DRAFT

Multi-Criteria Decision Tool to Evaluate Proposals for Change in Steller Sea Lion Protection Measures in the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries, 2006

Developed by the

Steller Sea Lion Mitigation Committee

North Pacific Fishery Management Council

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INTRODUCTION

The North Pacific Fishery Management Council (NPFMC) reinstituted the Steller Sea Lion Mitigation Committee (SSLMC) for the purpose of tracking the recent Section 7 Consultation, and to accept proposals for possible changes to existing Steller sea lion (SSL) mitigation measures for Pacific cod, pollock and Atka mackerel in the Gulf of Alaska and the Bering Sea/Aleutian Islands. The SSLMC began work in early 2006 by reviewing all relevant SSL research completed since the last Biological Opinion (2003 supplement). Next, the SSLMC developed a decision tool for evaluating proposals, which was presented to the NPFMC and the SSC in June 2006. The SSLMC was advised to institute a more rigorous approach to identifying potential anthropogenic impacts to the SSL resulting from fishing activity, and how changes in fishery regulations could be gauged to minimize impacts to the SSL. During July 25-27, August 29-30 and September 12-14, 2006, SSLMC members and scientific advisors with the National Marine Fisheries Service Alaska Fisheries Science Center (NMFS-AFSC), as well as members of the public, met in Seattle to develop a decision tool (hereafter called the proposal ranking tool or PRT).

The intent of the PRT is to assist the SSLMC in forming consensus judgments about their perception of the problem, and their beliefs in the likely relative consequences of fishery regulation proposals regarding the SSL and their prey field.

The PRT was developed using a facilitated systems approach to planning and evaluation – the Analytic Hierarchy Process (AHP). The AHP has been used extensively for decades to address planning, conflict resolution, and prioritization in such areas as policy development, economics, engineering, medical and military science, and has more recently been applied to fisheries research and management (Leung et al. 1998; Merritt and Criddle 1993; Merritt 1995, 2000 and 2001; Merritt and Skilbred 2002; Merritt and Quinn 2000; Ridgley et al. 1997; USFWS 2005, 2006). The AHP is a tool for facilitating decision-making by structuring the problem into levels comprising a hierarchy. Breaking a complex problem into levels permits decision makers to focus on smaller sets of decisions, improving their ability to make accurate judgments. Structuring also allows decision makers to think through a problem in a systematic and thorough manner. The AHP encourages people to explicitly state their judgments of preference or importance. Decision support software, Expert Choice 11,[1] was used interactively to structure the problem, depict the influence of weights, and derive the priority of elements.

The PRT is being reviewed and developed in phases:

1. July 25-27, Seattle, the SSLMC developed a prototype PRT, in collaboration with the NMFS-AFSC staff;

2. August 16, Juneau, the SSC reviewed and commented on the prototype PRT;

[1] Forman, E., T. Saaty, M. Selly, and R. Waldron. Expert Choice, Decision Support Software, McLean VA. 1983.

3. August 28-30, Seattle, the SSLMC explored comments from the SSC, and completed initial development of the PRT;

4. September 12-14, Seattle, the SSLMC reviewed the first four chapters of the new Biological Opinion in light of the PRT, and ran hypothetical proposals through the PRT to examine performance;

5. October 2-4, Dutch Harbor, the SSC reviews the revised PRT.

The purpose of this draft report is to describe and present the PRT as developed to date by the SSLMC, in concert with the NMFS-AFSC and the public in Seattle, July 25-27, August 29-30 and September 12-14, 2006. This draft report provides a basis for review and comment from the SSC at their October 2-4, 2006 meeting in Dutch Harbor.

Work on the PRT by the SSLMC does not imply that a clear linkage between fish harvest and abundance of SSL is known to exist. Rather, the PRT is predicated on the assumption by the NMFS in the current Biological Opinion that fishing had, and may continue to have, a relationship with SSL abundance. The judgments of SSLMC members reflect their assessments of the validity of that assumption. The meetings to date have been solely concerned with developing a tool to evaluate fishing impacts to the SSL and their prey field; insufficient time and information have been available to the SSLMC to fully develop a tool to evaluate benefits or "credit" in a proposal.

METHODS

PARTICIPANTS

A majority of SSLMC members participated in developing the PRT (see Appendix A), although not all members were present at all three meetings. Advice and scientific information was provided by NMFS-AFSC staff as well as members of the public. The meeting was facilitated by Dr. Margaret Merritt (Resource Decision Support).

APPROACH

The AHP was used to structure the problem and derive the interactions of its parts using data (when available) in combination with expert judgment (Saaty 1999). Expert judgment is defined as "previous relevant experience, supported by rational thought and knowledge" (Saaty and Kearns 1985; see Appendix B). The SSLMC used a variety of references, data tables and other sources of information in structuring and rating elements in the PRT. Those information sources not directly referenced in this report are found in Appendix C.

STRUCTURING AND ESTABLISHING PRIORITIES

A top-down structuring approach was used, whereby the goal forms the top of the hierarchy and dimensions form the second level of the hierarchy. A dimension is a path along which an impact can be measured. Variables are components of proposed changes to fishing regulations relevant to the PRT, and form the starting point for discussing the lower levels of the hierarchy. When variables are included into the hierarchy, they become "children" of the dimensions and are scored as to their potential degree of impact, relative to their "parent" dimension (see a schematic of a hierarchy in Figure 1). The group was tasked with discerning how variables associated with fishing regulation changes would be likely to impact the dimensions of the SSL and their prey.

1st Level **Goal**	**2nd Level** **Dimension** Parent node	**3rd Level** **Variable-1st order** Child node of the 2nd level, and parent node of the 4th level	**4th Level** **Variable-2nd order** Child node
Evaluate proposed changes in regulations	Effects of fishing on the SSL	SSL site type and sensitivity by season	Proximity of fishing activity
	Effects of fishing on the target prey field	Fishing season	Removal amount and duration

Figure 1. Schematic of a hierarchical structure, showing four levels.

Development of the hierarchy was completed first, and then priorities were assigned to the elements of the hierarchy, with discussion about criteria for judging importance. Judgments on the degree of importance (or degree of sensitivity to impact) of a group of elements was always made in relation to their parent node - thus linking the elements in the lower levels to the upper levels of the hierarchy. In discussing criteria, a question such as the following was asked for each group of judgments, "Are all elements of this group of equal importance in assessing impacts, or is one element of more or less importance than another, in relation to its parent node?" A specific example follows: "Are all SSL site types (rookery, haulout, or other) of equal importance (sensitivity) to impact from fishing activity, or is one of more or less importance than another, in relation to a given season (winter or summer)?" In-depth discussion, with supporting data from NMFS-AFSC staff (Appendix D) and research updates previously received by the SSLMC, followed each such question, in an attempt to establish a rationale for judging importance.

Using criteria as guidelines, the SSLMC was asked to use supporting data (when possible) and/or their expert judgment in individually assigning ratings of importance to elements in each level of the hierarchy. The relative importance of the dimensions was evaluated, then that of the variables within each dimension. Participants were given time to think and write down their ratings of importance before sharing and discussing their judgments. A positive ratio scale with associated verbal equivalents was used to rate importance, where numbers between those listed (e.g., 2, or 2.5, etc.) were used to interpolate meanings as a compromise:

Scale of Importance	Definition
9	Extreme importance
7	Very strong importance
5	Strong importance
3	Moderate importance
1	Slight importance

Elements judged to be of equal importance were given equal scores. Consensus in the rank order of elements was usually achieved among committee members. Disagreement is defined in this report as differences in the rank order of importance; for example, if one committee member rated elements "A" and "B" as 2 and 4, respectively, and another member rated "A" as 5 and "B" as 3, they disagreed about which element is more important. When disparity in judging importance occurred, it meant disagreement existed, and discussion and debate was encouraged. Debates advanced the understanding of important concepts and often resulted in a clearer definition of the dimension or variable. By seeking consensus not only were dialogue and learning encouraged, but also the formation of a group solution, rather than individual solutions, was promoted.

Expert Choice was used interactively to depict the influence of weights and derive the priority of variables. Priorities approximate the strength of importance for each variable, adjusted to reflect the importance assigned to the dimension addressed by that variable. Mathematically, relative ratings of importance are entered into a vector and normalized. The values from the vector are then multiplied by the weight in the next highest level, and the result is the weight of importance for variables. The total score for each variable is then calculated by adding the weighted proportions over all variables within a dimension:

$$T_m = \sum_{k=1}^{d} W_k p_{k,m}$$

where

T_m = the total weighted score for variable *m*,
W_k = the weight for dimension k,
$p_{k,m}$ = the weighted proportion of the total score for variable m addressing dimension k
d = the number of variables.

STRUCTURAL ADJUST

Structural imbalance in the hierarchy can lead to dilution of the weight of many variables under a single dimension, so an adjustment feature in Expert Choice can be used to restore priorities to their respective proportion of weight. Adjustment can be made to the priorities of the children of the current node, based on the total number of grandchildren. While approximate balance is sought and desired, complex problems do not always lend themselves to balance – thus the advantage of the structural adjust feature. Structural adjustment must always be examined to see if the results capture the intended proportion of weight and make sense.

In a conceptual example, consider that if (A) has four grandchildren, and (B) has two grandchildren, then there are six grandchildren in all and structural adjusting multiplies A's priority by 4/6 and B's by 2/6, then normalizes. Thus, the overall priorities for A's grandchildren are not diluted simply because there are many of them.

DISCUSSION OF SSC RECOMMENDATIONS

Before further development of the PRT, SSC review comments from their August 15-16 meeting in Juneau were carefully examined and discussed. The SSC made nine specific suggestions, six of which require SSLMC response. The remaining three suggestions were requested additions or general comments on the PRT. The SSC suggested that the tool should provide for:

- the suite of anthropogenic factors that have been identified as potential threats to the recovery of distinct population segments of the SSL population;
- the impact of proposals on non-target prey species, including species taken in fisheries for salmon and groundfish as well as bycatch of other non-target species that are SSL prey;
- a variable set other than a TAC/biomass ratio for depicting potential effects of fishing on the prey field;
- estimates of fishery removal rates as a function of gear type and total effort;
- an alternative to frequency of occurrence of prey items in scat as a proxy for SSL nutritional needs when better measures become available; and
- provisions to evolve the PRT as more refined data become available.

Additionally, the SSLMC should retain flexibility to address situations not currently incorporated into the PRT.

In regards to how a proposal may influence anthropogenic effects on SSL, such as through incidental catch or entanglement by fishing gear, illegal shooting or disturbance from vessel traffic, SSLMC discussion ensued at length. The SSLMC reviewed its previous in-depth considerations of this factor at the July 25-27 meeting and felt that its conclusions are still valid. The SSLMC also noted that historically this factor had greater importance; instances of anthropogenic effects currently are significantly reduced from the pre-1990 period. The SSLMC decided that this factor should be considered outside the PRT for several reasons. First, there is a lack of accurate information on several aspects of anthropogenic factors, and thus no way to judge impacts and legitimately assign ratings among separate fishery sectors. Lack of substantiating information would only lead to unnecessary speculation and contention, and likely would diminish the reliability of the PRT. Further, anthropogenic impacts are addressed by fishery in the annual List of Fisheries (LOF) process under the Marine Mammal Protection Act. The LOF process will be considered in the proposal review process.

The issue of bycatch of non-target SSL prey raised by the SSC led to a discussion of the importance of target species and prey other than target species to the nutritional needs of the SSL. The SSLMC noted that the entire prey field had already been considered at the July 25-27 meeting in Seattle; weightings of target species in relation to the frequency of occurrence of non-target prey in the scat of the SSL is accounted for in the model structure based on data in NMFS (2006a), under the node concerning nutritional needs of the SSL. The SSLMC wished to address SSC concerns for bycatch of non-target prey in relation to its biomass; however, biomass estimates for non-target prey were not readily available at the August 28-30 meeting in Seattle. Staff at the NMFS-AFSC agreed to develop a data set of biomass estimates of target and non-target prey by region so that the SSLMC can consider bycatch of non-target prey in the PRT to determine how this may affect overall proposal scoring. The data set was made available to the SSLMC on September 19, and has yet to be reviewed and discussed by committee members (Appendix E). The SSLMC intends to consider more fully the SSC recommendations to evaluate proposals in terms of impacts on other SSL prey items; however, the Committee has not had time yet to understand the implications of the information in Appendix E, and to decide on how to incorporate these data into the PRT. The SSLMC intends to address the information in Appendix E in an upcoming meeting.

Several members of the SSLMC cautioned that placing too much weight on the total sum of non-target prey in the SSL diet in some regions could discount the importance of the target species to the SSL, and thus run counter to the Biological Opinion on the impact of fisheries for Atka mackerel, Pacific cod and pollock on the SSL. The difficulty in understanding the dynamics of SSL prey based on scat data was noted again. It is yet to be fully described in the draft Biological Opinion.

An alternative to the TAC/biomass ratio was explored, with valuable input from NMFS-AFSC staff. Discussion included concern over lack of data to improve upon the TAC/biomass ratio. One suggested alternative was to use the target species biomass after removal by a fishery, relative to the combined pre-fishery biomass of Pacific cod, pollock and Atka mackerel. This ratio would put into perspective the harvest relative to the total prey field. For example, one region might have a large abundance of pollock relative to the combined biomass of all three target species, whereas another region might have a small amount of pollock relative to total combined species biomass. Thus, removals of pollock from each region would have potentially different impacts. However, it was noted that the alternative idea did not appear to improve the scoring process over the original idea because both were limited to data collected at the regional scale. Additionally, biomass survey data are collected during summer, whereas fishing occurs primarily in winter, thus reducing the utility of survey data. After considerable detailed discussions, the SSLMC concluded that no quantitative data set, or method to combine data sets, would serve as an acceptable proxy for judging the effects of fishing on the prey field. Therefore, the SSLMC turned to a qualitative way in which to judge the potential effects of fishing on the prey field relative to the status quo, by asking the following questions:

- In regards to harvest removal rate (intensity of fishing), will the proposal result in a shorter (longer, or the same) fishing duration, relative to the status quo?

- In regards to target fish biomass removed, will the proposal result in removing a lot more (a moderate amount more, a slight amount more, or the same or less) of target fish, relative to the status quo?

The status quo is defined by the SSLMC as the current fishing regulatory situation for each proposal. By asking questions in this manner, the SSLMC will be able to judge effects of the proposal at a local scale in relation to the current fishing situation.

While the rationale for a hierarchy of fishing power by gear type was provided in the June 2003 Supplement to the Biological Opinion (page 36), and explained to the SSLMC by NMFS-AFSC staff, the SSLMC concluded at the July 25-27 meeting in Seattle that gear type and vessel size are not satisfactory proxies for removal rate. Concerns include the lack of consideration for the number of vessels fishing, fisheries occurring on large schools of fish, agreement between sectors to avoid fishing conflicts, and the expectation that some proposals may be presented that would control removal rate directly.

The AHP that was used to create the PRT can also be used to modify it to accommodate any new information as it becomes available for examination and discussion.

RESULTS AND DISCUSSION

GOAL

The SSLMC's goal statement for the AHP model is to build upon previous efforts to develop a rational approach to evaluating proposed changes in fishing regulations for Atka mackerel, pollock and Pacific cod in the Bering Sea/Aleutian Islands and Gulf of Alaska that had been put in place previously to protect the SSL and their prey.

In the most recent Biological Opinion on the impact of Federal fisheries for Atka mackerel, pollock and Pacific cod in the Bering Sea, Aleutian Islands and Gulf of Alaska, the Protected Resources Division of NOAA Fisheries postulated that fisheries have somehow contributed to the decline in the number of SSL (in the western Distinct Population Segment), including indirectly by reducing the prey available to the SSL. Although the SSLMC's work on the PRT proceeded with the assumption that there may be a relationship between prey and the nutritional balance of the SSL, this does not imply that the SSLMC concurs with the assumption.

STRUCTURE OF THE PROPOSAL RANKING TOOL

Although the SSLMC discussed several topics of concern at great length, three major questions are currently included in the PRT because reasonably reliable data are available to address these questions that are not available for other issues of concern. The three questions are:

1. To what extent does fishing alter the (target) prey field by season, putting the percentage of removal and duration of removal in the context of the status quo?

2. To what extent is the SSL sensitive to fishing activity, in relation to proximity to a given site type, and the percentage of sites affected in the region, and by season?

