

**Minutes of the Fifth Meeting of the Alaska Steller Sea Lion Restoration Team,
June 28-29, 2001**

Participants

The fifth meeting of the Alaska Steller Sea Lion Restoration Team (ASSLRT or Restoration Team) was held on June 28-29, 2001. The following members of team were present: Morgen Crow, Gordon Kruse (chair), Earl Krygier, Denby Lloyd, Michelle Ridgway, Bob Small (June 28th only), Jay Stinson, and Kate Wynne. Ken Pitcher and Lorrie Rea were conducting field work and were unavailable.

Agenda

A draft agenda was adopted. The meeting was devoted to the following main items: review of Reasonable and Prudent Alternative (RPA) Committee activities and the final motion on Steller sea lions by the North Pacific Fishery Management Council (NPFMC) on June 9, 2001; ASSLRT comments on state and federally managed fisheries concerning sea lion protection; review of new ASSLRT work products; and a review of a draft ASSLRT report on activities to date.

Review of NPFMC's RPA Committee and Final Motion on Steller Sea Lions

Bob and Earl gave an overview of the recent activities of the Council and its RPA committee. Then, Bob distributed a draft "white paper" on satellite telemetry and Steller sea lion (SSL) research that was prepared by ADF&G and NMFS staff. Bob gave a short oral presentation on data requested by the RPA committee, specifically the distance from at-sea locations to the nearest point of land.

In presenting these data, Bob emphasized several caveats: (1) the probability of satellite transmission is higher when tagged animals are nearshore, thus leading to overestimation of the true proportion of time spent nearshore; (2) satellite data on the locations of tagged animals do not necessarily imply that SSL were foraging at those sites; (3) most pups, and perhaps most juveniles, were likely nursing and not foraging for prey while at sea; and (4) telemetry data are lacking for subadults and females without pups.

If the bias in the data for nearshore transmissions is ignored, then locations of animals tend to be concentrated within 10 nm from shore. On the other hand, if observations in the 0-2 nm range are assumed to be biased and are reduced by 90%, then the SSL split most of their time between nearshore (<10 nm) and further offshore (>20 nm). Bob emphasized the need for the sea lion scientists to complete their integrated analysis of foraging and movement data before any definitive conclusions can be drawn about SSL foraging areas.

Dave Witherell was invited to give a brief presentation on the Council's Final Motion from June 9, 2001. He indicated that a draft Environmental Assessment was due on July 23rd, and that it would be sent out to review on August 14th. The Council's first review is

scheduled in September, and final action is planned for October so that emergency regulations would go into effect in January 2002.

Dave indicated that the analysis was based on the assumption that state fisheries would be prosecuted according to the status quo (i.e., no change). The cumulative impacts section would address state fisheries, and assistance from ADF&G will be sought. An experimental design is being prepared for inclusion in the analysis. Also, a new Biological Opinion will be an appendix to the sea lion Supplemental Environmental Impact Statement.

Dave drew the Restoration Team's attention to Alternative 4 as sort of a quasi-preferred alternative. In particular, he pointed out the three large areas where no fishing would occur. He suggested that ASSLRT examine the following fishery management measures: fishing seasons, no transit zones, and no fishing zones.

ASSLRT Comments on State and Federally Managed Fisheries

The Restoration Team was provided copies of the draft list of groundfish fishery management alternatives prepared by the NPFMC during its June meeting and an associated set of maps. Regarding state fisheries, the team was previously provided with the 173 page report on state fisheries prepared by Kruse et al. (2000), the 18 May 2001 letter from ADF&G Commissioner Rue to NMFS Regional Administrator Balsiger, and proposed draft text on the cumulative effects of state-managed fisheries prepared by ADF&G staff.

The team discussed alternative approaches to reviewing and commenting on proposed state and federal sea lion protective measures. It was decided that it was best to take a science-based approach. The team first identified the important biological activities of sea lions. In particular, two critical sets of SSL activities were recognized: (1) breeding and resting on land, and (2) foraging at sea. Next, the team discussed the merits of alternative management measures to protect those vital activities.

