

A large group of Steller sea lions is shown resting on a rocky shore. The sea lions are of various sizes and are looking in different directions. The background is a dark, out-of-focus forest.

Steller Sea Lion Mitigation Committee Proposal Ranking Tool

Update!
NPFMC
October 2006

Kristin Mabry, NOAA Fisheries Analytical Team
Bill Wilson, NPFMC Protected Resources Coordinator
Larry Cotter, Chair, NPFMC Steller Sea Lion Mitigation Committee

SSLMC Proposal Ranking Tool

Outline of Presentation

- 'The Big Picture'
- Development and scope of PRT
- Model variables
- Model structure
- SSC Review Comments
- Remaining questions
- Next steps and considerations
- If time and interest, some model results

Revisions to SSL Protection Measures

SSLMC Proposal Ranking Tool (PRT)

- Spatially and temporally explicit model
- Built with Analytic Hierarchy Process
- Based on SSLMC Expert Judgment and data

Other considerations

- Anthropogenic effects
- Bycatch
- Economic Issues
- Safety
- Fisheries Management
- Jeopardy/Adverse modification determination

SSLMC Proposal Ranking Tool Development

SSLMC receives latest SSL and fisheries research updates

- April 28-30, May 16-18, June 26-29, August 28-30
- Updated NPFMC in June

SSC recommends course of action at June NPFMC meeting

*“The SSC or some other peer review body should review the tradeoff tool before it is used to inform Council decision-making... One of the challenges of devising a tradeoff tool is that the tradeoffs involve **different criteria measured in different ways** that cannot be easily subsumed into a unified criterion or ranked in terms of absolute importance. The SSC has previously commented on the **logical inconsistencies of summing scores across dissimilar criteria**. The SSC notes that there are a variety of decision-making analytic tools that are specifically designed to evaluate the performance of alternatives in the context of multiple dissimilar criteria. We suggest that tests for outcome, event, and stochastic dominance could serve as appropriate measures for ranking alternatives. In addition, the SSC notes that there are a variety of decision analytic methodologies that could be used to elicit implicit weighted rankings of plural criteria. The **analytic hierarchy process (AHP)**, is one such methodology for reducing complex multiple criterion decisions to an internally consistent set of pairwise comparisons and could serve as a useful approach to assess tradeoffs.”*

SSLMC Proposal Ranking Tool

Development - continued

SSLMC develops PRT using AHP methodology

- **June 26-29 and July 25-28**

SSC reviews PRT at special meeting Aug 15-16

SSC Recommendations and SSLMC responses later in this presentation

SSLMC revises PRT

- **Aug 28-30 and Sept 12-13**

SSC and Council review of revised PRT

- **Oct 2-10**

SSLMC fine-tunes PRT and scores proposals

- **Oct 16-18 and Oct 30 – Nov 1**

SSLMC Next steps – end of this presentation

SSLMC Proposal Ranking Tool

The SSLMC built a model that address 3 questions about how fisheries may interact with SSL

2 model dimensions

•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 current situation?

1st dimension - How fisheries affect the prey field

•To what extent are the SSL sensitive to fishing activity, in relation to proximity to a given site type, and the percentage of sites affected in the sub-region, by season?

2nd dimension - How fisheries affect SSL - proximity

•To what extent are the SSL sensitive to fishing activity, in relation to target species frequency of occurrence in SSL scat, by sub-region and season?

2nd dimension - How fisheries affect SSL - nutrition

Analytic Hierarchy Process

- **What is AHP?**

- A systems approach for thinking developed by Dr. Tom Saaty: examine parts of the whole system and their linkages
- A tool for integrating expert judgments

- **Why AHP?**

- Clearly & concisely communicates the problem
- Considers different points of view
- Encourages explicit statements of preference, importance
- Increases the likelihood of finding an optimal solution

- **How does it work?**

- Structures the problem into a hierarchy
- Prioritizes elements based on judgments

SSLMC Proposal Ranking Tool

Rating Scales

- 9 Extremely important**
- 7 Very strong**
- 5 Strong**
- 3 Moderate**
- 1 Slight**

The SSLMC used data when possible, either supplied by the NMFS-AFSC, found in the BiOp, or research reports.

Combining Judgments

- **Dissent & debate**
 - Explores alternative viewpoints
 - Debate can bring judgments closer through learning
 - Leads to understanding & cooperation
 - A well-informed person can effect change in belief !

- **When consensus is lacking:**
 - The geometric mean is the appropriate method for combining judgments made on a ratio scale
 - Disagreement is defined as differences in the rank order of importance. We also record the spread.

1st Dimension

How does fishing alter the Prey Field?



Variables include:

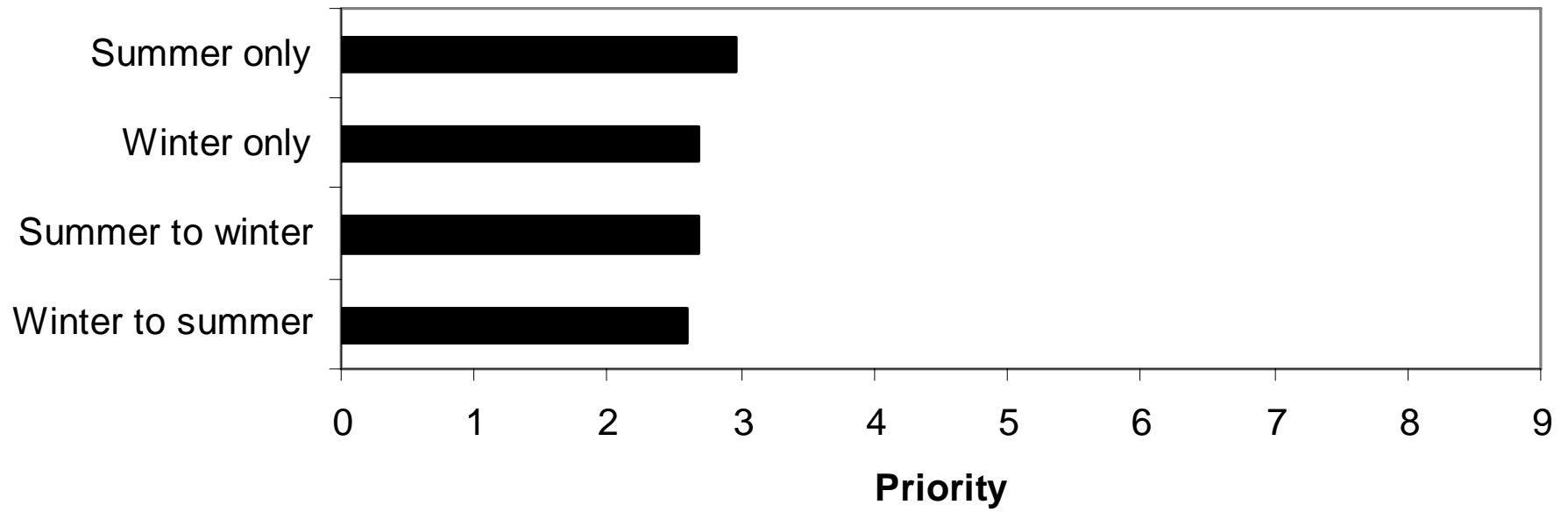
- *Season*
- *Target removals (% TAC)*
- *Duration of Fishery*

Season

Part of calendar year where fishing occurs

- Summer
 - roughly B and C fishing seasons
- Winter
 - roughly D and A fishing seasons
- Winter to Summer shift of fishing effort
- Summer to Winter shift of fishing effort

Remaining Question – Do we need to reconcile SSL seasons with fishing seasons?



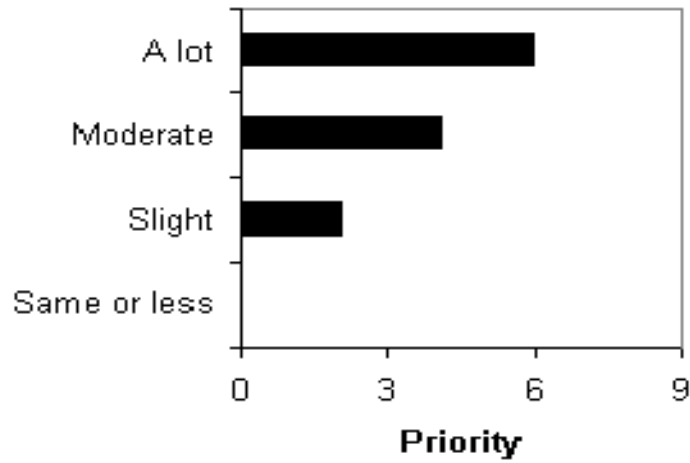
Target Species Removals (%TAC)

The percent TAC is defined as the sum of all sectors' seasonal TAC 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.

