

Analytical Approach for 2014 Groundfish BiOp
Compiled by the National Marine Fisheries Service Alaska Region Protected Resources
Division
May 2013

In its review of the preliminary Draft Environmental Impact Statement for Steller Sea Lion Protection Measures (EIS) at its April 2013 meeting, the North Pacific Fishery Management Council (Council) recommended a preliminary preferred alternative that is different from the status quo fishery management regime. To assess the potential impact of that preferred alternative, the National Marine Fisheries Service (NMFS) will reinitiate consultation under Section 7 of the Endangered Species Act (ESA) and will prepare a biological opinion analyzing the effects of the preferred alternative on the western distinct population segment (WDPS) of Steller sea lions and designated critical habitat.

In November 2010, NMFS completed a biological opinion on the effects of the Alaska groundfish fisheries on ESA-listed species (FMP BiOp). In the FMP BiOp, NMFS applied the demographic recovery criteria from the 2008 Steller Sea Lion Recovery Plan (NMFS 2008). Given continued, strong declines in Steller sea lions in the western Aleutian Islands (AI) and in the adjacent central AI, NMFS determined that the Alaska groundfish fisheries were likely to jeopardize the continued existence of the WDPS of Steller sea lions and adversely modify designated critical habitat. To insure the groundfish fisheries were not likely to jeopardize the continued existence of the WDPS of Steller sea lions, NMFS implemented changes to the Atka mackerel and Pacific cod fisheries in the AI in 2011.

The FMP BiOp has been reviewed by the courts for legal sufficiency and by external scientists for technical accuracy and rigor. The U.S. District Court for the District of Alaska upheld the FMP BiOp, but required the agency to prepare an EIS and complete it by March, 2014. The timeline is intended to allow Council and public participation in developing and recommending a preferred alternative.

The external scientific reviews were critical of many aspects of the FMP BiOp and highlighted concerns about the evidence that NMFS relied on to support the FMP BiOp's conclusions. NMFS has evaluated the external reviews and will incorporate the results into subsequent biological opinions, including the biological opinion to be developed on the preferred alternative in the Steller Sea Lion Protection Measures EIS.

NMFS and the U.S. Fish and Wildlife Service have developed analytical frameworks for ESA consultations to ensure consistency in the administration of section 7 and to produce consultations that are objective, transparent, and in accordance with the intent of Congress. While a general framework exists (Figure 1), analytical methods vary by consultation according to the species, nature of the action and potential risks, and the available data. Accordingly, to produce a biological opinion that is transparent, objective, evidence-based, and compliant with applicable law (the ESA, the Administrative Procedure Act, and the Data Quality Act) NMFS designed the following analytical approach based on a review of the general Section 7 analytical framework, prior groundfish fishery biological opinions, reviews conducted by the National Research Council, external reviews of the FMP BiOp, and risk assessment and structured

decision making literature. This approach was presented to the Scientific and Statistical Committee of the North Pacific Fishery Management Council at its April 2013 meeting.

