AGENDA C4(a)
February 2012

Habitat Areas of Particular Concern (HAPC)

Areas of Skate Egg Concentration
Initial Review Draft

Environmental Assessment (EA) /
Regulatory Impact Review (RIR) /
Initial Regulatory Flexibility Analysis (IRFA)

For Amendment to the Fishery Management Plans (FMP) for the Groundfish of the Bering Sea and Aleutian Islands (BSAI) (#), the BSAI Crab FMP (#), and the Scallop FMP (#)

January 2012

Photo credit: Gerald Hoff

North Pacific Fishery Management Council
National Marine Fisheries Service, Alaska Region

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1.0 EXECUTIVE SUMMARY

Habitat Areas of Particular Concern (HAPC) are geographic sites that fall within the distribution of essential fish habitat (EFH) for federally managed species. HAPCs are areas of special importance that may require additional protection from adverse fishing effects. EFH provisions provide a means for the North Pacific Fishery Management Council (Council) to identify HAPCs (50 C.F.R. 600.815(a)(8)) within Fishery Management Plans (FMP). Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or may be stressed.

The Council has a formalized process identified within its FMPs for selecting HAPCs. Under this process, the Council periodically considers whether to set a priority habitat type (or types). If so, the Council initiates a request for proposals (RFP) for HAPC candidate areas that meet the specific priority habitat type. Members of the public, non-governmental organizations, and Federal, State, and other agencies may submit HAPC proposals. Sites proposed under this process are then sent to the Council's Plan Teams for scientific review to determine ecological merit. Council and agency staff also review proposals for socioeconomic and management and enforcement impacts. This combined information is then presented to the Scientific and Statistical Committee (SSC), the Advisory Panel (AP), the Enforcement and Ecosystem Committees if necessary, and to the Council, which may choose to select HAPC proposals for a full analysis and subsequent implementation. The Council may also modify proposed HAPC sites and management measures during its review, or request additional stakeholder input and technical review.

In April 2010, the Council set a habitat priority type—"skate nurseries"—and issued a RFP in conjunction with the completion of its EFH five-year review process. Council staff initially screened the proposals received to determine consistency with the Council's habitat priority type, compliance with the Council's HAPC criteria, and for general adequacy and completeness. At its fall 2010 meeting, the joint groundfish Plan Teams reviewed HAPC proposals for rarity and for ecological merit, and in October 2010, the Council selected a HAPC proposal from the Alaska Fisheries Science Center (AFSC) to forward on for further analysis. In February 2011, the Council received a discussion paper on the AFSC's HAPC proposal and selected three alternatives and five options for conservation and management to forward on for full analysis.

Three alternatives for the identification of skate egg concentration HAPCs and five options (a through e) for conservation and management of those HAPCs are analyzed in this EA/RIR/IRFA, and are as follows below. Consideration of areas of skate egg concentration is limited to the six candidate sites from the AFSC proposal. Additional sites, when and if discovered, are not considered part of this action.

1.1 Alternatives and Options

1.1.1 <u>Alternative 1:</u> Status quo; no action.

No measures would be taken to identify, or to identify and conserve, skate egg concentration HAPCs.

1.1.2 <u>Alternative 2:</u> Identify skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs.[1]

[1] 50 C.F.R. 600.815(a)(8).

Table 1. The six proposed skate egg concentration HAPCs.

Site name	*Predominant* skate species	Boundaries of HAPC (°N latitude or °W longitude)				Area of HAPC	
		North	South	West	East	nm²	km²
1. Bering 1	Alaska	54°53′	54°49′	165°46′	165°38′	18.4	63
2. Bering 2	Aleutian	54°38′	54°33′	165°45′	165°34′	17.5	60
3. Bristol	Bering	55°21′	55°17′	167°40′	167°34′	13.7	47
4. Pribilof	Alaska	56°11′	56°10′	168°28′	168°26′	1.2	4
5. Zhemchug	Alaska	56°57′	56°54′	173°23′	173°21′	3.2	11
6. Pervenets	Alaska, Bering, and Aleutian	59°28′	59°22′	177°43′	177°34′	27.7	95

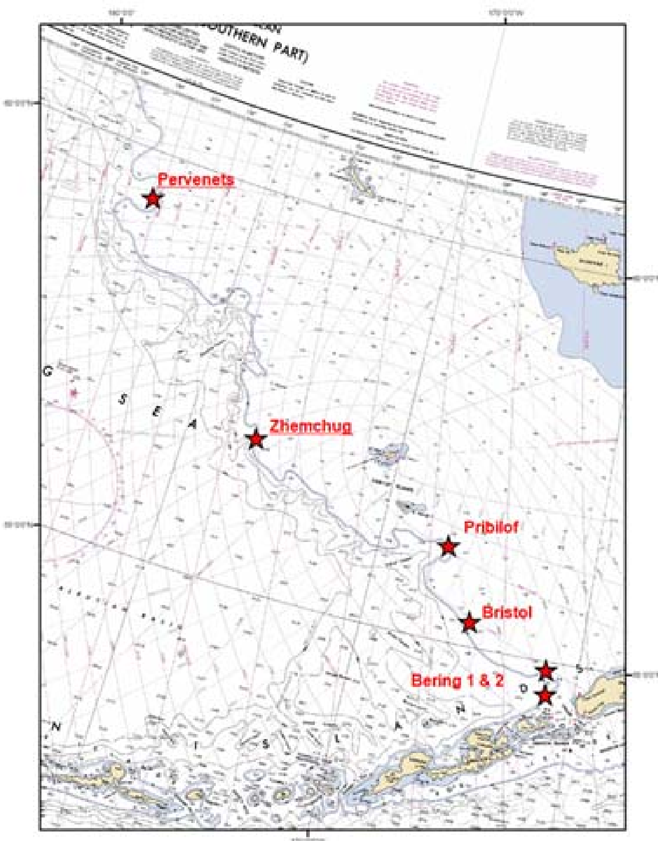

Figure 1. The locations in the eastern Bering Sea of the six proposed skate egg concentration HAPCs (not to scale).

1.1.3 <u>Alternative 3:</u> Identify and conserve skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs – AND – the Council may select different conservation and management options for any identified skate egg concentration HAPC.

The conservation and management options below may be selected in combination with any skate egg concentration HAPC:

Option a: **Prohibit within skate egg concentration HAPCs the use of "mobile bottom contact"[2] fishing gear: nonpelagic trawl, dredge, and dinglebar gear.**

Option b: **Prohibit within skate egg concentration HAPCs the use of "mobile bottom contact" and pelagic trawl fishing gear: nonpelagic and pelagic trawl, dredge, and dinglebar gear.[3]**

Option c: **Prohibit within skate egg concentration HAPCs the use of "bottom contact"[4] fishing gear: nonpelagic trawl, dredge, dinglebar, pot, and hook and line gear.**

Option d: **Prohibit within skate egg HAPC(s) the use of all fishing gear: nonpelagic and pelagic trawl, dredge, dinglebar, pot, and hook and line gear.**

The following option is applicable to ALL alternatives, in any combination of skate egg concentration HAPCs, with any combination of conservation and management measures the Council selects:

Option e: **Add research and monitoring of any area of skate egg concentration to the Council's annual research priority list.**
The Council may identify the research and monitoring of areas of skate egg case concentration as a research priority and incorporate it into the Council's annual research priority list for continuing research, to evaluate skates, skate egg concentration areas, and their ecology and habitat.

1.2 Summary of Environmental Impacts

The analysis of direct, indirect, and cumulative effects for the proposed action indicate no significant impacts on the human environment from the three alternatives. Environmental effects of this proposed action are considered insignificant under all Alternatives. These sites are small and discrete areas, that have had little fishing effort in them in the past, noting that there has been some limited trawling for groundfish, including for pollock, in some areas, in some years. No changes in catch effort are anticipated. As such, any effects on marine mammals, sea birds, and the ecosystem would be considered insignificant. The effects on skates are unknown but would be expected to provide some positive benefit.

Alternative 1, the status quo, or no action alternative, involves no measures to identify or conserve areas of skate egg concentration as HAPCs. Thus Alternative 1 is not likely to result in any significant effects regarding habitat, target species, non-target resources, protected species, or the ecosystem. The Council may, however, choose Option e under Alternative 1, which would add areas of skate egg concentration to the Council's annual Research Priority list.

Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as HPACs. Identification of HAPC areas highlights the importance of this essential fish habitat for conservation and consultation on activities such as: drilling, dredging, laying cables, and dumping, as well as fishing activities. The impacts of Alternative 2 likely are similar in magnitude to Alternative 1 because under Alternative 2, fishing activities are not restricted.

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[2] 50 C.F.R. 679.2.
[3] See 50 C.F.R. 679.2 for the particular and intricate components of "pelagic trawl" fishing gear.
[4] 50 C.F.R. 679.2.

Alternative 3 provides for both the identification of skate egg concentration HAPCs and for the conservation of these areas through prohibitions of gear types that make contact with the sea floor. The impacts of Alternative 3 depend on the Option for conservation and management (a through d) selected for each HAPC. The Council may select, in combination with any skate egg concentration designated as a HAPC, to limit fishing activities that make contact with the sea floor in these areas by prohibiting the use of "mobile bottom contact," pelagic, "bottom contact," or all fishing gear. Options that prohibit trawling in these areas would provide the most protection from potential direct impacts (bury or crush) and indirect impacts (dislodgement, movement, bycatch mortality) on egg cases. Other gear types likely have less potential to impact skate egg cases, so a prohibition on these gears may offer only marginal benefits. The potential effects of the options on skate populations remains unknown but are likely beneficial.

1.3 Summary of Economic Impacts

Economic impacts are expected to be insignificant under all alternatives as these are small areas with low levels of fishing effort. The most costly option (Alternative 3, Option e) would close these six areas to all fishing gears, encompassing a total area of 81.7 nm^2. Limited impacts to logline fisheries may occur if closures are implemented. Effort data indicates that several of these areas are fished at low levels to target Pacific cod. No impacts would be expected for pot gear targeting Pacific cod, or scallop fisheries using dredge gear, as none of these areas have been used in recent years. The effect of Alternative 3 on crab fisheries (pot gear) remains unknown at this time as quantitative information is not available, but the effects are likely insignificant due to the small area proposed and the depths of the areas relative to crab harvest.

Trawl fisheries would also be impacted, but these impacts are considered insignificant. Analysis suggests that on average, a closure to pelagic and bottom trawling of these sites would result in a maximum foregone catch of $1,087,071 per year on average. Of this total, pelagic trawling for pollock in the areas would generate a forgone catch of $791,897per year, and bottom trawling $295,174 per year (the total ex-vessel price divided by the nine years (2003-2011) of catch data examined). However, it would be expected that the fleet could make up this foregone catch in other areas, adjacent or elsewhere. Nevertheless, moving the fleet elsewhere to make up foregone catch could cause some increased operation costs and may require vessels to fish outside of their preferred zone.

2.0 INTRODUCTION

Habitat Areas of Particular Concern (HAPC) are geographic sites that fall within the distribution of essential fish habitat (EFH) for federally managed species. HAPCs are areas of special importance that may require additional protection from adverse fishing effects. EFH provisions provide a means for the North Pacific Fishery Management Council (Council) to identify HAPCs (50 C.F.R. 600.815(a)(8)) within Fishery Management Plans (FMP). Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or may be stressed.

The Council has a formalized process identified within its FMPs for selecting HAPCs. Under this process, the Council periodically considers whether to set a priority habitat type (or types). If so, the Council initiates a request for proposals (RFP) for HAPC candidate areas that meet the specific priority habitat type. Members of the public, non-governmental organizations, and Federal, State, and other agencies may submit HAPC proposals. Sites proposed under this process are then sent to the Council's Plan Teams for scientific review to determine ecological merit. Council and agency staff also review proposals for socioeconomic and management and enforcement impacts. This combined information is then presented to the Scientific and Statistical Committee (SSC), the Advisory Panel (AP), the Enforcement and Ecosystem Committees if necessary, and to the Council, which may choose to select HAPC proposals for a full analysis and subsequent implementation. The Council may also modify proposed HAPC sites and management measures during its review, or request additional stakeholder input and technical review. (See Appendix A for details on the HAPC process methodology for this 2010-2012 RFP cycle.)

This Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) examines the environmental, economic, and socioeconomic aspects of proposed Federal regulatory actions primarily to the groundfish fisheries in the eastern Bering Sea (EBS). The groundfish fisheries in the Exclusive Economic Zone (EEZ) off the coast of Alaska are managed by the National Marine Fisheries Service (NMFS) under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Under the authority of the MSA, the Council developed and adopted the *Bering Sea and Aleutian Islands Groundfish Management Plan* (NPFMC, 2010). This proposed action would designate areas of skate egg concentration in the BSAI, under the FMP, as HAPCs.

An Environmental Assessment (EA) is required by the National Environmental Policy Act of 1969 (NEPA) to determine whether the proposed Federal action will result in a significant impact on the human environment. The purpose of an EA is to analyze the environmental impacts of a proposed Federal action. The human environment is defined by the Council on Environmental Quality (CEQ) as the natural and physical environment, and the relationships of people with that environment (40 C.F.R. 1508.14). This means that economic or social effects are not intended, by themselves, to require preparation of an EA. When an EA is prepared and socio-economic and natural or physical environmental impacts are interrelated, the EA must discuss, however, all of these impacts on the quality of the human environment. If, based on an analysis of the relevant considerations, the Federal action is determined to be insignificant, the EA and accompanying finding of no significant impact (FONSI) would be the final environmental documents required by NEPA. An Environmental Impact statement (EIS) must be prepared for major Federal actions significantly affecting the human environment. In addition, NEPA requires a description of the purpose and need for the proposed action, as well as a description of alternatives which may address the problem**.** This document also includes a description of the affected human environment and information on the impacts of the alternatives on that environment.

Executive Order 12866 (EO) requires preparation of a Regulatory Impact Review (RIR) to assess the social and economic costs and benefits of available regulatory alternative to determine whether a proposed regulatory action is economically significant as defined by the order. This analysis also addresses requirements of the Regulatory Flexibility Act (RFA), which requires an analysis of potential adverse economic impacts accruing to small entities that would be directly regulated by the proposed action. This analysis also addresses other applicable laws, including the MSA and Marine Mammal Protection Act (MMPA), which are applicable to this proposed action. References and literature cited are in included, as well as a list of preparers and of agencies and individuals consulted during the evaluation.

2.1 Overview of Existing HAPCs

For the 2004 HAPC identification process, the Council designated two priorities: named seamounts in Alaska Federal waters a, and coral areas with rockfish associations. The Council received twenty-three proposals from six different organizations. After an initial screening by staff, the proposals were reviewed by the Council's Plan Teams, and assessed for management, enforcement, and socioeconomic issues. Ultimately, the Council identified a range of alternatives, staff completed an analysis, and in January 2005, the Council adopted several new HAPCs. Twenty sites in the GOA and Aleutian Islands, consisting of seamounts and high density coral areas, were identified as HAPCs. To protect these sites and eliminate environmental impacts due to fishing, the Council prohibited fishing in these areas by gear types that contact the seafloor. These sites and measures became effective in June 2006.

The Alaska Seamount Habitat Protection Area encompasses all 16 seamounts in Federal waters off of Alaska, named on NOAA charts: Bowers Brown, Chirkikof, Marchand, Dall, Denson, Derickson, Dickins, Giacomini, Kodiak, Odyssey, Patton, Quinn, Sirius, Unimak, and Welker. Bottom-contact fishing is prohibited in all of the HAPCs, which encompasses an area of 5,329 nm^2 in total. In Southeast Alaska, three sites with large aggregations ("tickets") of long-lived Primnoa coral are also identified as HAPCs. These three sites, in the vicinity of Cape Ommaney and Fairweather grounds, total 67 nm^2. The GOA Coral Habitat Protection Areas designates five zones within these sites where submersible observations have been made, totaling 13.5 nm^2. All bottom contact gear—longlines, trawls, pots, dinglebar gear, etc. — are prohibited in these areas. Finally, in the Aleutian Islands region, the relatively unexplored Bowers Ridge was also identified as a HAPC. As a precautionary measure, the Council acted to prohibit mobile fishing gear that contacts the bottom within this 5,286 nm^2 area.

The Current HAPC areas and bottom trawl closure areas are shown in Appendix C – Color Figure 2.

Table 2. Comparison of existing HAPCs with proposed HAPCs, in terms of area

HAPC		Area nm^2		HAPC (proposed)	Area nm^2
Bowers Ridge/Ulm Plateau		**5,286**		**Skate Nurseries**	**81.7**
Seamounts		**5,330**		Bering 1	18.4
	Dickins	147		Bering 2	17.5
	Denson	287		Bristol	13.7
	Brown	167		Pribilof	1.2
	Welker	162		Zhemchug	3.2
	Dall	950		Pervenets	27.7
	Quinn	201			
	Giacomini	164			
	Kodiak	158			
	Odessey	210			
	Patton	94			
	Chirikof & Marchan	2,248			
	Sirius	167			
	Derickson	218			
	Unimak	129			
	Bowers	29			
GOA Slope		**1,892**			
	Yakutat	194			
	Cape Suckling	51			
	Kayak Is	282			
	Middleton Is East	143			
	Middleton Is West	85			
	Cable	176			
	Albatross Bank	122			
	Shumagin	166			
	Sanak	279			
	Unalaska	590			
Other EFH HCA or HPC					
GOA Hard Corals		**14**			
	Cape Ommaney	0.85			
	Fairweather A	0.77			
	Fairweather B	3.20			
	Fairweather C	7.88			
	Fairweather D	0.86			
Aleutian Islands HCA		**279,114**			
Aleutian Islands Corals HPA		**112**			
	Great Sitkin	16.0			
	Cape Moffet	16.0			
	Adak Canyon	18.0			
	Bobrof	30.2			
	Ulak	15.3			
	Semisopochoi	16.0			
Arctic		**148,393**			
St Matthew HCA		**4,110**			
St Lawrence HCA		**7,033**			
Nunivak/Kuskokwim HCA		**9,718**			
Bering Sea HCA		**47,121**			
NBSRA		**65,559**			
Total		**573,681**			

2.2 HAPC Recommendations for Council Consideration

In 2006-2007, the Council considered whether to initiate a HAPC proposal process during discussion related to Bering Sea Habitat Conservation. The Council reviewed the previous HAPC cycle process and decided a review of process was needed to address plan team and public concerns. Some of these concerns included: how the Council assembles proposed HAPC nominations; the need to ensure uniformity in the information provided in the proposals; and the need for better definitions of the HAPC criteria, such as the requirement for rarity of candidate HAPCs. The Council formally revised the HAPC process to address many of these concerns and asked the SSC to provide further definition of the HAPC criteria prior to the next Council call for proposals. Following discussion through an SSC, agency, and plan team workgroup, the Council adopted the SSC's recommended revisions to the HAPC criteria.

Secondly, the Council considered whether to set a HAPC priority for Bering Sea skate nurseries (now termed "areas of skate egg concentration") and/or undersea canyons in the Bering Sea. The AFSC was contacted in October 2006 and asked to produce a white paper summarizing current scientific information on Canyons and skate nursery areas in the EBS. The Council received the paper at its December 2006 meeting (AFSC, 2006). Following public input and pan team and SSC review, the Council determined that it would be premature to initiate a call for proposals because there were no identified conservation concerns at that time.

Table 3. Recommendations on HAPC priorities from previous Council discussions

HAPC discussion at the Council	Priority types forwarded for consideration in 2010
2006-2007 discussion of Bering Sea Habitat Conservation	skate nurseries (in the Bering Sea) deepwater canyons (Pribilof and Zhemchug)

In June 2009, the Council considered whether to set priorities for identifying HAPCs and to re-solicit for HAPC proposals. The Council opted to postpone this decision pending the completion of its five-year EFH review. Recommendations on HAPC priorities were identified as a result of the EFH five-year review for individual species:

Table 4 .Recommendations on HAPC priorities from the individual species reviews

Council FMP	Species	Recommendation
Bergin Sea/Aleutian Islands (BSAI) Groundfish	Skates	The Council may want to consider closing known skate nurseries to fishing activity; the Council has discussed this in the past. *Note, this recommendation was originally made by the individual species author, and forwarded by the BSAI Groundfish Plan Team.*

At its April 2010 meeting, the Council set a habitat priority type—"skate nurseries" [5]—and issued an RFP in conjunction with the completion of the EFH five-year review process. The RFP, which included the Council's recently adopted revised evaluation criteria, was announced in the Federal Register (see 75 FR 21600) and in the Council newsletter. The proposal period opened April 26, 2010 and continued until August 31, 2010 (the period was extended from August 16). Council staff initially screened the proposals that were received to determine consistency with the Council's habitat priority type, compliance with the Council's HAPC criteria, and for general adequacy and completeness.

At their fall 2010 meeting, the joint groundfish Plan Teams reviewed the HAPC proposals for rarity and for ecological merit. The Plan Teams' recommendations are incorporated by reference in this analysis and within a matrix based on the Council's revised and adopted HAPC evaluation criteria. (See Appendix A

[5] "Skate nursery" sites are termed "skate egg concentration" areas for purposes of this analysis as per the Council's motion from February 2011.

for details on the HAPC evaluation methodology). At the October 2010 meeting, staff presented the preliminary report of screening results to the AP and the Council. The Council selected the HAPC proposal from the Alaska Fisheries Science Center (AFSC) to forward on for further analysis. At the February 2011 Council meeting, staff presented a discussion paper on the AFSC's HAPC proposal package to the SSC, the AP, the Ecosystem and the Enforcement Committees, and to the Council. The Council selected three alternatives and five options for conservation and management to forward on for full analysis.

At its February 2012 meeting, the Council may wish to select its preferred preliminary alternative (PPA) and preferred conservation and management options, identifying any of the six proposed areas of skate egg concentration as HAPCs and selecting any combination of gear prohibitions within an identified HAPC. The Council may also wish to designate research and monitoring of any areas of skate egg concentration as a research priority, to be added to its annual research priorities.

Note: the Ecosystem and Enforcement Committees are scheduled to take up the analysis of proposed skate egg concentration HAPCs, alternatives, and options for conservation and management, and will report out to the Council. The Committees could also discuss research and monitoring of areas of skate egg case concentration, and monitoring and enforcement of fishing activities and gear restrictions.

2.2.1 Current HAPC Process Timeline

At the April 2010 meeting, the Council set a HAPC habitat priority type for "skate nurseries" and issued an RFP. Council and NMFS staff received two proposals that identified six HAPC candidate sites. The Council selected the proposal from the AFSC to forward on for further review: a) Plan Team assessment using the evaluation criteria the Council adopted at its April 2010 meeting; b) Council staff review for socioeconomic considerations; and c) Committee review for enforcement and management considerations. The Council determined that the second HAPC proposal received was subsumed within the AFSC proposal, which was more extensive.

The HAPC proposal forwarded on for further review and analysis, as well as the 2010 Request for Proposals and the Application package, was posted on the Council's website. Applicants were asked to specify the geographic delineation of the proposed HAPCs, the purposes and objectives, any proposed management measures for the site(s), and any effects that would be expected from such measures. A schedule outlining the steps involved in the current HAPC proposal cycle is provided below.

Table 5. The current HAPC proposal cycle

Steps in the HAPC process	**Timeline**
Council identifies and sets HAPC priorities; criteria tables adopted.	April 2010
FR Notice of Request For Proposals (RFP); period to submit opens and closes.	April 26 – August 31 (18 weeks)
Council staff initial screening for adherence to priorities and completeness	September 2010
Plan Teams initial review for ecological merit	September 2010
Council review and decision on proposals to forward for further review	October 2010
Council staff review of proposals for socioeconomic considerations	October 2010 – January 2011
Ecosystem and Enforcement Committees conduct review and provide comments	February 2011
Council decision to formulate proposals into an amendment analysis	February 2011
Analysis	March 2011 – January 2012
Ecosystem and Enforcement Committees conduct review and provide comments	February 2012
Initial Review of amendment analysis	*February 2012* ***(*)***
Final action on amendment analysis	April or June 2012 (**T**)

(*) = The Council is currently at this step of HAPC proposal cycle.
(T) =Tentatively scheduled.

2.2.2 Revisions to HAPC Cycle Timing

At its June 2009 meeting, the Council considered whether to set priorities for identifying HAPCs and re-solicit for HAPC proposals. The Council opted to postpone its decision pending the completion of the EFH five-year review. The Council chose to synchronize the timing of the two actions so that results from the EFH five-year review could be considered in setting HAPC priorities and for the proposal cycle that might result. At the April 2009 Council meeting, the SSC recommended that the Council consider permanently changing the timeline to align HAPC cycles with the EFH five-year review. The Council added an amendment to revise the HAPC cycle timeline to the EFH Omnibus Amendment package, adopted by the Council at its April 2011 meeting. Though the HAPC process is now scheduled to occur every five years to coincide with EFH five-year reviews, the Council is not precluded from designating HAPC priorities out of cycle when appropriate; a HAPC cycle may be initiated at any time by the Council.

2.3 Summary of Proposed HAPCs

Six areas of skate egg concentration in the BSAI management area have been proposed for designation as HAPCs (Appendix C – Color Figure 1). These six sites have been identified by NMFS scientists. The localized nature of these skate egg concentration areas makes them ideal for spatial management: they are very small areas, are static, and have distinct boundaries. Skates are elasmobranch fishes that reproduce by depositing a small number of large eggs protected by proteinaceous egg cases directly on the seafloor in localized nursery areas. Skate embryos develop inside these cases, a process that can take over three years. During this development period, egg cases provide crucial protection to the fragile embryo and yolk mass. In the eastern Bering Sea (EBS), skate species deposit their eggs in highly localized areas known as nursery sites (Appendix C – Color Figures 1 and 9-13). Skate populations are characterized by low fecundity and slow growth rates, suggesting a bottleneck during early life history stages. As such, areas supporting large numbers of egg cases are important and warrant special consideration. This is especially true because of evidence of extended skate embryonic development (>3 years) and expected vulnerability of egg cases to removal or disturbance by bottom fishing activity.

Because skates are long-lived, slow to mature, and produce few offspring, it may be prudent to reduce or eliminate the potential for damage to these areas of skate egg concentration. The primary protection measures proposed by the AFSC authors for conservation and management are to prohibit the use of any fishing gear that makes contact with the seafloor within each area of skate egg concentration and to remotely monitor those areas. Providing some protection for the six areas proposed is intended to reduce the mortality of skate eggs due to fishing activity and to limit the disruption to adult skate reproduction.

Six areas of skate egg concentration in the EBS are proposed (Appendix C – Color Figures 1 and 9-13). Each site has been studied and mapped using research bottom trawls to determine the density of egg cases, the extent of the area of skate egg concentration, mortality sources to young skates, and distinguishing abiotic features of the site that may define EFH. The exception is the "Pribilof" site, which was mapped using an autonomous underwater vehicle (AUV) equipped with a high-resolution camera. Additional AUV mapping work has been performed at several of the other sites listed, but those data were not used to delineate the boundaries of the proposed area. At each site, the spatial extent of bottom trawls containing >1,000 egg cases/km^2 was established. The boundary lines were then snapped to the nearest minute of latitude or longitude away from the center of the area of skate egg concentration (Appendix C – Color Figure 8). This snapping creates a buffer region to account for the possibility of additional eggs in un-sampled areas. Using whole minutes also allows for a simpler boundary line that will be easier to discern by vessels and policymakers. See Appendix C – Color Figures 17-28.

The six proposed HAPC areas constitute a total of 280 km^2, or 0.05% of the estimated area for the EBS. The proportion of skate egg cases protected by the proposed HAPC areas is estimated to be 10%-20% for Alaska skate, and potentially larger for Aleutian and Bering skate due to their lower population size. The table below contains information regarding each site including the bounding latitude and longitude lines and the area contained within the proposed boundaries. The figure below shows the locations of the six areas in the eastern Bering Sea, at the heads of several major and minor undersea marine canyons, located in the upper low slope areas (generally from 145-380 m).

Table 6. The six areas of skate egg concentration proposed for identification as a HAPC.

Site name	Predominant skate species	Depth of max. egg density (m)	Maximum egg density (eggs/km^2)	Area of HAPC		Boundaries of HAPC (°N latitude or °W longitude)			
				nm^2	km^2	North	South	West	East
1. Bering 1	Alaska	145	800,406	18.4	63	54°53′	54°49′	165°46′	165°38′
2. Bering 2	Aleutian	380	62,992	17.5	60	54°38′	54°33′	165°45′	165°34′
3. Bristol	Bering	156	6,188	13.7	47	55°21′	55°17′	167°40′	167°34′
4. Pribilof	Alaska	205	16,473	1.2	4	56°11′	56°10′	168°28′	168°26′
5. Zhemchug	Alaska	217	610,064	3.2	11	56°57′	56°54′	173°23′	173°21′
6. Pervenets	Alaska, Bering, Aleutian	316	334,163	27.7	95	59°28′	59°22′	177°43′	177°34′
Total number of HAPC sites proposed at this time: 6				**Total area proposed HAPC = 81.7 nm^2 (280 km^2)**					

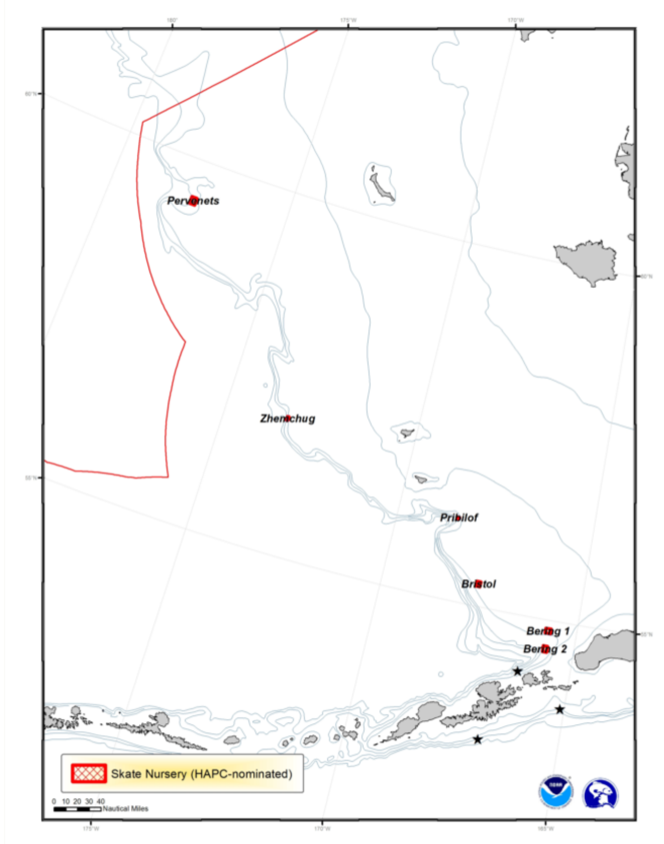

Figure 2. The six proposed skate egg concentration HAPCs in the eastern Bering Sea. Source: NMFS HCD.