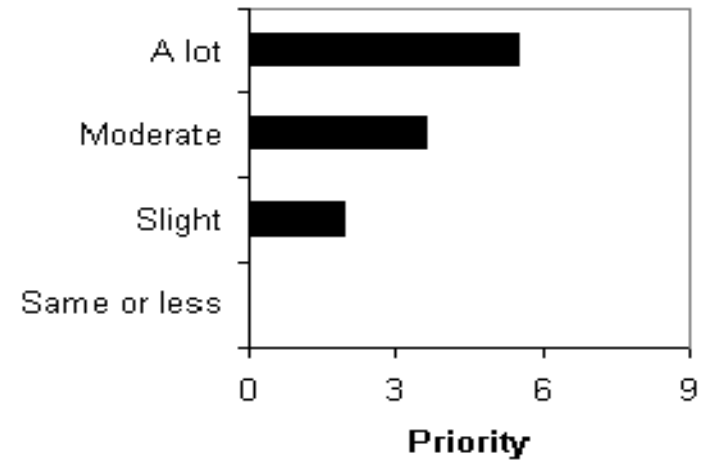
Page 11 of report.

- Slight increase (shift) in amount harvested
 - 1 to 5% of TAC
- Moderate increase (shift)
 - 6 to 10% of TAC
- Large increase (shift)
 - > 10% of TAC
- No change or a decrease (shift) in amount harvested

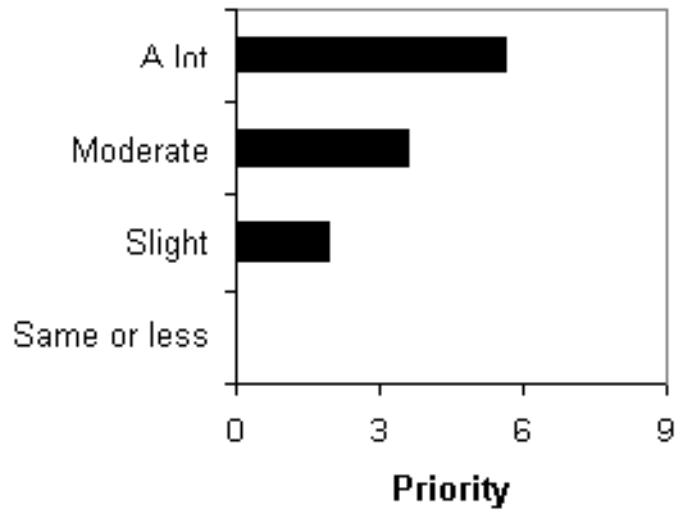
Winter to Summer



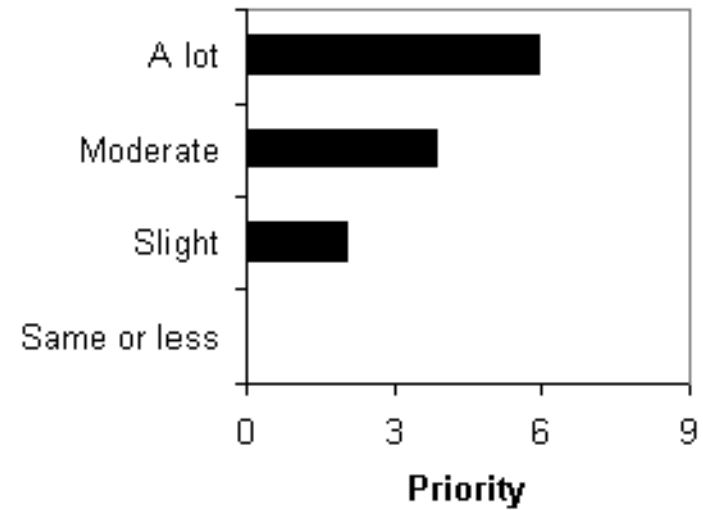
Summer to Winter



Winter Only



Summer Only

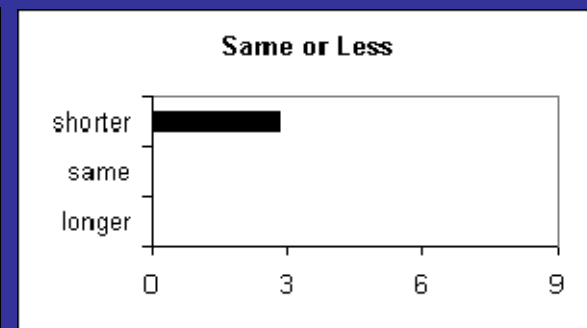
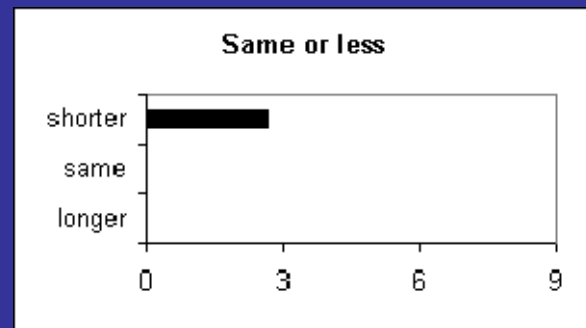
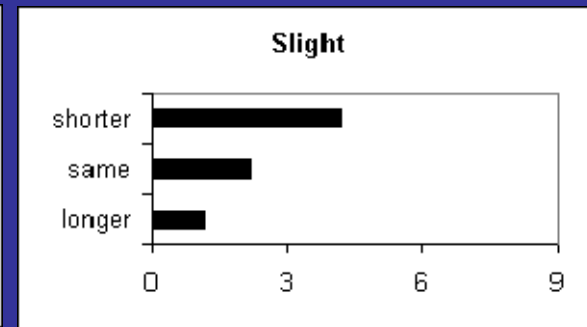
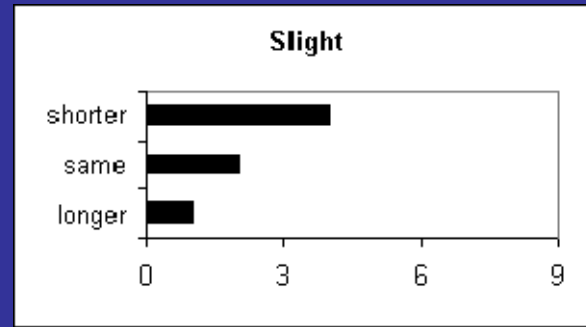
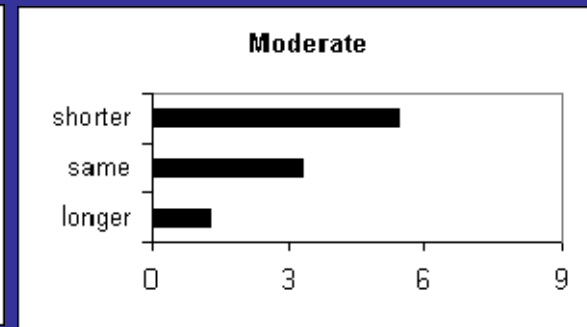
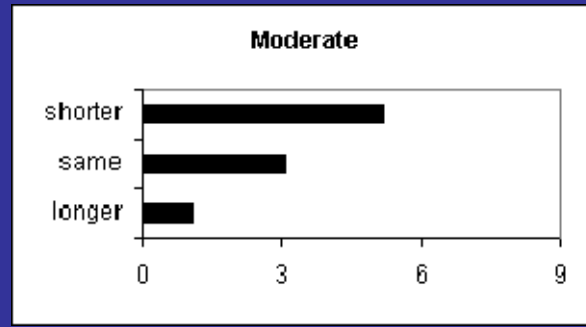
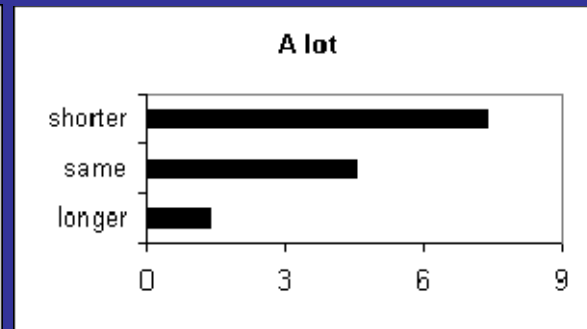
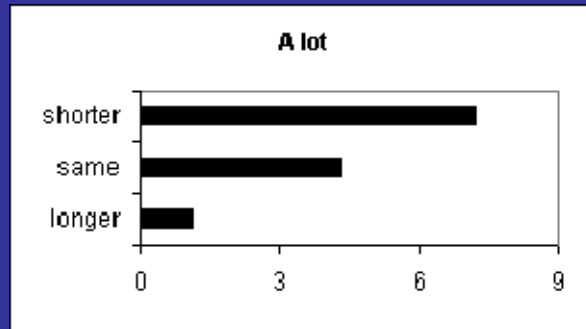