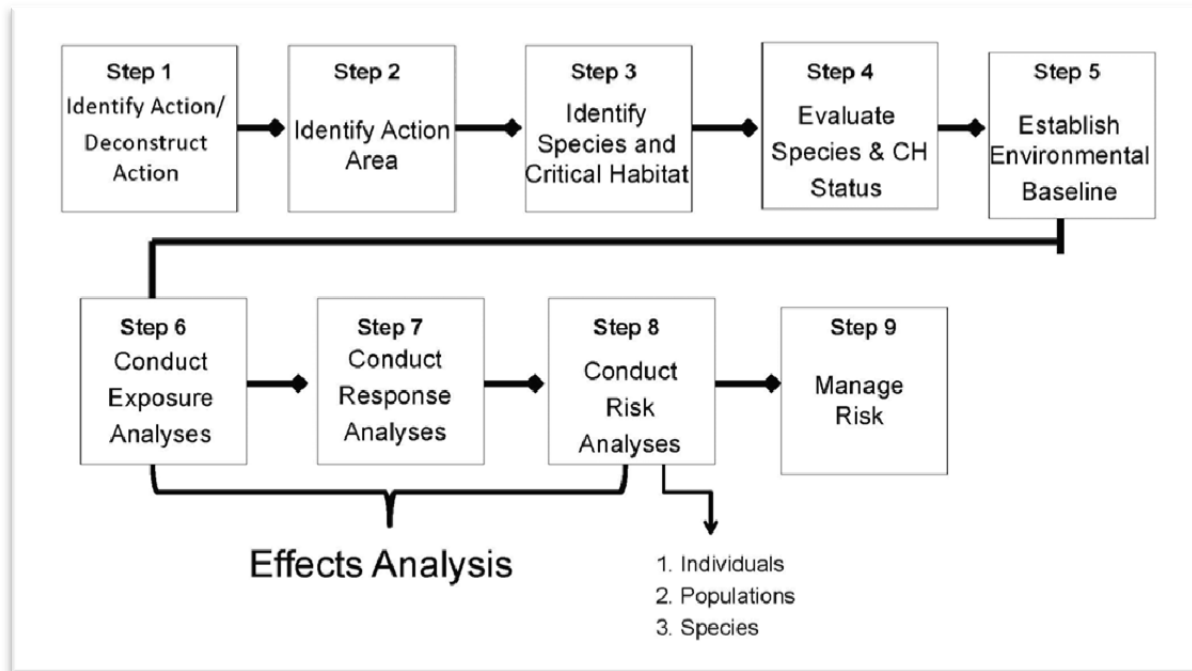


Figure 1. Overview of the general ESA section 7 consultation risk assessment framework.

Analytical Approach for the Anticipated 2014 Biological Opinion

The analytical approach will begin with a review of information that has become available since completion of the FMS BiOp. Following that review, the 2014 biological opinion will review the current status of the WDPS of Steller sea lions and designated critical habitat, establish an environmental baseline, assess the effects that the action may be expected to have on the WDPS of Steller sea lions and critical habitat exposed to the action, and finally assess the risks to the WDPS and critical habitat.

The following paragraphs outline the details of the analytical approach.

New Information Available Since Completion of the November 2010 FMP Biop for the Anticipated 2014 Biop

The following relevant new information is available since the completion of the FMP Biop¹:

1. Draft Steller Sea Lion Protection Measures EIS (NMFS 2013)

Updated information on Steller sea lions, fishery target species, the AI ecosystem, and retrospective and prospective fishery catch distribution

¹ Other recent scientific publications on Steller sea lions and their environment are also available since the FMP BiOp and relevant studies will be included in the new biological opinion.

2. Atka mackerel, Pacific cod, Pollock, and Ecosystem Stock Assessment and Fishery Evaluation Reports (Lowe et al. 2012, Thompson and Lauth 2012, Barbeaux et al. 2012, Zador. 2012).
3. 2010 and 2012 Groundfish Trawl Survey Data²
4. 2011 and 2012 Marine Mammal Stock Assessment Reports (Allen and Angliss 2011 and 2012)
5. States of Washington and Alaska Commissioned Review of the FMP Biop (Bernard et al. 2011)
6. Center for Independent Experts (CIE) Review of the FMP Biop (Stokes 2012, Bowen 2012, Stewart 2012)
7. 2010 through 2012 Steller sea lion survey data (Fritz and Gellat 2010, DeMaster 2011 and 2012)
8. Updated Steller sea lion at-sea habitat use and movement based on updated telemetry information (Lander et al. 2011, Fadely and Lander 2012, Fadely et al. 2013)
9. Updated Steller sea lion food habits information (Sinclair et al. Draft³)
10. Updated Steller sea lion trend information (Fritz et al. a Draft, Johnson and Fritz Draft)
11. Steller sea lion survival estimates from branding (Fritz et al. b Draft)

Analyses Expected for 2014 Biop

1. Species Status

When making a jeopardy assessment, NMFS evaluates the status of a species to identify its risk of extinction (or probability of persistence) at the time of consultation even if a proposed action did not occur. Thus, the status of a species provides the point of reference for the jeopardy analysis in the consultation. The status of designated critical habitat is also evaluated at this step to establish the basis for comparison when the effects of the action are evaluated at a later step in the analysis.

- The focus species of the 2014 BiOp will be the WDPS of Steller sea lions and designated critical habitat.
- The demographic recovery criteria specified for the WDPS in the Steller Sea Lion Recovery Plan (NMFS 2008) will continue to provide NMFS a frame of reference to evaluate the recovery status of the WDPS. These criteria include the sub-region criteria

² Available from: http://www.afsc.noaa.gov/RACE/groundfish/survey_data/default.htm

³ Documents cited as “Draft” are available from NMFS upon request and NMFS expects that they will have been approved through the Alaska Fisheries Science Center’s internal review process prior to their use in the 2014 BiOp.

intended to preserve the maintenance of sea lion populations across the range of the WDPS.

- Many population viability analyses (PVAs) have been produced for the WDPS of Steller sea lions. The last formal PVA included Steller sea lion survey data through 2006 (Boyd 2010). In this BiOp, NMFS intends to produce updated estimates of population persistence for the WDPS as a whole and for the sub-regions identified in the Steller Sea Lion Recovery Plan (NMFS 2008) by including survey data collected through 2012. These population trajectories will provide a contemporary assessment of the population status in order to examine the anticipated effects of the proposed action.

