seals over decades of research and enhancement activities included under Alternative 1, with the exception of the more recent addition of de-worming research and small-scale translocations of weaned pups within the NWHI, have demonstrated that procedures used do not result in major adverse effects on this species. In fact, potential effects on mortality and reproduction due to Alternative 1 research and enhancement are considered either minor or negligible.

Despite the fact that Alternative 1 does address many of the Recovery Plan objectives (see Section 3.3.1.8) to varying degrees, Status Quo efforts have not reversed the decline. Field research monitoring in the NWHI would continue to fulfill Recovery Plan objectives to monitor that portion of the population. Juvenile survival of females would potentially be improved by continued de-worming (if determined effective), current levels of translocations of nursing and weaned pups, disentanglement/de-hooking, and removal of aggressive males under Alternative 1. Continued growth of the MHI population would be

supported by de-hooking and disentangling seals, and by translocations of weaned pups from areas where they may be at risk. However, mitigation of disease risk and reduction of unmanageable human-seal interactions would be very limited under Alternative 1 measures.

Conclusions for Conservation Objectives

Alternative 1 would, to some degree, address many of the objectives of the Recovery Plan, though not at a level that would be expected to result in maximum potential effects on recovery. For this reason, the magnitude and intensity of Alternative 1 in meeting conservation objectives would be moderate. Research and enhancement activities would occur throughout the species range such that the geographic extent/biological level would be major. The effects of implementing Alternative 1 would be somewhat periodic in that many enhancement activities are reactive and can only be conducted when opportunities arise (such as disentangling seals). Yet, such interventions that do occur may have long-term effects. Thus, the duration and frequency of conservation contributions would be moderate. Given the past track record of the Status Quo activities, and these considerations described, Alternative 1 would result in a moderate beneficial contribution to conservation objectives.

4.8.1.18 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

Direct and Indirect Mortality Due to Research and Enhancement

Under Alternative 2, existing levels of research and enhancement could continue until the current permit expires in 2014. As of Spring 2011, there have been no accidental research or enhancement mortalities and no adult males have been brought into captivity or lethally removed. Assuming the risk of these mortalities is constant over time, mortality for the remainder of the current permit cycle through 2014 is not likely to result in the total number of adult males that could be removed (10 takes per year as authorized in the current Permit 10137). Because Alternative 1 mortality effects were all judged to be minor, and mortalities under Alternative 2 would be fewer given that after the permit expires in 2014, no additional research or enhancement would occur on wild seals. Thus, it stands to reason that there would be minor adverse effects on mortality under Alternative 2 until expiration of the permit in 2014 and negligible effects thereafter due to no research or enhancement.

Direct and Indirect Reproductive Effects of Research and Enhancement

As described under Alternative 1, mechanisms for possible adverse reproductive effects as a result of research or enhancement exist, but are likely indistinguishable from other natural stresses. Alternative 2 reproductive effects would also be negligible once the existing permit expires in 2014.

Contribution to Conservation Objectives

The difference between Alternative 2 and Alternative 1 in terms of conservation is that under Alternative 2 any positive contributions would cease after 2014. Some conservation actions, such as education/outreach, etc. could continue and some enhancement (*i.e.*, entanglement/de-hooking) could be accomplished but only under the separate permit for the Marine Mammal Health and Stranding Response Program (see Section 1.6) and not as part of this research and enhancement program. Given that most entangled monk seals are encountered in the NWHI during research field camps the majority of disentanglements are done under the Pacific Islands Fisheries Science Center (PIFSC) research and enhancement permit. Under Alternative 2, those field camps would cease after 2014, so there would be no opportunity to disentangle these seals. With the exception of those activities that could be accomplished without permits or under the auspices of stranding response, none of the objectives of the Recovery Plan would be obtained. There would be no field research to monitor populations and detect problems, and no interventions such as de-worming, translocation, etc. to improve juvenile survival.

Conclusions for Conservation Objectives

Considering that almost all research and enhancement would cease after 2014, the Alternative 2 would not address many of the Recovery Plan objectives, therefore the contribution of this Alternative to conservation of the species would be negligible in the long term. Because access to NWHI monk seals would practically cease after 2014, the geographic extent/biological level would be negligible because only scat and spew samples could be collected from vacant beaches, and seals could only be observed and photographed at great distances. The duration and frequency of meeting conservation objectives would be short-term, ending in 2014. Lack of future research and enhancement permits would result in major adverse contributions to conservation given the benefits of continued research and enhancement activities would cease and higher mortality could result from the lack of disentanglement or translocation of pups from harmful situations.

4.8.1.19 Direct and Indirect Effects of Alternative 3 – Limited Translocation

There are two notable differences between Alternative 3 and Alternative 1 (Status Quo). While, Alternative 3 includes the same activities as Alternative 1, the number of takes allowed is greater for certain activities (*e.g.*, two-stage translocation). In addition, new activities such as expanded deworming efforts and vaccinations are included in Alternative 3. These differences are described more fully in the following sections in order to provide context for the effects analysis for Alternative 3. Appendix I, Alternative 3 Take Table provides the numbers of animals proposed to be taken under this alternative (see also Table 4.8-3).

Increased Takes For Ongoing Activities Under Alternative 3

For some activities, the number of takes that may occur under Alternative 3 exceeds that allowed under Alternative 1, because of a recognition that new or expanded enhancement activities (*e.g.*, two-stage translocation, de-worming, behavioral modification) will require additional monitoring in order to evaluate the efficacy of these activities. Thus, for example, the number of monitoring takes was increased at most locations (except French Frigate Shoals where the steep decline in population has reduced the number of seals likely to be available for monitoring).

For sites in the MHI and Nihoa, the numbers of seals taken by monitoring, tagging and marking were all increased relative to status quo. This recognizes both the need for more monitoring at these historically under-sampled sites and the fact that these populations are expected to be increasing naturally (*i.e.*, independently of any NMFS action). Therefore, more takes would be required to monitor larger numbers of seals. Likewise, the increased number of weaned pups that may be translocated for risk alleviation (*i.e.*, to move them away from harm) is in anticipation of the growing MHI population and the probability that more pups will be weaned in high risk areas in the foreseeable future.

Health screening and foraging studies (instrumentation) are also higher in Alternative 3 in order to support activities such as translocation and the associated health screening and tracking after their release to monitor outcomes. De-worming takes are also higher under Alternative 3, which would allow for broader application of this potential enhancement tool, should research determine it is effective. Total allowable adult male removals (via euthanasia, placement in captivity, or translocation) were also increased from 10 over 5 years to 20 annually (although the number that could be lethally removed remained at 10 for a 5-yr period). This is in response to recent signs of increasing multiple male aggression at Laysan Island. When the current research and enhancement permit was granted (the basis for Alternative 1), adult male removals were primarily designed to deal with single male aggression. Should there be an increase in multiple male aggression, Alternative 3 allows for the flexibility to translocate sufficient numbers of aggressive males in any year to mitigate this source of mortality on juveniles or females.

Despite the fact that numbers of animals potentially involved in research activities under Alternative 3 increased relative to Alternative 1, the number of accidental research mortalities remains the same. This is because in the past, Status Quo levels of research and enhancement have not led to the allowable number of lethal takes. It is anticipated that the addition of some research and enhancement activities will not lead to more than the allowed level of takes under Alternative 1.

Increased Takes for New Activities Under Alternative 3

New research and enhancement activities in Alternative 3 include:

- Two-stage translocation (described in detail in Appendix E). This does not include any translocation of seals from the NWHI to the MHI.
- Translocations of juvenile seals for research to determine survival of juvenile seals post-translocation.
- Behavioral modification of seals in the MHI
- Chemical (*i.e.*, GnHR agonist) behavioral modification of aggressive males as an alternative to translocation, permanent captivity or euthanasia.
- Vaccination research and implementation to mitigate infectious disease.
- Accidental mortality due to enhancement. Recognizing that the increased enhancement efforts listed above entail increased risk as well as increased benefits, additional enhancement-only-related mortalities would be allowed under Alternative 3.

Direct and Indirect Mortality Due to Research and Enhancement Under Alternative 3

Excluding authorization for the humane euthanasia of up to 10 moribund or severely injured seals, Alternative 3 allows for three other types of lethal take of monk seals:

1. **Adult male removal**: 20 males can be removed from the population over a 5-year period. These seals can be taken into permanent captive care or by euthanasia (no more than 10 by euthanasia over the 5-year period), and may be removed in one or multiple years. While this alternative caps the lethal removals at 10 over 5 years, many more could hypothetically be taken into permanent captivity. However, in reality it has proven extremely difficult to identify a captive facility with space and resources to take any adult male monk seals. Therefore the simulated scenario allows for a rather liberal 10 to be taken into permanent captivity in addition to 10 lethal removals, for a total of 20.

2. **Accidental mortality due to research**: 4 seals may be taken in 5 years, with no more than 2 seals taken per year. These seals can be of any size and of either sex. This level of lethal take for research only is equal to that allowed for both research and enhancement under Alternative 1. Because there are separate allowances specifically for enhancement-related mortality under Alternative 3 (see below), the 4 research mortalities allowed could be viewed as an increase over Alternative 1. This is justified in the following way. Research-related mortalities have been

rare. For example, during the past 4 complete years of permitted research, there has been 1 accidental mortality, for an average of 0.25 per year. Under Alternative 3, there may be 4 mortalities in 5 years (an average of 0.8 per year). However, mortalities occur in whole numbers only, not fractions, and the proposed takes (4) is already a small whole number.

Thus, while it is unlikely that this level of takes will occur, it is certainly within the realm of reason that 4 lethal accidents could occur over a 5-year period of research. Moreover, Alternative 3 involves increased research takes in various categories. Many of these takes entail capture, restraint and sometimes sedation, which are the types of activities that present higher risk of accidental mortality. Specifically, over 5 years, Alternative 3 allows an additional 320 flipper taggings, 150 health screenings, and 30 juvenile monk seal research translocations over and above that allowed under Alternative 1. This additional risk exposure justifies maintaining the requested level of accidental research mortality.

3. **Accidental mortality during enhancement activities**: This lethal take is further subdivided into three groups:

    a. Weaned pup (either sex): 4 pups over 5 years, with no more than 2 in one year

    b. Juveniles (either sex): 8 seals over 5 years, with no more than 4 in one year

    c. Adult Males: 4 males over 5 years, with no more than 2 in one year.

Alternative 3 entails a dramatic increase in enhancement efforts in comparison to Alternative 1. New or expanded enhancement activities included in Alternative 3 which might result in increased takes include:

- Weaned Pups
    - Increased deworming
    - Increased translocation for risk alleviation
    - First stage of two-stage translocation
    - Behavioral modification
    - Vaccination
- Juveniles
    - Increased deworming

- Second stage of two-stage translocation
- Behavioral modification
- Vaccination

- Adult males
  - Doubling potential number of removals in response to increased multiple-male aggression.
  - Initiation of chemical behavior modification

Compounding the risk of simply increasing the number of animals involved in enhancement is that for some of the proposed activities, the inherent risks are not well known. Whereas a large number of weaned pup translocations have been conducted and the level of risk involved is quite low (Baker *et al.* in review), far fewer cases of juvenile translocations have occurred. The general sense, however, is that juvenile seals are at greater risk of stress and mortality when being held captive. In a 2006 captive care program at Midway Atoll, 6 weaned pups and 1 juvenile seal were held in shoreline pens to be fattened up. All the pups gained weight and were released in good body condition, while the single juvenile died of complications related to stress a few weeks after being brought into captivity (Baker and Littnan 2008). Because juveniles seem subject to greater risk in captivity, the number of allowed lethal juvenile takes in Alternative 3 (8 in 5 years) is higher than that for weaned pups (4 in 5 years), notwithstanding the fact that more weaned pups are likely to be involved in enhancement activities.

Compared to translocation, other enhancement activities with young seals (deworming, behavioral modification, vaccination) are thought to present lower risk. However, these are either entirely new or only rarely tested activities, so that their true risks remain uncertain and difficult to quantify pending initial trials.

A final risk magnifier that is reflected in the number of proposed accidental mortalities is that some activities, most notably two-stage translocation, involve "grouped risk" whereby several animals will be captured, transported, held in quarantine and released together. In statistical language, by grouping seals in this way, the risk of accidental mortality becomes "non-independent". That is, if some rare but lethal event should occur (disease outbreak, boating or vehicle accident, etc.), there is greater likelihood of losing multiple seals at one time.

Combining all of these types of take, under Alternatives 3, the total number of seals that could be removed from the population over a 5-year period consists of 24 males (20 removals and 4 accidental mortality), and 16 additional accidental mortalities of either sex (including 4 weaned pups, 8 juveniles, and 4 seals of any age/sex).

The simulated loss due to accidental mortality, in which all of the mortality not specifically designated as males was assumed to apply to females (juvenile females were assumed to be age 3 yr), reduced the mean total population abundance from 898 seals to 874 seals (2.7% reduction; scenarios 1 and 4 in Table 4.8-3). The additional removal of 20 aggressive males (scenario 5) reduced the mean abundance to 864 seals (3.8% reduction). The realized growth rate decreased from 0.985 to 0.981 when all of the allowable takes were included in the simulations.

Conclusions for Mortality Effects

Under the exceptionally high-impact scenario modeled, Alternative 3 could result in a reduction of total abundance of 34 seals, representing a 3.8% decline compared to baseline projections without these takes. This can also be viewed as a reduction in $\lambda_{realized}$ of 0.004.

While possible, it is unlikely that all the lethal takes would occur, nor is it likely that all those not specified as males would turn out to be female seals.

The expected small changes in the population would likely amount to an equivocal change in population status, so that the magnitude and intensity of mortality effects would be *moderate*. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would be minor. The allowable lethal takes are moderate frequency (no more than a few per year would be likely) and would occur with moderate duration (according to the 5-year permit cycle), such that the duration and frequency would be moderate. The majority of the potential lethal takes of female seals under Alternative 3 are associated with enhancement activities. These activities will focus on seals that are already at elevated risk of natural mortality and enhancement activities are expected to achieve benefits in improved survival (presented below) The overall adverse direct and indirect effects of research and enhancement on mortality would be minor to moderate adverse.

Direct and Indirect Reproductive Effects of Research and Enhancement

Reproductive effects of Alternative 3 are based on the same assumptions as described for Alternative 1, such that Alternative 3 reproductive effects would be negligible as in Alternative 1.

Contribution to Conservation Objectives

All of the contributions to conservation that would occur under Alternative 1 would also be realized under Alternative 3. However, the suite of additional enhancement activities available under Alternative 3, while they may entail some additional unintended mortalities, are, in aggregate, expected to reap far more benefits. For example, the expansion of de-worming, if effective, would improve

juvenile survival and condition. While additional removals of aggressive males would reduce the number of adult males in the future, this would only occur if adult females or young animals were being harmed and killed by these males. In such a case, there is no question that removing aggressive males would yield far greater population benefit by saving female seals relative to the loss of a small number of males. Moreover, to the extent that chemical treatment of aggressive male behavior proves feasible, this could also result in improved female survival.

Behavior modification research is intended to develop tools that would allow seals in the MHI that have developed undesirable behaviors to remain in the wild population. This would likely prevent the need to either translocate such seals to areas where their survival may be impaired (NWHI) or to bring them into captivity. Any additional seal that remains wild in the MHI addresses the Recovery Plan objective of fostering MHI population growth. Vaccination research, should it lead to a tool for mitigating the introduction or spread of infectious disease, also directly addresses a Recovery Plan objective.

Illustrative simulations to evaluate conservation benefits of two-stage translocation under the constraints of Alternative 3 are as follows. Alternative 3 allows for two-stage translocation to occur among sites within the NWHI, or among sites within the MHI. Seals can also be translocated from the MHI to the NWHI, but no facilitated movements from the NWHI to the MHI are allowed under this alternative (that is, no two-stage translocation from the NWHI to the MHI is permitted). For this alternative, the monk seal model was used to simulate the two-stage translocation of 10 pups per year, collected at French Frigate Shoals and released at Laysan Island (chosen because the most recent data indicate this site has the most consistently favorable juvenile survival among the six main NWHI subpopulations). All surviving seals were returned to French Frigate Shoals at age 3 years. This pattern was repeated for the first 5 years of each simulation.

In the simulated translocations, the translocated seals were returned to their natal site at age 3 years, and therefore the effects of the translocations at the nursery site (Laysan Island) were ephemeral (in other words, they did not cause a direct, long-term change in the local population at the nursery site because they were moved back to French Frigate Shoals). As expected, final abundance at Laysan Island was approximately the same with or without the translocations (171 seals), but the mean population trajectory was elevated while the project was underway (years 1-8) as compared to the baseline trajectory.

At French Frigate Shoals, the mean abundance at the end of the 10-year projection increased from 93 seals (baseline scenario) to 96-101 seals as a result of the temporary translocation of seals to Laysan Island. The highest value (101 seals) resulted from imposing no survival decrements following either stage of the translocation. Similarly, V_{pop} in year 10 increased from 165 newborn equivalents to 203 newborn equivalents with the translocation and no survival

decrements. The basis for the V_{pop} increase is evident in the number of mature females present at French Frigate Shoals: 26 with no translocation, versus a maximum of 33 mature females with translocation. With no survival decrements, survivorship to age 4 yr (l_4)of the translocatees increased from 0.123 (baseline) to 0.226 with translocation and no decrements, thereby increasing the intrinsic growth rate of the lifetable describing the demography of the translocated seals (λ_{trans}) from 0.916 to 0.952.

Table 4.8-1 represents results of simulated translocations from French Frigate Shoals to Laysan Island (10 female pups per year for five consecutive years). Result columns are: N = mean final abundance at French Frigate Shoals (5% and 95% tails in parentheses); V_{pop} = population reproductive value in year 10 of the ten year simulation (5% and 95% tails in parentheses); Nf_{mature} = mean final number of mature females (age 5-20 yrs); l_4 = survivorship of translocated seals to age 4 yrs; and λ_{trans} = intrinsic growth rate of modified life table applicable only to the translocated seals.

Table 4.8-1 Results of Simulated Translocations from French Frigate Shoals to Laysan Island

Scenario	Survival Decrements*	N	V_{pop}	Nf_{mature}	l_4	λ_{trans}
Baseline	NA	93 (61,131)	165 (100, 244)	26	0.123	0.916
No decrements	1.00, 1.00	101 (67,141)	203 (124, 299)	33	0.226	0.952
Nursery decrement only	0.90, 1.00	99 (67, 138)	198 (120, 291)	32	0.205	0.944
Return decrement only	1.00, 0.71	97 (66, 135)	187 (115, 275)	30	0.161	0.932
Both decrements	0.90, 0.71	96 (65, 133)	181 (112, 274)	29	0.145	0.926

* Survival decrements for first year after initial release at nursery site, and first year after return to natal site. Tabulated values give proportion of mean survival rate as compared to resident (non-treatment) seals on site.

Conclusions for Conservation Objectives

Alternative 3 would, to at least some degree, address all of the objectives of the Recovery Plan. However, maximum benefits would not be realized through the two-stage translocation proposed under Alternative 3 because seals could not be moved from areas of current low survival in the NWHI to higher survival in the MHI. Seals would only be translocated within each region or from the MHI to the NWHI. This limits the potential effectiveness of the translocation process given current demographic rates. Further, the inflexibility to adapt to

unpredictable future conditions that might make translocations from the NWHI to MHI even more beneficial, would constrain the suite of options available to NMFS and reduce potential conservation benefits further.

Given that Status Quo (Alternative 1) efforts have failed to reverse the decline, more ambitious measures as represented in Alternatives 3 and 4 have been developed. Relative to Status Quo, the contribution to conservation through Alternative 3 measures would be moderate in magnitude and intensity. The activities would occur throughout the species range such that the geographic extent/biological level would be major. Alternative 3 provides a variety of ways to conduct enhancement at any one time and the benefits are more likely to be long-term (because in any year it is likely that some suite of enhancement tools could be implemented) therefore considered major in terms of duration and frequency. Overall, the contribution of beneficial effects towards conservation objectives under Alternative 3 would be major.

4.8.1.20 Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)

Direct and Indirect Mortality Due to Research and Enhancement

Alternatives 3 and 4 are quite similar except for the approach to two-stage translocation. Under Alternative 4, NMFS would be permitted to move seals from the NWHI to the MHI. Since the level of lethal takes are the same for Alternatives 3 and 4, the expected small changes in the population would likely amount to an equivocal change in population status, so that the magnitude and intensity of mortality effects would be moderate. Further, because the losses amount to a small number of individuals, the geographic extent/biological level of the impacts would be minor. The allowable lethal takes are moderate frequency (no more than a few per year being likely) and would occur with moderate duration (5 year permit cycle), such that the duration and frequency would be moderate. As discussed under Alternatives 1 and 3, the levels of take specified in the alternatives present the maximum number possible and likely would not be reached under any alternative, including Alternative 4. Therefore, the overall direct and indirect effects of mortality would likely be minor to moderate adverse under Alternative 4, considering this represents the exceptionally high-impact simulation scenario and risks must be balanced with the potential gains from the contribution towards conservation objectives summarized below.

Direct and Indirect Reproductive Effects of Research and Enhancement

The same logic applied in analysis of Alternatives 1 and 3 reproductive effects, would also apply to Alternative 4. Thus, Alternative 4 reproductive effects would be negligible as in the other Alternatives.

Contribution to Conservation Objectives

The distinction between Alternatives 3 and 4 becomes apparent when considering the potential benefits to conservation of two-stage translocation. Under Alternative 4, while many of the benefits described under Alternative 3 would be the same, there would be potential to yield greater results given the additional option of moving seals from the NWHI to the MHI as discussed here.

Given recent survival rates, the benefits associated with two-stage translocation of weaned pups from French Frigate Shoals to the MHI, an option which is unique to Alternative 4, are greater than those likely to result from a within-NWHI translocation (Alternative 3). The mean final abundance at French Frigate Shoals increased from 93 seals (baseline) to 104-112 seals with translocation. Similarly, the number of mature females increased from 26 at the end of the ten year baseline projection, to 36-43 with translocation, giving an increase in V_{pop} from 165 newborn equivalents (baseline) to 221-263 newborn equivalents. Survivorship to age 4 yr (l_4)for the translocatees increased from 0.123 to 0.434 with translocation and no survival decrements, giving λ_{trans} = 0.991 for the lifetable associated with the translocated seals.

Table 4.8-2. Results of simulated translocations from French Frigate Shoals to MHI (10 female pups per year for five consecutive years). Result columns are: *N* = mean final abundance at French Frigate Shoals (5% and 95% tails in parentheses); V_{pop} = population reproductive value in year 10 of the ten year simulation (5% and 95% tails in parentheses); Nf_{mature} = mean final number of mature females (age 5-20 yrs); l_{x-4} = survivorship of translocated seals to age 4 yrs; and $\boldsymbol{\lambda}_{trans}$ = intrinsic growth rate of modified life table applicable only to the translocated seals (see Table 4.8-2).

Table 4.8-2 Results of Simulated Translocations form French Frigate Shoals to MHI (10 Female Pups per Year for 5 Consecutive Years)

Scenario	Survival Decrements*	N	V_{pop}	Nf_{mature}	l_4	λ_{trans}
Baseline	NA	93 (61,131)	165 (100, 244)	26	0.123	0.916
No decrements	1.00, 1.00	112 (78, 151)	263 (169, 375)	43	0.434	0.991
Nursery decrement only	0.90, 1.00	111 (77, 151)	252 (162, 360)	41	0.391	0.985
Return decrement only	1.00, 0.71	105 (71, 144)	228 (144, 326)	37	0.310	0.969
Both decrements	0.90, 0.71	104 (71, 143)	221 (138, 325)	36	0.279	0.964

Note:
Survival decrements for first year after initial release at nursery site, and first year after return to natal site. Tabulated values give proportion of mean survival rate as compared to resident (non-treatment) seals on site.