Breeding, Resting, and Pup Rearing on Land

Summary of Team Discussion on Disturbance Mitigation

Breeding and pup rearing occurs on rookeries during May through September. Resting and nursing occurs on winter haulouts during October through April, and resting occurs on summer haulouts during May through September. Disruption of these activities by approaching vessels at sea or people on land has been well documented. On rookeries, human disturbance may disrupt breeding and nursing activities, lead to pup abandonment or loss at sea, and increase the likelihood of killer whale predation of animals that are provoked into the sea. On haulouts, disturbance can lead to disruption of social structure and increased predation.

ASSLRT expressed no opinion on the extent to which disturbance of SSLs on rookeries and haulouts might have contributed to the population decline, but the team concluded that it would be prudent to reduce the potential for such disturbances nonetheless. Further, the Restoration Team felt that the best management tools to protect animals while on land are no-approach zones for persons on land and no-transit zones for vessels at sea. No other management tools offer similar protection to that provided by these buffer zones.

The Restoration Team next discussed the appropriate size of the buffer zones needed to prevent disturbance of animals. In 1993, in response to the proposed federal rule 50 CFR Part 226, the State of Alaska urged adoption of a 3,000-foot seaward boundary of rookeries and major haulouts throughout the sea lion's range in order to provide a buffer zone that could be used to prevent disturbance and other possible impacts. Previously (1991), the federal Steller Sea Lion Recovery Team recommended 3,000-foot buffer zones around rookeries and major haulouts, and also noted that larger buffer zones could be appropriate for rookeries that experienced major declines. Currently, standard federal marine mammal guidelines suggest that vessels remain at least 100 yards from whales, dolphins, and porpoises at sea and 100 yards from seals and sea lions on land, rock, or ice. For the endangered western stock of SSL, current federal regulations generally prohibit persons on land from approaching a sea lion rookery within 0.5 miles (or 0.8 km) and vessels at sea from transiting within 3 nm of listed rookeries. In its Biological Opinion issued on 30 November 2000 (BiOp3), NMFS proposed continuation of the 3-nm no-transit zones around rookeries year-round, and additional 3-nm no-fishing zones around major haulouts for all federally permitted vessels. Current state regulations include 3-nm no fishing zones, but do not include no-transit zones, around SSL rookeries. The rookeries protected by state Emergency Order include the same rookeries protected by federal regulations except for recent federal changes that added and deleted a couple of rookeries from the list. State regulations do not include no-transit nor no-fishing zones around haulouts at the present time.

ASSLRT is unaware of any studies that quantify the distance needed to protect SSLs from disruption while on land. Anecdotal information suggests that animals may have different tolerances depending on location, activity, time of year, and degree of habituation. Examples included new haulouts in the presence of many activities within Kodiak harbor, haulouts where seiners attach their nets directly to the rocks where sea lions have learned to dive into nets to catch fish, and Kate Wynne's observations that animals can become agitated and will herd into the water if vessels approach within 2,000 feet of Long Island in the Kodiak Archipelago. The team discussed the possibility that existing and proposed buffer zones may more reflect a distance that may discourage illegal shooting of sea lions than the distance at which disruption occurs from approaching vessels.

The Restoration Team considered whether the size of no-transit zones around major haulouts should be 3,000 feet, whether the size of no-transit zones around rookeries should be 3 nm, or whether these distances are larger than needed to prevent disruption of land-based animals. In its final analysis, the team agreed that it does not have a basis to

select particular buffer sizes for no-transit zones. Moreover, regarding haulouts, the team felt that a fixed size may not be appropriate everywhere. Additionally, some accommodation should be made, where needed, for local conditions, such as required human activity, areas where the radius includes harbors or routes needed for safe navigation, and traditional use. Habituation should be considered, but the team noted that habituation does not necessarily infer a lack of negative effects from human interactions.

ASSLRT Management Advice for Mitigation of Disturbance at Rookeries and Haulouts

General advice. ASSLRT feels that regulations are needed for no-transit zones around rookeries and haulouts, *during the seasons occupied*, to prevent disruption of critical biological activities on land. The team recognizes that seasonal sea lion use patterns are not well understood at all sites. The size of the zones should be based on biology. The team feels that the appropriate size of the no-transit zones around haulouts to prevent disturbance is in the range of hundreds to thousands of feet. The team realizes that larger zones may be more effective in limiting direct mortality from illegal shooting. Also, the size of the no-transit zone for rookeries should be larger than around haulouts owing to the greater risks of adverse effects on pups. Information does not exist to quantify the merits of particular alternatives. Therefore, the size of no-transit zones should be a matter of public consultation, so that sizes chosen for particular locations can reflect best available scientific data, anecdotal information, and local traditional knowledge of the site.