NMFS's National Marine Mammal Lab (NMML) will project data from a simulated population dataset based on WDPS non-pup and pup survey data (from 1990-2012). The methods used to develop the dataset are described in a new manuscript that is referenced in the draft EIS as Johnson and Fritz (in prep) and referenced here as Johnson and Fritz (Draft)⁴. NMML will report the updated trend information using methods as described in Johnson and Fritz (in prep). For the population forecast, NMML will partition the quasi-extinction threshold specified in the 2008 Recovery Plan ($N = 4,743$) across all 35 rookeries in the WDPS to set a quasi-extinction threshold for each sub-region (as delineated in NMFS 2008). NMML will then project the expanded trend information forward in time to estimate the probability of quasi-extinction over various time frames; noting that uncertainty increases with increasing projection time.

The available data on Steller sea lion vital rates are spatially and temporally patchy. When reporting vital rate information, NMFS will make a concerted effort to distinguish empirical data from inferential studies and information gaps. NMFS expects that the bulk of the updated information on birth and survival rates is presented in the draft EIS. NMFS will summarize the current understanding and interpretations about birth and survival rates of Steller sea lions in the AI.

- In response to the CIE reviews of the FMP BiOp, NMML is conducting analyses to determine the conditions under which pup/non-pup ratios are useful in making inferences regarding Steller sea lion birth rates.

NMML will address this issue in two ways:

- a) The ratio of pups/non-pups will be calculated for each year 1990-2012 and by region using the time series models that were recently constructed to assess trends in abundance (Johnson and Fritz Draft). This will provide annual estimates of the pup/non-pup ratio over the 22-year span by sub-region for the WDPS in Alaska.
- b) A simulation will be conducted to determine the conditions under which pup/non-pup ratios are useful in making inferences regarding Steller sea lion birth rates by sampling simulated populations with known demographics. Population time series (numbers at age by sex and in 2-3 adjoining sub-regions) with known underlying changes in survival, birth

⁴ Now available as a draft from NMFS upon request.

rate, and trend will be constructed. Populations in each sub-region will be sampled (simulated aerial surveys using literature values of proportions of different age/sex classes hauled out) to construct corresponding time series of pup and non-pup counts. Pup/non-pup ratios from the time series of counts will be calculated to determine how well they track known changes in birth rate given changes in other population parameters (e.g., rates and age/sex classes of movement, juvenile survival, adult survival, trends, proportions hauled out). NMML can use empirical data from vital rate work in the eastern Aleutians, central and eastern Gulf, as well as existing 1970s birth rate data for some of the inputs. However, this will be a purely simulated population with an objective of simply evaluating the utility of the ratio as a proxy for birth rate.

- NMFS will summarize the available telemetry information and make a general conclusion about the current understanding and inferences about at-sea habitat use of Steller sea lions by area, season, and life stage. This will inform development of a conceptual model that will be used to analyze the effects of the proposed action.
- In addition to updating information on at-sea habitat use and movements of Steller sea lions with the information listed above, NMFS is reviewing the agency's interpretation of the Platforms of Opportunities sighting database information in prior BiOps over time (POP). Based on this review, NMFS will discuss the agency's current interpretation of the POP data for inferring at-sea habitat use of sea lions and how that fits with the conclusions inferred from the telemetry information and how that affects the conceptual model for the effects analysis.
- The prevailing condition of designated critical habitat is an important frame of reference for the adverse modification analysis. The status of designated marine critical habitat is the relevant focal habitat for this proposed action. Important Steller sea lion prey species are essential features of designated marine critical habitat. It has been virtually impossible to assess the status of prey resources in critical habitat since its designation. NMFS is hampered by an absence of data on the proportion of biomass inside and outside of critical habitat, the density of prey patches inside critical habitat, and the composition of prey patches inside critical habitat. NMFS is reviewing the best available information to determine how best to assess and characterize the current condition of critical habitat so that the anticipated effects of the proposed action can be assessed. Potential information sources include fishery catch and effort data from inside critical habitat, summer trawl survey data, results from Fishery Interaction Team studies, and limited winter Echo-Integrated trawl surveys (data for one year in late winter exist). Where data are unavailable, NMFS may infer biomass distribution based on the prey species life history information (seasonal migration, depth information, and oceanographic fronts and eddies).
- NMFS is developing methods to spatially extrapolate catch in critical habitat by using groundfish observer data for years prior to 2003 (when vessel monitoring system (VMS) data were not available). NMFS intends to calibrate this new method with the catch in area database.

- NMFS will conclude this section with a summary of the status of sea lions and designated critical habitat, against which the estimated effects of the proposed action will be evaluated.

2. Environmental Baseline

The environmental baseline assesses the condition of individuals and populations of listed species in an Action Area, given their exposure to prior and contemporaneous human activities and natural phenomena in the area. The environmental baseline identifies the antecedent physiological and fitness conditions of the individuals in the action area as well as the ecology of the populations those individuals represent before NMFS considers stressors produced by the proposed action. Thus, the environmental baseline will contain similar information to the species status section, but will be specific to populations, critical habitat, and effects in the Action Area. For this consultation the Action Area is the U.S. Exclusive Economic Zone of the Bering Sea/Aleutian Islands, plus state waters that will be affected by the State parallel groundfish fisheries.