Conclusions for Conservation Objectives

Alternative 4 would, to the highest degree considered feasible, address all of the objectives of the Recovery Plan. The option to conduct two-stage translocation using the MHI as a temporary nursery site, would allow the maximal benefits, given current demographics, to be achieved. Also, the flexibility to adapt to potential future conditions that might make translocations from the NWHI to MHI even more beneficial, would allow NMFS to adapt strategies to a greater range of future scenarios. These considerations make the magnitude and intensity of Alternative 4 conservation benefits *major*. The activities would occur throughout the species range such that the geographic extent/biological level would be *major*. The effects of implementing Alternative 4 would be quite immediate in that many enhancement activities could begin right away. Because this Alternative offers a variety of ways to conduct enhancement at any one time, the benefits are more likely to be long-term (because in any year it is likely that some suite of enhancement tools could be implemented), making the duration and frequency of conservation contributions *major*. Overall, there would likely be a *major* beneficial contribution of Alternative 4 towards conservation objectives.

Table 4.8-3 simulation results for lethal takes for Alternatives 1 and Alternatives 3/4 (allowable lethal take is equivalent for Alternatives 3 and 4). Main cell entry is the mean value (over 500 simulations), with the 5% and 95% tails from the projections in parentheses. Details of number and types of take and simulation design are provided in the text.

Table 4.8-3 Simulation Results for Lethal Takes for Alternatives 1, 3, and 4

Scenario	Description	Total abundance	Realized growth rate
1	Baseline (no takes)	898 (773,1025)	0.985 (0.971, 0.998)
2	Alt. 1 Status Quo (accidental mortality only)	889 (766,1019)	0.984 (0.970, 0.998)
3	Alt. 1 Status Quo (accidental mortality and male removals)	887 (770,1014)	0.983 (0.970, 0.997)
4	Alt. 3-4 (accidental mortality only)	874 (757,996)	0.982 (0.969, 0.996)
5	Alt. 3-4 (accidental mortality and male removals)	864 (749,985)	0.981 (0.968, 0.994)

4.8.1.21 *Cumulative Effects on Hawaiian Monk Seals*

Summary of Direct and Indirect Effects

Direct and indirect mortality and reproductive effects of research and enhancement activities may result from disturbance, capture, and handling. The alternatives vary by the levels of take permissible for research and enhancement and were evaluated in terms of the amount of mortality and reproductive effects that would occur under a given scope of research (Sections 4.8.1.15 through 4.8.1.18 and Appendix I, Take Tables). For Alternatives 1 (Status Quo), 3 (Limited Translocation), and 4 (Enhanced Implementation), the estimated mortality would result in minor to moderate adverse effects given the low number of mortalities expected from research and enhancement activities also supported by the fact that levels of take that are permitted are often higher than actual takes (or in this case mortalities) documented in the field. Direct and indirect effects on mortality under Alternative 2 (No Action) would likely be negligible given that no research or enhancement activities on wild Hawaiian monk seals would occur in the long term (after expiration of the current permit on 2014).

The effects of the alternatives on reproduction would be negligible for all alternatives. Alternatives 3 and 4 would seek to enhance monk seal survival by bolstering the translocation program and beginning deworming and vaccinations (if found effective) which would be expected to result in more female seals reaching the age of reproduction. Alternative 1 would, on a small scale, address some conservation objectives described in the 2007 Recovery Plan. Alternative 2 would address almost zero conservation objectives and would therefore result in a major adverse effect for the contribution to conservation. Alternative 3 would address most conservation objectives but not to their fullest extent while Alternative 4 would address most conservation objectives and several to their fullest extent.

Summary of Past Actions and Events

As described in detail in Section 3.3.1.3, Hawaiian monk seals are the most endangered pinniped species in U.S. waters and the second most endangered pinniped in the world. Hawaiian monk seals were listed as endangered in 1976 (41 FR 51611; November 23, 1976) due to a significant decline of over 70% since 1958 based on 2010 population estimates. The most recent (2009) best estimate of total abundance is 1,125 seals (Carretta *et al.* 2011 SAR draft), and the number is declining at approximately 4.5% per year.

The species was driven to near extinction due to hunting in the 19th Century (Ragen 1999) but by 1958 had at least partially recovered. In that year, beach counts (an indicator of abundance) of non-pups at the six main NWHI subpopulations was over 900 (total population would have been considerably larger). Currently, food limitation, entanglement in marine debris, predation by sharks, male seal aggression, and other stressors are contributing to a continued decline. The causes of the decline as listed in detail in Section 3.3.1.7 include several key stressors from the past, many of which continue to be threats today. Table 4.4-9 provides a list of past actions and events considered in the cumulative effects assessment in this PEIS.

Prey Limitation

Juvenile monk seals struggle to find sufficient prey in the NWHI likely due to climate variability and competition. Climate-ocean conditions appear to lead to variable primary productivity and, consequently, variable prey for top predators such as monk seals (Polovina *et al.* 1994; Antonelis *et al.* 2003; Baker *et al.* 2007; Polovina *et al.* 2008a). In addition, large sharks and jacks (*Caranx sp.*) are extremely abundant in the NWHI compared to the MHI (Friedlander and DeMartini 2002) and may be competing with seals. Direct competition of seals and these fishes has been documented on video (Parrish *et al.* 2008).

Entanglement and Hooking

For many years, derelict fishing gear and marine debris collected and documented in the NWHI has been transported by ocean currents from fishing or other maritime industries, and this debris has been responsible for monk seal mortalities and injury for decades. During 1982-2009, there were 298 cases of entangled seals, 8 of which were confirmed to have died as a direct result. A total of 64 seals have been observed with embedded hooks in the MHI during 1989-2009 (including 12 in 2009, 4 of which resulted in serious injuries).

Shark Predation

Tiger shark predation on monk seals of all ages has long been documented but in recent years, Galapagos shark predation has become a significant problem at

French Frigate Shoals. From 6 to 11 pups (15–28% of those born at French Frigate Shoals) has been lost each year to shark predation since 2000.

Parasites

The predominant parasites identified in monk seals are gastrointestinal: tapeworms (*Diphyllobothrium spp.*), nematodes (*Contracaecum spp.*), and an acanthocephalan species (Rausch 1969; Dailey *et al.* 1988). Even though internal parasites are not identified as a cause of death, they have been shown to be significant stressors in many other species. Reif *et al.* (2006) reported that young Hawaiian monk seal seals infected with tape worms tended to be in poorer body condition than those uninfected.

Contaminants

Hawaiian monk seals, like other mammals, accumulate persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT), and polybrominated diphenyl ethers (PBDEs) in their tissues through nursing when young and through their diet later in life. Multiple studies have shown links between contaminant exposure and detrimental health effects such as reproductive impairment, immune dysfunction, and cancer in several pinniped species (northern fur seals: Beckmen *et al.* 2003, harbor seals: De Swart *et al.* 1994; California sea lions: Ylitalo *et al.* 2005a; and DeLong *et al.* 1973).

Climate change

Global sea-level rise threatens critical monk seal habitat at low-lying NWHI (Baker *et al.* 2006). As noted above, monk seal prey limitation appears to be partially mediated by climate ocean variability (Baker *et al.* 2007). Due to the unpredictable dynamics of future climate changes and their potential for significant effects on monk seal prey and/or habitat, the potential impact of ocean climate change is of concern.

Male Aggression

During the 1980s and early 1990s, injuries and deaths of female monk seals caused by multiple male aggression attacks inhibited population recovery at Laysan Island. This threat was greatly reduced through targeted translocations of adult males (Johanos *et al.* 2011), but this threat remains and is not unique to Laysan Island. Likewise, single male aggression directed toward pups remains a concern.

Critical Habitat Designation

In 1986, critical habitat for the Hawaiian monk seal was designated at all beach areas, sand spits and islets, including all beach crest vegetation to its deepest

extent inland, lagoon waters, inner reef waters, and ocean waters out to a depth of 10 fathoms (18.3 m) around Kure Atoll, Midway Islands (except Sand Island), Pearl & Hermes Reef, Lisianski Island, Laysan Island, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island in the NWHI (51 FR 16047; April 30, 1986). In 1988, critical habitat was expanded to include Maro Reef and waters around previously designated areas out to the 20 fathom (36.6 m) isobath (53 FR 18988; May 26, 1988). (See also *Critical Habitat Revision* under RFFAs below.)

Hawaiian Monk Seal Rehabilitation, Research and Enhancement

Hawaiian monk seal research and enhancement efforts have also resulted in mortalities. From 1982 to 1994, 23 seals died during rehabilitation efforts. Most of these involved seals brought into captivity for rehabilitation when they were already in exceedingly poor health. Additionally, two other seals have died in captivity, two adult males died when captured for translocation to mitigate male aggression, one was euthanized (an aggressive male known to cause mortality), four died during captive research and four died during field research (Baker and Johanos 2002; Carretta *et al.* 2011 draft SAR.).

Human-Caused Mortality and Serious Injury

In the 1800s, this species was decimated by sealers, crews of wrecked vessels, and guano and feather hunters (Dill and Bryan 1912; Wetmore 1925; Bailey 1952; Clapp and Woodward 1972). In recent years, Three seals (including a pregnant female) were shot and killed in the MHI in 2009 (Baker *et al.* 2011). There are also other reported cases of people intentionally harming seals. Fines and penalties have been lenient until only recently when a new law was passed imposing strict penalties of up to $100,000 fine and 40-year imprisonment term for conviction of intentionally killing or harming monk seals, now a Class C Felony (Hawai‘i Senate Bill 2441, sponsored by Kaua‘i Senator Gary Hooser).

Stranding Response and Disentanglement/De-Hooking

The MMHSRP (Stranding Program) has been authorized (Permit 932-1905) to take an unlimited number of wild monk seals via response, rescue, and rehabilitation (this includes disentanglement/de-hooking). This program is responsible for response, rescue, rehabilitation, and release of stranded seals; health-related research on captive and rehabilitating seals (excluding vaccination research); hazing or relocating seals away from imminently harmful situations; and translocation of MHI seals for their protection.

Military Activities

Incidental harassment permits are issued by NMFS F/PR1 for activities where Hawaiian monk seals may be unintentionally disturbed. The Navy has been authorized to incidentally harass up to 120 monk seals.

Coastal Infrastructure and Development

Development projects ranging from private homes to resorts to bridges, roads and other infrastructure along the coast likely have resulted in changes to the quality and quantity of monk seal critical habitat and may have resulted in disturbance of seals though the effects of this disturbance are difficult to measure.

Reasonably Foreseeable Future Actions

In addition to all of the past actions described above, the following information provides an overview of RFFAs (see Table 4.4-10) that would likely affect Hawaiian monk seals when considered cumulatively.

Infectious Diseases

Infectious diseases do not appear to be currently limiting recovery of the monk seal. The emergent threat of WNV and morbilliviruses is a serious concern. Although these diseases as well as others have yet to be detected in Hawaiian monk seals in Hawai'i, the threat they pose has high potential for causing devastating adverse effects should a disease outbreak occur.

Critical Habitat Revision

In 2008, NMFS received a petition to revise Hawaiian monk seal critical habitat designation under the ESA. The critical habitat review is considering adding the following areas in the MHI: key beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and ocean waters offshore. On June 12, 2009, in a 12-month finding, NMFS announced that a revision to critical habitat is warranted on account of new information available regarding habitat use by the Hawaiian monk seal and also announced the Agency's intention to proceed towards a proposed rule (74 FR 27988; June 12, 2009). The proposed rule is likely to be published in 2011 and is expected to benefit the species through protection of habitat.

Commercial Shipping

The potential disturbance impacts of commercial and recreational vessel traffic vary depending on the location, speed and size of the vessels, and physiological stage of the animal. Commercial shipping also contributes to the potential for oil spills. Overall, due to the protection offered by the NWHI Monument, the potential impacts from commercial shipping are likely to be low.

Spinner Dolphin EIS and Rulemaking

NMFS is currently in the process of developing a proposed rule and associated EIS to consider instituting partial (time-area based) closures for certain specified spinner dolphin resting habitat (or a subset thereof) in the main Hawaiian

Islands. Under the proposed action, NMFS would identify the primary areas utilized by spinner dolphins for resting habitat on each of the main Hawaiian Islands, and would institute closures of these areas during certain time periods. These time-area closures would likely result in negligible effects for monk seals due to the small areas that could potentially be affected.

Hawaiian Monk Seal Rehabilitation Facility at Natural Energy Laboratory of Hawai'i Authority (NELHA)

The Marine Mammal Center (Sausilito, CA) plans to construct a monk seal rehabilitation facility on a 2.6-acre property at Keahole Point on the Island of Hawai'i through an arrangement with NELHA, an agency of the State of Hawai'i. The facility will consist of a holding facility with two in-ground, custom-built fiberglass pools and two smaller in-ground pools designed specifically for monk seals. The proposed facility would provide moderate to major beneficial effects for monk seals needing rehabilitation, thereby further supporting the species' recovery.

Cumulative Effects

Mortality

The primary contributors to adverse cumulative effects on Hawaiian monk seal mortality include starvation (food limitation), entanglement, predation, with male aggression, infectious diseases, habitat loss, fishery interactions, and other human interactions also contributing to mortality on some level.

In the long term, once the current permit expires in 2014, Alternative 2 would contribute no mortalities and would therefore have negligible cumulative effect on mortality.

Alternative 1, assuming the maximum allowed mortality impact, would result in an estimated 11 fewer seals in the population at the end of 10 years. Compared to the number of mortalities caused by predation and starvation (6-11 pups per year eaten by sharks at French Frigate Shoals alone) combined with mortalities resulting from but not limited to entanglement, intentional lethal shootings by humans and potential diseases in the future, the contribution of Alternative 1 to cumulative adverse effects from mortality would be minor and would therefore be unlikely to cause the population to decline.

In addition, Alternative 1 would result in benefits to survival through enhancement activities intended to promote survival. Alternatives 3 and 4, assuming the maximum allowed mortality impact, would result in an estimated 34 fewer seals in the population at the end of 10 years. This level of mortality would result in a minor adverse contribution to cumulative effects of mortality considering other causes of mortality as just described. To the contrary, other

actions proposed under Alternatives 3 and 4 would contribute to recovery and promote better survival of the species as described below.

Reproductive Effects

Disturbance from research and enhancement activities, other human disturbance such as recreation, and coastal development may cause physical responses and physiological effects in monk seals as described in detail in Section 4.8.1. The intensity of response to a particular stress or 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 stress or disturbance.

Outward observable indications are that Hawaiian monk seals do not usually exhibit strong disturbance responses, and the consequences of other stressors can be difficult to attribute to reproductive effects alone. However, it is currently not possible to rule out that there may be unobserved deleterious effects on reproduction.

Many seals have become extremely habituated to people and choose to rest on beaches with hundreds of humans in proximity. Still, Baker and Johanos (2004) conducted aerial surveys of all MHI shorelines in 2000 and 2001, and found that most of the seals seen had chosen to land at beaches less frequented by people. This suggests that beach habitat selection of MHI monk seals may be influenced by human disturbance. The alternatives vary in the amount of research- and enhancement-related activities that may cause disturbance or other stress on the seals although none of the proposed alternatives are expected to contribute anything but negligible effects on reproduction.

Contribution to Conservation Objectives

Section 3.3.1.3 and the 2007 Recovery Plan (NMFS 2007) describe numerous factors that influence the population dynamics of Hawaiian monk seals and many types of management actions that are likely to be necessary to promote the recovery of the population. The proposed alternatives were evaluated against the conservation objectives outlined by the Recovery Plan and, in essence, Alternatives 3 and 4 provide the most benefit to the species by providing major beneficial contributions to conservation while Alternative 2 would likely result in major adverse effects to conservation because research and enhancement actions would stop in 2014. Alternative 1 provides some conservation benefits however, the limitations described in Section 4.8.1.15 result in only moderate contribution to overall cumulative effects to conservation objectives. Other factors contributing beneficially to conservation of the species include the MMHSRP (Permit 932-1905) responsible for disentanglement, dehooking and moving seals away from other harmful situations. The proposed NEHLA rehabilitation facility at Keahole Point on Hawai`i would also benefit the species through rehabilitation. Information from scientific research and benefits of enhancement activities on monk seals play a crucial role in making informed decisions about

these regulations and management actions with the overall purpose of recovering the species.

4.8.2 Marine Water Quality

As described in Section 3.2.7, Marine Water Quality, the overall quality of Hawai'i 's coastal waters, based on the Water Quality Index, is rated good with 78% rated Good, 18% fair and 4% poor (EPA 2008).

Marine waters surrounding Hawai'i are classified as either Class AA or Class A, based on protection of water quality (HAR Chapter 11-54). The open coastal waters around the NWHI are classified as Class AA waters (HAR Section 11-54-6[b][2][A][ix] and [x] from the shoreline to a depth of 183 meters or 600 feet). The objective of Class AA waters is that they remain as nearly as possible in their natural pristine state, while Class A waters are maintained for multiple uses, with lower water quality standards applied to them.

Research and enhancement activities that could cause impacts to marine water quality in the near shore regions include spills and leaks of fuels and contaminants during vessel and small boat operations, introduction of biohazards from the use of antibiotics and vaccination research, introduction of heavy metals and other contaminates from external instruments deployed on animals, and effluent from maintenance of seals in shore-based temporary pens.

4.8.2.1 Direct and Indirect Effects of Alternatives

Status Quo (Alternative 1) activities would have zeor to negligible adverse impacts on nearshore marine water quality. Researchers using small boats and large vessels would be required to follow protocols for boat operations and refueling prior to receiving approval to conduct the work under a Monument permit (PMNM-2011-001 presented in Appendix G). In the NWHI, boat emissions are controlled by the Monument proclamation and management requirements; and researchers are required to follow these requirements. Researchers would also follow these protocols for operations in the MHI.

In addition to permit conditions, there are several Monument Best Management Practices (BMPs) that are designed to avoid, minimize or mitigate potential impacts to water quality (see Appendix G). Monument Permit PMNM-2011-001 specifies measures to minimize impacts on water quality due to boating:

- Tenders and small vessels mush be equipped with engines that meet EPA emissions requirements;
- Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or nearshore waters; and

- Special Conditions and Rules for Small Boat Operations are required at Tern Island (Monument BMP #013), which mandate specific notification and operator training.

Under the Status Quo, small boats (less than 20 ft) used by NMFS researchers conducting Hawaiian monk seal research and enhancement activities include: Boston whalers, ridged hull Zodiacs, Zodiac and Achilles inflatables and personal watercraft. These small boats can be launched from larger ships to access the islands and conduct research or can be used for access between research locations. All small boats and the larger research vessels used by NMFS such as the NOAA R/V Oscar Elton Sette (224 ft), the R/V Searcher (97 ft), and the M/V Kahana (160 ft), would be required to follow all permit requirements, provisions, and BMPs to protect water quality when working in the Monument and MHI. Thus, impacts to water quality from boat operations would be negligible.

For seals that are maintained in temporary pens in the NWHI, any seal effluent would not be expected to be substantially higher than that which naturally occurs in nearshore waters. The construction of temporary shoreline or land-based pens to hold seals temporarily (up to 2 weeks) for translocations would not be expected to impact water quality. A limited number of animals would be held at any given time, so feces and urine would not concentrate more than would from a natural aggregate of seals. Wastes would be diluted from currents and scats would be removed from the dry section of the pen before they could enter the water column.

External instruments deployed on monk seals for foraging and monitoring studies are sealed by plastic polymer resin. Therefore, no leakage of metals or other materials from batteries would occur in the water column or on haulout areas if researchers are not able to retrieve the instruments and they fall off when an animal molts.

Alternative 2 (No Action) would result in no additional effects on marine water quality once the current permit expires in 2014 as no research and enhancement activities for Hawaiian monk seal would be permitted.

Alternative 3, which adds new activities with expanded scope and methods, has a slightly greater potential to impact water quality compared to Alternative 1 due to increased research activity and use of small boats. However, considering the strict guidelines described above for Alternative 1, which would also be in place under Alternative 3, the potential adverse effects of Alternative 3 on water quality would be negligible to minor. Alternatives 3 (and 4) include the use of long acting antibiotics to treat abscesses and the initiation of vaccination studies, potentially on free-ranging Hawaiian monk seals. It is not likely that the antibiotics or viruses that would be shed due to vaccination would be encountered in high enough concentrations to affect water quality.

Alternative 4 will have a slightly greater potential impact than Alternative 3, again due (in part) to the additional use of small boats and possibly larger research vessels to translocate weaned pups between NHWI and MHI. However, any potential adverse effects on water quality would likely be negligible to minor due to the controls and mitigation measures already in place.

4.8.3 Sea Turtles

This section addresses potential direct, indirect and cumulative effects of the alternatives on sea turtles in the NWHI and MHI. In general, there are two potential types of effects on sea turtles that could result from the Alternatives: disturbance

- Disturbance of individual sea turtles in the nearshore environment; or
- Disturbance of individual sea turtles on beaches during nesting.

Based on these types of potential effects, Table 4.4-2 in Section 4.4.2 summarizes the criteria used to evaluate impacts of the Alternatives on sea turtles. As indicated in the table, the geographic extent, magnitude, frequency, and intensity are used to evaluate the level of potential effects on sea turtles. While sonic tags (which would transmit signals up to 69 kHz) may also be used during research and enhancement activities, sea turtles have a hearing range from approximately 100 to 1000 Hz (Bartol *et al.* 1999, Ridgway *et al.* 1969), and also would not be affected by the sonic tag transmissions. Therefore, effects of sonic tags are not further evaluated here.

The alternatives could result in direct effects on individual sea turtles through vessels in the nearshore environment, or through human activity on beaches during ground surveys or other research and enhancement beach activities. Activities related to field camps (Section 3.3.1.9) may also disturb turtles. Adherence to the BMPs for Monument (Appendix G) would minimize potential adverse effects on turtles. These special conditions for field camps and research activities in the Monument are in place to ensure preservation of the NWHI native ecosystem, including turtles (PMNM 2008).

Indirect effects on sea turtles could result from disturbance, and are evaluated here in terms of how potential indirect effects might ultimately impact turtle reproduction. Such effects would only occur if an alternative affects the monk seal population in the NWHI and MHI, and then the Hawaiian monk seal population, in turn, affects the sea turtle population. Even if the Hawaiian monk seal population increased substantially, it is unlikely that any seal interactions with sea turtles would result in population-level effects, as neither species is a major predator or competitor with the other. Therefore, effects discussed below focus on the potential for direct effects.

The research and enhancement could affect sea turtles if included activities resulted in measurable effects including:

- Breeding and nesting success; and
- Disturbance of sea turtles.

The following discussion analyzes the potential for the Alternatives to affect sea turtles through these two pathways.

4.8.3.1 *Breeding and nesting success*

Green sea turtles which are asleep and basking on the beach are generally unaware of unobtrusive human presence such as observing seals. However, some activities, such as small boat transits and landings, capturing a seal, and other research activities may waken basking turtles, causing them to flee into the water. To the extent that the research and enhancement activities in the NWHI or MHI could result in increased human presence near nesting beaches due to ground surveys, specimen collection, or other activities, up to 200 sea turtles nesting on beaches could be incidentally harassed. This disturbance could alter their breeding and nesting activities. The extent of these effects would depend on whether humans were present during nesting or breeding season, the proximity of activities to nesting areas, as well as the duration of the activity. Although green sea turtles nest throughout the Hawaiian Archipelago, over 90% nest at French Frigate Shoals in the NWHI (NMFS 1998). Thus, by minimizing the presence of humans in specific areas such as French Frigate Shoals during green turtle nesting season, potential effects could be avoided.

4.8.3.2 *Mortality Effects on Sea Turtles*

Sea turtles could be killed if vessels used during research and enhancement activities collided with individual sea turtles. To date, no collisions with sea turtles during Hawaiian monk seal research and enhancement activities have been documented. Additionally, if monk seal researchers encountered basking turtles on beaches, and the turtles subsequently moved away from their basking site, this could result in turtles entering the water making them more vulnerable to predation or collisions however this effects is difficult to document or measure. While the consequences of vessel collisions is high (*i.e.,* resulting in serious injury or mortality), the likelihood of this occurring is low. Researchers may enhance habitat for sea turtles when they remove marine debris during field activities. Marine debris affects turtles via ingestion of anthropogenic materials (*e.g.,* plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.). Removal of marine debris by researchers for Hawaiian monk seals would likely result in a beneficial effect on sea turtles.