2.4 Subsequent Developments

Estimates of egg and juvenile abundance from AFSC research surveys and stock assessments (Hoff 2010b) indicate that known skate nursery sites/areas of skate egg concentration are not likely sufficient to sustain the estimated total population of Alaska skates, which indicates that there are likely to be nursery sites/ areas of skate egg concentration yet observed and identified. Recently, ASFC scientists have identified three new skate nursery sites (Appendix C – Color Figure 14) from recent research efforts. Preliminarily, these sites appear to be of similar size (very small) and nature (distinct) to the known BSAI areas of skate egg concentration. Notably, two nursery areas are identified south of the Aleutian Islands, in the Gulf of Alaska. Site specific research has not been conducted, and it is too early to determine the overall distribution of these sites based upon egg case concentration. An issue raised during this HAPC proposal was how to submit additional HAPC sites that meet existing HAPC priorities.

In response to concerns that there may be other skate nursery sites in Alaskan waters, the Council determined that additional sites would NOT be included within the 2010-2012 HAPC cycle. The Council's consideration of sites to identify as HAPCs is limited to the six areas of skate egg concentration identified as potential HAPCs by the AFSC's proposal, at the time the proposal was submitted in August 2010. There will be no "grandfathering-in" of additional sites. Though the proposers anticipate identification of additional areas of skate egg concentration and would propose similar protections for those sites, any new sites would need to be considered during a separate HAPC cycle. The Council may wish to periodically review the efficacy of HAPC priorities and allow for input, such as new scientific research for priority areas.

2.4.1 Number of Expected Concentration Areas

It is helpful in the current HAPC cycle to produce a reasonable estimate of the habitat area used as skate nurseries/areas of skate egg concentration and the expected number of sites and locations in the BSAI. Ecologically, this information can help scientists understand how skates partition and use their habitat and what environmental parameters may be the most critical for successful reproduction. Biologically, nursery sites/areas of skate egg concentration shed new light on skate reproduction and what role they may play in the skates' life history strategies. Economically the number, location, and area used as skate nursery sites/areas of skate egg concentration become useful as a gauge for the impact it could have on fishing activity.

To estimate the expected number of areas of skate egg concentration of these three skate species in the eastern Bering Sea, a synthesis of directed nursery studies as well as results of the eastern Bering Sea shelf and upper continental slope groundfish bottom trawl surveys have been used. The following analysis compared the estimated number of viable skate eggs from a single cohort in all known nursery sites combined for a single species to the estimated young-of-the-year (YOY) skates from the eastern Bering Sea shelf and slope trawl surveys. When YOY exceeded the total single cohort viable egg counts, an estimate of the number of average areas of skate egg concentration that could meet the production estimate was calculated:

Equation 1. Estimated number of areas of skate egg concentration in the eastern Bering Sea

Single Cohort Viable Eggs = (Total Nursery Area (km^2) × Mean Egg Density ($eggs/km^2$) / 3) × 0.8
Number of Expected Sites=Young-of-the-Year / Single Cohort Viable Eggs × Known Number of Sites
The total eggs are divided by 3 to estimate a single cohort when 3 cohorts are present at each site and 0.8 is the viable portion of the egg population accounting for empty discarded eggs.

Table 7. Egg estimates for each nursery site and the annual cohort estimate comparing nursery sites to trawl survey estimates (YOY=young-of-the-year)

Nursery	Total nursery area (km^2)	Egg density (mean km^2)	Total eggs	Viable eggs (single cohort)	Number of identified sites	YOY survey estimate	Juvenile length range	Number of sites expected for YOY
Alaska skate								
Pervenets Canyon	37	67,124	2,483,313	662,217	1			
Zhemchug Canyon	102	42,066	4,279,687	1 ,141,250	1			
*Pribilof Canyon	1	18	174,811	46,616	1			
Bristol Canyon	56	65	3,656	975				
Bering Canyon	38	43,496	1,671,775	445,807	1			
Totals	**234**	**30,554**	**8,613,243**	**2,296,865**	**4**	**3,552,698**	**21-27 cm**	**6**
Bering skate								
Pervenets Canyon	71	14,616	1,034,895	275,972	1			
Zhemchug Canyon	7	1,411	9,760	2,603				
Bristol Canyon	9	7,198	62,682	16,715	1			
Bering Canyon	13	835	10,585	2,823				
Totals	**99**	**6,015**	**1,117,923**	**304,361**	**2**	**286,204**	**16-20 cm**	**2**
Aleutian skate								
Pervenets Canyon	12	17,015	204,294	54,478	1			
Zhemchug Canyon	102	12	1,194	319				
Bristol Canyon	9	445	3,876	1,034				
Bering Canyon	30	14,616	334,201	89,120	1			
Totals	**152**	**8,022**	**543,566**	**144,951**	**2**	**605,164**	**22-27 cm**	**8**

*Based on AUV study

The results suggest approximately one half of the nursery sites/areas of skate egg concentration for the Alaska, Bering, and Aleutian skates combined are known, eight, with an expected sixteen total for these three species. In reality, one would expect at least two additional sites for the Alaska skate, zero to one additional for the Bering skate and an additional six for the Aleutian skate. The species-specific populations, distributions, and nursery dynamics all play significant roles in determining how many nursery sites a species may use.

The Bering skate deposits its eggs at low densities in many sites other than its own. The extrapolations indicate the number of sites known can account for the juvenile production estimates from the trawl surveys. However, it is expected that a significant portion of this species population is not surveyed well on the shelf because of the sparse sampling in its primary habitat. It is likely there are many more YOY for the Bering skate and that an additional nursery site/area of skate egg concentration is probable.

The Aleutian skate is a very abundant species along the slope; however, at its known nursery sites/areas of skate egg concentration are not found at high densities and the species has high fidelity to its own nursery site, suggesting it does not widely scatter its eggs at other sites. This results in a higher than expected number of sites given the species population and one of the highest estimated (eight sites).

Table 8. Estimation of nursery sites by species based on egg densities and young of the year estimates from bottom trawl surveys

Skate species	Density eggs (km^2)	Total area (km^2)	Total eggs	YOY survey estimate	Total population estimate	Expected sites
Alaska	30,554	234	8,613,243	3,552,698	119,152,780	*6*
Bering	6,015	99	1,117,923	286,204	12,629,198	*2*
Aleutian	6,722	144	357,392	605,164	7,090,172	*8*

2.4.2 Council Policy Statement for Future Areas

At the February 2011 Council Meeting, the Ecosystem Committee recommended that the Council specifically address the broader HAPC policy question of whether Council HAPC priorities are, by default, continuing priorities for which HAPC site proposals may be submitted on a continuing basis, or whether a Council HAPC priority exists exclusively for the duration of a Council HAPC proposal cycle. In the latter case, no further HAPC proposals would be accepted for a given HAPC priority after the conclusion of the HAPC proposal cycle, unless a), the Council re-designates that particular HAPC priority, and initiates another HAPC proposal cycle; or b), NMFS brings forward compelling information to suggest that the Council should re-designate the HAPC priority. At its April 2011 meeting, the Council adopted the following policy statement to clarify the timing and duration of HAPC cycles through Final Action on the EFH Omnibus Amendment package:

> In conjunction with the EFH five-year review and resulting EFH Omnibus Amendment package, the Council identified ambiguity in its HAPC process with respect to whether Council HAPC priorities are considered to be valid in perpetuity, or whether they are specific to a particular HAPC cycle and expire at the conclusion of a particular call for proposals and subsequent Council action.
>
> At the February 2011 Council meeting, the Council considered this ambiguity and made a policy statement with respect to how the Council's HAPC process should be interpreted. The Council indicated that a HAPC priority exists exclusively for the duration of a Council HAPC proposal cycle. Thus, HAPC site proposals for a previously-designated HAPC priority may not be submitted on a continuing basis. No HAPC proposals responding to a given HAPC priority need be accepted after the conclusion of the HAPC proposal cycle unless the Council re-designates that particular HAPC priority and initiates another HAPC proposal cycle or NMFS brings forward compelling information to suggest the Council should re-designate the HAPC priority.
>
> During the development of the Council's HAPC process (as outlined in the 2005 EFH EIS), it was understood that there would be two primary avenues for alerting the Council to habitat priorities that may need consideration as HAPCs. The first is the Council's periodic consideration of habitat priorities, at which time staff, the Plan Teams, or members of the public may bring up habitat issues for Council consideration. Under the current program, this periodic review will occur every five years, changed from every three by the EFH Omnibus Amendment package so that the gathering of information for the five-year EFH review can provide the basis of the Council's HAPC consideration.

Also during development of the HAPC process, it was understood that NMFS would be reviewing habitat information on a continuous basis. When warranted, NMFS may bring proposed habitat concerns or suggested HAPC priorities to the Council and the Council may choose to take action. The HAPC process language in the FMPs that remains unchanged under the EFH Omnibus Amendments allows the Council to initiate a HAPC process and solicit HAPC proposals on a schedule established by the Council.

2.4.3 Nomenclature for Areas of Skate Egg Concentration

The concept of North Pacific skates using "nursery sites" for egg deposition is certainly not a new one and this terminology has been applied to oviparous species for many years. As with much terminology for skates and rays the terms currently used were originally determined for sharks which have been studied in much more detail. Primarily skates (Rajidae) in the North eastern Pacific deposit eggs directly on the substrate and the embryo develops independent of maternal nutrients or care other than what was initially.

Research since 2003 on skate reproduction has found that "nursery sites" are not the optimal terminology for how skates utilize the habitat. The most appropriate terminology follows the concept of "skate nesting sites." Functionally, they operate much like marine turtles in which their reproductive habitat and mode is widely accepted as "nesting sites." To understand how skates utilize the nursery habitat, one can simply apply all the mechanics and strategies that turtles use. At a designated time of year, both turtles and skates migrate to a predetermined habitat and specific location (possibly where they were hatched) and the females deposit eggs in mass. The females then depart the nesting site, provide no additional parental care, and most likely never again encounter the young.

After egg deposition, internally the skate egg looks identical to birds and many reptiles. There is a large yolk mass surrounded by a cushion of clear to white albumin like substance (superficially equivalent to the white of a chicken egg). For North Pacific skates, there is no appreciable development before egg deposition and the skate develops entirely on the reserves of the yolk provided during the initial egg production similar to all birds and reptiles. Embryo development progresses with external integuments and internal organ development until finally full development results in a chick, or juvenile skate or reptile emerging from the egg casing. All these stages are remarkably similar in vertebrates and all standard terminology and stages are applicable.

After a prolonged development, juveniles emerge in mass and quickly exit the nesting site, avoiding being consumed by waiting predators. The young are fully mobile and able to feed upon hatching. In both cases (skates and turtles), the area of egg deposition is not where the newly hatched juveniles occur. In the eastern Bering Sea, the juveniles move either much deeper or much shallower (depending on the species) specifically avoiding the nursery sites. Technically the nursery site for skates would be far from the area of skate egg deposition and for most species in the eastern Bering Sea would be much deeper along the slope. This makes for a strong argument to change the nomenclature for skates to much more accurately describe their reproductive strategy, however until the new terminology is vetted nursery sites could be accurately retained. However, per the Council's motion at its February 2011 meeting, these nursery, or nesting, sites will be referred to throughout this analysis as "skate egg concentration" areas.

2.5 Recent Supporting Research

Much of the information used to support these HAPCs candidate areas comes from the AFSC and years-long research effort by Gerald R. Hoff, AFSC fishery biologist, to identify, map, and study skate nursery sites in the EBS. Hoff's work has been supported by NOAA EFH funds and by grants from the North Pacific Research Board. In addition, the AFSC was asked by the Council to produce a white paper summarizing the current scientific information skate nursery areas in the eastern Bering Sea (as well as

Pribilof, Pervenets, and Zhemchug Canyons in the eastern Bering Sea). The document produced was structured as an inventory of available data and applicable information as of fall 2006 and presented to the SSC, AP, and Council at the December 2006 meeting.

Because areas of skate egg concentration are rare and small in size, identifying these areas has been a major challenge. Data regarding trawl catches of egg cases from research surveys and fishery observers are used to identify potential sites. Dedicated skate nursery research surveys using a bottom trawl and an adaptive sampling design were conducted to map the spatial extent of seven areas of skate egg concentration and provide information regarding embryo size and viability, as well as egg case predation (Hoff 2010). Areas of skate egg concentration are small in area and highly localized, with abrupt transitions from areas of high egg case density to areas with little or no egg cases. They occur over a narrow depth range (from 150 m to 375 m) on generally flat sandy to muddy bottom, with little bottom structure or attached biota. Sites are associated with major undersea canyons and are generally located in the upper portion of canyon heads. These areas of skate egg concentration are highly productive, with some sites possessing estimated egg densities of >100,000 eggs/km^2.

This work and earlier research (Hoff 2008) also identified the presence of multiple cohorts within nurseries and suggested that development time of Alaska skate embryos exceeded three years. This may be temperature dependent, a hypothesis supported by subsequent work where viable embryos were raised at different temperatures in the laboratory (Hoff *et al* 2010). This long development time substantially increases the exposure of the delicate embryos to predation and disturbance.

Skates, and elasmobranchs in general, are considered low-productivity species. This results in part from delayed sexual maturity (e.g., 9 years for the Alaska skate; Matta and Gunderson 2007) and low fecundity (e.g., Ebert 2005). Thus skates are considered to be “equilibrium” life history strategists: they put a large amount of energy into a small number of offspring and rely on the high survival rate of offspring for maintaining the strength of populations. This may be compared to species such as Pacific cod that produce huge numbers of eggs, very few of which are likely to survive. This underscores the importance of skate early life survival and reducing the potential for damage to embryos in nursery sites.

AUV surveys conducted in 2009 were also used to obtain estimates of egg production in the four then-known Alaska skate nursery sites, which were then compared to estimates of egg and juvenile abundance from AFSC research surveys and stock assessments (Hoff 2010b). This work indicated that the known nursery sites probably are not sufficient to sustain the population of Alaska skates and that there are likely to be nursery areas yet to be identified

3.0 ENVIRONMENTAL ASSESSMENT (EA)

The purpose of this section is to analyze the environmental impacts of the proposed Federal action to designate six areas of skate egg concentration as HAPCs. An environmental assessment (EA) is intended to provide evidence of whether or not the environmental impacts of the action are expected to be significant (40 CFR 1508.9).

3.1 Organization of the EA

The following Sections of this analysis contain extensive information on the Bering Sea and Aleutian Islands fishery management areas BSAI, marine resources, habitat, ecosystem, social, and economic parameters, of the fisheries in primarily the eastern Bering Sea. All of the required components of an EA are included below. These include brief discussions of: the need for the action, the alternatives and options for the action, the status of the affected environment, and the environmental impacts of the proposed action, alternatives, and options. An RIR and IRFA are also included. References and a list of agencies and persons consulted are included later in this document.

In addition, an EA must consider whether an action will have a significant effect on the quality of the human environment (40 CFR 1508.27; NAO 216-6, 6.01b). Significance is determined by considering the contexts (geographic, temporal, and societal) in which the action will occur, and the intensity of the effects of the action. The evaluation of intensity should include consideration of the magnitude of the impact, the degree of certainty in the evaluation, the cumulative impact when the action is related to other actions, the degree of controversy, and consistency with other laws. If an impact is not considered significant, a Finding of No Significant Impact (FONSI) is issued.

3.2 Relevant NEPA Documents

The NEPA documents listed below have detailed information on the BSAI groundfish fisheries, and on the natural resources and the economic and social activities and communities affected by those fisheries. These documents contain valuable background for the actions under consideration in this EA/RIR/IRFA. The Council on Environmental Quality (CEQ) regulations encourage agencies preparing NEPA documents to incorporate by reference the general discussion from a broader EIS and concentrate solely on the issues specific to the environmental assessment subsequently prepared. According to the CEQ regulations, whenever a broader EIS has been prepared and a NEPA analysis is then prepared on an action included within the entire program or policy, the subsequent analysis shall concentrate on the issues specific to the subsequent action. The subsequent EA need only summarize the issues discussed and incorporate discussions in the broader EIS by reference (see 40 CFR 1502.20).

3.2.1 Alaska Groundfish Programmatic Supplemental Environmental Impact Statement EIS (PSEIS)

In June 2004, NMFS completed the PSEIS that disclosed the impacts from alternative groundfish fishery management programs on the human environment (NMFS 2004). The following provides information on the relationship between this EA/RIR/IRFA and the PSEIS. NMFS issued a Record of Decision on August 26, 2004, with the simultaneous approval of Amendment 74 and Amendment 81 to the FMP to implement the preferred alternative in the PSEIS, respectively. This decision implemented a policy for the groundfish fisheries management programs that is ecosystem-based and is more precautionary when faced with scientific uncertainty. For more information on the PSEIS, see the NMFS Alaska Region website at: http://www.fakr.noaa.gov/sustainablefisheries/seis/default.htm.

The PSEIS brings the decision-maker and the public up to date on the current state of the human environment, while describing the potential environmental, social, and economic consequences of alternative policy approaches and their corresponding management regimes for management of the groundfish fisheries off Alaska. In doing so, it serves as the overarching analytical framework that will be used to define future management policy with a range of potential management actions. Future amendments and actions will logically derive from the chosen policy direction set for the PSEIS' preferred alternative.

As stated in the PSEIS, any specific FMP amendments or regulatory actions proposed in the future will be evaluated by subsequent EAs or EISs that incorporate by reference information from the PSEIS but stand as case-specific NEPA documents and offer more detailed analyses of the specific proposed actions. As a comprehensive foundation for management of the GOA and BSAI groundfish fisheries, the PSEIS functions as a baseline analysis for evaluating subsequent management actions and for incorporation by reference into subsequent EA/EISs that focus on specific Federal actions.

The Council will take up discussion on scheduling the next review of the ground fish PSEIE during Staff Tasking at the February 2012 Council meeting in Seattle, Washington.

3.2.2 Alaska Groundfish Harvest Specifications

In January 2007 NMFS completed the EIS analyzing the impacts of various harvest strategies for the Alaska groundfish fisheries (NMFS 2007a). Except for the no action alternative, the alternatives analyzed would implement the preferred management strategy contained in the PSEIS. This document contains an analysis of the effects of the alternative harvest strategies on target groundfish species, non-target species, prohibited species, marine mammals, seabirds, habitat, ecosystem relationships and social and economic concerns. The analysis is based on the latest information regarding the status of each of these environmental components and provides the most recent consideration of reasonably foreseeable future actions to consider in the cumulative effects analysis. The EIS provides the latest overall analysis of the impacts of the groundfish fisheries on the environment and will provide a substantial amount of reference material for the purposes of this EA/RIR/IRFA.

3.2.3 BSAI Final 2011-2012 Harvest Specifications

Final Harvest specifications for BSAI groundfish fisheries for 2011 and 2012 were analyzed in an environmental assessment to determine significance of the potential effects of alternative harvest strategies (NMFS 2005). This EA/FRFA provided recent, applicable methods of determining significance of effects on marine mammals and seabirds. These criteria are used in this Bering Sea Habitat Conservation analysis because they apply the latest understanding of the potential effects of groundfish fisheries on marine mammals and seabirds to determine the significance of an effect. This EA will analyze alternatives to further conserve fish habitat in the EBS. This proposed action derives from the policy established in the preferred alternatives in the PSEIS and in the EFH EIS. This EA incorporates by reference information from the NEPA documents described above, when applicable, to focus the analysis on the issues ripe for decision and eliminate repetitive discussions.

3.2.4 Essential Fish Habitat EIS

In 2010 NMFS and the Council conducted an EFH five-year Review. The review examined information within the 2005 EFH EIS and determined: 1) new and more recent information exists to refine EFH for a small subset of managed species; 2) certain fishing effects may be impacting sensitive habitats of Bristol Bay red king crab; however additional analysis is needed; and 3) the non-fishing impacts analysis, including advisory EFH Conservation Recommendations, should be updated with the most current level of information. The Council is revising the EFH sections of its Fishery Management Plans (FMPs) to address the results of the five-Year Review, and will complete an EFH Omnibus Amendment in 2012.

In 2005, NMFS and the Council completed the EIS for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS, NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: 1) describing and identifying EFH for Council managed fisheries; 2) adopting an approach to identify Habitat Areas of Particular Concern within EFH; and 3) minimizing to the extent practicable the adverse effects of fishing on EFH. The Council's preferred alternatives from the EFH EIS are implemented through Amendments 78/65 and 73/65 to the GOA and BSAI groundfish FMPs, respectively, Amendments 16 and 12 to the FMP for BSAI King and Tanner Crab, Amendments 9 and 7 to the FMP for the Scallop Fishery off Alaska, and Amendments 7 and 8 to the FMP for Salmon Fisheries in the Exclusive Economic Zone (EEZ) off the Coast of Alaska. A Record of Decision was issued on August 8, 2005. NMFS approved the amendments on May 3, 2006. Regulations implementing the EFH/HAPC protection measures were effective July 28, 2006 (71 FR 36694, June 28, 2006). The Final EIS may be found on the NMFS AKR web site at:
http://www.fakr.noaa.gov/habitat/seis/efheis.htm.

3.3 Purpose and Need for the Action

The purpose of the proposed HAPC sites is to protect eggs and developing embryos of skate (Rajidae) species in the eastern Bering Sea. Skate eggs are deposited in small, highly localized areas. Eggs and embryos are protected by proteinaceous egg cases; however the egg cases, eggs, and embryos are susceptible to damage or destruction from fishing gear that contacts the sea floor. In addition, fishing activity may be disruptive to reproductive adult skates depositing eggs in these localized areas. Because skates have relatively low productivity (i.e., low fecundity, long embryo development times, and delayed adult maturity), a need exists to protect skate nursery sites and limit the potential loss of skate early life stages.

The Council adopted the following Statement of Purpose and Need at its February 2011 meeting:

> *HAPCs are geographic sites that fall within the distribution of Essential Fish Habitat for the Council's managed species. The Council has a formalized process, identified in its FMPs, for selecting HAPCs that begins with the Council identifying habitat priorities—here, areas of skate egg concentration. Candidate HAPCs must be responsive to the Council priority, must be rare (defined as uncommon habitat that occurs in discrete areas within only one or two Alaska regions), and must meet one of three other considerations: provide an important ecological function; be sensitive to human-induced degradation; or be stressed by development activities.*
>
> *The candidate HAPCs identify sites of egg concentration by skate species (Rajidae) in the eastern Bering Sea. Skates are elasmobranch fish that are long-lived, slow to mature, and produce few young. Skates deposit egg cases in soft substrates on the seafloor in small, distinct sites. A reproducing skate deposits only several egg cases during each reproductive season. Depending on the species, a single egg case can hold from one to four individual skate embryos, and development can take up to three years. Thus, a single egg case site will hold several year classes and species, and eggs growing at different rates.*
>
> *Distinct skate egg case sites have been highlighted by skate stock experts while assessing skate information from research survey and catch locations. The scientists noted repeated findings of distinct sites where egg cases recruit to sampling or fishing gear contacting the seafloor: egg*

case prongs (or horns) entangle in or cases recruits into the gear. The eggs and embryos are highly susceptible to disturbance, damage, or destruction from fishing gear that contacts the seafloor during their lengthy development. Fishing activities within these sites can also disrupt recently hatched juveniles and reproductive adult skates depositing new eggs in nursery sites. It is therefore important to protect areas of concentrated skate egg concentration and limit the loss of skates during the early life stages.

This EA/RIR/IRFA evaluates the impacts of three Alternatives, which include the status quo, and four gear limitations components that are considered as Options to Alternative 3. The Alternatives and Options are not mutually exclusive to the six proposed HAPCs, and any combination may be selected: the Options may be chosen in any combination with the Alternatives.

3.4 Description of the Action, Alternatives, and Options

In order to address the problem described in the above statement of Purpose and Need, the Council identified three alternatives and five options for analysis, shown below. Alternative 1, the status quo, or no action alternative, involves no measures to identify or conserve areas of skate egg concentration as HAPCs. Alternative 2 would identify areas of skate egg concentration as HPACs. The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs. Under Alternative 2, the Council is not required to limit fishing activities or prohibit gear types that make contact with the sea floor. Alternative 3 provides for both the identification of skate egg concentration HAPCs and for the conservation of these areas through prohibitions of gear types that make contact with the sea floor. The Council may select, in combination with any skate egg concentration designated as a HAPC, to limit fishing activities that make contact with the sea floor in these areas by prohibiting the use of “mobile bottom contact,” pelagic, “bottom contact,” or all fishing gear.

Further, under any Alternative, in any combination of skate egg concentration HAPCs and with any combination of conservation and management measures, the Council may identify the research and monitoring of areas of skate egg case concentration as a research priority and incorporate it into the Council’s annual research priority list for continuing research, to evaluate skates, skate egg concentration areas, and their ecology and habitat.

3.4.1 Alternative 1: Status quo; no action.

No measures would be taken to identify, or to identify and conserve, skate egg concentration HAPCs.

3.4.2 Alternative 2: Identify skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs.[6]

[6] 50 C.F.R. 600.815(a)(8).

Table 9. The six proposed skate egg concentration HAPCs

Site name	*Predominant* skate species	Boundaries of HAPC (°N latitude or °W longitude)				Area of HAPC	
		North	South	West	East	nm^2	km^2
1. Bering 1	Alaska	54°53′	54°49′	165°46′	165°38′	18.4	63
2. Bering 2	Aleutian	54°38′	54°33′	165°45′	165°34′	17.5	60
3. Bristol	Bering	55°21′	55°17′	167°40′	167°34′	13.7	47
4. Pribilof	Alaska	56°11′	56°10′	168°28′	168°26′	1.2	4
5. Zhemchug	Alaska	56°57′	56°54′	173°23′	173°21′	3.2	11
6. Pervenets	Alaska, Bering, and Aleutian	59°28′	59°22′	177°43′	177°34′	27.7	95

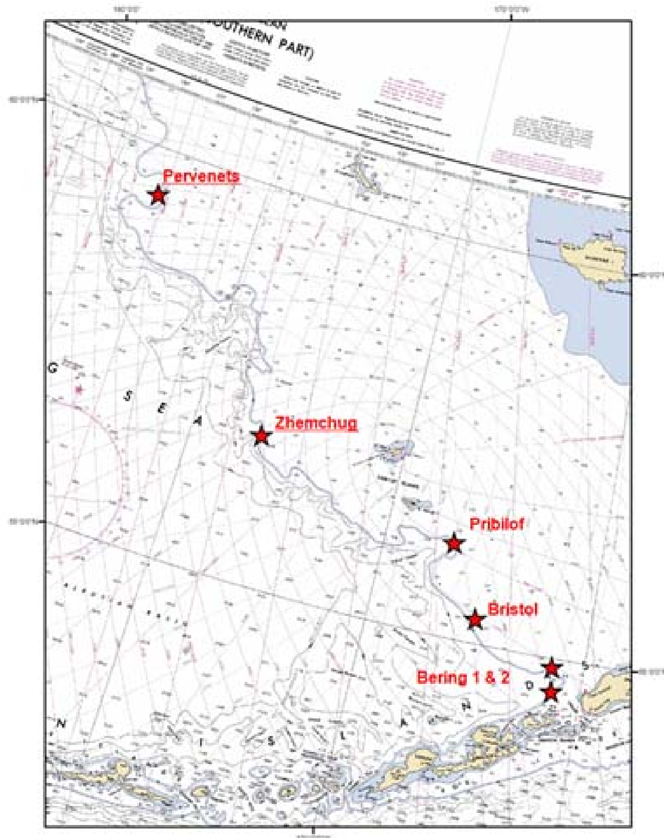

Figure 3. The locations in the eastern Bering Sea of the six proposed skate egg concentration HAPCs (not to scale)

3.4.3 Alternative 3: Identify and conserve skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs – AND – the Council may select different conservation and management options for any identified skate egg concentration HAPC.

The conservation and management options below may be selected in combination with any skate egg concentration HAPC:

Option a: Prohibit within skate egg concentration HAPCs the use of "mobile bottom contact"[7] fishing gear: nonpelagic trawl, dredge, and dinglebar gear.

Option b: Prohibit within skate egg concentration HAPCs the use of "mobile bottom contact" and pelagic trawl fishing gear: nonpelagic and pelagic trawl, dredge, and dinglebar gear.[8]

Option c: Prohibit within skate egg concentration HAPCs the use of "bottom contact"[9] fishing gear: nonpelagic trawl, dredge, dinglebar, pot, and hook and line gear.

Option d: Prohibit within skate egg HAPC(s) the use of all fishing gear: nonpelagic and pelagic trawl, dredge, dinglebar, pot, and hook and line gear.

The following option is applicable to ALL alternatives, in any combination of skate egg concentration HAPCs, with any combination of conservation and management measures the Council selects:

Option e: Add research and monitoring of any area of skate egg concentration to the Council's annual research priority list.

The Council may identify the research and monitoring of areas of skate egg case concentration as a research priority and incorporate it into the Council's annual research priority list for continuing research, to evaluate skates, skate egg concentration areas, and their ecology and habitat.