- NMFS will describe the factors likely affecting the status of Steller sea lion populations in the Action Area. NMFS will differentiate factors known to be affecting sea lions versus those hypothesized to be affecting sea lions in the Action Area. Factors identified include climate and oceanic conditions, variation in sea lion prey species, predators, disease, direct take in fisheries, subsistence harvest, other shooting, entanglement in marine debris, fishery removals of prey species, contaminants, and research disturbance (for which NMFS has authorized take). The Steller Sea Lion Recovery Plan contains a thorough threats assessment. NMFS will not replicate that work in the BiOp but rather carry over those threats and build forward with information on threats available since the 2008 Steller Sea Lion Recovery Plan.
- NMFS will also describe the natural and anthropogenic effects on Steller sea lion critical habitat in the Action Area (there is overlap with the bullet above).
- NMFS will conclude this section with a summary of the Environmental Baseline to which the anticipated effects of the proposed action will be added.

3. Effects of the Action

a. Assess the Species Exposure to the Proposed Action

Listed species are exposed to the effects of an action when their spatial and temporal distributions overlap. In the exposure analysis we identify the spatial and temporal co-occurrence between stressors caused by the action and listed species as well as direct and indirect exposure pathways.

- In the 2000 FMP BiOp (NMFS 2000), NMFS used the following “seven questions” to establish potential overlap between prey species targeted by the fishery and Steller sea lions:

Seven questions were posed for each FMP managed fish species in the fishery management areas. If question 1 was answered “No,” then the answers to questions two through seven were also “No,” so the concern level was nil, thus scoring a “zero” total. Steller sea lions did not eat

the targeted fish species and no grounds for a competitive interaction existed. If question one was “Yes”, it was scored one point; remaining questions two through six scored one point for a “Yes” and zero points for a “No.” If question seven was yes, it scored two points to underscore concern for potential effects of localized depletion.

1. Do Steller sea lions forage on the target fish species?
2. Do Steller sea lions forage on the target fish species at a rate of at least 10% occurrence?
3. If yes to Number two, does the size of Steller sea lion prey overlap with the size caught by commercial fisheries?
4. If yes to Number two, does the fishery overlap spatially with the area used by Steller sea lions to forage on this species?
5. If yes to Number two, does the fishery operate at the same time Steller sea lions are foraging on the fish species?
6. If yes to Number two, does the fishery operate at the same depth range that Steller sea lions are using to forage on the fish species?
7. If yes to one through six, does that fishery operate in a spatially or temporally compressed manner in Steller sea lion critical habitat?

From this analysis, NMFS determined that the groundfish fisheries were likely to compete with Steller sea lions for Atka mackerel, Pacific cod, and pollock (NMFS 2000). Given the best available information today, NMFS maintains that the fisheries are likely to compete with Steller sea lions for fish and thus the focus of the 2014 BiOp will be on the fisheries for these three species. In contemporary analyses to examine overlap between fisheries and Steller sea lions, we also consider the daily and seasonal movements of fish, including vertical migrations which may make the same fish susceptible to the fishery or predation by sea lions at different depths. We also consider competition between sea lions and fisheries to be more probable when the fish stocks are depleted relative to previously observed levels of biomass.

- One critique of the 2010 FMP BiOp was the use of frequency of occurrence (FO) of prey hard parts (bones and otoliths) in opportunistically collected sea lion scats to infer sea lion diet habits. Upon review, NMFS maintains that FO remains the prevailing scientific standard by which newer experimental methods in diet analyses are judged. Bowen (2012) recommended that NMFS use alternative methods to analyze Steller sea lion diet and referred to two general categories of research (fatty acids, prey genetics) and two specific research studies (Tollit 2003, 2007) for consideration. An objective review of the conclusions reached in those studies confirms that FO remains among the best tools currently available when appropriately applied to wild diets, and that other methods and correction factors remain developmental. Further, (Tollit et. al 2006) cites the NMML evaluation of the wild diet of SSLs as an example of appropriate application of the FO metric. Moreover, Bowen and Iverson (2012) determined FO to be reasonably accurate for inferring diet of wild marine mammals when number correction factors are applied. Bowen and Iverson (2012) conclude that the analysis of hard parts recovered from feces and the chemical and statistical analysis of fatty acids of predator and prey are informative of diets in pinnipeds. Other emerging methods are promising and NMFS is committed to supporting their development. However,

these methods are not currently standalone options for detailing Steller sea lion prey consumption patterns at the scale described in the FMP BiOp. NMFS will elaborate on this topic in the 2014 BiOp.

