MARINE MAMMAL COMMISSION

3 September 2010

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National Marine Fisheries Service
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Dear Dr. Balsiger:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the National Marine Fisheries Service's Draft Biological Opinion for the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Fisheries Section 7 Consultation, August 2010. The Commission offers the following recommendations and rationale to help the Service ensure that the biological opinion addresses the central questions regarding the effects of the Alaska groundfish fisheries on the western distinct population segment of Steller sea lions (hereafter referred to as the western population).

RECOMMENDATIONS

The Marine Mammal Commission recommends that the National Marine Fisheries Service—

- revise the biological opinion to—
  (1) describe the full extent of biomass reduction in each of the fisheries in question over time and as projected under the proposed management strategy for these fisheries;
  (2) provide a detailed explanation for how such reductions in biomass affect the foraging efficiency of western Steller sea lions; and
  (3) explain how such reductions still allow for the recovery of the western Steller sea lion population (as required by the recovery plan) despite the fact that apparently no changes to the overall harvest strategy are required to mitigate either jeopardy to the western population's continued existence or adverse modifications to its critical habitat;
- include a description of the shift in the age/size distribution of the prey stocks and explain how this shift in distribution, coupled with the overall reduction in prey biomass, affects the foraging efficiency of western Steller sea lions and their ability to survive, grow, and reproduce at rates sufficient for population recovery in accordance with the Service's recovery plan;
- describe changes in the distribution of the fished stocks under unfished and fished conditions and taking into account the large-scale reduction in biomass from fishing, the shift in age/size distribution of the fished stocks, the seasonal movement patterns of the fished stocks, the effects of removing the annual and seasonal catches, and the means and extent of replenishment of the prey fields after fishing is completed each year;
- take advantage of the circumstances surrounding the Alaska groundfish fisheries by developing an adaptive, experimental approach to fisheries management that will provide

- better insights into the potential effects of the fisheries on the fished ecosystems and, in particular, the western population of Steller sea lions;
- correct and clarify the use of the terms "recovery" and "carrying capacity" and ensure that references to recovery in the opinion are consistent with the recovery criteria set forth in the Service's revised Steller Sea Lion Recovery Plan; and
- analyze individually all of the reasonable and prudent measures and reasonable and prudent alternatives and explain how they move Steller sea lions toward recovery rather than just maintaining the status quo.

RATIONALE

The central questions of this biological opinion pertain to the ecological effects of the Alaska groundfish fisheries on the western population of Steller sea lions. The operational effects of the fisheries are generally thought to be under satisfactory management control. Observer programs indicate that relatively few sea lions are killed as fishery bycatch, and available evidence suggests that the shooting of sea lions is now rare, if it occurs at all.

Competition is the ecological effect of primary concern, and the question is whether the fisheries leave sufficient prey biomass for Steller sea lions to survive, grow to maturity, and reproduce at rates sufficient for the population to recover in accordance with criteria set forth in the Service's revised Steller Sea Lion Recovery Plan. The sea lions most at risk from such competition are juveniles and adult females. With exceptions, these age/sex classes are central-place foragers that must find sufficient food within foraging range of their rookeries. Juveniles are relatively inexperienced foragers (compared to adults) with high energetic and metabolic demands to support growth to adult size and to compensate for relatively high heat loss because of their larger surface to volume ratio. Adult females may be more at risk than juveniles because they must find sufficient food to support themselves, their nursing pups, and their developing fetuses.

Foraging success is determined by the prey that a sea lion encounters, captures, and consumes during a foraging trip. Therefore, this biological opinion cannot evaluate competitive effects without a clear description of the changes that fishing causes to the prey field—that is, the resource for which competition occurs. To fulfill its purpose, the opinion must describe those changes and provide a reasoned assessment of their impact on individual sea lions and the western population's ability to recover. At least four types of changes should be considered: a reduction in biomass of the target stocks, a shift in the age/size distribution of the target stocks, a change in the spatial/temporal distribution of the target stocks, and a change in the composition/diversity of the ecosystem in which the target stocks occur.