3. To what extent do the target species appear in the diet of SSL, by region and season?

The SSLMC identified two dimensions of the problem along which impacts may occur,

- how fisheries affect the prey field of the SSL, and
- how fisheries affect the SSL.

The SSLMC then structured the questions as a hierarchy, according to the two dimensions:

Goal: Evaluate proposed changes in regulations that encompass relevant dimensions of the SSL and their prey

- Dimension: effects of fishing on the prey field (Question #1)

- Dimension: effects of fishing on the SSL
  - Sensitivity of the SSL in relation to site type and proximity (Question #2)
  - Appearance of target species in SSL scat (Question #3).

The Prey of the SSL

The SSLMC engaged in lengthy discussions relating fishing to the prey field, including NMFS' concerns about the availability of prey as affected by dispersal from fishing activities (Wilson et al. 2003). Issues discussed included the response of the prey field to fishing, possible changes in fish schooling behavior, prey switching, and the SSL's ability to capture and consume prey. The question that arises is, "Will prey availability be altered in a manner that affects the SSL?" The NMFS assumption is that more aggregated prey are easier for the SSL to capture, and removal of fish can result in a reduced number of fish or fish aggregations. The question that arises is, "Will prey be measurably depleted in a manner that affects the SSL?"

Both of the above concerns were ultimately combined by the SSLMC into one dimension because it was thought that realistically there could be little measurable distinction between the two.

The SSL

Much discussion focused on SSL foraging ecology, reproductive behavior, energy balance needs, and potential disturbance from fishing activity. Degree of impacts was related to adult females and weanlings, as these categories of individuals have more restrictive energy balance needs, as compared with adult males. Non-territorial adult males are able to forage further and longer because they do not maintain breeding territories, care for young, lactate. Females have dual roles of their own maintenance and reproduction (Maniscalco et al. 2006). For NMFS, fishing competition with juvenile SSL that have not yet weaned and are still partly reliant on maternal care is a primary concern (Rehberg 2005). Weanlings have lesser diving capability and fewer reserves for energy balance over time than adults because of smaller body size (Loughlin et al. 2003, Fadely et al. 2005, Pitcher et al. 2005). In addition to the concept of competition, the concept of fishing activity having other deleterious effects on SSL through disturbance was discussed. The SSLMC intended the term "disturbance" to include behavioral and physical aspects.

All concerns were ultimately combined into one dimension because adult females and weanlings largely overlap in time and space, thus making these components of the problem nearly indistinguishable from an impact point of view, and SSL foraging is an overarching concern, related to several variables, including proximity of fishing activities to SSL sites.

Variables

Prior to the meeting, a scoping survey was distributed to a sub-group, to identify variables that might be encountered in proposals. The question asked was, "What's on the table for change?" And, "Given the set of variables, which will be used in the PRT?"

The entire SSLMC modified the list. Table 1 lists the variables identified as useful to the PRT.

Table 1. Variables from proposed fishing regulation changes that are included in the model to evaluate impacts to the SSL and their prey.

Variable	Sub-units
1. Target fish species	a. Pacific cod b. Pollock c. Atka mackerel
2. Target species removals	a. a slight increase in amount harvested = 1 to 5% of the total seasonal TAC for all sectors in that fishery for season. b. a moderate increase = 6 to10% increase in amount harvested c. a large increase is > 10% increase in amount harvested d. no change or a decrease in amount harvested
3. Fishing duration	a. a shorter fishing season relative to status quo b. a longer fishing season relative to status quo c. a fishing season of the same duration as status quo
4. Geographic regions	a. Eastern Gulf of Alaska (EGOA) b. Central Gulf of Alaska (CGOA) c. Western Gulf of Alaska (WGOA) d. Eastern Aleutian Islands (EAI; includes the Bering Sea) e. Central Aleutian Islands (CAI) f. Western Aleutian Islands (WAI) g. Pribilof Islands
5. Seasons	a. Summer (the SSL breeding season, defined as May-September) b. Winter (non-breeding season, October-April) c. Shifting fishing from winter to summer d. Shifting fishing from summer to winter
6. SSL site types	a. Rookery b. Haulout c. other
7. Proximity zones to a SSL site	a. 0-3 nm b. 3-10 nm c. 10-20 nm d. 20+ nm e. not critical habitat
8. The percentage of SSL sites affected in a region	a. 1-10% b. 11-25% c. 26-50% d. 51-75% e. 76-100%

Explanations of variables used in the hierarchy follow for each dimension.

Variables Applicable to the Prey Dimension

Variables that can potentially impact the prey field are:

- season,
- target species removals, and
- fishing duration.

The ideal way to evaluate impacts of proposed changes on the prey field is to know fish biomass at the site and time in question, understand SSL prey needs at the site and time, and predict with accuracy the amount and rate of harvest relative to biomass associated with the proposed change. However, this is a data-poor environment in which to make decisions, so judgments must be made on the best available information.

The SSLMC determined after long discussions that the best characterization of removal amount and rate, given limited knowledge, is a qualitative assessment, by answering these questions:

- Would the proposal result in an increase in harvest of the total seasonal TAC for all sectors in that fishery for that season, when compared to the status quo?
- Would the seasonal harvest be taken in a shorter, longer or the same time period compared to the status quo?

Prey removal rate may be complicated by seasonal behavior of fish; for example, pollock aggregate for spawning in winter and a fishery targeting these fish would have an exploitation rate that is high, in part because of the schooling behavior of the fish. Fish migratory behavior could also affect exploitation rate.

The percent TAC is defined as the sum of all sectors' seasonal TACs for a given target species. The calculation would either add or subtract the percent of TAC from the status quo, thus eliminating the need to specify a TAC value for a given year.

Removal amount must be discussed in relation to the duration of removal. The SSLMC engaged in an extended debate about the impacts of "pulsed" (defined as approximately 3 to 10 days) versus "prolonged" fishing on the prey field (small amounts of fish harvested incrementally over long periods of time). If the time taken to harvest decreases from longer than 10 days to a period of 3 to 10 days, then the fishery would be classified as a pulsed fishery. The SSLMC turned to the NMFS-AFSC for data in this regard. There is some research that suggests SSL are most vulnerable to prey field disruptions that are characterized by a high removal rate in a pulsed time frame in a given area (June 2003 Supplement to the Biological Opinion). That is, an individual SSL can probably deal with low food abundance for a few days, but going without food for 3 to 10 days could be detrimental to the health of the SSL. The concern with pulsed fishing is localized removals of large quantities of available biomass.

At the September 12-14 meeting, fishing duration was further defined as relating to intensity of harvest (amount and time), and addressing localized depletion concerns. For example, a smaller harvest over a longer time is less likely to result in localized depletion – this is considered a longer duration fishery. Shifting TAC by eliminating or instituting seasonal splits might change the duration of a fishery, but not necessarily the duration within the season.

Variables Applicable to the SSL Dimension

Variables that can potentially impact the SSL dimension are:

- fishing near a type of SSL site,
- fishing within zones of proximity to the site, in a given season,
- the percentage of SSL sites in a region affected by the proposed change,
- fish species targeted for harvest, and
- fishing within a geographic region, in a given season.

<u>Sensitivity of the SSL in relation to site type and proximity</u>
The ideal way to evaluate the impacts of proposed changes to fishing regulations on the degree of disturbance to SSL is to examine the impacts related to the number of SSL per site seasonally, and the trend in SSL abundance at that site. However, survey counts of SSL are not conducted at every site, occur primarily in summer, and movement of SSL between sites is known to occur. Thus, the effects of fishing in winter at a particular site would have little relation to SSL abundance counts that were conducted in summer. Lack of complete knowledge of SSL abundance per site seasonally and the extent of movement between sites also hampers incorporation of SSL trend information into the PRT. Trends per area are subject to error due to variability in SSL movement between sites, and thus trends are not meaningful on a per-site basis. The NMFS-AFSC staff suggested that incorporation of the concept of the sensitivity of site type and proximity of fishing activities to the site in a given season into the PRT would serve as the best available proxy to site specific SSL abundance and trend, because data on the type of sites are more reliable.

The SSLMC discussed the best way to incorporate time, and concluded that seasons based on the energy needs of the SSL would be the most useful since we are discussing the availability of energy (food) to the SSL. Summer is defined as the breeding season (May-September) and is roughly equivalent to the B and C GOA pollock fishing seasons. It is assumed that energy needs are greater for lactating females and other nutritional stresses associated with breeding; thus, summer would be a more important (sensitive) time than winter. Winter is defined as the non-breeding season (October-April) and is roughly equivalent to the D and A GOA pollock fishing seasons.

The NMFS-AFSC staff distributed a table characterizing SSL site types as rookery, haulout or “other”, based on the type of activity at the site and the numbers of animals counted there in a given time period (NMFS 2006b; Appendix C). The “other” designation is given to sites that are listed in the Biological Opinion, but do not meet the seasonal criteria for rookery or haulout; SSL can still be present at these sites. The new telemetry data show that both rookeries and haulouts are used for longer periods of time by more diverse groups of SSL that had been observed previously (NMFS 2006c).

Members of the SSLMC wanted to account for the percentage of SSL sites in a region affected by a proposal, combined with proximity of activity to a site. Consensus was reached to include five categories of site percentages affected, within three proximity zones (Figure 4). The greatest adverse impacts (scored as “9”) would occur if the proposal sought to affect from 11-100% of SSL sites in the 0-3 nm zone for a given region.

Appearance of Target Species in SSL Scat

The combination of variables - fish species harvested, in a given geographic region, by season - is a proxy for nutritional needs of the SSL. Fish species of interest are Pacific cod, pollock and Atka mackerel, based on scat research that has defined these species as occurring frequently in the diet of SSL (Sinclair and Zeppelin *in review*). Data presented to develop ratings of importance included the most recent SSL food habits data (including Sinclair and Zeppelin 2002). The SSL diet can be diverse and not wholly comprised of Pacific cod, pollock or Atka mackerel, but rather a combination of prey items. Other species observed in high diet proportions include Irish lords, salmon, and cephalopods. Thus, a fishery that harvested Pacific cod, pollock or Atka mackerel may not harvest many other SSL prey items.

The seven geographic regions are defined in relation to the SSL draft revised recovery plan; also, proposals concerning these regions are expected. The seven regions include three in the Gulf of Alaska (western, central, eastern), three in the Aleutian Islands (western, central, eastern which includes the Bering Sea), and the Pribilof Islands region.

OVERALL MODEL STRUCTURE

The hierarchy consists of two dimensions, with eight variables organized in six levels (Figure 2). Some variable names are repeated to capture different aspects in relation to other variables, and to provide multiple scenarios, thus allowing flexibility in the scoring process. Reuse of variable names does not imply additional weight (“double counting”) but a lack of other appropriate terms.

OTHER VARIABLES

The SSLMC considered possible variables that do not apply to evaluating impacts; that is, those variables that may offer a benefit, or a “credit”. One such variable discussed was whether a fishery was rationalized. A rationalized fishery has some capacity to reduce practices that could adversely affect SSL, however the capacity might not always be exercised. The consensus of the SSLMC was not to include the variable, “rationalized fishery”, in the model.

Other variables mentioned that do not apply to the impacts model are proposals that seek to increase safety or economic benefits, and proposals to improve administrative or management efficiency. These benefits can be listed during the proposal screening process and examined after the impact evaluation is completed.

2nd Level | **3rd Level** | **4th-5th Levels**

- **Effects of fishing on the prey field**
  - Fishing in Summer only
    - Removing a lot relative to status quo
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing a moderate amount
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing slightly more
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing the same or less
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
  - Fishing in Winter only
    - Removing a lot relative to status quo
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing a moderate amount
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing slightly more
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing the same or less
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
  - Shifting a portion of the fishery from winter to summer
    - Removing a lot relative to status quo
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing a moderate amount
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing slightly more
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing the same or less
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
  - Shifting a portion of the fishery from summer to winter
    - Removing a lot relative to status quo
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing a moderate amount
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing slightly more
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration
    - Removing the same or less
      - Removal occurs during a shorter duration
      - Removal occurs during the same duration
      - Removal occurs during a longer duration

Figure 2. Hierarchy of potential impacts of fishing on the SSL and their prey field.