Specific Advice to the State of Alaska. In addition to its general advice, the Restoration Team developed additional specific advice to the State of Alaska concerning no-transit zones:

1. The State should amend its list of SSL rookeries to reflect most recent changes in the federal list;
2. Assuming that the State of Alaska is vested with such authority, state regulations should include no-transit zones around SSL haulouts for the season occupied with minimum size on the order of hundreds to thousands of feet;
3. The State should carefully consider fisheries that are currently prosecuted within close proximity of occupied haulouts and should implement appropriate no-transit (and therefore no-fishing) buffers between those fisheries and the haulouts during the seasons occupied; and
4. If the State continues to allow the prosecution of any salmon or other fisheries within close proximity of occupied haulouts, then field programs should be implemented to monitor potential direct fishery-SSL interactions for those fisheries.

Foraging at Sea

Summary of General Team Discussion on Fisheries and SSL Foraging Success

The Restoration Team revisited its previous findings about the potential role of fisheries in SSL declines. ASSLRT continues to recognize that the preponderance of evidence indicates that nutritional limitation was problematic in the 1970s and 1980s, but that data collected in the 1990s do not indicate that the western population of SSLs has been nutritionally stressed with respect to the eastern population, at least during summer for pups and adult females with pups on which studies have focused to date.

Nonetheless, if nutritional limitation does exist, then an important question is whether fisheries cause it. In this regard, ASSLRT noted conclusions of the Scientific and Statistical Committee who, in their report dated 18 May 2001, stated, “*There is no information supporting the conclusion that local depletion is now occurring in Alaska’s fisheries.*” Likewise, in an independent review dated May 2001 by Bowen, Harwood, Goodman, and Swartzman, it was stated “*There is, as far as we know, no direct evidence that prey depletion by fisheries has affected the demography of any seal population, whereas there are a number of cases in which seal populations have continued to increase exponentially following the complete collapse of an important prey stock as a result of overfishing.*”

Nevertheless, owing to a lack of recent data on all life stages of SSLs, ASSLRT feels that we cannot rule out the possibility that juvenile and females without pups may be experiencing nutritional stress. Among these, the Restoration Team is most concerned about the lack of data on juveniles owing to their caloric needs per unit body weight and their relative inexperience to capture prey. Also, the Restoration Team acknowledges that the few studies conducted to date are insufficient to fully address the issue of localized depletion. An unpublished NMFS manuscript, prepared in July 1998, provided some evidence for localized depletion in the Atka mackerel fishery in the early 1990s, and in January 1999 the NMFS issued a final rule to spatially and temporally distribute the Atka mackerel fishery in the Aleutian Islands as a precautionary approach to reduce the probability of localized depletions of Atka mackerel inside SSL critical habitat.

Because ASSLRT took a scientific approach, the team struggled with the formulation of management advice to mitigate nutritional limitation and fishery-caused localized depletion, two potential problems for which there is no direct evidence. The team decided to evaluate a suite of alternative management measures that could be used to mitigate the *possibility* that juvenile SSLs are nutritionally stressed owing to competition with fisheries. Unlike pups and females with pups, there are no contemporary data with which to ascertain whether juveniles are food limited. The team considered the following suite of management measures for their ability to increase prey available to juvenile SSLs: no-fishing zones, harvest rates and fishery thresholds, fishing seasons, fisheries rationalization programs, and gear types.

Summary of Team Discussion on Measures to Protect Juvenile Foraging at Sea

No-fishing Zones. The team recalled Bob Small's presentation on telemetry studies that showed a preponderance of juvenile locations nearshore, and the team also reflected on a statement on page 90 in BiOp3: "*the maximum depth measured for winter young-of-the-year was 72 m.*" However, the team revisited Bob's cautions that satellite transmission of location is dependent upon transducers being dry, which is more likely close to land, and that, because of SSL behavioral differences nearshore versus offshore, satellite locations do not necessarily indicate foraging patterns. Also, those data showed that juveniles spent large amounts of time offshore (>20 nm) particularly in summer when data were adjusted to account for the nearshore bias. Also, the team is aware that recent dive data are leading to substantial revision in the concept that young SSLs are restricted to shallow water dives. As results of new analyses will provide a more direct measurement on foraging patterns, ASSLRT feels that it is inappropriate to characterize juvenile foraging areas by depth and distance from shore.