4.8.3.3 *Direct and Indirect Effects of Alternative 1 – Status Quo*

Negligible effects on sea turtles would be expected to occur under the Status Quo Alternative. Disruption of breeding and nesting activities or disturbance of individual turtles would not likely result in adverse effects on individuals or the population thus these effects would be negligible. Minor, short-term disturbance during nesting and breeding activities could occur, but with the implementation of BMPs required by Monument permits, these effects would be minimized to a negligible level. Similarly, the likelihood of collisions with vessels during research and enhancement are low due to Monument BMPs and associated mitigation measures described in Appendix G. Mortality effects on turtles are considered negligible under Alternative 1.

4.8.3.4 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

Similar to Alternative 1, negligible effects on sea turtles would be expected to occur under Alternative 2. Though not likely, disruption of breeding and nesting activities or mortality of turtles could occur as a result of research and enhancement activities on wild monk seals only until 2014. Once the current permit expires in 2014, no research or enhancement would occur that could result in disturbance or mortality.

4.8.3.5 *Direct and Indirect Effects of Alternative 3 (Limited Translocation) and Alternative 4 (Enhanced Implementation; Preferred Alternative)*

Alternatives 3 and 4 do not differ in their potential effects on turtles thus they are described together here. Alternatives 3 and 4 could result in minor to moderate disruption of breeding and nesting activities on beaches due to human presence due to the potential for increased activity in the Hawaiian Islands.

Alternatives 3 and 4 would increase the level of ground, boat, and aerial Hawaiian monk seal surveys and beach activities; however, restrictions and mitigation measures for all new activities would be required by the MMPA, ESA, and NMFS to minimize disturbances from research and enhancement activities. In addition, requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse impacts of research activities (Appendix G, PMNM 2011-001).

Minor short-term decreases in sea turtle survival and/or productivity could hypothetically result from disturbance of nesting and breeding, but with the implementation of procedures required by NMFS, these potential reproductive effects would be minimized to a negligible level.

Alternatives 3 and 4 could result in a small number of individual sea turtles being disturbed by vessels given the increase in activities such as translocation, but this effect would be expected to be very infrequent and of low magnitude, and would thus be negligible.

4.8.3.6 Cumulative Effects

Sea turtles in the NWHI and MHI, including leatherback, loggerhead, olive ridley, hawksbill, and green sea turtles, are all listed as threatened or endangered under the federal ESA. Sea turtle populations have declined due to incidental take in fishing operations, direct harvest of turtles, entanglement in marine debris, ocean pollution, and disease (*e.g.*, fibropapillomatosis). While the green sea turtle population remains under stress due to these threats, the population is increasing (Section 3.3.2).

Reasonably foreseeable future actions including removal of marine debris, vessel collisions during recreational, fishing or shipping activities, tuna aquaculture programs, and the joint high speed vessel programs may all contribute to potential adverse effects on sea turtles when considered cumulatively. Turtles encounter orders of magnitude more people and boats in the MHI from non-Hawaiian monk seal related activities than under any of the proposed alternatives. While green sea turtles are the turtle species most likely to overlap with Hawaiian monk seals, the contribution of the proposed research and enhancement activities are not likely to result in anything but negligible effects given the mitigation measures implemented during research and enhancement. In addition, the removal of marine debris by monk seal researchers would likely be beneficial for sea turtles.

4.8.4 Cetaceans

This section addresses potential direct, indirect and cumulative effects of the alternatives on cetaceans in the NWHI and MHI. As discussed in Section 3.3.3, humpback whales and spinner dolphins are the cetacean species most likely to be present in nearshore areas where Hawaiian monk seals and activities associated with the alternatives would occur. The impact discussion therefore focuses on potential effects of the alternatives on humpback whales and spinner dolphins.

In general, there are two potential types of mechanisms for effects that could result from the alternatives:

- Disturbance due to vessel, airplane or beach activities; or
- Collisions with vessels.

Table 4.4.3 in Section 4.4.2 summarizes the criteria used to evaluate effects of the alternatives on cetaceans. As indicated in the table, the geographic extent, magnitude, frequency, and intensity are used to evaluate the level of potential effects.

The alternatives could result in direct and indirect reproductive effects on spinner dolphins or humpback whales as a result of disturbance due to vessel or aircraft activity during surveys or transport Hawaiian monk seals. However, the disturbance that could occur would likely be short-term and not result in lasting effects on these species.

Spinner dolphins may alter their behavior and approach a small boat transiting within lagoons where research and enhancement activities may occur. The level of disturbance is temporary and dolphins typically approach researchers, versus showing avoidance behaviors. This disturbance is not likely to result in adverse effects on reproduction. Similar disturbance effects on humpback whales may occur, however, these effects are not likely to result in notable adverse effects on reproduction.

As summarized in the 2010 EA for NMFS Permit 10137 for monk seal research and enhancement, abundance of humpback whales for the entire North Pacific Ocean is estimated to be 18,302 individuals, with over 50% of the population (approximately 10,000) estimated to winter in Hawaiian waters (Calambokidis *et al.* 2008). Most aerial surveys would occur during summer months when these whales are not present, but vessel and aerial surveys and transporting seals by air and boat could occur year-round.

The potential effects of sonic tags are summarized in the 2010 EA for NMFS Permit 10137 for Hawaiian monk seal research and enhancement (NMFS 2010) and are summarized here. Sonic tags used during research and enhancement would transmit signals at 69 kHz. While spinner dolphins that occur in lagoon waters of French Frigate Shoals have an estimated auditory range of 150 Hz to 160 kHz (Southall *et al.* 2007), it is not likely that the presence of these tags on pups would have a measurable impact on dolphins. Therefore, under all alternatives, the potential effects of sonic tags are considered negligible.

While it is possible that collisions with vessels used during research and enhancement could result in mortality of humpback whales or spinner dolphins, the likelihood of this occurring is very low. Mitigation measures and BMPs implemented by NMFS such as NAO 217-103 (Management of Small Boats) and Monument Permit Conditions presented in Appendix G. While the risk of collisions does exist, to date, there have been no documented incidents of collision with monk seal research and enhancement vessels.

4.8.4.1 *Direct and Indirect Effects of Alternative 1 – Status Quo*

Under Status Quo, Permit No. 10137 authorizes annual harassment of 500 spinner dolphins within the lagoon waters at four NWHI sites (Midway Atoll, Pearl and Hermes Reef, Kure Atoll, and French Frigate Shoals). Harassment would occur primarily during summer months but may occur year-round (NMFS 2010). As described above, the presence of sonic tags on pups would have a negligible effect on dolphins under all alternatives.

Negligible effects on cetaceans would be expected to occur under Alternative 1 given that the interactions with cetaceans are not likely to cause disturbance that would result in reproductive effects, and collisions would be extremely rare. Mitigation would be incorporated as follows:

- Aerial surveys would be conducted above shoreline areas; in the event cetaceans were encountered near shore, researchers would fly to an altitude of 1000 feet to avoid harassment (NMFS 2010); and
- If encountered by boat, researchers would maintain a distance of 50 yards (150 feet) for cetaceans other than humpback whales, and a distance of 300 feet if a humpback whale is encountered.

These approach distances are consistent with Federal Regulation (50 CFR 224.103) to avoid take if humpback whales are encountered and NMFS guidelines to avoid harassment of other cetaceans (NMFS 2010).

4.8.4.2 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

While there is potential for short-term disturbance or low probability of collisions with vessels under Alternative 2 while the permit is still valid, negligible effects on cetaceans would still be expected to occur under the No Action Alternative given that the magnitude of potential disturbance is not likely to cause reproductive effects and collisions would be extremely rare. Research and enhancement activities on wild monk seals would discontinue after the current permit expires in 2014.

4.8.4.3 *Direct and Indirect Effects of Alternative 3 Limited Translocation and Alternative 4 Enhanced Implementation (Preferred Alternative)*

While Alternatives 3 and 4 could result in disturbance of individual spinner dolphins or humpack whales, these incidents are expected to be short-term and not result in long-term or population level effects on reproduction. Given the stringent BMPs and other permit conditions implemented by NMFS (see Appendix G), there would be negligible effects on reproduction due to research and enhancement activities. As stated under Alternative 1 above, the presence of

sonic tags on pups would have a negligible effect on dolphins under all alternatives (NMFS 2010).

The same procedures and mitigation would be followed in the Preferred Alternative as that described under Alternative 1. Aerial survey altitudes would be increased if cetaceans are encountered, and boat surveys would maintain distances to cetaceans consistent with NMFS regulations and guidelines. While collisions with survey vessels may occur, the increased level of activity under Alternatives 3 and 4 are still not expected to result in mortalities of cetaceans. Vessel activities associated with the research and enhancement would not be frequent, and it is expected that individual dolphins or whales would move away from survey vessels in their vicinity. Although individual dolphins or whales could be injured during collisions, this would be an extremely rare occurrence, and the effect on the populations of humpback whales and spinner dolphins would be negligible.

4.8.4.4 Cumulative Effects

Humpback whales are listed as endangered, under the ESA and depleted under the MMPA. Spinner dolphins in Hawai`i are not listed as threatened or endangered under the ESA, or a depleted stock under the MMPA. Recent Stock Assessment Reports (SARs) indicate that Central North Pacific Stock of humpback whale (which winters in Hawaii) has been increasing in the 1990s and 2000s. Estimates of the rate of increase vary, but are generally between 4 and 9% (NMFS 2009). Despite recent concerns regarding potential adverse effects on spinner dolphins due to human interaction (see Section 4.5.2), interactions with monk seal researchers are managed through the stringent Monument permit process and are relatively infrequent compared to other interactions with humans throughout the Islands.

Reasonably foreseeable future actions could have effects on humpback whales and spinner dolphins including other types of research, tuna aquaculture programs, shipping, recreation such as whale- or dolphin-watching tours, and the joint high speed vessel programs.

There are few other disturbances to spinner dolphins in the NWHI concurrent with research and enhancement activities, as a limited number of people are able to access the Monument via a permit issued by the Monument, and such permits would not authorize harassment of spinner dolphins unless a research and enhancement permit were issued. There are no other permits authorizing harassment of spinner dolphins in the NWHI. Permit No. 1007-1629-01 issued to Dr. Leszek Karczmarski, Marine Mammal Research Program, Texas A&M University, authorized research on spinner dolphins in the NWHI over a six-year period, and expired on August 31, 2007.

Overall, Hawaiian monk seal research under any of the alternatives is expected to result in a negligible contribution to cumulative effects on cetaceans. Effects are likely to be negligible due to the temporary duration of research and enhancement activities in the open ocean or nearshore environment. Also, the minimal amount of vessel and airplane activity from monk seal research and enhancement as compared to those associated with recreation, fishing, shipping and other human activities is not likely to result in anything but negligible effects on cetaceans.

4.8.5 Fish

This section addresses potential direct, indirect and cumulative effects of the alternatives on fish in the NWHI and MHI, by assessing the potential for increased predation from Hawaiian monk seals. Table 4.4.4 in Section 4.4.2 summarizes the criteria used to evaluate effects of the alternatives on fish. Potential effects on fish populations would be similar for Essential Fish Habitat, commercially harvested fish species, and nearshore fish species; thus, potential effects for these categories are discussed together.

As described in Section 3.3.1.5, Hawaiian monk seals are foraging generalists, with a wide variety of prey including several varieties of fish and multiple species of crab and lobster. There is also evidence of variation in diet among individuals, demographic groups (between juveniles and adults/sub adults) and locations (Iverson 2006); indicating that individual monk seal foraging preferences and capabilities play a role in selection of foraging habitat. In other words, diets differ considerably among individual seals.

4.8.5.1 Direct and Indirect Effects of All Alternatives on Fish

Given the wide variety of fish consumed by monk seals, the likelihood that seal predation on fish could cause a long-term decline in fish populations is unlikely. Therefore, none of the alternatives would result in any notable effect on fish populations as a result of monk seal predation. Nearshore activities such as vessel surveys are not likely to result in disturbance or mortality of fish and would be considered negligible under all alternatives.

Negligible effects on fish would be expected to occur under the Status Quo Alternative given that the Hawaiian monk seal population is projected to continue to decline despite research and enhancement covered under the existing permit. While this is not to say that predation on fish species by monk seals does not occur, the continuation of research and enhancement activities on seals would not result in dramatic changes in the levels of fish consumed by seals throughout the Hawaiian Islands. In fact, given the projected decline in Hawaiian monk seals under all alternatives, a potential decline in predation on fish over the next 10 years could be reasonably assumed.

The potential effects of sonic tags, which may transmit signals up to 69 kHz, are summarized in the 2010 EA for NMFS Permit 10137 for Hawaiian monk seal research and enhancement (NMFS 2010) as summarized here. Many fish species hear outside of this frequency (A. Scholik, personal communication, March 31, 2009), with the exception of some clupeids (Popper *et al.* 2004). Only a few species of clupeids are found in Hawaiian waters (*e.g.,* the clupeid Spratelloides delicatulus is found from O`ahu to Kure), and if these fish can hear within the frequency emitted by the sonic tags it is highly unlikely that there would be any significant effects on these fish.

4.8.5.2 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Alternatives 3 and 4 could result in a slight reduction in the decline of the numbers of Hawaiian monk seals. In other words, though the decline may slow, the population would still likely decrease. As described in more detail in Section 3.3.1.5, foraging competition may help explain differential survival rates of juvenile Hawaiian monk seals at various subpopulations between different habitat areas, but does not provide any indication that the monk seals would be more effective predators than other predators in the vicinity (*e.g.*, birds, sharks, large predatory fish).

Translocating a small number of juvenile monk seals (potentially 20 per year) between islands in the NWHI would not have a measurable effect on any fish species, as the number translocated would typically be small relative to the seal abundance at the recipient subpopulation and would likely represent a small segment of the large marine predator population, particularly when compared to the numbers of predatory fish present in the NWHI. Additionally, the predatory effect on fish resulting from the juvenile monk seals is likely to be the same whether it occurs at the original island or at the island where the juveniles are translocated. Effects of this alternative would be negligible.

It is unlikely that Hawaiian monk seals would have a predatory effect on fish populations that is measurably different than any other predatory effect of other species. Fish consumption by Hawaiian monk seals would be distributed across a wide variety of available prey species, and the effect of translocating Hawaiian monk seals (slowing their population decline) is not likely to be detectable.

4.8.5.3 Cumulative Effects

Fish populations have been affected by commercial fishing, ocean pollution, climate change, and habitat degradation. Reasonably foreseeable future actions could have effects on fish populations including but not limited to commercial, (Table 4.5-2) recreational and subsistence fishing, climate change, ocean acidification, aquaculture programs, pollution and storm water runoff from population areas, construction projects, and tsunamis. The contribution of the

proposed monk seal research and enhancement activities to cumulative effects on fish are expected to be negligible given there would be no dramatic changes in the levels of fish consumed by seals throughout the Hawaiian Islands. Given the small population of monk seals now, the continued decline under the best case scenario of Alternative 4, and the wide variety of prey species distributed across the Hawaiian Archipelago, the potential contribution to cumulative effects from the proposed alternatives for research and enhancement would be negligible.

4.8.6 Birds

4.8.6.1 Direct and Indirect Effects of Alternative 1 – Status Quo

Under Alternative 1, the current NMFS Research and Enhancement Permit (10137) would continue until its expiration in 2014, and subsequent permits would be issued to continue research and enhancement activities according to the scope and methods currently permitted. For a complete description of research and enhancement activities allowed under Alternative 1, please refer to Section 2.7, Alternative 1 Status Quo, and Table 2.10-1.

Seabirds

Alternative 1 would result in minor, adverse short-term effects on productivity of seabird species identified in Table 3.6-6. Seabirds that nest in proximity to areas where monk seals haul out could be disturbed by researchers' presence on beaches. Accidental crushing of eggs, chicks, or nest burrows, blockage of access to nest sites with gear, thermal stress, increased predation of chicks, and elevated stress levels in birds are examples of impacts that are possible each time a human or humans enter a nesting seabird colony (PMNM 2008). Thermal stress could occur to eggs and/or very young chicks if adult seabirds are flushed from the nest and kept away for more than 3 minutes (PMNM 2008). In addition, if adult seabirds are flushed from nests, unattended eggs or hatchlings are more vulnerable to predation. Stress reactions (elevated heart rate, elevated levels of corticosterone, and behavioral responses) have also been documented in several species of nesting seabirds as a result of human activities in nesting colonies (PMNM 2008).

All reasonable precautions would be implemented to avoid take of seabirds incidental to research and enhancement activities and nesting seabirds on beaches would be avoided. To mitigate impacts, USFWS gives research and enhancement field researchers a briefing on appropriate mitigation to avoid take of seabirds in the NWHI (USFWS 2010a). Mitigation includes:

- Looking for nests or for adults flushing from inconspicuous nests when approaching seabird colonies;

- Not disturbing any colonies of ground-nesting sooty terns, gray-backed terns or brown noddies with chicks 2-7 days old (before scapular feathers have erupted);
- Planning activities to avoid displacing adults from eggs or chicks for longer than 3 minutes;
- Never leaving string or line anywhere in nesting colonies;
- Planning work when the fewest birds are in the area;
- Extinguishing all ship lights except for running lights or anchor lights when operating in proximity to seabird colonies;
- Traveling on marked trails to avoid subsurface nests; and
- Digging out shearwaters or petrels if nests are stepped on (PMNM 2008).

Alternative 1 would result in minor, periodic, adverse short-term effects on survival of seabirds. There is limited risk that seabirds, particularly albatross that require a long straight-line ground trajectory to become airborne, could fly into fencing associated with shoreline or inland pens with resultant injury.

Temporary pens for Hawaiian monk seals were seasonally maintained by researchers at Kure Atoll, Midway Atoll, and French Frigate Shoals for ten years during summer months with no incidents of seabirds becoming entangled in the fence. However, during a three-month period in 2006, a single Laysan albatross flew into fencing associated with a temporary pen at French Frigate Shoals and was injured, but not killed (USFWS 2010a).

In order to minimize hazards from shoreline pens for birds, including short tail albatross, researchers would increase monitoring on windy days and would dismantle the pen after use, which would not exceed two weeks for holding seals (USFWS 2010a).

Airplane flight activities could also have minor adverse effects on birds due to the increased noise disturbance and potential risk for birds being hit by aircraft (PMNM 2008). Noise disturbance results in an energetic cost to the bird although the energetic cost of response may not equate to reduced survival or productivity.

The millions of seabirds in the NWHI make aircraft flights to the islands potentially hazardous to both the birds and the aircraft personnel. At Tern Island and French Frigate Shoals, the species most commonly killed during aircraft operations is the sooty tern, but occasionally wedge-tailed shearwaters, great frigate birds, and both species of albatross are also hit (PMNM 2008). Both Laysan and black-footed albatross use the runway at Midway as a soaring area on their way to feed during the day (PMNM 2008). However, bird use of the

airport runways declines dramatically at night, so night flights have a greatly reduced chance of hitting birds.

Requirements of the Monument would be in place to ensure the overall effects of air strikes on birds is minimal (PMNM 2008).

Requirements of the Monument include:

- Night flights for most of the year at Midway;
- Vegetation management along the runways to modify bird flight and nesting behavior;
- Flight path advisories given to pilots; and
- Runway clearing of birds and other wildlife by personnel prior to landing and takeoffs (PMNM 2008).

As described above and in Section 3.3.1.9, field camps in the NWHI are typically supplied and staffed using vessels, rather than aircraft. While the use of aircraft may occur under special circumstances (at Midway Islands or French Frigate Shoals), this is expected to be infrequent, thereby further minimizing the potential for these effects to occur.

Alternative 1 would result in, minor localized effects on habitat for seabirds which could be short or long-term depending on the extent or type of damage to the physical environment. The NWHI or the islets off the MHI are particularly vulnerable to the introduction of invasive species. Invasive plants and introduced mammals (*.e.g.,* rats) are a primary threat to nesting seabirds, both indirectly by altering the ecosystem (plants) and directly by eating eggs and chicks (mammals).

For example, the invasive plant golden crownbeard (*Verbesina encelioides*) displaces almost all native vegetation in some nesting areas at Kure, Midway, and Pearl and Hermes Atolls. This plant causes entanglement of albatross adults and chicks and increases chick mortality due to heat stress by reducing the birds' ability to use convective cooling for thermoregulation (PMNM 2008). BMPs for Monument Special Conditions for Moving between Islands and Atolls and packing for field camps would be in place to ensure preservation of the NWHI native ecosystem, and temporary field camps are established primarily during summer months only (PMNM 2008).

Researchers may enhance habitat for birds when they remove marine debris during field activities. Marine debris affects seabirds via ingestion of anthropogenic materials (*e.g.,* plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.).

Removal of marine debris by researchers for Hawaiian monk seals would result in a beneficial impact for birds.

Activities to be undertaken by researchers in the MHI are not likely to have a measurable impact to the environment relative to those activities that already exist (*e.g.,* recreational boating and fishing, aerial tour operations, use of beaches by tourists), and no permanent damage to the physical environment (*e.g.,* construction) is expected. Thus, the analysis of potential effects of the research and enhancement alternatives focuses on potential effects in the NWHI.

Shorebirds

Alternative 1 is expected to have minor or negligible effects on shorebirds. The only nesting shorebird in the Hawaiian Archipelago is the endangered Hawaiian Stilt. This species breeds in the MHI and large coastal wetlands and ephemeral playas, not beaches, are important habitats for this species.

Large numbers of overwintering shorebirds occur throughout the Hawaiian Archipelago, but negligible effects on their productivity or survival are expected from research and enhancement activities associated with Alternative 1.Overwintering shorebirds may be temporarily displaced from foraging areas during research and enhancement activities on the beach (ground surveys, holding pens, etc.), but these are expected to be brief, temporary disturbances with no measurable effects on shorebirds.

Minor risk from aircraft collisions is possible, but requirements of the Monument would be in place to ensure the overall effects of air strikes on birds is minimal. Requirements of the Monument are the same as described above. As described above and in Section 3.3.1.9, , field camps in the NWHI are typically supplied and staffed using vessels, rather than aircraft, and any aircraft use is expected to be infrequent, minimizing the potential for these effects to occur.

Protected Bird Species

Most nesting seabirds and commonly occurring shorebirds that occur in the Hawaiian Archipelago (Table 3.3-5) are considered Species of Greatest Conservation Need (SGCN) by the State of Hawai'i. Thus, effects from Alternative 1 on the altered survival or productivity and habitat alteration for SGCN species are identical to the effects identified for seabirds and shorebirds in the above sections.

Components of Alternative 1 with the greatest potential to affect protected Birds of Conservation Concern (BCC) (Laysan and black-footed albatross) would be the same as those described in Section 3.3.6.1 for seabirds. Because albatross species require long runways for takeoffs, they are the protected species most likely to collide with aircraft or holding pens. However, Monument requirements for the use of aircraft and of the USFWS for holding pens would be in place to

ensure the overall effects of air strikes on birds is minimal (Appendix D, PMNM 2011-001).

ESA-listed seabird and shorebirds and all bird species occurring in the NWHI include:

- Short-tailed albatross;
- Laysan duck;
- Nihoa millerbird;
- Laysan finch, Nihoa finch;
- Hawaiian petrel;
- Newell's shearwater;
- Band-rumped storm petrel (candidate species); and
- Hawaiian stilt (USFWS 2010a).

All species except Laysan finch occur outside of the Project Area and would rarely, if ever, come into contact with monk seal research personnel (see Section 3.3.6.1, Seabirds). USFWS previously found NMFS monk seal activities were not likely to affect the Nihoa millerbird, Nihoa finch and Laysan duck because they primarily occur in the vegetated or interior areas of the NWHI (USFWS 2010a). Nihoa millerbird and Nihoa finch only occur at Nihoa Island which is infrequently visited by researchers and no regular field camps occur here.

Laysan ducks may fly or run into holding pens when foraging, but requirements of the USFWS for holding pens would be in place to ensure the overall effects of air strikes on Laysan ducks are minimal (Appendix D, PMNM 2011-001). Short-tailed albatross typically nest higher in elevation than where NMFS monk seal activities will occur (USFWS, pers. Comm.). Monument requirements for the use of aircraft and of the USFWS for holding pens would be in place to ensure the overall effects of air strikes on short-tailed albatross are minimal (Appendix G, PMNM 2011-001).