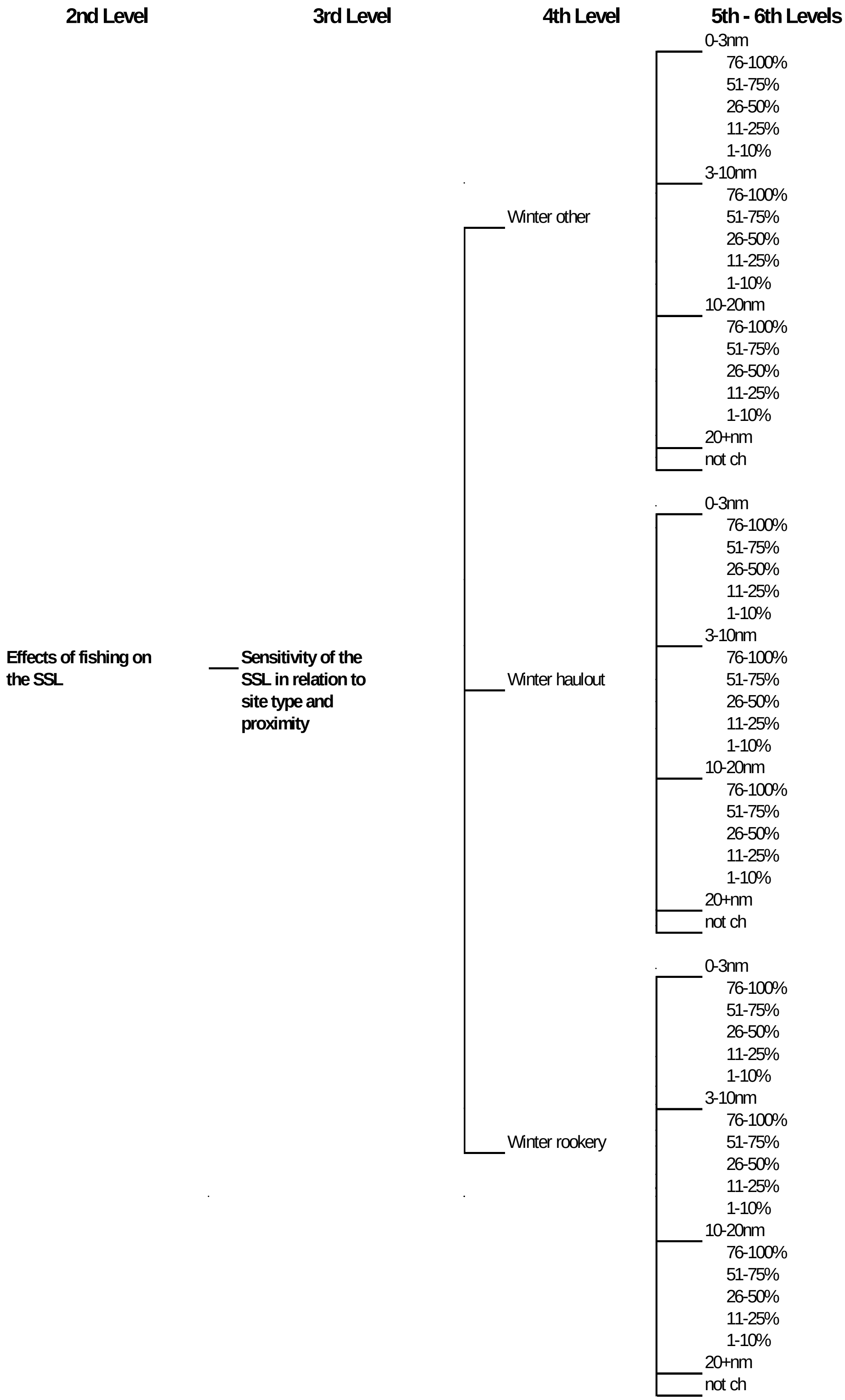

Figure 2. continued

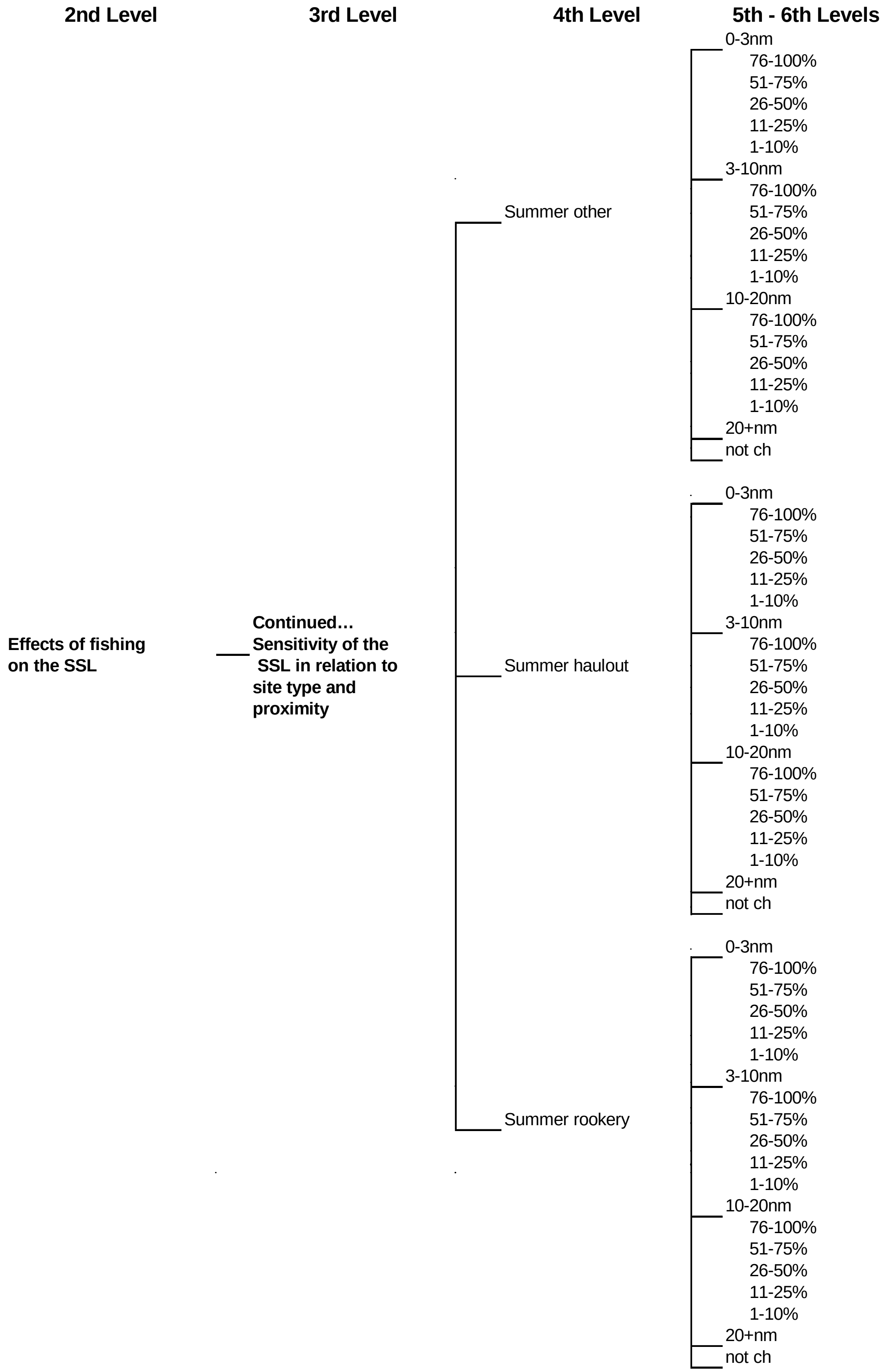

Figure 2. continued

2nd Level | **3rd Level** | **4th Level** | **5th - 6th Levels**

- **Effects of fishing on the SSL**
  - **Appearance of target species in SSL scat**

    Nutritional needs (what they eat, when, and where)
    - Summer
      - EGOA
        - P. cod
        - pollock
        - A. mackerel
      - CGOA
        - P. cod
        - pollock
        - A. mackerel
      - WGOA
        - P. cod
        - pollock
        - A. mackerel
      - EAI
        - P. cod
        - pollock
        - A. mackerel
      - CAI
        - P. cod
        - pollock
        - A. mackerel
      - WAI
        - P. cod
        - pollock
        - A. mackerel
      - Pribilofs
        - P. cod
        - pollock
        - A. mackerel
    - Winter
      - EGOA
        - P. cod
        - pollock
        - A. mackerel
      - CGOA
        - P. cod
        - pollock
        - A. mackerel
      - WGOA
        - P. cod
        - pollock
        - A. mackerel
      - EAI
        - P. cod
        - pollock
        - A. mackerel
      - CAI
        - P. cod
        - pollock
        - A. mackerel
      - WAI
        - P. cod
        - pollock
        - A. mackerel
      - Pribilofs
        - P. cod
        - pollock
        - A. mackerel

Figure 2. continued

JUDGMENTS OF IMPORTANCE (IMPACT)

Weighting elements as to their importance in the overall assessment of impacts from fishing was based on data, testimony and expert judgment. Weights express the group's beliefs that the effects of fishing on the SSL is 1.5 times more important than the effects of fishing on the prey field, and that sensitivity of SSL to fishing activity is 2 times more important in regards to impacts of fishing than the appearance of target species in the scat of SSL. Unadjusted for balance, these weights are:

Goal: Evaluate proposed changes in regulations that encompass relevant dimensions of the SSL and their prey (1.000)

- Dimension: effects of fishing on the prey field (0.400)
- Dimension: effects of fishing on the SSL (0.600)
    - Sensitivity of the SSL in relation to site type and proximity (0.400)
    - Appearance of target species in SSL scat (0.200),

where the two children of the SSL dimension sum to their parents' weight of 0.600. However, because the hierarchy is unbalanced, the intended weights of the children of the SSL dimension are diluted. To correct for imbalance, and restore the relative proportion of weights, the Expert Choice software makes the following structural adjustment:

Goal: Evaluate proposed changes in regulations that encompass relevant dimensions of the SSL and their prey (1.000)

- Dimension: effects of fishing on the prey field (0.250)
- Dimension: effects of fishing on the SSL (0.750)
    - Sensitivity of the SSL in relation site type and proximity (0.500)
    - Appearance of target species in SSL scat (0.250),

Thus, the group believes that the potential impacts of fishing are greater on the individual SSL than on the prey field, and further, that the SSL are most sensitive to the proximity of fishing activity. For each of the three questions, possible scenarios that could be encountered in proposals were developed from key variables open to change (Table 2).

Table 2. The number of scenarios developed in the PRT for each question.

Question	Variables	Number of scenarios
#1: effects of fishing on the prey field	• Season • Qualitative amount of target species removed relative to status quo, expressed as % of the TAC • Duration of fishing, relative to status quo	48
#2: sensitivity of SSL to fishing activity	• Season • Site type • Zone-distance from site • Percent of sites affected in a region	102
#3: appearance of target species in SSL scat	• Season • Region • Target species	42

The number of scenarios for Question #2 (102) is more than twice as many as Question #3 – the sheer magnitude of scenarios dilutes the intended importance of each. To correct for imbalance, and restore the relative proportion of weights, the Expert Choice software makes the following structural adjustment in the children of the SSL dimension:

Goal: Evaluate proposed changes in regulations that encompass relevant dimensions of the SSL and their prey (1.000)

- Dimension: effects of fishing on the prey field (0.250)
- Dimension: effects of fishing on the SSL (0.750)
    - Sensitivity of the SSL in relation site type and proximity (0.643)
    - Appearance of target species in SSL scat (0.107).

The Prey of the SSL

The SSLMC discussed the relative importance of harvesting in winter versus summer, and how to rate a proposal that might shift harvest between seasons. Four seasonal harvest scenarios were identified and rated according to the extent that SSLMC believe harvest removed may impact the prey field (Figure 3).

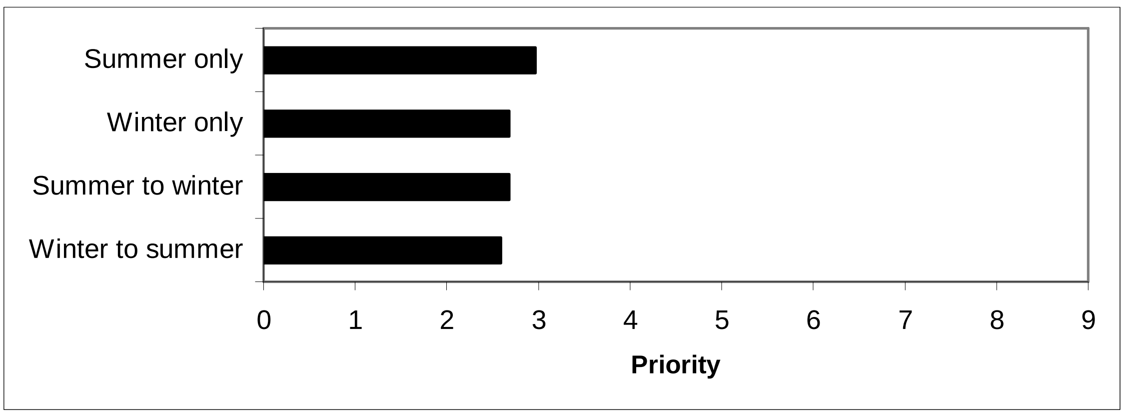

Figure 3. Judgments of the extent that harvest may impact the prey field by season.

The four categories of amount harvested relative to the status quo were then rated as to their impact on the prey field, in each of the four seasonal scenarios (Figure 4).

The category, "a lot" represents a proposed 10+ percent increase in the total seasonal TAC for all sectors in that fishery for a given season relative to that fishery's status quo. A 10+ percent change in TAC was judged to have the greatest potential impact on the prey field, in relation to the other possible categories of harvest amount. The ratings of potential impacts due to harvest amount did not differ appreciably among seasons.

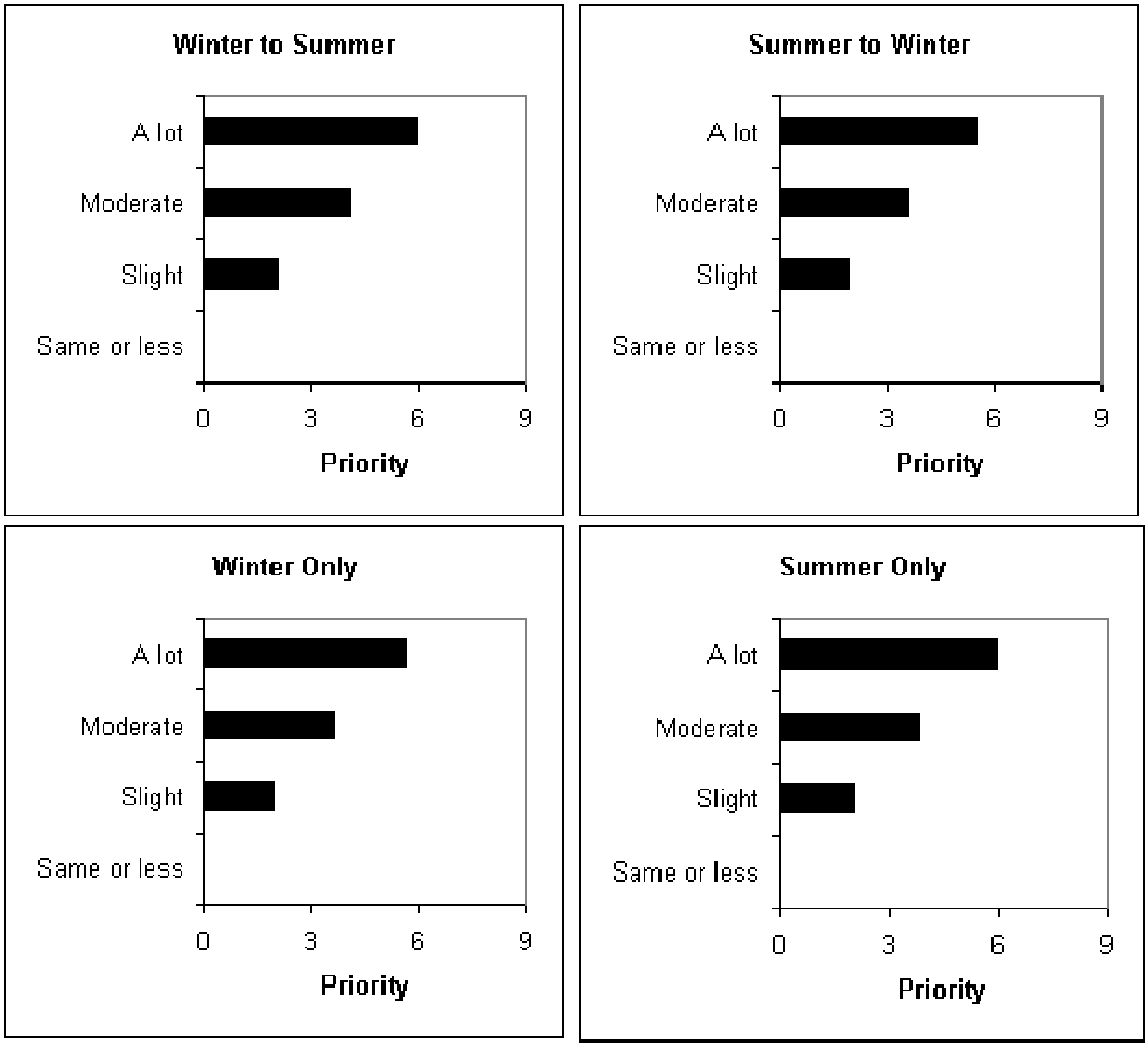

Figure 4. Judgments of the extent that amount harvested, relative to the status quo, will impact the prey field, by fishing season.

Characterization of removal amount must be discussed in relation to the duration of removal. There is some research that suggests SSL are most vulnerable to prey field disruptions that are characterized by a high removal rate in a pulsed time frame in a given area, where pulsed is defined as 3-10 days (June 2003 Supplement to the Biological Opinion). That is, an individual SSL can probably deal with low food abundance for a few days, but going without food for 3-10 days would be detrimental to the health of the SSL. The concern with pulsed fishing is localized removals of large quantities of available biomass. The SSLMC discussed the potential impacts of duration of fishing on the prey field, in relation to the amount harvested, in a given fishing season, considering the status quo (Figure 5). The SSLMC judged that adjusting fishing to occur in a shorter time frame than the status quo would increase the impact on the prey field; conversely, extending the fishing season would produce less of an impact than the status quo.

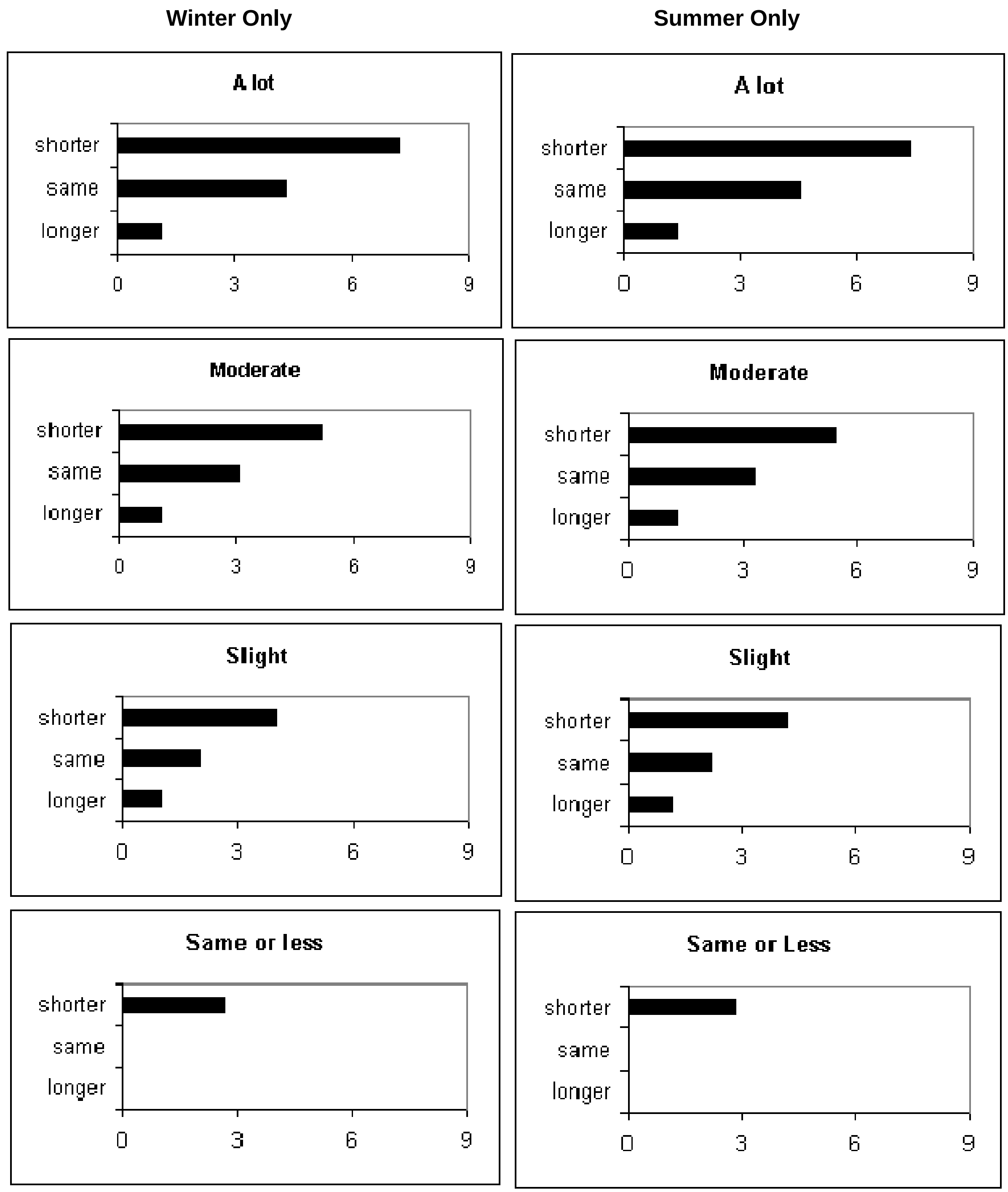

Figure 5. Judgments of potential impacts to the prey field that could result from three possible changes in fishing duration, in relation to the amount harvested, for a given fishing season, considering the status quo of that fishery. (Judgments in regards to shifting fishing between winter and summer seasons are similar).