Duration

Length of the fishing season

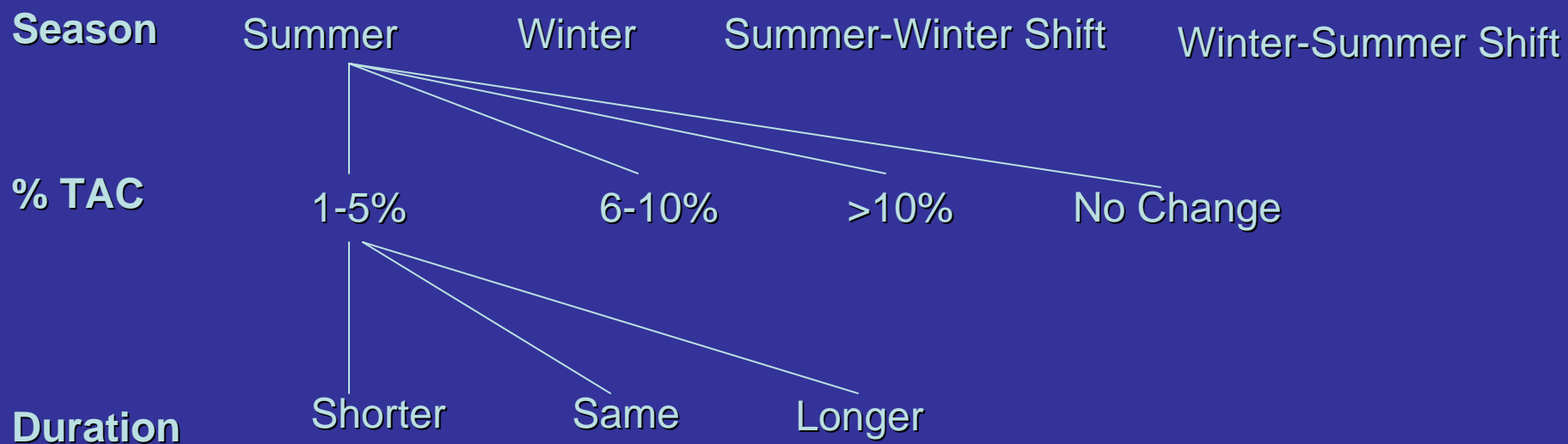
- Shorter fishing season relative to status quo
- Longer fishing season relative to status quo
- No change

Remaining question – Does this variable capture enough?
What about seasonal splits and temporal distribution?
What about 5-10 day shifts in the season start dates?



First Dimension - Effects of fishing on fish

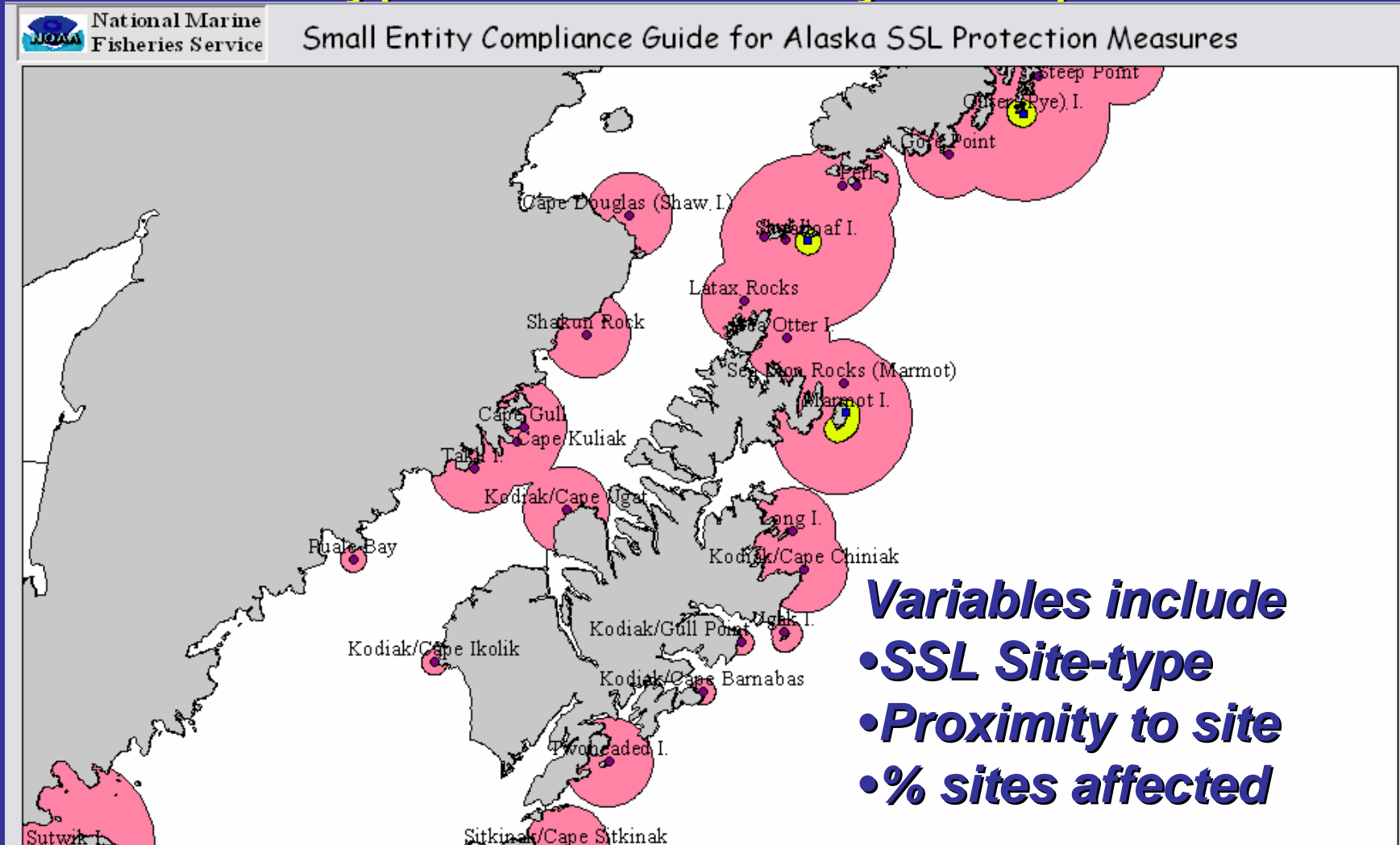
To what extent does fishing alter the (target) prey field by season, putting the percentage of removal and duration of removal in the context of the current situation?



48 possible bins

2nd Dimension – Part 1

How sensitive are SSL to fishing? Site Type and Proximity Component



Type of SSL Site

Definitions from NMML – refer to question 32

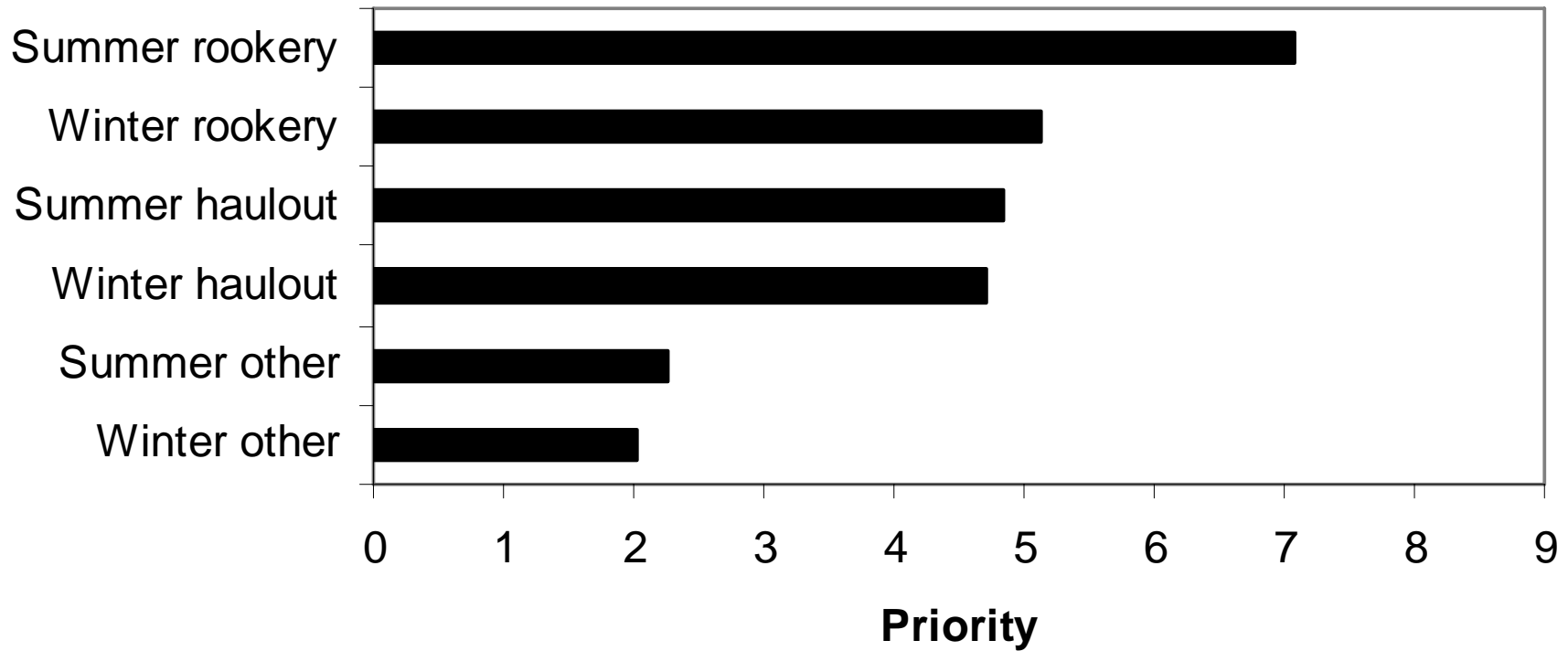
- **Summer Rookery** - >50 pups counted in at least one year since 1975 (39)
- **Summer Haulout** - >200 non-pups counted in at least one year since 1990 (47)
- **Summer Other** – site does not meet minimum number of observations in the summer to count as haulout or rookery since 1990, but is still critical habitat under ESA (>200 non-pups counted at least once)
- **Winter Rookery** – site is a rookery in summer and a haulout in winter (>100 non-pups counted in at least one year since 1990)
- **Winter Haulout** – >100 non-pups counted in at least one year since 1990 (92)
- **Winter Other** - site does not meet minimum number of observations in the winter to count as haulout since 1990, but is still critical habitat under ESA (>200 non-pups counted at least once)