Alternative 1 may moderately affect Laysan Finch (USFWS 2010a). Both NMFS and USFWS maintain field camps at Laysan Island, and NMFS maintains field camps at Pearl and Hermes Reef (see Section 3.3). Laysan finches are tame to human presence, thereby entering these field camps in search of food and water. Unintentional mortality or serious injury of two Laysan finches is possible. Under Permit 10137, NMFS is currently authorized to harass up to 200 Laysan finches. Despite efforts to prevent mortality, finches have previously drowned in camp containers which filled with rainwater during cloudbursts when biologists were away from camp, or have become trapped in camp gear. To mitigate effects

to Laysan finch, monk seal research personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species (USFWS 2009). Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds (USFWS 2009).

Conclusions For Direct and Indirect Effects of Alternative 1

Overall, Alternative 1 is expected to have minor or negligible effects on seabird and shorebird productivity, survival, and habitat. Because beaches in the Hawaiian Archipelago are not used by nesting shorebirds, they are much less likely to be affected by human disturbance. Alternative 1 would also have minor or negligible short-term adverse effects on productivity or survival of SGCN-listed seabirds and shorebirds and BCC listed albatross species. Alternative 1 may have moderate adverse affects on Laysan Finch. Although not likely, monk seal research and enhancement activities may cause reduced productivity in nesting seabird colonies, collisions of birds with aircraft or holding pens, introduction of exotic species, and incidental take of Laysan finch.

BMPs and protocols of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds (PMNM 2008). USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species and to minimize human effects on endangered land birds. Therefore, Alternative 1 would result in minor effects on bird productivity, survival, and habitat.

4.8.6.2 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

Alternative 2, the No Action Alternative, would only allow for status quo research and enhancement activities on Hawaiian monk seals to continue until the current permit (10137) expires in 2014. When the existing permit expires, all research and enhancement activities that require a permit (except under the separate MMHSRP permit) would cease. For a complete description of research and enhancement activities allowed under Alternative 2, please refer to Section 2.8, Alternative No Action, and Table 2.10-1.

Seabirds

Effects from potential disturbance, altered survival and/or productivity, and habitat alteration from Alternative 2 mirror the effects described for seabirds Alternative 1 (Status Quo) but would occur for a shorter timeframe. Hawaiian monk seal ground surveys and beach activities would cease after 2014, resulting in fewer disturbances to seabirds by monk seal research personnel, fewer chances of collisions by seabirds with airplanes and Hawaiian monk seal holding pens, fewer opportunities for the introduction of exotic species. Therefore, effects from

Alternative 2 would be less likely to impact seabirds than those outlined for Alternative 1. It is possible that seabirds may be affected by monk seal research activities until 2014, and thus implementation of Alternative 2 may result in minor short-term decreases in survival and/or productivity in seabirds and/or short or long-term localized effects on seabird habitats.

Once the current permit expires in 2014, potential effects on birds are likely to be negligible as no research or enhancement activities would occur on wild Hawaiian monk seals under Alternative 2; however, the beneficial removal of marine debris by monk seal researchers would also cease.

Shorebirds

Effects from potential disturbance, altered survival, and habitat alteration from Alternative 2 mirror the effects described for Alternative 1 for shorebirds but would occur for a shorter timeframe. Overwintering shorebirds may be temporarily displaced from foraging areas during research and enhancement activities on the beach (ground surveys, holding pens, etc.), but these brief, temporary disturbances with no measurable effects on shorebirds would cease after 2014. Implementation of Alternative 2 is not likely to have any measurable effects on shorebird survival and is unlikely to, but may cause minor adverse short or long-term localized effects on habitat.

Protected Bird Species

Effects from potential disturbance, altered survival or productivity, and habitat alteration from Alternative 2 mirror the effects described for the protected species in Alternative 1 but would occur for a shorter timeframe. Hawaiian monk seal ground surveys and beach activities would cease after 2014, resulting in fewer disturbances to protected species by monk seal research personnel, fewer chances of collisions of birds with airplanes and Hawaiian monk seal holding pens, and fewer opportunities for the introduction of exotic species.

It is possible that protected birds may be affected by research activities prior to 2014, and thus, Alternative 2 may result in minor, short-term decreases in survival and/or productivity in SGCN-listed seabirds and shorebirds and/or short or long-term localized effects on habitat. However, requirements of the Monument and protocols established by the USFWS would be in place to minimize effects to protected seabirds and shorebirds. Alternative 2 may have moderate effects on the Laysan Finch prior to 2014. To mitigate effects to Laysan finch, MMRP personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species. Campsites at islands where Laysan finches occur would be inspected regularly for presence of hazards to the birds.

Conclusions for Direct and Indirect Effects of Alternative 2

Effects from potential disturbance, altered survival and/or productivity, and habitat alteration from Alternative 2 mirror the effects described for seabirds under Alternative 1 (Status Quo) except research activities would cease to occur after 2014.

It is possible that birds may be affected by monk seal research activities prior to 2014, and thus implementation of Alternative 2 may result in minor short-term decreases in survival and/or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 2 may also have moderate adverse affects on Laysan Finch. However, requirements of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds. Once the current permit expires in 2014, potential effects on birds are likely to be negligible as no research or enhancement activities would occur on wild Hawaiian monk seals under Alternative 2; however, the beneficial removal of marine debris by researchers would also cease.

4.8.6.3 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Under Alternative 3, all activities currently permitted would continue, and new permissions would be granted with expanded scope and methods. For a complete description of research and enhancement activities allowed under Alternative 3, please refer to Section 2.9, Atlernative 3 Limited Translocation, and Table 2.10-1.

Seabirds

Potential effects from Alternative 3 on seabirds are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be slightly increased due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities (*i.e.,* remote camera installations, increased capturing and translocation of Hawaiian monk seals, increased use of shore pens) that may be authorized under this alternative. Increased field activities would also correlate to increased removal of marine debris for Hawaiian monk seals by researchers, which indirectly results in a beneficial impact to birds. In addition, once remote cameras are installed, fewer Hawaiian monk seal ground surveys would be needed, thereby reducing effects on nesting seabirds overall. Restrictions and mitigation measures would be required by the MMPA, ESA and NMFS to minimize disturbances caused by all new and existing monk seal research and enhancement activities. Thus,

Alternative 3 is expected to have minor short-term adverse effects on seabird productivity and/or survival.

Potential effects from Alternative 3 on seabird habitat are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be slightly increased due to the additional research and camp activities that may occur under this alternative. Alternative 3 would result in minor localized effects on habitat for seabirds if fire, disease, or introduced species are spread through research or field camp activities. Habitat effects could be short or long-term depending on the extent or type of damage to the physical environment. However, BMPs would be in place by the Monument for camp protocols and to prevent the spreading of disease or introduced species (PMNM 2008).

Shorebirds

Potential effects from Alternative 3 on shorebirds are identical to the effects described for Alternative 1 (Status Quo) but their likelihood of occurrence would slightly increase due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities (*i.e.,* remote camera installations, increased capturing of Hawaiian monk seals) that may be authorized under Alternative 3. However, restrictions and mitigation measures would be required by the MMPA, ESA and NMFS to minimize disturbances caused by all new research and enhancement activities. Thus, Alternative 3 is expected to have minor short-term adverse effects on shorebird survival and/or adverse short or long-term localized effects on shorebird habitats.

Protected Bird Species

Potential effects from Alternative 3 on SGCN protected seabird and shorebird species are identical to the effects described for Status Quo (Alternative 1), but their likelihood of occurrence would slightly increase due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities that may be authorized under this alternative. However, restrictions and mitigation measures for all new activities would be required by the MMPA, ESA and NMFS to minimize disturbances by research and enhancement activities. Alternative 3 may thus result in minor short-term decreases in survival and/or productivity and/or adverse short or long-term localized effects on habitats. Alternative 3 may have moderate adverse effects to Laysan Finch. To mitigate effects to Laysan finch, monk seal researchers adhere to strict procedures mandated by USFWS to avoid injury or death to this species. Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds.

Conclusions for Direct and Indirect Effects of Alternative 3

Potential effects from Alternative 3 on birds are identical to the effects described under Status Quo (Alternative 1), but their likelihood of occurrence would be

slightly increased due to the additional ground, boat, and aerial Hawaiian monk seal surveys and beach activities that may be authorized under this alternative. Implementation of Alternative 3 may result in minor short-term decreases in survival and/or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 3 may also have moderate adverse affects on Laysan Finch. However, requirements of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives monk seal field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs (PMNM 2008) are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds.

4.8.6.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

The enhanced implementation Alternative would encompass all the activities permitted under Alternative 3, with the addition of the option for temporary translocation of weaned pups from the NWHI to the MHI. For a complete description of research and enhancement activities allowed under Alternative 4, please refer to Section 2.10, Alternative 4 Enhanced Implementation (Preferred Alternative), and Table 2.10-1.

Seabirds

Potential effects from Alternative 4 on seabirds are identical to the effects described under Alternative 3. Requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse effects of monk seal research and enhancement activities on nesting seabirds. Overall, Alternative 4 is expected to have minor short-term adverse effects on seabird productivity, survival, or habitat.

Shorebirds

Potential effects from Alternative 4 on shorebirds are identical to the effects described under Alternative 3. Requirements of the Monument and protocols established by the USFWS would be in place to minimize adverse effects of research activities (Appendix G, PMNM 2011-001). Thus, Alternative 4 is expected to have minor short-term adverse effects on shorebird survival and could result in adverse short or long-term localized effects on shorebird habitats depending on the extent or type of damage to the physical environment.

Protected Species

Potential effects from Alternative 4 on SGCN-protected seabird and shorebird species are identical to the effects described under Alternative 3. Requirements of

the Monument and protocols established by the USFWS would be in place to minimize adverse effects of MMRP activities. Overall, Alternative 4 would have minor short-term decreases in survival and/or productivity and/or adverse short or long-term localized effects on habitats for SGCN-protected seabirds and shorebirds. Alternative 4 may have moderate adverse effects on the Laysan Finch. To mitigate effects to Laysan finch, monk seal personnel adhere to strict procedures mandated by USFWS to avoid injury or death to this species. Campsites at islands where Laysan finches occur will be inspected regularly for presence of hazards to the birds.

Conclusions for Direct and Indirect Effects of Alternative 4

Potential effects from Alternative 4 on birds are identical to the effects described in Alternative 3. Implementation of Alternative 4 may result in minor short-term decreases in survival and/or productivity in birds and/or short or long-term localized effects on bird habitats. Alternative 4 may also have moderate adverse affects on Laysan finch. However, requirements of the Monument would be in place to ensure preservation of the NWHI ecosystem and the resources it holds. USFWS gives MMRP field researchers a briefing on appropriate mitigation to avoid take of nesting seabirds and BMPs are in place by the Monument to reduce incidental take of birds by collisions with aircraft and holding pens, to prevent the spreading of disease or introduced species, and to minimize human effects on endangered land birds.

4.8.6.5 *Cumulative Effects of the Proposed Alternative on Birds*

Summary of Direct and Indirect Effects

Monk seal research and enhancement ground and aircraft surveys, holding pens, and the possible introduction of exotic species by research personnel or equipment under Alternative 1 may adversely affect bird survival, reproduction and habitat. However, protocols and BMPs in place by the Monument and briefing by USFWS regarding nesting seabirds would minimize the disturbance to birds. Thus, Alternative 1 would have minor or negligible adverse affects on birds. Alternative 2 would result in identical effects on birds, but for a shorter duration. Thus, the overall effect on seabird survival would be minor until the permit expires and thereafter would be considered negligible. Alternatives 3 and 4 would result in increased ground, boat, and aerial surveys, as well as increased research and enhancement activities on the beach. However, protocols and BMPs in place by the Monument would continue to be strictly followed, and new activities would have restrictions and mitigation measures required by the MMPA, ESA, and NMFS. Thus, Alternatives 3 and 4 would have minor adverse effects on bird survival, productivity, and habitat.

Summary of Lingering Past Effects

Since the arrival of the first humans to the Hawaiian Archipelago, more than half of the islands' 140 native bird species have become extinct (Hawaiian invasive species.org). Today, 31 Hawaiian bird species are endangered. Past threats to birds within the Project Area include habitat loss (MHI), bird poaching, seabird bycatch from longline fisheries, invasive species, marine debris, habitat loss, and contaminants.

Current threats are outlined below.

- Mortality in longline fisheries is a global threat to most albatross and large petrel species (Gilman 2004). Hundreds of thousands of seabirds, including tens of thousands of albatrosses, are caught annually in longline fisheries worldwide (Gilman 2004).

- Invasive species spread disease, destroy habitat, and indirectly and directly kill Hawaiian birds. Rats, mongoose, ants, mosquitoes (carrying bird pox and bird malaria), cats, and the golden crownbeard have been some of the most damaging invasive species for nesting seabirds in the Hawaiian Archipelago.

- Marine debris affects seabirds via ingestion of anthropogenic materials (*e.g.,* plastics, pellets, fish hooks, etc.) and entanglement in derelict fishing gear (recreational or commercial fishing nets, lines, etc.).

- Contaminants left over from military use of the NWHI islands also continue to affect emergent land areas, especially at Midway and French Frigate Shoals (Keller *et al.* 2010).

- Global climate change factors are already affecting the NWHI ecosystem and will have widespread effects. Global mean sea levels have risen an estimated 3.1 ± 0.7 mm yr-1 from 1993-2003, an amount higher than any other 10-year period since 1950 (Keller *et al.* 2010). Habitat loss from sea level rise may be devastating to seabird populations that depend on these low islands for survival (Baker *et al.* 2006).

Analysis of Reasonably Foreseeable Future Actions

Avian mortality or reduced survival/reproductive success from RFFAs is identified for wind farms, residential and commercial construction (beach, nearshore), commercial fishing, scientific research activities on land, natural events, introduction of invasive species, tourism and recreation, and marine pollution. Particularly in the MHI, all of the mortality factors except bird poaching identified in the previous section may continue to occur within the Project Area in the future. Some of the greatest sources of human-caused bird mortality from the past include the introduction of invasive species, habitat loss,

and commercial fishing. However, effects of global climate change may become the largest threat to seabirds, especially in the NWHI, in the future.

Components of climate change most likely to affect seabirds in the NWHI include sea level rise, changing storm intensity and frequency (causing erosion), sea surface temperature rise and acidification (Keller *et al.* 2010). Habitat loss from sea level rise may be devastating to seabird populations that nest at or near sea level (Baker *et al.* 2006;Keller at al. 2010). Models predict that sea level will continue to rise (Keller *et al.* 2010). In addition, there is the potential for further habitat degradation with the release of contaminants contained in landfills as the islands are eroded or flooded from sea level rise (Keller *et al.* 2010). As sea surface temperature increases, seabird prey species may move to deeper, cooler water, thereby decreasing food availability for foraging birds, or requiring birds to fly further north in the Pacific to obtain food resources.

Cumulative Effects

Birds, especially nesting seabirds, of the Hawaiian Archipelago are susceptible to future human-caused mortality factors. The contribution from Hawaiian monk seal research and enhancement activities, however, is considered minor or negligible on birds. Activities to be undertaken by researchers in the MHI are not likely to have a measurable impact to the environment relative to those activities that already exist (*e.g.,* recreational boating and fishing, aerial tour operations, use of beaches by tourists), and no permanent damage to the physical environment (*e.g.,* construction) is expected. Thus, the contribution of any alternatives to cumulative effects on birds in the MHI are considered negligible.

Because BMPS and protocols in place for the NWHI minimize human disturbance to birds, the direct and indirect effects associated with Alternative 1 are minimized, and research and enhancement activities would contribute very little to the overall cumulative effects on bird species. Alternative 2 would involve even less disturbance to birds from research and enhancement activities, and the direct and indirect effects associated with Alternative 2 would contribute even less to the overall cumulative effects on birds. Alternatives 3 and 4 would involve additional human disturbance associated with increased research and enhancement ground activities and/or aerial surveys than Alternative 1. However, the magnitude/intensity and duration of these effects are still considered minor. Overall, the contribution to an overall adverse cumulative effect from any of the alternatives is considered minor.

4.8.7 Corals

As described in Section 3.3.7, Coral, the Hawaiian Islands contain about 6,700 square miles of coral reef habitats, consisting of both shallow water species inhabiting waters less than 98 ft (30 m) and deep water species found in waters greater than 98 ft (30 m) (NOAA 2008b).

4.8.7.1 *Direct and Indirect Effects of Alternatives*

Status Quo (Alternative 1) activities would have negligible adverse impacts on shallow water corals due to the strict protocols described for entering the NWHI under a Monument permit. Vessel anchors and chains have the potential to destroy corals and live rock. To mitigate this type of damage, mooring buoys are used in areas where frequent or extended anchoring is necessary. In addition, Monument regulations, codified under 40 CFR Part 404 prohibit anchoring on corals.

In order to conduct monk seal research and enhancement activities in the Monument, NMFS must obtain a permit from the Co-Trustees. The current Monument permit (PMNM-2011-001 presented in Appendix D) dictates certain mitigation measures that are standard practice for NMFS when working in the area and also in the MHI. In addition to permit conditions and as described in Section 3.3.10.1 Monument Permitted Activities, there are several Monument BMPs that are designed to avoid, minimize or mitigate potential impacts (see Appendix G).

Monument Permit PMNM-2011-001 specifies measures to minimize impacts on corals due to boating:

- Anchoring of authorized vessels is allowed on non-coral substrate only, and anchors must be lowered slowly and carefully
- All vessels, engines, and anchor lines must be free of introduced species prior to entry into the monument
- Tenders and small vessels must be equipped with engines that meet EPA emissions requirements
- Specific measures are required for boat operations and diving activities to reduce or eliminate adverse effects on protected marine species (Monument BMP #004); and
- Special Conditions and Rules for Small Boat Operations are required at Tern Island (Monument BMP #013), which mandate specific notification and operator training.

Under the Status Quo, small boats (less than 20 ft) used by NMFS researchers conducting Hawaiian monk seal research and enhancement activities in areas with shallow corals include: Boston whalers, ridged hull Zodiacs, Zodiac and Achilles inflatables and personal watercraft. These small boats can be launched from larger ships to access the islands and conduct research or can be used for access between research locations. All small boats and the larger research vessels used by NMFS such as the NOAA R/V Oscar Elton Sette (224 ft), the R/V Searcher (97 ft), and the M/V Kahana (160 ft), would be required to follow all

permit requirements, provisions, and BMPs to protect coral when working in the Monument. Thus, impacts to shallow or deep water corals under the status quo would be expected to result in negligible effects.

Alternative 2 (No Action) would result in no additional effects once the current permit expires in 2014 as no research and enhancement activities for Hawaiian monk seal would be permitted.

Alternative 3, which adds new activities with expanded scope and methods, has a slightly greater potential to impact shallow water corals as compared to Alternative 1 due to increased research activity and use of small boats. However, considering the strict guidelines described above for Alternative 1, which would also be in place under Alternative 3, the potential adverse effects of Alternative 3 on the corals would be negligible to minor.

Alternative 4 will have a slightly greater potential impact than Alternative 3, again due (in part) to the additional use of small boats and possibly larger research vessels to translocate weaned pups between NHWI and MHI. However, any potential adverse effects on coral would likely be negligible to minor due to the controls and mitigation measures already in place.

4.8.8 Invasive Species

The Hawaiian Archipelago is home to many rare and endemic species of plants and animals, many of which are formally listed as endangered (under the ESA), protected (MMPA) and/or listed as a species of concern under various federal, state or international laws or agreements. Endemic species are particularly vulnerable to harm from the introduction of non-native species, for example, through competition for resources (such as food and habitat), disease or predation.

The introduction of non-native species could have effects on plant and animal species endemic to the islands and atolls used for Hawaiian monk seal research and enhancement activities. The Hawai`i Invasive Species Council (HISC) identifies 46 high-profile invasive species/categories, of which only hull fouling species, algae and mussels, are of concern within the MHI (HISC 2010d). In the NWHI, there is special concern over the introduction and proliferation of non-native seeds, insects or other alien species such as snakes, rodents, dogs, cats and so forth, as wells as hull-fouling species (algae and mussels). Section 3.3.9 provides more detail on invasive species in the Hawaiian Archipelago relative to the proposed action and associated Project Area.

4.8.8.1 Direct and Indirect Effects of Alternatives

Research and enhancement on Hawaiian monk seals would likely result in minor or negligible effects for the following reasons. Any increase in activity, especially

within the NWHI, does increase the potential to introduce alien species. However, access to the Monument is limited and is contingent on the express permission of the Co-Trustees through the permitting process. Strict adherence to the special permit conditions and rules for the prevention of introduction of non-native species, as described in Appendix G of the Monument Permit, PMNM 2011-001, Attachment 13 *Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment.* The Monument permit General Terms and Conditions sets out protocols and procedures to reduce the risk of the spread of non-native (invasive) species including the assurance that "…all vessels are inspected for potential introduced species prior to departing the last port before entering the Monument". In addition, NOAA Administrative Order (NAO) 216-6, Section 7.03 addresses the integration of EO 13112, Invasive Species, in the NOAA Decisionmaking process, requiring the agency to "…use authorities to prevent introduction of invasive species, respond to and control invasions in a cost effective and environmentally sound manner".

NMFS closely follows these precautions when conducting any research and enhancement activities in the NWHI, thus the potential for vessels or personnel to introduce non-native species would likely be minor, particularly given that field camps in the NWHI are seasonal, typically staffed between April to August. Camps are rarely re-supplied during the field season thereby further reducing the potential introduction of invasive species. Research and enhancement activities in the MHI are not likely to result in the spread of invasive species relative to numerous other activities in the region including recreation, fishing, ecotourism and general habitation of the area.

Alternative 1 (Status Quo) activities would not likely result in the spread of invasive species due to the strict protocols described for entering the NWHI under a Monument permit however the possibility still exists. Given the high population and level of ecotourism, recreation, fishing, and other human activities that have the potential to spread non-native species, the research and enhancement activities proposed would be expected to result in minor adverse effects as the introduction of invasive species.

Alternative 2 (No Action) would result in negligible effects once the current permit expires in 2014 as no research and enhancement on wild monk seals would be permitted.

Alternative 3, which adds new activities with expanded scope and methods, has a slightly greater potential to introduce non-native species than Alternative 1 due to increased activity. Specifically, the translocation of seals from MHI to NWHI may increase the probability that alien species already established in MHI could be transferred to the Monument. However, considering the strict guidelines described above, the potential adverse effects of Alternative 3 on the spread of invasive species would be minor.

Alternative 4 could have only a slightly greater potential effect than Alternative 3, due to the potential increased transport between the MHI and NWHI. Still, the likelihood of cross-region transport would also be negligible because of the strict quarantines that apply.

4.8.8.2 *Cumulative Effects of the Alternatives*

Alternative 1

While the USFWS also maintains field research camps in the NWHI during periods throughout the year, mitigation measures and appropriate BMPs are in place as described above, to minimize the potential spread of invasive species. Given the high population and level of ecotourism, recreation, fishing, and other human activities in the MHI, research and enhancement activities proposed would be expected to result in negligible effects. Strict protocols for entering the NWHI prevent the spread of invasive species.

Alternative 2

After the permit expires in 2014, no additional research or enhancement would occur on wild seals thus there would be no potential to spread invasive species.

Alternative 3 and 4

The translocation of seals from MHI to NWHI may increase the probability that alien species already established in MHI could be transferred to the Monument but mitigated through strict protocols. While the USFWS also maintains field research camps in the NWHI during periods throughout the year, mitigation measures and appropriate BMPs are in place as described above, to minimize the potential spread of invasive species. High population and level of ecotourism, recreation, fishing, and other human activities in the MHI would be expected to have a greater probability to spread invasive species.