3.5 Delineation of HAPCs

Six skate nursery HAPC sites in the BSAI management area are proposed for HAPC designation. These sites have been identified by NMFS and AFSC scientists. Each site has been studied and mapped using research bottom trawls to determine the density of egg cases, extent of the nursery sites, mortality sources to young skates, and distinguishing abiotic features of the site that may define essential fish habitat. The exception is the "Pribilof" site, which was mapped using an autonomous underwater vehicle (AUV) equipped with a high-resolution camera. Additional AUV mapping work has been performed at several of the other sites listed, but those data were not used to delineate the boundaries of the proposed area. At each site, the spatial extent of bottom trawls containing more than (>) 1,000 egg cases per kilometer squared ($km^{2)}$ was established. The boundary lines were then snapped to the nearest minute of latitude or longitude away from the center of the nursery area. This snapping creates a buffer region to account for the possibility of additional eggs in un-sampled areas. Using whole minutes also allows for a simpler boundary line that will be easier to discern by fishing vessels, regulators, and policymakers.

3.5.1 Concentration Threshold

Data for the AFSC HAPC proposal and this analysis was collected predominately from bottom trawl directed studies at skate egg concentration sites where an adaptive sampling strategy was applied. The goal was to identify the skate nursery/areas of high skate egg case concentration and subsequently move in all four (or more) directions away from the center to detect the drop in egg case density, and therefore locate the extent of the egg concentration site. In the process, and due to mechanics of trawling, ability to

[7] 50 C.F.R. 679.2.
[8] See 50 C.F.R. 679.2 for the particular and intricate components of "pelagic trawl" fishing gear.
[9] 50 C.F.R. 679.2.

clean the net, and the moderate scattering of empty egg cases out of the nursery site, it was found that there is a slight ‘contamination’ from one trawl to the next due to the entanglement of skate eggs in the trawl cod-end. A threshold of 1,000 eggs/km^2 equates to approximately ten eggs encountered in the trawl and during the study was often found to be from a previous tow. Because of the uncertainty of this low level, it has been designated as background levels and not included as part of the egg concentration area.

From the AFSC standard trawl survey conducted on an annual basis throughout the eastern Bering Sea, encountering skate eggs at this threshold level (1,000 eggs km^2) can be frequent and does not indicate a skate nursery in that immediate area. There are several possible explanations why there may be low level skate eggs widely scattered outside nursery sites, which include: 1) a certain amount of “wandering” by skates where they deposit eggs randomly away from nursery sites for unknown reasons; 2) the distance a skate may be from a nursery site when the eggs are ready to deposit and concentration occurs whether inside a nursery site or not; 3) newly maturing skates may have a learning curve to find the appropriate nursery habitat and they may not be successful immediately upon maturation; and 4) there may be scatter out of the nursery site due to currents, predator disturbances, or fishers disturbances. Throughout this analysis, an order of magnitude greater (10,000 eggs km^2) than background has been used to identify nursery sites from survey trawls or commercial fishing and this method has been very reliable on the determination of egg concentration sites when egg encounters at level of ~100 eggs in a single trawl (10,000 eggs/km^2).

3.5.2 Shape of Area

The distribution maps at each skate egg concentration site display two possible alternatives to determine the extent of the skate egg concentration area based on trawl studies. The ovals are based on the distribution of trawl sites where skate eggs were >1,000/km^2. This oval is limited to locations where there is density information and the egg case density is unknown beyond the location of samples. The outside boxes are approximately 10 km (100 km^2) on each side using the trawl with the highest concentration as the center of the box. This design accomplishes two goals, that of estimating the effective skate egg habitat area and provide a comfortable buffer around the sites that produces a manageable area and shape to facilitate enforcement.

At the February 2011 Council Meeting, the Enforcement Committee received the Preliminary review of proposed skate HAPCs and made recommendations on the most appropriate shape and size. The Enforcement Committee recommended that the Council maintain square- or rectangular-shaped closures. Areas closed to certain gear types for conservation are more practical to enforce if they are square- or rectangle-shaped. It is more clear that a fishing vessel is either west/east or north/south of a delineation, and therefore, in or outside a closed area using VMS or aircraft overflight. This clarity also benefits fishing vessels in avoiding or inadvertently entering a closure.

3.6 Skate Biology

Skates (from the family Rajidae) are cartilaginous fishes related to sharks. Skates are dorso-ventrally depressed animals with large pectoral “wings” attached to the sides of the head, and long, narrow whip-like tails. There are at least 15 species of skates in three genera, *Raja*, *Bathyraja*, and *Amblyraja*, distributed throughout the eastern North Pacific, and common from shallow inshore waters to very deep benthic habitats (Eschmeyer et al. 1983, Stevenson et al. 2006). The table below lists the 15 skate species found in Alaskan waters.

Table 10. **Skate species in the North Pacific Ocean**

Common Name	**Species Nomenclature**
*Alaska skate	*Bathyraja parmifera*
*Aleutian skate	*Bathyraja aleutica*
*Bering skate (complex?)	*Bathyraja interrupta*
deepsea skate	*Bathyraja abyssicola*
Commander skate	*Bathyraja lindbergi*
whiteblotched skate	*Bathyraja maculate*
butterfly skate	*Bathyraja mariposa*
whitebrow skate	*Bathyraja minispinosa*
"Leopard" parmifera	*Bathyraja sp. cf. parmifera*
mud skate	*Bathyraja taranetzi*
roughtail skate	*Bathyraja trachura*
Okhotsk skate	*Bathyraja violacea*
big skate	*Raja binoculata*
roughshoulder skate	*Amblyraja badia*
longnose skate	*Raja rhina*

* The 3 representative skate species in defining EFH.

The species within the skate assemblage occupy different habitats and regions within the BSAI FMP area: the eastern Bering Sea shelf (< 200 m depth), the eastern Bering Sea slope (> 200 m depth), and the Aleutian Islands region (all depths). Within the eastern Bering Sea, the skate species composition varies by depth, and species diversity is generally greatest on the upper continental slope at 250 to 500 m depth (Stevenson et al. 2006). The eastern Bering Sea shelf skate complex is dominated by a single species, the Alaska skate (*Bathyraja parmifera*). The Alaska skate is distributed throughout the eastern Bering Sea shelf habitat area, most commonly at depths of 50 to 200 m (Stevenson 2004), and has accounted for between 91% and 97% of aggregate skate biomass estimates since species identification became reliable in 1999. The Bering or sandpaper skate (*B. interrupta*) is the next most common species on the eastern Bering Sea shelf, and is distributed on the outer continental shelf.

While skate biomass is much higher on the eastern Bering Sea shelf than on the slope, skate diversity is substantially greater on the EBS slope. The dominant species on the EBS slope is the Aleutian skate (*B. aleutica*). A number of other species are found on the EBS slope in significant numbers, including the Alaska skate, Commander skate (*B. lindbergi*), whiteblotched skate (*B. maculata*), whitebrow skate (*B. minispinosa*), roughtail skate (*B. trachura*), and mud skate (*B. taranetzi*). Two rare species, the deepsea skate (*B. abyssicola*) and roughshoulder skate (*Amblyraja badia*), have only recently been reported from EBS slope bottom trawl surveys (Stevenson and Orr 2005). The Okhotsk skate (*B. violacea*) is also occasionally found on the eastern Bering Sea slope.

The skate complex in the AI is quite distinct from the EBS shelf and slope complexes, with different species dominating the biomass, as well as at least one endemic species, the recently described butterfly skate, *Bathyraja mariposa* (Stevenson et al. 2004). In the AI, the most abundant species is the whiteblotched skate, *B. maculata*. The whiteblotched skate is found primarily in the eastern and far western Aleutian Islands. Aleutian and Alaska skates are also common in the AI. The mud skate (*B. taranetzi*) is relatively common in the AI but represents a lower proportion of total biomass because of its smaller body size. The common species formerly known as the Alaska skate in the western Aleutians looks very different from the Alaska skate found on the EBS shelf. The Aleutian Islands type or "leopard skate" (*Bathyraja* sp. cf. *parmifera*) has been confirmed to be a separate species (J. Orr pers. comm.).

3.6.1 Life History and Stock Structure

Skate life cycles are similar to sharks, with relatively low fecundity, slow growth to large body sizes, and dependence of population stability on high survival rates of a few well developed offspring (Moyle and Cech 1996). Skates and sharks in general have been classified as "equilibrium" life history strategists (Winemiller and Rose 1992), with very low intrinsic rates of population increase implying that sustainable harvest is possible only at very low to moderate fishing mortality rates (King and McFarlane 2003). Within this general equilibrium life history strategy, there can still be considerable variability between skate species in terms of life history parameters (Walker and Hislop 1998). While smaller sized species have been observed to be somewhat more productive, large skate species with late maturation (11+ years) are most vulnerable to heavy fishing pressure (Walker and Hislop 1998; Frisk et al. 2001; Frisk et al. 2002). Little is known about life history parameters of Alaska skate. Studies own elsewhere have determined age at maturity and maximum age for big skates and longnose skates to be about 12 to 26 years, with maturity occurring at approximately 8 years.

Several recent studies have explored the effects of fishing on a variety of skate species in order to determine which life history traits might indicate the most effective management measures for each species. Major life stages include the egg stage, the juvenile stage, and the adult stage (summarized here based on Frisk et al. 2002). All skate species are oviparous (egg-laying), investing considerably more energy per large, well-protected embryo than most commercially exploited teleost groundfish. The large, leathery egg cases incubate for extended periods (several months to over a year) in benthic habitats, exposed to some level of predation and physical damage, until the fully formed juveniles hatch. The juvenile stage lasts from hatching through maturity, several years to over a decade depending on the species.

The reproductive adult stage may last several more years to decades depending on the species. Age and size at maturity and adult size/longevity appear to be more important predictors of resilience to fishing pressure than fecundity or egg survival in the skate populations studied to date. Frisk et al. (2002) estimated that although annual fecundity per female may be on the order of less than 50 eggs per year (extremely low compared with teleost groundfish), there is relatively high survival of eggs due to the high parental investment, and therefore egg survival did not appear to be the most important life history stage contributing to population stability under fishing pressure. Juvenile survival appears to be most important to population stability for most North Sea species studied (Walker and Hislop 1998) and for the small and intermediate sized skates from New England (Frisk et al. 2002). For the large and long-lived barndoor skate, adult survival was the most important contributor to population stability (Frisk et al. 2002). Comparisons of length frequencies for surveyed North Sea skates from the mid and late 1900s led Walker and Hislop (1998, p. 399) to the conclusion that after years of very heavy exploitation "all the breeding females, and a large majority of the juveniles, of Dipturus batis, Leucoraja fullonica and R. clavata have disappeared, whilst the other species have lost only the very largest individuals." Although juvenile and adult survival may have different importance by skate species, all studies found that one metric, adult size, reflected overall sensitivity to fishing. After modeling several New England skate populations, Frisk et al. (2002, p. 582) found "a significant negative, nonlinear association between species total allowable mortality, and species maximum size." This may be an oversimplification of the potential response of skate populations to fishing; in reality it is the interaction of natural mortality, age at maturity, and the selectivity of fisheries which determines a given species' sensitivity to fishing and therefore the total allowable mortality (i.e., ABC).

3.6.2 Embryology and Development Duration

Fecundity is a very difficult quantity to measure in skates, as individuals of some species may reproduce throughout the year and thus the number of mature or maturing eggs present in the ovary may represent only a fraction of the annual reproductive output. Matta (2006) estimated the average fecundity of the Alaska skate to range between 21 and 37 eggs per female per year, based on the assumed relationship between reproductive potential and *M* (Gunderson 1997). Additional work, such as laboratory rearing experiments, is needed to validate these estimates.

Eggs are deposited in horny cases on the floor of the continental shelf and slope. Development time for oviparous elasmobranchs is dependent of environmental temperature. A retrospective analysis of 14 species worldwide from field and laboratory studies demonstrates that the relationship between environmental temperature during development and time describe an exponential curve and display the well-known Q_{10} effect of temperatures influence on metabolic rates of ectotherms (Appendix C – Color Figure 29). The result is that in tropical to temperate waters oviparous elasmobranchs emerge from the egg case in the range of 1 to 6 months after concentration. However, in sub-temperate to sub-arctic waters such as the North Pacific, the development time is dramatically extended taking years for embryo development. Field and recent laboratory studies conducted on the Alaska skate confirms that at environmental temperatures experienced in the EBS, time to emergence for juvenile skates is >3 years (Appendix C – Color Figure 29).

With annual egg concentration events at skate egg concentration sites, it is expected there will be multiple cohorts at any given moment in time since new eggs are deposited at a faster rate than embryo development. Appendix C – Color Figure 30 shows within an egg concentration site there are multiple embryo length modes at a particular instance, where in the case of the Aleutian skate-Pervenets Canyon having up to seven cohorts developing simultaneously. Because of temperatures influence on development time, skates have optimized nursery locations along the slope where sites selected possess warm annual temperatures for any given latitude (Appendix C – Color Figure 31). Due to currents and the strong influence the central EBS cold pool has on the outer shelf waters; for a given depth in the upper 400 meters of the slope bottom temperatures are colder with increased latitude. The shelf condition influence dissipates at about 400 meters and below this depth all latitudes show similar depth temperature relationships. This phenomenon explains why a single species nursery sites are continually deeper at increased latitude in the EBS (Appendix C – Color Figure 31).

3.6.3 Role of Skates in the Ecosystem

This section focuses on the Alaska skate in both the Bering Sea and Aleutian Islands (BSAI), with all other species found in each area summarized within the group “Other Skates.” Aggregation is necessary due to current data constraints. Skates are predators in the BSAI FMP area. Some species are piscivorous while others specialize in benthic invertebrates; additionally, at least three species, deepsea skate, roughtail skate, and longnose skate, are benthophagic during the juvenile stage but become piscivorous as they grow larger (Ebert 2003, Robinson 2006). Each skate species would occupy a slightly different position in eastern Bering Sea and Aleutian Islands food webs based upon its feeding habits, but in general skates as a group are predators at a relatively high trophic level. In the EBS, the skate biomass is dominated by the Alaska skate, which eats primarily pollock (as do most other piscivorous animals in the BSAI). Aside from sperm whales, most of the “predators” of BSAI skates are fisheries. Cod and halibut are both predators and prey of skates.

In terms of annual tons removed, it is instructive to compare fishery catches with predator consumption of skates. It is estimated that fisheries were annually removing about 13,000 and 1,000 tons of skates from the BSAI, respectively on average during the early 1990s (Fritz 1996, 1997). While estimates of predator consumption of skates are perhaps more uncertain than catch estimates, the ecosystem models incorporate uncertainty in partitioning estimated consumption of skates between their major predators in each system. The predators with the highest overall consumption of Alaska skates in the EBS are sperm whales, which account for less than 2% of total skate mortality and consumed between 500 and 2,500 tons of skates annually in the early 1990s. Consumption of EBS Alaska skates by Pacific halibut and cod are too small to be reliably estimated. Similarly, sperm whales account for less than 2% of Other Skate mortality in the EBS, but are still the primary predator of Other Skates there, consuming an estimated 50 to 400 tons annually. Pacific halibut consume very small amounts of Other Skates in the EBS, according to early 1990s information integrated in ecosystem models. The predators with the highest consumption of Alaska skates in the AI are also sperm whales, which account for less than 2% of total skate mortality and consumed between 20 and 120 tons of skates annually in the early 1990s. Pinnipeds (Steller sea lions) and sharks also contributed to Alaska skate mortality in the AI, averaging less than 50 tons annually. Similarly, sperm whales account for less than 2% of Other Skate mortality in the AI, but are still the primary predator of Other Skates there, consuming an estimated 20 to 150 tons annually. Pinnipeds and sharks consume very small amounts of Other Skates in the AI, according to early 1990s information. Gerald Hoff's research on skate nursery areas suggests that gastropod predation on skate egg cases may account for a significant portion of mortality during the embryonic stage, and Pacific cod and Pacific halibut consume substantial numbers of newly hatched juvenile skates within nursery areas. These sources of mortality may be included in future stock assessments.

Diets of skates are derived from food habits collections taken in conjunction with EBS and AI trawl surveys. Skate food habits information is more complete for the EBS than for the AI, but we present the best available data for both systems here. Over 40% of EBS Alaska skate diet measured in the early 1990s was adult pollock, and another 15% of the diet was fishery offal, suggesting that Alaska skates are opportunistic piscivores. Eelpouts, rock soles, sandlance, arrowtooth flounder, salmon, and sculpins made up another 25-30% of Alaska skates' diet, and invertebrate prey made up the remainder of their diet. This diet composition combined with estimated consumption rates and the high biomass of Alaska skates in the EBS results in an annual consumption estimate of 200,000 to 350,000 tons of pollock annually. EBS Other Skates also consume pollock (45% of combined diets), but their lower biomass results in consumption estimates ranging from 20,000 to 70,000 tons of pollock annually. Other Skates tend to consume more invertebrates than Alaska skates in the EBS, so estimates of benthic epifaunal consumption due to Other Skates range up to 50,000 tons annually, higher than those for Alaska skates despite the disparity in biomass between the Groups.

Because Alaska skates and all "other skates" are distributed differently in the EBS, with Alaska skates dominating the shallow shelf areas and the more diverse species complex located on the outer shelf and slope, we might expect different ecosystem relationships for skates in these habitats based on differences in food habits among the species. Similarly, in the AI the unique skate complex has different diet compositions and consumption estimates from those estimated for EBS skates. The skate in the AI formerly known as the Alaska skate is opportunistically piscivorous like its EBS relative, feeding on the common commercial forage fish, Atka mackerel (65% of diet) and pollock (14% of diet), as well as fishery offal (7% of diet). Diets of Other Skates in the AI are more dominated by benthic invertebrates, especially shrimp (pandalid and non-pandalid total 42% of diet), but include more pelagic prey such as juvenile pollock, adult Atka mackerel, adult pollock and squids (totaling 45% of diet). Estimated annual consumption of Atka mackerel by AI (former) Alaska skates in the early 1990s ranged from 7,000 to 15,000 tons, while pollock consumption was below 5,000 tons. Shrimp consumption by AI Other Skates was estimated to range from 4,000 to 15,000 tons annually in the early 1990s, and consumption of pollock ranged from 2,000 to 10,000 tons. Atka mackerel consumption by AI Other Skates was estimated to be below 5,000 tons annually. The diet composition estimated for AI Other Skates is likely dominated by the biomass dominant species in that system, whiteblotched skate and Aleutian skate. The diet compositions of both Aleutian and whiteblotched skates in the AI appear to be fairly diverse, and are described in further detail in Yang (2007) along with the diets of big skate, Bering skate, Alaska skate, roughtail skate, and mud skate in the AI. In the future, we hope to use diet compositions to make separate consumption estimates for whiteblotched and Aleutian skates along with (former) Alaska skates in the AI. Examining the trophic relationships of EBS and AI skates provides a context for assessing fishery interactions beyond the direct effect of bycatch mortality. In both areas, the biomass-dominant species of skates feed on commercially important fish species, so it is important for fisheries management to maintain the health of pollock and Atka mackerel stocks in particular to maintain the forage base for skates (as well as for other predators and for human commercial interests).

3.7 Environmental Impacts

The proposed action is limited to six locations in the EBS and to fishing activities that make contact with the sea floor. Any effects of this action are therefore limited to these six locations and to any component of the environment that may be impacted by fishing activities that make contact with the sea floor in these locations.

3.7.1 Effects of Fishing Activities on Fish Habitat

This section provides descriptions of fishing gear and methods used in the proposed HAPCs and their effects on fish habitat. It is a summary of the more detailed analysis of the studies most pertinent to the gear and habitats of the Alaska region found in the EFH EIS (NMFS 2005). Only a few studies have been completed in Alaska on the habitat effects of fishing gear, so the review incorporates the results of pertinent studies from other regions. The descriptions and research summaries below are organized by gear type.

Four main classes of fishing gear are used in the fisheries affected by the proposed alternatives: trawls, scallop dredges, longlines, pots, and troll gear (including dinglebar). These gear types have different characteristics that determine their impact on the benthic environment and on the amount of habitat encountered. Effects also depend on properties of the substrate and organisms. Because no comprehensive, systematic surveys have been conducted on the effects of these gears on habitat, this information is based on the knowledge of NMFS gear researchers and related information available to them.

Research conducted on effects of fishing gear on benthic habitats broadly recognizes several factors that influence the occurrence and degree of effect. Among these are (1) the intensity of fishing, (2) the frequency of fishing, (3) the class and specific characteristics of the fishing gear, (4) the environmental/ habitat characteristics, and (5) the level of naturally occurring disturbance. This section summarizes worldwide literature on the habitat effects of fishing gear relevant to the groundfish fisheries of Alaska, which is discussed and referenced in greater detail in the EFH EIS (NMFS 2005).

3.7.1.1 Nonpelagic Trawls (Bottom Trawls)

Nonpelagic trawls (i.e., bottom trawls), as shown the figure below, are conical nets that are pulled through the water, gathering fish into the open forward end and retaining them in a restricted bag (codend) at the back end. This type of trawl has four main components that may contact the seabed: doors, sweeps, footrope, and netting.

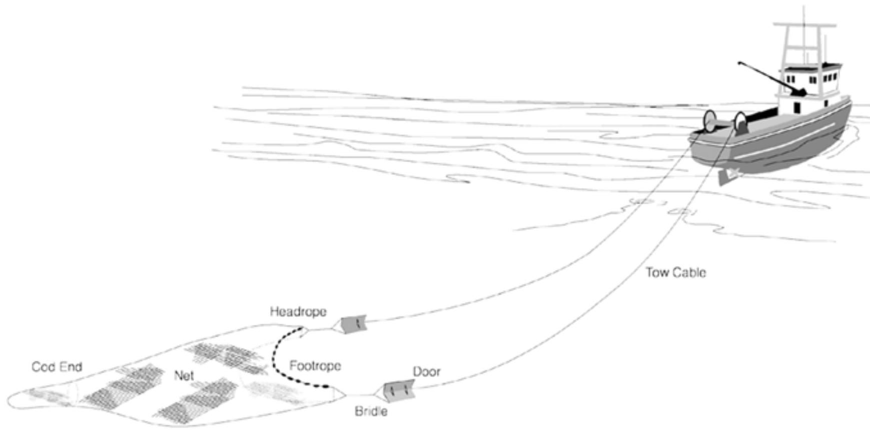

Figure 4. Bottom trawling

Doors are flattened metal structures that ride vertically in the water and use the force of their motion through the water to spread the net horizontally. Some bottom trawl doors also use contact with the seafloor to augment this hydrodynamic spreading force. The weight of the doors (and some hydrodynamic forces) overcomes the upward pull of the towing cables to force the net down into the water.

Sweeps (as the term is used here; nomenclature varies between regions and individuals) are steel cables that connect the doors to the trawl net. Fiber and combination fiber/steel cables are also used. On bottom trawls, sweeps are required to have elevating devices (bobbins) that lift the wire at least 2.5 inches from the seafloor. The footrope consists of cable or chain connected along the bottom edge of the trawl net and is designed to contact the seafloor on bottom trawls. A 1996 survey of footrope types used off Alaska (168 observers delivered and returned forms from 95 vessels; Rose, C., NMFS, unpublished data) indicated that all vessels used large-diameter (averaging 39–47 cm by fishery) cones, spheres, or disks (i.e., bobbins). These bobbins are usually made of rubber, strung over the entire length of the footrope. Large-diameter bobbins are separated by sections of small-diameter disks, creating openings under the footrope that are an average of 13 cm in height and average two-thirds of the footrope in length. Elevating most of the footrope above the seabed reduces damage to netting and bycatch of crabs and other invertebrates. During fishing, the footrope is shaped like a horizontally spread “U” with the opening forward. Bobbins are nearly always used on the sides of the U (wings). In the center section, “tire gear” is used for cod, rockfish, and Dover and rex sole, as reported in all six reports from the Atka mackerel fishery and about half of the reports from the GOA fisheries. This gear consists of vehicle tires or sections of tires linked side-by-side to form a continuous cylinder (averaging 68 cm in diameter). Tire gear and other large-diameter bobbins are very effective at protecting the netting and making it possible to fish in areas with hard and uneven substrates.

The netting is the most easily damaged component of bottom trawls; hence, trawls are designed to prevent the netting from contacting the seafloor. Bobbin or tire footropes raise the netting so that only particularly prominent seafloor features should touch the netting. If the codend contained enough fish sufficiently heavier than water (flatfish) or rocks, pulling it down to the sea floor, the bottom of the codend would drag across the sea floor. Because codends have to be pulled up the vessel’s stern ramp, they are equipped with ropes that limit their diameter to less than 8 feet, which also limits the amount of bottom affected by a dragging codend. Chafing gear is also installed on the underside of the codend to prevent damage to the net during towing, which probably also reduces the amount of interaction between habitat and the web of the trawl.

An important aspect of gear design, when considering bottom habitat effects, is the proportion of the trawl contact footprint that is made by each of the components. Trawl doors used in Alaska are typically less than 3 m along the edge that contacts the seafloor; because they are fished at an angle to their direction of movement, the doors will affect a path narrower than 3 m. The length of the sweeps will vary with target species, substrate, and individual/operator preference. A large vessel targeting flatfish on a smooth bottom may use 350 m of sweeps on each side, while a small rockfish trawler on rough bottom may only use 30 m. Adjusting for the angle of the sweeps, the sweep path may vary from 10 to 100 m on either side of the net. Thus, the area covered by the sweeps can vary significantly. The width of the trawl net itself will depend on how large a trawl the vessel can pull and whether a high opening or a wide, low trawl is selected. An approximate range would be from 12 to 30 m wide. Thus, most of the trawl's footprint results from the sweeps, followed by the footrope, with a relatively small area contacted by the doors.

Alaska experiences lower overall fishing intensity relative to many of the areas where fishing effects research has been done (i.e., NW Atlantic and North Sea) (NRC 2002). Overall, the areas experiencing trawling intensities above one trawl tow per year in small (5 by 5 km) areas are less than 2% for the EBS, 3% for the Aleutians, and 2% for the GOA; in comparison, it is 56% for northeastern United States fisheries. A more detailed study of the distribution of effort intensities during recent years is being conducted by the AFSC. Estimated for each study summarized below are fishing intensities, in number of trawl contacts of studied locations.

While Alaska marine waters include a full range of substrates, the dominant bottom trawl fisheries target species that primarily occur over sand and gravel substrates, including yellowfin and rock soles (Smith and McConnaughey 1999, McConnaughey and Smith 2000) and cod. Studies on silt/clay environments are more relevant to the smaller fisheries for flathead, Dover and rex soles, and Alaska plaice. Studies of hard bottom, gravel, and boulder habitats are most applicable to the rockfish and Atka mackerel fisheries of the GOA and AI.

While fishing depths off of Alaska also range widely (10 to 1,000 m), most of the effort is concentrated in the 25 to 100 m range. Average fishing depth is deeper in the GOA than in the EBS, with more effort in the 100 to 200 m range. Alaska fisheries are conducted between latitude 51º and 61º N. Biotic habitat responses affecting recovery may be different in warmer climates.

Based on the information available to date, the predominant direct effects caused by bottom trawling include smoothing of sediments, moving and turning of rocks and boulders, resuspension and mixing of sediments, removal of seagrasses, damage to corals, and damage or removal of epibenthic organisms (Auster et al. 1996, Heifetz 1997, Hutchings 1990, ICES 1973, Lindeboom and de Groot 1998, McConnaughey et al. 2000). Trawls affect the seafloor through contact of the doors and sweeps, footropes and footrope gear, and the net sweeping along the seafloor (Goudey and Loverich 1987). Trawl doors leave furrows in the sediments that vary in depth and width depending on the shoe size, door weight, and seabed composition. The footropes and net can disrupt benthic biota and dislodge rocks. Larger seafloor features or biota are more vulnerable to fishing contact, and, larger diameter, lighter footropes may reduce damage to some epifauna and infauna (Moran and Stephenson 2000).

Seamounts are also affected by trawl fishing. Corals from seamount slope areas comprised the largest bycatch from trawls with large bobbins along the ground rope fished in water depths of 662 to 1,524 m in tropical New Zealand. These coral patches may require over 100 years to recover, and many may be crushed or overturned without coming to the surface in a net (Probert et al. 1997). Koslow and Garrett-Holmes (1998) sampled benthic fauna over seamounts in Tasmania subject to varying levels of fishing effort. Substrates in heavily fished areas were predominantly bare rock or coral rubble and sand. Colonial corals and associated fauna were lacking. Species abundance and richness were also lower than in lightly fished areas. Observed differences in faunal composition and distribution on fished and un-fished seamount off Tasmania and concluded that although the depths of the seamounts differed, trawling was response for stripping coral cover from the fished features (Koslow and Garrett, 2001). The authors attribute these differences to fishing effort and recommend permanently closed areas to protect fragile seamount ecosystems.

In summary, only very limited chronic and immediate effects of bottom trawling were detected by these studies. Whereas these results are consistent with some reports for other shallow, sandy, and naturally disturbed areas, an unequivocal determination of negligible effect is not possible in this case. However, seamounts are widely recognized as areas of high productivity, and important commercial fisheries worldwide focus on these habitats because fish species form large aggregations in such areas (Clark and O'Driscoll, 2003).

Reports of several relevant studies done recently in Alaska waters are in process and are expected to provide relevant and useful information on the effects of bottom trawling in this region.

- Bottom trawls commonly, but not always, cause detectable short-term changes in infauna, epifauna, megafauna and substrate in different habitat types.

- In comparable environments, studies using larger diameter footropes with non-continuous contact along their length, such as those used in Alaska, indicated less damage to upright, attached epifauna than those with smaller diameters and continuous contact (Moran and Stephenson 2000, Van Dolah et al. 1987).

- At higher trawling intensities, bottom trawling with large-diameter footropes can produce persistent changes in megafauna communities (McConnaughey et al. 2000) on naturally disturbed sandy substrates.

- Even at relatively high intensities (12 tows per year), effects on infaunal communities may be ephemeral (Kenchington et al. 2001) on fine- to medium-grained sandy bottoms.

- Large bodied, attached, and emergent epifauna are particularly vulnerable to trawl damage, even by a single pass at un-impacted sites (Collie et al. 2000, Van Dolah et al. 1987, Freese et al. 1999, Moran and Stephenson 2000), and effects can remain for at least a year in Alaska waters (Freese 2002).