<u>Reducing the biomass of the target stocks</u>

Evaluation of fishery-induced reductions in target stock biomass requires an understanding of the fishery exploitation strategy. The Magnuson-Stevens Fishery Conservation and Management Act establishes the framework for this strategy, and it is then implemented in accordance with fishery management plans developed under the Act. The Act's first national standard sets the goal of the exploitation strategy, requiring that "[c]onservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry." The Act defines "optimum" to mean "the amount of fish which

(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
(B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery."

The concept of maximum sustainable yield is a theoretical construct with practical implications that can serve as a harvest guide in a single-species context. However, the question underlying this biological opinion is whether the maximum sustainable yield concept also is useful in an ecosystem context (Goodman et al. 2002). In the single-species context, fishery managers for the Alaska groundfish fisheries generally seek to achieve the maximum sustainable yield by reducing the spawning biomass per recruit of each fished stock to about 40 percent of what that biomass would be if the stock were not fished. Indeed, stocks are frequently reduced to even lower levels, and the biological opinion reports that in 2003 in the Gulf of Alaska pollock spawning biomass was only 26 percent of the estimated unfished level, while in 2010 in the eastern Bering Sea it was 27 percent of that level. Both of these levels suggest marked reductions (i.e., >70 percent) in the biomass of prey available to marine mammals including, but not limited to, Steller sea lions. In addition, other target stocks—including those that also are important prey for sea lions—are reduced in accordance with this exploitation strategy.

The Magnuson-Stevens Act indicates that "optimum yield," when based on the maximum sustainable yield, is to be "reduced by any relevant…ecological factor." Therefore, the biological opinion must provide a description of these reductions in fish biomass over time for each of the target stocks, explain how such reductions affect Steller sea lions and other species dependent upon the stocks that fisheries target, and consider whether reductions in the optimum yield are appropriate because of ecological factors, including the impact of fish removals on Steller sea lions. This is the central question regarding the ecological soundness of the Service's fishing strategy under the maximum sustainable yield paradigm. If we are to take an ecosystem-based approach to management of marine ecosystems, then this question must be evaluated in this particular biological opinion if it is to fulfill its purpose in protecting Steller sea lions and the ecosystems upon which they depend. To ensure that the Service's analysis of groundfish fishery effects on Steller sea lions takes full account of these large-scale reductions in available stock biomass, <u>the Marine Mammal Commission recommends</u> that the National Marine Fisheries Service revise the biological opinion to—

(1) describe the full extent of biomass reduction in each of the fisheries in question over time and as projected under the proposed management strategy for these fisheries;

(2) provide a detailed explanation for how such reductions in biomass affect the foraging efficiency of western Steller sea lions; and
(3) explain how such reductions still allow for the recovery of the western Steller sea lion population (as required by the recovery plan) despite the fact that, apparently, no changes to the overall harvest strategy are being considered to mitigate either jeopardy to the western population's continued existence or adverse modifications to its critical habitat.

Shifting the age/size distribution of the target stocks

The mechanism by which such large-scale reduction in biomass is achieved often is misunderstood. Unlike salmon and other target stocks where a cohort (age class) is harvested only once, the target stocks of the Alaska groundfish fisheries (e.g., pollock, Atka mackerel, Pacific cod) are age-structured and each cohort is subjected to repeated annual harvesting from the time the cohort recruits to the fishery (i.e., individuals in the cohort reach the physical size at which they are caught in the fishery) until the cohort reaches the stock's maximum age. For a stock like pollock that recruits at about age three, the cohort of 3-year-olds will have been harvested once at the end of any given year, the 4-year-olds will have been harvested twice, the 5-year-olds three times, and so on to about age 12 to 15. The cumulative effect of such harvesting is the mechanism by which stocks can be reduced by 60 percent or more even with an annual harvest rate on the order of 10 to 12 percent.