A juvenile Hawaiian monk seal may weigh approximately 250 pounds and consume between 2,738 and 7,300 pounds of fish, cephalopod and crustacean biomass annually. Based on a total commercial catch of approximately 27 million pounds in 2009 (WPacFIN 2010) (see Table 3.4-5 Quantity, Value, and Price per Pound of Commercial Landings in Hawai'i, 1990- to 2009), this amounts to only about 0.01 to 0.03% of the catch per seal.

4.9 *SOCIAL AND ECONOMIC ENVIRONMENT*

4.9.1 *Commercial Fishing*

This section of the PEIS analyzes potential direct, indirect and cumulative effects of the Alternatives on commercial fishing. The area of analysis includes both the nearshore and offshore areas surrounding the MHI. As discussed in Section 4.4.3 *Impact Criteria for Socioeconomic Resources*, given the restrictions on commercial

fishing due to the Monument, effects of the Alternatives on commercial fishing are unlikely in the NWHI. Therefore, this analysis focuses on the MHI.

Effects on commercial fishing could be anticipated if an action results in a change in profits for the commercial fishermen and, therefore, not only affects their well-being and quality of life, but can have a larger effect on the economy of the area. Given that profit is a function of revenue and cost, profits for fishermen could decrease or increase if the cost associated with fishing increases or decreases and/or the revenue derived decreases or increases, respectively. While there could potentially be some effects on costs associated with fishing due to the alternatives, there are no scientific data that can be used to examine whether any of the alternatives may result in increasing or decreasing such costs. Available historic data do not support a relationship between commercial catch and Hawaiian monk seal population in the MHI. Therefore, this analysis addresses any change in revenues for commercial fishermen as a consequence of the alternatives. The indicator used to assess this change is the potential variation in commercial catch, both in terms of quantity and value, due to the alternatives, as presented in Table 4.4-6 in Section 4.4.3 *Impact Criteria for Socioeconomic Resources*.

The alternatives are not anticipated to result in any direct effects on commercial fishing. However, indirect effects on commercial fishing may be possible if an Alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the commercial catch because Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are commercially viable. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators of those species. This possible affect is examined in the paragraphs that follow.

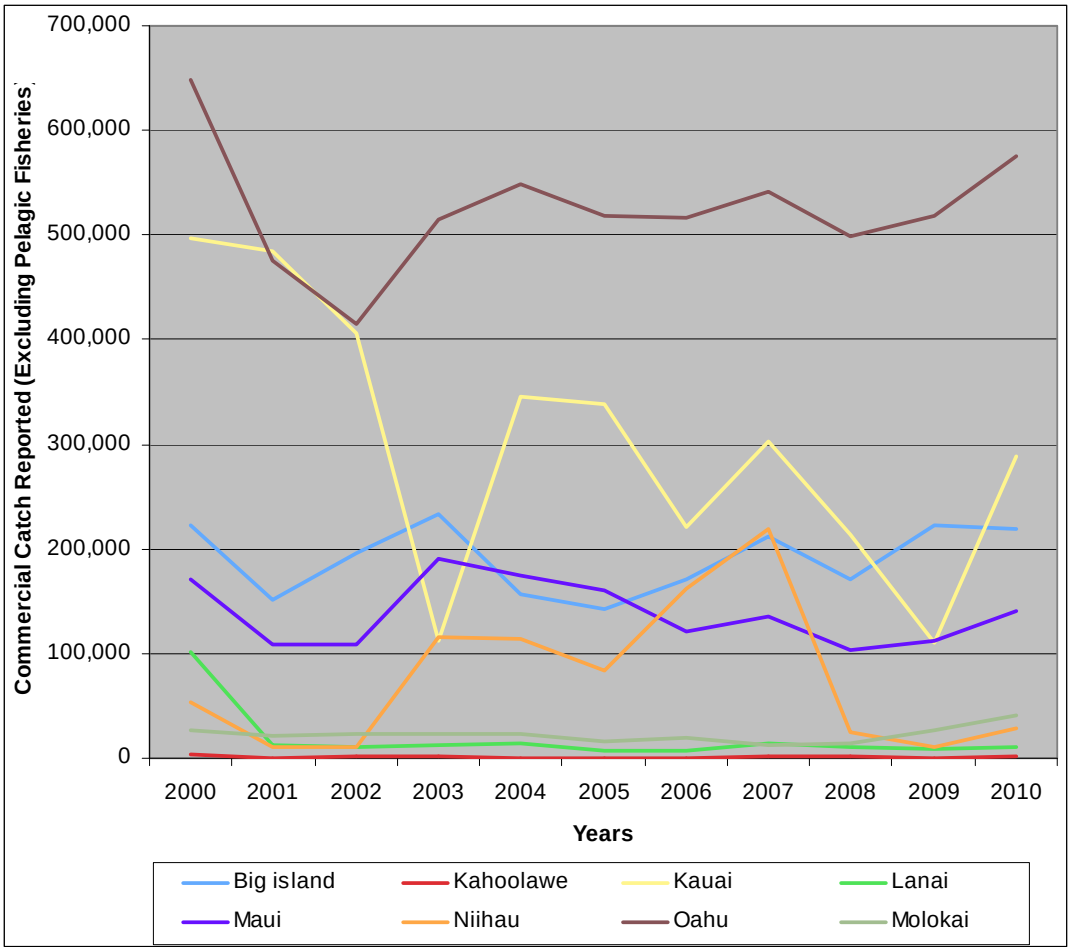
Among the various categories of fisheries, the pelagic fishing industry is the largest and most valuable one, accounting for almost 96% of commercial landings with 25.7 million pounds of pelagic fish caught commercially in 2009 (WPacFin 2010). According to the "Recovery Plan for the Hawaiian Monk Seal" (NMFS 2007), while seals and fisheries may exploit similar species in some cases, there is no evidence or study of ecological competition between fisheries and seals for a small seal population such as the Hawaiian monk seal. The Hawaiian monk seals are estimated to consume about three to eight percent of their body weight in biomass per day based on limited studies on monk seals and literature available on other marine carnivores (Littnan [NMFS] Personal Communication 2011). A juvenile Hawaiian monk seal may weigh approximately 250 pounds and consume between 2,738 and 7,300 pounds of fish, cephalopod (squid and octopus), and crustacean biomass annually (assuming 3 to 8% of body weight eaten per day). Total commercial catch in 2009 was approximately 27 million pounds (WPacFIN 2010) (see Table 3.4-5 *Quantity, Value, and Price per Pound of Commercial Landings in Hawai'i, 1990- to 2009*). This would amount to only about 0.01 to 0.03% of the catch per seal if seals exclusively ate individual marine

organisms that would have otherwise been caught by commercial fishermen. This is not likely to be the case.

For Alternatives that are anticipated to result in an increase in Hawaiian monk seal population in the MHI, either through translocation or because of the long-term success of the enhancement actions, additional fish consumption by seals may occur. However, Hawaiian monk seals are known to prey on a wide variety of fishes, cephalopods, and crustaceans, some of which are not commercial fished. Further, it is likely that even commercially viable fish that a monk seal eats would not necessarily have otherwise been available to fishermen. For example, those fish may have been eaten by another predatory fish, seabird or marine mammal. Hawaiian monk seals are also known to forage over a wide range of areas, both in terms of depth and variety of habitats, many of which are not used by commercial fishermen. Given these considerations, the percentage of commercial catch that might be consumed by seals present in the MHI due to research and enhancement activities would be even smaller than indicated by the above calculation.

This is further supported by historic data on commercial catch and Hawaiian monk seal population in the MHI. Figure 4.9-1 presents the commercial catch reported (in pounds) for all zones in the MHI within 100 fathom bathyline between 2000 and 2010. These data are filtered by the zones where Hawaiian monk seals tend to haul out and forage. Also, these data do not include catch associated with pelagic fisheries given that most of those fish are not popular Hawaiian monk seal prey species. As stated above, the pelagic fisheries account for almost 96% of the commercial catch. It is evident from Figure 4.9-1 that while Hawaiian monk seal population in the MHI has been increasing since 2000 when the first formal surveys were conducted, commercial catch in the MHI has fluctuated. The increases and declines in commercial catch could be based on a variety of factors. However, there appears to be no relations hip between changes in commercial catch and Hawaiian monk seal population in the MHI.

Figure 4.9-1 Total Commercial Catch Reported (Excluding Pelagic Fisheries) in Pounds for All Zones within 100 Fathoms Bathyline 2000 to 2010



Source: Catch landings for fish (minus sharks and jacks) from the Hawai`i State Commercial C-3 coastal reporting zones (100-108, 300-314, 400-409, 500-506) for year 2000-2010.

4.9.1.1 *Direct and Indirect Effects of Alternative 1 – Status Quo*

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.6 *Alternatives Carried Forward for Analysis*.

Alternative 1 is not anticipated to have any direct effects on commercial catch in the MHI. Under Alternative 1 (and all other alternatives), the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011) independent of actions take by NMFS. While this natural growth may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation

measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As discussed above, effects on commercial fishing could stem from changes in the quantity and/or value of commercial catch.

Indirect effects of Alternative 1 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. As stated above, the Hawaiian monk seal population is anticipated to increase in the MHI regardless of the alternatives, but some activities under Alternative 1 may enhance this growth. Given the marginal increase in Hawaiian monk seal population due to Alternative 1 activities, the potential effects on commercial fishing are anticipated to be negligible.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 1 would directly affect commercial fishing in MHI. Therefore, direct effects are likely to be negligible to none. A marginal increase in the already positive growth rate of the Hawaiian monk seal population within the MHI under Status Quo (Alternative 1) is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.9.1.2 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

Alternative 2 is not anticipated to have any direct effects on commercial fishing in the MHI. As noted above, demographic data suggest that the Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on commercial fishing under Alternative 2 would not likely occur. As discussed above, effects on commercial fishing could stem from changes in the quantity or value of commercial catch.

Indirect effects of Alternative 2 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. However, given the marginal increase in the Hawaiian monk seal population that might be realized due to Alternative 2 actions, these effects are anticipated to be negligible.

Conclusion for Direct and Indirect Effects

Alternative 2 is not anticipated to directly affect commercial fishing in MHI. Because monk seal research and enhancement would cease after 2014 under Alternative 2, any indirect adverse effect on commercial fishing would be even smaller than under Alternative 1, and thereby likewise negligible.

4.9.1.3 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities.

Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce potential effects on fishing by minimizing interactions.

Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP) (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal increases in the MHI monk seal population if seals with undesirable behaviors are able to remain in the wild. This would be expected to involve only a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce potential effects on fishing by minimizing interactions. Alternative 3 is not anticipated to have any direct effects on commercial fishing in the MHI.

Indirect effects of Alternative 3 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to an increased Hawaiian monk seal population. However, given the potential marginal increase in the rate of MHI Hawaiian monk seal population growth due to Alternative 3 activities, these effects are anticipated to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested commercially.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 3 would directly affect commercial fishing in MHI. Therefore, direct effects are likely to be negligible to none. A marginal increase in the MHI Hawaiian monk

seal population growth rate due to Alternative 3 is not likely to result in an indirect adverse effect on subsistence fishing. Therefore, this effect would likely be negligible.

4.9.1.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 would exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth that is naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 3 years of age. Alternative 4 is not anticipated to result in any direct effects on commercial fishing in the MHI.

Indirect effects of Alternative 4 on commercial fishing could be possible if there were marked changes in the population of commercially viable fish and, consequently, the quantity of commercial catch, due to increased Hawaiian monk seal population. Under this Alternative, a maximum of 20 weaned pups per year could be translocated to the MHI from NWHI for the five-year permit period. Each group of monk seals would be returned to the NWHI once they reached 3 years of age. The maximum number of additional seals that would be present in a single year is 60 seals if it is assumed that:

- the maximum allowed number of juvenile monk seals per year (20) are translocated for at least 3 consecutive years;
- all of these are translocated from the NWHI to the MHI and not vice versa; and
- there is no mortality of translocated seals for three years;

Assuming a worst case scenario in which all fish consumed by the translocated Hawaiian monk seals are commercially viable species and all prey eaten by these monk seals would have otherwise been available to fishers (i.e., not eaten by other predators or not taken in areas where fisheries do not operate), this constitutes only a 0.6% to 1.6% of annual commercial catch in the MHI.

While it is important to consider this scenario in order to understand what might happen if all of these seals survived, that would be very unlikely. A more realistic estimate of the maximum number of translocated monk seals in the MHI is derived by applying the survival rates of native-born MHI monk seals to translocated seals. Retaining the first two assumptions in the preceding bullets, this results in a projected maximum number of 51 additional seals. Again, while this analysis acknowledges that an additional 60 seals in these years would be unlikely, it uses this number in order to present the worst case scenario for the purposes of evaluating potential effects on commercial fish in the MHI under Alternative 4.

Based on the above discussion on annual food consumption, 60 juvenile Hawaiian monk seals could potentially consume 164,250 to 438,000 lb. of fish. Assuming a worst case scenario in which all fish consumed by the translocated Hawaiian monk seals are commercially viable species and all prey eaten by these monk seals would have otherwise been available to fishers (*i.e.,* not eaten by other predators or not taken in areas where fisheries do not operate), this constitutes only a 0.6% to 1.6% of annual commercial catch in the MHI. Given the temporary increase in the Hawaiian monk seal population in the MHI, the effect on commercial catch is anticipated to be negligible. As previously stated, available historic data do not support that there is a relationship between commercial catch and the number of Hawaiian monk seals.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 4 would directly affect commercial fishing in the MHI. Therefore, direct effects are likely to be negligible. A temporary and only marginal Hawaiian monk seal population increase within the MHI due to Alternative 4 is not likely to result in an indirect adverse effect on commercial fishing. Therefore, this effect would likely be negligible.

4.9.1.5 Cumulative Effects

This section presents the cumulative effects on commercial fishing in the context of past actions and the RFFAs listed in Tables 4.5-1 and 4.5-2 respectively.

Summary of Direct and Indirect Effects

The alternatives are not anticipated to result in any *direct* effects on commercial fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. However, *indirect* effects on commercial fishing may be possible if an alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the commercial catch because Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are commercially viable. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators of those species. However, further analysis suggests that the indirect effects of the alternatives on commercial fishing are likely to be negligible at most.

Summary of Lingering Past Effects

Actions in the past that have affected commercial fishing in the MHI are fisheries management in Hawai'i, the national and local economic recession in recent years, and overfishing. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the Fisheries Ecosystem Plans (FEPs) for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. The local and global economic recession in recent years likely resulted in both a reduction in fish consumption, as well as fish exports, which may have led to reduced catch. However, as the economy is beginning to recover, commercial catch may be trending upwards (HIPA 2009).

Other possible effects from past actions are any short term limitations of access for commercial fishermen due to offshore military activities, especially if coincident with peak fishing locations. However, most of these events are of short duration and have a limited operational footprint.

Analysis of Reasonably Foreseeable Future Actions

Fisheries regulations, such as measures to prevent bottomfish overfishing in the Hawai'i Archipelago, could indirectly affect all commercial (and recreational) fisheries, as bottomfish fishermen will seek alternatives to supplement their incomes. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai'i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the no action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of implementation measures under these plans include, among others, ecosystem boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc.

Cumulative Effects

Commercial fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Other factors include offshore military activities that could have temporary effects on fishing through restricting access. Figure 4.9-1 presents the variation in commercial catch in select zones over the past ten years. It is evident that many factors affect this industry.

Because the direct and indirect effects associated with the alternatives are negligible, these would not contribute to the overall cumulative effects on commercial fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.2 Subsistence Fishing

This section addresses the potential direct, indirect and cumulative effects of the Alternatives on subsistence fishing. The area of analysis includes both the nearshore and offshore areas surrounding the MHI. As discussed in Section 3.4.4 *Subsistence Fishing*, there is no license required for subsistence fishing in Hawai`i. Therefore, it is difficult to assess the overall level of subsistence fishing activity due to a lack of detailed catch data. Absent formal data on subsistence fishing in Hawai`i, this analysis partly relies on data presented and analyzed in Section 4.9.1.

Fish are an important part of the diet for the people of Hawai`i, with about 90 pounds per capita consumed annually, over twice the national average. Some fish species also have cultural significance for Native Hawaiians. Effects on subsistence fishing could be expected if an action results in changes in fish consumption by Hawaiian residents and, therefore, affects not only their well being and quality of life, but also has a larger effect on their way of life and identity. As per Table 4.4-6 in Section 4.4.3, these effects are measured through looking at any changes in the quantity of fish consumed.

One factor that could potentially affect consumption is change in access to fishing areas, especially for onshore and nearshore fishing, as many Hawaiians tend to fish close to their homes for subsistence purposes. None of the

Alternatives propose any area closures or other seasonal or catch restrictions. Another factor that may result in altering fish consumption is change in the amount of fish caught due to less fish available. This is examined in more detail below.

The Alternatives are not anticipated to result in any direct effects on subsistence fishing. However, indirect effects on subsistence fishing may be possible if an Alternative results in a change in Hawaiian monk seal population in the MHI, and the Hawaiian monk seal population, in turn, affects the quantity of fish caught for subsistence purposes because Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are consumed by subsistence fishers. On the other hand, some fish species may increase in population if Hawaiian monk seals consume predators of those species. This possible effect is evaluated in Section 4.9.1 for commercial fisheries.

The analysis presented in Section 4.9.1 revealed that based on the fish biomass a juvenile Hawaiian monk seal can consume in a year as a percentage of total annual commercial catch, the potential decline in fish populations in the MHI due to any increase in Hawaiian monk seal populations under the Alternatives is negligible. Further, historic data on trends in commercial catch and Hawaiian monk seal population in the MHI does not reveal any relationship between the two variables. Given that it is widely believed that nearshore and offshore recreational and subsistence catch is likely equal to or greater than the nearshore and offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander *et al.* 2004), the results presented in Section 4.9.1 of the analysis of commercial fisheries in terms of negligible change in fish population are applicable to subsistence fishing.

4.9.2.1 Direct and Indirect Effects of Alternative 1 – Status Quo

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.6.

Alternative 1 is not anticipated to have any direct effects on subsistence fishing in the MHI. Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker et al 2011) independent of any actions taken by NMFS. While this natural growth may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As discussed above, effects on subsistence fishing

could stem from changes in the quantity of fish caught for subsistence purposes, leading to modifications in the amount of fish consumed.

Indirect effects of Alternative 1 on subsistence fishing could be possible if there were marked changes in the populations of fish targeted by subsistence fishers and, consequently, the quantity of catch for subsistence purposes, due to increases in the Hawaiian monk seal population associated with the alternatives. However, given the marginal increase in the Hawaiian monk seal population growth rate expected under Alternative 1, these effects are likely to be negligible.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 1 would directly affect subsistence fishing in MHI. Therefore, direct effects are likely to be negligible. Marginal increases in the Hawaiian monk seal population growth rate in the MHI may have an indirect adverse effect on subsistence fishing due to possible decreases in fish caught for subsistence purposes. However, this adverse effect is likely to be negligible.

4.9.2.2 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

The Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on subsistence fishing under Alternative 2 would not likely occur. As discussed above, effects on subsistence fishing could stem from changes in the quantity of fish caught for subsistence purposes, leading to modifications in the amount of fish consumed. Alternative 2 is not anticipated to have any direct effects on subsistence fishing in the MHI.

Indirect effects of Alternative 2 on subsistence fishing could be possible if there were marked changes in the population of fish popular among subsistence fishers and, consequently, the quantity of catch for subsistence purposes, due to an increased Hawaiian monk seal population. However, given that after 2014, most research and enhancement activities on Hawaiian monk seals would cease, these effects are anticipated to be negligible. Further, as presented in Section 4.9.1, available historic data do not support the relationship between catch and Hawaiian monk seal population abundance in the MHI.

Conclusion for Direct and Indirect Effects

Alternative 2 is not anticipated to directly affect subsistence fishing in the MHI. Because monk seal research and enhancement would cease after 2014 under Alternative 2, any indirect adverse effect on subsistence fishing would be even less than under Alternative 1, and thereby likewise negligible.

4.9.2.3 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities. Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP) (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal increases in the MHI Hawaiian monk seal population if seals with undesirable behaviors are able to remain in the wild as a result of behavioral modification. This would be expected to involve only a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce impacts on fishing.

As discussed previously, effects on subsistence fishing could stem from changes Alternative 3 is not anticipated to change the quantity of fish caught for subsistence purposes or the amount of fish consumed. Therefore, Alternative 3 would not have any direct effects on subsistence fishing in the MHI.

Given the small increase in Hawaiian monk seal population, indirect effects of Alternative 3 on subsistence fishing, such as changes in the population of fish popular among subsistence fishers or changes in the quantity of subsistence catch, are expected to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for subsistence.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 3 would directly affect subsistence fishing in the MHI. Therefore, direct effects are likely to be negligible. A marginal increase in the Hawaiian monk seal population growth rate in the MHI due to Alternative 3 is not likely to result in an indirect adverse effect on subsistence fishing. Therefore, this effect would likely be negligible.

4.9.2.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 will exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 3 years of age.

In order to understand potential effects on subsistence fishers, the following worst-case scenario is evaluated. If all fish consumed by the translocated Hawaiian monk seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch for subsistence in the MHI. This extrapolation is based on the belief that nearshore and offshore recreational and subsistence catch [combined] is likely equal to or greater than the nearshore and offshore commercial fisheries catch (Friedlander, *et al.* 2004) and, therefore, annual subsistence catch quantity is assumed to be one half the quantity of annual commercial catch for which data are available).

Alternative 4 is not anticipated to have any direct effects on subsistence fishing in the MHI because there are not likely to be any changes in the quantity of fish caught for subsistence purposes or the amount of fish consumed. Given the temporary and increase in the MHI monk seal population under Alternative 4, the effects on subsistence catch are anticipated to be negligible.

Indirect effects of Alternative 4 on subsistence fishing are not likely because changes in the population of fish popular among subsistence fishers or the quantity of catch for subsistence purposes are not likely to occur. As per the analysis provided in Section 4.9.1.4, a maximum of 60 additional (translocated) monk seals could be in the MHI temporarily, and these seals may consume 164,250 to 438,000 lb of fish annually, much of which would likely be species or in areas not shared with subsistence fishers.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 4 would directly affect subsistence fishing in the MHI. Therefore, direct effects are likely to be negligible. A temporary increase in the MHI monk seal population due to Alternative 4 is not likely to result in an indirect adverse effect on subsistence fishing. Therefore, this effect would likely be negligible.

4.9.2.5 Cumulative Effects

This section presents the cumulative effects on subsistence fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects

The Alternatives are not anticipated to result in any direct effects on subsistence fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. Indirect effects on subsistence fishing would be negligible because changes in the fish caught by subsistence fishers are not likely. Hawaiian monk seals may potentially prey on and reduce the population of certain fish species that are popular among the subsistence fishers however, some fish species may actually increase in abundance if Hawaiian monk seals consume predators of those species.

Summary of Lingering Past Effects

Actions in the past that have affected subsistence fishing in the MHI are overfishing (NMFS and WPRFMC 2006) and any short term effects on access limitations for subsistence fishermen due to offshore military activities, especially if coincident with peak fishing locations. While overfishing has had longer-term effects on all fisheries, most of the military events are of short duration and have a limited operational footprint.

Other actions that have indirectly affected subsistence fishing are fisheries management in Hawai`i and the national and local economic recession in recent years. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. The local and global economic recession in recent years likely resulted in both a reduction in fish consumption, as well as fish exports, which may have led to reduced catch. However, as the economy is beginning to recover, commercial catch may be trending upwards (HIPA 2009). However, as the economy is beginning to recover, commercial catch is likely to trend upwards, possibly resulting in a decline in fish available for subsistence.

Analysis of Reasonably Foreseeable Future Actions

There is no license required for subsistence fishing in Hawai`i and, therefore, it is difficult to regulate these fisheries. Fisheries regulations, such as plans to end bottomfish overfishing in the Hawaiian Archipelago, could indirectly affect subsistence fishing, as commercial and recreational bottomfish fishermen will seek alternatives to supplement their incomes or derive recreational value, respectively. This could result in changes in the populations of other fish species, including those popular for consumption by the subsistence fishers. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai`i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the No Action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of implementation measures under these plans include, among others, ecosystem boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc.