- NMFS will attempt a refined analysis to increase the resolution of the extent of spatial and temporal overlap between the Atka mackerel, Pacific cod, and pollock fisheries and foraging adult female and juvenile Steller sea lions. NMFS will assess the available data and determine the finest scale at which spatial and temporal overlap can be assessed. Data sources, assumptions, and uncertainty will be explicitly stated. This analysis will incorporate the best available data on size of prey consumed by sea lions.
- Since the implementation of the global harvest control rules in the BSAI and GOA FMPS, biological opinions on the effects of the Alaska groundfish fisheries on Steller sea lions and results of the risk assessment conducted by the National Research Council (2003) unanimously conclude that the broad-scale fishery prey depletion hypothesis is not supported by available data but that Steller sea lions may be affected by localized depletion of prey species. While fish populations appear to recover to pre-fishery biomass levels each year, the seasonal and monthly effect of fishery depletions on Steller sea lions is not known (NRC 2003). Analyses of available biomass to forage requirements for a recovered sea lion population consistently reveal a substantial surplus in available prey biomass on an annual basis (NMFS 2010). Thus, the effects analysis in the 2014 BiOp will focus primarily, but not exclusively, on the effects of the fisheries on the local availability of Steller sea lion prey species in designated critical habitat.
- NMFS is developing conceptual models in the form of diagrams to depict influences on essential features of Steller sea lion critical habitat by area and season to frame the exposure analysis for the 2014 BiOp.

b. Assess the species' expected response to exposure to localized depletion of prey in designated critical habitat

- NMFS will build on the exposure and response schematics from the FMP BiOp. FMP BiOp Figure 4.25 shows the response pathways for the effects of fishing, in the form of competition for prey, on Steller sea lions. In that schematic, two indirect pathways for harm to exposed sea lions are: (1) the potential for reduced survival due to increased foraging effort resulting in increased predation risk; and (2) the potential for reduced survival, birth rate, and growth through acute or chronic nutritional stress.
- NMFS is developing a conceptual model depicting the exposure pathway via the Steller sea lion life cycle to reveal vulnerable life-stages and seasons. As always, vulnerable life stages to local prey depletion in critical habitat are assumed to be adult females nursing and tending pups in summer, adult females in a simultaneous state of lactation and gestation in winter and spring, and juvenile animals year-round.
- NMFS will explore scenarios of time lags over which nutritional stress responses would be expected to affect sea lion vital rates and observed growth rates based on the conceptual model of the response pathway.

c. Assess the species' risk

In the biological opinion, NMFS must consider the risk of the fisheries to Steller sea lions and their designated critical habitat. Risk assessment considers both the probability of harm and the severity of the consequence.

To “jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species (51 FR 19926). The best available science and latest conceptual models suggest that the current risk posed to Steller sea lions by fisheries is depletion of prey at a scale important to foraging adult female and juvenile Steller sea lions.

On a basic level, the potential harm to Steller sea lions as a result of insufficient availability of prey is hypothesized to include (among others) (NMFS 2008 and NMFS 2010):

- (a) a reduction in sea lion survival due to a change in foraging behavior that results in increased exposure to predation
- (b) a reduction in juvenile sea lion survival due to nutritional stress that manifests as starvation (acute nutritional stress response) or disease (one of several potential chronic nutritional stress responses)
- (c) a reduction in reproduction due to insufficient energy intake by adult females during winter when in state of simultaneous lactation and gestation (chronic nutritional stress response).

Thus, the current understanding is that indirect effects of the fisheries that manifest as local depletion of Steller sea lion prey resources may reduce the reproduction and numbers of the species. In the risk assessment, NMFS must evaluate the likelihood that the proposed action will result in or contribute to localized depletion of prey in important sea lion foraging habitat. NMFS must then evaluate the severity (consequence) of the expected response of the impacts to the individuals and populations on the likelihood of survival and recovery of the WDPS.

The regulatory definition of critical habitat is codified at 50 CFR 424.02(d). Critical habitat means “(1) the specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (i) essential to the conservation of the species and (ii) that may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species.”

More specifically, Steller sea lion critical habitat is defined as the physical and biological habitat features that support reproduction, foraging, rest and refuge and are essential to the conservation of the Steller sea lion (58 FR 45269).

To estimate the effects of the proposed action on designated critical habitat NMFS will:⁵