Remaining questions

Protocol for multiple site types in one proposal?

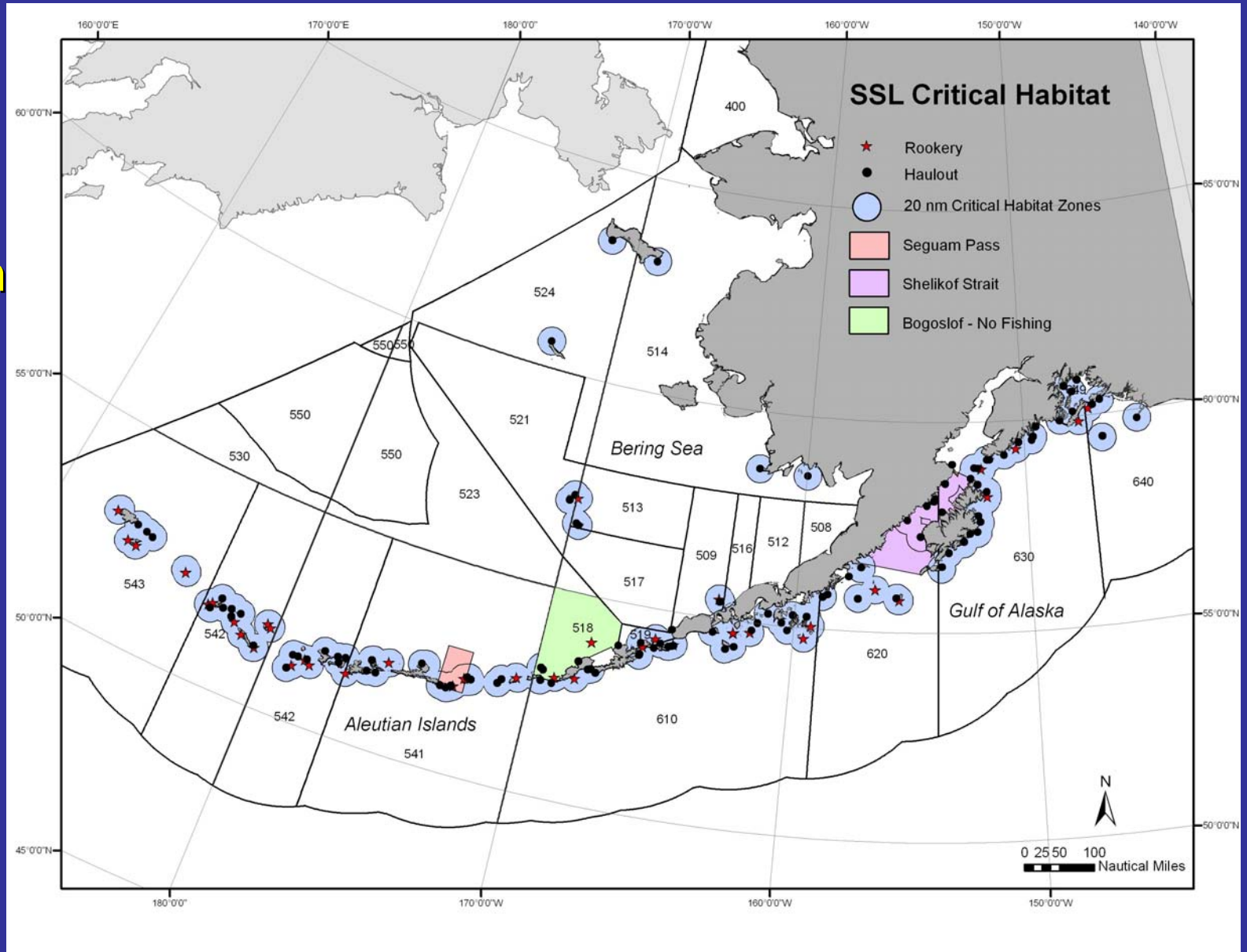
Are all sites equal within rookery and haulout groupings?

The Priority of SSL Site Type by Season

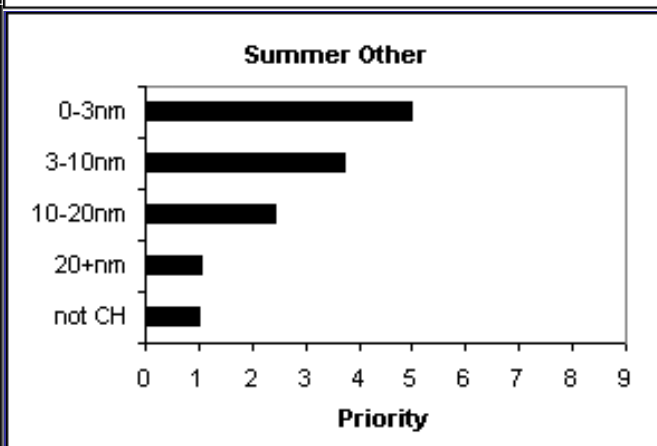
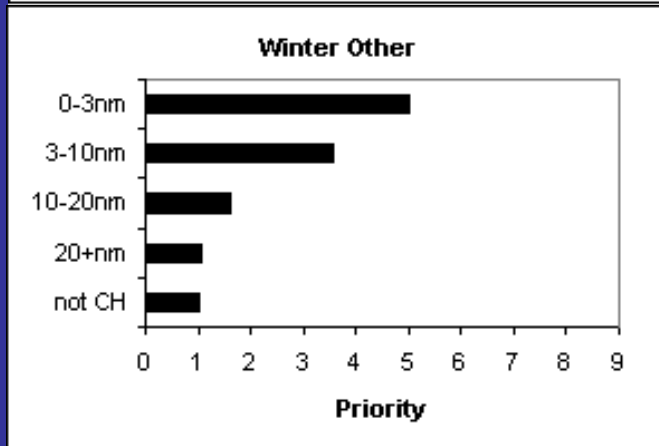
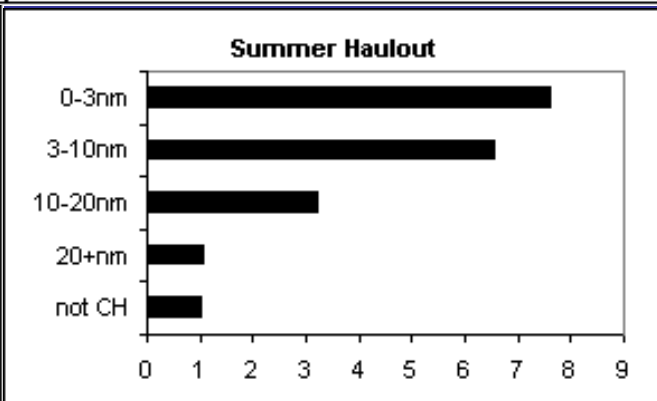
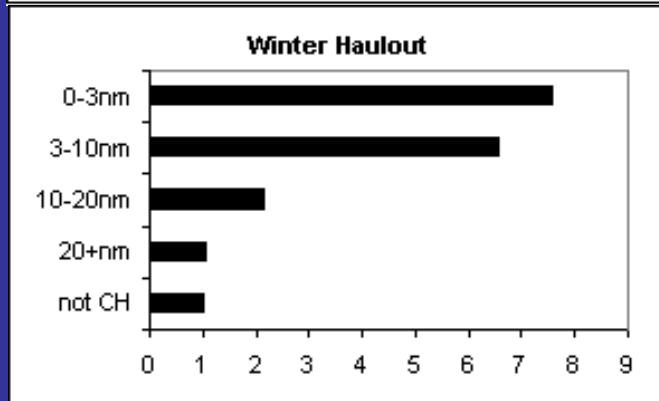
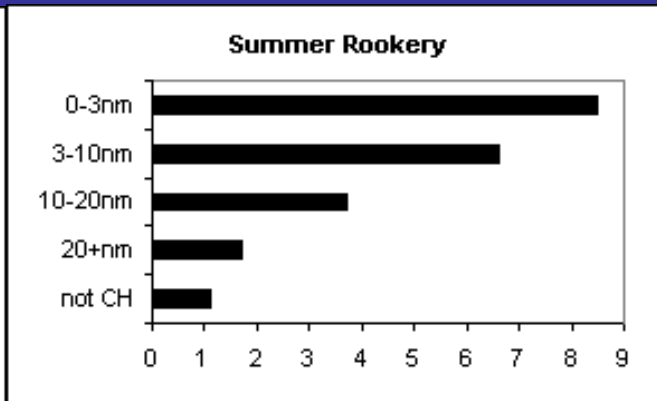
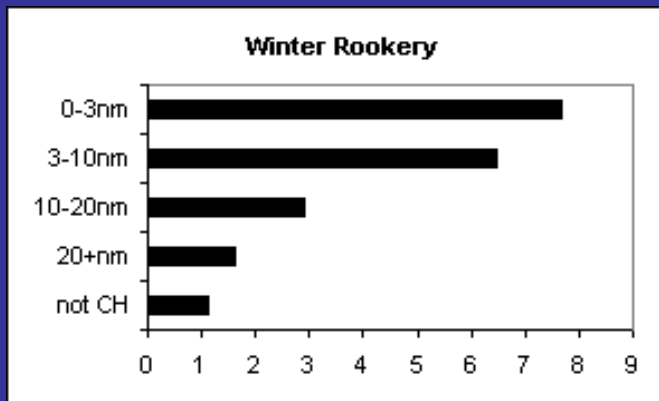