As stated above, most of these management actions do not apply to subsistence fishing, but can have indirect effects on fish available for subsistence purposes due to their effects on commercial and recreational fishing.

Cumulative Effects

Subsistence fishing in the MHI could be indirectly affected by fisheries management actions in Hawai`i, as well as the local and global economy. While both these factors do not affect subsistence fishing directly, these can have indirect effects on the fish available for subsistence purposes through their effects on commercial and recreational fishing. Other factors include overfishing and offshore military activities that could have temporary effects on fishing through restricting access.

Because the direct and indirect effects associated with the Alternatives are expected to be negligible, the proposed monk seal research and enhancement would not contribute to the overall cumulative effects on subsistence fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.3 Recreational Fishing

The potential direct, indirect and cumulative effects of the Alternatives on recreational fishing are analyzed in this section. The area of analysis includes both the nearshore and offshore areas surrounding the MHI. Based on Hawaii Marine Recreational Fishing Survey data (2006), it is estimated that 396,413 recreational fishers brought in 17.6 million pounds of fish (this amount does not include subsistence fishers). As discussed in Section 3.4.5 *Recreational Fishing*, there was no license required for non-commercial saltwater fishing in Hawai`i until recently. The new NMFS initiative, MRIP, is anticipated to collect better data and produce improved estimates of marine recreational catch and effort through the National Saltwater Angler Registry. At this point, however, similar to subsistence fishing, assessing the overall level of saltwater recreational fishing activity is a challenge due to a lack of detailed catch data. Occasional surveys, including those carried out as part of the national level Marine Recreational Fisheries Statistical Survey and the Hawai`i Marine Recreational Fishing Survey have been fielded over the years, but there has been no systematic collection of such data. In the absence of formal data on recreational fishing in Hawai`i, this analysis partly relies on data presented and analyzed in Section 4.9.1 for commercial fisheries.

Fishing is popular with both the residents and tourists visiting Hawai`i. A quarter of Hawai`i's population participates in some form of fishing at least once a year (U.S. Department of the Navy 2008a). Effects on recreational fishing could be expected if an action results in changing the recreational experience of locals and tourists through either affecting the quantity or type of fish caught for recreational purposes, or the enjoyment derived from the natural beauty of their surroundings and wildlife. As per Table 4.4-6 in Section 4.4.3, these effects are measured through looking at any changes in the number of recreational fishing trips.

One factor that could potentially affect recreational fishing trips is the experience recreational fishermen derive from enjoying their surroundings. Alternatives that can potentially enhance that experience, such as those resulting in additional Hawaiian monk seals to view in the area, would have a positive effect on recreational fishing trips. It is acknowledged that some fishers may not derive a positive experience from viewing more seals. However, given the temporary and marginal change in the Hawaiian monk seal population in the MHI attributable to any of the alternatives, this affect on recreational fishing trips is considered negligible. Another factor considered here is whether there would be any change in the number of recreational fishing trips or a change in the amount of fish caught due to less fish being available. This is examined in more detail below.

The alternatives are not anticipated to result in any direct effects on recreational fishing. Indirect effects on recreational fishing, such as changes in the number of fishing trips or the quantity of fish caught for recreational purposes, are not

likely under any of the Alternatives. Hawaiian monk seals are not expected to reduce the population of certain fish species that are popular with recreational fishermen.

As presented in Section 4.9.1 on commercial fishing, a potential decline in fish populations in the MHI due to an increase in Hawaiian monk seal populations under the alternatives would likely be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to recreational fishers. Given that it is widely believed that nearshore and offshore recreational and subsistence catch is likely equal to or greater than the nearshore and offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander, *et al.* 2004), the results of the analysis of commercial fisheries are applicable to recreational fishing. For these reasons, the potential of any alternative to affect recreational fishing would be negligible.

4.9.3.1 Direct and Indirect Effects of Alternative 1 – Status Quo

Alternative 1 (Status Quo) entails the continuation of the current NMFS Research and Enhancement Permit (10137) until it expires in 2014. Following this date, subsequent permits would be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.6.

Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker et al 2011) independent of any actions taken by NMFS. While this natural growth may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. Changes in the quantity of fish caught for recreational purposes, leading to modifications in the number of recreational fishing trips are not anticipated under Alternative 1. Therefore, Alternative 1 is not anticipated to have any direct effects on recreational fishing in the MHI.

Indirect effects of Alternative 1, such as marked changes in the population of fish popular among recreational fishermen or the quantity of catch for recreational purposes, due to a marginal increase in the MHI monk seal population growth rate is not likely. Therefore, these effects would be negligible.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 1 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible. Continued marginal increases in the MHI monk seal population growth rate due to Alternative 1 actions would only result in an

indirect adverse effect on recreational fishing if there were possible decreases in fish caught for recreational purposes and, consequently, decreases in the number of recreational fishing trips. However, this is not likely to occur therefore, this effect would be negligible.

4.9.3.2 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

The Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of the any actions taken by NMFS under the proposed alternatives. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on subsistence fishing under Alternative 2 would be negligible.

Indirect effects of Alternative 2 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen, are not expected to result given the temporary small increase in Hawaiian monk seal population attributable to Alternative 2 actions. Therefore, these effects would likely be negligible.

Conclusion for Direct and Indirect Effects

It is not anticipated that Alternative 2 would directly affect recreational fishing in the MHI. Increased MHI monk seal population growth rate attributable to Alternative 2 would not result in an indirect adverse effect on recreational fishing due to possible decreases in fish caught for recreational purposes or the number of recreational fishing trips. Therefore, this effect would likely be negligible.

4.9.3.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities. Vaccination could prevent Hawaiian monk seal population declines in the MHI if a disease outbreak occurs for which a safe and effective vaccine is available, and if a significant portion of the Hawaiian monk seal population can be vaccinated. Also, emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine MMHSRP (Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP. Behavioral modification may also lead to marginal

increases in the MHI Hawaiian monk seal population if seals with undesirable behaviors are able to remain in the wild as a result of behavioral modification. This would be expected to involve only a very few individual seals. Importantly, behavioral modification may also succeed in reducing habitual seal interactions with fishing operations. If so, then this activity could actually reduce impacts on fishing.

Alternative 3 is not anticipated to have any direct effects on recreational fishing in the MHI because changes in the quantity of fish caught for recreational purposes or modifications in the number of recreational fishing trips are not likely. Indirect effects of Alternative 3 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen are not expected to result from the small increase in the MHI Hawaiian monk seal population that would attributable to Alternative 3 activities , these effects are anticipated to be negligible. Data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for recreation.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 3 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible to none. A marginal increase in the MHI monk seal population growth rate due to Alternative 3 is not likely to result in an indirect adverse effect on recreational fishing and would be negligible.

4.9.3.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, would be focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 would exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2 or 3. The benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth naturally occurring (*i.e.,* without NMFS intervention). The proportion of seals temporarily translocated to the MHI under Alternative 4 would constitute a small proportion of the already naturally increasing seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the MHI population of monk seals due to that action because any translocated seals would be returned to the NWHI once they reached 3 years of age.

As per the analysis provided in Section 4.9.1.4 for commercial fisheries, if all fish consumed by the translocated Hawaiian monk seals were species popular with recreational fishers and all these fish would have otherwise been available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch for recreation in the MHI. This extrapolation is based on the belief that nearshore and offshore recreational and subsistence catch [combined] is likely equal to or greater than the nearshore and offshore commercial fisheries catch (Friedlander, *et al.* 2004). Therefore, annual recreation catch quantity is assumed to be one half the quantity of annual commercial catch for which data are available). Given the temporary increase in the Hawaiian monk seal population due to Alternative 4 actions, the effect on recreational catch is anticipated to be negligible.

Alternative 4 is not anticipated to have any direct effects on recreational fishing in the MHI because no changes in the quantity of fish caught for recreational purposes or the number of recreational fishing trips would likely occur.

Indirect effects of Alternative 4 on recreational fishing, such as marked changes in the population of fish popular among recreational fishermen or the quantity of recreational catch, are not likely to result due to any increase in the Hawaiian monk seal population attributable to Alternative 4 actions.

Conclusion for Direct and Indirect Effects

None of the research and enhancement activities permitted under Alternative 4 would directly affect recreational fishing in MHI. Therefore, direct effects would likely be negligible. Any short-term increase in the Hawaiian monk seal population within the MHI due to Alternative 4 actions would not likely adversely affect recreational fishing and would likely be negligible as a change number of seals is not anticipated to result in higher predation of fish available for recreational fishing.

4.9.3.5 Cumulative Effects

This section presents the cumulative effects on recreational fishing in the context of past actions and the RFFAs.

Summary of Direct and Indirect Effects

The Alternatives are not anticipated to result in any direct effects on recreational fishing, given that the actions proposed (such as vaccinations, de-worming, translocation) will not likely occur in locations popular for fishing. Indirect effects on recreational fishing, such as a change in the number of fish caught for recreation or a reduction in the population of certain recreational fish species, are not expected to result due to Alternative 4 actions. The indirect effects of the Alternatives on recreational fishing are likely to be negligible at most.

Summary of Lingering Past Effects

Actions in the past that have affected recreational fishing in the MHI are overfishing (NMFS and WPRFMC 2006) and any short term effects on access limitations for recreational fishermen due to offshore military activities, especially if coincident with peak fishing locations. While overfishing has had longer-term effects on all fisheries, most of the military events are of short duration and have a limited operational footprint.

Other actions that have indirectly affected recreational fishing are fisheries management in Hawai'i and the national and local economic recession in recent years. Notable fisheries management actions in the past include efforts to end bottomfish overfishing in the MHI and the FEPs for the various fisheries. These are discussed later in the analysis of RFFAs given that these actions extend into the future. The local and global economic recession in recent years resulted in a reduction of fish exports by commercial fishermen, leading to reduced commercial catch. Consequently, there was possibly more fish available for recreational purposes. Another effect of the global recession on recreational fishing was decrease in tourism, leading to lesser non-local recreational fishermen in the MHI and possibly consequently more fish available for local recreational fishermen, as well as for subsistence and commercial fishing. However, as the economy is beginning to recover, commercial catch is trending upwards and more tourists are visiting the MHI, which may increase recreational fishing pressure.

Analysis of Reasonably Foreseeable Future Actions

Similar to subsistence fishing, there is no license required for saltwater recreational fishing in Hawai'i and, therefore, it is difficult to regulate these fisheries. Fisheries regulations, such as plans to end bottomfish overfishing in the Hawai'i Archipelago, could indirectly affect recreational fishing, as commercial bottomfish fishermen will seek alternatives to supplement their incomes. This could result in changes in the populations of other fish species, including those popular for recreational fishing. The management measures considered in the "Draft Supplemental Environmental Impact Statement – Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region – Measures to End Bottomfish Overfishing in the Hawai'i Archipelago" (March 2006), which supplements the May 2005 Final Environmental Impact Statement, target a 15% or greater reduction in bottomfish fishing mortality in the MHI (except for the no action alternative). Alternatives include area closures, seasonal closures, catch limits, and combinations of the three.

In addition to this, the Western Pacific Regional Fishery Management Council is implementing "ecosystem-based" approaches to fishery management in the Hawaiian Archipelago. This is a move from the "species-based' approach. Notable RFFAs in this context are "Fishery Ecosystem Plan for the Hawaiian

Archipelago" (September 2009) and "Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region" (December 2005). Examples of implementation measures under these plans include, among others, ecosystem boundaries, area closures, size restrictions, seasonal closures, gear restrictions, etc.

As stated above, most of these management actions do not apply to saltwater recreational fishing, but can have indirect effects on fish available for recreational purposes due to their effects on commercial fishing.

Cumulative Effects

Recreational fishing in the MHI could be indirectly affected by fisheries management actions in Hawai`i, as well as the local and global economy. While both these factors do not affect recreational fishing directly, these can have indirect effects on the fish available for recreational purposes through their effects on commercial fishing and reduced tourism. Other factors include overfishing and offshore military activities that could have temporary effects on fishing through restricting access.

Because the direct and indirect effects associated with the alternatives are negligible, activities proposed would not contribute to the overall cumulative effects on recreational fishing. Therefore, the contribution to an overall cumulative effect from any of the alternatives is considered negligible.

4.9.4 Cultural Resources and Historic Properties

As described in more detail in Section 3.4.6, a variety of cultural resources are found in the MHI and NWHI, including fish ponds, heiau, prehistoric village sites, historic structures including residences, government buildings, churches, and schools, military facilities, and shipwrecks. The purpose of this section is to identify direct, indirect and cumulative effects to cultural resources that may occur within the area of potential effect. Figures 3.4-2 through 3.4-6 present NRHP sites located within the Area of Potential Effect (APE) while Figures 3.4-6 through 3.4-9 present known shipwrecks and navigational hazards located within the APE. Based on the analysis below, NMFS has determined that the proposed action is a type of activity that does not have the potential to cause effects on historic or cultural properties, assuming such properties are present. Therefore, no further obligations are required under NHPA section 106. A letter documenting this determination will be sent to the Hawai`i SHPD.

NMFS has been conducting research and enhancement activities on Hawaiian monk seals for decades and to date, no impacts to historic or cultural properties resulting from NMFS research or enhancement activities have been reported. Because the proposed undertaking will have no lasting visible manifestations, there is no potential for permanent indirect visual effects. Because the

undertaking will not involve direct impacts on any structures or landforms, the potential for direct effects is minimal. Vehicles and activities associated with handling and transport of the Hawaiian monk seals could modify the land surface to a limited extent, but the modification would be no greater than that anticipated from normal use of the areas. Any land vehicles used for transport would be restricted to existing roads. As described in NAO 217-103 (Management of NOAA Small Boats), and BMPs 004 (Small Boat Operations Diving Activities in Water) and 013 (Small Boat Operations at Tern Island), NMFS follows strict policies for operation of small boats that would be used for monk seal research and enhancement.

The APE is limited to areas onshore (approximately 25 m inland from the shoreline) and offshore within 300 m of the shoreline, as well as camp sites further inland in NWHI, as described in Section 3.4.6. Historic structures adjacent to the shore do not have the potential to be affected by activities that may take place along the shoreline under any of the alternatives. The potential for researchers to encounter significant cultural or historic properties is expected to be extremely low. Evidence of past cultural activity found along the shoreline has survived regular tides, significant wind and waves from storms, and possibly boat or recreational traffic. Therefore, cultural resources along the shoreline are not expected to be subject to damage by any of the activities proposed under any of the alternatives.

NMFS recognizes there are numerous fishponds throughout the Hawaiian Islands and that these areas are considered sacred places to many Hawaiians. While no research and enhancement activities are planned near places where fishponds are located (see Figures 3.4-10 through 3.4-13, Fishponds), we acknowledge the potential, however rare, for Hawaiian monk seals to enter fishponds on their own. Should this occur in the future under any alternative, NMFS would work closely with the Hawai`i State Historic Preservation Office, landowner, local Native Hawaiian Organizations, and/or other appropriate entities to ensure that appropriate action be taken to minimize impacts on the fishpond and the monk seal.

The camp sites in the NWHI to be used by researchers have already been seasonally in use since the 1980's, with rigorous protocols in place to protect the natural and cultural resources surrounding the camps (see Appendix G, Monument Permit PMNM-2011-001). Therefore, use of the NWHI camps by researchers will not impact cultural resources.

Permits from the Monument are required to conduct Hawaiian monk seal research and enhancement activities in the NWHI and any associated activities must comply with general terms and conditions that satisfy Proclamation 8031 and Monument Regulations. Specifically, Monument regulations state that "permittees [must] attend a cultural briefing on the significance of Monument resources to Native Hawaiians" and that there are "prohibitions against the

disturbance of any cultural or historic property" (NOAA 2008b). Thus, the "Monument permit program allows for a comprehensive review of proposed activities and will be administered to ensure compliance with Presidential Proclamation 8031, as well as other applicable federal (such as the NHPA) and state laws and regulations (NOAA 2008b).

In addition to the cultural briefing and protective measures described in the NAO 217-103 for operating small boats, the following precautions to avoid impacts to cultural resources and historic properties would also be undertaken for any of the proposed alternatives:

- Develop an unanticipated discovery plan for use by all field researchers, to include training for field personnel in recognition of cultural resources, guidance on cultural resources avoidance, and protocols for responding if any cultural resources are inadvertently encountered.

- Make boat crews aware of the locations of shipwrecks that could pose a hazard to navigation. These areas should be avoided, so as not to disturb any wrecks.

- Limit vehicle traffic to developed roads, to avoid impacting any areas previously undisturbed by vehicle traffic.

- Train all researchers camping in NWHI in cultural resource recognition and avoidance (as already required by NOAA).

- Require researchers landing on Nihoa and Necker (Mokumanana) Islands to limit activities to the extent possible, and avoid any potentially undisturbed areas, to protect the significant archaeological sites known on these islands.

- Launch and retrieve boats from developed locations, keeping out of previously undisturbed areas.

- Remove all markers put in place as soon as their temporary function has expired, such as those on beaches to guide people away from areas in use by Hawaiian monk seal.

- Remove all temporary pens as soon as their function if fulfilled, returning the location to its original state with minimal disturbance.

As described in Section 1.5.4, NMFS has prepared a Section 106 consultation document to satisfy such requirement under the NHPA. This document summarizes the analysis presented herein and is included as Appendix L, Draft Section 106 Analysis of the PEIS for the Hawaiian Monk Seal Recovery Program (April 2011).

4.9.4.1 *Direct and Indirect Effects of Alternative 1 – Status Quo*

As described in Section 2.6, Alternative 1, the Status Quo, involves aerial, vessel and land-based surveys, and some handling and transportation of Hawaiian monk seals. Boats would periodically come to shore. Hawaiian monk seals may be found in the shore zone (as described in Section 1.3), and land vehicles would transport researchers and possibly animals. These activities could occur in MHI, NWHI, and Johnston Atoll. In addition, researchers would seasonally (typically April or May through August) occupy existing camp sites in the NWHI (see Section 3.3.1.9).

Historic structures adjacent to the shore do not have the potential to be affected by proposed activities that may take place along the shoreline. Evidence of past cultural activity found within the APE has survived regular tides, significant wind and waves from storms, and possibly boat and recreational traffic. Therefore, cultural resources within the APE are not expected to be fragile. Based on the impact criteria presented in Table 4.4-7, if simple precautions are taken by researchers, Alternative 1 is expected to result in minor direct or indirect effects on cultural resources and historic properties given the likelihood of encountering such resources is expected to be rare. Even if such a sensitive area were encountered, activities in the area would be temporary and researchers would take all necessary precautions to avoid impacts to those sites.

Recommended precautions to avoid impacts to cultural resources as described above would be implemented under Alternative 1 thereby further reducing the potential for impacts. Because Alternative 1 will have no lasting physical manifestations, there is no potential for permanent indirect visual effects. Research and enhancement authorized under Alternative 1 would not result in direct impacts on any structures or landforms, therefore potential direct adverse effects on cultural and historic resources are considered minor. In the event that unforeseen impacts arise, the unanticipated discovery plan would protect historic and cultural resources to the extent possible.

4.9.4.2 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

Alternative 2 allows the currently permitted activities to continue through 2014, after which time no new permits would be issued. During the execution of the current permit through 2014, the potential impacts would be the same as for Alternative 1, and the same precautions would be recommended. After the current permit expires, activities would be limited to remote observation and some collection of samples from materials left by Hawaiian monk seals, but no Hawaiian monk seal translocation or handling would occur. Therefore, after 2014, Alternative 2 would involve less boat and land vehicle traffic, and less shoreline activity. While the unanticipated discovery plan is still recommended for Alternative 2 after 2014, the likelihood that historic and cultural resources would be encountered would be reduced, based on the reduced activity. Similar

to Alternative 1, Alternative 2 has no potential for permanent indirect visual effects. Under Alternative 2, no direct impacts to any structures or landforms would occur, and any activities that could occur through 2014 are likely to be temporary thus potential direct effects are considered minor. In the event that unforeseen impacts arise, the unanticipated discovery plan would protect historic and cultural resources to the extent possible. Once the current research permit expires in 2014, potential impacts after that date are expected to be negligible given that no research on wild monk seals would occur.

4.9.4.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

Alternative 3 includes all of the proposed actions included in Alternative 1, plus additional actions including increased handling of Hawaiian monk seals for vaccination, more deworming, and translocation of Hawaiian monk seals within the MHI or within the NWHI, and from the MHI to the NWHI only (see Figure 2.9-1). Therefore, boat and land vehicle activity as well as shoreline activities would be greater under Alternative 3 than under Alternatives 1 or 2. For example, approximately 25 more weaned pups may be translocated under Alternative 3 annually than under Status Quo (Alternative 1). If the recommended precautions listed in the introduction of this section are followed for Alternative 3, including the unanticipated discovery plan, potential indirect visual effects under Alternative 3 would be minor as research and enhancement activities would likely be temporary and the likelihood of encountering a cultural or historic resource is low, or such properties could be avoided. Because Alternative 3 will not involve direct impacts on any structures or landforms, there is no potential for direct effects unless unforeseen impacts arise, in which case the unanticipated discovery plan will protect historic and cultural resources to the extent possible. Potential direct and indirect adverse effects on historic and cultural resources are considered minor under Alternative 3 due to the fact that, while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.

4.9.4.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 includes all of the actions included in Alternative 3, plus two-stage translocation of juvenile Hawaiian monk seal from NWHI to MHI, and then back to the NWHI when the Hawaiian monk seal reach the age of 3 years. While the number of seals potentially translocated does not increase in Alternative 4, increasing the transport of the seals may increase boat and land vehicle traffic. However, the recommended precautions described at the beginning of this section would be implemented for Alternative 4, including the unanticipated discovery plan. Alternative 4 therefore, is not expected to result in any permanent indirect visual effects. Under Alternative 4, research and

enhancement on Hawaiian monk seals would not result in direct effects on any structures or landforms. Therefore, potential direct adverse effects are considered minor given the low likelihood of encountering a cultural or historic property, the temporary nature of research activities, and the fact that even if such an area were encountered, the unanticipated discovery plan would protect resources to the extent possible.

4.9.4.5 *Cumulative Effects*

The analysis of cumulative effects on cultural and historic resources considers the potential direct and indirect effects of proposed alternative on resources within the Project Area (or APE) as well as external (not research or enhancement) past activities that may have resulted in substantial impacts (see Table 4.4-10). In addition, any external future actions that are reasonably foreseeable, referred to as RFFAs, must be considered (see Table 4.4-10 for the list of RFFAs considered in this PEIS).

Summary of Direct and Indirect Effects

The effects of research and enhancement activities proposed under Alternatives 1, 3, and 4 could result in minor direct and indirect effects on cultural and historic resources within the Project Area. Research and enhancement activities would be temporary and would occur in a very narrow area along the shoreline within the MHI and NWHI where few resources of this nature are likely to occur or could be avoided all together. While research and enhancement activities could occur under Alternative 2 through 2014, in the long term, no research on wild monk seals would occur, thus potential effects on cultural and historic resources would be negligible.

Summary of Past Actions and Reasonably Foreseeable Future Actions

Past actions on cultural and historic properties within the Project Area that may have caused impacts included but are not limited to coastal human settlements or development (earth moving activities for residential, commercial, government or transportation projects), military operations or warfare, looting or other deleterious activities, and significant storm events such as a hurricane or tsunami. While awareness and protection of cultural and historic resources throughout Hawai`i is supported through legislation such as the NHPA and associated Section 106, potential impacts to these resources could still occur as a result of the same activities and events listed as past actions.

Cumulative Effects

The design of each alternative includes best practices to avoid areas where cultural or historic resources may be located. The likelihood of researchers encountering cultural or historic properties is low given that activities would be

limited to a relatively narrow shorezone and activities that could take place would be temporary in nature. Based on this information, the contribution of Alternatives 1, 3 and 4 to cumulative effects on cultural and historic resources is minor while Alternative 2 would result in negligible cumulative effects.