1. Assess the status of essential features in critical habitat across designated critical habitat.
2. Assess the status of essential features in critical habitat in the BSAI (Action Area).
3. Assess how the proposed action is likely to affect designated critical habitat in the action area (including activities that occur outside of critical habitat that affect the status of the features inside critical habitat).
 - As mentioned in the status of the species section, data are not available to directly measure prey biomass inside Steller sea lion critical habitat. Also, NMFS does not have the information to determine with precision the density of prey required to ensure successful foraging. NMFS will attempt to fill in these data and information gaps by estimating critical habitat biomass availability and harvest rates in the 2014 BiOp, though NMFS expects to continue to be confronted with wide data gaps for assessing fishery effects on local prey biomass.
 - In lieu of direct measurements, several studies have correlated fishery harvest rates with Steller sea lion trends to understand if fisheries negatively affect foraging success of Steller sea lions. The external reviews of the 2010 FMP BiOp were critical of NMFS's treatment and interpretation of fishery correlation analyses. The majority of reviewers asserted that NMFS should be able to determine the effect of fisheries on Steller sea lion populations by regressing harvest against sea lion trends. During the formal consultation that resulted in the 2010 BiOp, NMFS concluded that the spatial scale of the fishery correlation studies were too coarse and statistical power was too low to detect an effect of fishery harvests on Steller sea lion trends. In response to the external reviews, NMFS will undertake an examination and critical review of the studies included in Bernard et al. (2011) and research whether these studies are useful for determining fishery competition effects.
 - NMFS will begin with a careful review of the methods used in the literature cited by Bernard et al. (2011). From a cursory review, it appears that the majority of the papers listed used a similar approach. This approach can be characterized by fitting a linear model to the survey counts using some metric of fish abundance or catch as a predictive covariate. However, NMFS hypothesizes that this method does not have sufficient power to make a determination of presence or absence of a fish harvest effect on Steller sea lion population levels. If prey removal primarily acts on survival and/or birth rate, the effects are unlikely to be seen in the current year or any subsequent fixed time lags. Changes in demographic parameters are unlikely to be severe enough to cause detectable changes in survey counts within any specific time lag. They are more likely to manifest themselves through gradual changes in survey counts as age structure changes. To illustrate this point, NMFS will perform a simulation (similar to a PVA) to test whether external


⁵ Approach summarized from the November 7, 2005 Memorandum from the NMFS Assistant Administrator (Hogarth) to Regional Administrators and the Office of Protected Resources.

drivers of survival can be detected with the regression analysis used in the Bernard et al. (2011) literature. Using a matrix model, NMFS will simulate an age-structured population in which survival and birth rate can be functions of a simulated external covariate (e.g., fishing harvest or prey availability). After simulation, the regression analysis will be performed to determine the power of this analysis with respect to detecting influence of the covariate.

- Numerous experts have concluded that, given the complexity of the marine ecosystems off Alaska and the multiple factors likely affecting the dynamics of apex predators including Steller sea lions, the only way to understand the impact of fisheries on Steller sea lions is to conduct a large scale, adaptive management experiment with replicated open and closed areas. Such an approach has not been implemented. A simulation study by Punt and Faye (2006) demonstrated that uncontrollable factors (movement of sea lions among treatment areas, different trends at rookeries irrespective of fishing, and demographic stochasticity) of the marine environment have a major impact on the power of the experiments. Their simulated experiments did not resolve the question of whether the cause for the decline in Steller sea lions was due to fishing-related factors.
- Also, over the past 20 years, most biological opinions on the groundfish fisheries and the Steller Sea Lion Recovery Plan (NMFS 2008) state the need to expand groundfish surveys to understand the proportion of biomass inside and outside of Steller sea lion critical habitat in summer and winter to understand how fisheries may affect the conservation value of Steller sea lion critical habitat. Such a monitoring protocol has never been implemented.
- Despite these information gaps, NMFS must endeavor to understand the effects of the fisheries on Steller sea lions and their designated critical habitat. Based on the language of the ESA, its legislative history, and court decisions interpreting the ESA, NMFS must give the benefit of the doubt to the listed species when the data are equivocal. The 2014 BiOp will endeavor to distill the available scientific and commercial data to the extent possible to evaluate whether the fisheries are likely to jeopardize the continued existence of Steller sea lions or adversely modify their designated critical habitat.
- Recent case law has affirmed that the Services are to rely on the ordinary definition of “likely” when applying ESA standards (*Safari Club International, et al. v. Kenneth Lee Salazar, et al.*, March 1, 2013). Therefore, NMFS will continue to rely on the ordinary definition of likely, notwithstanding external reviewers’ criticism of NMFS’s use of “likely” in the 2010 BiOp.
- Unlike BiOps in the late 1990s and early 2000s, the risk analysis in the 2014 BiOp has the benefit of 15 years of management measures intended to disperse the groundfish fisheries in time and space to protect prey availability for Steller sea lions. Over the past 22 years, NMFS’s understanding of the potential consequences of the fisheries on Steller sea lions has evolved. Through this consultation, NMFS aims to clarify the current understanding of Steller sea lion biology and ecology and the consequences of the fisheries on Stellers sea lions. While much remains unknown, NMFS has narrowed down

the potential effects and areas of particular concern over the past two decades. Extensive research on Steller sea lions and their habitats has filled some key information gaps.