- Specific effects on EFH will depend on the fine-scale distribution and intensity of fishing effort relative to habitat distribution, levels of natural variability relative to fishing effects, and the nature of habitat dependencies of managed fish stocks. These are poorly known for Alaska EFH. Given discrete but overlapping spatial distributions of species reflecting different habitat preferences/requirements (e.g., McConnaughey and Smith 2000), differential responses to fishing gear effects are likely. In general, the ecological implications of reported changes due to bottom trawling are poorly known, particularly as they relate to sustainable fishery production and healthy ecosystem function.

3.7.1.2 Pelagic Trawls

Pelagic trawls are special types of trawls that are fished off the seabed. These trawls are typically much larger than bottom trawls, but the leading parts of the net are constructed of large meshes (more than 1 m) for herding pelagic species into the trawl. The very large mesh openings greatly reduce hydrodynamic drag, so vessels can fish pelagic trawls that are much taller and wider than any bottom trawls they may use. These large meshes are required by law to allow for the escape of bycatch species that are not herded by these large meshes as easily as pollock, including halibut, sole, and crabs. Walleye pollock in the BSAI are caught exclusively by pelagic trawls, since non-pelagic trawling for pollock is prohibited.

Pelagic trawls dominate the GOA pollock fishery and are sometimes used in rockfish fisheries. Seafloor contact is discouraged by prohibiting devices that protect trawl footropes. In the BSAI, vessels fishing for pollock are also limited by a performance standard prohibiting vessels from having more than 20 crab on board, which would be an indication of bottom trawling. The danger of trawl damage is likely to be effective in minimizing on-bottom trawling with pelagic trawl gear in areas of rough, hard, or complex substrates, but not necessarily in areas where significant obstructions are unlikely. Anecdotal evidence indicates that pelagic trawls are frequently fished on the bottom in areas with smooth floors. An indication of the distribution of such substrates in the EBS is that NMFS surveys the entire EBS shelf with a trawl whose footrope is as vulnerable as those of pelagic trawls; however, NMFS uses bobbin-protected footropes in the GOA and Aleutians because of the frequency of rough substrates.

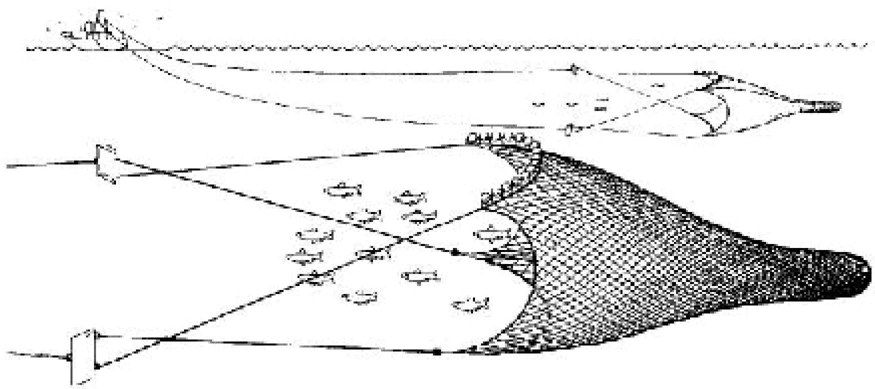

Figure 5. Pelagic trawling

Pelagic trawls fished off-bottom have no known effect on benthic EFH. While some pelagic habitats may be very important to fish species, the chemical and hydrological features that make them important are not subject to change by the passage of fishing gear because of the continuous/fluid nature of the environment.

Indirect and anecdotal evidence suggests that, in some seasons and areas, pollock are distributed so close to the seabed that they could not be caught effectively without putting some parts of pelagic trawls in contact with the seafloor. Confirmation that such near-bottom distributions can be widespread includes the following: (1) in 5 out of 9 years that both acoustic and bottom trawl surveys were conducted in the EBS, the bottom trawl, which opens only 2 m high, detected more than 95% of the total biomass estimate for pollock more than 2 years old (2000 BSAI SAFE); and (2) the average acoustic measurements of pollock density from those surveys were five times higher half a meter above the bottom than at 2 to 4 m (Williamson, N., unpublished data, AFSC). As such, there is a strong incentive for fishing pelagic pollock trawls near/on the bottom.

The effects from pelagic gear being fished on the bottom have not been specifically studied, and there are some important differences from bottom trawls in ways that must be considered in assessing likely habitat impacts. Pelagic trawls used off Alaska are generally designed to fish downward, with the entire net fishing deeper in the water column than the doors. Pelagic doors are not designed to contact the seafloor. Pelagic trawls are pulled downward by weights attached to the lower wing ends, producing several hundred pounds of downward force. If the trawl is put in firm contact with the seafloor, most of this weight will be supported by the bottom, producing narrow scour tracks. Pelagic trawl footropes used in Alaska are most commonly made of steel chain, with some use of steel cable. Thus, their effects on habitat are more similar to tickler chains or small-diameter trawl footropes than to the large-diameter, bobbin-protected, footropes used in Alaska bottom trawls. Small footrope diameter will reduce the height that sediments are suspended into the water column, but make penetration of the sediment when bumps and ridges are encountered more likely. Animals anchored on or in the substrate would be vulnerable to damage or uprooting by this type of footrope. The very large mesh openings in the bottom panels of these trawls make it unlikely that animals not actively swimming upward in reaction to the net will be retained and hence removed from the seafloor, though they may be displaced a short distance or damaged in place.

In summary, pelagic trawls may be fished in contact with the seafloor, and there are times and places where there may be strong incentives to do so, for example, the EBS shelf during the summer. No data are available to estimate the frequency of this practice. Potential impacts would depend on the vulnerability of epibenthic animals in sand or mud substrates to contact with the small-diameter footropes. Prohibition of footrope protection makes the use and, hence, the impact of such gear on hard or rugged substrates unlikely.

3.7.1.3 Scallop Dredges

The Alaska weathervane scallop fishery is pursued using a standard “New Bedford style” scallop dredge (Posgay 1957, von Brandt 1984, Smolowitz 1998, NREFHSC 2002, Barnhart 2003). These dredges are heavy-framed devices with an attached holding bag, and they are towed along the surface of the seabed. The upper and forward part of the rectangular frame, or bail, is attached to the towing bar. The fixed opening in the frame is low in height relative to its width. Steel dredge “shoes” are welded onto both lower corners of the cutting bar, which is located at the bottom of the aft part of the frame. The dredge shoes bear most of the weight and act as “sled runners,” permitting the dredge to move easily along the substrate. Regulation requires that the trailing ring bag, which retains the catch, consists of 4-inch (inside-diameter) steel rings connected with steel links to allow undersized scallops to escape. Rubber chaffing gear may be used to protect the steel links and the integrity of the ring bag. The top of the bag consists of 6-inch stretched mesh polypropylene netting, known as the “twine back.” The mesh netting helps hold the bag open while it is dragged along the ocean floor. A club stick attached at the end of the bag helps maintain the shape of the bag and provides for an attachment point to dump the dredge contents on the deck. A sweep chain footrope sweeps back in an arc and is attached to the bottom of the mesh bag. The bottom of the bag was formerly attached directly to the lower bar of the frame, but most fishers believe that the dredge tends bottom better with the chain footrope rigging. Bottom tending is also assisted by a pressure plate, which is a length of steel attached along the width of the dredge and angled so that the water pressure passing over it creates a downward force on the dredge.

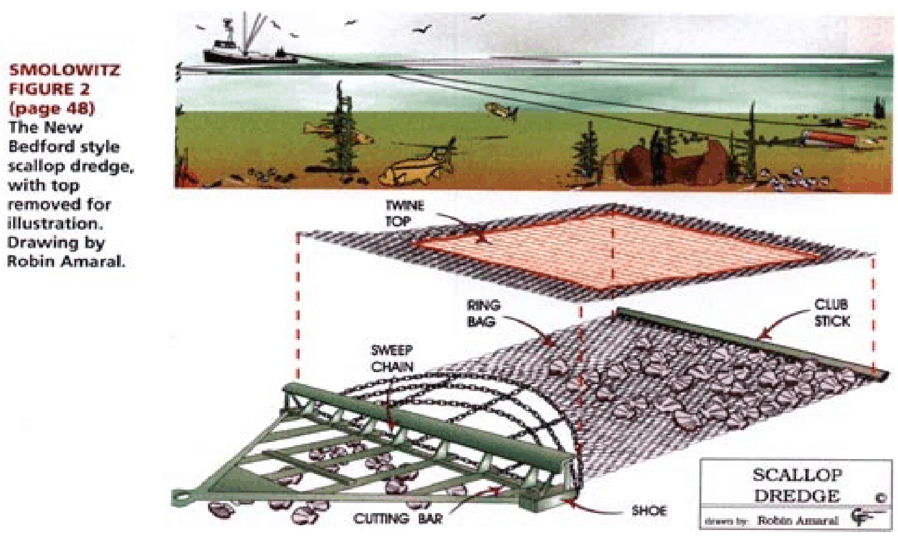

Figure 6. Scallop dredge, the New Bedford style

When fishing properly, the dredge shoes, ring bag, and club stick maintain contact with the seabed. The side of the bail is designed so that the angle between the bail and the mouth of the dredge may be changed to suit bottom conditions. When the bottom is soft, the dredge is rigged so that the cutting bar (or scraper blade) will tend to ride up over the bottom and there will be less tendency for the dredge to become clogged with mud. The turbulence created by the cutting bar stirs the substrate and kicks up scallops into the ring bag. On harder bottoms, a different setting is used so that the dredge will dig in somewhat and catch more of the scallops in its path. In Alaska fisheries, however, the cutting bar is fixed and rides above the surface of the substrate.. Tickler chains that run from side to side between the frame and the ring bag may also be used in harder areas or as an alternate fishing method when catch rates are low. If used on softer bottoms, the tickler chains will also stir up the substrate and kick scallops into the twine top. Rock chains that run from front to back are used in Atlantic scallop fisheries to keep larger rocks out of the ring bag, but are not used in Alaska.

Vessels used in the Alaska weathervane scallop fishery range in size from 58 to 124 feet LOA. The number of vessels is tightly limited, so vessels can be selective regarding the times and places that they fish. Those fishing inside the Cook Inlet Registration Area are limited to operating a single dredge not more than 6 feet wide. Vessels fishing in the remainder of the state are limited to operating no more than two scallop dredges at one time, and each scallop dredge is limited to a maximum width of 15 feet. Each dredge is attached to the boat by a single steel cable operated from a deck winch. On average, a 15-foot New Bedford dredge weighs approximately 2,600 pounds, and a 6-foot dredge weighs about 900 pounds.

The magnitude and extent of seabed disturbances by scallop fishing vary according to the gear used and the habitats that are fished. For example, Drew and Larsen (1994) conducted a worldwide trawl and dredge study for the submarine cable industry to determine the depths to which various fishing gears penetrate the seabed. For normal fishing conditions, maximum cutting depths ranged from 40 mm for a New Bedford style dredge on sandy/rocky bottom to 300 mm for a mechanized (hydraulic) dredge on softer bottoms. Scallop dredges as a class penetrated less (40 to 150 mm) than beam trawls (60 to 300 mm) and bottom ( ) trawls and doors (50 to 300 mm). Box dredges that are used in shallow water European and Australian bivalve fisheries, some with toothed cutting bars, penetrated up to 250 mm. Overall, lower values were associated with light gear and hard bottoms, while higher values resulted from heavier gears and softer bottoms. Even within a particular gear class, such as scallop dredges, there may be substantial differences in effects. For example, damage to non-captured scallops is reported to be significantly higher on rock substrate as compared to sand, perhaps due to crushing action of the dredge (Murawski and Serchuk 1989, Messiah et al. 1991, Shepard and Auster 1991). Moreover, a panel of experts recently concluded that much of the scientific literature on benthic habitat effects is based on the European style dredge, which differs in structure and use from the New Bedford style dredge (NREFHSC 2002). The leading edge of the European dredge contains teeth which dig into the substrate. This type of gear is used by smaller vessels that cannot tow a non-toothed dredge fast enough (4 to 5 knots) to fish effectively. The panel noted that because of these differences, research using the European dredge was not very relevant to North American scallop fisheries or the habitats in which they are found, and should only be applied in a limited fashion. The fishing configuration is also an important consideration influencing seabed effects. Although spring-loaded scallop dredges used in Ireland may be relatively narrow (75 cm), some vessels tow as many as 14 of these dredges simultaneously (Maguire et al. 2002). For East Coast and most Alaskan scallop fisheries, two 15-foot New Bedford dredges are simultaneously towed from opposites sides of the vessel, effectively doubling the footprint for each tow.

The weathervane scallop fishery in Alaska occurs in limited, but well-defined areas of the GOA and the EBS (Barnhart 2003). Based on an analysis of sediment properties associated with 28,000 individual dredge hauls for the period 1993 to 1997, Turk (2001) concluded that commercially fished beds occur most frequently on sand and sandy-silt in the GOA. Limited effort occurred in silty-clay substrates and in areas where bedrock and gravelly mud occurred, but was relatively high in sand, sandy to muddy gravel, gravelly sand, and clayey silt to silt substrates. These same data indicate commercial aggregations of scallops in the GOA occur over fairly narrow depth ranges from 25 to 195 m. The overall broad depth range was attributed to additional physical factors that were not investigated. Barnhart (2003) reports the majority of fishing effort for all of Alaska occurs at 40 to 60 fathoms (73 to 110 m). Although there are some areas or portions of areas that contain rock (e.g., Alaska Peninsula Registration Area), the Alaska scallop fishery occurs primarily on soft-bottom areas because fishers avoid harder areas if possible, because of probable damage to their fishing gear (Barnhart, J., May 1, 2003, Alaska Department of Fish and Game, Kodiak, personal communication).

Scallop dredges are designed to disturb the seabed in order to dislodge and capture scallops (NRC 2002). The following summaries of scientific research detail physical effects on the seafloor and effects on living substrate such as benthic invertebrates. Generally, these studies discuss changes that occur as a result of scallop dredging, but do not interpret the ecological consequences of these changes.

Sediment plumes generated by scallop dredging may cause burial, clog respiratory surfaces, and reduce light levels; they may also release heavy metals, nutrients, or toxic algal cysts (Black and Parry 1999). The magnitude and spatial extent of the suspended sediment field around any dredging operation are a function of the type of dredge used, the physical/biotic characteristics of the material being dredged (e.g., density, grain size, organic content), and site-specific hydrological conditions (e.g., currents, water body size/configuration). The rate of change of plume characteristics depends critically on suspended sediment grain sizes, current strength, and the related water column turbulence (Black and Parry 1999).

At least some of these reported effects can be considered unintentional bycatch by dredges that have inherently poor selection characteristics (Bourne 1966). Overall, dredge impact studies that are relevant to the Alaska fishery and environments, particularly those with a biological focus, are very limited. Similarly, although offshore scallop dredging has occurred on the sandy Scotian Shelf off eastern Canada since 1862, the thorough review by Messiah et al. (1991) of trawl and dredging impact literature did not include a single study from this area. Although there are obvious differences in the nature of trawls and scallop dredges, it is nevertheless reasonable under the circumstances to consider the results of bottom trawl studies in softer sediments, including sand, as representative of the effects due to scallop dredging. In fact, dredge and trawl studies summarized in major reviews of the literature are frequently handled in this fashion (e.g., Auster and Langton 1999, NRC 2002).

3.7.1.4 Longlines

Demersal longlines consist of two buoy systems that are situated on each end of a mainline to which leaders (gangions) and hooks are attached. The groundline (or mainline), usually made of sinking line (more dense than water), can be several miles in length and have several thousand baited hooks attached. Small weights may be attached to the groundline at intervals. Below each buoyed end is a weight or an anchor. A vessel may set a number of lines, depending on the area, fishery, and site. The principal components of the longline that can contact the seabed are the anchors or weights, the hooks, the gangions (lines connecting the hooks to the groundline), and the groundline (ICES 2000). This gear is used in both the GOA and BSAI cod and sablefish fisheries.

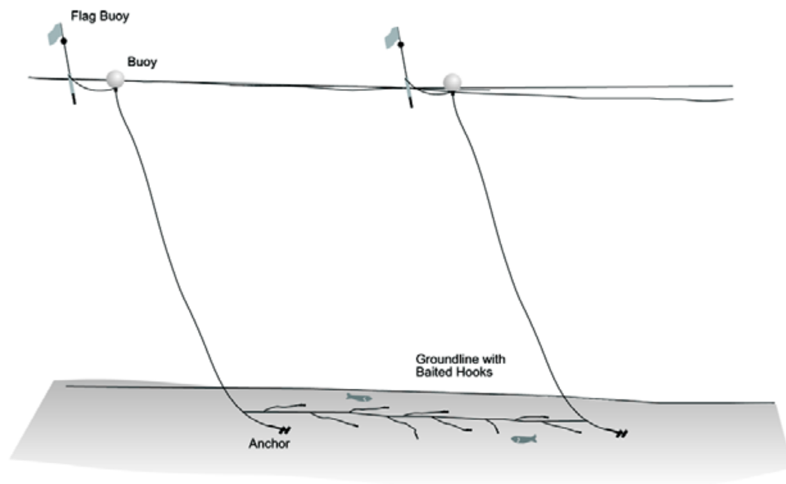

Figure 7. Set longline gear

Longline gear in Alaska is fished on-bottom. In 1996, average mainline set length was 9 km for the sablefish fishery, 16 km for Pacific cod, and 7 km for Greenland halibut; average hook spacing was 1.2 m for the sablefish fishery, 1.4 m for Pacific cod, and 1.3 m for Greenland halibut. The gear is baited by hand or by machine, with smaller boats generally baiting by hand and larger boats generally baiting by machine. Circle hooks usually are used, except for modified J-hooks on some boats with machine baiters. The gear usually is deployed from the vessel stern with the vessel traveling at 5 to 7 knots. Some vessels attach weights at intervals along the longline, especially on rough or steep bottom, so that the longline stays in place and lays on-bottom.

Very little information exists regarding the effects of longlining on benthic habitat, and published literature is essentially nonexistent.

Observers on hook and line vessels have recorded bycatch of HAPC biota. Bycatches of benthic epifauna by Pacific cod fisheries using longline gear off Alaska were comparable to those using trawl gear (NMFS 2000). Bycatches of anemones and seawhips/pens were higher for longlines than trawls, while trawl bycatches were higher for corals and sponges. On a regional scale, these removals do not represent a large portion of the population. For example, anemone abundance on the EBS shelf, likely underestimated due to the sampling trawl not catching 100% of anemones in the trawl path, was estimated at 26,570,000 kg (McConnaughey, B., unpublished data) of which the 3-year (1997 to 1999) longline bycatch of 86,063 kg was at most 0.3%. A similar estimate for the Aleutian Islands area, where more of the hard substrates favored by anemones are available, could not be included because the trawl used for those surveys retains very few of the anemones in its path.

Observations of halibut gear made by NMFS scientists during submersible dives studying other aspects of longline gear off southeast Alaska provide some information on potential ways that longlines can affect bottom habitats (High 1998). The following is a summary of these observations:

Setline gear often lies slack and meanders considerably along the bottom. During the retrieval process, the line sweeps the bottom for considerable distances before ascending. It snags on objects in its path, including rocks and corals. Smaller rocks are upended, hard corals are broken, and soft corals appear unaffected by the passing line. Invertebrates and other lightweight objects are dislodged and pass over or under the line. Fish, notably halibut, frequently moved the groundline numerous feet along the bottom and up into the water column during escape runs, disturbing objects in their path. This line motion was noted for distances of 50 feet or more on either side of the hooked fish.

These submersible observations only demonstrate the potential, and some mechanisms for, effects of longlines on benthic habitat, particularly structure-forming animals. Those observations are insufficient to assess whether habitats are significantly altered at either local or regional levels or whether they vary in fisheries that use different gear or methods (i.e., setting mainline under tension). Important missing information includes the area of seafloor affected by longlines, the proportion of animals in that area that are affected, the severity of effects, rates of recovery, and the importance of affected structures in the function of EFH.

3.7.1.5 Pot Gear

Pots are baited enclosures, usually with one-way entrances, that retain entering fish and crab. They are used in the GOA cod fishery, and in BSAI cod, brown king crab, red king crab, and sablefish and turbot fisheries. Pots used in the Alaska cod fishery are generally modified from the designs developed for the crab fishery, with the one-way entrances modified to account for differences in crab and cod behavior. The most common design is a rectangular frame approximately 2 by 2 by 1 m made of welded steel rods with entrances on opposite walls. Because of solid steel construction, the pot weight (500 to 700 pounds) is not greatly reduced by immersion in water such that no additional anchors are required. Except in the Aleutians and certain months in the EBS, Alaska groundfish regulations require that each pot have its own buoyed line, so there are no underwater lines connecting adjacent pots (longlining). An exception to this is the deep-water golden king crab fishery in the Aleutian region, where the pots are longlined.

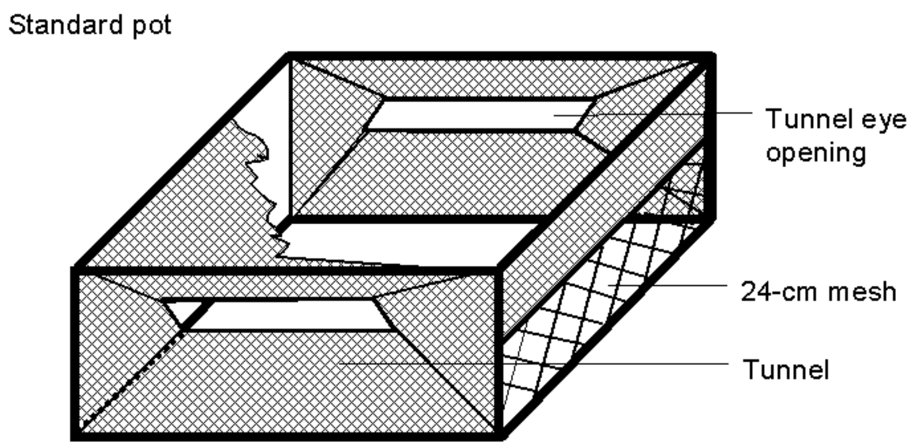

Figure 8. Crab Pot / Pacific Cod Pot

Pots are considered to be less damaging than mobile gear, because they are stationary in nature, and thus, come into direct contact with a much smaller area of the seafloor. Pots affect habitat when they settle to the bottom and when they are hauled back to the surface (Eno et al. 2001, Stewart 1999), but single pots and pots connected in strings or longlines may also affect seafloor habitat when they are pulled along the seafloor. This would occur in steeper terrain when wind and tide conditions dictated that gear be pulled upslope rather than to open water.

Physical damage from pots is highly dependent on habitat type. Sand and soft sediments are less likely to be affected, whereas reef-building corals, sponges, and gorgonians are more likely to be damaged because of their three-dimensional structure above the seafloor (Quandt 1999). Damage by pots also makes coral more susceptible to secondary infections.

Eno et al. (2001) observed effects of pots set in water depths from approximately 14 to 23 m over a wide range of sediment types in Great Britain, including mud communities with sea pens, limestone slabs covered by sediment, large boulders interspersed with coarse sediment, and rock. Observations demonstrated that sea pens were able to recover fully from pot impact (left in place for 24 to 48 hours) within 72 to 144 hours of the pots being removed. Pots remained stationary on the seafloor, except in cases where insufficient line and large swells caused pots to bounce off the bottom. When pots were hauled back along the bottom, a track was left in the sediments, but abundances of organisms within that track were not affected. The authors did observe detached ascidians and sponges and damage to rose coral, but it was not clear if these resulted from this study or from previous damage. Authors concluded that no short-term effects result from the use of pots, even for sensitive species. The study did not examine chronic effects.

The pots used off Alaska are much larger and heavier than those in any of the studies cited. Except in the Aleutians and certain months in the EBS, Alaska groundfish regulations require that each pot have its own buoyed line, so there are no underwater lines connecting adjacent pots (longlining) which could be an additional source of effects. Little research has been conducted to date on their habitat effects. The area of seafloor contacted by each pot during retrieval is unknown and is expected to depend on vessel operations, weather, and current.

However, there is some evidence from submersible video transects conducted in the central AI that damage sustained to dense areas of coral and sponge habitat may have been caused by crab pots in contact with that habitat (Robert Stone, NOAA Fisheries). Scientists observed elongated tracks where sessile epifuana had been removed or pushed and piled aside. Tracks were well delineated, straight, and about 3 m wide. Tracks did not appear to be consistent with damage observed from longlines or bottom trawl gear, nor that expected from submersible contact with the seafloor or landslides. There is still some uncertainty as to whether pot fishing was responsible for the damage, and the researchers are planning, pending the availability of research funds, to drag longlines of pots through the area to determine if they can replicate such tracks.

A large number of pots are lost in Alaska fisheries every year. Although pots might be considered less damaging to habitat than mobile gear, lost pots can have effects on populations of fish and crustaceans. Bullimore et al. (2001) observed traps left out off the coast of Wales for 398 days and reported that lost pots continued to collect fish for as long as they were left out, even though the bait was gone after 13 to 27 days. Derelict pots add vertical structure that is frequently colonized by sedentary invertebrates, altering the local environment. Alaska pot fisheries must install untreated biodegradable cotton twine in pot walls to eventually stop ghost fishing.

3.7.1.6 Dinglebar Troll Gear

Troll vessels catch fish, typically salmon, or groundfish by moving lures or bait through the water column through feeding concentrations of fish. Two forms of trolling are legal, power troll and hand troll. The gear is typically comprised of four main wire lines that fish. They have a large lead sinker, referred to as a cannon ball, on the terminal end and 8-12 nylon leaders spaced out along its length, each of which ends in either a lure or baited hook. To retrieve hooked fish, the main lines are brought on board by hand or power, and the fish can be gaffed when they are alongside the vessel. The leaders are then re-baited and let back down to the desired depth with the cannon ball (ADF&G 1999a).

Troll vessels come in a variety of sizes and configurations, ranging from small, hand troll skiffs to large, ocean-going power troll vessels of 50’ or more in length. Troll fisherman operate throughout Southeast Alaska in both state and federal waters (ADF&G 1999b).

Dinglebar troll gear consists of a single line that is retrieved and set with a power or hand troll gurdy, with a terminally attached weight (cannon ball -12 lbs.), from which one or more leaders with one or more lures or baited hooks are pulled through the water while a vessels is underway (NPFMC 2003). Dinglebar troll gear is essentially the same as power or hand troll gear, the difference lies in the species targeted and the permit required. For example, dinglebar troll gear can be used in the directed fisheries for groundfish (e.g. cod) or halibut. These species may only be taken incidentally while fishing for salmon with power or hand troll gear. There is a directed fishery for ling cod in Southeast Alaska using dinglebar troll gear.

Trolling can occur over any bottom type and at almost any depths. Trollers work in shallower coastal waters, but may also fish off the coast, such as on the Fairweather Grounds. In most situations, the gear rarely contacts the ocean bottom.

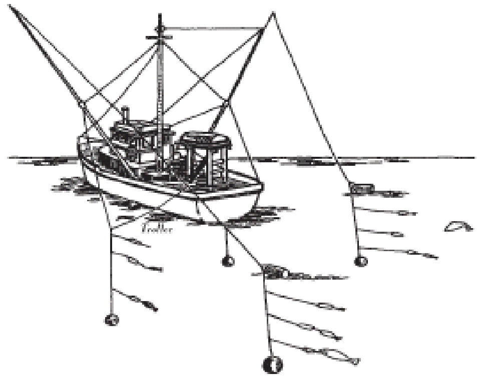

Figure 9. Troll Gear (courtesy A. Dean-ADF&G).

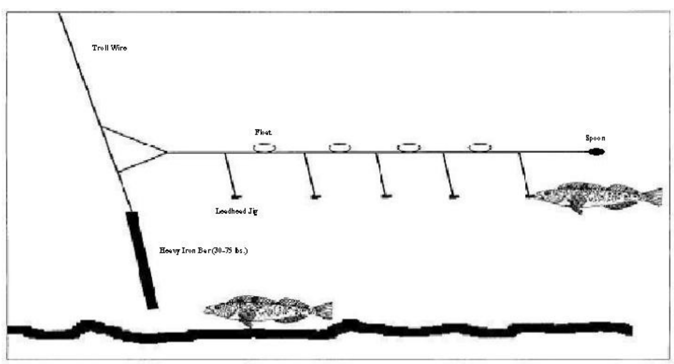

Figure 10. Troll, dinglebar gear (courtesy D. Gordon & T. O'Connell, ADF&G)

3.7.2 Physical and Biological Impacts

The issues of primary concern with respect to the effects of fishing on the sea floor and benthic habitat are the potential for damage or removal of fragile biota within each area that are used by fish as spawning habitat and the potential reduction of habitat complexity, benthic biodiversity, and habitat suitability. Habitat complexity is a function of the structural components of the living and nonliving substrate and could be affected by a potential reduction in benthic diversity from long-lasting changes to the species mix. Many factors contribute to the intensity of these effects, including the type of gear used, the type of bottom, the frequency and intensity of natural disturbance cycles, and the history of fishing in an area.

In terms of habitat, the BS/AI has complicated mixes of substrates, including a proportion of hard substrates (pebbles, cobbles, boulders, and rock), but data are not available to describe the spatial distribution of all of these substrates. Therefore, it is difficult to assess habitat complexity in terms of specific substrates. Some information on vulnerable or fragile habitats can be surmised through the NMFS groundfish surveys or from anecdotal information provided by fishers who utilize these areas.