One of the other consequences of this cumulative harvesting is that, because older cohorts will have been subject to harvesting more times, the age/size distribution of the remaining stock shifts toward smaller individuals. This means that older, larger individuals are less common, which may have significant implications for the stock itself, including reductions in rates of reproduction and increases in cannibalism. For sea lions, the implications also may be important because their prey field must then consist of individual prey that are younger in age and smaller in size (on the order of 30 percent for pollock), which means that, on average, each fish caught has less nutritional and energetic value. Thus, in addition to the overall reduction in biomass, fishing causes a shift in the size distribution of the target stock that must affect the foraging efficiency and energy balance of Steller sea lions. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service revise the draft biological opinion by including a description of the shift in the age/size distribution of the prey stocks and explain how this shift in distribution, coupled with the overall reduction in prey biomass, affects the foraging efficiency of western Steller sea lions and their ability to survive, grow, and reproduce at rates sufficient for population recovery in accordance with the Service's recovery plan.

Changing the spatial/temporal distribution of the target stocks

Fishing can alter the spatial/temporal distribution of target stocks through a number of mechanisms. Again, such changes may be important, particularly for young Steller sea lions whose foraging range may be limited by behavioral or physiological constraints and adult females whose range may be limited because they are still nursing a rookery-bound pup. Generally speaking, the removal of some large portion of a target stock could have at least four potential effects on its distribution.

First, the fished stock might maintain its original distribution so that removals would reduce the stock's density, or the biomass per volume of water. Such an outcome might decrease the foraging efficiency of sea lions by reducing encounter rates with prey. At least hypothetically, encounter rates might decrease by 60 percent or more given the large reduction in prey biomass from fishing under the maximum sustainable yield paradigm. Resulting reduction in foraging success might affect survival, physical growth, or reproduction, and may be manifested as population decline.

Second, the fished stock might retain similar density but contract its distribution more or less consistently (i.e., throughout all parts of its range). This kind of effect would be expected to compromise foraging by sea lions at the limits of edges of their prey's range. If so, then sea lions might be forced to adjust their own distribution to match that of the prey, particularly at the geographic edges of prey distribution. Such an adjustment might appear as a range contraction of both prey and sea lions.

Third, the fished stock might contract its distribution based on habitat characteristics (as might occur if the stock followed an ideal-free distribution; Fretwell 1972). In this case, the result might appear as a reduction of the fished stock in certain types of habitat that are of secondary quality. For example, if pollock habitat in the Aleutian Islands is of lesser quality than habitat in the southeastern Bering Sea, one might expect to see a reduction of pollock in the Aleutian Islands region before a reduction in the southeastern Bering Sea because the pollock stock would preferentially seek out the favored habitat. The fact that pollock have generally not recovered in the central Bering Sea/Aleutian Islands region after being fished heavily in the 1970s and 1980s suggests that these areas might be secondary habitat for them. For sea lions, the outcome of this kind of habitat-based range contraction could be a decline in foraging success and population status in or near the fished stock's secondary habitat. Again, such an outcome might appear as a range contraction or population decline similar to that occurring in the western Aleutian Islands.

Fourth, fishing might simply result in gaps or holes in the distribution of the fished stock that persist for some time and that, again, could compromise the foraging efficiency of sea lions. Such gaps might be particularly likely for patchily distributed fish species, such as Atka mackerel, that return to multiple spawning grounds each year. This effect would be consistent with the evidence for localized depletion of prey, as has been best illustrated in the Atka mackerel fishery in the central and western Aleutian Islands. This effect also may result from concentrated fishing on pollock and Pacific cod stocks, which occurs in Steller sea lion critical habitat.

Because spatial and temporal changes in the prey field are central to this biological opinion, <u>the Marine Mammal Commission recommends</u> that the National Marine Fisheries Service revise the biological opinion by describing changes in the distribution of the fished stocks under unfished and fished conditions and taking into account the large-scale reduction in biomass from fishing, the shift in age/size distribution of the fished stocks, the seasonal movement patterns of the fished stocks, the effects of removing the annual and seasonal catches, and the means and extent of replenishment of the prey fields after fishing is completed each year. The description also should explain the propensity for localized depletion of prey from fishing effort concentrated in critical habitat and the effects of all these spatial/temporal changes in fish distribution on the foraging efficiency of Steller sea lions.