Sensitivity of the SSL in relation to site type and proximity

Following testimony from the NMFS-AFSC regarding site type and importance based on seasonal use, The SSLMC voted on degree of sensitivity, where a high score represents a site that has great importance in the overall recovery of the SSL and is sensitive to change (Figure 6).

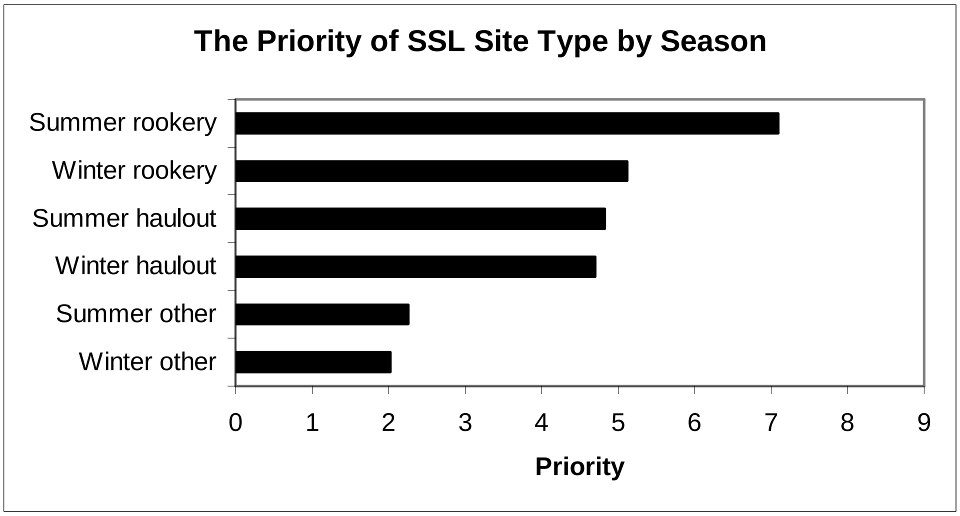

Figure 6. The priority of SSL site types, by season

Thus, a summer rookery is more important and is more sensitive to impact than a winter "other" site because of SSL breeding activity. The SSLMC all voted similarly in regards to rank order, rating summer rookery as most important and winter "other" as least important.

The impact of fishing to a site/season combination depends on how close fishing takes place to the site. The NMFS assumption is that fishing in increasing proximity to a SSL site may have increasingly deleterious effects on the prey of the SSL. Much work and discussion has previously gone into the "zonal approach" presented in Tables II 1-9, on pg 94 of the June 2003 Supplement to the Biological Opinion. New juvenile telemetry data (Appendix C) supports high sensitivity for the 0-3 nm and 3-10 nm zones. The assumption is that increasing distance of activity from the SSL site reduces disturbance to the SSL. The SSLMC wished to incorporate the concept of the zonal approach into the PRT, and prior ratings of importance were adjusted to reflect the 1-9 rating scales used in the AHP. The SSLMC expanded on the zonal approach by considering sensitivity to proximity in relation to site type and season (Figure 7).

There was agreement among the SSLMC on the sensitivity of the zones per site/season combination. The most important zone is 0-3 nm for all site types by season; the least important zones are the 20+ nm and that area designated as "not critical habitat (CH)". The priority scores assigned by the SSLMC are consistent with those recommended by the NMFS-AFSC. The most critical habitat surrounds rookeries, in the 0-3nm and 3-10 nm zones.

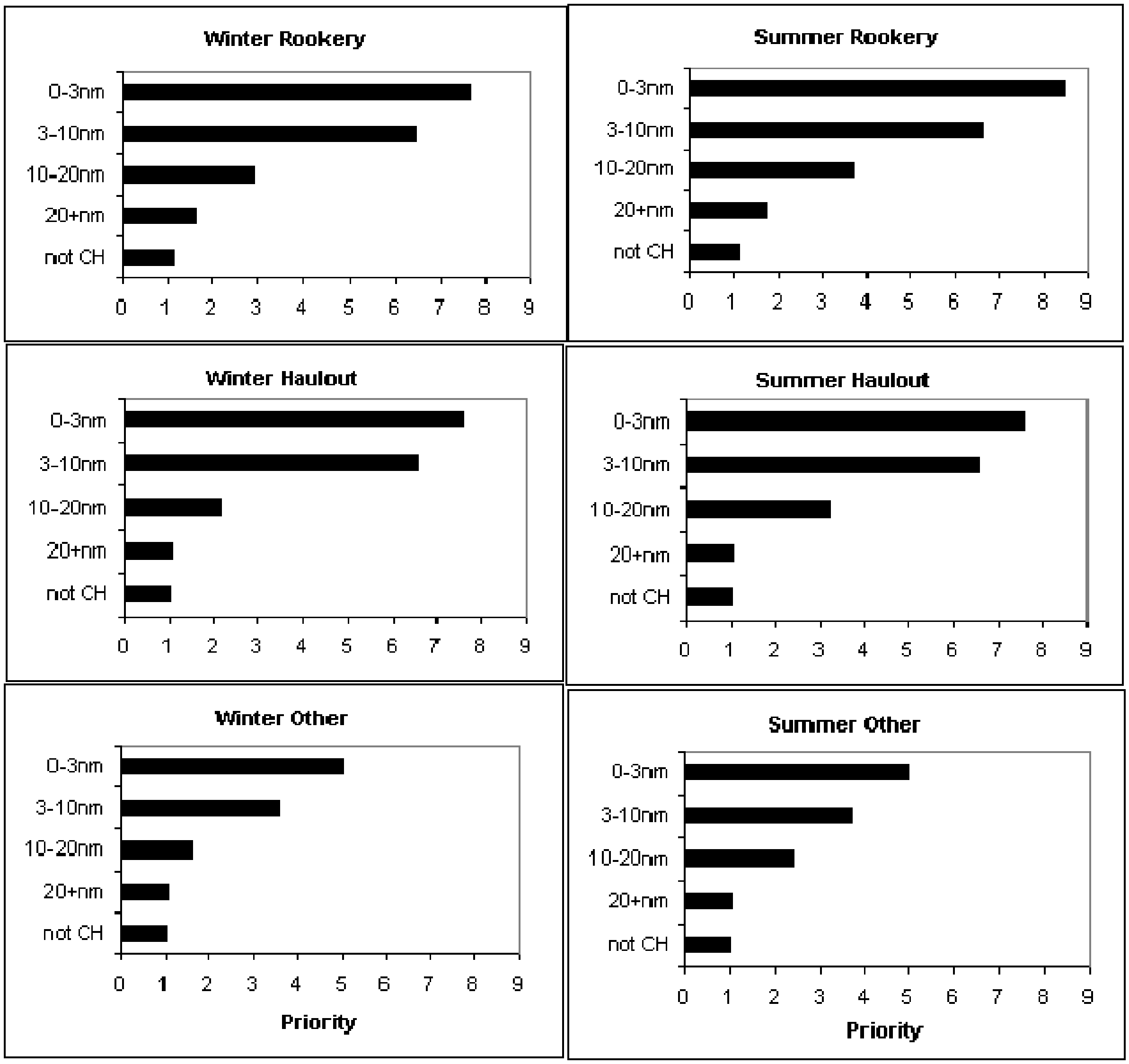

Figure 7. The sensitivity (priority) of a SSL site type to proximity of fishing, by season.

Members of the SSLMC wanted to account for the percentage of SSL sites in a region affected by a proposal, combined with proximity to a site. Consensus was reached to include five categories of site percentages affected, within three proximity zones (Figure 8). The greatest adverse impacts (scored as "9") would occur if the proposal sought to affect from 11-100% of SSL sites in the 0-3 nm zone for a given region.

Appearance of Target Species in SSL Scat

The combination of variables - fish species harvested, in a given geographic region, on a seasonal basis - is a proxy for nutritional needs of the SSL. Fish species of interest are Pacific cod, pollock and Atka mackerel, based on scat research that has defined these species as occurring frequently in the diet (Sinclair and Zeppelin *in review*).

The seven geographic regions are defined in relation to the SSL draft revised recovery plan; also, proposals concerning these regions are expected. The seven regions include three in the Gulf of Alaska (western, central, eastern), three in the Aleutian Islands (western, central, eastern which includes the Bering Sea), and the Pribilof Islands region. The NMFS stated that equal weights of importance (score = 5) must be assigned to each of the Gulf of Alaska and Aleutian Islands regions because the draft revised recovery plan requires an increasing trend in all regions for delisting, so all are considered of equal importance to recovery[2]. (If the criteria in the draft recovery plan change regarding the importance of regions, then the PRT would need to be adjusted to reflect those criteria changes.) The Pribilofs were assigned a slightly lesser rating of importance (score = 3.56) because those haulouts are not identified in the draft revised recovery plan. At least one proposal is likely to address the Pribilof area.

The importance of the combination of fish species by region and season was assigned based on diet data (Figure 9). A concern was raised about the relatively high ratings of importance for Pacific cod and pollock removals in the EGOA given the increasing trend in SSL in this region and the general lack of large Pacific cod or pollock fisheries in the region.

[2] Although, the draft revised recovery plan requires an increasing trend in only five of seven regions for downlisting.

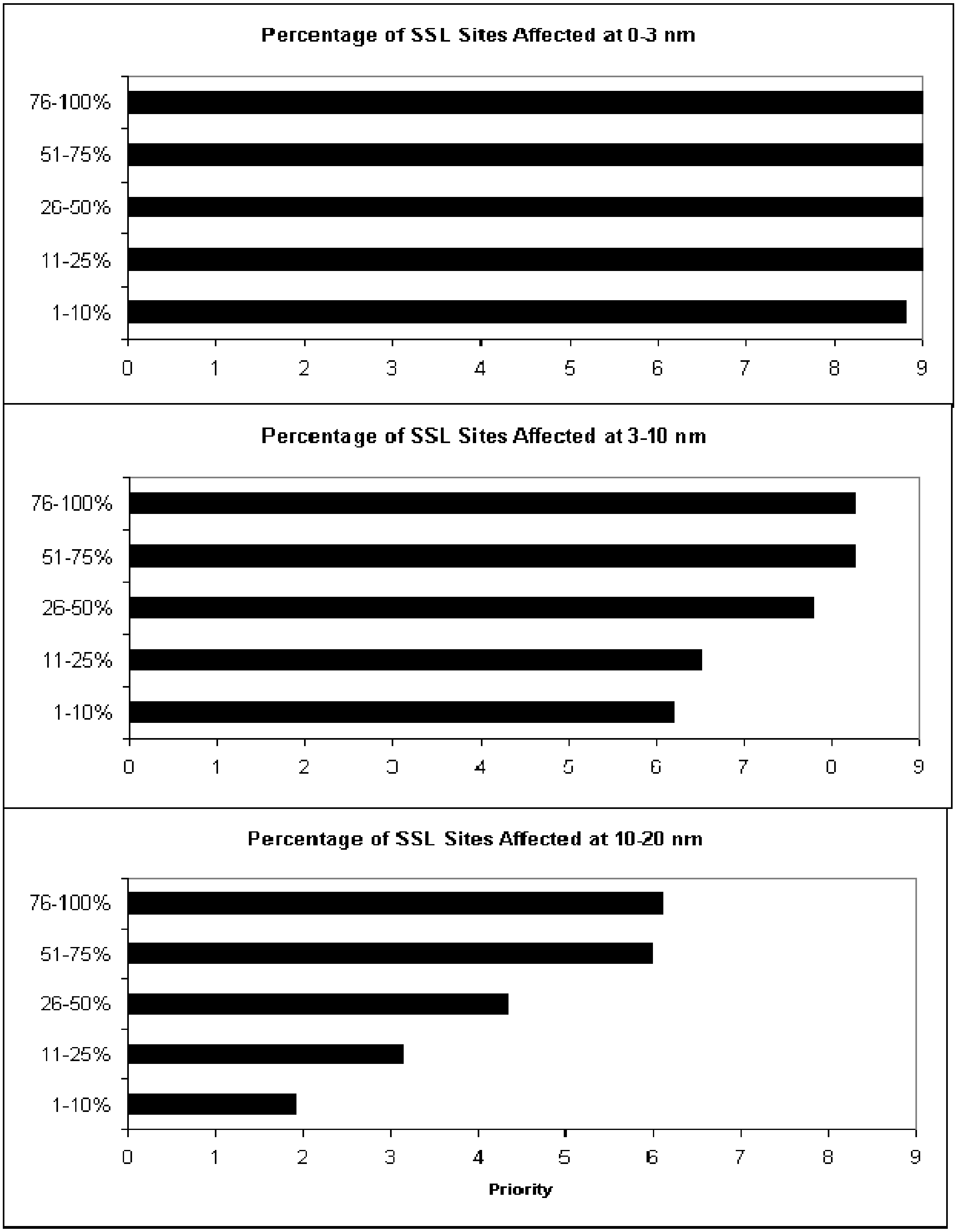

Figure 8. The potential of adverse impact (priority) of a change in fishing, considering percentages of SSL sites affected in a region, and fishing in proximity to the sites.