This section will focus on the effects of Alternative 3 on the components of the human environment and compare those effects to the significance criteria for each component and compare effects to Alternative 1 and Alternative 2 effects. The action is limited to changes in fishing activities that make contact with the sea floor, and therefore, the analysis will focus on the effects of allowing or prohibiting by fishing activities that make contact with the sea floor in the discrete locations identified in Alternative 2 (and also Alternative 3).
To estimate the potential effects of trawling over the skate egg concentration areas, the amount of recent trawl effort in these areas was examined. At least 50% of each site (not including Pribilof & Zhemchug, which were not fished) has been trawled over the 2003-2010 period, according to the CIA database. For this analysis, ArcGIS was used to buffer each VMS track line with 1/2 the net width figure from the EFH EIS. Those buffered lines were then joined and an area calculation performed. This area calculation represents the footprint of the fishery in these sites where a trawl net (area between doors) has passed over at least once, but does not account for multiple passes. The Bering 2 site was the most heavily fished by both pelagic and non-pelagic trawls, with 80.5 and 91.6 % swept respectively. Bering 1, Bristol, and Pervenets were all fished extensively as well.

Table 11. Trawl footprint analysis of areas of skate egg concentration according to available VMS data

HAPC Area	Total area (nm^2)	NPT area Swept (nm^2)	Percent (%) of NPT area swept	PTR area swept (nm^2)	Percent (%) of PTR area swept
1. Bering 1	18.44	14.03	76.1	10.12	54.9
2. Bering 2	17.41	15.95	91.6	14.02	80.5
3. Bristol	13.81	0	0	7.95	57.6
4. Pervenets	27.66	17.96	64.9	19.46	70.4
5. Pribilof	1.09	0	0	0	0
6. Zhemchug	3.26	0	0	0	0

3.7.2.1 Direct Impacts on Habitat

Due to the very small size and limited fishing effort in four of these six locations, adjacent areas will likely support the amount of fishing displaced if fishing activities and gear types that make contact with the sea floor were restricted. It is then possible to assume that some fishing grounds would be fished with more frequency, with the potential for increased direct impact. However, it is likely that the increased fishing effort in habitats currently fished would not be much greater than effort that already exists. The fleet may be displaced into areas with similar conditions for fishing, however, and not necessarily into areas that are more fragile or vulnerable (e.g., coral habitat). Because the maximum potential area closed to certain fishing activities under Options a through d of Alternative 3 is 81.7 nm^2, the proposed action is not likely to result in any substantial changes to the current features of benthic habitat (other than skate egg EFH) including the habitat complexity, benthic diversity or habitat suitability. Because there are no areas impacted, the effects of Alternatives 1 and 2 on habitat are the same, with Alternative 2 being slightly more protective of known skate egg deposition habitat. Therefore, any potential effects of Alternatives 1 and 2 on habitat are likely insignificant.

The closure of these six areas may seem insignificant in relation to the vast areas open to fishing in the BSAI, and taking action to protect areas known or thought to contain sensitive marine habitats is a precautionary approach recognized in marine fisheries management and meets the management objectives of the FMPs (NMFS 2004). These areas of skate egg concentration are an example of vulnerable habitat that may be affected by fishing gear that makes contact with the sea floor. A limit on fishing activities that make contact with the sea floor would result in a positive effect on habitat because fishing has already occurred there, and spawning habitat will likely be protected with limits on fishing gear that makes contact with the seafloor.

3.7.2.2 Direct Impacts on Skate Eggs

The Direct impact on skate egg cases from fishing gear has not yet been investigated. Components of bottom trawl gear that would be in direct contact with an egg case are those in direct contact with the seafloor and include the doors, sweep, footrope, and net. Bottom trawl doors are heavy (exceeding 1,000 lbs.) and are designed to contact the seafloor riding on the door's edge or shoe. A door shoe width generally ranges from 4 to12 feet wide. Therefore, impact from the shoe would likely cause injury. However, the width of door shoes is rather minimal. The sweeps have potential to directly injure an egg case and are more likely to dislodge or roll over cases. Note that current regulations require elevating devices on sweeps and the only contact is on the bobbins spaced approximately 60 feet apart. The foot rope impact is similar to the sweep, except it is heavier overall and meant to skim the seafloor and designed to catch fish. Thus, egg cases directly contacted by the footrope may be dislodged, rolled over, or pushed down-upon. The net itself can recruit egg cases and cases are then considered bycatch. Cases caught in the net are subject to pressures created by fish concentrating in the cod end. It is unknown how much pressure would cause direct impact to the embryo. Further, egg cases caught by the net, brought aboard, and then subsequently rolled-up onto the net reel are crushed and results in mortality.

What is known is that egg cases themselves are robust capsules. Gear coming in contact with an egg case could dislodge, roll over, settle the case further in sediments, injure or increase risk of mortality. Given the gear, when towed, has lift supplied by the tow vessel and some buoyancy and that skate egg cases are most often in softer substrates, the potential to physically cause injury to the case exists, however the extend of these effects remains unknown.

<u>Indirect Impacts</u>

Skate egg cases can entangle on the outside of the net with edge *horns*[10], if present. Thus, entangled cases could be dislodged or 'ride-along' the net, to then be re-distributed within or outside of the nursery area. Indirect contact may also affect skate development or cause an increase in mortality.

<u>Bycatch of Egg Cases</u>

Egg cases recruited within the gear and brought on-deck are considered bycatch and discarded over the side. No studies have been developed to relate any direct handling mortality, exposure surface air and potential freezing conditions, or time out of the water. The egg case is just that, where the egg supplies nutrients to the developing embryo. Thus, for some time prior to either freezing or drying, then skate is sustained by the egg. However, no studies have been investigated egg case exposure and survival rates.

Gear tow times and distances vary. Egg cases recruiting to the gear and observed as bycatch are likely not caught where the net is brought aboard. Discarded cases are then transported and discarded outside of the

[10] *Horns* are hook-like extensions located on the posterior and anterior corners of the egg case and thought to help anchor the case in sediment. Horn presence and size varies between species.

nursery area where originally caught. There is no conventional means to determine when cases are caught when towing, other than when they are observed at the surface. Thus, it would be unreasonable to be certain of where to discard any cases once caught.

3.7.1 Target Species

Target species for the BSAI area are managed within the BSAI Groundfish FMP. In terms of target species, the FMP describes the target fisheries as, "those species which are commercially important and for which a sufficient data base exists that allows each to be managed on its own biological merits. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, 'other flatfish' sablefish, Pacific Ocean Perch, 'other rockfish,' Atka mackerel, and squid. Other non-groundfish targeted FMP species in Federal waters include crab and scallops. In terms of state managed crab and invertebrates fisheries, no effects of these target species are expected as no fisheries for these species are prosecuted in these areas of the alternatives.

It was determined within the EFH EIS (NMFS 2005) that considerable scientific uncertainty remains regarding the consequences of habitat changes for managed species. Nevertheless, the EIS analysis concluded that the effects on EFH from fishing target species are minimal because no indication exists that continued fishing at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term.

These closures would likely not result in a reduction in catch, biomass, or any significant protection of habitat EFH for species other than skates. Therefore the effects on target FMP-managed species (groundfish, crab, and scallops) would be insignificant.

3.7.1.1 Effects on Skate Populations

Adult skates appear capable of significant mobility in response to general habitat changes, but any effects on the small scale nursery habitats/area of skate egg concentration crucial to reproduction could have disproportionate population effects. Eggs are mostly limited to isolated nursery grounds/areas of skate egg concentration, and juveniles use different habitats than adults. Changes in these habitats have not been monitored historically, so assessments of habitat quality and its trends are not currently available. The stack assessment authors have recommended continued study of skate nursery areas to evaluate their importance to population production. After hatching, juveniles most likely remain in continental shelf and slop waters, but specific distribution is unknown; adults are found across wide areas of the shelf and slope.

In the case of Alaska skates, survey biomass estimates, though variable, have been basically trendless since species identification began in 1999. Model estimates of spawning biomass have also basically been trendless over the 1992-2011 period covered by the most recent biomass estimation model, while total biomass has tended to increase fairly steadily at an average rate of about 0.7 % per year over the same time period. Recruitment does not appear to vary much from year to year, with a CV for the time series of only 18 %. The most recent above-average year class was spawned in 2004.

See Appendix C – Color Figures 44-48 for recent trends in skate biomass.

None of the Alternatives are likely to have adverse effect on skate population; however, Alternatives 2 and 3 may have some potential benefit on skate populations. Increased egg survival may be expected under Alternative 3, particularly under any of the conservation and management Options (a through d).

3.7.2 Non-Target Resources

Non-target resources include groundfish species taken as bycatch in the targeted Atka mackerel, Pacific Ocean perch, and Pacific cod fisheries, prohibited species, non-specified species and forage fish. Retention of prohibited species (PSC) is forbidden in the BSAI fisheries. The prohibited species include: Pacific salmon, steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner, and snow crab. Pacific salmon include Endangered Species Act (ESA)-listed salmon that may occur in the BSAI. Pacific salmon are primarily taken in the eastern Bering Sea pollock fishery; very few Pacific salmon are taken in the AI. No change in potential takes of ESA-listed salmon is expected with this action, because of the proposed action gear type, fishery locations, small areas, and no changes in overall harvest levels.

Management measures are currently in 50 CFR 679.21 to reduce the potential for incidental take of PSC species. These measures include limits on the take of certain PSC species and closures of areas to protect places where PSC species may occur. At present no active management and only limited monitoring of species in the other species and non-specified species occurs. Most of these animals are not currently considered commercially important and are not targeted or retained in groundfish fisheries. The information available for non-specified species is much more limited than that available for target fish species. Directed fishing for forage fish species is prohibited and most of the bycatch of theses occur in the pollock pelagic trawl fishery.

The significance criteria used in the 2006-2007 Groundfish Harvest Specifications EA/RIRs for non-specified species is applicable to this analysis of the effects on non-target species (NMFS 2006a). This EA/RIR provided the latest ideas on determining the significance of effects on non-target species from the groundfish fisheries considering the lack of data regarding biomass and sustainability of most non-target species. The first criterium in the table was further refined for this analysis from NMFS 2006a to clearly provide a criterium for “insignificant impact” and to be consistent with other analyses of environmental components in this EA/RIR/IRFA. This analysis and the 2006-2007 EA/RIR analyze the effects of groundfish fisheries on non-target resources in the AI with this proposed action being much narrower in focus.

The proportion of non-target species (non-specified, forage fish, and PSC) removed would be very small in relationship to the entire management area. In terms of bycatch of non-target species, it not expected that any negative incremental changes will occur from Alternatives 2 or 3 because the amount of effort in these sites is low. Under all Alternatives, the total harvest or target species and associated PSC are expected to be the same. Because the groundfish harvest is not expected to increase, the harvest of non-specific, PSC species and forage species are also not expected to increase and no change in the sustainability of non-target species biomass is expected. Therefore the effects of either Alternative 2 or 3 are expected to be the same and to be insignificant.

3.8 Marine Mammals and Seabirds

Impacts of the proposed Federal action on marine mammals and seabirds may be a concern because they may be listed as endangered or threatened under the ESA, they may be protected under the Marine Mammal Protection Act (MMPA), they may be candidates or being considered as candidates for ESA listings, their populations may be declining in a manner of concern to State or federal agencies, they may experience large bycatch or other mortality related to fishing activities, or they may be particularly vulnerable to direct or indirect adverse effects from some fishing activities. These species have been given various levels of protection under the current FMPs of the Council, and are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on these species. A current description of ESA consultations for each species is contained in section 3.4 of the harvest specifications EIS (NMFS 2007).

Table 12. ESA listed and candidate species that range into the BSAI and GOA groundfish management areas

Common Name	Scientific Name	ESA Status
Blue Whale	*Balaenoptera musculus*	Endangered
Bowhead Whale	*Balaena mysticetus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Right Whale[1]	*Balaena glacialis*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion (Western Population)	*Eumetopias jubatus*	Endangered
Steller Sea Lion (Eastern Population)	*Eumetopias jubatus*	Threatened
Chinook Salmon (Lower Columbia R.)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Upper Columbia R. Spring)	*Oncorhynchus tshawytscha*	Endangered
Chinook Salmon (Upper Willamette)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Snake River spring/summer)	*Oncorhynchus tshawytscha*	Threatened
Chum Salmon (Hood Canal Summer run)	*Oncorhynchus keta*	Threatened
Coho Salmon (Lower Columbia R.)	*Oncorhynchus kisutch*	Threatened
Steelhead (Snake River Basin)	*Oncorhynchus mykiss*	Threatened
Steller's Eider [2]	*Polysticta stelleri*	Threatened
Short-tailed Albatross [2]	*Phoebaotria albatrus*	Endangered
Spectacled Eider[2]	*Somateria fishcheri*	Threatened
Kittlitz's Murrelet[2]	*Brachyramphus brevirostris*	Candidate
Northern Sea	*Enhydra lutris*	Threatened

[1]NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).

[2] The Steller's eider, short-tailed albatross, spectacled eider, Kittlitz's murrelet, and Northern sea are species under the jurisdiction of the USFWS. For the bird species, critical habitat has been established for the Steller's eider (66 FR 8850, February 2, 2001) and for the spectacled eider (66 FR 9146, February 6, 2001). The Kittlitz's murrelet has been proposed as a candidate species by the USFWS (69 FR 24875, May 4, 2004).

Many measures are already in place to protect marine mammals and seabirds from potential adverse effects from fishing activities. These measures include seasonal and geographic closed areas, requirements for seabird avoidance devices, observer requirements, and voluntary industry research activities to reduce vessel and gear encounters with protected species. These measures will remain in place in the future. And as new knowledge becomes available to minimize adverse impacts of fishing activities on protected species, the Council and NMFS likely will consider employing additional or modified measures to further reduce adverse effects on seabirds and marine mammals.

Assumed in this analysis is the global potential for fuel spills, other accidental contaminant releases, and accidental loss of fishing gear (nets, lines, buoys, pots or traps, hooks) from fishing activities throughout the North Pacific. Much of this lost gear or released contaminants disperse in the ocean, settle to the sea floor, or wash up on shore along the Alaskan or other coastlines. Some of the lost gear may entangle with marine mammals or birds, and this is further discussed below. Some contaminants may contact swimming fish, mammals, or birds and be absorbed by animal tissues. While these instances of contamination are most likely not lethal, some mortalities may occur to these species that are unseen and undocumented. Vessel strikes of mammals and sea birds also may occur and be either unknown to the vessel operator or unreported. Thus there likely are some unrecorded mortalities to marine mammals and seabirds from ship strikes, but Angliss and Lodge (2002) note that the mortality levels from such instances can only be estimated. They have made some attempts to estimate a minimum mortality level to marine mammals from vessel strikes where possible. It is likely that strikes are few in number and have little effect on overall animal populations in the North Pacific. To summarize, these elements of fishing activities cannot be quantified to the extent necessary to be evaluated in any one fishery, region, or season, but are considered here generally and recognized as a byproduct of commercial fishing in the North Pacific. Because this action is limited in scope and intensity to a few small areas, substantial displacement of vessel activity is not anticipated. Thus the effects of all Alternatives are expected to be insignificant.

3.8.1 Marine Mammals

Direct and indirect interactions between marine mammals and groundfish harvest activity may occur due to overlap of groundfish fishery activities and marine mammal habitat. Fishing activities may either directly take marine mammals through injury, death, or disturbance, or indirectly affect these animals by removing prey items important for growth and nutrition or cause sufficient disturbance that marine mammals avoid or abandon important habitat. Fishing also may result in loss or discard of fishing nets, line, etc. that may ultimately entangle marine mammals causing injury or death. Because of the gear type, fisheries, and discrete location of the action and limited harvest, most marine mammals are not likely to be affected by the action. None of the Alternatives would not change the implementation of the Steller sea lion protection measures, and therefore would not affect Steller sea lions or their designated critical habitat beyond those effects already analyzed in previous consultations (NMFS 2010). Harvest of prey species would be similar under both alternatives.

3.8.2 Seabirds

Given the sparse information, it is not likely that groundfish fishery effects on most individual bird species are discernible. For reasons explained in previous Steller Sea Lion Protection Measures SEIS (NMFS 2001), the following species or species groups may be considered possible receptors of fishing activity impacts: northern fulmar, short-tailed albatross, spectacled and Steller’s eiders, other albatrosses and shearwaters, piscivorous seabird species, and all other seabird species. Most of these effects are the incidental takes of these species by hook-and-line fisheries. Fishery-related processing waste and offal may also affect seabirds. ESA listed seabirds are under the jurisdiction of the USFWS. Past BiOps (2003) for the groundfish fisheries and the setting of annual harvest specifications. Both BiOps concluded that the groundfish fisheries and the annual setting of harvest specifications were unlikely to cause the jeopardy of extinction or adverse modification or destruction of critical habitat for ESA listed seabirds.

The seabird species most likely to be impacted by any indirect gear effects on the benthos would be diving sea ducks, such as eiders and scoters, and cormorants and guillemots (NMFS 2004). Additional impacts from nonpelagic (bottom trawling) could occur, if sand lance habitat is adversely impacted. This would affect a wider array of piscivorous seabirds that feed on sand lance, particularly during the breeding season, when this forage fish is also used for feeding chicks. Bottom trawl gear has the greatest potential to indirectly affect seabirds via their habitat. It is anticipated there would be an insignificant impact on seabirds based on the small amount of fishing effort in the four northern areas of the eastern Bering Sea. Because the proposed action involves small discrete areas with small fishing effort.. The impacts are not likely to lead to population level effects on the prey from benthic habitat, other prey availability or incidental takes. Therefore, Alternatives 2 and 3 have insignificant impacts on seabirds.

3.8.3 Ecosystem

The proposed action could affect the marine ecosystem through removals of fish biomass or alteration of the habitat. Three primary means of measurement of ecosystem change are evaluated here: predator-prey relationships, energy flow and balance, and ecosystem diversity. The reference point for predator-prey relationships against which the criteria are compared are fishery induced changes outside the natural level of abundance or variability for a prey species relative to predator demands. The reference point for energy flow and balance will be based on bottom gear effort (qualitative measure of unobserved gear mortality particularly on bottom organisms) and a quantitative assessment of trends in retained catch levels over time in the area. The reference point for ecosystem diversity will be a qualitative assessment whether removals of one or more species (target, non-target) affects overall species or functional diversity of the area.

Fisheries can remove predators, prey, or competitors and thus alter predator-prey relationships relative to an un-fished system. Fishing has the potential to impact food webs, but each ecosystem must be examined to determine how important the potential impacts to the food webs are for that ecosystem. A review of fishing impacts to marine ecosystems and food webs of the North Pacific under the status quo and other alternative management regimes was provided in the programmatic groundfish SEIS (NMFS 2004).

Fishing may alter the amount and flow of energy in an ecosystem by removing energy and altering energetic pathways through the return of discards and fish processing offal back into the sea. From an ecosystem point of view, total fishing removals are a small proportion of the total system energy budget and are small relative to internal sources of inter-annual variability in production.

Fishing can alter different measures of diversity. Species level diversity, or the number of species, can be altered if fishing removes a species from the system. Fishing can alter functional or trophic diversity if it selectively removes a trophic guild member and changes the way biomass is distributed within a trophic guild. Fishing can alter genetic level diversity by selectively removing faster growing fish or removing spawning aggregations that might have different genetic characteristics than other spawning aggregations. Large, old fishes may be more heterozygous (i.e., have more genetic differences or diversity) and some stock structures may have a genetic component, thus one would expect a decline in genetic diversity due to heavy exploitation.

Predator-Prey Relationships– No effect on predator prey relationships is expected for Alternative 2 or 3. No substantial changes would be anticipated in biomass or numbers in prey populations, nor would there be an increase in the catch of higher trophic levels, or the risk of exotic species introductions. No large changes would be expected in species composition in the ecosystem. The trophic level of the catch would not be much different from the status quo, and little change would be expected in the species composition of the groundfish community, or in the removal of top predators. All Alternatives would likely have the same insignificant effects on predator-prey relationships because of the small spatial difference between the alternatives and the same types of species and amounts expected to be harvested.

Energy Flow and Balance – The amount and flow of energy in the ecosystem would be the same as the status quo with regard to the total level of catch biomass removals from groundfish fisheries. No substantial changes in groundfish catch or discarding would be expected. Therefore the effects on energy flow and balance under all Alternatives are the same and insignificant.

3.8.4 Economic and Socioeconomic Aspects

No significance determination is required for this component of the analysis. A thorough discussion of the socioeconomic effects of the proposed action is included in the RIR section of this EA/RIR/IRFA. Economic impact would be expected with adoption of any of the options under Alternative 3. At its most extreme option (Option e), this alternative would close areas these areas to all fishing gears. In total, all 6 proposed HAPC sites encompass 81.7 nm^2.

Limited impacts to longline fisheries may occur if closures are implemented. Effort data indicates that several of these areas are used somewhat to target Pacific cod, and perhaps Greenland turbot. No impacts would be expected for pot gear targeting Pacific cod, or scallop fisheries using dredge gear, as, none of these areas have been used in recent years. The effect of Alternative 3 on crab fisheries (pot gear) remains unquantified at this time. However, these areas are generally deeper (156-380 m) than the depths at which *C.opilio* (120-160 m, 60-80 fathoms), Tanner, and blue King Crab are fished, but not as deep as brown King Crab (400 m, 200 fathoms) which is at waters deeper than any skate site. However, in some years *C.opilio* has been fished to 240 m (120 fathoms), which could have the potential to overlap a few skate sites.

Trawl fisheries would also be impacted, but these impacts are considered insignificant. Analysis suggests that on average, a closure to pelagic and bottom trawling of these sites would result in a maximum foregone catch of $1,087,071 per year on average. Of this total, pelagic trawling for pollock in the areas would generate a forgone catch of $791,897 per year, and bottom trawling $295,174 per year (the total ex-vessel price divided by the nine years (2003-2011) of catch data examined). However, it would be expected that the fleet could make up this foregone catch in other areas, adjacent or elsewhere.

3.9 Cumulative Impacts

This section analyzed the cumulative effects of the action considered in this environmental assessment. A cumulative effects analysis includes the effects of past, present and reasonably foreseeable future action (RFFA). The past and present actions are described in several documents and are adopted by reference. These include the PSEIS (NMFS 2004), the EFH EIS (NMFS 2005) and the harvest specifications EIS and most recent BSAI groundfish harvest specifications (NMFS 2007, 2011). This analysis provides a brief review of the RFFA that may affect environmental quality and result in cumulative effects. Future effects include harvest of federally managed fish species and current habitat protection from federal fishery management measures, harvests from state-managed fisheries and their associated protection measures, efforts to protect endangered species by other federal agencies, and other non-fishing activities.

The most recent analysis of RFFAs for the groundfish fisheries is in the harvest specifications EIS and most recent BSAI groundfish harvest specifications (NMFS 2007, 2011). The RFFAs are described in the Harvest Specifications EIS section 3.3 (NMFS 2007), are applicable for this analysis, and are adopted by reference. A summary table of these RFFA is provided below. The table summarizes the RFFAs identified applicable to this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply "under consideration" have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

Table 13. Reasonable foreseeable future actions (RFFAs)

Ecosystem-sensitive management	• Increasing understanding of the interactions between ecosystem components, and on-going efforts to bring these understandings to bear in stock assessments, • Increasing protection of ESA-listed and other non-target species components of the ecosystem, • Increasing integration of ecosystems considerations into fisheries decision-making
Fishery rationalization	• Continuing rationalization of Federal fisheries off Alaska, • Fewer, more profitable, fishing operations, • Better harvest and bycatch control, • Rationalization of groundfish in Alaskan waters, • Expansion of community participation in rationalization programs
Traditional management tools	• Authorization of groundfish fisheries in future years, • Increasing enforcement responsibilities, • Technical and program changes that will improve enforcement and management
Other Federal, State, and international agencies	• Future exploration and development of offshore mineral resources • Reductions in United States Coast Guard fisheries enforcement activities • Continuing oversight of seabirds and some marine mammal species by the USFWS Expansion and construction of boat harbors • Expansion of State groundfish fisheries • Other State actions • Ongoing EPA monitoring of seafood processor effluent discharges
Private actions	• Commercial fishing Increasing levels of economic activity in Alaska's waters and coastal zone • Expansion of aquaculture

Ecosystem management, rationalization and traditional management tools are likely to improve the protection and management of target and prohibited species and are not likely to result in significant effects when combined with the direct and indirect effects of Alternatives 2 or 3. The Council is pursuing methods of reducing salmon and halibut bycatch through FMP amendments and exempted fishing permits to allow testing of salmon and halibut excluder devices. Other government actions and private actions may increase pressure on the sustainability of target and prohibited fish stocks either through extraction or changes in the habitat or may decrease the market through aquaculture competition, but it is not clear that these would result in significant cumulative effects. Any increase in extraction of target species would likely be offset by federal management.

RFFA for marine mammals and seabirds include ecosystem-sensitive management, rationalization, traditional management tools, actions by other federal, state and international agencies, and private actions. Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to marine mammals and seabirds by considering these species more in management decisions and by improving the management of the fisheries through the observer program, catch accounting, seabird avoidance measures, and vessel monitoring systems (VMS). Any action by other entities that may impact marine mammals and seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed mammals and seabirds are not likely to experience jeopardy or adverse modification of critical habitat. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of marine mammals and seabirds. The cumulative effect of these impacts in combination with Alternatives 2 or 3 is likely to be primarily beneficial and is not likely to be significant because of the limited intensity of Alternatives 2 and 3.

RFFA for habitat and the ecosystem include ecosystem-sensitive management, rationalization, traditional management tools, actions by other federal, state and international agencies, and private actions. Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to ecosystems and habitat by considering ecosystems and habitat more in management decisions and by improving the management of the fisheries through the observer program, catch accounting, seabird and marine mammal protection, gear restrictions, and VMS. Overall the cumulative effects on habitat and ecosystems are beneficial and not likely to result in significant impacts in combination with the impacts from Alternatives 2 or 3.

4.0 REGULATORY IMPACT REVIEW (RIR)

A Regulatory Impact Review (RIR) is required under Presidential Executive Order (EO) 12866 (58 FR 51735; October 4, 1993). The requirements for all regulatory actions specified in EO 12866 are summarized in the following statement from the Order:

> *"In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach."*

EO 12866 requires that the Office of Management and Budget (OMB) review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

4.1 Introduction and Problem Statement

Habitat Areas of Particular Concern (HAPC) are geographic sites that fall within the distribution of essential fish habitat (EFH) for federally managed species. HAPCs are areas of special importance that may require additional protection from adverse fishing effects. EFH provisions provide a means for the North Pacific Fishery Management Council (Council) to identify HAPCs (50 C.F.R. 600.815(a)(8)) within Fishery Management Plans (FMP). Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or may be stressed.

The Council has a formalized process identified within its FMPs for selecting HAPCs. Under this process, the Council periodically considers whether to set a priority habitat type (or types). If so, the Council initiates a request for proposals (RFP) for HAPC candidate areas that meet the specific priority habitat type. Members of the public, non-governmental organizations, and Federal, State, and other agencies may submit HAPC proposals. Sites proposed under this process are then sent to the Council's Plan Teams for scientific review to determine ecological merit. Council and agency staff also review proposals for socioeconomic and management and enforcement impacts. This combined information is then presented to the Scientific and Statistical Committee (SSC), the Advisory Panel (AP), the Enforcement and Ecosystem Committees if necessary, and to the Council, which may choose to select HAPC proposals for a full analysis and subsequent implementation. The Council may also modify proposed HAPC sites and management measures during its review, or request additional stakeholder input and technical review. (See Appendix A for details on the HAPC process methodology for this 2010-2012 RFP cycle.)

4.1.1 Statement of Purpose and Need

The Council adopted the following Statement of Purpose and Need at its February 2011 meeting:

> *HAPCs are geographic sites that fall within the distribution of Essential Fish Habitat for the Council's managed species. The Council has a formalized process, identified in its FMPs, for selecting HAPCs that begins with the Council identifying habitat priorities—here, areas of skate egg concentration. Candidate HAPCs must be responsive to the Council priority, must be rare (defined as uncommon habitat that occurs in discrete areas within only one or two Alaska regions), and must meet one of three other considerations: provide an important ecological function; be sensitive to human-induced degradation; or be stressed by development activities.*
>
> *The candidate HAPCs identify sites of egg concentration by skate species (*Rajidae*) in the eastern Bering Sea. Skates are elasmobranch fish that are long-lived, slow to mature, and produce few young. Skates deposit egg cases in soft substrates on the seafloor in small, distinct sites. A reproducing skate deposits only several egg cases during each reproductive season. Depending on the species, a single egg case can hold from one to four individual skate embryos, and development can take up to three years. Thus, a single egg case site will hold several year classes and species, and eggs growing at different rates.*
>
> *Distinct skate egg case sites have been highlighted by skate stock experts while assessing skate information from research survey and catch locations. The scientists noted repeated findings of distinct sites where egg cases recruit to sampling or fishing gear contacting the seafloor: egg case prongs (or horns) entangle in or cases recruits into the gear. The eggs and embryos are highly susceptible to disturbance, damage, or destruction from fishing gear that contacts the seafloor during their lengthy development. Fishing activities within these sites can also disrupt recently hatched juveniles and reproductive adult skates depositing new eggs in nursery sites. It is therefore important to protect areas of concentrated skate egg concentration and limit the loss of skates during the early life stages.*

4.2 Description of Alternatives and Options

In order to address the problem described in the above statement of Purpose and Need, the Council identified three alternatives and five options for analysis, shown below. Alternative 1, the status quo, or no action alternative, involves no measures to identify or conserve areas of skate egg concentration as HAPCs. Alternative 2 would identify areas of skate egg concentration as HPACs. The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs. Under Alternative 2, the Council is not required to limit fishing activities or prohibit gear types that make contact with the sea floor. Alternative 3 provides for both the identification of skate egg concentration HAPCs and for the conservation of these areas through prohibitions of gear types that make contact with the sea floor. The Council may select, in combination with any skate egg concentration designated as a HAPC, to limit fishing activities that make contact with the sea floor in these areas by prohibiting the use of "mobile bottom contact," pelagic, "bottom contact," or all fishing gear.

Further, under any Alternative, in any combination of skate egg concentration HAPCs and with any combination of conservation and management measures, the Council may identify the research and monitoring of areas of skate egg case concentration as a research priority and incorporate it into the Council's annual research priority list for continuing research, to evaluate skates, skate egg concentration areas, and their ecology and habitat.