No-fishing zones can be useful tools to maximize prey availability to juvenile sea lions, if the zones indeed correspond to juvenile foraging areas, and if prey abundance is reduced over the time scales associated with SSL nutrition as a result of fishery removals. Lacking a complete analysis of foraging data and the effect of fisheries on the prey field, the merits of potential particular no-fishing zones cannot be evaluated. The Restoration Team discussed the possibility that creation of nearshore no-fishing zones could actually prove to be deleterious to SSLs if the offshore areas turn out to be more important SSL foraging areas and if imposition of nearshore closures zones increases fishing effort offshore. In this regard, the team discussed the prospects that some use of no-fishing zones could be used in an experimental management approach to evaluate positive and negative effects on SSL trends.

The team noted that, in BiOp3, NMFS found jeopardy to SSLs by groundfish fisheries and no-fishing zones were proposed as part of the RPA to remove jeopardy. However, ASSLRT has not seen compelling evidence on which to base specific recommendations about no-fishing zones. ASSLRT members anxiously await foraging analyses of diving, movement, and prey consumption data to see if identifiable patterns exist. Lacking such comprehensive foraging analyses and better information on the effects of fisheries on SSL prey fields, ASSLRT was unable to recommend meaningful no-fishing zones despite the team's desire to be precautionary.

Harvest Rates. The Restoration Team considered the value of changes in fishery harvest rate to increase the abundance of SSL prey. The team believes that this topic is intimately tied to the code of conduct for responsible fisheries management. Harvested fish stocks should be enumerated with precise assessment programs, and a harvest rate strategy should be based on conservative target reference points set safely below limit reference points associated with overfishing. Of the commercially harvested species in SSL diets, most stocks (e.g., walleye pollock, Pacific cod, Atka mackerel, rockfishes, arrowtooth flounder, rock sole, and other flatfishes) are enumerated by assessment programs, generally considered to be technically sound, and managed by harvest rates

(e.g., $F_{40\%}$) thought to be conservative. Many flatfishes are harvested at rates markedly below $F_{40\%}$ owing to bycatch concerns and market demands. Nonetheless, the team recognizes that uncertainty in stock assessments and imprecision in estimates of reference points can lead to actual harvest rates that exceed intended rates in some instances.

Some species (e.g., sockeye, king) of Pacific salmon are fully enumerated as they pass by weirs on some river systems, whereas other species (e.g., pink and chum salmon) are imprecisely assessed by stream or aerial surveys. However, all salmon runs are managed on an escapement goal policy that uses open/closed fishing periods in an attempt to allow an optimum escapement of spawners to return to natal streams so as to maximize future run sizes.

Several key herring stocks in the eastern Gulf of Alaska are assessed relatively precisely by spawn deposition or hydroacoustic surveys that are conducted routinely. Stocks with such data are managed by a harvest rate strategy. Harvest rate is zero, if the stock is below threshold, and intermediate harvest rates are applied at intermediate levels of abundance up to a maximum harvest rate of 20% of spawning biomass. This harvest rate is thought to be conservative, and the rationale for the harvest rate is partly to provide for the role of herring as a forage species for upper trophic level predators, such as SSLs. However, to our knowledge, the degree of harvest rate reduction associated with ecological considerations, and the effect of this reduction on herring biomass has not been quantified. On the contrary, Kodiak Island herring stocks have not been comprehensively assessed. Associated with this lack of assessment, there is risk that harvest rate could exceed the acceptable harvest rate range in any one year or area. If such overharvest is chronic, then recruitment overfishing occurs, and the long-term fishery productivity and availability of herring as SSL prey would decline, as well.

The team had a long discussion about difficulties in estimating the increase in SSL prey abundance to be expected from a given reduction in harvest rate. The team noted that harvest rate reductions do not translate directly into proportionate increases in abundance. For instance, ignoring all other complicating factors, if a harvest rate of 20% was reduced by half to 10%, the biomass of a species does not double. Instead, in simplistic terms, biomass would increase about 12.5% from 80% of virgin levels to 90% of virgin levels. Further, “biomass” is typically estimated as spawning biomass. If one considered total population biomass, including juveniles that are available to SSL as prey but are not included in the spawning biomass estimates, then the harvest rate is actually lower and the marginal benefits of a harvest rate reduction are less. ASSLRT offers this example for illustrative purposes only, and we realize that this rough calculation involves a number of unrealistic simplifying assumptions.