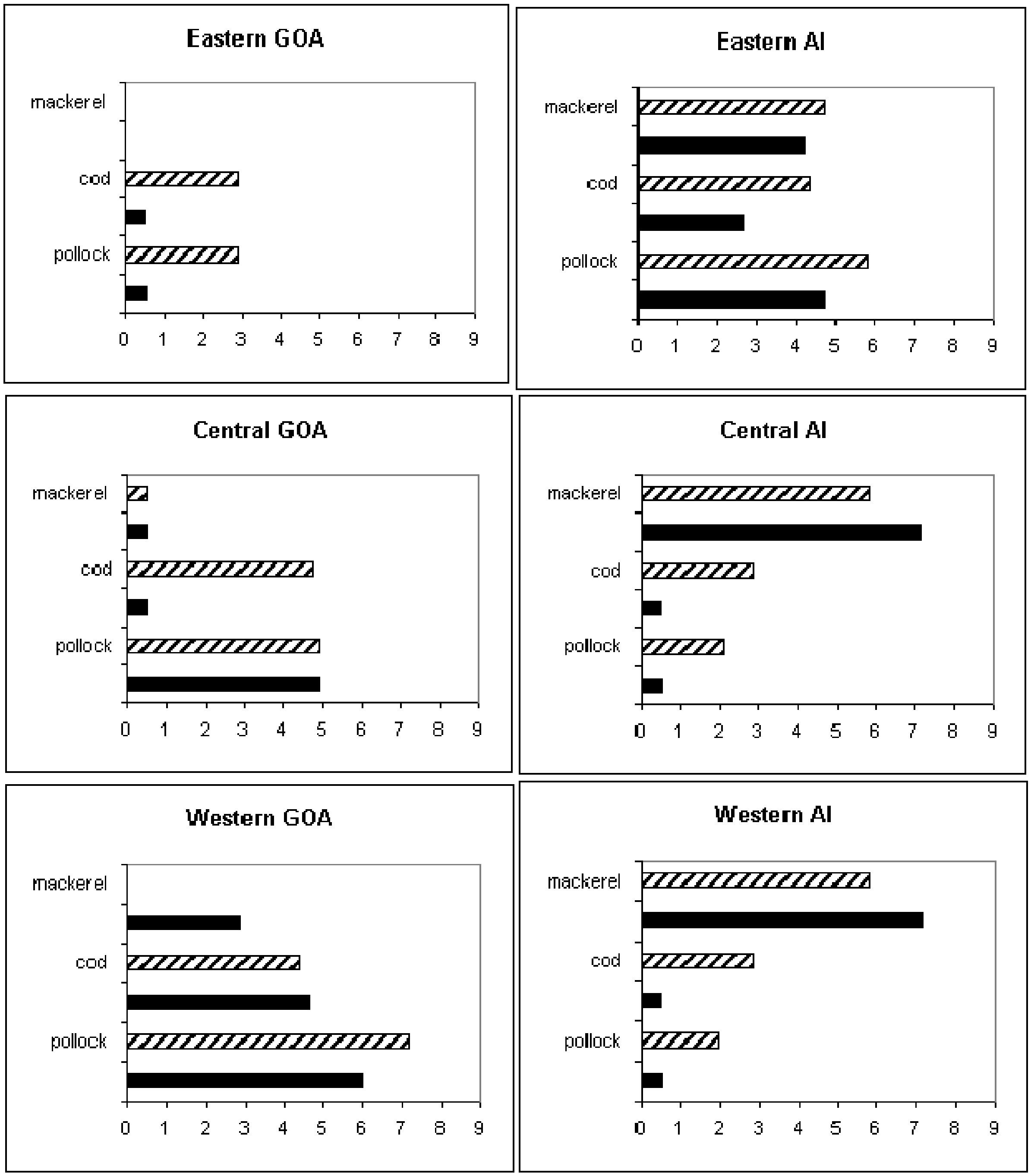

Figure 9. Ratings of importance of Atka mackerel, Pacific cod and pollock to the SSL, by region and season; the striped bar is winter and the solid black bar is summer. The absence of a bar indicates the lack of a fishery for the species in that region. A high score indicates high relative importance of that species in the SSL diet in that region at that season.

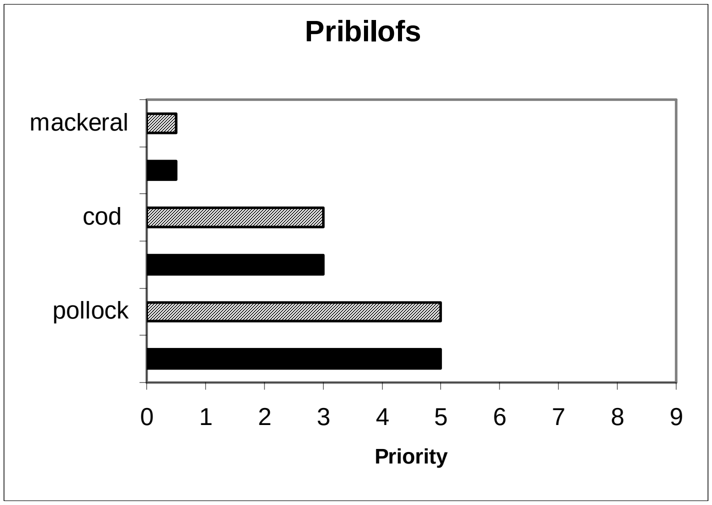

Figure 9 continued.

The repetition of a variable name does not result in inappropriate weights for these elements because different aspects of the variables are considered. For example, the variable name "season" is found in several places of the hierarchy but in one place it refers to the seasonal occupation of the SSL sites, in another the relative importance of a diet element, and in another the timing of a fishery.

To facilitate the evaluation of proposals, the lowest levels of the hierarchy were transferred to the Data Grid format. The Data Grid is a recommended format for evaluating large numbers of alternatives (proposals) with respect to each variable in the next highest level in the hierarchy.

IMPLEMENTATION OF THE PROPOSAL RANKING TOOL

The metric against which proposals will be measured has been debated by the SSLMC at several meetings. Questions about implementation of the PRT include:

- "What is the relative ranking of proposals in terms of negative impact?"
- "How much more impact does each proposal create relative to status quo?"
- "Do the cumulative effects of a suite of proposals put the SSL (western Distinct Population Segment) in jeopardy?"
- "Once we know how much additional impact to SSL is acceptable, can we use the model to evaluate trade-off scenarios, including benefits from additional closures?"

The PRT can answer the first two questions by ranking proposals according to their relative impact to SSL against each other, and against the status quo as defined for each proposal. It is very important to note, however, that the PRT does not provide any information about whether or not the proposals individually or cumulatively will result in jeopardy to the SSL or adverse modification of their habitat - that determination will come from the final Biological Opinion, yet to be published. Scores from both the proposed and status quo scenarios can be used to 'trade' one score for another, and to compare status quo to additional restrictions, in order to find a suitable cumulative accounting of impacts.

EVALUATION OF THE MODEL

At the September 12-14 meeting, staff ran example proposals through the model so that the SSLMC could examine model performance. The PRT is spatially and temporally explicit, so its use in scoring proposals that have spatial and temporal components is straightforward. Many of the proposals received by the SSLMC and some examples discussed at the September 12-14 meeting do not fit easily into the current model structure. These proposals will require clarification and additional information from the proposers to ensure the model correctly characterizes expected effects. A PRT subcommittee was appointed to include Dan Hennen and Sue Hills with Kristin Mabry, Doug DeMaster, and Lowell Fritz as staff. The subcommittee is tasked with assembling datasets for model use and making and documenting technical determinations about best use practices for the PRT.

The SSLMC used the PRT to examine two proposals that were considered in 2004 for potential changes to GOA SSL protection measures. One of the proposals was accepted by the NPFMC and NMFS and implemented (Puale Bay), and one proposal (Marmot Island) was rejected. Because the expert judgments in the PRT weight proximity and site-type very heavily in scoring proposals, the model gave a higher score (more negative impact) to the Puale Bay proposal than to the Marmot Island proposal. Even though Marmot Island is a rookery, this proposal only opened up critical habitat down to 10nm from shore. The Puale Bay (haulout) proposal opened up critical habitat down to 3nm. In 2004, Protected Resources Division determined that Marmot Island as a single rookery was important to the recovery of the species and the agency needed to maintain protection in that area. Currently the model does not have this level of detail. The SSLMC discussed the possibility of assigning differential weights to individual sites based on detailed information from the Protected Resources Division. If the model is not fully informed with this type of information, then decisions about proposals outside the use of the model should be fully documented with that information.

Another test example proposal discussed by the SSLMC involved multiple sites in the CGOA.

> "Open waters around all haulouts in area 620 of the CGOA from 10-20 nm to pollock trawling. These sites would include: Kak, Lighthouse Rocks, Sutwik Is., and Nagai Rocks."

This example showed the many considerations necessary to place a proposal's score in the correct bin. Defining status quo in this context is more complicated and generated discussion. Previous examples included proposed changes at just one SSL site, so status quo was considered to be the protection measures in place at just that one site. In this example, what is the spatial scope of status quo? Is it the entire CGOA? Is it area 620? Is it just the four haulouts? Additionally, if the four haulouts currently had different weights of impact, a decision would have to be made with regards to which bins should be selected in the model, in order to characterize status quo correctly. The PRT subcommittee will examine each proposal submitted to the SSLMC and determine a consistent way to enter status quo.

Other example proposals discussed included a temporal shift of TAC and gear allocation shifts. The SSLMC discussed whether it is possible to use the model to score these proposals. Because the site-type and proximity category of the SSL dimension is weighted heavily, proposals without a score for this element will receive a lower total score (less impact). The SSLMC felt that this was a good indication that these types of proposals would have less of an impact on SSL than proposals which open up SSL critical habitat.

Several members of the SSLMC and the public stayed after the close of the formal meeting to look at the sensitivity of the model. In Expert Choice software, the user can interactively shift priorities among variables, and watch the resulting model weight change. Two hypothetical proposals were run through the model to test model response. One had an expected high impact, and the other had an expected low impact.

	Hypothetical proposal with an expected high impact	**Hypothetical proposal with an expected low impact**
1. Target fish species	Atka mackerel	cod
2. Target species removals	A lot	slight
3. Fishing duration	shorter	longer
4. Geographic sub-regions	WAI	CGOA
5. Seasons	summer	winter
6. SSL site types	rookery	other
7. Proximity zones to a SSL site	0-3nm	20+nm
8. The percentage of SSL sites affected in a region	76-100%	1-10%

Scores for each of the three questions were examined individually, summed, and compared between the two hypothetical proposals. The results are as follows:

	Hypothetical proposal with an expected high impact	**Hypothetical proposal with an expected low impact**
Score for just Question #1: The prey field	.019	.002
Score for just Question #2: Sensitivity to proximity	.008	.003
Score for just Question #3: Target species in scat	.014	.0004
Total score	.041	.005

The SSLMC was pleased to see that the PRT generated scores that reflect a common sense approach to categorizing impacts to SSL.

Additionally, SSLMC members wanted to see what happened to total proposal scores when different bins were selected for the variables. For example, if a proposal changed from a shorter duration to the same (current) duration, they could see the total score decrease, reflecting the preference for a longer temporal fishery distribution to avoid SSL nutritional stress. Also, if a proposal changed species from Atka mackerel in the western Aleutian Islands to Pacific cod in the same area, the total score decreased, reflecting the importance of Atka mackerel in SSL scats in that area. This also pleased those in attendance, as the PRT is accurately representing the expert judgments of the SSLMC members who contributed to its development.

Robustness in model performance can be tested by changing the weight of influence of the two dimensions: (1) effects of fishing on the target prey field, and (2) effects of fishing on the SSL. A model is thought to be robust if rank order of variables in the lower levels of the hierarchy is preserved with a 10% or greater shift in weights in the higher levels of the hierarchy. Increasing weight on the SSL dimension reinforced the rank order of variable sets. However, as weight increased on the prey field dimension, rank order of fishing duration increased from third to second. A good 10% change in weight in one direction (increasing weight on the prey field) was needed to effect change in rank order of lower level variable sets; thus, the model may be characterized as fairly robust.

Weights for: Effects of fishing on the target prey field / Effects of fishing on the SSL	Rank order of the percentage of SSL sites affected in a region	Rank order of target fish species	Rank order of fishing duration
25/75 (Actual adjusted model)	1	2	3
20/80 (Increase weight on the SSL)	1	2	3
15/85 (Increase weight on the SSL)	1	2	3
30/70 (Increase weight on the prey field)	1	2	3
35/65 (Increase weight on the prey field)	1	3	2

REMAINING ISSUES

In October, the SSLMC will take testimony regarding proposals to clearly understand what is being requested. Variables relevant to the PRT will be highlighted to assist in evaluating proposals. The SSLMC may choose to revisit variables and their definitions as data become available and proposals are more clearly understood. The SSLMC anticipates that these issues will require additional discussion:

- If a shift of seasonal TAC is for one sector, the model would need to estimate the overall effect for the entire Pacific cod fishery.
- The model does not currently differentiate importance among individually named sites, for example Marmot Island versus other rookeries/haulouts in the GOA. Criteria in the current version of the draft revised SSL recovery plan specify six regions of equal importance to delisting, based on historical and survey locations. However, the SSLMC notes that all sites and regions may in fact not be

considered equal based on population trajectories from York et al. (1996) and opinions provided by the Protected Resources Division in the 2004 informal consultation on the GOA proposals.

- The SSLMC needs to decide how to deal with different types of sites in a region. Options include using:
    - the worst case scenario, or
    - the type of site that constitutes the majority in the proposed fishing area.

- The regulatory seasons for fishing do not correspond with the breeding seasons for SSL. The PRT subcommittee needs to determine how to use the model to address partial overlaps between these two variable definitions. Ms. Bonney and Mr. Henderschedt volunteered to work with Ms. Mabry to develop a table that assigns the regulatory seasons to the SSL breeding seasons in the model. This table will include their experience regarding timing of harvest to ensure the actual harvest during a season is taken into consideration.

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Appendix A2. Participants involved in the development of the PRT, Seattle, August 29-30, 2006.

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Appendix A3. Participants involved in the development of the PRT, Seattle, September 12-13, 2006.

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Appendix B. Glossary of terms used in the discussion and development of the PRT, as defined by the SSLMC.

AHP – Analytic Hierarchy Process

Critical habitat – Sites that are considered by the NMFS as important; this includes rookeries and haulouts as well as sites that do not do not meet the criteria for being classified as rookery or haulout, and yet SSL can still be present at those sites.

Dimension – the path or extent along which impacts of fishing on SSL are assessed in an overarching, broad category.

Duration - related to intensity of harvest (amount and time) and addresses localized depletion concerns. For example, a smaller harvest in a longer time frame is less likely to result in localized depletion - this would be considered a longer duration fishery. Shifting TAC by eliminating or instituting seasonal splits may change the duration of a fishery, but not necessarily the duration within the season.

Expert judgment - previous relevant experience supported by rationale thought and knowledge.

Hierarchy – a tree-like structure that is used to decompose a complex decision problem; it has a top-down flow, moving from general categories to more specific ones.

Node – a group of elements in the hierarchy that are related by criteria and structure; a parent node is an element in the next higher level that is connected to children nodes in the lower level.

Percent TAC - percentage of the sum of all the sectors seasonal Total Allowable Catches (TACs) for that target species. The calculation would either add or subtract the percent of TAC from the status quo, thus eliminating the need to specify a TAC value for a given year.

Season - based on breeding/non-breeding SSL behavior.

Status Quo – the current fishing regulatory situation for each proposal**.**

Target prey – pollock, Pacific cod, Atka mackerel.

Variable – pertains to any fishing regulation that is open to change, and that is considered in the PRT.

Appendix C. List of references relevant to the structuring and rating of elements in the PRT.

General

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SSL Diet

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Wynne, K, R. Foy, and C. Foy. 2006. University of Alaska and Aleutians East Borough, SSL Research Program: Presentation to SSLMC, AFSC, August, 2006.

Zeppelin, T.K., K. A. Call, D. J. Tollit, T.J. Orchard, and C.J. Gudmundson. 2003. Estimating the size of walleye pollock and Atka mackerel consumed by the western stock of Steller sea lions. In Marine Science in the Northeast Pacific: Science for resource dependent communities. January 13-17, 2003, Hotel Captain Cook, Anchorage, AK.

SSL Abundance/Trends/Counts

Alaska Fisheries Science Center. 2006. AFSC and NMML SSL Research Program, Presentations to SSLMC, AFSC, April 2006, May, 2006.

Holmes, E., and A.E. York. 2003. Using age structure to detect impacts on threatened populations: a case study using Steller sea lions. Conservation Biology 17 (6):1794-1806.

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Gear Interactions/Incidental Take

Angliss, R.P., and R.B. Outlaw. 2005. Alaska marine mammal stock assessments, 2005. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-AFSC-161. 250 p.

Appendix D. Handouts developed by the NMFS-AFSC and provided to the SSLMC and referenced during development and scoring elements in the PRT.

Percent frequency of occurrence of prey occurring in Steller sea lion scats collected from 1999 to 2005 (NMFS 2006b).

Weighting factors for area by species harvested in the pollock, P. cod, and Atka mackerel fisheries.

Weighting factors for summer and winter periods, by distance from centrum of SSL sites.

Proportions of locations associated with diving to >4 m for juvenile Steller sea lions >10 months old at capture; zones based on distances from nearest listed haulout or rookery and proportions stratified by season. Proportions of 14,441 locations associated with diving to >4 m for 116 juvenile Steller sea lions based on distance to nearest listed haulout or rookery and stratified by region and season.

Catch rate distribution of 2004 BSAI pollock, Atka mackerel, and P. cod fisheries.

(Tables follow)

Table 3.21 Percent frequency of occurrence of prey occurring in Steller sea lion scats collected from 1999 to 2005 (NMFS 2006b).