Proximity to SSL Sites

0-3nm
3-10nm
10-20nm
20+nm
Not CH



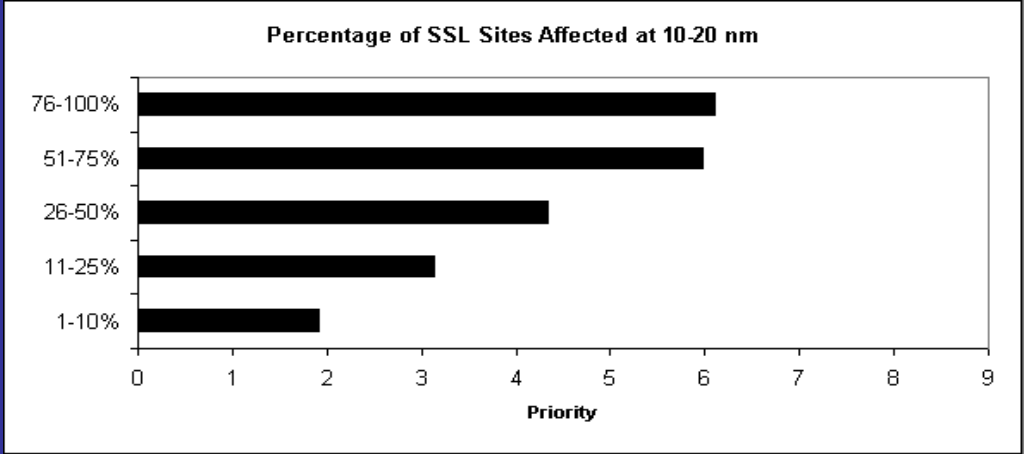
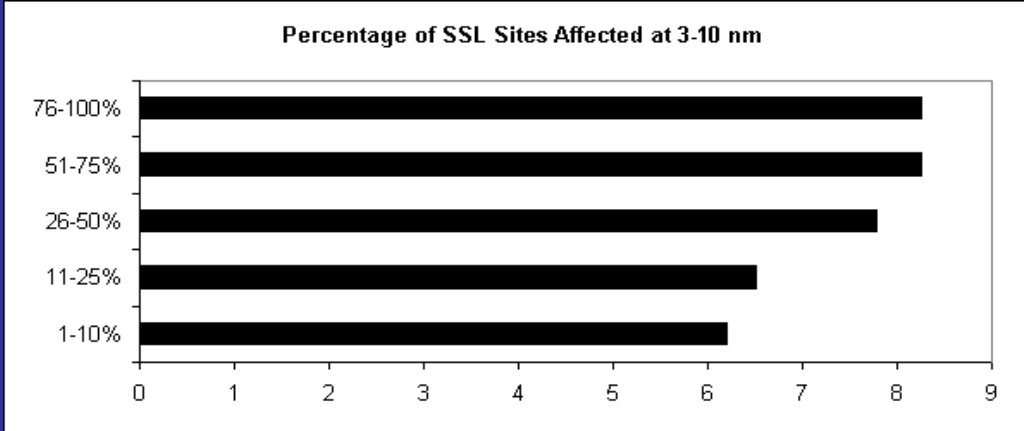
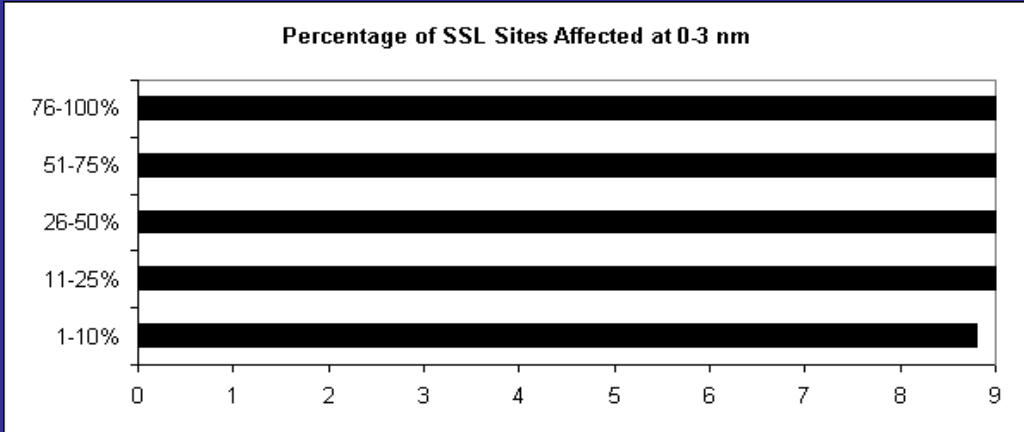
Oct 2006
SSLMC PRT



Percentage of Sites

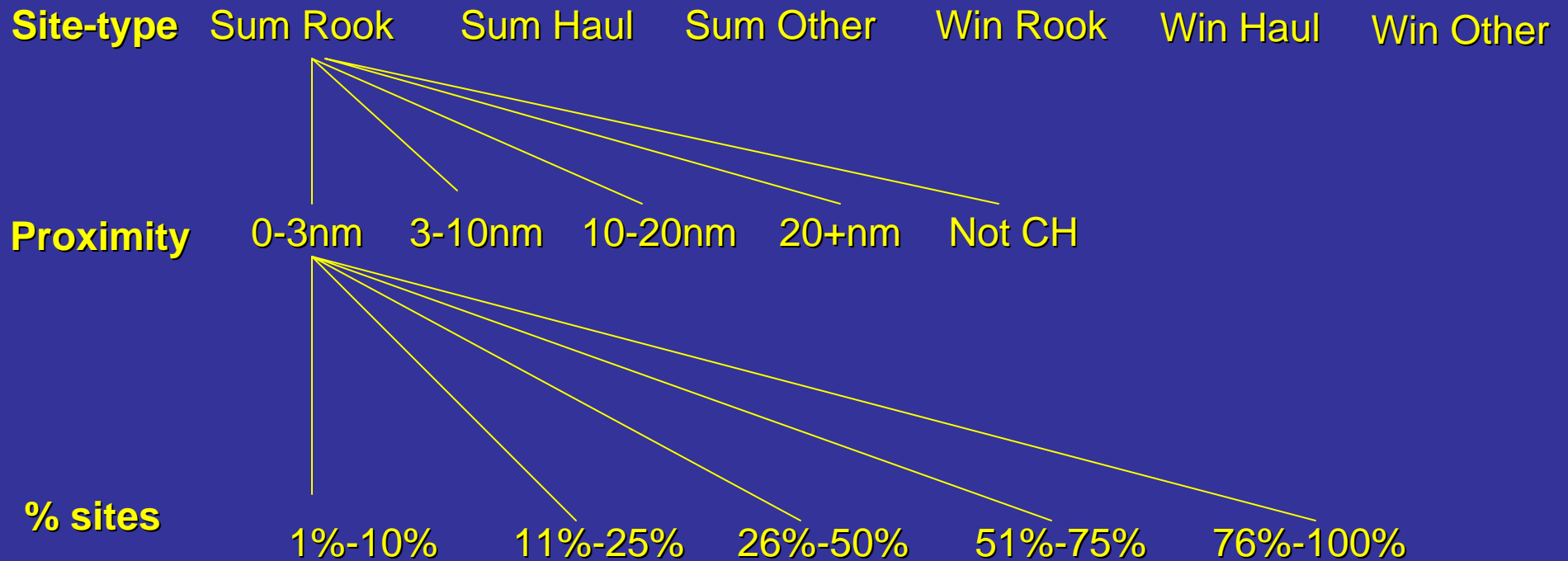
*Within each site-type and proximity grouping,
how many sites are affected?*