In the real world, intricacies of population dynamics and trophic dynamics makes it much more difficult to predict the resultant increase in SSL prey from a reduction in harvest rate. In fact, ASSLRT is not convinced that a reduction in harvest would, in fact, result in any increase in prey abundance for a number of reasons. First, gadids generally have fairly strong density-dependent stock-recruit (S-R) relationships. So, increases in standing stock above a mid-range result in lower levels of recruitment on average. If

juvenile SSLs generally eat juvenile fish, then an increase in standing stock may reduce prey availability to juvenile SSLs. Flatfish, on the other hand, tend to have S-R relationships in which recruitment is independent of stock size over a broad range of spawning stocks, except when stocks fall to very depressed levels. So, reduced harvest rate, would not increase the production of juvenile flatfish from the stock, but adult flatfish abundance would increase as abundance accrues from the harvest rate reduction. Better information on the sizes and ages of groundfish consumed by SSLs would help to evaluate the tradeoffs between stock productivity (recruitment) and biomass (standing stocks), including caloric value related to spawning, with respect to SSL prey density.

Some fish species (e.g., pollock, cod, arrowtooth flounder) that are prey of SSL at one life stage are competitors of SSL at later life stages. Pollock are cannibalized by larger pollock, particularly in the Bering Sea. Adult pollock consume other SSL prey, including Pacific cod, herring, arrowtooth flounder and other flatfishes. Adult cod eat SSL prey, such as pollock, flatfish, squid, octopus, and sand lance. Likewise, the arrowtooth flounder diet includes pollock, squid, octopus, sand lance, smelts, herring, and flatfish. So, a reduction in harvest rate on some species that are SSL prey at one life stage will increase the abundance of SSL competitors at another life stage. The dynamics are too complex for us to evaluate whether reductions in harvest rates for these species will result in a net increase or net decrease in the abundance of prey available to juvenile SSLs.

Aside from the SSL prey that are targets of commercial fisheries, the team noted that about half of the primary species in the SSL diet shown in Figure 4.6 in BiOp3 includes species that are unfished or very lightly fished, such as squid, octopus, Pacific sand lance, Irish lord, Pacific sandfish, smelt, snailfishes, rock greenling, capelin, and some species of flatfishes. Although some of these species are subjected to bycatch mortality in some fisheries, factors other than fisheries are likely to regulate the abundance of these species. Thus, a reduction in harvest rate is not a viable management tool to affect an increase in the abundance of unfished SSL prey species.

Fishery Thresholds. A fishery threshold is an abundance level below which no fishing is allowed, i.e., harvest rate is set equal to zero. The use of thresholds for fishery management increased in the 1990s. However, thresholds are not applied to all exploited fish stocks. Typically, thresholds are set as a fraction (e.g., 20%) of estimated virgin spawning biomass. When current biomass levels fall below threshold, then no fishing is permitted. Threshold is intended as a safeguard against recruitment overfishing. However, if the exploited species is eaten by SSLs, then the threshold will help to maintain SSL prey abundance above some density level. Of course, there are no guarantees that prey biomass will not continue to decline below threshold in the absence of fishing. Also, prey densities required for SSL nutritional requirements have not been explicitly considered in the establishment of current threshold levels. Nonetheless, ASSLRT feels that thresholds should be a routine component of any conservative fishery management plan, especially when the target species is a SSL prey species. For fish stocks lacking abundance estimates, assessments should be initiated to implement a threshold-based harvest policy.

Fishing Seasons. The Restoration Team discussed the use of fishing seasons as a means to increase the density of prey available to SSLs and briefly talked about the ability of this management tool to reduce the likelihood of localized depletion. It was pointed out that fishing seasons could be used to spread out the harvest over the year, but that average abundance of fish would be unchanged, as the fishing mortality would remain the same. The team noted that the abundance of a species in a particular time and place is largely a function of seasonal migrations between spawning and feeding grounds. The team also noted that, as a management measure, fishing seasons are primarily used to meet socio-economic objectives, such as spreading out seafood employment over the course of the year.