4.2.1 Alternative 1: Status quo; no action.

No measures would be taken to identify, or to identify and conserve, skate egg concentration HAPCs.

4.2.2 Alternative 2: Identify skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs.[11]

Table 14. The six proposed skate egg concentration HAPCs.

Site name	*Predominant* skate species	Boundaries of HAPC (°N latitude or °W longitude)				Area of HAPC	
		North	South	West	East	nm^2	km^2
1. Bering 1	Alaska	54°53′	54°49′	165°46′	165°38′	18.4	63
2. Bering 2	Aleutian	54°38′	54°33′	165°45′	165°34′	17.5	60
3. Bristol	Bering	55°21′	55°17′	167°40′	167°34′	13.7	47
4. Pribilof	Alaska	56°11′	56°10′	168°28′	168°26′	1.2	4
5. Zhemchug	Alaska	56°57′	56°54′	173°23′	173°21′	3.2	11
6. Pervenets	Alaska, Bering, and Aleutian	59°28′	59°22′	177°43′	177°34′	27.7	95

[11] 50 C.F.R. 600.815(a)(8).

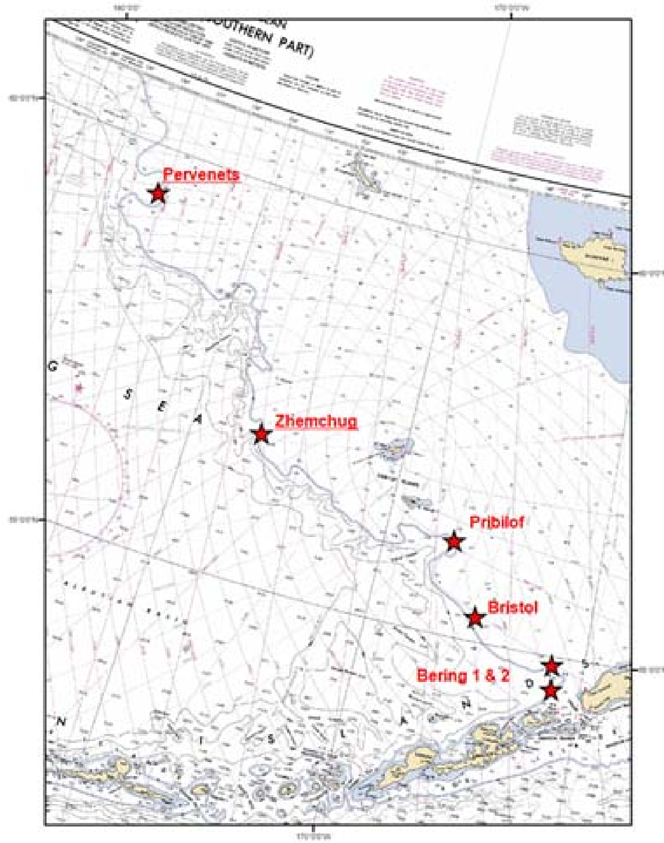

Figure 11. The locations in the eastern Bering Sea of the six proposed skate egg concentration HAPCs. (not to scale).

4.2.3 Alternative 3: Identify and conserve skate egg concentration HAPC(s).

The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs – AND – the Council may select different conservation and management options for any identified skate egg concentration HAPC.

4.3 Background

4.3.1 BSAI Groundfish Fisheries

The domestic groundfish fishery off Alaska is the largest fishery by volume in the U.S. The Economic SAFE Report contains economic summaries and detailed information about the BSAI commercial groundfish fisheries. The 2012-13 BSAI groundfish annual catch limits (ACLs) are shown in the table below. The sum of the total allowable catches (TACs) for all groundfish is 2,000,000 mt. The TACs were set below the sum of the recommended ABCs for 2012 and 2013 (2.51 million t and 2.64 million t, respectively). The status of BSAI groundfish stocks continues to appear favorable. Many stocks are rebounding due to increased recruitment. The sum of the biomasses for 2012 (19.4 million t) is down approximately 6 percent compared to 2011 (20.6 million t). Pollock and Pacific cod biomasses are increasing after a period of decline. Flatfishes generally are trending upwards.

Table 15. Draft recommendations for OFL, ABC, and TAC (mt) for 2012-13 in the BSAI groundfish fisheries (as of December 2011)

		2012			2013		
Species	Area	OFL	ABC	TAC	OFL	ABC	TAC
Pollock	EBS	2,474,000	1,220,000	1,200,000	2,840,000	1,360,000	1,201,900
	AI	39,600	32,500	19,000	42,900	35,200	19,000
	Bogoslof	22,000	16,500	500	22,000	16,500	500
Pacific cod	BSAI	369,000	314,000	261,000	374,000	319,000	262,900
Sablefish	BSAI	5,070	4,280	4,280	5,010	4,220	4,220
	BS	2,640	2,230	2,230	2,610	2,200	2,200
	AI	2,430	2,050	2,050	2,400	2,020	2,020
Atka mackerel	Total	96,500	81,400	50,763	78,300	67,100	42,083
	EAI/BS		38,500	38,500		31,700	31,700
	CAI		22,900	10,763		18,900	8,883
	WAI		20,000	1,500		16,500	1,500
Yellowfin sole	BSAI	222,000	203,000	202,000	226,000	207,000	203,900
Rock sole	BSAI	231,000	208,000	87,000	217,000	196,000	87,000
Greenland turbot	Total	11,700	9,660	8,660	9,700	8,030	8,030
	BS		7,230	6,230		6,010	6,010
	AI		2,430	2,430		2,020	2,020
Arrowtooth flounder	BSAI	181,000	150,000	25,000	186,000	152,000	25,000
Kamchatka flounder	BSAI	24,800	18,600	17,700	24,800	18,600	17,700
Flathead sole	BSAI	84,500	70,400	34,134	83,100	69,200	34,134
Alaska plaice	BSAI	64,600	53,400	24,000	65,000	54,000	24,000
Other flatfish	BSAI	17,100	12,700	3,200	17,100	12,700	3,200
Pacific Ocean perch	BSAI	35,000	24,700	24,700	33,700	28,300	28,300
	BS		5,710	5,710		6,540	6,540
	EAI		5,620	5,620		6,440	6,440
	CAI		4,990	4,990		5,710	5,710
	WAI		8,380	8,380		9,610	9,610
Northern rockfish	BSAI	10,500	8,610	4,700	10,400	8,490	4,700
Blackspotted/Rougheye	BSAI	576	475	475	605	499	499
	EBS/EAI		231	231		241	241
	CAI/WAI		244	244		258	258
Shortraker rockfish	BSAI	524	393	393	524	393	393
Other rockfish	BSAI	1,700	1,280	1,070	1,700	1,280	1,070
	BS		710	500		710	500
	AI		570	570		570	570
Squid	BSAI	2,620	1,970	425	2,620	1,970	425
Skate	BSAI	39,100	32,600	24,700	38,300	32,000	24,746
Shark	BSAI	1,360	1,020	200	1,360	1,020	200
Octopus	BSAI	3,450	2,590	900	3,450	2,590	900
Sculpin	BSAI	58,300	43,700	5,200	58,300	43,700	5,200
Total	BSAI	3,996,000	2,511,778	2,000,000	4,341,869	2,639,792	2,000,000

4.3.1.1 Skate Fishery Management and Stock Status

The BSAI skate complex is managed in aggregate, with a single set of harvest specifications applied to the entire complex. Two different assessment methodologies are used for skates, however. Beginning with the 2008 assessment, harvest recommendations for Alaska skate (*Bathyraja parmifera*), the most abundant skate species in the BSAI, are made using the results of an age structured model and Tier 3. The remaining species ("other skates") are managed under Tier 5 due to a lack of data. The Tier 3 and Tier 5 recommendations are combined to generate recommendations for the complex as a whole.

There is currently no target fishery for skates in the BSAI. Most skates are caught incidentally in the hook-and-line/longlining fishery for Pacific cod, and in trawl fisheries for pollock and flatfish. Between 24% and 39% of the total observed skate catch was retained during 2003-2006, primarily consisting of Aleutian and Alaska skate.

Until 2011, skate species were managed as part of the "Other Species" management category within the BSAI FMP. In October 2009 the NPFMC approved amendment 95 to the BSAI FMP, which separated skates from the BSAI Other Species complex an into a target category. Beginning in 2011, skates have been managed as a single complex with skate-specific ABC and OFL. Previously, skates were taken only as bycatch in fisheries directed at target species in the BSAI, so future catches of skates are more dependent on the distribution and limitations placed on target fisheries than on any harvest level established for this category.

Table 16. Aggregate 2011-2013 harvest recommendations for the BSAI skate complex

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2011	2012	2012	2013
OFL (t)	37,817	37,169	39,077	38,326
ABC (t)	31,523	30,966	32,621	31,974

The ABC and OFL recommendations for Alaska skates and Other Skates are slightly higher in the 2011 assessment than in 2010. For Other Skates, a slight decrease in the 2011 biomass estimate reduced the 3-survey-average and the resulting harvest recommendations. There is an overall increase in skate biomass in the Aleutian Islands and eastern Bering Sea (biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year). The OFL and ABC for 2012 and 2013 are those recommended by the Plan Team. The data included in the 2011 year assessment are updated 2010 and preliminary 2011 catch data, the 2011 EBS shelf survey data, and updated fishery and survey length compositions. Catch data are current through November 5, 2011. In the most recent SAFE, no changes were made to the assessment methodology.

Table 17. Status and catch specifications (t) of skates in recent years in the BSAI

Year	Age 0+ Biomass	OFL	ABC	TAC	Catch
2010	608,000	n/a	n/a	n/a	n/a
2011	612,000	37,800	31,500	16,500	21,034
2012	645,000	39,100	32,600	n/a	n/a
2013	629,000	38,300	32,000	n/a	n/a

2011 is the first time that the skate complex was managed outside the context of the former "other species" complex. The Alaska skate portions of the 2011 ABC and OFL were specified under Tier 3, while the "other skates" portions were specified under Tier 5. For the skate complex as a whole, ABCs for

2012 and 2013 total 32,600 t and 32,000 t respectively, and OFLs for 2012 and 2013 total 39,100 t and 38,300 t respectively.

4.3.1.2 Bycatch and Discards

There is currently no target fishery for skates in the BSAI. Most skates are caught incidentally in the longline fishery for Pacific cod, and in the bottom trawl fisheries for pollock and flatfish. Retention rates ranged from 30-40% of the total observed skate catch during 2003-2009, primarily consisting of Aleutian and Alaska skate; it is likely that only the larger skates are retained. Incidental catch of skates in the BSAI was 5% of the 2008 survey biomass estimate for skates.

In the BSAI, there is no directed fishery for skates at present. A directed skate fishery developed in the Gulf of Alaska in 2003 (Gaichas et al. 2003). There has been interest in developing markets for skates in Alaska, and the resource was economically valuable to the GOA participants in 2003, although the price apparently dropped in 2004. Continued interest in skates as a potential future target fishery in the BSAI as well as in the GOA should be expected.

In the EBA pollock fishery, Skate bycatch as on-target species nearly doubled in 2008 compared to 2007 but declined to just over one thousand t in 2010. The bycatch estimates of Alaska skate as a target species in 2010 was 1,228 t and 881 in 2011. In the Aleutian Islands Atka mackerel fishery, the bycatch of skates, considered a sensitive or vulnerable species based on life history is variable and has averaged 158 t in the last 3 years (2007-2009). Over this same time period, the Atka mackerel fishery has taken an average of 13% of the total Aleutian Islands skate bycatch. It is unknown if the absolute levels of skate bycatch in the Atka mackerel fishery are of concern.

At present the Catch Accounting System (CAS) reports species specific catch for big (*Raja binoculata*) and longnose (*Raja rhina*) skates. All remaining skate species are reported as “other”. Big and longnose skates make up only a small fraction of BSAI skate biomass, which is dominated by the Alaska skate. The fraction of Alaska skate catch in the total “other skates” is estimated by applying the average species composition encountered during trawl surveys. In the Alaska skate model, a catch rate of 100% mortality is assumed by the assessment team. In reality, skate mortality is dependent upon the time spent out of water, the type of gear, and handling practices after capture. From fishery observer data, approximately 30% of skates are retained; however there currently is no information regarding the survival of skates that are discarded at sea.

Skates are caught in almost all fisheries and areas of the Bering Sea shelf, but most of the skate bycatch is in the hook and line fishery for Pacific cod. Trawl fisheries for pollock, rock sole, flathead sole, and yellowfin sole also catch significant amounts. The catch of skates in pollock fisheries has increased in recent years, possibly because the fisheries are targeting pollock closer to the bottom. In this assessment, "bycatch" is interpreted as incidental or unintentional catch regardless of the disposition of catch – it can be either retained or discarded. We do not use the Magnuson Act definition of "bycatch," which always implies discard. When caught as bycatch, skates may be discarded (and may survive depending upon catch handling practices) although skates caught incidentally are sometimes retained and processed. Due to incomplete observer coverage, it is difficult to determine how many skates are actually retained. However, between 24% and 39% of the total observed skate catch was retained during the years 2003-2006. More skates were retained in the EBS than the AI, and it appears that species that grow to a larger maximum size (>100 cm TL) are more likely to be retained than smaller-bodied species. For example, while the Aleutian skate, a large-bodied species, made up a relatively small portion of the observed skate catch in 2005 (approximately 2%), 31% of the Aleutian skates caught were retained. However, Bering skates (a small-bodied species less than 100 cm TL) were retained less frequently (10% in 2005). Larger percentages of Alaska skates and *Raja* species are also retained; all three are relatively large-bodied skates.

Historically, skates were almost always recorded as "skate unidentified", with very few exceptions between 1990 and 2002. However, due to improvements in species identification by fishery observers initiated by Dr. Duane Stevenson (AFSC) within the Observer program in 2003, it is possible to estimate the species composition of observed skate catches 2004-2006 (Fig. 12). Recent observer data indicates that only about 50% of skate catch is not identified to the species level. This is largely because most skates are caught in longline fisheries, and if the animal drops off the longline as un-retained incidental catch, it cannot be identified to species by the observer (approximately 80% of longline-caught skates are unidentified, and longline catch accounts for the majority of observed skate catch). Changes made to the observer manual at the author's request have resulted in a large increase in skate length measurements beginning in 2008.

In 2005, observers were encouraged to identify skates dropped off longlines to genus, which can be done without retaining the skate; hence in 2005 more than half of the unidentified skates were at least assigned to the genus *Bathyraja*. Of the identified skates, the majority (90%) were Alaska skates, as would be expected by their dominance in terms of overall skate biomass in the BSAI. The next most commonly identified species BSAI-wide was Aleutian skate, at 6.6% of identified catch, followed by Bering skates at 4.3 %, big skates at 3.6%, and whiteblotched at approximately 1.3% across the BSAI. It should be noted that the observed skate catch composition may not reflect the true catch composition, possibly due to selective retention of larger species or to a higher likelihood of identifying distinctive species. However, when viewed by area (EBS vs. AI), it is clear that the majority of identified Aleutian and whiteblotched skates are caught in AI fisheries, and that the species composition of the observed catch in the AI is very different from the EBS.

4.4 Effects on Harvesters, Processors, and Communities

Fisheries impact communities through the economic and socioeconomic activities generated by participants in the various harvesting sectors, processing sectors, and supporting industries.

4.4.1 Catch by Longline, Pot, Dredge, and Dinglebar Gear in Proposed HAPC Sites

Longline effort for groundfish in the proposed HAPC sites is low, as shown in Appendix C – Color Figure 3. Over the years 1998 to 2010, there were no sets in the Bering 2 site, 11 to 50 sets in the Pervenets and Bristol sites, 51 to 100 sets in the Zhemchug and Pribilof sites, and 101 to 500 sets in the Bering 1 site. In the shallower HAPC sites (less than 200 m) – Bering 1, Bristol, Zhemchug – the likely target was Pacific cod. In the deeper water proposed HAPC sites – Bering 2, Pribilof, and Pervenets – Pacific cod was also likely the target, although sablefish, Greenland turbot, and rockfish may also have been taken.

Pot effort for groundfish (i.e., Pacific cod) in the proposed HAPCs sites is essentially nil during the years examined, as shown in Appendix C – Color Figure 4. Over the years 1998 to 2010, there were no sets in the Pervenets, Zhemchug, Pribilof, Bristol, and Bering 1 sites, and only a very small indication of lifts in the Bering 2 site (3-10 overall in the southern portion of Bering 2).

Dredge and dinglebar effort for groundfish in the six proposed HAPC sites did not occur, based on examination of locations where fisheries for scallops have occurred in the eastern Bering Sea (see the figure below, which shows scallop fishing areas), which do not overlap with the locations of the six proposed HPACs. Commercial concentrations of weathervane scallops occur along the Alaska coast in elongated beds oriented in the same direction as prevailing currents, at depths from approximately 100 to

120 meters, which is shallower than any of the proposed sites. Dinglebar gear is not used in the eastern Bering Sea, and therefore no fishery would be limited by prohibitions on its use in the six proposed HAPC areas.

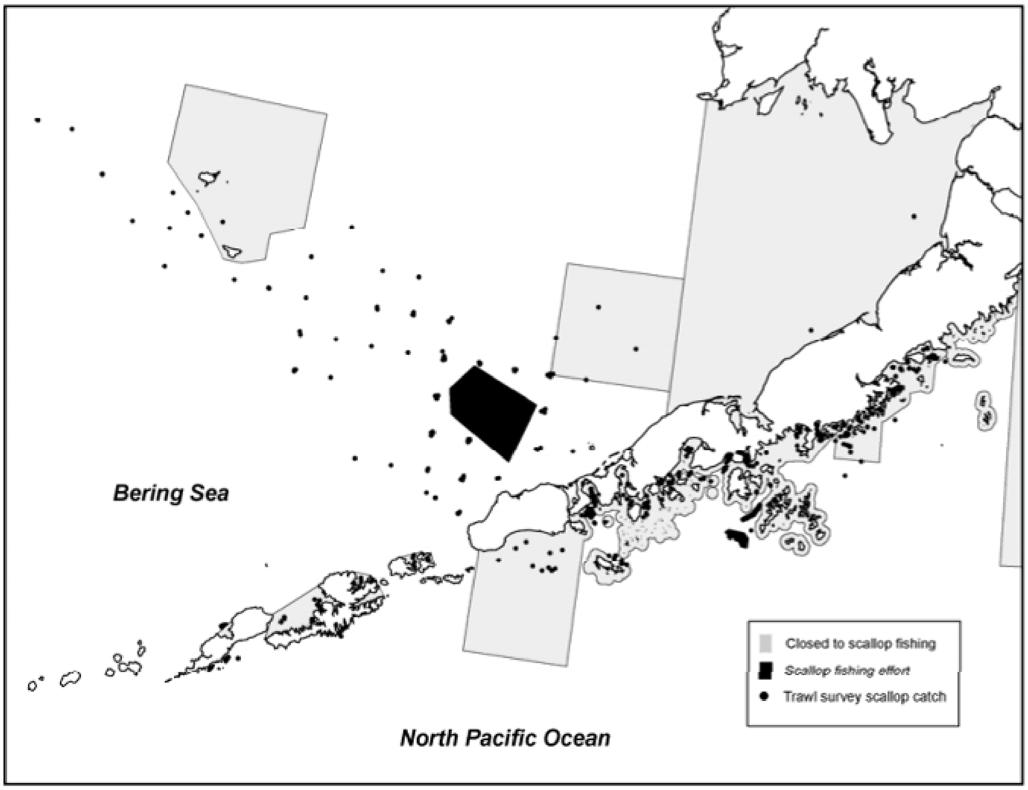

Figure 12. Map showing scallop fishing areas, areas closed to scallop fishing by regulation, and locations where weathervane scallops were captured during NMFS and ADF&G trawl.

4.4.2 Catch by Trawl Gear in Proposed HAPC Sites

Trawl data were obtained from the VMS-enabled Catch-in-Areas database by Steve Lewis of the AKRO (See appendix B). The query selected trawl effort (2003-2011) inside any of the six skate nursery areas identified by the NPFMC for HAPC consideration. These data represent observed hauls only (VMS track lines). The targeting algorithm used in the database differentiates between mid-water pollock as more than 90% pollock, and bottom pollock as predominately, but less than 90%, pollock. Two sites, Zhemchug and Pribilof, showed no trawl effort. Note that all catch from any tow passing through a proposed HAC accrued towards the total.

4.4.2.1 Pelagic Trawls

Pelagic trawl effort in skate nursery sites between 2003 and 2011 was focused on the Bering 1 and 2, Bristol, and Pervenets sites, as shown in the table below. In these sites, effort has shifted between areas, with some being relatively more important between years. The target of the pelagic trawl fishery was pollock in all cases. Approximately one half of all pollock catch from skate nursery areas took place in the Pervenets site between 2007 and 2010, showing a northward shift in the fishery. Bering 2 was fished most consistently, and Bristol showed higher catches in 2003 and 2004 but has not been active since 2007.

A total amount of 23,898 mt of groundfish (virtually all pollock, with de minis amounts of other groundfish) were taken in hauls intersecting the four proposed HAPC sites during the years 2003-2011. If all catches were retained and processed, it is estimated that the ex-vessel value of this catch is $7,127,070. Thus, on average, a closure to bottom trawling of these sites would result in a maximum foregone catch of $791,897 per year (the total ex-vessel price divided by the nine years (2003-2011) of catch data collected). However, it would be expected that the fleet could make up this foregone catch in other areas, adjacent or elsewhere. Nevertheless, moving the fleet elsewhere to make up foregone catch could cause some increased operation costs and may require vessels to fish outside of their preferred zone.

Table 18. Pelagic trawl catch, in tons of groundfish (pollock) per year. Sites not listed experienced no catch in the years examined. Source: NMFS HCD.

HAPC Area and Year	Bottom pollock (mt)	Mid-water pollock (mt)	Grand Total (mt)	Ex-vessel price/lb. ($)	Max. Estimated Ex-vessel Value ($)
1. Bering 1		**3,544.01**	**3,544.01**		**890,872**
2003		360.55	360.55	0.107	84,875
2004		2,268.48	2,268.48	0.106	529,010
2005		177.89	177.89	0.125	48,920
2006		46.16	46.16	0.128	12,998
2007		14.89	14.89	0.129	4,225
2009		95.44	95.44	0.189	39,682
2011		580.60	580.60	0.134	171,162
2. Bering 2	**517.81**	**4,651.65**	**5,169.46**		**1,468,168**
2003	7.06	301.62	308.68	0.107	72,663
2004	259.55	919.93	1,179.48	0.106	275,055
2006	41.51	481.70	523.21	0.128	147,335
2007	40.99	2,276.03	2,317.01	0.129	657,568
2008		204.68	204.68	0.210	94,563
2009	168.71	107.10	275.81	0.189	114,682
2010		260.56	260.56	0.134	76,812
2011		100.03	100.03	0.134	29,489
3. Bristol		**3,739.30**	**3,739.30**		**886,099**
2003		2,142.26	2,142.26	0.107	504,289
2004		1,411.41	1,411.41	0.106	329,141
2006		5.37	5.37	0.128	1,511
2007		180.26	180.26	0.129	51,159
6. Pervenets		**11,445.55**	**11,445.55**		**3,881,931**
2007		4,505.81	4,505.81	0.129	1,278,750
2008		2,804.08	2,804.08	0.210	1,295,487
2009		731.43	731.43	0.189	304,129
2010		3,404.22	3,404.22	0.134	1,003,565
Total	**517.81**	**23,380.52**	**23,898.33**		**7,127,070**
				Average for 2003-2011 = $791,897	

4.4.2.2 Bottom Trawls

Non-pelagic trawl effort in skate nursery sites between 2003 and 2011 was focused on Bering 1 & 2 and Pervenets site, with no effort in Bristol, Pribilof, or Zhemchug, as shown in the tables below. Approximately one half of the total catch in nursery sites was in Bering 2 and focused on arrowtooth flounder. Pacific cod and flathead sole were the other two species with substantial catches, although the 6 other species were identified as targets in the three fished sites. A total amount of 5,881 metric tons of groundfish were taken in hauls intersecting the three proposed HAPC sites during the years 2003-2011.

The value of potential foregone catch was estimated using annual catch by species from the tables below and annual ex-vessels prices from the Economic SAFE Reports. For Greenland turbot, first wholesale value was used, rather than ex-vessel price, because turbot were only taken by catch/processors.

If all catches were retained and processed it is estimated that the ex-vessel value of this catch is $2,656,562, as shown by the tables below. Thus, on average, a closure to bottom trawling of these sites would result in a maximum foregone catch of $355,941 per year (the total ex-vessel price divided by the nine years (2003-2011) of catch data collected). However, it would be expected that the fleet could make up this foregone catch in other areas, adjacent or elsewhere. Nevertheless, moving the fleet elsewhere to make up foregone catch could cause some increased operation costs and may require vessels to fish outside of their preferred zone.

Table 19. Non-pelagic trawl catch per year. Sites not listed experienced no catch in the years examined. Source: NMFS HCD.

HAPC Area and Year	Species catch, in metric tons (mt)									Total
	Atka	Bottom pollock	Cod	Other flats	Rockfish	Flathead	Other	Turbot	Arrowtooth	
1. Bering 1	**5.73**	**32.13**	**334.09**	**16.06**		**5.16**	**312.83**		**193.81**	**899.81**
2003			72.20				312.83		97.97	483.00
2004			232.03	16.06						248.09
2005	5.73		29.85						93.23	128.82
2008						5.16			2.61	7.77
2009		12.52								12.52
2010		19.61								19.61
2. Bering 2	**42.35**	**8.90**	**301.76**	**360.64**		**161.68**		**76.41**	**2,731.48**	**3,683.23**
2003			92.86	51.06				36.96	50.86	231.74
2004	11.88		204.88	222.97		92.36		39.45	245.41	816.96
2005	30.47		4.01	79.56		69.32			188.23	371.59
2006									201.30	201.30
2007				7.04					21.47	28.51
2008									742.00	742.00
2009									1,051.00	1,051.00
2010		8.90							188.86	197.76
2011									42.37	42.37
6. Pervenets		**9.31**	**204.74**		**18.96**	**286.45**		**47.93**	**730.58**	**1,297.97**
2003						7.57		47.93		55.49
2004			186.61			181.60				368.20
2005									95.31	95.31
2006			18.13						19.03	37.17
2008						88.67			545.42	634.09
2009						8.62			70.82	79.44
2010		9.31			18.96					28.27
Total	**48.08**	**50.34**	**840.58**	**376.70**	**18.96**	**453.30**	**312.83**	**124.33**	**3,655.88**	**5,881.00**

Table 20. Non-pelagic trawl estimated ex-vessel value.[a] Sites not listed experienced no catch in the years examined.

HAPC Area and Year	Species value ($)									Total	Max. Estimate Ex-vessel Value ($)
	Atka	Bottom pollock	Cod	Other flats	Rockfish	Flathead	Other	turbot[b]	Arrowtooth		
1. Bering 1											**395,362**
2003	0	0	42,572	0	0	0	99,103	0	57,763	199,438	
2004	0	0	111,791	5,831	0	0	0	0	0	117,622	
2005	1,500	0	15,237	0	0	0	0	0	47,586	64,323	
2008	0	0	0	0	0	1,988	0	0	1,003	2,991	
2009	0	5,206	0	0	0	0	0	0	0	5,206	
2010	0	5,781	0	0	0	0	0	0	0	5,781	
2. Bering 2											**1,605,689**
2003	0	0	54,752	16,176	0	0	0	96,756	29,987	197,672	
2004	3,006	0	98,713	80,939	0	33,528	0	111,962	118,238	446,385	
2005	7,978	0	2,048	34,656	0	30,194	0	0	96,071	170,947	
2006	0	0	0	0	0	0	0	0	77,500	77,500	
2007	0	0	0	2,913	0	0	0	0	8,880	11,793	
2008	0	0	0	0	0	0	0	0	285,668	285,668	
2009	0	0	0	0	0	0	0	0	335,269	335,269	
2010	0	2,624	0	0	0	0	0	0	63,571	66,195	
2011	0	0	0	0	0	0	0	0	14,260	14,260	
6. Pervenets											**655,512**
2003	0	0	0	0	0	2,397	0	125,470	0	127,867	
2004	0	0	89,906	0	0	65,921	0	0	0	155,827	
2005	0	0	0	0	0	0	0	0	48,645	48,645	
2006	0	0	13,643	0	0	0	0	0	7,328	20,972	
2008	0	0	0	0	0	34,137	0	0	225,587	259,724	
2009	0	0	0	0	0	2,749	0	0	27,265	30,014	
2010	0	2,744	0	0	9,718	0	0	0	0	12,462	
Total											**2,656,562**
[a] Note that the ex-vessel values are taken from the most recent SAFE report. [b] The first wholesale value, rather than ex-vessel value, was used for Greenland turbot as all turbot were taken by catcher processors.										**Average value per year = $ 295,174**	

4.4.3 Effects on Processors and Communities

The effects of the Alternatives and Options on processors and communities would be expected to be insignificant due to the low caches from these proposed HAPC areas, and the likelihood that the catch will be made up elsewhere.

4.5 Effects on Management, Monitoring, and Enforcement

There are several options offered to conserve these areas of skate egg concentration from the effect s of fishing. The AFSC recommend in its HAPC proposal that all fishing gear be prohibited from making contact with the seafloor within areas of skate egg concentration (which is size dependent on the concentration or density of skate egg cases. Conservation areas were offered as a range of conservation areas based upon egg case concentrations of each particular site buffered to the nearest minute of latitude and/or longitude. See Appendix C – Color Figures 1 and 17-28.

In February 2011, the Enforcement Committee took up the Preliminary Review on the proposed skate HAPCs. The Enforcement Committee noted that the proposed Council actions included options for restricting bottom trawling while allowing pelagic trawling in the proposed HAPC sites. As noted by the US Coast Guard (USCG) in the discussion below, at-sea enforcement of areas where pelagic trawl gear is permitted and nonpelagic trawl gear is prohibited is problematic. Aerial surveillance and VMS remain the most effective means to monitor closed or restricted gear areas. While aircraft can readily identify the type of vessel by gear, identification of pelagic and nonpelagic trawl gear by aircraft is virtually impossible. It will be difficult to monitor compliance with very small discreet closed areas because this would require excessive use of the major enforcement assets that are used to patrol the Bering Sea. Therefore, a minimum threshold size is proposed of $25nm^2$.