NMFS will present a chronology of the understanding of the effects of the groundfish fisheries on the population viability of the WDPS. NMFS will summarize the history of fishery management measures implemented to protect sea lions by answering the following questions in an iterative fashion until we reach the current observations and hypotheses:

1. What was observed?
 2. What was hypothesized?
 3. What was changed?
- 
- Adaptive management cycle

NMFS will provide a timeline of changes made to the Alaska groundfish fisheries to protect Steller sea lions and will analyze the effect of those changes on the spatial and temporal distribution of groundfish catch.

NMFS will undertake an analysis to investigate the efficacy of closing areas to fishing. This analysis aims to estimate the probability of sea lion decline at a trend rookery or haulout given a closure from 0-3 nm, 3-10 nm, and 10-20 nm. For example, NMFS will investigate whether a closure from 3-10 nm appears to be more effective than a closure from 0-3 nm from rookery and haulout sites. First NMFS will frame the questions and then evaluate whether data are available to answer these questions. The availability of data will determine whether this analysis can be completed.

- NMFS will conduct a weight of evidence analysis to determine whether it can insure that the proposed action is not likely to reduce the conservation value of designated critical habitat by appreciably increasing the likelihood of localized depletion of Steller sea lion prey. NMFS will present available evidence that is consistent with the hypothesis that the fisheries, as proposed, reduce the survival and recovery of Steller sea lions and adversely modify designated critical habitat. NMFS will also present available evidence consistent with the hypothesis that fisheries do not reduce the survival and recovery of Steller sea lions or adversely modify designated critical habitat. NMFS will conclude which hypothesis is more probable given the evidence.
- If the evidence shows that NMFS cannot insure that its action is not likely to jeopardize the continued existence of endangered Steller sea lions or adversely modify critical habitat, then NMFS will present performance measures and metrics to further address the stressors of concern. These recommendations will flow from the preceding evidence and conclusions from the analyses in the 2014 BiOp.

References Cited

- Allen, B.M. and R.P. Angliss. 2011. Alaska Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-AFSC-234. Available from: <http://nmfs.noaa.gov/pr/pdfs/sars/ak2011.pdf>.
- Allen, B.M. and R.P. Angliss. 2012. Alaska Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-AFSC-234. Available from: <http://www.nmfs.noaa.gov/pr/sars/pdf/ak2012.pdf>. Barbeaux, S., J.N. Ianelli, and W. Palsson. 2012. Assessment of the pollock stock in the Aleutian Islands for 2013. North Pacific Fishery Management Council, 605 West 4th Ave. Suite 306. Anchorage, AK 99501.
- Bernard, D.D.R., S.J. Jeffries, D.G. Knapp, and D.A.W. Trites. 2011. An independent, scientific review of the Biological Opinion (2010) of the Fisheries Management Plan for the Bering Sea/Aleutian Islands management areas. Anchorage, Alaska. Available from: http://wdfw.wa.gov/conservation/steller_sealions/final_fmp_biop_ind_sci_rev_08oct2011.pdf.
- Bowen, W. 2012. Center for Independent Experts Independent Peer Review of the November 2010 North Pacific Groundfish Fishery Biological Opinion CIE Independent Peer Review Report by Hammonds Plains Nova Scotia, Canada. Nova Scotia. Available from: <http://www.fakr.noaa.gov/protectedresources/stellers/esa/biop/final/cie/reports/bowen0912.pdf>.
- Bowen WD, Iverson SJ. 2012. Methods of estimating marine mammal diets: a review of validation experiments and sources of bias and uncertainty. *Marine Mammal Science*.
- Boyd IL. 2010. Assessing the effectiveness of conservation measures: Resolving the “wicked” problem of the Steller sea lion. *Biological Conservation* 143:1664-1674.
- DeMaster, D. 2011. Memorandum of Results of Steller Sea Lion Surveys in Alaska, June-July 2011. <http://www.afsc.noaa.gov/nmml/PDF/SSL-Survey-memo-2011.pdf>.
- DeMaster, D. 2012. Memorandum of Results of Steller Sea Lion Surveys in the Aleutian Islands, Alaska. June 2012. Available from: <http://www.afsc.noaa.gov/nmml/PDF/SSL-Survey-memo-2012.pdf>
- Fadely B, Lander M. 2012. Satellite Tracking of Adult Female Steller Sea Lions in the Western-Central Aleutian Islands Reveals Diverse Foraging Behaviors. Seattle, WA. Available from: <http://www.afsc.noaa.gov/quarterly/ond2012/divrptsNMML1.htm>.
- Fadely BS, Gelatt T, Lander ME, Haulena M, Rea LD, Vollenweider J, Mcdermott S, Rehberg MJ, Beckmen K. 2013. Highlights from : Remotely-delivered chemical immobilization of adult female Steller sea lions (*Eumetopias jubatus*) and post handling foraging behaviors.

In: Alaska Marine Science Symposium, Anchorage, Alaska. January 21-25, 2013. p. Page 207.