There was discussion about the possibility that fishing activity may disrupt fish spawning behavior. We are aware of an unpublished NMFS study in which pollock aggregations at depth appeared to react to the vessel noise from a factory trawler. Also, spawning aggregations of Atlantic cod show avoidance behavior in response to bottom trawls (Morgan et al. 1997). This avoidance behavior affected the shoal structure up to 200-400 m on either side of the trawl track for a time period on the order of the length of the study, 77 minutes. However, we do not know if fish school responses on the order of hundreds of meters and tens of minutes cause adverse effects on the ability of SSL to forage successfully. [Citation: Morgan, M.J., E.M DeBlois, and G.A. Rose. 1997. An observation on the reaction of Atlantic cod (*Gadus morhua*) in a spawning shoal to bottom trawling. Can. J. Fish. Aquat. Sci. 54 (Suppl. 1): 217-223.]

Finally, ASSLRT discussed the issue of which type of fishery causes less disruption of SSL foraging success: a short or a long fishery? A herring fishery may be prosecuted in the vicinity of many sea lions, but the fishery may be extremely fast, perhaps as short as an hour or less. On the other hand, a protracted fishery, which is spread out over the entire year, may involve fewer SSL interactions per hour, but involves many more hours of fishing.

ASSLRT did not delve deeply into the concept of localized depletion, and the team struggled to apply fishing seasons as a management tool to address this concern largely owing to the lack of data on fishing effects, SSL foraging, and seasonal prey dynamics. In the absence of such data, the team could not recommend a preferred structure of fishing seasons to improve the density of prey available to juvenile SSLs.

Fisheries Rationalization Programs. Following fishing seasons, the team briefly discussed rationalization programs that lead to effort reduction. The team noted that smaller fishing fleets may have greater flexibility to harvest at alternative times of the year. Thus, there may be more potential to avoid seasons when SSL interactions are more likely. Also, if effort is reduced, then there would be fewer vessels to interact with SSLs. However, again, the team had difficulty in evaluating effects of fishery-SSL interactions under a short fishery versus a protracted fishery.

Gear Types. The team was unable to identify gear types as a means to increase the availability of prey to juvenile SSLs. A switch to a more inefficient gear type was not

viewed to be a means to this end, because if the catch quota is unchanged, then there is unlikely to be any net change in SSL prey availability as a result of gear changes. Also, allocation of harvest to an inefficient gear type may lead to more effort causing more vessel-sea lion interactions.

Also, although not related to the topic at hand (i.e., means to improve juvenile SSL foraging success) the team held a brief discussion about incidental takes by different gear types. ASSLRT noted that the rate of incidental “take” of SSL by fishing gears in Alaska is very low, although takes have been documented from virtually all gears at some time or another. Most Alaskan fisheries are classified under the Marine Mammal Protection Act as Category III that designates fisheries with a remote likelihood or no known serious injuries or mortalities. A few fisheries, such as a few purse seine, set net, and gillnet fisheries are designated as Category II that designates fisheries with occasional serious injuries and mortalities. In the status of stocks document for SSL in 2000 it was estimated that the mean annual mortality rate of the western stock of SSL in observed fisheries was 24 per year during the 1990s. From voluntary reports, an additional 6 mortalities per year were estimated for unobserved fisheries. Additionally, there was one report of a stranded SSL associated with fishing gear during 1993-1997. The animal had troll gear in its mouth thought to be sport gear. ASSLRT noted that fishing related mortalities are likely underestimated because not all fisheries are observed. As incidental mortality is not considered to be a major contributor to the lack of recovery of the western stock of SSL, the team did not consider the development of management advice on this topic.

ASSLRT Management Advice to Increase Prey Availability to Juvenile SSLs

General advice. ASSLRT struggled to form specific management advice to mitigate a fishery-driven SSL prey limitation problem that may not exist. Data collected in the 1990s suggest that the pups and females with pups from the western stock of SSL are not nutritionally limited during the breeding period. The possibility remains a viable hypothesis, because of a lack of contemporary data on all life stages in all seasons. Also, the possibility of fisheries-related localized depletion has not been thoroughly investigated. With this in mind, ASSLRT considered a suite of management options to increase the amount of prey available to juvenile SSLs with the expectation that, if any segment of the western stock of SSLs is nutritionally limited, it is most likely to be the juveniles. We propose:

1. No one management measure is ideal to achieving this purpose of increased prey to juvenile SSLs.
2. No-fishing zones are difficult to develop at this time, because comprehensive analyses of SSL foraging are not yet available and effects of fishing on SSL prey fields remain uncertain. Accordingly, we cannot determine whether nearshore no-fishing zones, based on distances from shore, would be advantageous or deleterious to SSL foraging success. However, there may be merits to including

no-fishing zones in an experimental management approach to evaluate positive and negative effects on SSL trends.