Please note that the Enforcement Committee will again take up the issue of management and enforcement of the proposed conservation management options described within during the February 2012 Council Meeting in Seattle and will report out to the Council on its findings.

4.5.1 Enforcement Concerns for Trawl Gear Area Restrictions

Several proposals have been made over the past year to design fishing closure areas that would prohibit nonpelagic trawlers, but allow pelagic trawl vessels to fish. During the February 2011 Council meeting, the United State Coast Guard (USCG), together with NOAA, presented a white paper to the Council's Enforcement Committee to provide a background relating to the definitions enforcement personnel must work within, as well as the challenges to at-sea enforcement, and changes to boarding procedures that would have to be addressed in order to effectively monitor this type of regulation.

4.5.1.1 Relevant Regulatory Definitions

50 C.F.R. 679.2 provides the following definitions:

(11) Mobile bottom contact gear means nonpelagic trawl, dredge, or dinglebar gear.

(12) Nonpelagic trawl means a trawl other than a pelagic trawl.

(14) Pelagic trawl gear means a trawl that:

(i) Has no discs, bobbins, or rollers;

(ii) Has no chafe protection gear attached to the footrope or fishing line;

(18) Trawl gear means a cone or funnel-shaped net that is towed through the water by one or more vessels. For purposes of this part, this definition includes, but is not limited to, beam trawls (trawl with a fixed net opening utilizing a wood or metal beam),   trawls (trawl with a net opening controlled by devices commonly called   doors), and pair trawls (trawl dragged between two vessels) and is further described as pelagic or nonpelagic trawl.

679.24(b)(3) *Trawl footrope.* No person trawling in any GOA area limited to pelagic trawling under §679.22 may allow the footrope of that trawl to be in contact with the seabed for more than 10 % of the period of any tow.

This phrasing indicates that pelagic trawling is defined by trawling during which the foot rope is not in contact with the bottom for more than 10 % of the time.

In the prohibitions section, 679.7(a)(14) *Trawl gear performance standard*, trawl vessels are prohibited to:

(i) *BSAI*. Use a vessel to participate in a directed fishery for pollock using trawl gear and have on board the vessel, at any particular time, 20 or more crabs of any species that have a carapace width of more than 1.5 inches (38 mm) at the widest dimension.

(ii) *GOA*. Use a vessel to participate in a directed fishery for pollock using trawl gear when directed fishing for pollock with nonpelagic trawl gear is closed and have on board the vessel, at any particular time, 20 or more crabs of any species that have a carapace width of more than 1.5 inches (38 mm) at the widest dimension.

4.5.1.2 Enforcement Concerns

Aircraft Surveillance

Aerial surveillance and VMS remain the most effective means to monitor closed or restricted gear areas. Due to the size of the Alaska region and the number of enforcement assets available, one of the most effective means of surveillance is by aircraft. While an aircraft can identify the type of vessel (e.g. longliner, trawler, seiner, pot boat, etc.), there is no way for aircraft to readily identify whether a trawl vessel is using pelagic or nonpelagic trawl gear.

Because of these definitions, the only time an aircraft would be able to determine whether a vessel was using pelagic or nonpelagic trawl gear would be if they witnessed a haulback and noted chafing gear on the foot rope or roller gear. By definition, this would make the vessel a nonpelagic trawler. All other definitions used to identify whether a vessel is conducting pelagic or nonpelagic trawl activities must be conducted by a boarding team on the vessel.

At-sea Enforcement

Outside the pollock fishery, which has specific crab bycatch limits to define bottom contact, it is almost impossible to define how much time a trawl net is in contact with the sea floor.

Specific to pollock vessels using pelagic trawl gear in the BSAI and GOA, these vessels are held to the performance indicator of not having more than 20 crabs of any species with a carapace of more than 1.5 inches, but there are no performance indicator definitions for other target species where vessels use pelagic or nonpelagic trawl gear.

Case study in the protection of crab

For example, recent enforcement proposals focus specifically in allowing the pollock pelagic trawlers into areas prohibited to nonpelagic trawl gear for the protection of crab. In order for the USGC to enforce this regulation on the catcher/processor fleet, a boarding team would be required to be on board for significantly more time than they currently are. The boarding team would remain on board to witness a haul back of the gear, during which time they could check the net for the roller and chafing gear that would define the vessel as nonpelagic. The boarding team would also have to remain on board until the entire catch was sorted. This would necessitate that there is no mixing of catch from different hauls, and may impact the operations of some trawlers.

In speaking with Marlon Concepcion with the NMFS Fisheries Monitoring and Analysis Division in Dutch Harbor, this would require Coast Guard Boarding Teams to remain on the vessels approximately 12 hours vice the current 3-6 hour average. This time would allow the team to witness the haul back, the dumping of the catch from the bag into the hold, and sorting time for the entire catch. The boarding team would have to watch for any crab discard on the deck, and then observe the entire sorting process to ensure compliance with the 20 crab limit.

Current fishing practice is for the vessel to allow the catch to sit for 4-6 hours after it is dumped into the hold before beginning processing. During this time, boarding personnel would have to remain in the area to witness the sorting to ensure catch of not more than 20 crab greater than 1.5 inches. Based upon an average catch size for this fleet of between 80 and 110 metric tons per haul, and a 15 metric ton/hour processing rate, this would require an additional 6-8 hours of time for the boarding team to monitor for crab catch.

The average boarding time is approximately 3-6 hours in duration. If the boarding team must remain on board to observe the sorting of all the catch, the result is a boarding taking 6-8 hours longer. This additional time would reduce the total number of boardings the USGC can conduct in a given time period, reducing the overall contact rate for the fleet.

The additional boarding time also imposes an additional logistical burden on boardings due to increased ship to ship personnel transfers, small boat hours, meals, etc. The duration of the boarding also increases the likelihood of night operations, which presents increased risk. During the boarding, vessels would not be permitted to mix the catch from various cod ends, as the 20 crab measure would be compromised should the catch from more than one haul be in the hold at any given time during the boarding.

4.5.1.3 Conclusions and possible mitigating factors

Current practice, when in large fleets of vessels, is often to send boarding teams to more than one vessel. Due to the duration of the boarding, cutters would likely be restricted in the number of boardings they can conduct simultaneously due to the risk to boarding team members and concerns for the recovery of personnel at the completion of the boarding. If cutters had teams on multiple vessels, they would likely have to restrict the movement of fishing vessels until the boarding was complete to ensure appropriate response distances for the safety of boarding teams.

At-sea enforcement of areas where pelagic trawl gear is permitted and nonpelagic trawl gear is prohibited is problematic. Aerial surveillance remains the most effective means to monitor closed or restricted gear areas. While aircraft can readily identify the type of vessel by gear, identification of pelagic or nonpelagic trawl gear by aircraft is virtually impossible.

Identification of pelagic or nonpelagic trawl gear can easily be done by definition during an at sea boarding based upon the definition of rollers and chafing gear, but becomes more problematic in cases where gear that appears to be pelagic in nature is in contact with the sea floor more than the allowable ten % of the time. It is nearly impossible for a boarding team to determine how much time pelagic trawl gear is in contact with the bottom, and this regulation is almost unenforceable. The exception to this is in the pollock fleet where bottom contact is defined by the number of crab caught.
In order to monitor the crab metric, boarding teams would have to remain on board for a much longer duration, possibly impacting vessel operational procedures, vessel freedom of movement, and safety of boarding personnel.

One possible mitigating factor, at least for the aerial surveillance factor, would be to have vessels declare what they are targeting and what gear they are using through their VMS units. This is a system that is used extensively in other regions of the country, and allows enforcement personnel to quickly identify locations of various fleets by gear type and targeted species. It does not, however; address the issue of the 20 crab limit, which would still have to be monitored by boarding personnel in a protracted boarding.

4.5.2 Vessel Monitoring Systems (VMS)

Another tool that can be used in tandem with a real time data reporting system is to require a vessel monitoring system (VMS). VMS is an essential requirement to show the vessel was at-sea, how long it was out, where it docked when it came into port, and the present vessel location. VMS is capable of understanding and recording small details of the ship's evolutions. It can document, for instance, specific course changes and engine speed changes by a vessel. Collectively this pattern is termed a signature. At present there is not enough data to make a signature admissible in court as an indicator of fishing. Regardless, VMS technicians are trained to look at positioning data and other factors indicating potential fishing activity. An investigator can be dispatched to the landing site intercepting the vessel as it comes into port or even anchors in a remote area. If the captain and crew are believed to have illegally harvested a LAP species, the agent or officer can intercept the vessel. If, during the course of an initial investigation, a violation surfaces the agent or officer will bring the vessel to port, seize the catch and cite the errant fisherman.

4.5.3 Enforceable Threshold Size and Shape

If the Council wishes to protect the proposed skate egg concentration HAPCs, and VMS is the mechanism utilized to monitor closures of these areas, then the ideal minimum size according to the USCG and NOAA is approximately 5nm to a side, or 25nm^2. This is the minimum size that will provide sufficient buffer space in order to use VMS to determine an incursion into the area. The primary reason for this size would be to guarantee that at least one VMS poll is within the much finer area that the Council wishes to protect, and to ensure that vessels do not transit all the way through the area between polls, or merely cut through the corners. This minimum size will guarantee that the USCG and the NOAA Office of Law Enforcement (OLE) would be able to get at least one VMS poll within the closed area despite issues of cutting the corner, or other means, and would ensure the smaller area you want to protect is protected.

There have been no VMS only cases that have stood up in court, unless the area has a no-transit provision, unless a cutter or aircraft was able to verify that fishing gear is in the water. This is done to ensure the vessel is actively engaged in fishing, and not merely transiting slowly through the area, or dealing with mechanical or weather issues that slow them down.

The Council has the option under Alternative 3 to prohibit nonpelagic gear, as this is the primary gear that would impact the area of skate egg concentration, but would allow pelagic trawl gear. In discussing trawlers, the USGC feels the white paper prepared and presented in February 2011 is applicable to the discussion on problems with closed areas that prohibit nonpelagic trawling, but allow pelagic trawling.

The distribution maps at each nursery site (Appendix C – Color Figures 17-28) display two possible alternatives to determine the extent of the skate nursery area based on trawl studies, ovals and boxes. The ovals are based on the distribution of trawl sites where skate eggs were >1,000 km^2. The outside boxes are approximately 10 km on each side (100 km^2) using the trawl with the highest concentration as the center of the box. The box design accomplishes two goals, that of estimating the effective nursery habitat area and provide a comfortable buffer around the sites that produces a manageable area and shape to facilitate enforcement.

At the February 2011 Council Meeting, the Enforcement Committee received the Preliminary review of proposed skate HAPCs and made recommendations on the most appropriate shape and size. The Enforcement Committee recommended that the Council maintain square- or rectangular-shaped closures. Areas closed to certain gear types for conservation are more practical to enforce if they are square- or rectangle-shaped. It is more clear that a fishing vessel is either west/east or north/south of a delineation, and therefore, in or outside a closed area using VMS or aircraft overflight. This clarity also benefits fishing vessels in avoiding or inadvertently entering a closure.

4.6 Net Benefits to the Nation

Overall benefits to the Nation may be affected by the proposed actions, though our ability to quantify those effects is limited to a qualitative description. Overall net benefits to the Nation would not be expected to change to an identifiable degree between the alternatives under consideration. Overall, this action is likely to have a limited effect on net benefits realized by the Nation.

5.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS (IRFA)

5.1 Introduction

This Initial Regulatory Flexibility Analysis (IRFA) addresses the statutory requirements of the Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 (5 U.S.C. 601-612). When an agency proposes regulations, the RFA requires the agency to prepare and make available for public comment an IRFA that describes the impact of the proposed rule on small businesses, small nonprofit entities, and small government entities. The IRFA is to aid the agency in considering all reasonable regulatory alternatives that would minimize the economic impact on the small entities to which the proposed rule applies. This IRFA evaluates the potential adverse economic impacts on small entities directly regulated by the proposed actions.

The RFA, first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities, and on the consideration of alternatives that may minimize adverse economic impacts, while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the SBREFA. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file *amicus* briefs in court proceedings involving an agency's alleged violation of the RFA.

In determining the scope, or 'universe', of the entities to be considered in an IRFA, NMFS generally includes only those entities that can reasonably be expected to be directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis.

5.2 IRFA Requirements

Until the Council makes a final decision on a preferred primary alternative(s) (PPA), a definitive assessment of the proposed management alternatives, within the context of the RFA, cannot be conducted. In order to allow the agency to make a certification decision, or to satisfy the requirements of a RFA of the PPA, this section addresses the requirements for an IRFA. The level of detail and sophistication of the analysis should reflect the significance of the impact on small entities. Under 5 U.S.C. 603(b) of the RFA, each IRFA is required to address:

- A description of the reasons why action by the agency is being considered;
- A succinct Statement of the objectives of, and the legal basis for, the proposed rule;

- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);

- A description of the projected reporting, record keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;

- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap, or conflict with the proposed rule;

- A description of any significant alternatives to the proposed rule that accomplish the Stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the Stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

  1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
  2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
  3. The use of performance rather than design standards;
  4. An exemption from coverage of the rule, or any part thereof, for such small entities.

In preparing an IRFA, an agency may provide either a quantifiable or numerical description of the effects of a proposed action (and alternatives to the proposed action), or more general descriptive statements if quantification is not practicable or reliable.

5.3 Definition of a Small Entity

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) small government jurisdictions.

5.3.1 Small Businesses

Section 601(3) of the RFA defines a "small business" as having the same meaning as "small business concern," which is defined under Section 3 of the Small Business Act (SBA). "Small business" or "small business concern" includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor…A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49% participation by foreign business entities in the joint venture."

The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. Effective January 5, 2006, a business involved in fish harvesting is a small business if it is independently owned and operated, not dominant in its field of operation (including its affiliates), and if it has combined annual gross receipts not in excess of $4.0 million for all its affiliated operations worldwide.[12] A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the $4.0 million criterion for fish harvesting operations. Finally, a wholesale business servicing the fishing industry is a small business if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

The SBA has established “principles of affiliation” to determine whether a business concern is “independently owned and operated.” In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern’s size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when: (1) a person is an affiliate of a concern if the person owns or controls, or has the power to control 50 % or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock, or (2) if two or more persons each owns, controls or has the power to control less than 50 % of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors, or general partners, controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

5.3.2 Small Organizations

The RFA defines “small organizations” as any not-for-profit enterprise that is independently owned and operated, and is not dominant in its field.

[12] Effective January 6, 2006, the SBA updated the Gross Annual Receipts thresholds for determining “small entity” status under the RFA. This is a periodic action to account for the impact of economic inflation. The revised threshold for “commercial fishing” operations (which, at present, has been determined by NMFS HQ to include catcher-processors, as well as catcher vessels) changed from $3.5 million to $4.0 million in annual gross receipts, from all its economic activities and affiliated operations, worldwide.

5.3.3 Small Governmental Jurisdictions

The RFA defines "small governmental jurisdictions" as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of fewer than 50,000.

5.4 Reasons for Consideration of Proposed Actions

In the Magnuson-Stevens Act (MSA), Congress recognized that one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Congress adopted specific requirements for FMPs to identify Essential Fish Habitat (EFH) and minimize to the extent practicable any adverse effects of fishing on EFH. In the regulations implementing the EFH provisions of the Magnuson-Stevens Act, NMFS encourages Councils to identify types or areas of habitat within EFH as HAPCs (50 CFR 600.815(a)(8)). HAPCs provide a valuable mechanism to acknowledge areas where more is known about the ecological function and/or vulnerability of EFH, and to highlight priority areas within EFH for conservation and management. HAPCs and associated management measures considered by the Council would provide additional habitat protection and further minimize potential adverse effects of fishing on EFH. Such actions are consistent with the EFH Environmental Impact Statement (EIS) because they address potential impacts that are discussed in the EIS. In effect, through its evaluation of HAPCs, the Council is considering new measures that would be precautionary.

The Council adopted the following statement of purpose and need at its February 2011 meeting:

> *HAPCs are geographic sites that fall within the distribution of Essential Fish Habitat for the Council's managed species. The Council has a formalized process, identified in its FMPs, for selecting HAPCs that begins with the Council identifying habitat priorities—here, areas of skate egg concentration. Candidate HAPCs must be responsive to the Council priority, must be rare (defined as uncommon habitat that occurs in discrete areas within only one or two Alaska regions), and must meet one of three other considerations: provide an important ecological function; be sensitive to human-induced degradation; or be stressed by development activities.*
>
> *The candidate HAPCs identify sites of egg concentration by skate species (Rajidae) in the eastern Bering Sea. Skates are elasmobranch fish that are long-lived, slow to mature, and produce few young. Skates deposit egg cases in soft substrates on the seafloor in small, distinct sites. A reproducing skate deposits only several egg cases during each reproductive season. Depending on the species, a single egg case can hold from one to four individual skate embryos, and development can take up to three years. Thus, a single egg case site will hold several year classes and species, and eggs growing at different rates.*
>
> *Distinct skate egg case sites have been highlighted by skate stock experts while assessing skate information from research survey and catch locations. The scientists noted repeated findings of distinct sites where egg cases recruit to sampling or fishing gear contacting the seafloor: egg case prongs (or horns) entangle in or cases recruits into the gear. The eggs and embryos are highly susceptible to disturbance, damage, or destruction from fishing gear that contacts the seafloor during their lengthy development. Fishing activities within these sites can also disrupt recently hatched juveniles and reproductive adult skates depositing new eggs in nursery sites. It is therefore important to protect areas of concentrated skate egg concentration and limit the loss of skates during the early life stages.*

5.5 Legal Basis for Proposed Actions

Actions taken to amend FMPs or implement other regulations governing these fisheries must meet the requirements of federal laws and regulations. In addition to the Magnuson-Stevens Act, the most important of these are the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), EO 12866, and the RFA.

Under the Magnuson-Stevens Act (MSA), the U.S. has exclusive fishery management authority over all marine fishery resources found within the EEZ, 3 to 200 nautical miles from the baseline used to measure the territorial sea. The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the Regional Councils. In the Alaska Region, the North Pacific Fishery Management Council has the responsibility for preparing FMPs for the marine fisheries it finds that require conservation and management, and for submitting their recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the federal mandates of the Department of Commerce with regard to marine and anadromous fish. The groundfish fisheries in the EEZ off Alaska are managed under the FMP for the Groundfish Fisheries of the GOA and the FMP for the Groundfish Fisheries of the BSAI. The crab fisheries in the EEZ off Alaska are managed under the FMP for the Crab Fisheries of the BSAI. The scallop fisheries in the EEZ off Alaska are managed under the FMP for the Scallop Fisheries of Alaska. The halibut fishery is managed by the International Pacific Halibut Commission (IPHC), which was established by a Convention between the governments of Canada and the United States. The IPHC's mandate is research on and management of the stocks of Pacific halibut within the Convention waters of both nations.

5.6 Small Entities Impacted by Actions

Federal courts and Congress have indicated that a RFA analysis should be limited to small entities directly regulated by the proposed regulation. As such, small entities to which implementing regulations would not apply are not considered in this analysis. The entities that could be directly regulated by the proposed action are those businesses that use certain gear types to harvest groundfish, halibut, crab, scallops, and other fishery resources in the waters off of Alaska. The proposed action would not apply to any small governmental jurisdiction or small organization, as defined by the RFA.

5.7 Recordkeeping and Reporting Requirements

The proposed rule does not directly mandate "reporting" or "record keeping" within the meaning of the Paperwork Reduction Act (PRA). However, implementing rules could contain compliance requirements not subject to the PRA. For example, implementing regulations could prohibit the use of certain types of fishing gear in habitat areas designated as HAPCs.

Of those vessels that could be directly regulated, only a small fraction would incur compliance costs as a result of implanting rule. In many cases, it is likely that any displaced catch would be made up by shifting effort to another area. Given the low level of revenue at risk under the proposed rule, the potential increase in vessel operating costs would also likely be small. On this basis, implementing regulations should not be expected to have the potential to adversely affect the cash flow or profitability of any small entities. Implementation of these alternatives would potentially mean that fishing vessels actively fishing in the areas under consideration for HAPC designation would be subject to NMFS recordkeeping and reporting requirements for as long as they hold the FFP.

5.8 Duplicate, Overlap, or Conflict with Federal Rules

No relevant Federal rules have been identified that would duplicate, overlap, or conflict with the proposed action.

5.9 Alternatives that Accomplish Objectives at Lower Cost to Small Entities

An IRFA also requires a description of any significant alternatives to the proposed action(s) that accomplish the stated objectives, are consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. All of the directly regulated entities under this action are considered small entities, as defined under the RFA. Within the universe of small entities that would be directly regulated by this action, impacts may accrue differently (i.e., some small entities may be negatively affected, while others may be positively affected). Thus, the action represents tradeoffs in terms of impacts on small entities. Based upon the best available scientific data, and consideration of the objectives of this action, it appears that there are no alternatives to the proposed action that have the potential to accomplish the stated objectives of the Magnuson-Stevens Act and any other applicable statutes, and have the potential to minimize any significant adverse economic impact of the proposed rule on small entities.

6.0 CONSISTENCY WITH APPLICABLE LAW

This section examines the consistency of HAPC designation for areas of skate egg concentration with a Finding of No Significant Impact (FONSI), the ten National Standards, and Fishery Impact Statement (FIS), requirements of the National Environmental Policy Act (NEPA), the Magnuson-Stevens Act (MSA), and Executive Order (EO) 12866.

6.1 Environmental Analysis Conclusions

One of the purposes of an environmental assessment (EA) is to provide the evidence and analysis necessary to decide whether an agency must prepare an environmental impact statement (EIS). The Finding of No Significant Impact (FONSI) is the decision maker's determination that the action will not result in significant impacts to the human environment, and therefore, further analysis in an EIS is not needed. The Council on Environmental Quality regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." An action must be evaluated at different spatial scales and settings to determine the context of the action. Intensity is evaluated with respect to the nature of impacts and the resources or environmental components affected by the action. NOAA Administrative Order (NAO) 216-6 provides guidance on the National Environmental Policy Act (NEPA) specifically to line agencies within NOAA. It specifies the definition of significance in the fishery management context by listing criteria that should be used to test the significance of fishery management actions (NAO 216-6 §§ 6.01 and 6.02). These factors form the basis of the analysis presented in this EA/RIR/IRFA. The results of that analysis are summarized here for those criteria.

Context: For this action, the setting is the eastern Bering Sea, primarily within the BSAI groundfish fisheries that participate in the specific areas of the EBS that are proposed for identification as a HAPC and gear limitations. Any effects of this action are limited to these areas, or areas immediately adjacent in the EBS where vessels may choose to catch their target fish if they are closed out of specific fishing areas. The effects of this action on society within this area are on individuals directly and indirectly participating in these fisheries and on those who use the ocean resources. Because this action concerns the use of a present and future resource, this action may have impacts on society as a whole or regionally.

Intensity: Considerations to determine intensity of the impacts are set forth in 40 CFR 1508.27(b) and in the NAO 216-6, Section 6. Each consideration is addressed below in order as it appears in the NMFS Instruction 30-124-1 dated July 22, 2005, *Guidelines for Preparation of a FONSI*.

1) *Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?*

No. No significant adverse impacts on target species were identified for Alternatives 2 or 3. No changes in overall amount or timing of harvest of target species are expected with any of the alternatives or options in the proposed action, and the general location of harvest is also likely to be similar to the status quo, although there may be localized shifts. Therefore, no impacts on the sustainability of any target species are expected.

2) *Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?*

No. Potential effects of Alternatives 2 and 3 on non-target and prohibited species are expected to be insignificant and similar to status quo because no overall harvest changes to target species were expected. Some benefit to skate eggs caught as bycatch in the groundfish fisheries may accrue due to the area closures. Because no overall changes in target species harvests under the alternatives is expected, the alternatives and option are not likely to jeopardize the sustainability of any non-target/prohibited species.

3) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in the fishery management plans?

No. No significant adverse impacts were identified for Alternatives 2 or 3 on ocean or coastal habitats or EFH. The alternatives provide additional protection to areas in the EBS where area closures and gear limitations are proposed. Alternative 2 is less protective of habitat than Alternative 3 because it only designates areas as HAPCs without gear limitations for conservation of habitat and skate egg concentrations.

4) Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

No. Public health and safety will not be affected in any way not evaluated under previous actions or disproportionately as a result of the proposed action. The proposed action for Alternatives 2 and 3 will not change overall fishing methods, timing of fishing, or quota assignments to gear groups, which are based on previously established seasons and allocation formulas in regulations.

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

No. Alternative 3 would create area in the EBS. The proposed action would not change the Steller sea lion protection measures, ensuring the action is not likely to result in adverse effects not already considered under previous ESA consultations for Steller sea lions and their critical habitat. The area adjacent to these closures, into which fishing vessels may be displaced, is not identified as critical habitat for any ESA-listed species and population level effects are not expected. Because there will be no change in overall harvest, the alternatives are not likely to adversely affect ESA-listed species or their designated critical habitat.

6) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

No significant adverse impacts on biodiversity or ecosystem function were identified for Alternatives 1-3. Alternative 3 would provide protection to biodiversity and ecosystem function by creating area closures in the EBS, and likely benefit marine features that provide an ecosystem function. No significant effects re expected on biodiversity, the ecosystem, marine mammals, or seabirds

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Socioeconomic impacts of this action could result from *de minimis* displacement of vessels that make contact with the sea floor while fishing in the proposed area closures, or additional costs associated with the options that would allow them to be exempted from the closures. The social or economic impacts of the alternatives are not expected to be significant as target fish are harvested in areas immediately adjacent to the proposed closure areas, and meeting the requirements for the exemptions are not excessively expensive to the fishing fleet.. No significant adverse impacts were identified for Alternatives 1-3 for social or economic impacts interrelated with natural or physical environmental effects.

8) Are the effects on the quality of the human environment likely to be highly controversial?

No. This action is limited to specific areas in the EBS that are historically of some and limited value to the groundfish fleet. Development of the proposed action has involved participants from the scientific and fishing communities, and the potential impacts on the human environment are well understood. No issues of controversy were identified in the process.

9) *Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?*

No. This action would not affect any categories of areas on shore. This action takes place in the geographic area of the EBS. The land adjacent to this marine area may contain archeological sites of native villages, but this action would occur in adjacent marine waters so no impacts on these cultural sites are expected. The marine waters where the fisheries occur contain ecologically critical areas. Effects on the unique characteristics of these areas are not anticipated to occur with this action because of the amount of fish removed by vessels are within the total allowable catch (TAC) specified harvest levels and the alternatives provide protection to EFH and ecologically critical areas at the heads of undersea canyons.

10) *Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?*

No. The potential effects of the action are well understood because of the fish species, harvest methods involved, and area of the activity. For marine mammals and seabirds, enough research has been conducted to know about the animals' abundance, distribution, and feeding behavior to determine that this action is not likely to result in population effects. The potential impacts of different gear types on habitat also are well understood, as described in the EFH EIS (NMFS 2005).

11) *Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?*

No. Beyond the cumulative impact analyses in the 2011 and 2012 harvest specifications EA and the Groundfish Harvest Specifications EIS, no other additional past or present cumulative impact issues were identified. Reasonably foreseeable future impacts in this analysis include potential effects of climate change due to global warming. The combination of effects from the cumulative effects and this proposed action are not likely to result in significant effects for any of the environmental component analyzed and are therefore not significant.

12) *Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?*

No. This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources. Because this action occurs in marine waters, this consideration is not applicable to this action.

13) *Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?*

No. This action poses no effect on the introduction or spread of nonindigenous species into the Bering Sea and Aleutian Islands beyond those previously identified because it does not change fishing, processing, or shipping practices that may lead to the introduction of nonindigenous species.

14) *Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?*

No. This action would provide additional protections for North Pacific skate species by designating areas of skate egg concentration as HPACs, implementing conservation and management measures, and research and monitoring these areas in the EBS. This action does not establish a precedent for future action because the Council has indicated that a HAPC priority exists exclusively for the duration of a Council HAPC proposal cycle. Thus, HAPC site proposals for a previously-designated HAPC priority may not be submitted on a continuing basis. In addition, HPAC designation has been used as a management tool for the protection of marine resources in the Alaska groundfish fisheries. Pursuant to NEPA, for all future actions, appropriate environmental analysis documents (EA or EIS) will be prepared to inform the decision makers of potential impacts to the human environment and to implement mitigation measures to avoid significant adverse impacts.

15) *Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law, or requirements imposed for the protection of the environment?*

No. This action poses no known violation of Federal, State, or local laws, or requirements for the protection of the environment. The proposed action would be conducted in a manner consistent, to the maximum extent practicable, with the enforceable provisions of the Alaska Coastal Management Program within the meaning of Section 30(c)(1) of the Coastal Zone Management Act of 1972 and its implementing regulations.[13]

16) *Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?*

No. The effects on target and non-target species from the alternatives are not significantly adverse as the overall harvest of these species will not be affected. No cumulative effects were identified that added to the direct and indirect effects on target and non-target species would result in significant effects.

6.1.1 Comparison of Alternatives

Alternative 1 is the status quo, calls for no action, and does not provide for protection of habitat supporting skate egg concentration areas on the seafloor from fishing activities or fishing gear that make contact with the sea floor in these areas of the EBS. No measures would be taken to designate and conserve areas of skate egg concentration as HAPCs. Under Option e, however, the Council may add research and monitoring of these areas of skate egg concentration to the Council's annual research priority list. Thus, Alternative 1 has no significant impacts identified and or potential beneficial socioeconomic effects.

Alterative 2 would provide for a degree of protection for areas of skate egg concentration from fishing activities by designating areas of supporting habitat as HAPCs, highlighting their existence to the fishing fleets, which could voluntarily avoid those areas or prevent their fishing gear from making contact with the sea floor. The Council may select individually, severally, or all of the six areas identified as potential skate egg concentration HAPCs. Alternative 2 has no additional environmental impacts beyond those already identified in the analysis, but Alternative 2 would not provide for additional protections by limiting the use of fishing gear that makes contact with the sea floor. Alternative 2 has no significant impacts identified and potential beneficial socioeconomic effects.