Region	Central & Western Aleutians		Eastern Aleutians		Western Gulf		Central Gulf		Eastern Gulf	Western DPS		
Season	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Summer	Winter	ALL
Number of scats	483	301	290	773	184	42	85	204	38	1080	1320	2400
Pollock	7	12	46	53	53	93	46	44	8	28	44	37
Pacific cod	6	26	18	39	36	31	2	43	5	14	37	26
Atka mackerel	96	55	32	43	21		1	2		55	38	46
Salmon	17	6	38	25	57	17	56	29	84	35	21	27
Herring			35	1	3	2	12	12	24	12	2	6
Sand lance	4	1	34	28	65	17	16	38	39	25	23	24
Arrowtooth	1	1	8	21	14	7	45	31	5	9	17	13
Irish Lord sp.	3	23	11	33	13	5		17		7	27	18
Sand fish	1	5	16	11	3	7		13		5	10	8
Halibut		1	1	10	4	5	4	12		1	8	5
Cephalopods	13	18	7	4	1		5	7	3	8	7	8
Rock sole	0	6	19	14	9	5		7		7	11	9
Snailfish sp.	1	12	1	14				4		1	12	7
Capelin			2	0	3		13	4	13	3	1	2
Poacher sp.			14	1						4	0	2

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Area by Species Harvested

	WAI		CAI		EAI	
	Summer	Winter	Summer	Winter	Summer	Winter
POLL	0.5	3	0.5	3	5	6
PCOD	0.5	3	0.5	3	3	5
ATKA	7	6	7	6	5	5

	WGOA		CGOA		EGOA	
	Summer	Winter	Summer	Winter	Summer	Winter
POLL	6	7	5	5	0.5	3
PCOD	5	5	0.5	5	0.5	3
ATKA	3	0	0.5	0.5	0	0

Limited Sampling in the EGOA
Assigned low weight in summer based on data
Assigned moderate weight in winter based on seasonal relationships in other areas (see WAI/CAI)
Rationale for Seasonal Split:
Reflects seasonal differences in prey aggregations and representation in SSL diets

% FO	Weight	Description
>70	7	Very Strong
50-70	6	Kinda Very Strong
30-50	5	Strong
10-30	3	Moderate
<10	0.5	Trace

Summer = May-October; Winter = November – April

SSL Location Type by Proximity

Distance	Summer Rookery	Summer Haulout	Summer Neither	Winter Rookery	Winter Haulout	Winter Neither
<3	~~8~~ 9	8	5	8	8	5
3-10	7	7	4	7	7	4
10-20	4	~~4~~ 3	3	3	~~3~~ 2	2
>20	2	~~2~~ 1	1	2	~~2~~ 1	1
Not CH	2	~~2~~ 1	1	2	~~2~~ 1	1

	Importance to SSLs
0-10	High
10-20	Low to Moderate (less in winter)
>20	Low
Out CH	Low

A winter 'rookery' is a site that is a rookery in summer and acts as a haulout in winter

Importance 'adjectives' from 2003 supplement to 2001 BiOp

Table 3.16 Table II-9 (NMFS 2003) updated with proportions of locations associated with diving to >4 m for juvenile Steller sea lions >10 months old at capture and instrumented during 2000-2005. Zones based on distances from nearest listed haulout or rookery, and proportions were stratified by season.

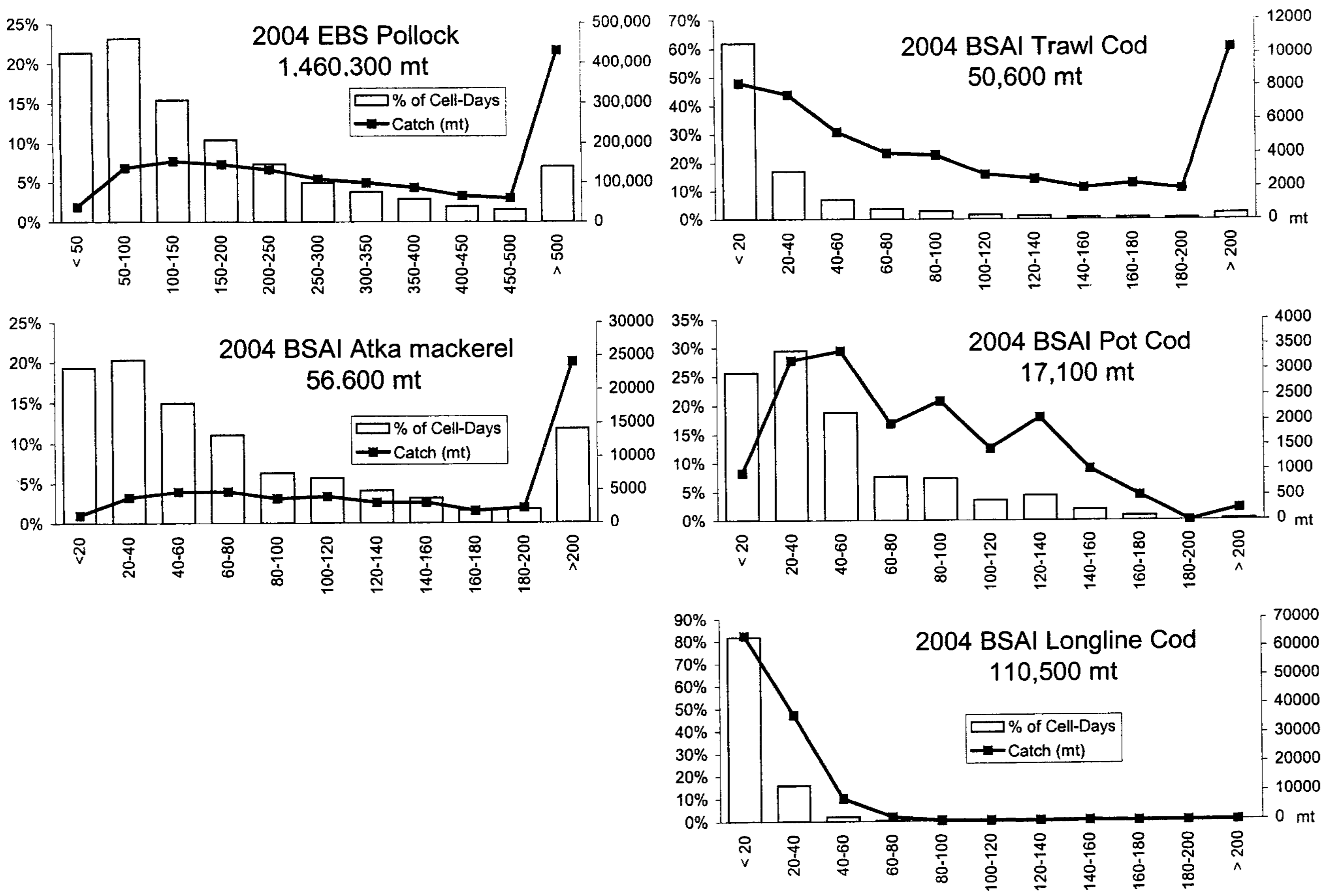
	Level of concern	Summer (Apr-Sept)	Winter (Oct-Mar)
Zone	2001 BiOp	>10 months (n=4,816)	>10 months (n=1,990)
Inside CH			
0-10 nm	High	78.4%	88.9%
10-20 nm	Low to moderate	8.7%	8.9%
>20 nm	Low	0.9%	0.3%
Outside CH	Low	11.9%	1.9%

Table 3.17 Proportion of 14,441 locations associated with diving to >4 m for 116 juvenile Steller sea lions based on distance to nearest listed haulout or rookery and stratified by region and season.

	Prince William Sound		Kodiak		Eastern Aleutians		Central/Western Aleutians	
Zone	Summer[1]	Winter[2]	Summer	Winter	Summer	Winter	Summer	Winter
Inside CH								
0-10 nm	92.0%	94.5%	86.8%	93.0%	88.5%	91.2%	68.8%	100.0%
10-20 nm	7.1%	4.6%	7.5%	5.2%	5.5%	6.9%	8.8%	0.0%
>20 nm	0.0%	0.1%	0.3%	0.3%	2.8%	0.2%	0.5%	0.0%
Outside CH	0.9%	0.9%	5.4%	1.6%	3.3%	1.7%	21.9%	0.0%

[1] Summer is defined as April through September.
[2] Winter is defined as October through March.

Catch Rate Distribution of BSAI Pollock, Atka mackerel and Cod Fisheries



Binned Range of Groundfish Catch (mt) by Target Fisheries only in 100 km^2 grid cells per day

Appendix E. Average catch of SSL prey species, 2003-2005 (Gaichas and Hiatt 2006)

(Spreadsheet tables follow)

September 19 2006

Three data sources were used to compile these tables (see prey list below for which prey species come from which source):

1. AKRO catch accounting system prohibited species tables (V_GG_PSCNQ_ESTIMATE, CDQ_CATCH_REPORT)
2. AKRO nontarget species tables (V_GG_NONTARGET_ESTIMATE)
3. AKRO target species tables (V_GG_TXN_PRIMARY_ALL, CDQ_CATCH_REPORT)

Queries were completed between Sept 12 and Sept 18 2006, and only data from the three complete years 2003-2005 were used in calculating averages
S. Gaichas did the prohib and nontarget queries, and T. Hiatt did the target species queries.

Steller Sea Lion seasons (SSL_Season) were defined as May through September for "Summer" and October through April for "Winter."

Fisheries were defined in the AKRO catch accounting system tables by the TRIP_TARGET_CODE or TARGET_FISHERY_CODE field, and all flatfish targets were combined.

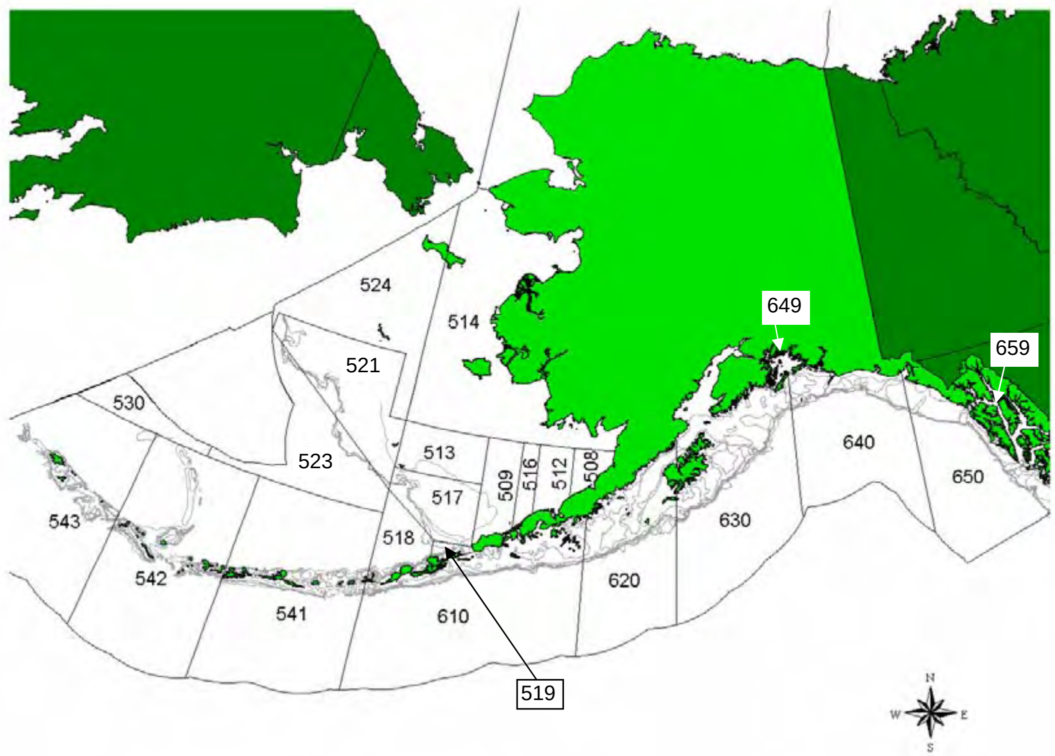
Gears were defined in the AKRO catch accounting system tables by the AGENCY_GEAR_CODE field, and were grouped into the following categories.

HAL	"Hook and Line" includes longline gear and jig gear
POT	"Pot" includes pot gear
TRW	"Trawl" includes non-pelagic trawl, pelagic trawl, and undefined trawl gear

Areas are AKRO management areas, which are defined on the map below, and are defined in words in the AI and GOA.

SSL prey species (listed below) were taken from Table 3.21 of the recovery plan which lists frequency of occurrence of prey in SSL scats 1999-2005.
Where no estimate was available for a given prey species, an aggregate category containing that species is listed. Therefore, catches in the aggregate categories may be higher than the catch of the individual prey species.
PLEASE NOTE DIFFERENT UNITS used by AKRO in making these estimates

Prey	**Data Source**	**Units**	**Species category in tables**
Salmon	1	numbers	Chinook salmon and Other salmon
Halibut	1	kilograms	Halibut
Herring	1	kilograms	Herring
Sand lance	2	kilograms	Sand lance
Irish Lord spp	2	kilograms	Large sculpins
Capelin	2	kilograms	Capelin
Cephalopods	2	kilograms	Octopus and Squid
Poacher spp	2	kilograms	Misc fish
Snailfish spp	2	kilograms	Misc fish
Sand fish	2		**Not found in estimated catch
Pollock	3	tons	Pollock
Pacific cod	3	tons	Pacific cod
Atka mackerel	3	tons	Atka mackerel
Arrowtooth	3	tons	Arrowtooth
Rock sole	3	tons	Rock sole