- 1-10%
- 11-25%
- 26-50%
- 51-75%
- 76-100%



Second Dimension - Effects of fishing on SSL - Proximity

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



102 possible bins

How sensitive are SSL to fishing? Prey composition component



Menu

Pollock
Pacific Cod
Atka Mackerel
Herring
Sand Lance
Octopus
Squid
Salmon
Snailfish

Variables include:

- *Season*
- *Sub-region*
- *Target species*

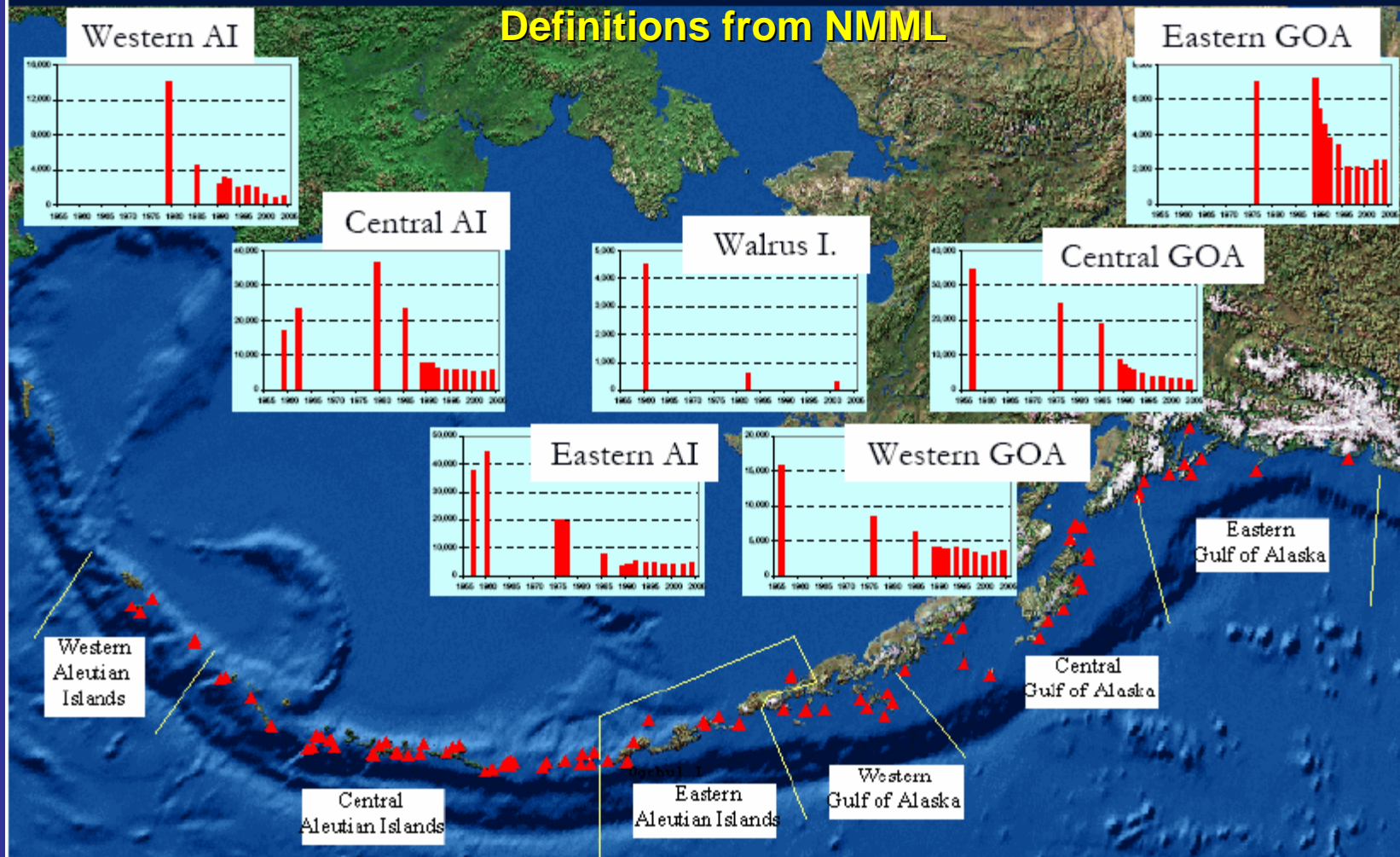
SSL Seasons

Definitions from NMML

- Summer (breeding)
May through September
- Winter (non-breeding)
October through April

Sub-Regions of WDPS

Western Steller Sea Lion **Non-Pup** Counts in Alaska 1955-2004



Remaining questions

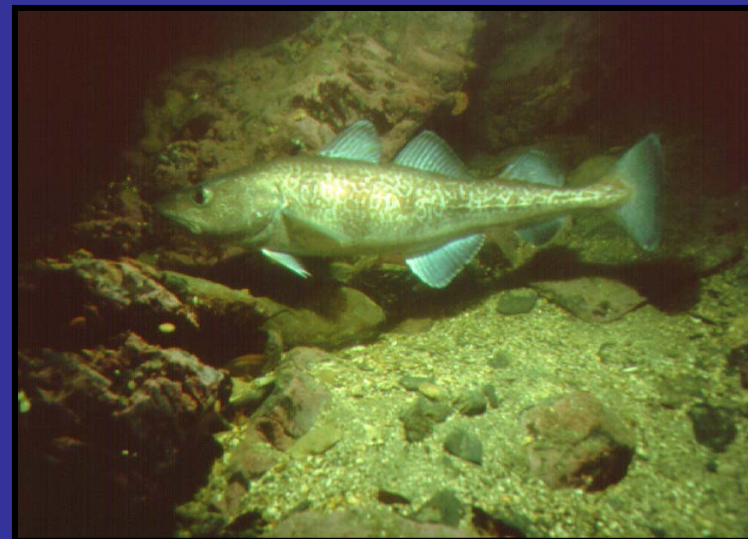
Currently, all regions weighted equally according to SSL recovery criteria (SSLRP p. 117).
Do we want to account for varying population trajectories and weight regions accordingly?

Target Species of Concern

Walleye Pollock
(*Theragra chalcogramma*)



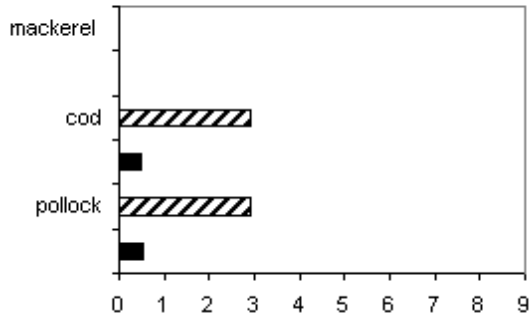
Pacific Cod
(*Gadus macrocephalus*)



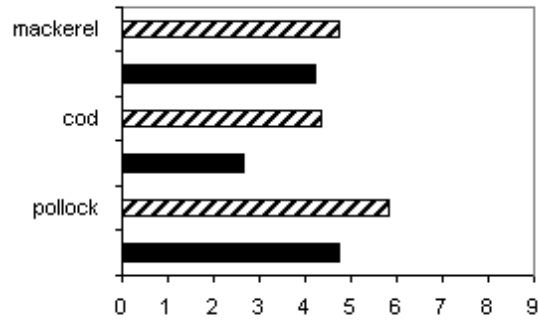
Atka Mackerel
(*Pleurogrammus monopterygius*)