4.9.5 Recreation and Tourism

This section addresses potential direct, indirect and cumulative effects of the alternatives on recreation and tourism in the MHI. In general, there are two potential types of effects on recreation and tourism of any type of action: effects on the recreation and tourism economy that may result from changes in the number of visitors and their expenditures, and effects on the level of enjoyment and value of the experience to the recreators/tourists themselves. These two types of effect are closely related as the level of visitor enjoyment also affects the number of visitors and their expenditures. Based on these types of potential effect, Table 4.4-6 in Section 4.4.3 summarizes the criteria used to evaluate effects of the Alternatives on recreation and tourism. As indicated in the table, the number of recreation and tourism trips is the primary criteria used to evaluate effects on recreation and tourism.

The Alternatives are not expected to result in direct effects on recreation or tourism as such actions as vaccination or translocation will not likely occur in locations popular for recreation or tourism activities. However, it is possible that there may be indirect effects on recreation or tourism if an Alternative affects the monk seal population in the MHI, and then the monk seal population, in turn, affects the number or value of recreation/tourism trips.

Changes in the monk seal population could affect recreation and tourism activities if the size of the population affects any of the four characteristics of recreation/tourism resources:

1. Quality or quantity of recreation/tourism resources,
2. Level of access to recreation/tourism resources,
3. Public safety associated with use of recreation / tourism resources, and
4. Cost of recreation/tourism resources.

The following discussion analyzes the potential for monk seal populations to affect recreation and tourism through these three pathways.

4.9.5.1 Quality/Quantity of Recreation Resources

Wildlife-related recreation, including whale watching, is popular in Hawai'i. Many people enjoy viewing wildlife, particularly marine mammals such as

whales and the monk seal, in their native habitat. To the extent that the monk seal population in the MHI increases due to an Alternative, the Alternative may indirectly enhance the recreation/tourism experience through increased wildlife viewing opportunities and benefit the recreation/tourism economy.

Increases in the monk seal population could affect the populations of fish species that are important for recreation, thereby affecting recreation and tourism. As discussed above in the biological resources sections, there is uncertainty surrounding the monk seal diet, but fish consumption by monk seal may decrease certain fish populations (and may increase other fish populations by consuming predators of those populations), but these effects are expected to be negligible under all Alternatives. It is possible that such changes in fish abundance may also affect other aquatic recreation activities, such as snorkeling. However, as noted in the recreational fishing section, effects to the abundance of fish species important for recreational fishing (and other recreation activities) due to any of the Alternatives are expected to be negligible.

Therefore, it is expected that any measurable effects on the quality/quantity of recreation resources in the MHI due to the Alternatives would be related to changes in wildlife viewing opportunities, specifically, monk seal viewing opportunities that would be enhanced with increased populations of monk seal.

4.9.5.2 *Access to Recreation / Tourism Resources*

At times, NMFS does establish protective zones on beaches for seals. These protective zones are not closures and do not prohibit access, but simply discourage people from approaching the monk seals too closely.

Many recreation and tourism activities in Hawai`i are beach and water-related. Recreation and tourism can be affected if an Alternative affects access to recreational resources, such as shoreline or waters for boating. NMFS does not use beach closures as a part of their seal management strategy at present, and no such management is in any of the Alternatives. At times, NMFS does establish protective zones on beaches for seals, particularly areas where monk seals are pupping. These protective zones are not closures and do not prohibit access, but simply discourage people from approaching the monk seals too closely. If an alternative were to increase the monk seal population such that more monk seals are pupping on public beaches and more protective zones are established, access to some areas of some beaches would be discouraged. It is expected that the benefit of viewing the monk seals would outweigh any adverse effects of reduced access, resulting in a net positive for tourists and recreationists. Pupping in such areas would provide high quality wildlife viewing opportunities for beach recreationists. Many tourists and recreationists actively seek and value marine wildlife viewing opportunities, as indicated by the popularity of such activities as whale watching tours, snorkeling, and scuba diving. Furthermore, reduced access from the establishment of protective zones

is not mandatory, but is rather a recommendation. So no enforced access reduction is expected to occur.

4.9.5.3 *Public Safety*

It is also possible that increased monk seal populations due to an Alternative could result in increased human-seal interactions, with potential implications for public safety. However, as discussed in more detail in Section 3.4.9 *Public Safety*, there are few reported incidents of adverse human-seal interactions. Further, the few reported incidents involved disturbance of mother and pup. Alternatives 3 and 4 include provisions for behavior modification to develop new strategies for resolving conflicts with habituated seals that might pose a risk to public safety. Given the short-term and marginal increase in the population of monk seal in the MHI under the alternatives and the fact that no translocated seals will pup in the MHI (they will be moved back to NWHI prior to reaching breeding age), the public safety implications, and attendant effects on recreation and tourism resources due to the proposed alternatives, are expected to be negligible. In fact, behavioral modification activities proposed under Alternatives 3 and 4 are intended, in part, to mitigate seals behaving in a way that involves public safety concerns.

4.9.5.4 *Cost of Recreation Resources*

Changes in cost can also affect recreation and tourism. However, it is not expected that there would be any direct or indirect effects on the cost of business for recreation or tourism service providers that would translate into changes in prices, or any effects on costs of admission to parks and other recreational areas. Therefore, it is not expected that changes in the monk seal population due to any of the Alternatives would affect the cost to tourists or recreationists of enjoying recreational resources in Hawai'i.

4.9.5.5 *Direct and Indirect Effects of Alternative 1 – Status Quo*

Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011) independent of any actions taken by NMFS. While this growth that is occurring naturally already may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As discussed above, increases in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 1 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 1 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, increases to the monk seal population would likely enhance wildlife viewing recreation, and consequently, enhance the visitor experience.

Increases in the monk seal population under Alternative 1 may limit small portions of some public beaches if more protective zones are established to discourage people from approaching monk seals too closely. However, the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access. Some weaned pup translocations within the MHI are intended to move pups away from areas where they may be interacting with people and pose a public safety risk. By translocating seals that may be socializing with humans, public safety as well as safety for the seals, would likely be improved. Finally, any small increases in the monk seal population due to Alternative 1 would have negligible effects on public safety and cost of recreation experiences.

Conclusion for Direct and Indirect Effects

There are negligible direct effects of Alternative 1 anticipated for recreation and tourism activities in Hawai'i. Continued slight monk seal population increases within the MHI due to Alternative 1 may have an indirect effect on recreation and tourism activities, but is likely to be negligible due to the small population increase predicted. In summary, direct and indirect effects on recreation and tourism due to changes in the monk seal population under Alternative 1 are expected to be negligible but may result in positive effects on wildlife viewing opportunities.

4.9.5.6 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits or Authorizations)*

Alternative 2 (No Action) entails the continuation of existing research as permitted under the existing permit (10137) until 2014. Once expired, these research and enhancement activities would cease. Unlike the activities under some other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation.

As discussed above, changes in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 2 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 2 related to changes in the monk seal population would likely be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a smaller increase in the monk seal population compared to Alternative 1 will result in smaller positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Changes in the monk seal population under Alternative 2 would be negligible as no research or enhancement would occur after 2014. Activities that could occur prior to that date are not anticipated to result in notable changes to beach access if protective zones were established to discourage people from approaching monk seals too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 2 is expected to provide fewer benefits to recreation/tourism than Alternative 1. Some weaned pup translocations within the MHI are intended to move pups away from areas where they may be interacting with people and pose a public safety risk. By translocating seals that may be socializing with humans, public safety as well as safety for the seals, would likely be improved. Finally, changes in the monk seal population due to Alternative 2 would have negligible effects on public safety and cost of recreation experiences.

Conclusion for Direct and Indirect Effects

There are negligible to no direct effects of Alternative 2 anticipated for recreation and tourism activities in Hawai`i. Compared to Alternative 1, MHI monk seal population will increase slightly less, resulting in less indirect effect on recreation and tourism activities. In summary, Alternative 2 is expected to provide fewer benefits to recreation/tourism than Alternative 1 due to fewer wildlife viewing opportunities from a smaller monk seal population.

4.9.5.7 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on improving the population status in the NWHI. The Alternative 3 expanded activities most relevant to the MHI are a vaccination program and behavioral modification activities.

Under Alternative 3, changes in the MHI monk seal population could affect recreation and tourism if any of the following characteristics of recreation/tourism resources were affected: quality/quantity of resources, level of access, public safety, and cost. Alternative 3 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 3 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation

resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a larger increase in the monk seal population compared to Alternative 1 will result in larger positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Increases in the monk seal population under Alternative 3 could reduce access to some additional public beaches, compared to Alternative 1, if more protective zones were established to discourage people from approaching monk seals too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 3 is expected to provide greater benefits to recreation/tourism than Alternative 1. Changes in the monk seal population due to Alternative 3 would have negligible effects on the cost of recreation experiences. Behavioral modification proposed under Alternative 3 is intended to reduce public safety concerns by reducing human-seal interactions. This would likely result in a moderate beneficial effect on public safety.

Conclusion for Direct and Indirect Effects

There are negligible to no direct effects of Alternative 3 anticipated for recreation and tourism activities in Hawai'i. Compared to Alternative 1, the MHI monk seal population will increase slightly more, resulting in greater indirect effect on recreation and tourism activities. However, public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized. Alternative 3 is expected to provide more benefits to recreation and tourism than Alternative 1 due to the potential for more wildlife viewing opportunities of monk seals as well as improve public safety by reducing human-seal interactions. Therefore, the effect of Alternative 3 on tourism and recreation is likely to be moderate and beneficial.

4.9.5.8 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving weaned seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 will exhibit the greatest benefit by being the most effective at slowing the decline of the Hawaiian monk seal population as compared to Alternatives 1, 2, or 3. The benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the increase in MHI population growth naturally occurring (*i.e.,* without NMFS intervention). Therefore, the proportion of seals temporarily translocated to the MHI under Alternative 4 would comprise

a small portion of the total MHI monk seal population. Further, should the option to translocate seals from the NWHI to the MHI (allowed only under this alternative) be exercised, there would only be a temporary increase in the population of monk seals due to that action because seals would be returned to the NWHI once they reach age 3 yr.

As discussed above, changes in the MHI monk seal population may affect recreation and tourism if any of the following characteristics of recreation/tourism resources are affected: quality or quantity of resources, level of access, public safety, and cost. Alternative 4 is not expected to have any direct effects on these characteristics.

Indirect effects of Alternative 4 related to increases in the monk seal population are expected to be primarily limited to effects on the quantity of recreation resources, specifically the quantity of monk seal viewing opportunities. As many people enjoy viewing wildlife, a larger increase in the monk seal population compared to Alternative 1 will result in larger positive effects on wildlife viewing recreation, and consequently, the visitor experience.

Similar to Alternative 3, increases in the monk seal population under Alternative 4 could reduce access to some additional public beaches, compared to Alternative 1, if more protective zones were established to discourage people from approaching monk seal too closely. However, as the benefits associated with increased wildlife presence on such beaches are expected to outweigh any adverse effects due to changes in access, Alternative 4 could provide slightly greater benefits to recreation/tourism than Alternative 1. Changes in the monk seal population due to Alternative 4 would have negligible effects on public safety and cost of recreation experiences. Public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized. For this reason, the overall effect of Alternative 4 on public safety would likely be moderate and beneficial.

Conclusion for Direct and Indirect Effects

Of all the alternatives, Alternative 4 would be the most effective at slowing the rate of population decline in the Hawaiian monk seal population. In addition, behavioral modification would likely reduce the number of human-seal interactions, thereby improving public safety and safety for seals. Assuming there would be better seal survival, more wildlife viewing opportunities from a larger monk seal population could occur. The overall effect of Alternative 4 on public safety would likely be moderate and beneficial.

4.9.5.9 *Cumulative Effects*

This section discusses cumulative effects on recreation and tourism in the context of past and future foreseeable actions.

Summary of Direct and Indirect Effects

The alternatives are not expected to result in any direct effects on recreation or tourism as such actions as vaccination or translocation will not likely occur in locations popular for recreation or tourism activities. However, it is possible that there may be indirect effects on recreation or tourism if an Alternative affects the monk seal population in the MHI, and then the monk seal population, in turn, affects the number or value of recreation/tourism trips. In particular, indirect effects include changes in recreation opportunities related to monk seal wildlife viewing. Many people enjoy viewing wildlife, particularly marine mammals such as whales and the monk seal, in their native habitat. To the extent that the monk seal population in the MHI increases due to an Alternative, the Alternative may indirectly enhance the recreation/tourism experience through increased wildlife viewing opportunities and benefit the recreation/tourism economy.

Summary of Lingering Past Effects

The primary past effect on recreation and tourism in the MHI is the national and global economic decline in recent years that resulted in reduced tourism to the MHI. According to the Hawai'i Tourism Authority, in 2006 and 2007, there were a total of 69.1 million visitor days in Hawai'i. Visitor days decreased to 63.1 million in 2008 and then decreased further to 60.3 million in 2009. Tourism visits in 2010 started recovering (as discussed in Affected Environment section), with an increase of nearly 9 percent over 2009 visitor days.

Global health concerns can also limit air travel and affect the number of visitors to the MHI. For example, the 2009 H1N1 flu virus affected the number of visitors to Hawai'i, particularly from China, Taiwan, Singapore, and Japan (HTA, 2009).

While global economic and health concerns have affected the number of total visitors, visitor surveys show that the level of satisfaction and the likelihood of repeat visits by Hawai'i tourists has actually increased from 2005 to 2009, indicating that visitor perception of the overall quality of recreation and tourism resources in Hawai'i is becoming more positive (HTA 2009).

Analysis of Reasonably Foreseeable Future Actions

Reasonably foreseeable future wildlife management that may affect recreation and tourism on beaches and near shore areas include potential restrictions on human interaction with spinner dolphins in Hawai'i. NOAA is currently preparing an EIS (Spinner Dolphin Human Interaction EIS) regarding conservation measures to protect wild spinner dolphins. Among other potential

effects, these management actions may limit opportunities for 'swim with wild dolphin' tours or boating tours that closely approach the spinner dolphins. Other future conservation efforts by NMFS and the State of Hawai'i may also affect recreation and tourism on the MHI, with potential positive effects (i.e. enhanced wildlife populations and therefore increased chances of wildlife viewing) and potential adverse effects (*i.e.*, decreased proximity of access) on wildlife-viewing opportunities.

Cumulative Effects

The alternatives would take place against a backdrop of recovering recreation and tourism levels. However, as discussed above, the direct and indirect effects of the alternatives on recreation and tourism are expected to be negligible. As the direct and indirect effects are anticipated to be so small, none of the alternatives is expected to contribute to overall cumulative effects on recreation and tourism.

4.9.6 Environmental Justice

CEQ, which has oversight of Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued guidance in 1997 for implementing the EO. Since then, some federal agencies such as the Department of Energy's (DOE) Office of NEPA Policy and Compliance, have provided additional detailed guidance for implementation through NEPA. In addition to NMFS' guidance for environmental justice implementation through NEPA, CEQ and DOE guidance was also followed in this analysis.

The legal foundations for environmental justice in Hawai'i were also considered in this analysis, including but not limited to the Hawai'i Constitution, Hawai'i Revised Statutes, and the Hawai'i Environmental Justice Bill – Act 294 as presented in Kahihikolo (2008).

EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2011). Fair treatment is further explained to mean that no population group of any makeup should "bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies" (EPA 2011).

For each alternative, this analysis considered if disproportionately high and adverse human health or environmental (inclusive of the social and economic environment) effects would occur to minority and low-income populations that would appreciably exceed effects to the general population or other comparison group. Specifically, this analysis considered if there were different or unique

exposure pathways, exposure rates, special sensitivities, or different uses of natural resources (Office of NEPA Policy and Compliance 2004; CEQ 1997).

As noted in Section 3.4.10 in Table 3.4-11 Study Area Race and Ethnicity 2009, a high percentage of minority populations exist in the state of Hawai'i in all counties and islands, ranging from 60.9% on the island of Maui (Maui County) to 91.4% on Moloka'i (Maui County). Statewide, the average presence of minority populations is 69.8%. With the entire state of Hawai'i comprising the Project Area, all communities are assumed to be minority population communities.

Table 3.4-11 Study Area Income Below Poverty Level 2008, presents the percentage of Hawaiian residents with low-income living on each of the islands and collectively from a statewide perspective. The threshold for analysis is the state of Hawai'i poverty level, which is approximately 9.3% of residents earning incomes below the poverty level. The counties and islands with greater percentages of residents living in poverty include Kaua'i County (9.9%), Moloka'i in Maui County (16.7%), and the Big Island (13.3%). The counties and islands with lesser percentages of residents living in poverty include the City and County of Honolulu (8.5%), Maui and Lāna'i in Maui County (7.9% and 8.3% respectively), and Kalawao County (0%).

Using the State's poverty level rate as a threshold, disproportionately high and adverse human health and environmental effects experienced by the communities on the islands of Kaua'i, Moloka'i, and the Big Island would trigger environmental justice concerns. However, all communities in the Project Area are assumed to be those of minority makeup; therefore, any disproportionately high and adverse human health or environmental effects to the populations of Hawaiian communities would raise environmental justice concerns that would need to be addressed and potentially mitigated.

In the context of effects to environmental justice communities for this PEIS, specific concerns would arise from potential effects to subsistence fishers who target a fish species that overlaps with one of the various fish species the monk seal includes in their diet. Any such overlap would have to decrease availability of targeted fish species to fishers, and this decreased availability would have to result from an alternative. As described in Section 4.9.3, effects of the alternatives on subsistence fishing are likely to be negligible.

As described in Section 3.4.4, the State defines subsistence fishing as the customary and traditional Native Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing. As Native Hawaiians are a minority population covered under environmental justice, this analysis considers that potential effects to subsistence could merit potential environmental justice concerns. Economic effects realized from commercial and recreation fishing could also warrant potential environmental justice concerns. Additionally, environmental justice concerns could arise from effects to cultural resources and

historic properties meaningful to Native Hawaiians and potentially other minority groups. Mitigations to address any potential disproportionately high and adverse environmental effects to environmental justice communities would be developed and implemented as appropriate.

With regard to human health, potential effects would result from a significant decrease in subsistence fish if they were the primary sustenance for a family or individual for cultural or economic reasons. No alternatives would result in human health effects from the perspective of diminished resources impacting diet; therefore, environmental justice communities would not experience disproportionately high or adverse human health effects.

Under all alternatives, NMFS would continue to conduct education and outreach efforts (to varying degrees), ensuring that environmental justice communities are included in those efforts so that these populations are aware of best practices around wild Hawaiian monk seals. These efforts are conducted in part to limit highly unlikely potential negative consequences of interaction with the wild animals.

4.9.6.1 Direct and Indirect Effects of Alternative 1 – Status Quo

Under Alternative 1 Status Quo, the current level of research and enhancement activities would be sustained through the next permit cycle. The population of monk seals is expected to naturally increase in the MHI for the timeframe of this PEIS with this level of research and enhancement activities. However, the overall population will decrease. As such, effects to fishery resources (commercial, subsistence, or recreation) that low-income and minority populations might depend on would likely continue with their current trends, barring any unforeseen disruptive natural occurrences. Additionally, minor effects to cultural resources and historic properties would be expected under this alternative.

Disproportionately high and adverse effects to environmental justice communities would not be likely because negligible to no effects are expected to fishery resources or cultural resources and historic properties. NMFS implements best management practices and other mitigations are also in place to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.9.6.2 Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)

If no action is taken with regard to issuing new permits for research and enhancement for Hawaiian monk seals after 2014, then the number of seals is likely to decrease in the NWHI and increase in the MHI. Although fishing occurs in the MHI where the monk seal population is increasing naturally, effects are unlikely to negligible to subsistence or commercial fishing. Cultural resources

and historic properties effects would be expected to be negligible to minor under this alternative.

As no fishery, economic, or cultural effects would appreciably exceed effects to the general population, it is unlikely disproportionately high and adverse effects to environmental justice communities would result. For the remainder of the current permit cycle, NMFS would continue to implement best management practices and have other mitigations in place to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.9.6.3 *Direct and Indirect Effects of Alternative 3 – Limited Translocation*

Alternative 3 Limited Translocation encompasses all activities in Alternative 1 Status Quo; plus increased activities as detailed in Section 2.9.

Although the rate of MHI monk seal population growth may increase marginally due to Alternative 3 activities, the potential fisheries effects are congruent with those under Alternative 1 Status Quo. Consequently, disproportionately high and adverse effects to environmental justice communities would not be likely as negligible effects are expected to fishery resources or cultural resources and historic properties. As in the previous two alternative scenarios, NMFS would continue to implement best management practices and maintain other mitigations to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.9.6.4 *Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)*

Alternative 4 Enhanced Implementation differs from Alternative 3 with regard to the way translocations would be conducted. Under this alternative, weaned Hawaiian monk seals could be moved from the NWHI to the MHI, and then taken back to the NWHI when they reach the age of 3 years. Details of this alternative are included in Section 2.10 Alternative 4 Enhanced Implementation (Preferred Alternative).

Effects under Alternative 4 are expected to be negligible. Disproportionately high and adverse effects to environmental justice communities would not be likely, as negligible effects are expected to fishery resources or cultural resources and historic properties. As in the previous two alternative scenarios, NMFS would continue to implement best management practices and maintain other mitigations to minimize or eliminate potential effects to these resources in an effort to ensure major adverse effects are not suffered by Native Hawaiians, other minority populations, and/or low-income populations.

4.9.6.5 *Cumulative Effects*

Summary of Direct and Indirect Effects

As discussed, anticipated environmental effects that could potentially raise environmental justice concerns would be negligible and not likely to be disproportionately borne by Native Hawaiians, other minority populations, and/or low-income populations. Nor would any of these effects appreciably exceed effects to the general population. Further, human health effects are not expected.

Also, under all alternatives, NMFS would continue to conduct education and outreach efforts, ensuring that environmental justice communities are included in those efforts so that these populations are aware of best practices around wild Hawaiian monk seals. To further minimize any potential for disproportionately high and adverse effects to environmental justice communities, NMFS would continue to implement best management practices and maintain other mitigations to minimize and/or eliminate potential effects to socioeconomic resources.

Summary of Past Actions and Reasonably Foreseeable Future Actions

Previous subsections of the larger socioeconomics section of this PEIS detail the past and reasonably foreseeable future actions that might have contributed to effects to commercial, recreation, and subsistence fisheries; economics; and cultural resources and historic properties. In summary, those actions include coastal human settlements or development, military operations or warfare, looting or other deleterious activities, significant natural occurrences such as storms such as typhoons and tsunamis, and past legislation and EOs such as NHPA, Hawai`i Acts 50 and 294, HEPA (HRS 343), and EO 12898.

Cumulative Effects

All alternatives would result in negligible effects to fisheries, economics, and cultural resources. Based on these resource analyses, the contribution of the alternatives would be expected to result in negligible cumulative effects. As a result, the alternatives are not likely to contribute cumulative effects that would raise environmental justice concerns.

4.9.7 *Military Activities*

Military operations and exercises occur along the shoreline and in the offshore areas within the Project Area described in Section 1.3 *Description of the Project Area*. The Army installations (DMR and MMR) together have approximately three miles of shoreline. The shoreline area adjacent to the U.S. Coast Guard (USCG) installation has been removed from base operations.

As described in Section 3.4.12.3, NMFS currently has an MOU with the USCG to assist with translocation activities that are part of the Marine Mammal Health and Stranding Response Program (MMHSRP) (Permit 932-1905). Thus, the translocation described in this assessment would not necessarily involve the USCG. The USCG area operates in an area of approximately 14.2 million square miles in and around the Hawaiian Archipelago (USCG and NOAA, 2010; see Section 3.4.12.3 *Coast Guard*).

The U.S. Marine Corps (USMC) operates in approximately 12.5 miles of shoreline and nearly four square miles of area directly offshore of the Marine Corps Base Hawai`i (MCBH).

Both the Air Force and the Navy operate in approximately 40 miles of shoreline (Pearl Harbor and PMRF) and approximately 1,200 square miles of ocean in and around the Hawaiian Archipelago.

This section discusses the potential direct and indirect effects for military installations in Hawai`i. There would be no direct effects associated with any of the alternatives. Indirect effects for the Navy, USMC and the Air Force are based upon whether or not the proposed alternatives would be likely to result in changes to military operations, exercises or military response efforts throughout the Project Area. As described in Chapter 3, the Hawaiian monk seal are located where the majority of military activities occur in Hawai'i.