					Prohibited species				NonTarget species						Target species				
Three year average bycatch estimates 2003-2005					NUMBERS	NUMBERS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAI	KILOGRA	KILOGRAI	KILOGRAM	TONS	TONS	TONS	TONS	TONS
Region	Fishery	Gear	SSL_Season	Area	Chinook	Other salmon	Pacific halibut	Pacific herring	Sand lance	Large Sculpins	Capelin	Octopus	Squid	Misc fish	Pollock	P. cod	Atka mack.	Arrowtooth	Rock Sole
AI	Atka mackerel	TRW	summer	Eastern AI 541	107	0	6,084	0	0	766	0	0	6	1,047	2.229	17.971	1,416.858	2.485	1.299
				Central AI 542	0	123	21,988	0	0	58,466	0	513	4,262	39,606	90.443	622.920	15,164.444	55.990	42.849
				Western AI 543	0	219	13,729	0	0	25,660	0	0	3,684	23,211	52.439	204.819	6,462.365	24.562	11.740
			winter	Eastern AI 541	0	56	4,549	0	0	1,389	0	59	96	1,285	6.769	107.301	2,468.129	18.189	2.217
				Central AI 542	272	30	3,440	3	0	145,336	0	861	496	15,196	93.133	611.199	15,552.244	21.910	39.755
				Western AI 543	147	866	14,389	4	0	49,343	0	137	3,193	27,348	69.692	488.287	12,763.273	33.200	15.766
	Cod	HAL	summer	Eastern AI 541	0	0	49,073	0	0	11,258	0	1,118	0	194	1.754	321.438	1.807	7.375	0.444
				Central AI 542	0	0	14,735	0	0	5,731	0	1,631	0	371	0.878	287.895	4.752	2.349	0.113
				Western AI 543	0	0	52,387	0	0	1,090	0	132	0	421	1.233	147.226	2.304	3.489	0.028
			winter	Eastern AI 541	0	0	57,587	0	0	91,352	0	4,582	0	381	5.600	1,298.226	5.565	8.140	1.682
				Central AI 542	0	0	16,967	0	0	2,843	0	584	0	119	0.701	183.202	0.544	0.866	0.111
		TRW	summer	Eastern AI 541	13	0	16,857	0	0	2,816	0	9	272	1,310	1.766	459.599	97.804	47.470	5.824
				Central AI 542	0	0	446	0	0	524	0	0	2	55	0	12.450	0.102	0.015	0.536
			winter	Eastern AI 541	1,043	133	34,593	0	0	41,395	0	6,003	1,613	12,496	355.883	16,254.385	354.985	148.878	479.033
				Central AI 542	55	7	8,828	15	0	26,298	0	623	135	4,173	204.631	3,942.402	135.925	25.504	79.585
				Western AI 543	17	0	6,464	0	1	37,766	0	93	27	2,695	101.395	2,736.965	112.868	2.634	80.682
	Flatfish	HAL	summer	Eastern AI 541	2	0	243,824	0	0	419	0	210	0	33	0.100	45.136	0.008	23.268	0.199
				Central AI 542	0	0	85,713	0	0	1,544	0	221	0	51	0.071	13.147	0.095	28.960	0.038
				Western AI 543	0	0	95,050	0	0	528	0	243	0	19	0.001	42.272	0.177	9.659	0.221
			winter	Eastern AI 541	0	0	52,918	0	0	159	0	7	0	15	0.132	15.104	0.003	4.510	0
				Central AI 542	0	0	25,531	0	0	67	0	0	0	16	0	0.065	0	3.668	0
		TRW	winter	Eastern AI 541	0	0	315	1	0	45	0	0	0	3	0.192	2.771	0.001	0.216	6.167
	Pollock	TRW	summer	Eastern AI 541	0	0	0	0	0	0	0	0	31	0	3.869	0	0.251	0	0
			winter	Eastern AI 541	14	6	0	0	0	34	0	0	108	31	64.958	0	0	0.130	0
	Rockfish	HAL	summer	Eastern AI 541	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
			winter	Western AI 543	0	0	38	0	0	0	0	0	0	0	0	0	0	0.004	0
		TRW	summer	Eastern AI 541	0	0	19,828	0	0	1,305	0	59	2,701	595	96.984	91.811	197.776	185.298	1.627
				Central AI 542	0	0	16,219	0	0	924	0	113	1,641	3,912	172.052	8.191	70.118	75.293	1.216
				Western AI 543	0	0	27,311	0	0	1,808	0	362	3,684	12,628	135.212	14.023	50.664	77.863	0.552
			winter	Eastern AI 541	0	0	1,005	0	0	33	0	0	174	136	11.332	40.210	16.089	2.980	7.495
				Central AI 542	0	0	0	0	0	55	0	0	7	0	0.122	0.295	9.271	0.099	0.014
				Western AI 543	0	0	15	0	0	32	0	0	38	220	3.198	5.026	55.930	0.033	0.075
	Sablefish	HAL	summer	Eastern AI 541	0	5	27,618	0	0	6	0	2	0	297	0.016	2.648	0	8.547	0.474
				Central AI 542	0	0	17,053	0	0	3	0	7	0	166	0.004	0.917	0	7.121	0
				Western AI 543	0	0	1,708	0	0	0	0	0	0	7	0.002	0.081	0.071	0.884	0
			winter	Eastern AI 541	0	0	12,852	0	0	1	0	9	0	65	0.077	2.848	0.004	13.912	0
				Central AI 542	0	0	14,837	0	0	1	0	0	0	55	0	0.018	0	5.058	0
				Western AI 543	0	0	42	0	0	0	0	0	0	0	0.000	0	0	0.300	0
		POT	summer	Eastern AI 541	0	0	4,575	0	0	4	0	100	0	36	0.009	0.638	0.012	7.749	1.246
				Central AI 542	0	0	1,165	0	0	1	0	523	0	13	0.003	0.114	0	1.886	0.093
			winter	Eastern AI 541	0	0	2,368	0	0	1	0	42	0	55	0.019	0.094	0.022	12.235	0

					Prohibited species				NonTarget species						Target species				
Three year average bycatch estimates 2003-2005					NUMBERS	NUMBERS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	TONS	TONS	TONS	TONS	TONS
Region	Fishery	Gear	SSL_Season	Area	Chinook	Other salmon	Pacific halibut	Pacific herring	Sand lance	Large Sculpins	Capelin	Octopus	Squid	Misc fish	Pollock	P. cod	Atka mack.	Arrowtooth	Rock Sole
EBS	Atka mackerel	TRW	summer	517	1	2	4,406	1	0	1,163	0	0	46	341	23.446	21.489	76.618	39.409	5.515
				519	2	6	17,079	11	0	18,099	0	596	401	2,450	120.654	115.874	502.256	116.238	24.078
			winter	517	17	0	3,870	0	0	1,746	0	0	77	127	9.019	24.016	111.848	17.373	4.533
				519	17	5	8,719	1	0	15,197	0	0	1	215	11.904	23.907	265.042	58.599	9.006
	Cod	HAL	summer	509	0	2	206,690	0	0	15,538	0	655	0	378	157.543	2,906.848	0.004	68.060	2.617
				512	0	0	2,950	0	0	3,732	0	43	0	0	4.162	216.154	0.000	0.784	0.036
				513	0	0	80,760	0	0	22,299	0	888	0	1,880	114.522	2,181.575	0.109	34.234	0.940
				514	0	0	572	0	0	0	0	0	0	0	2.821	32.125	0	0.008	0.006
				516	0	0	4,375	0	0	2,016	0	0	0	12	3.494	367.158	0	0.699	0.040
				517	3	12	288,038	0	0	11,354	0	3,444	0	1,889	178.267	3,711.899	0.192	164.108	1.575
				518	0	0	317	0	0	83	0	0	0	2	0	10.422	0	0	0
				519	0	4	66,192	0	0	12,166	0	1,016	0	1,261	10.311	454.552	6.372	7.668	1.328
				521	4	29	402,695	2	0	86,097	0	6,417	0	2,802	498.294	9,946.280	0.015	264.346	5.312
				523	0	2	10,121	0	0	1,223	0	1,091	0	76	21.117	445.713	0.007	17.737	0.223
				524	2	0	85,969	2	0	14,501	0	222	0	97	219.534	2,476.791	0	47.675	3.772
			winter	509	2	0	317,711	0	0	42,983	0	3,538	0	1,225	301.853	6,848.127	0.027	35.832	1.854
				512	0	0	5,377	0	0	3,242	0	5	0	1	9.764	227.613	0	0.260	0.074
				513	0	1	499,131	0	0	224,367	0	1,184	0	3,718	499.882	12,367.870	0.183	41.629	9.708
				514	0	0	969	0	0	73	0	0	0	1	3.818	33.504	0	0.032	0.005
				516	0	0	34,578	0	0	5,331	0	84	0	11	44.957	1,062.305	0	0.602	0.334
				517	0	0	584,152	0	0	66,368	0	3,351	3	8,377	302.022	7,709.337	0.345	203.447	2.187
				518	0	0	4,408	0	0	914	0	0	0	38	0	123.493	0	0.000	0.000
				519	0	0	188,255	0	0	63,980	0	5,250	0	3,750	12.930	1,839.291	4.098	10.698	1.605
				521	16	3	1,236,908	1	0	256,044	0	9,151	17	20,767	2,554.245	48,555.360	0.524	439.718	8.517
				523	0	0	58,210	0	0	4,225	0	1,186	0	195	92.767	1,375.257	0	34.175	0.371
				524	1	0	114,766	1	0	38,939	0	1,049	1	195	488.648	6,766.971	0	51.767	2.615
		POT	summer	509	0	0	244	0	0	1,129	0	14,558	0	541	0.257	291.295	0.016	0.023	0.007
				513	0	0	3	0	0	16	0	3	0	4	0	2.919	0	0	0
				517	0	0	450	0	0	409	0	3,908	0	289	0.033	102.598	1.476	0.085	0.036
				519	0	0	15,366	0	0	11,194	0	41,996	178	4,919	2.260	2,808.068	100.007	2.495	0.494
				521	0	0	106	0	0	105	0	0	0	5	0.434	99.534	0	0	0
				524	0	0	543	0	0	89	0	0	0	3	0.735	367.835	0	0	0.005
			winter	509	0	0	1,097	0	0	22,440	0	26,205	0	4,944	2.936	4,689.467	4.009	0.297	0.398
				513	0	0	2,134	0	0	12,205	0	132	0	66	1.348	2,080.531	0	0	0.034
				516	0	0	48	0	0	206	0	103	0	37	0.015	44.161	0.127	0	0.002
				517	0	0	1,036	0	0	8,066	0	13,167	0	2,648	0.489	1,390.909	1.170	0.231	0.062
				518	0	0	1	0	0	5	0	2	0	0	0	0.469	0.001	0	0
				519	0	0	11,807	0	0	80,643	0	75,480	0	6,020	1.669	5,981.866	92.219	1.368	0.687
				521	0	0	574	0	0	4,348	0	29	0	41	1.498	466.079	0.104	0.008	0.110
				524	0	0	605	0	0	1,153	0	0	0	90	0.753	415.134	0.000	0.003	0.131
		TRW	summer	509	735	1,622	295,475	4,425	51	133,737	1	4,055	22	14,182	1,698.913	1,848.522	30.688	1,381.111	988.363
				513	3	6	26,135	3,658	0	74,677	0	1,708	0	837	373.436	620.907	0.187	209.624	107.563
				514	2	1	1,026	29	0	783	3	0	0	53	9.273	12.119	0	0	5.996
				516	0	0	433	1	0	167	0	0	0	19	1.273	6.953	0.431	1.589	1.431
				517	342	450	365,187	1,175	0	67,553	7	4,822	959	12,057	1,250.879	2,679.404	572.995	1,676.978	213.867
				519	162	149	229,014	754	0	77,545	0	953	1,364	28,684	752.374	2,062.901	1,627.419	817.052	142.508
				521	10	85	75,186	582	0	27,161	0	551	117	760	441.945	571.673	14.446	253.497	293.979
				524	1	0	7,841	229	0	9,905	0	0	0	428	193.176	250.841	0.000	16.108	316.104
			winter	509	1,493	180	586,648	916	45	350,964	0	13,524	439	76,840	4,624.181	17,712.300	26.308	222.013	4,646.486
				513	4	5	5,146	17	0	7,498	0	0	0	150	47.451	83.299	0	3.742	32.641
				514	0	0	0	0	0	1,475	0	0	0	44	7.462	5.448	0	0	1.415
				516	0	0	1,415	1	0	1,236	0	0	0	22	13.006	9.909	0	1.480	19.298
				517	551	90	435,608	110	0	112,664	0	6,315	196	22,008	1,016.562	7,414.756	166.984	474.096	255.093
				519	232	13	63,945	104	0	68,772	0	1,928	23	2,633	150.207	994.473	492.360	228.629	35.086
				521	153	30	16,404	91	0	14,649	27	1,529	3	655	151.090	355.827	0.003	137.131	38.000
				523	10	0	259	0	0	0	0	0	0	6	1.556	0.373	0	1.359	0.013
				524	5	0	416	2	0	3,395	0	0	3	0	7.671	19.866	0	1.781	8.656
	Flatfish	HAL	summer	513	0	0	1,373	0	0	2	0	76	0	0	0	1.005	0	0	0
				514	0	0	876	0	0	1	0	12	0	0	0.001	0.289	0.004	0.076	0.002
				517	0	0	22,317	0	0	38	0	1	0	844	0.009	1.710	0	15.553	0
				518	0	0	72,106	0	0	149	0	43	0	292	0.016	22.269	0.004	10.832	0.104
				519	0	0	11,362	0	0	42	0	18	0	5	1.183	3.831	0.005	1.998	0.006
				521	3	32	72,975	0	0	65	0	114	0	458	1.457	23.988	0.006	81.902	0.007
				523	7	13	46,382	0	0	45	0	13	0	588	0.065	3.325	0	45.547	0.001
				524	0	0	25,010	0	0	189	0	22	0	58	0.023	6.375	0.009	4.707	0.081
			winter	517	0	0	10,616	0	0	43	0	1	0	6	0.011	0.748	0	2.421	0
				518	0	0	5,875	0	0	7	0	0	0	2	0	0.515	0	1.016	0
				519	0	0	4,683	0	0	2	0	0	0	1	0	0.452	0	0.088	0
				521	0	0	6,018	0	0	7	0	0	0	0	0.005	0	0	0.996	0
				523	0	0	618	0	0	0	0	0	0	0	0.002	0	0	0.817	0

			524	0	0	0	0	0	11	0	0	0	0	0	2.078	0	0.073	0
	POT	summer	517	0	0	25	0	0	0	0	0	0	0	0	0	0	0.029	0
			521	0	0	28	0	0	0	0	2	0	0	0.004	0	0	0.065	0
			523	0	0	56	0	0	0	0	0	0	0	0	0.233	0	0.041	0
	TRW	summer	509	70	38	76,886	161	8	26,341	20	1,247	11	2,903	337.578	326.910	0.631	312.075	629.151
			512	1	1	915	10	0	112	0	0	0	52	22.736	5.390	0	6.118	2.291
			513	41	383	223,305	16,633	0	305,040	74	1,513	593	30,414	4,141.104	1,785.674	3.113	997.567	1,537.330
			514	82	111	339,444	19,833	95	269,658	1,380	0	2	21,041	1,435.833	822.926	0.024	44.557	6,592.662
			516	2	0	456	5	0	306	0	0	0	27	17.789	0.739	0	2.268	2.819
			517	109	93	103,862	452	2	23,062	9	1,232	8,628	13,871	618.695	166.997	97.817	1,115.558	83.488
			519	106	16	63,450	69	0	34,473	1	116	3,903	4,986	152.318	92.718	215.191	329.740	32.949
			521	2	827	168,303	1,301	0	136,207	0	1,537	129	4,291	1,267.210	772.847	0.009	1,052.742	662.107
			524	0	1	26,904	2,847	0	13,158	40	262	1	3,919	763.321	449.313	0.065	270.519	577.254
		winter	509	380	0	689,241	14,682	9	217,116	0	16,246	0	15,149	6,617.510	3,491.967	6.448	278.749	11,270.519
			513	159	2	214,238	2,937	0	107,419	73	349	9	18,311	3,758.463	874.128	0.061	103.995	1,374.997
			514	0	0	12,304	4,352	0	66,440	75	0	0	5,369	782.824	312.708	0	1.022	824.860
			516	67	0	160,983	11	2	48,427	0	1,181	0	2,699	1,233.097	986.564	13.889	62.503	6,411.023
			517	1,312	6	91,953	51	0	8,590	8	3,188	3,010	4,193	169.043	142.899	9.017	1,005.692	119.107
			518	0	0	0	0	0	0	0	0	0	0	0.064	0	0	0.038	0
			519	69	2	30,229	25	0	15,782	0	107	710	3,352	76.092	47.945	111.966	292.713	10.278
			521	144	53	157,316	1,630	0	77,796	1	3,960	15	3,052	903.527	798.743	0.021	503.589	833.780
			524	12	0	6,103	2,893	0	77,168	5	42	0	6,078	527.608	307.143	0.002	41.755	355.291
Pollock	TRW	summer	509	446	22,446	767	46,264	0	1,169	5	2,638	3,731	108	43,919.291	149.639	26.861	20.607	1.097
			513	66	1,742	304	8,017	0	1,043	0	13	69	1,391	16,023.372	45.254	0.232	10.853	3.306
														2.311	0.591	1.963	0.196	0.039
			516	2	33	5	78	0	315	0	2	0	7	1,317.933	2.585	0.002	0.154	0.426
			517	4,614	270,809	15,540	475,528	0	7,437	96	373	328,566	21,035	302,705.177	612.350	280.085	213.633	8.669
			518	0	0	0	0	0	0	0	0	10	0	0	0.086	0	0.019	0
			519	710	17,102	13,483	169,561	0	3,088	0	56	325,124	4,272	33,724.223	40.546	339.470	48.636	1.833
			521	3,849	57,558	12,478	97,931	0	15,225	0	477	19,174	8,439	377,087.726	737.818	5.247	81.203	4.545
			523	184	2,899	282	360	0	53	0	34	647	33	5,398.481	13.700	0.207	1.006	0.043
			524	229	6,202	190	6,550	0	1,922	0	15	8	667	19,334.133	79.922	0.003	23.310	0.504
		winter	509	12,356	978	29,794	3,052	0	23,982	0	647	482	27,721	262,370.917	2,486.868	12.517	84.042	872.481
			512	2	7	4	42	0	1	0	0	0	4	58.759	0.129	0.000	0.000	0.115
			513	2,165	807	8,035	40,079	0	10,858	0	30	821	10,064	70,296.791	461.980	0.283	21.504	295.954
														3.926	3.328	0.000	0.554	1.624
			516	210	35	1,052	200	0	3,409	0	0	10	1,226	17,510.777	61.219	0.012	1.178	147.867
			517	20,526	42,185	12,330	31,941	0	8,668	53	97	250,270	19,277	150,482.440	1,305.784	26.886	89.817	156.895
			519	2,965	7,632	4,291	93	0	1,097	0	28	77,366	2,207	12,350.941	10.845	135.693	24.916	1.156
			521	4,770	7,595	5,489	2,238	0	27,754	4	217	17,574	18,133	124,708.017	578.650	0.605	17.556	203.363
			523	599	1,318	47	449	0	50	0	0	118	82	870.702	3.688	0.326	0.204	0.000
			524	121	1,191	4	5,561	0	221	54	2	55	1,723	7,418.326	11.395	0.011	3.585	0.024
Rockfish	HAL	summer	513	0	0	42	0	0	0	0	0	0	0	0	0	0	0.212	0
			518	0	0	65	0	0	0	0	0	0	0	0	0	0	0.025	0
			519	0	2	13	0	0	2	0	0	0	0	0	0.008	0	0.057	0
			523	0	0	0	0	0	0	0	0	0	1	0.012	0.005	0	0.039	0.001
	TRW	summer	508	0	0	336	0	0	57	0	0	3	72	0.308	4.504	0	0.254	0.566
			517	0	0	283	0	0	6	0	0	321	116	7.137	2.386	0	11.404	0.021
			518	0	0	117	0	0	0	0	0	0	0	8.026	0	0	0.473	0
			519											0.020	0	0	0.219	0
		winter	517	0	0	621	0	0	16	0	0	52	1	0.151	0	0	4.580	0.405
Sablefish	HAL	summer	508	0	0	138	0	0	0	0	0	0	1					
			517	0	0	1,804	0	0	0	0	0	0	14	0	0.340	0	0.866	0
			518	0	1	11,769	0	0	2	0	0	0	94	0.005	1.052	0	2.160	0
			519	0	0	2,702	0	0	0	0	0	0	22	0.013	0.059	0	3.524	0
			521	0	0	315	0	0	0	0	0	0	3	0	0	0	0.041	0
			523	0	0	34	0	0	0	0	0	0	0					
		winter	508	0	0	195	0	0	0	0	0	0	2	0	0	0	0.446	0
			517	0	0	1,252	0	0	3	0	0	0	0	0.070	0.334	0	0.428	0
			518	0	0	1,254	0	0	0	0	0	0	10	0	0	0	0.035	0
			519	0	0	1,651	0	0	3	0	0	0	26	0	0	0	0.011	0
			521	0	0	17	0	0	0	0	0	0	0	0	0.010	0	0	0
	POT	summer	517	0	0	170	0	0	3	0	0	0	1	0.001	0.038	0	0.709	0.045
			518	0	0	4,562	0	0	1	0	34	0	53	0.010	0.005	0	13.812	0
			519	0	0	3,257	0	0	7	0	1,386	0	69	0.058	0.403	0	16.765	0
		winter	517	0	0	293	0	0	1	0	0	0	4	0.001	0.007	0	2.514	0
			518	0	0	740	0	0	0	0	23	0	24	0.013	0.053	0.002	6.181	0
			519	0	0	1,463	0	0	22	0	82	0	118	0.273	1.434	0.165	20.189	0.001
	TRW	summer	519	0	0	1,005	211	0	194	0	0	80	1	10.911	1.137	1.267	10.037	0.368
		winter	521	0	0	137	44	0	40	0	0	0	0	5.667	0.000	0.000	0.167	0.000