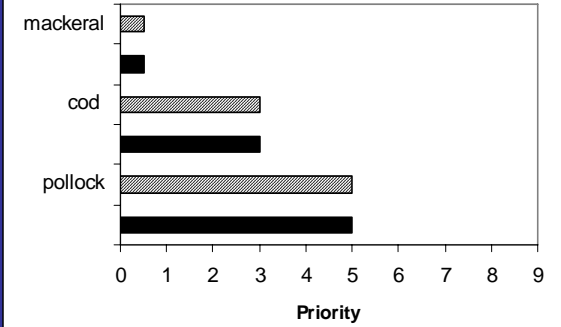
Eastern GOA



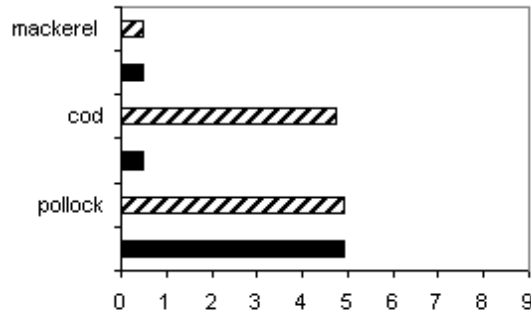
Eastern AI



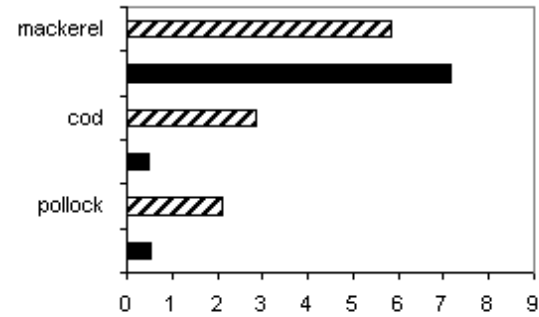
Pribilofs



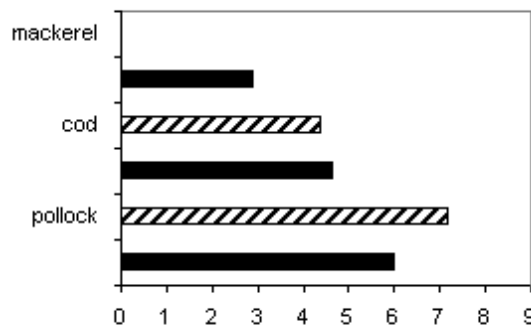
Central GOA



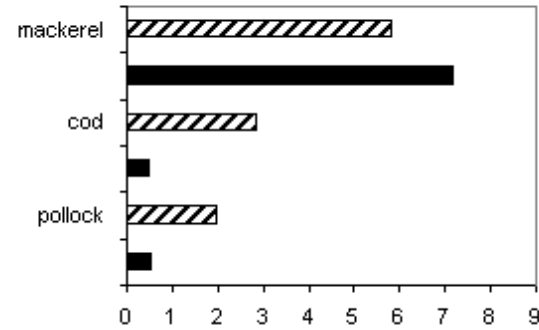
Central AI



Western GOA

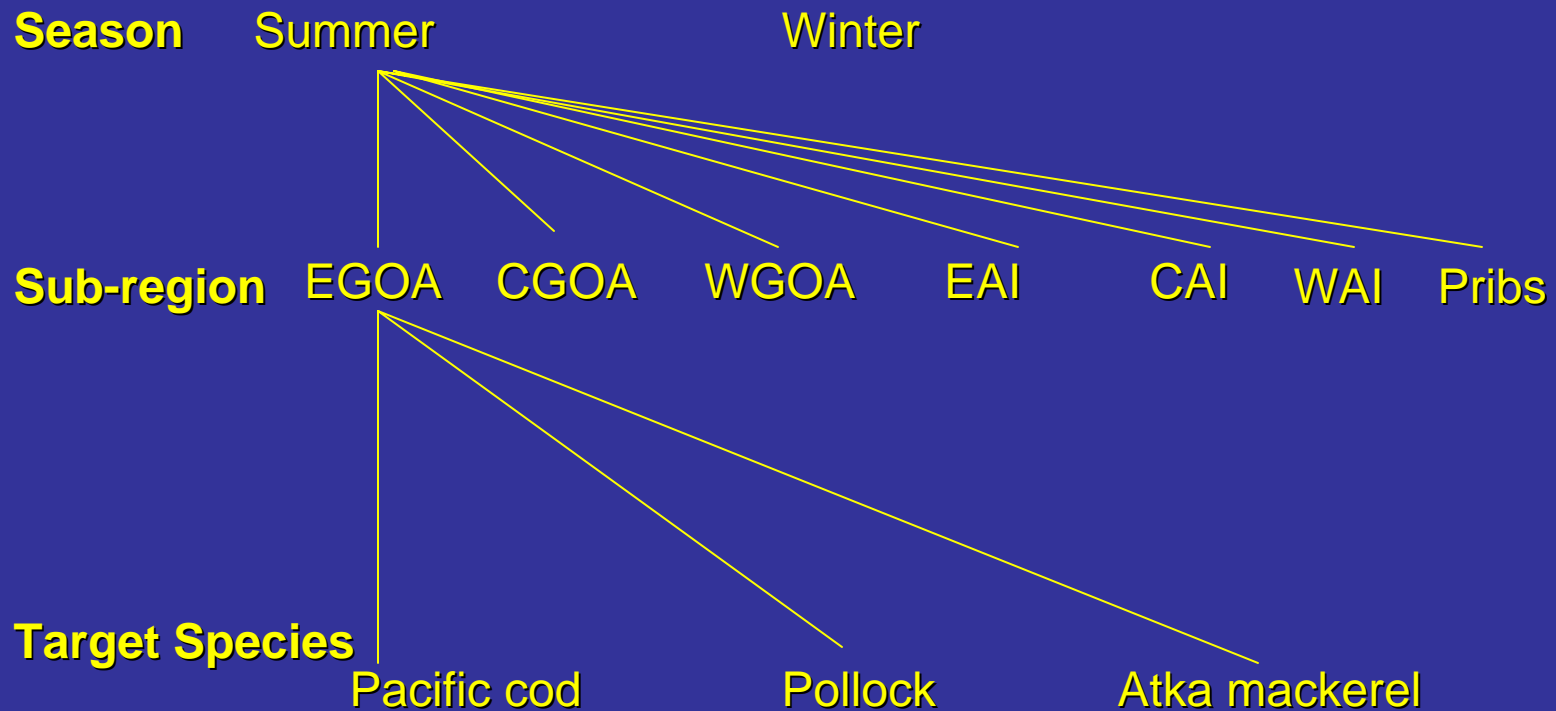


Western AI



Second Dimension - Effects of fishing on SSL - Nutrition

To what extent do the target species appear in the frequency of diet items of the SSL, by sub-region and season?



42 possible bins

Other Species in SSL Diet

Hot off the press from AFSC...

Tables of prohibited species, non-target species, and target species by fishery, by SSL season, by area

Data examples:

- An annual average of 2,500 MT of Pacific cod were taken in the pollock trawl fishery in the winter from 2003 – 2005 in area 509.
- An annual average of 1,700 MT of arrowtooth flounder were taken in the Pacific cod trawl fishery in the summer from 2003-2005 in area 517.
- An annual average of 20,526 Chinook salmon were taken in the pollock trawl fishery in the winter from 2003-2005 in area 517.
- An annual average of 475 MT of herring were taken in the pollock trawl fishery in the summer from 2003-2005 in area 517.

Remaining question - Do we use this data to inform the model, or use it separately to inform decision-making?

SSLMC Proposal Ranking Tool

Model Structure

PRT will tell us the relative impact of proposed changes in fishery regulations that pertain to SSL and their prey

The following analytic hierarchy was developed from the variables listed above.

The importance (and resulting model weight) of each variable was assigned based on judgments from members of the SSLMC and AFSC data and expertise.

SSLMC Proposal Ranking Tool

Effects of fishing on fish 0.250

Effects of fishing on SSL 0.750

How does fishing alter the prey field? 0.250

How sensitive are SSL to fishing? 0.643
spatial/temporal

How sensitive are SSL to fishing? 0.107
diet composition

Season Summer 0.068
Winter 0.061
Summer-Winter 0.061
Winter-Summer 0.059

Site-type Summer Rookery 0.175
Summer Haulout 0.120
Summer Other 0.056
Winter Rookery 0.126
Winter Haulout 0.068
Winter Other 0.068

Season Summer 0.060
Winter 0.047
Sub-region EGOA
CGOA
WGOA
EAI/BS

% TAC 1-5%
6-10%

Proximity 0-2 nm

Thus, the SSLMC 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.

Duration Shorter
Longer
Same duration

% sites 1-10%
11-25%
26-50%
51-75%
76-100%

Target Pacific cod
Pollock
Atka mackerel

SSLMC Proposal Ranking Tool

SSC Review Comments

Consider anthropogenic factors

Page 6 of report – will be considered outside the model

anthropogenic effects currently are rare

lack of accurate information

anthropogenic impacts are addressed by fishery in the annual List of Fisheries (LOF)

Consider bycatch of non-target species that are SSL prey

Page 6 of report – have new data available, SSLMC has yet to determine best use of this dataset

However, the entire prey field was considered in the node concerning nutritional needs

of the SSL. SSLMC weighted target species in relation to the FO of non-target prey in SSL scat

Replace TAC/biomass ratio concept for prey availability in favor of an alternative: target species biomass/biomass of all principal prey species, current prey species abundance to B0, biomass density/area or depth stratum, prey species biomass in a local area/# SSLs

Page 7 of report – no additional data readily available at meeting

local scale effects cannot be captured

biomass survey data is collected in summer, fishing occurs primarily in winter

SSLMC Proposal Ranking Tool

SSC Review Comments Continued

Include fishery removal rates by gear type and total effort

Page 7 of the report – SSLMC concluded that gear type and vessel size are not satisfactory proxies for removal rate. Lack of consideration for the number of vessels fishing, fisheries occurring on large schools of fish, agreement between sectors to avoid fishing conflicts, and some proposals control removal rate directly.