Changes in the composition/diversity of the fished ecosystems

Finally, the biological opinion must address the question of how fishing affects the composition/diversity of the fished ecosystems. This is, of course, very challenging and, in the Commission's view, would require an experimental approach carried out over a long period of time. Nonetheless, without such an approach, attributing changes in ecosystem composition/diversity to fishing is largely speculative. The Service has used multi-species models to explore potential changes, but such results must be considered hypothetical until verified by real-world data. In some respects, the Service has invoked such modeling results to support its belief that fishing under the maximum sustainable yield paradigm has relatively insignificant effects on the ecosystem, including Steller sea lions. The Commission cannot find such results convincing until the Service has verified them through adaptive or experimental management, as recommended in the revised Steller Sea Lion Recovery Plan.

Indeed, the call for an adaptive or experimental approach to assess the effects of the Alaska groundfish fisheries on Steller sea lions is now several decades old. Perhaps the timing for pursuing such an approach has never been better. The need is clear with regard to understanding the effects of fishing on Steller sea lions. In addition, experimentation could produce valuable information for promoting a more ecosystem-based approach to fisheries management. Fisheries management in the Alaska Region is well-regarded for its leadership on a number of fronts, and there is now an opportunity to provide such leadership again. In view of the present and anticipated information needs for shifting fisheries management toward a more ecosystem-based approach, the Marine Mammal Commission recommends that the National Marine Fisheries Service take advantage of the circumstances surrounding the Alaska groundfish fisheries by developing an adaptive, experimental approach to fisheries management that will provide better insights into the potential effects of the fisheries on the fished ecosystems and, in particular, the western population of Steller sea lions.

Defining and aiming for recovery

In a number of places the draft biological opinion refers to the term "recovery" in ways that are inconsistent with the recovery criteria set forth in the Steller Sea Lion Recovery Plan. The criteria set forth in the recovery plan for the western population require statistically significant growth in the non-pup count at an annual growth rate of 3 percent over a 30-year period. Yet this biological opinion often implies or refers to the occurrence of recovery in an area when, at best, the population segment in that area is unchanged. Such use of the term "recovery" therefore seems misleading and may result in misguided expectations about the need to promote growth of the population. The population is still between 10 and 20 percent of what it was just a few decades ago, and it is a long way from being recovered.

Similarly, the document frequently refers to the term "carrying capacity" without indicating whether the term is intended to mean the pristine environmental carrying capacity or a carrying capacity that reflects modifications to the environment as a result of human activities. The latter use of the term is a poor indicator of the status of the population as, through various activities, humans can adversely modify the environment to create an artificially low carrying capacity of almost any value below the pristine level.

To ensure that the biological opinion is not misleading readers as to what is required to achieve population recovery, the Marine Mammal Commission recommends that the National Marine Fisheries Service revise the opinion by correcting and clarifying the use of the terms "recovery" and "carrying capacity" and ensure that references to recovery in the opinion are consistent with the recovery criteria set forth in the Service's revised Steller Sea Lion Recovery Plan.

Using the standards of jeopardy and adverse modification

Correctly conveying the criteria and meaning of such terms as recovery and carrying capacity is particularly important because the standards of jeopardy and adverse modification should be evaluated relative to the recovery standard, not a standard that seeks simply to hold the population at a "stable" level. Under section 7, the burden of proof rests with the action agency (in this case the Sustainable Fisheries Division) to demonstrate that it has taken measures necessary and sufficient to avoid jeopardy and adverse modification as measured against a standard of both survival and recovery rather than against maintaining stability at a vastly reduced level. Given the National Marine Fisheries Service's responsibility for managing and conserving this population, the burden should be on the Service to affirm that the measures being implemented under this opinion will, in fact, promote its recovery. To that end, the Marine Mammal Commission recommends that the National Marine Fisheries Service analyze individually all of the reasonable and prudent measures and reasonable and prudent alternatives and explain how they move Steller sea lions toward recovery rather than just maintaining the status quo.

Please contact me if you have questions regarding the Commission's recommendations or rationale.

Sincerely,

Michael L. Gosliner for

Timothy J. Ragen, Ph.D.
Executive Secretary

Literature Cited

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