4.9.7.1 Direct and Indirect Effects of Alternative 1 – Status Quo

Under Alternative 1 Status Quo, the current NMFS Research and Enhancement Permit (10137) would continue until expiring in 2014. Following this date, subsequent permits will be issued to continue the research and enhancement activities that are currently permitted. For a complete description of permitted research under Alternative 1, please refer to Section 2.6 *Alternatives Carried Forward for Analysis*.

Under Alternative 1, the Hawaiian monk seal population in the MHI is anticipated to increase due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker et al 2011) independent of actions take by NMFS. While this growth, that is occurring naturally already, may be enhanced by Alternative 1 activities such as de-hooking, disentanglement, and weaned pup translocation measures, the contribution of Alternative 1 activities to any increase in the monk seal population would be marginal. As described above, NMFS may cordon off small sections of beaches where monk seals haul out but this would be temporary until the seal moved or swam away.

Under Alternative 1, at most 85 Hawaiian monk seals can be translocated by boat, vehicle, or aircraft per year (Table 2.10-1). While the *Coast Guard* does assist

NMFS with the translocation of Hawaiian monk seals, approximately three to five annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. NMFS may involve USCG in future translocations if the activity fits within their existing operations and does not require significant effort. Thus the majority of these 85 possible translocations would not involve *Coast Guard* assistance (NMFS pers. comm. 2011). Any small areas to be cordoned off around seals would not likely affect USCG activities and would therefore be negligible.

As previously described, the MHI Hawaiian monk seals population is naturally increasing independent of any research or enhancement taken by NMFS. The implementation of Alternative 1 may have a negligible indirect effect on MHI Hawaiian monk seal population beyond that of natural MHI population growth due to de-hooking, disentanglement and weaned pup translocation. However, it is anticipated that this small population effect will have negligible indirect effects upon military training and operations within the MHI.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 1 would directly affect military activities or operations in Hawai`i. Furthermore, it is unlikely that Hawaiian monk seal population changes within the MHI resulting from enhancement activities would indirectly affect military training activities or operations. Therefore, direct and indirect effects are likely to be negligible.

4.9.7.2 *Direct and Indirect Effects of Alternative 2 – No Action (No New Permits After 2014)*

Under the No Action Alternative, existing research as permitted under the current permit (10137) would continue until 2014. Once this permit expires, no research or enhancement activities on monk seals would occur. Unlike the activities under other alternatives, there would be no field research to monitor populations, implement de-worming, or translocation once the permit expires in 2014.

As discussed above, demographic data for monk seals suggests that the Hawaiian monk seal population in the MHI is anticipated to continue to increase regardless of NMFS actions. Under Alternative 2, given that most monk seal research and enhancement activities would cease after 2014, potential effects on military activities under Alternative 2 would not likely occur and are therefore considered negligible.

It is unlikely that Alternative 2 would result in any direct or indirect affect on the military in Hawai`i. Under Alternative 2, regardless of any NMFS action, the MHI Hawaiian monk seal population is anticipated to grow, however under this Alternative this increase is expected to be lower than all other Alternatives. Indirect effects of Alternative 2 might include fewer occasions of cordoning off

areas near military installation shorelines and fewer instances of Navy training exercise conflicts. However, the potential effects of Alternative 2 would likely be negligible for all branches of the military.

Conclusion for Direct and Indirect Effects

It is anticipated that there would be no direct affects to military activities or operations in Hawai`i resulting from Alternative 2. Given that most research and enhancement would cease once the permit expires in 2014, military activities are not likely to affected and therefore, potential effects would be considered negligible.

4.9.7.3 Direct and Indirect Effects of Alternative 3 – Limited Translocation

Under Alternative 3, the research and enhancement activities currently permitted would be expanded (see section 2.6 for details).

Alternative 3 entails the expansion of research and enhancement activities currently permitted, most of which are focused on slowing Hawaiian monk seal population decline within the NWHI. The expanded activities under Alternative would include translocation, vaccination, behavioral modification, and deworming none of which, themselves would likely affect military activities. Emergency response to a disease outbreak is already mandated under provisions of the MMPA's Marine Mammal Health and Stranding Response Program (MMHSRP)(Title IV, 16 U.S.C. 1421) and the permit held by the MMHSRP.

The implementation of Alternative 3 could result in translocations of seals (see Appendix F, Take Tables) by boat, vehicle, or aircraft. While the *Coast Guard* does assist NMFS with the translocation of approximately three to five Hawaiian monk seals annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. Therefore, these possible translocations would not involve *Coast Guard* assistance (NMFS 2011).

The geographic extent of haul out occurrences within the MHI is not likely to expand as a result of NMFS actions, rather independent of such actions as the natural population growth in the MHI may continue to alter their distribution (Baker *et al.* 2011). While it is noted that the frequency of these events could increase it is not likely to be attributable to NMFS actions under Alternative 3 and the effect of increased haulouts on military operations is anticipated to be negligible for each military branch.

The marginal population increase in monk seal populations in the MHI due to research and enhancement activities are not likely to result in any change in the number of conflicts with Navy training activities. It is anticipated that the number of Navy training exercises affected by monk seal is to be negligible.

Conclusion for Direct and Indirect Effects

None of the research methods permitted under Alternative 3 would directly affect military activities or operations in Hawai`i. Furthermore, it is unlikely that Hawaiian monk seal population changes within the MHI resulting from enhancement activities will indirectly affect military training activities or operations. Therefore, direct and indirect effects of Alternative 3 are likely to be negligible.

4.9.7.4 Direct and Indirect Effects of Alternative 4 – Enhanced Implementation (Preferred Alternative)

Under Alternative 4, the research and enhancement activities would be the same as presented for Alternative 3 with the addition of a more robust translocation program to potentially include translocation of weaned seals from areas of low survival in the NWHI to areas of higher survival in the MHI for a temporary period until age 3 years at which point they may be returned to the NWHI.

Alternative 4 entails expanded research and enhancement activities, most of which, as under Alternative 3, are focused on improving the population status in the NWHI. The Alternative 4 expanded activities most relevant to the MHI are potential two-stage translocation involving temporarily moving juvenile seals from the NWHI to the MHI, a vaccination program, and behavioral modification activities. It is anticipated that Alternative 4 will exhibit the greatest benefit to Hawaiian monk seal populations relative to all alternatives. However, that benefit is expected to primarily manifest as a reduction in the rate of decline in the NWHI as opposed to making significant contributions to the already underway MHI population growth.

The implementation of Alternative 4 could result in additional monk seal translocation activities each year for 5 years. While the Coast Guard does assist NMFS with the translocation of Hawaiian monk seals, approximately three to five annually, these translocation activities are authorized under NMFS permit 932-1905 and not under Permit 10137. Therefore, these possible translocations would not involve Coast Guard assistance (NMFS 2011).

Indirect effects of Alternative 4 on military activities could occur if there were marked changes in the population of Hawaiian monk seals within the MHI due to NMFS action. Under this Alternative, up to a maximum of 60 translocated (from the NWHI) juvenile Hawaiian monk seals could be present in the MHI in some years. This temporary increase in the Hawaiian monk seal population is anticipated to have negligible effect on military training activities and operations.

Conclusion for Direct and Indirect Effects

None of the activities permitted under Alternative 4 would directly affect military activities or operations in Hawai`i. Furthermore, it is unlikely that temporary Hawaiian monk seal population increases within the MHI resulting from enhancement activities would indirectly affect military training activities or operations. Therefore, direct and indirect effects would likely be negligible.

4.9.7.5 Cumulative Effects on Military Activities

Summary of Direct and Indirect Effects

Research and enhancement activities would likely result in negligible direct and indirect effects on military operations under all alternatives.

Summary of Lingering Past Effects

Lingering past effects on military operations in Hawai`i due to sensitive species interaction is largely related to the permitting process for various military activities and due to the implementation of Integrated Natural Resource Management Plans (INRMP). While the permitting process requires additional military labor and mitigation efforts these documents are not completely dedicated to monk seal management and mitigation. Examples of this would be the Navy Hawai`i Range Complex Final EIS as well as the other environmental compliance documents discussed in Section 3.4.12.3 *Coast Guard*.

As described in Section 3.4.11 *Sanctuaries, Monuments, and Refuges*, the USCG and NMFS have a standing MOA that allows for the USCG to assist NMFS in the translocation of Hawaiian monk seals. This MOA is authorized under NMFS permit 932-1905 and not under Permit 10137 (USCG and NOAA, 2010; see Section 3.4.12.3 *Coast Guard*). The protection of marine resources, such as the Hawaiian monk seal is but one of eleven USCG missions mandated by law.

Analysis of Reasonably Foreseeable Future Actions

RFFAs are described in Section 4.5.2. RFFAs that may potentially affect military activities and operations in the Hawaiian Islands would include but are not limited to those actions that could alter the ability of the military to carry out missions, additional administrative requirements, new restrictions or changes to areas where operations may occur, or other potential natural disasters such as tsunamis or hurricanes, etc.

Under all alternatives, the Hawaiian monk seal population in the MHI is anticipated to increase naturally (*i.e.,* independent of NMFS action) due to the apparent favorable conditions for continued growth as evidenced by the demographics of the Hawaiian monk seal population (Baker *et al.* 2011). This growth may be enhanced by alternative activities, such as de-hooking,

disentanglement, and weaned pup translocation measures, with the exception of Alternative 2 as most research and enhancement would cease in 2014.

Military environmental planning would necessitate studying the potential implications of slight changes in the Hawaiian monk seal population on operations and management. However, it is likely that the existing mitigation efforts outlined for Navy operations within the Hawai`i Range Complex in Section 3.4.12.3 would apply and that minimal changes to operations or management of military activities would be needed. Current Navy mitigation efforts include a lookout and the decreasing of active sonar levels during training exercises when marine mammals are in close proximity. The contribution of any alternatives to cumulative effects on military activities due to minor changes in the monk seal population would likely be negligible.

4.10 SUMMARY OF EFFECTS

The following tables (Tables 4.10-1 through 4.10-12) summarize the direct, indirect, and cumulative effects under each alternative for resources where environmental consequences were evaluated. More detailed discussions of direct, indirect, and cumulative effects can be found in Sections 4.8 through 4.10.

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Table 4.10-1 Summary of Direct/Indirect and Cumulative Effects – Hawaiian Monk Seals

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
HAWAIIAN MONK SEALS				
DIRECT / INDIRECT EFFECTS				
Mortality	**Minor Adverse** - could result in a reduction of total abundance of 9 seals, representing a 1% decline.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Minor to Moderate Adverse** - small changes in the population, a small number of individuals would be affected, although levels of take are not likely to be realized.	**Minor to Moderate Adverse –** same as Alternative 3.
Reproduction	**Negligible** - precautionary measures undertaken such that no adult female is captured that appears to be pregnant.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.
Contribution to Conservation Objectives	**Moderate beneficial** - addresses conservation though not at a level that would be expected to result in notable effects on recovery.	**Major adverse** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals. No contribution towards conservation objectives after 2014.	**Major beneficial** - provides a variety of ways to conduct enhancement at any one time. Benefits are more likely to be long-term.	**Major beneficial** - flexibility to adapt to potential future conditions that might make translocations from the NWHI to MHI even more beneficial would allow NMFS to adapt strategies to a greater range of future scenarios for promoting survival.
CUMULATIVE EFFECTS				
Mortality	**Negligible** - Relative to mortalities caused by predation, starvation, entanglement, intentional lethal shootings by humans and potential diseases, contribution of effects of	**Negligible –** after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
	Alternative would be negligible.			
Reproduction	**Negligible** - alternatives vary in the amount of research- and enhancement-related disturbance although none of the proposed alternatives are expected to contribute anything but negligible effects on reproduction.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** - same as Alternative 1.	**Negligible** - same as Alternative 1.
Contribution to Conservation Objectives	**Moderate beneficial contribution** – addresses conservation though not at a level that would be expected to result in notable cumulative effects on recovery.	**Major adverse contribution** - no additional research or enhancement would occur on wild seals could result in higher seal mortality.	**Major beneficial contribution** - promotes better survival through limited translocation, disentanglement, possible deworming, vaccination, and other measures.	**Major beneficial contribution –** enhanced translocation promotes best chance of survival combined with disentanglement, possible deworming, vaccination, and other measures.

Table 4.10-2 Summary of Direct/Indirect and Cumulative Effects – Sea Turtles

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
SEA TURTLES				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - Injury or mortality affecting sea turtles rare.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible**- injury or mortality due to collisions with sea turtles extremely rare; effect on population/species level. Despite slight increase in level of activities, BMPs and other mitigations minimize risks for collisions with turtles.	**Negligible** - same as Alternative 3.
Reproduction	**Negligible**- disturbance is not likely to result in effects on sea turtle reproduction.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible** - while level of disturbance may increase, this is not likely to cause measurable changes in sea turtle reproduction.	**Negligible –** same as Alternative 3.
CUMULATIVE EFFECTS				
Mortality and Reproductive Effects	**Negligible contribution** - compared with other external sources of mortality, BMPs and other mitigation measures minimize risk of mortality and potential effects on reproduction.	**Negligible contribution** - no research or enhancement on wild seals after 2014. Contribution to sea turtle population declines negligible.	**Negligible contribution –** despite slight increase in research and enhancement, compared with other external sources of mortality, BMPs and other mitigation measures minimize risk of mortality and potential effects on reproduction.	**Negligible contribution –** same as Alternative 3.

Table 4.10-3 Summary of Direct/Indirect and Cumulative Effects – Cetaceans

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
CETACEANS				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - injury or mortality due to collisions with cetaceans from activities such as vessel surveys extremely rare.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
Reproduction	**Negligible** - vessel activity infrequent; disturbance would be short-term and not likely to result in reproductive effects.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
CUMULATIVE EFFECTS				
Mortality and reproductive effects	**Negligible contribution** - potential effects of all alternatives on mortality or reproduction negligible at the population level relative to other external stressors. BMPs and other mitigation measures in place to minimize risks of collisions and disturbance. Vessel activity infrequent and not likely to result in any long-term effects. Under Alternative 2, no research or enhancement on wild seals after 2014. Contribution to cetacean population declines negligible. Long-term effects on reproduction negligible.			

Table 4.10-4 Summary of Direct/Indirect and Cumulative Effects – Fish

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
FISH				
DIRECT / INDIRECT EFFECTS				
Mortality	**Negligible** - given the wide variety of fish consumed by monk seals, long-term decline in fish populations not likely.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
CUMULATIVE EFFECTS				
Mortality	**Negligible contribution** - relative to other external sources of fish mortality, research and enhancement alternatives are not likely to result in any measurable effects on mortality.	**Negligible contribution** - no research or enhancement on wild seals after 2014.	**Negligible contribution** - same as Alternative 1.	**Negligible contribution** - same as Alternative 1.

Table 4.10-5 Summary of Direct/Indirect and Cumulative Effects – Birds

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
BIRDS				
DIRECT / INDIRECT EFFECTS				
Productivity	**Minor adverse** effects expected from human disturbance on beach-nesting seabirds. **Negligible** effects on shorebird productivity. **Minor adverse** effects on Laysan Finch from research and enhancement camp activities.	**Negligible** - no research or enhancement on wild seals after 2014.	**Negligible to Minor adverse –** same as Alternative 1.	**Negligible to Minor adverse –** same as Alternative 1.
Survival	**Minor adverse** - periodic effects on avian survival due to potential collisions with aircraft and fencing from monk seal holding pens.	**Negligible** - no research or enhancement on wild seals after 2014.	**Minor adverse –** same as Alternative 1.	**Minor adverse** - same as Alternative 1.
Habitat Alteration	**Minor adverse** - strict protocols for entering the NWHI prevent the spread of invasive species. Despite protocols, minor effects on habitat, survival, and productivity due to introduction of invasive species.	**Negligible** - no research or enhancement on wild seals after 2014.	**Minor adverse** - increased translocation of seals from MHI to NWHI may introduce invasive species to the Monument but would be mitigated through strict protocols.	**Minor adverse –** same as Alternative 3.
CUMULATIVE EFFECTS				
	Minor adverse contribution– Relative to other sources of mortality and effects on productivity such as longline fisheries, climate change, invasive species and marine debris, the contribution of research and enhancement activities is considered minor adverse for avian mortality, productivity and habitat. Precautions would be implemented to avoid take of seabirds and nesting seabirds on beaches would be avoided.			

Table 4.10-6 Summary of Direct/Indirect and Cumulative Effects – Invasive Species

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
INVASIVE SPECIES				
DIRECT / INDIRECT EFFECTS				
Spread of Invasive Species	**Minor adverse** - strict protocols described for entering the NWHI under a Monument permit prevent the spread of invasive species.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild.	**Minor adverse** - strict protocols for entering the Monument would help prevent spread of invasive species; however, increased activity may slightly increase chances of doing so.	**Minor adverse** – same as Alternative 3.
CUMULATIVE EFFECTS				
Spread of Invasive Species	**Negligible** – given the high population and level of ecotourism, recreation, fishing, and other human activities in the MHI, research and enhancement activities proposed would be expected to result in negligible effects. Strict protocols for entering the Monument limit spread of invasive species.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals thus there would be no potential to spread invasive species	**Minor adverse** – increased translocation of seals from MHI to NWHI may increase spread of invasive species but would be mitigated through strict monument protocols. High population and level of ecotourism, recreation, fishing, and other human activities in the MHI would be expected to have a greater probability to spread invasive species.	**Minor adverse** – same as Alternative 3.

Table 4.10-7 Summary of Direct/Indirect and Cumulative Effects – Commercial Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
COMMERCIAL FISHERIES				
DIRECT / INDIRECT EFFECTS				
Commercial Landings	**Negligible** – no direct affect on commercial fishing. Marginal Hawaiian monk seal population increase within the MHI not likely to result in indirect effect on subsistence fishing.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** – no direct affect on commercial fishing in MHI. Assuming a worst case scenario, if translocated seals preyed on commercial species and all prey eaten by these seals would have otherwise been available to fishers, this constitutes only 0.6% to 1.6% of annual commercial catch. Behavioral modification may reduce seal interactions with fishing operations. Marginal, temporary monk seal population increase not likely to result in an indirect adverse effect on subsistence fishing.	**Negligible** – same as Alternative 3.
CUMULATIVE EFFECTS				
Commercial Landings	**Negligible contribution** - Commercial fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Direct and indirect effects associated with the alternatives are negligible and would not contribute to overall cumulative effects on commercial fishing.			

Table 4.10-8 Summary of Direct/Indirect and Cumulative Effects – Subsistence Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
SUBSISTENCE FISHERIES				
DIRECT / INDIRECT EFFECTS				
Subsistence Catch	**Negligible** - data do not indicate that the number of monk seals relates to the amount of fish available to be harvested for subsistence. Given the marginal, temporary increase in seals in the MHI, these effects are likely to be negligible.	**Negligible –** after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** same as Alternative 1. If all fish consumed by the translocated seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch.	**Negligible –** same as Alternative 3.
CUMULATIVE EFFECTS				
Subsistence Catch	**Negligible contribution –** Subsistence fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Overfishing and offshore military activities could have temporary effects on fishing through restricting access. The direct and indirect effects associated with the Alternatives are expected to be negligible, thus would not contribute to the overall cumulative effects on subsistence fishing.			

Table 4.10-9 Summary of Direct/Indirect and Cumulative Effects – Recreational Fisheries

	Alternative 1: Status Quo	Alternative 2: No Action No Permit after 2014; activities	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
RECREATIONAL FISHERIES				
DIRECT / INDIRECT EFFECTS				
Recreational Catch	**Negligible** – no direct effects on recreational fishing in MHI. No decrease in fishing trips or in number of fish caught for recreation.	**Negligible** – after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible** – same as Alternative 1. If all fish consumed by the translocated seals were species popular with subsistence fishers and all these fish would have been otherwise available to these fishers, it would constitute only approximately 1.2% to 3.3% of annual catch.	**Negligible** – same as Alternative 3.
CUMULATIVE EFFECTS				
Recreational Catch	**Negligible contribution** – recreational fishing in the MHI could be affected by fisheries management actions in Hawai'i, as well as the local and global economy. Overfishing and offshore military activities could have temporary effects on fishing through restricting access. Direct and indirect effects associated with the alternatives are negligible, thus would not contribute to the overall cumulative effects on recreational fishing.			

Table 4.10-10 Summary of Direct/Indirect and Cumulative Effects –Cultural and Historic Properties

	Alternative 1: Status Quo	Alternative 2: No Action No Permit After 2014	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
CULTURAL AND HISTORIC PROPERTIES				
DIRECT / INDIRECT EFFECTS				
Archaeological Sites	**Minor adverse** - would not result in direct impacts on any structures or landforms, therefore potential direct effects on cultural and historic resources are considered minor.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Minor adverse** - while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.	**Minor adverse** - while the likelihood of encountering a cultural or historic property is low, no impacts to those areas would occur as result of research and enhancement on monk seals.
CUMULATIVE EFFECTS				
Archaeological Sites	**Negligible contribution** - low likelihood that researchers would encounter cultural or historic properties given that activities would be limited to a relatively narrow shorezone and would be temporary in nature. Compared to other sources of disturbance to cultural and historic resources including development, major storm events, previous military actions (*i.e.*, warfare), looting or other deleterious activities, the contribution of any alternative to cumulative effects on cultural and historic resources would be negligible.			

Table 4.10-11 Summary of Direct/Indirect and Cumulative Effects – Recreation and Tourism

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
RECREATION AND TOURISM				
DIRECT / INDIRECT EFFECTS				
Recreation Experience and Cost, and Public Safety	**Negligible** - small portions of some public beaches may be cordoned off but benefits associated with increased wildlife presence. Pup translocations would continue to minimize human-seal interactions.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Moderate beneficial** - potential for more wildlife viewing opportunities of monk seals. Public safety would likely benefit from reduced human-seal interactions from the combination of behavioral modification and translocating seals that may become socialized.	**Moderate beneficial** – same as Alternative 3.
CUMULATIVE EFFECTS				
Recreation Experience and Cost, and Public Safety	**Negligible contribution** - alternatives would take place against a backdrop of recovering recreation and tourism levels due to the nation's economic downturn. Direct and indirect effects are anticipated to be so small, none of the alternatives is expected to contribute to overall cumulative effects on recreation and tourism.			

Table 4.10-12 Summary of Direct/Indirect and Cumulative Effects – Environmental Justice

	Alternative 1: Status Quo	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
ENVIRONMENTAL JUSTICE				
DIRECT / INDIRECT EFFECTS				
Disproportionate Effects on Minority Populations	**Negligible -** disproportionately high and adverse effects to environmental justice communities would not be likely because negligible to no effects are expected to fishery resources or cultural resources and historic properties.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible -** same as Alternative 1.	**Negligible -** same as Alternative 1.
CUMULATIVE EFFECTS				
Disproportionate Effects on Minority Populations	**Negligible contribution** - none of the alternatives would likely contribute to cumulative effects that would raise environmental justice concerns.			

Table 4.10-13 Summary of Direct/Indirect and Cumulative Effects – Military Activities

Effect	Alternative 1: Baseline	Alternative 2: No Action	Alternative 3: Limited Translocation (only MHI to NWHI or within each region)	Alternative 4: Enhanced Implementation (Preferred Alternative)
MILITARY ACTIVITIES				
DIRECT / INDIRECT EFFECTS				
Military Activities	**Negligible –** no direct effect on military activities. Translocation of seals would likely not involve USCG. Any small areas to be cordoned off around seals would not likely affect military activities or operations.	**Negligible** - after the permit expires in 2014, no additional research or enhancement would occur on wild seals.	**Negligible –** same as Alternative 1.	**Negligible –** same as Alternative 1.
CUMULATIVE EFFECTS				
Military Activities	**Negligible contribution -**RFFAs that may potentially affect military activities and operations may include but are not limited to those actions that could alter the ability of the military to carry out missions, additional administrative requirements, new restrictions or changes to areas where operations may occur, or other potential natural disasters such as tsunamis or hurricanes, etc. Direct and indirect effects associated with alternatives would be negligible, thus would not contribute to the overall cumulative effects on military activities.			