%TAC and duration characterize removals adequately without need for gear type

Retain flexibility to address situations (proposals) the PRT cannot adequately address

SSLMC will use other tools as necessary and process of changing protection measures will require additional analyses

Describe intent of the PRT and a problem statement

Page 7 of report - 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 SSL and their prey.

Page 8 of the report – model is built to answer 3 questions in 2 dimensions

SSLMC Proposal Ranking Tool

SSC Review Comments Continued

Be cautious in use of scat data as descriptors of SSL diet, as scat data may not adequately indicate energetic value – but scat data may be the best available now Best available spatial data on diet composition to inform model

Provide for ability to revise PRT as more refined data become available. Use bounding and sensitivity tests to understand PRT limitations.

Page 7 of the report - 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 review.

Page 29 of the report – sensitivity tests; Page 30 – robustness;
Model development is continuing through October.

Examine weightings at various levels in hierarchy to verify SSLMC intent

Started this at September SSLMC meeting, need to complete at October meetings

Consider using PRT to conduct pairwise comparisons, compare against a status quo standard, and impacts of combinations of proposals

Page 7 of report – developing status quo standards and protocols for model usage after initial ranking

SSLMC Proposal Ranking Tool

Remaining Questions

- Are all SSL sites of a given type equal in importance?
- Are all SSL regions equal?
- Using bycatch data to inform model?
- Fishing seasons compared to SSL seasons
- Multiple effects in one proposal – worst case or additive?
- Status quo definitions
- Using PRT for benefits and trade-offs
- Use of models for proposals that don't fit neatly into structure

SSLMC Proposal Ranking Tool

Next Steps for SSLMC

- SSLMC will receive presentations on proposals (Oct)
 - Need datasets, status quo descriptions, remaining questions
- Run proposals through model to get relative ranking (Oct)
- Complete draft BiOp released (Dec)
- Assemble package for NPFMC review (Jan)
 - Possibly using PRT for trade-off scenarios
- NMFS Protected Resources Division review
- NEPA analysis of alternatives parallel with NPFMC process
 - Economic, enforcement, admin, safety, biological, ecosystem
- NPFMC initial review and selection of alternatives (Feb)
- NPFMC final action

SSLMC Proposal Ranking Tool



Example model runs?

SSLMC Proposal Ranking Tool

Two Contrasting Hypothetical Examples

SSLMC Proposal Ranking Tool

Hypothetical Example #1

Let's fish to the beach
for a lot more Atka Mackerel
In a shorter amount of time
at all of the Rookeries
In the Western Aleutian Islands
in the summer.

Expectations of
model output?

SSLMC Proposal Ranking Tool

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Effects of fishing on SSL 0.750

How does fishing alter the prey field? 0.250

How sensitive are SSL to fishing? 0.643
spatial/temporal

How sensitive are SSL to fishing? 0.107
diet composition

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Winter 0.061
Summer-Winter 0.061
Winter-Summer 0.059

Site-type Summer Rookery 0.175
Summer Haulout 0.120
Summer Other 0.056
Winter Rookery 0.126
Winter Haulout 0.068
Winter Other 0.068

Season Summer 0.060
Winter 0.047

Sub-region EGOA
CGOA
WGOA
EAI/BS
CAI
WAI
Pribis

% TAC 1-5%
6-10%
>10%
No change

Proximity 0-3 nm
3-10 nm
10-20 nm
20+ nm
Not CH

Duration Shorter
Longer
Same duration

% sites 1-10%
11-25%
26-50%
51-75%
76-100%

Target Pacific cod
Pollock
Atka mackerel

<u>Hypothetical proposal #1</u>	How does fishing alter the prey field?	How sensitive are SSL to fishing? <i>spatial/temporal</i>	How sensitive are SSL to fishing? <i>diet composition</i>
Weight based on judgments	.250	.643	.107
Model score	.0191	.0080	.0138

Total Score = 0.0409

Proposal Ranking Tool

Hypothetical Example #2

Let's fish outside of 20nm from 'other' CH sites
for a little more Pacific cod
Over a longer duration
In the central Gulf of Alaska
in the winter.

Expectations of
model output?

Relative significance of proposed changes in fishery regulations that pertain to SSL and their prey

Effects of fishing on fish **0.250**

Effects of fishing on SSL **0.750**

How does fishing alter the prey field? **0.250**

How sensitive are SSL to fishing? **0.643**
spatial/temporal

How sensitive are SSL to fishing? **0.107**
diet composition

Season

Summer	0.068
Winter	0.061
Summer-Winter	0.061
Winter-Summer	0.059

Site-type

Summer Rookery	0.175
Summer Haulout	0.120
Summer Other	0.056
Winter Rookery	0.126
Winter Haulout	0.068
Winter Other	0.068

Season

Summer	0.060
Winter	0.047

Sub-region

- EGOA
- CGOA
- WGOA
- EAI/BS
- CAI
- WAI
- Pribs

% TAC

- 1-5%
- 6-10%
- >10%
- No change

Proximity

- 0-3 nm
- 3-10 nm
- 10-20 nm
- 20+ nm
- Not CH

Duration

- Shorter
- Longer
- Same duration

% sites

- 1-10%
- 11-25%
- 26-50%
- 51-75%
- 76-100%

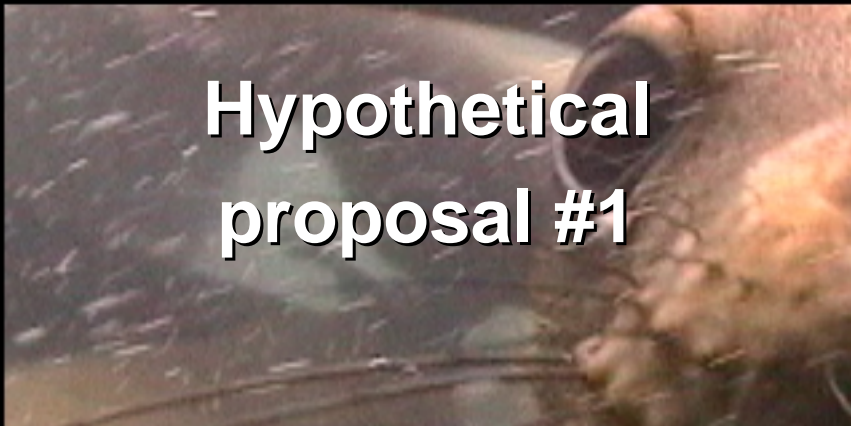
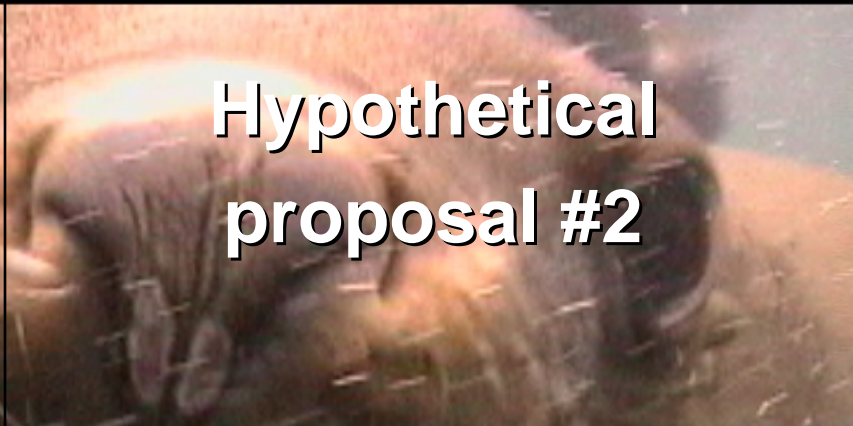
Target

- Pacific cod
- Pollock
- Atka mackerel

<u>Hypothetical proposal #2</u>	How does fishing alter the prey field?	How sensitive are SSL to fishing? <i>spatial/temporal</i>	How sensitive are SSL to fishing? <i>diet composition</i>
Weight in model	.250	.643	.107
Model score	.0015	.0030	.0004

Total Score = 0.0049

Compare Hypothetical Model Scores

 <p>Hypothetical proposal #1</p>	 <p>Hypothetical proposal #2</p>
<p>0.0409</p>	<p>0.0049</p>
<p>More impact</p>	<p>Less impact</p>

NMML Photo Gallery, 2002



THANKS to Members of SSLMC

Jerry Bongen	Daniel Hennen	Frank Kelty	Larry Cotter (Chair)
Julie Bonney	Sue Hills	Terry Leitzell	Steve MacLean
Sam Cotten	Ed Dersham	Dave Little	Max Malavansky, Jr.
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