3. Superficially, reduced fishery harvest rates may appear to be an obvious management measure to increased SSL prey abundance. However, ASSLRT discussed a number of prey taxa for which this may not necessarily be the case. First, many SSL prey species are not targeted by directed fisheries, and changes in their abundance are mostly likely due to environmental factors rather than fishing. Second, some fish species that are SSL prey as juveniles become SSL competitors as adults. Reduced harvest rates of these species may increase the abundance of adults and therefore may lead to future *reductions* in juvenile abundance owing to density-dependent stock-recruit relationships. Reductions in harvest rate of harvested species (e.g., herring) that remain SSL prey throughout their life span are most likely to result in a net increase SSL prey abundance.
4. Fishery thresholds should be developed for fishery management plans in which they are not currently used. Aside from their merits as a precautionary approach to avert possible recruitment overfishing, ASSLRT feels that thresholds can help maintain minimum prey densities to benefit predators, such as SSLs.
5. Fishing seasons may not be an effective mechanism to increase SSL prey abundance. If annual fishing mortality rate is unchanged, then mean prey abundance is unchanged. It is not clear whether a protracted fishing season with SSL-fishery interactions spread throughout the year results in less deleterious effects than a short, intense season with all SSL-fishery interactions occurring at once.
6. More comprehensive biomass surveys should be considered, including surveys of forage fishes. Additional research on the life history of major prey species (e.g., Pacific cod) should be considered, as well.

Specific Advice to the State of Alaska. In addition to its general advice, the Restoration Team developed additional specific advice to the State of Alaska concerning the conduct of fisheries on prey species of juvenile SSLs:

1. In the future, if NMFS develops more comprehensive biomass surveys on forage fishes, ASSLRT recommends that the state should consider working with NMFS to expand potential new surveys into state waters because forage fish distributions are unrelated to jurisdictional boundaries. Much better information on the status, trends, and distribution of forage fishes would be invaluable to understanding the contribution of these species to SSL population health.
2. Notwithstanding the potential for comprehensive forage fish surveys in the future, the state should implement assessment surveys for Kodiak herring stocks. This would allow the implementation of a fishery management strategy, comprised of a harvest rate and fishery threshold, like that used in the Southeast Alaska. The

assessments would provide important information about the abundance of this important SSL prey species, and the harvest rate and threshold strategies could be established to reduce the potential for adverse affects of the fishery on the availability of herring as prey to SSLs.

Review of New ASSLRT Work Products

The Restoration Team considered several draft new work products since its last meeting:

1. Bob presented a draft list of SSL research recommendations. The team endorsed the list in concept, and additional detailed review will occur by email. In particular, the team felt that a more comprehensive approach to fishery interaction studies was needed, and some members will focus their reviews on this topic.
2. Michelle presented information that she collected on the threatened status of the eastern stock of SSLs. The team pointed out that Leah Gerber's Ph.D. thesis considered determinations of ESA status, and a copy of her thesis will be secured for consideration.
3. Gordon presented short summaries of a few recent or ongoing SSL-fishery interaction studies being conducted by UAF and NMFS scientists.
4. Gordon presented a complete draft review of BiOp3 that expanded on previous ASSLRT comments issued via meeting minutes.

Review of Draft ASSLRT Report

The team reviewed the outline of a draft ASSLRT report that incorporates all work products to date. There was discussion about the merits of a full report versus the use of meeting minutes to disseminate ASSLRT advice and work products. In the end, the team agreed that a report would be useful if it could be completed quickly. Accordingly, a complete draft report will be distributed to team members in mid-July for review shortly after the meeting minutes are finalized. With an expedited internal review, it is hoped that a report could be submitted for publication by the end of July. In early August, the report will be published as an ADF&G Regional Information Report for distribution to the public.