- Fritz, L. and T. Gelatt. 2010. Memorandum of Surveys of Steller sea lions in Alaska, June-July 2010. Available from: <http://www.afsc.noaa.gov/nmml/PDF/SSL-Survey-memo-2010.pdf>.
- Fritz L., K. Sweeney, D. Johnson, M. Lynn, and J. Gilpatrick. A. DRAFT. Aerial and ship-based surveys of Steller sea lions (*Eumetopias jubatus*) Conducted in Alaska in June-July 2008 through 2012, and an update on the status and trend of the western stock in Alaska.
- Fritz, L.W., R. Towell, T.S. Gelatt, and T.R. Loughlin. B. DRAFT. Temporal and regional variability in the survival of western Steller sea lions in Alaska.
- Johnson, D.S., L.W. Fritz. Draft. agTrend: a method for estimating trend of aggregated animal counts at sites with different survey histories. *Methods in Ecology and Evolution*.
- Lander ME, Logsdon MG, Loughlin TR, VanBlaricom GR. 2011. Spatial patterns and scaling behaviors of Steller sea lions (*Eumetopias jubatus*) distributions and their environment. *Journal of Theoretical Biology*:74–83.
- Lowe, S. J. Ianelli, and W. Palsson. 2012. Assessment of the Atka mackerel stock in the Bering Sea/Aleutian Islands for 2013. North Pacific Fishery Management Council, 605 West 4th Ave. Suite 306. Anchorage, AK 99501.
- NMFS 2000. ESA Section 7 Biological Opinion and Incidental Take Statement for authorization of the Alaska groundfish fisheries. National Oceanic and Atmospheric Administration. P. O. Box 21668, Juneau, AK 99802: NMFS Alaska Region: Protected Resources Division.
- NMFS 2008. Recovery Plan for the SSL (*Eumetopias jubatus*), revision. National Oceanic and Atmospheric Administration. P.O. Box 21668, Juneau AK 99801.
- NMFS. 2010a. ESA Section 7 Biological Opinion on the Alaska Groundfish Fisheries. National Oceanic and Atmospheric Administration. P. O. Box 21668, Juneau, AK 99802. Available from: <http://209.112.168.2/protectedresources/stellers/esa/biop/final/1210.htm>.
- NMFS. 2013. Draft Environmental Impact Statement for Steller sea lion protection Measures for Groundfish Fisheries in the Bering Sea and Aleutian Islands Management Area. May 10, 2013. National Oceanic and Atmospheric Administration P.O. Box 21668, Juneau, AK 99802. Available from: <http://alaskafisheries.noaa.gov/sustainablefisheries/sslpm/eis/default.htm>.
- National Research Council. 2003. Decline of the Steller Sea Lion in Alaskan Waters: Untangling Food Webs and Fishing Nets. National Academy Press. Washington , D.C. 204 pp.

- Punt, A.E. and G. Fay. 2006. Can Experimental Manipulation Be Used To Determine The Cause Of The Decline Of The Western Stock of Steller Sea Lions? In: Sea Lions of the World. A.W. Trites, S.K. Atkinson, D.P. DeMaster, L.W. Fritz, T.S. Gelatt, L.D. Rea, and K.M. Wynne eds. Alaska Sea Grant College Program, University of Alaska, Fairbanks. 664 pp.
- Sinclair EH, Johnson DS, Zeppelin TK, Gelatt TS. DRAFT. Patterns in the diet of western stock steller sea lions (*eumetopias jubatus*) a decadal comparison.
- Stewart B. 2012. Center for Independent Experts (CIE) External Independent Peer Review on the 2010 Biological Opinion on the effects of the federal groundfish fisheries and state parallel fisheries on listed species in Alaska, including Steller sea lions. San Diego. Available from:
<http://www.alaskafisheries.noaa.gov/protectedresources/stellers/esa/biop/final/cie/reports/stewart0912.pdf>.
- Stokes K. 2012. Center for Independent Experts Independent Peer Review of the Biological Opinion on the effects of the federal groundfish fisheries and state parallel fisheries on listed species in Alaska; including Steller sea lions. New Zealand. Available from:
<http://www.fakr.noaa.gov/protectedresources/stellers/esa/biop/final/cie/reports/stokes0912.pdf>.
- Thompson, G.G. and R.R. Lauth. 2012. Assessment of the Pacific Cod Stock in the Eastern Bering Sea and Aleutian Islands Area for 2013. North Pacific Fishery Management Council, 605 West 4th Ave. Suite 306. Anchorage, AK 99501.
- Tollit, D.J., S.G. Heaslip, R.L. Barrick, and A.W. Trites. 2006. Impact of diet-index selection on the digestion of prey hard remains on determining the diet of the Steller sea lion (*Eumetopias jubatus*). *Can J. Zool.* 85:1-15.
- Zador, S. (Ed). 2012. Ecosystem Considerations 2012. North Pacific Fishery Management Council, 605 West 4th Ave. Suite 306. Anchorage, AK 99501.