					Prohibited species				NonTarget species						Target species				
Three year average bycatch estimates 2003-2005					NUMBERS	NUMBERS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	KILOGRAMS	TONS	TONS	TONS	TONS	TONS
Region	Fishery	Gear	SSL_Seas	Area	Chinook	Other salmon	Pacific halibut	Pacific herring	Sand lance	Large Sculpins	Capelin	Octopus	Squid	Misc fish	Pollock	P. cod	Atka mack.	Arrowtooth	Rock Sole
GOA	Cod	HAL	summer	Shumagin (Western GOA) 61	2	0	195,900	0	0	7,966	0	146	0	277	0.113	580.893	1.379	18.353	0.8115
				Chirikof (Central GOA) 620	0	0	5,660	0	0	228	0	30	0	36	0.100	82.594	0	0.159	0
				Kodiak (Central GOA) 63	1	0	164,550	0	0	7,573	0	19	0	459	0.159	884.108	0	0.002	0
				Yakutat (Eastern GOA) 64	0	0	203	0	0	9	0	0	0	2	0	1.119	0	0.000	0
				Prince William Sound 64	0	0	3	0	0	0	0	0	0	0	0	0.008	0	0.000	0
				Southeast Outside 6	0	0	56	0	0	2	0	0	0	0	0	0.271	0	0.000	0
				Southeast Inside 6	0	0	1,554	0	0	72	0	0	0	6	0	5.803	0	0.028	0
			winter	Shumagin (Western GOA) 61	1	2	448,230	0	0	18,171	0	453	563	3,461	5.150	3,223.670	0.936	13.478	0.54
				Chirikof (Central GOA) 620	0	0	123,123	0	0	3,999	0	292	0	558	1.776	1,300.209	0.001	1.881	0.3965
				Kodiak (Central GOA) 63	1	1	798,926	0	0	36,704	0	5,014	2,946	1,596	21.902	5,127.332	0.003	19.086	0.029
				Yakutat (Eastern GOA) 64	0	0	4	0	0	0	0	0	0	0	0	0.019	0	0.000	0
				Prince William Sound 64	0	0	67	0	0	3	0	0	0	0	0	0.370	0	0.000	0
				Southeast Outside 6	0	0	7,374	0	0	375	0	2	0	36	0.003	35.925	0	0.001	0
				Southeast Inside 6	0	0	3,149	0	0	148	0	30	0	21	0.009	17.078	0	0.010	0
		POT	summer	Shumagin (Western GOA) 61	0	0	27,648	0	0	6,173	0	44,654	82	5,215	0.097	2,115.636	6.874	0.740	0.002
				Chirikof (Central GOA) 620	0	0	3,082	0	0	2,014	0	305	0	1,010	0.022	320.561	0.136	0.025	0
				Kodiak (Central GOA) 63	0	0	25,145	0	0	601	0	3,716	0	13,318	0.003	497.495	0.434	0.164	0.012
			winter	Shumagin (Western GOA) 61	0	0	50,774	0	0	78,870	0	80,674	1	15,477	3.146	11,437.270	5.679	0.119	0.02
				Chirikof (Central GOA) 620	0	0	26,709	0	0	14,972	0	6,992	0	8,882	1.471	3,339.019	0.395	0.080	0
				Kodiak (Central GOA) 63	0	0	33,450	0	0	39,692	0	54,250	6	16,254	3.867	5,837.250	0.674	0.831	0.0065
				Prince William Sound 64	0	0	87	0	0	1	0	16	0	3	0.000	7.576	0.005	0.000	0
		TRW	summer	Shumagin (Western GOA) 61	64	1	21,219	0	0	196	0	0	328	856	10.157	74.288	17.508	117.237	9.95
				Chirikof (Central GOA) 620	145	0	41,075	0	0	636	0	11	10	800	0.263	440.035	0	450.670	23.412
				Kodiak (Central GOA) 63	270	61	713,288	7	0	1,958	0	770	0	35,688	6.567	3,830.323	0.016	262.798	235.028
			winter	Shumagin (Western GOA) 61	86	2	98,442	1	0	31,434	0	1,288	730	4,006	31.146	2,436.308	0.994	38.718	4.1555
				Chirikof (Central GOA) 620	57	0	27,915	0	0	236	0	0	0	66	5.273	100.667	0	45.946	8.365
				Kodiak (Central GOA) 63	812	0	238,086	0	3	5,357	0	44	0	16,482	102.804	5,782.007	0.035	177.472	189.2215
	Flatfish	HAL	summer	Shumagin (Western GOA) 61	0	7	352,355	0	0	11,492	0	1,301	0	161	0.030	99.049	0.005	7.581	0.0365
				Chirikof (Central GOA) 620	1	2	115,597	0	0	698	0	266	0	53	0	22.606	0.001	1.376	0.004
				Kodiak (Central GOA) 63	0	15	579,692	0	0	3,326	0	1,208	0	574	0.001	32.272	0	2.754	0
				Yakutat (Eastern GOA) 64	0	2	86,681	0	0	1,077	0	122	0	71	0.002	1.912	0	0.174	0
				Prince William Sound 64	0	1	196,915	0	0	1,425	0	108	0	170	0	18.630	0	0.496	0
				Southeast Outside 6	0	4	250,082	0	0	2,586	0	735	0	335	0.011	8.257	0	1.790	0
				Southeast Inside 6	0	1	57,497	0	0	589	0	323	0	160	0	7.911	0	0.178	0
			winter	Shumagin (Western GOA) 61	0	0	142,833	0	0	1,615	0	45	0	29	0	46.825	0.001	3.693	0.0365
				Chirikof (Central GOA) 620	0	1	173,025	0	0	1,533	0	0	0	84	0.053	21.018	0.002	7.302	0.0265
				Kodiak (Central GOA) 63	0	3	609,704	0	0	2,592	0	0	0	307	0.208	23.659	0	9.022	0.0025
				Yakutat (Eastern GOA) 64	0	1	91,081	0	0	842	0	0	0	126	0	0.157	0	2.356	0
				Prince William Sound 64	0	0	2,889	0	0	34	0	0	0	2	0	0.068	0	0.012	0
				Southeast Outside 6	0	3	170,956	0	0	1,866	0	0	0	235	0	2.284	0	5.605	0
				Southeast Inside 6	0	0	35,375	0	0	351	0	0	0	72	0	6.188	0	0.935	0
		TRW	summer	Shumagin (Western GOA) 61	377	303	95,588	0	0	2,660	0	117	438	3,055	54.271	103.942	36.599	1,972.970	40.5725
				Chirikof (Central GOA) 620	594	266	243,287	7	0	17,407	1	39	601	10,517	14.289	439.402	3.895	2,786.093	420.778
				Kodiak (Central GOA) 63	203	1,727	473,120	27	0	51,598	7	1,883	68	10,022	96.291	606.567	0.547	2,164.888	1643.097
			winter	Shumagin (Western GOA) 61	1,399	109	134,754	0	0	4,722	0	76	650	2,973	58.146	194.740	24.992	1,955.845	14.497
				Chirikof (Central GOA) 620	292	87	182,106	2	0	3,211	0	84	183	2,885	17.404	204.701	0.771	1,550.321	57.7895
				Kodiak (Central GOA) 63	1,255	284	657,342	47	1	50,062	23	3,080	1,045	18,476	267.907	847.923	0.733	6,762.755	446.2455
				Yakutat (Eastern GOA) 64	0	0	5,235	0	0	165	0	0	32	0	0.729	2.303	0.000	16.013	0.2905
	Pollock	TRW	summer	Shumagin (Western GOA) 61	357	1,331	258	0	0	0	0	0	3,566	232	7,525.296	19.767	0.295	31.764	0.036
				Chirikof (Central GOA) 620	319	216	248	1,772	0	0	8	0	605	1,425	1,822.405	8.692	0	33.309	0.281
				Kodiak (Central GOA) 63	797	456	3,805	31,674	0	0	12	0	432	674	3,819.982	33.642	0	190.775	2.942
			winter	Shumagin (Western GOA) 61	2,638	322	293	4,631	0	1	647	0	4,230	3,259	15,735.869	81.794	6.778	127.867	0.1375
				Chirikof (Central GOA) 620	4,098	60	4,402	57,992	1	27	24,601	2	252,302	13,295	22,196.461	92.650	0	279.278	0.784
				Kodiak (Central GOA) 63	6,883	182	5,877	4,508	0	0	38	17	4,518	4,713	10,912.667	140.487	0.059	659.122	1.367
				Yakutat (Eastern GOA) 64	186	36	23	456	0	0	130	0	476	280	1,010.631	0.042	0	4.471	0
				Prince William Sound 64	83	7	6	1,131	0	0	209	0	7,938	131	1,021.756	0.260	0	1.080	0
	Rockfish	HAL	summer	Shumagin (Western GOA) 61	0	0	152	0	0	0	0	0	0	0	0	0.019	0	0	0
				Chirikof (Central GOA) 620	0	0	1,531	0	0	0	0	0	0	0	0	0.145	0	0	0
				Kodiak (Central GOA) 63	0	0	814	0	0	0	0	0	0	42	0	3.910	0	0.069	0.0875
				Yakutat (Eastern GOA) 64	0	0	1,083	0	0	0	0	0	0	0	0	0.042	0	0	0
				Prince William Sound 64	0	0	254	0	0	0	0	0	0	0	0	0.017	0	0	0
				Southeast Outside 6	0	0	4,677	0	0	0	0	0	0	0	0	0.518	0	0	0
				Southeast Inside 6	0	0	2,796	0	0	0	0	0	0	0	0	1.145	0	0	0

			winter	Shumagin (Western GOA) 61	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
				Chirikof (Central GOA) 620	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
				Kodiak (Central GOA) 63	0	0	853	0	0	0	0	0	0	0	0	0.385	0	0	0
				Yakutat (Eastern GOA) 64	0	0	120	0	0	0	0	0	0	0	0	0	0	0	0
				Prince William Sound 64	0	0	52	0	0	0	0	0	0	0	0	0.103	0	0	0
				Southeast Outside 65	0	0	16,889	0	0	0	0	0	0	0	0	5.202	0	0	0
				Southeast Inside 6	0	0	4,683	0	0	0	0	0	0	0	0	2.393	0	0	0
		TRW	summer	Shumagin (Western GOA) 61	0	0	44,274	0	0	7,585	0	18	2,966	15,394	183.513	86.991	378.915	169.107	11.3965
				Chirikof (Central GOA) 620	0	37	34,283	0	0	2,976	0	298	2,604	41,224	6.027	55.844	178.596	152.859	0.9
				Kodiak (Central GOA) 63	722	1,943	313,288	0	0	9,214	0	108	787	61,349	117.318	1,307.271	9.319	1,037.390	52.072
				Yakutat (Eastern GOA) 64	42	179	6,735	0	0	91	0	0	817	6,813	4.488	0.107	0	7.388	0
			winter	Shumagin (Western GOA) 61	0	0	9,560	0	0	0	0	0	333	1,530	0.530	7.444	53.286	11.436	0
				Chirikof (Central GOA) 620	0	0	1	0	0	0	0	0	17	0	0.137	0	0	0.052	0
	Sablefish	HAL	summer	Shumagin (Western GOA) 61	0	19	163,024	0	0	4,580	0	110	56	433	1.020	32.314	0.017	51.652	0
				Chirikof (Central GOA) 620	0	6	66,467	0	0	424	0	10	14	164	0.001	0.975	0	4.316	0
				Kodiak (Central GOA) 63	0	77	642,594	0	0	97	0	614	1,160	3,511	0.041	15.766	0	52.548	0
				Yakutat (Eastern GOA) 64	2	33	72,007	0	0	24	0	7	0	349	0.010	1.482	0	8.053	0
				Prince William Sound 64	0	0	4,180	0	0	9	0	1	5	31	0	0.122	0	0.433	0
				Southeast Outside 65	1	12	181,823	0	0	200	0	41	0	3,043	0.012	4.217	0	19.100	0
				Southeast Inside 6	1	12	108,071	0	0	186	0	13	17	758	0.004	3.685	0	10.296	0
			winter	Shumagin (Western GOA) 61	0	2	126,103	0	0	293	0	62	0	723	0.430	14.974	0.004	67.571	0
				Chirikof (Central GOA) 620	0	0	52,382	0	0	13	0	4	1	76	0.010	1.554	0	5.944	0
				Kodiak (Central GOA) 63	0	5	400,215	0	0	127	0	172	16	669	0.001	5.333	0	14.737	0
				Yakutat (Eastern GOA) 64	0	2	56,458	0	0	38	0	0	0	302	0	0.411	0	3.338	0
				Prince William Sound 64	0	0	2,296	0	0	3	0	3	0	14	0	0.032	0	0.091	0
				Southeast Outside 65	0	4	161,575	0	0	18	0	5	0	5,834	0.026	1.246	0	10.156	0
				Southeast Inside 6	0	4	40,500	0	0	84	0	0	0	280	0	1.006	0	6.748	0
		TRW	summer	Kodiak (Central GOA) 63	0	0	122	0	0	0	0	0	0	16	0	0.660	0	4.000	0
				Yakutat (Eastern GOA) 64	0	0	614	0	0	0	0	0	65	50	0	0	0	3.205	0
			winter	Kodiak (Central GOA) 63	0	0	0	0	0	0	0	0	0	0	0.314	0	0	2.351	0