Alternative 3 provides for both the identification of skate egg concentration HAPCs and for the conservation of these areas through prohibitions of gear types that make contact with the sea floor. The impacts of Alternative 3 depend on the Option for conservation and management (a through d) selected

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The Alaska Coastal Management Program expired July 1, 2011 (AS 44.66.030). The State Legislature adjourned its special legislative session May 14, 2011 without passing legislation required to extend the Coastal Program.

for each HAPC. The Council may select, in combination with any skate egg concentration designated as a HAPC, to limit fishing activities that make contact with the sea floor in these areas by prohibiting the use of "mobile bottom contact," pelagic, "bottom contact," or all fishing gear. Options that prohibit trawling in these areas would provide the most protection from potential direct impacts (bury or crush) and indirect impacts (dislodgement, movement, bycatch mortality) on egg cases. Other gear types likely have less potential to impact skate egg cases, so a prohibition on these gears may offer only marginal benefits. The potential effects of the options on skate populations remains unknown but are likely beneficial.

6.2 The Ten National Standards

Below are the ten National Standards as contained in the MSA and a brief discussion of the consistency of the proposed alternatives with each of those National Standards, as applicable (MSA 301(a)).

National Standard 1: *Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery.*

None of the alternatives considered in this action would result in overfishing in the EBS or of groundfish in the BSAI. The alternatives would also not impact, on a continuing basis, the ability to achieve the optimum yield from EBS fisheries or the BSAI groundfish fishery.

National Standard 2; *Conservation and management measures shall be based upon the best scientific information available.*

The analysis for this action is based upon the best and most recent scientific information available.

National Standard 3: *To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.*

The proposed action is consistent with the management of individual stocks as a unit or interrelated stocks as a unit or in close coordination.

National Standard 4: *Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation shall be (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.*

The proposed alternatives treat all fishing vessels the same. The proposed alternatives would be implemented without discrimination among participants and are intended to promote conservation of North Pacific skate species in the EBS

National Standard 5: *Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.*

This action will potentially improve efficiency in utilization of the fishery resources in the EBS and the BSAI groundfish fishery by highlighting areas in which there is a very high likelihood that skate egg casings will be encountered.

National Standard 6: *Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.*

None of the proposed alternatives is expected to affect the availability of and variability in the groundfish resources in the BSAI in future years.

National Standard 7: *Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.*

This action does not duplicate any other management action.

National Standard 8: *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

This action is not expected to have adverse impacts on communities or affect community sustainability.

National Standard 9: *Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*

The proposed action is expected to reduce the impact of bycatch and bycatch mortality of skate egg casings primarily in the BSAI groundfish fishery.

National Standard 10: *Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.*

The proposed action is not expected to have a substantial impact on safety at sea.

6.3 Fisheries Impact Statement (FIS)

Section 303(a)(9) of the Magnuson-Stevens Act requires that any management measures submitted by the Council take into account the potential impacts on the participants in the affected fisheries, as well as participants in adjacent fisheries. The impacts on participants in the BSAI groundfish, crab, and scallop fisheries have been discussed in previous sections of this document. The proposed alternatives are not anticipated to have effects on participants in other fisheries.

7.0 REFERENCES [PLACEHOLDER]

[INSERT]

8.0 PREPARERS, CONTRIBUTORS, AND PERSONS CONSULTED

NPFMC	Sarah Melton, David Witherell, Diana Evans
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9.0 APPENDICES

9.1 Appendix A – HAPC Process Methodology

Methodology for Proposal Evaluation

Evaluation Criteria

The Council has determined, through the HAPC identification process defined in the Council FMPs, that HAPCs in Alaska must be geographic sites that are rare AND must meet one of three other considerations: (1) provide an important ecological function; (2) be sensitive to human-induced degradation; or (3) be stressed by development activities. To provide guidance to proposers and reviewers about how proposals should be evaluated against these considerations, the Council adopted the following criteria:

1. In order to be considered rare, proposals should meet the criteria identified in a score of "2" or "3."
2. For the other three factors, a score of "0" indicates that a proposal does not meet the particular consideration in question.

Table 21. Criteria to evaluate HAPC proposals for the Council's consideration

Score	HAPC Considerations			
	Rarity	**Ecological Importance**	**Sensitivity**	**Level of Disturbance (applicable to activities other than fishing)**
	The rarity of the habitat type.	*The importance of the ecological function provided by the habitat*	*The extent to which the habitat is sensitive to human induced environmental degradation*	*Whether and to what extent development activities are or will be stressing the habitat type*
0	N/A	Habitat does not provide any ecological associations[14] for managed species.	Habitat resilient (not sensitive).	Habitat not subject to developmental stress.
1	N/A	Habitat provides little structure[15] or refugia. Foraging and spawning areas do not exist.	Habitat somewhat sensitive and quickly recovers; 1- 5 years. Effects considered temporary.	Habitat is or will be exposed to minimal disturbance from development.
2	Habitat uncommon, less frequent, and occurs to some extent in one or two of the Alaska regions: Gulf of Alaska, Bering Sea, Aleutian Islands, and Arctic.	Habitat exhibits structure and provides refugia or substrates for spawning and foraging.	Habitat sensitive and recovery is within ten years. Effects considered temporary; may be more than minimal, however.	Habitat is or will be stressed by activities. Short term effects evident.
3	Habitat uncommon and occurs in discrete areas within only one Alaska region.	Complex habitat condition and substrate serve as refugia, concentrate prey, and/or are known to be important for spawning.	Habitat is highly sensitive and slow to recover; exceeds 10s of years. Effects will persist and more than minimal.	Habitat is or will be severely stressed or disturbed by development. Cumulative impacts require consideration from long term effects.

Data Certainty Factor

The Data Certainty Factor (DCF) determines the level of information known to describe and assess the HAPC site. The DCF is used to determine if information is adequate prior to taking further action. Thus, a HAPC proposal with a high criteria score and a low DCF is to be highlighted (flagged) as a potential candidate for HAPC and for further consideration as a research priority. In this HAPC cycle, the DCFs are scored according to their weight to further inform the criteria scores, i.e., a DCF of 3, 2, or 1.

Table 22. The Data Certainty Factor (DCF)

Weight	Data Certainty
3	Site-specific habitat information is available.
2	Habitat information can be inferred or proxy conditions allow for information to be reliable.
1	Habitat information does not exist; neither by inference nor proxy.
N/A	Research Priority Flag – as applicable.

HAPC Proposal Rank

The HAPC ranking formula provides a score (sum of criteria scores) to provide information on the proposal as it is considered by the Council in the HAPC process. A highly ranked HAPC proposal with a

[14] Ecological associations are those associations where the habitat provides for reproductive traits (i.e. spawning and rearing aggregations) and foraging areas; areas necessary for survival of the species. Associations include habitat complexity (features, structures, etc.) and habitat associations (provide refugia, spawning substrates, concentrate prey, etc.). Ecological importance is not to be applied across all waters or substrates.
[15] "Structure" refers to three-dimensional structure.

DCF of 3 has a high criteria score AND information exists to assess the site. High scoring proposals with a low data certainty factor may warrant consideration as a research priority:

HAPC Proposal Rank = Additive HAPC Criteria Score supplemented with Data Certainty Factor

Methodology for Selection

Plan Teams' Review

At their September 2010 meeting, the Joint Groundfish Plan Teams reviewed the HAPC proposals for ecological merit. The joint plan teams found merit to the proposals, recognizing that there will always be some level of scientific uncertainty in the design of proposed HAPCs and how they meet the criteria and stated goals and objectives. The plan teams highlighted: low population growth rate of skates; the long development time for skate embryos, during which they are vulnerable to fishing gear that contacts the sea floor; and the relatively high level of production provided by small geographic areas of the eastern Bering Sea. The joint plan teams also encouraged allocation of research funds to monitor the effectiveness of the protection measures for skate embryos.

Evaluation of Proposed Sites Using HAPC Criteria

Table 23. Criteria Evaluation

	HAPC Considerations			
	Rarity	**Ecological Importance**	**Sensitivity**	**Level of Disturbance** (applicable to activities other than fishing)
	The rarity of the habitat type.	*The importance of the ecological function provided by the habitat*	*The extent to which the habitat is sensitive to human induced environmental degradation*	*Whether and to what extent development activities are or will be stressing the habitat type*
Score	**2**	**3**	**2**	**1**
Description	**Habitat uncommon, less frequent, and occurs to some extent in one or two of the Alaska regions: Gulf of Alaska, Bering Sea, Aleutian Islands, and Arctic.**	**Complex habitat condition and substrate serve as refugia, concentrate prey, and/or are known to be important for spawning.**	**Habitat sensitive and recovery is within ten years. Effects considered temporary; may be more than minimal, however.**	**Habitat is or will be exposed to minimal disturbance from development.**
Proposed HAPCs' Responsiveness to HAPC Considerations				
Responsiveness	The current state of knowledge indicates that skate nursery sites are very rare. The HAPC areas proposed here constitute only 280 km^2 total, compared to an estimated area of 495,218 km^2 for the eastern Bering Sea.	Skate nursery sites are distinct benthic habitat sites used for skate egg case deposition and embryo development. Nursery sites concentrate multiple cohorts of early life stages that are highly vulnerable, as well as reproductive adult skates. As a result, they are extremely important for the sustainability of skate populations and have great ecological significance.	Skate egg cases and the embryos they contain are sensitive to being dislodged, damaged, destroyed, or captured by fishing gear contacting the seafloor. Fishing also increases the mortality risk to reproductive adults in nursery sites.	Development is unlikely to affect the six nursery sites identified.

Ranking of Proposed HAPCs

The HAPC ranking formula provides a score (sum of criteria scores) to provide information on the proposal as it is considered by the Council in the HAPC process. The HAPC Proposal Rank is the additive HAPC Criteria Score supplemented with the Data Certainty Factor (DCF). DCF determines the level of information known to describe and assess the HAPC sites. Here, detailed and site-specific habitat information is available—in 2009, an AUV was used to map parts of four nurseries using a high-resolution camera (Hoff *et al* 2010).

Table 24. Evaluation of HAPC proposal

HAPC Evaluation	**Proposal Score**
Rarity*	2
Ecological importance	3
Sensitivity	2
Stress / disturbance	1
Criteria Score Total (+)	8
Data Certainty Factor	3
HAPC Proposal Rank (=)	**11**
Research Priority Flag	**N/A**

***** Proposals must meet the rarity consideration.

9.2 Appendix B – VMS-Observer Enabled Catch-In-Areas Database

Steve G. Lewis
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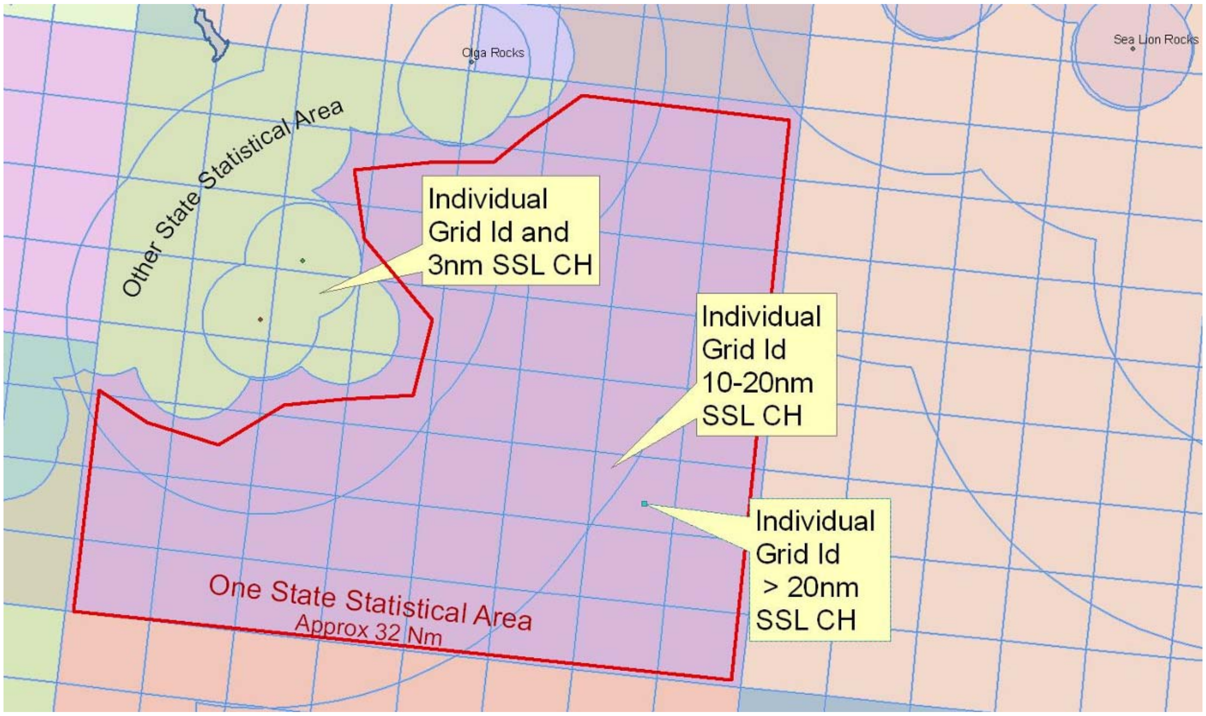
In 2007, NMFS/Alaska Region began developing a fisheries harvest database that would integrate data acquired from onboard observers and data on vessel movements acquired by satellite through the Vessel Monitoring System (VMS). This VMS-Observer Enabled Catch-In-Areas (VOE-CIA) database is designed to increase the spatial resolution of the Catch Accounting System for both the observed and unobserved vessel fleet and thus to facilitate more accurate analysis of fisheries management issues.

The VOE-CIA database integrates catch data from the Catch Accounting System (which has the spatial resolution of a NMFS Reporting Area) into a database that resolves the GIS data into polygons with areas of approximately seven kilometers. In an unrestricted area, sixty four grid IDs fit inside one state statistical area. However, a given seven-kilometer polygon may be further divided into smaller polygons by the boundary of state statistical areas, the boundary of state and federal waters, or by the boundary of Steller sea lion critical habitat (broken out at 3, 10, and 20 nautical miles from one of 154 Steller sea lion rookeries or haulouts). Where confidentiality needs to be protected, a seven-kilometer polygon may be grouped with others into 20km polygons. Each polygon (the exact size of which will vary with latitude) and its subparts will have a distinct grid ID.



Splitting the Catch Accounting data from NMFS Reporting Areas into these grid IDs requires an iterative and ordered process; no single step can capture all the data. To start, a record is reported and entered into the database, and a unique transaction ID is created for that record. A record is considered either a single haul for an observed vessel, a single fishing trip for an unobserved catcher vessel, or a single week—as designated by the week-ending-date—for an unobserved catcher processor (at present, this is the finest temporal catch resolution currently available; in 2009, however, catcher processors will begin reporting at a finer temporal resolution).

After the transaction ID is established for that record, one of the following six steps is then used to incorporate the record into the Catch-in-Areas database. (Note that the following tables and figures use 2008 data solely for purposes of illustrating the operations of the database.)

1) The first step in the process coordinates the date and time of observed deployment and retrieval of gear with the vessel's VMS points that are within the same observed date and time. This 'fixes' the VMS points associated with an observed haul.

   VMS data are designed to transmit position reports every 30 minutes. It is probable that the process could miss the first and last VMS point by only a few minutes since it is based on Observed times. Therefore, a trackline is also drawn between the observed and deployed locations. A distinct set of grid IDs for both the VMS and Observer points are coordinated and associated.

   The associated grid IDs from the steps above are then attributed an equal amount of the catch for that record. Hence, a record that has eight grid IDs associated with it will receive 12.50% of the catch for that record from Catch Accounting.

   In 2008, 827,140 tons or 47.4% of the catch was matched in Step 1; and 52.6% of the catch remained to be matched in the processes that follow.

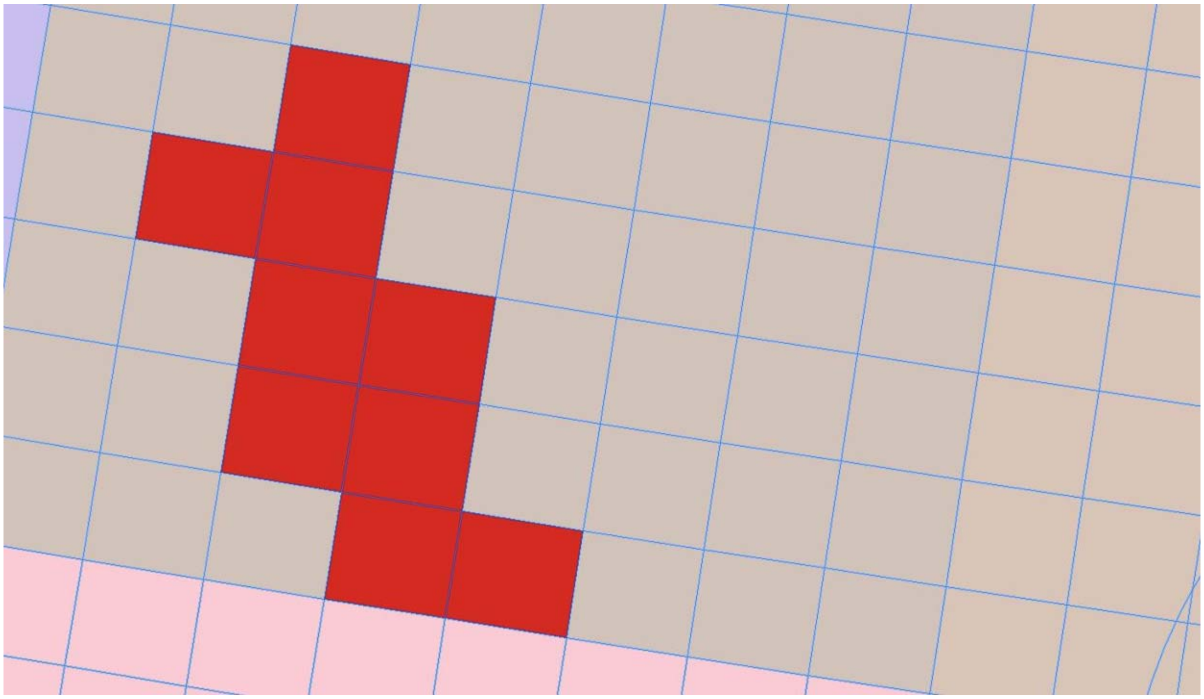
The tables below indicate average number of Grid IDs that were captured in Step 1: VMS-Observer by Date/Time matching process. The average is based on individual hauls shown by each row in the table. The data is shown in three base groups: FMP, FMP and harvest sector, and, FMP, harvest sector, and target fishery.

FMP	Avg#Grid IDs / Grid
AI	6
BS	8
GOA	6

FMP	Harvest Sector	Avg#Grid IDs per Grid
AI	CP	7
AI	CV	12
BS	CP	7
BS	CV	16
GOA	CP	6
GOA	CV	5

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs per Grid
AI	CP	Pcod	7
AI	CP	Rock	3
AI	CV	Pcod	13
AI	CV	Rock	5
BS	CP	Pcod	9
BS	CP	Rock	4
BS	CP	Plck	5
BS	CV	Plck	17
GOA	CP	Pcod	7
GOA	CP	Rock	4
GOA	CV	Rock	4

A graphic illustrating captured Observed grid IDs (red - highlighted blocks below) from Bering Sea using a combination of VMS and Observer data.



2) The next step uses observer data that were not matched from Step 1. Some vessels are unmatched from Step-1 because transponder IDs may not be directly associated with a vessel ID for a given trip: for example, a vessel may lend a VMS transponder to another vessel, but the database fails to be updated to reflect that before catch is assigned to a trip/haul.

   As in the observer data process above, a line is drawn from the observer deployment location to the retrieved location, and the associated grid IDs are identified for that trackline. Catch is equally apportioned between the grid IDs for that record.

   In 2008, 219,709 tons or 12.59% of the catch was matched in Step 2; and 40.01% of the catch remained to be matched.

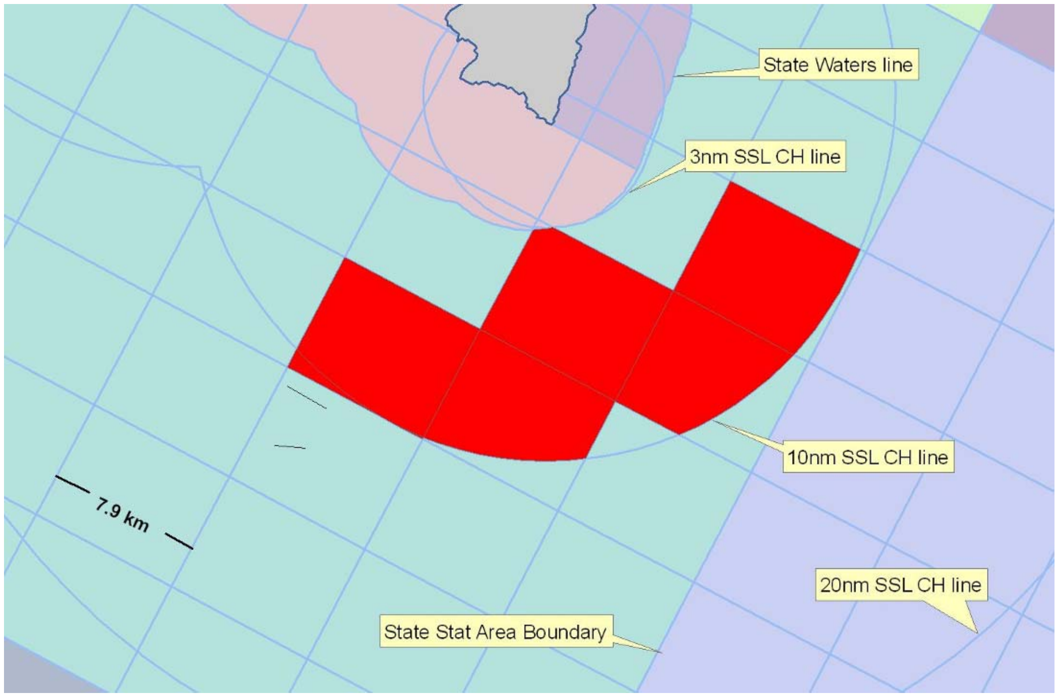
The tables below indicate average number of Grid IDs that were captured in Step 2: an individual observed haul trackline from observed deploy location to the retrieve location. The average is based on individual hauls shown by each row in the table. The data is shown in three base groups: FMP, FMP and harvest sector, and, FMP, harvest sector, and target fishery.

FMP	Avg#Grid IDs
AI	6
BS	8
GOA	5

FMP	Harvest Sector	Avg#Grid IDs
AI	CP	7
AI	CV	8
BS	CP	7
BS	CV	16
GOA	CP	5
GOA	CV	5

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs
AI	CP	Pcod	8
AI	CP	Rock	3
AI	CV	Pcod	9
AI	CV	Rock	6
BS	CP	Pcod	9
BS	CP	Rock	4
BS	CP	Plck	7
BS	CV	Plck	16
GOA	CP	Pcod	7
GOA	CP	Rock	4
GOA	CV	Rock	5

A graphic illustrating captured Observed grid IDs (red - highlighted blocks below) that were not captured in Step 1.



3) The next step uses VMS data to capture an individual record for unobserved catcher vessels. In order to capture a vessel 'fishing,' four criteria must be in place: 1) A vessel must be operating between .9 knots and 4.1 knots; 2) a vessel must not be in an area known not to be a fishing area, e.g., very near ports; 3) a vessel must be operating inside at least one of the state statistical areas reported on its fish ticket; and 4) the date of the VMS point must match the date range on the fish ticket.

   We use the vessel's VMS points to calculate vessel speed for the database. In a GIS Albers conic coordinate system, we find the meters traveled using the Pythagorean Theorem and divide that by the time between one VMS point and the next.

   A catch record is weighted by how many VMS points are associated with a particular grid ID that met the four criteria above. For example, a vessel transiting through Unimak Pass: the vessel has to slow down to fishing speed (greater than .9 knots and less than 4.1 knots), is not in an area known not to be a fishing area, is inside at least one of the state statistical areas reported for the vessel, and has a trip time within the date range on the fish ticket. A single ping will be associated with that grid ID even though the vessel may not have been fishing. But a few hours later the vessel gets to its fishing grounds and continues to fish for the next two days. The vessel's trip time was three days. For two days (48 hours) the vessel met all of four of the criteria for fishing.

   The single grid ID associated with Unimak Pass receives 1/48th (2.08%) of the catch. If the vessel spends a full day in one grid ID, that grid ID gets nearly 50% of the catch. If the vessel then spends the entire next fishing day equally in eight other grid IDs, each of those eight grid IDs gets 6.25% of the catch. It should be noted that this is a simple example and chances are that a vessel will not meet all four criteria for two full days.

   A final adjustment is made after the catch is weighted. Consider a catcher vessel targeting flatfish in the GOA and which uses its MRA to top off with Pacific cod on the way back to port. On the fish ticket the vessel is reported to have been in one state statistical area with a catch composed of mostly flatfish and in another state statistical area with a catch of mostly Pacific cod. We do not reapportion the total amount of the catch; we only adjust the species composition in the grid ID associated with state statistical areas. This algorithm will not change the overall species composition or the overall catch weight associated with a grid ID.

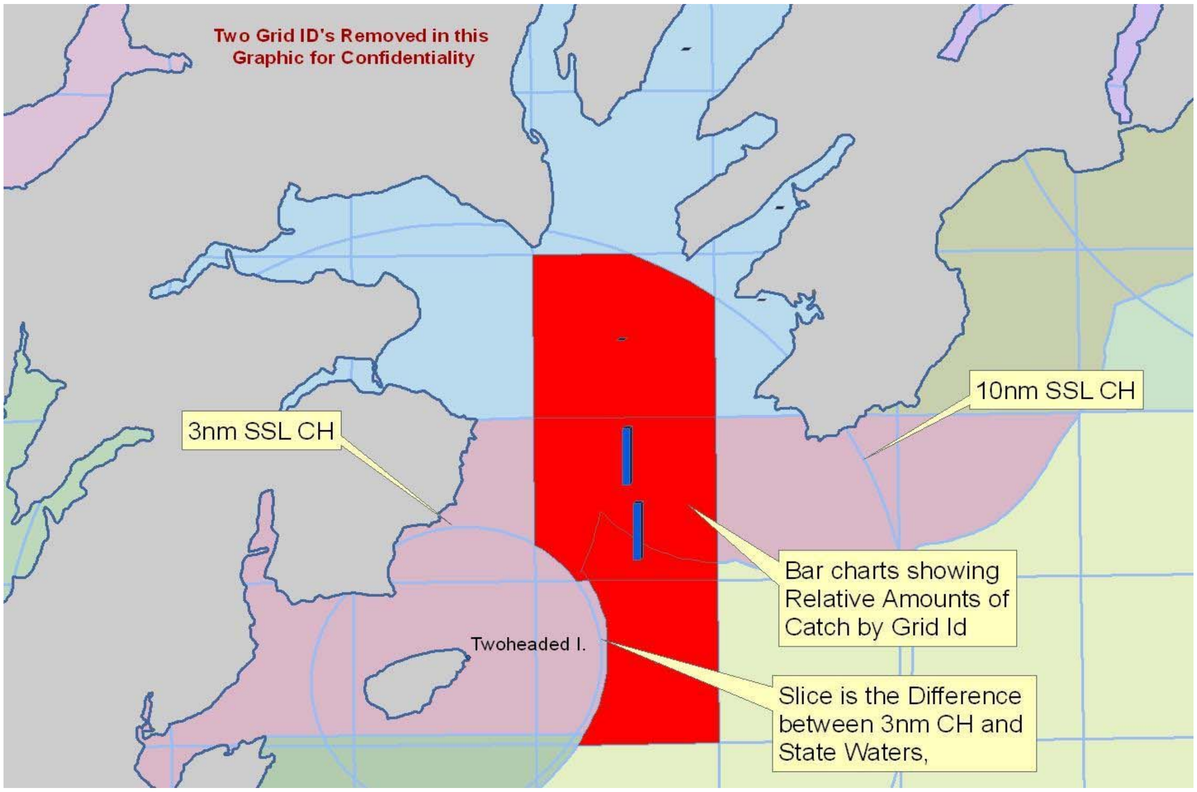
   In 2008, 569,074 tons or 32.65% of the catch was matched in Step 3; and 7.35% of the catch remained to be matched in the following steps.

The tables below indicate average number of grid IDs that were captured in Step 3. The four criteria for the catcher vessel: speed, trip dates, fishing area, and state stat area. The average of captured grid IDs is based on individual trips. The data is shown in two base groups: FMP and FMP and target fishery.

FMP	Avg#Grid IDs
AI	15
BS	19
GOA	10

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs
AI	CV	Pcod	9
AI	CV	Rock	14
AI	CV	Plck	7
BS	CV	Pcod	17
BS	CV	Plck	20
GOA	CV	Pcod	8
GOA	CV	Rock	9
GOA	CV	Plck	7

A graphic illustrating a catcher vessel's trip and the grid IDs captured using the criteria outlined in Step 3. Blue bar charts show relative amounts of catch distribution by grid ID. Captured grid IDs shown in red - highlighted blocks below



4) Some catcher vessels may not accurately report their state statistical areas. In step 4, we drop the requirement for state statistical areas and replace it with NMFS Reporting Areas. The four criteria become: 1) a vessel must be operating between .9 knots and 4.1 knots; 2) a vessel must not be in an area known not to be a fishing area, e.g., very near ports; 3) a vessel is operating inside their reported NMFS Reporting Areas; and 4) the date of the VMS point must match the date range on their fish ticket.

   As with Step 3, this catch is weighted as to how many VMS fishing points are associated with a Grid ID. No reapportionment of catch composition is completed in this step.

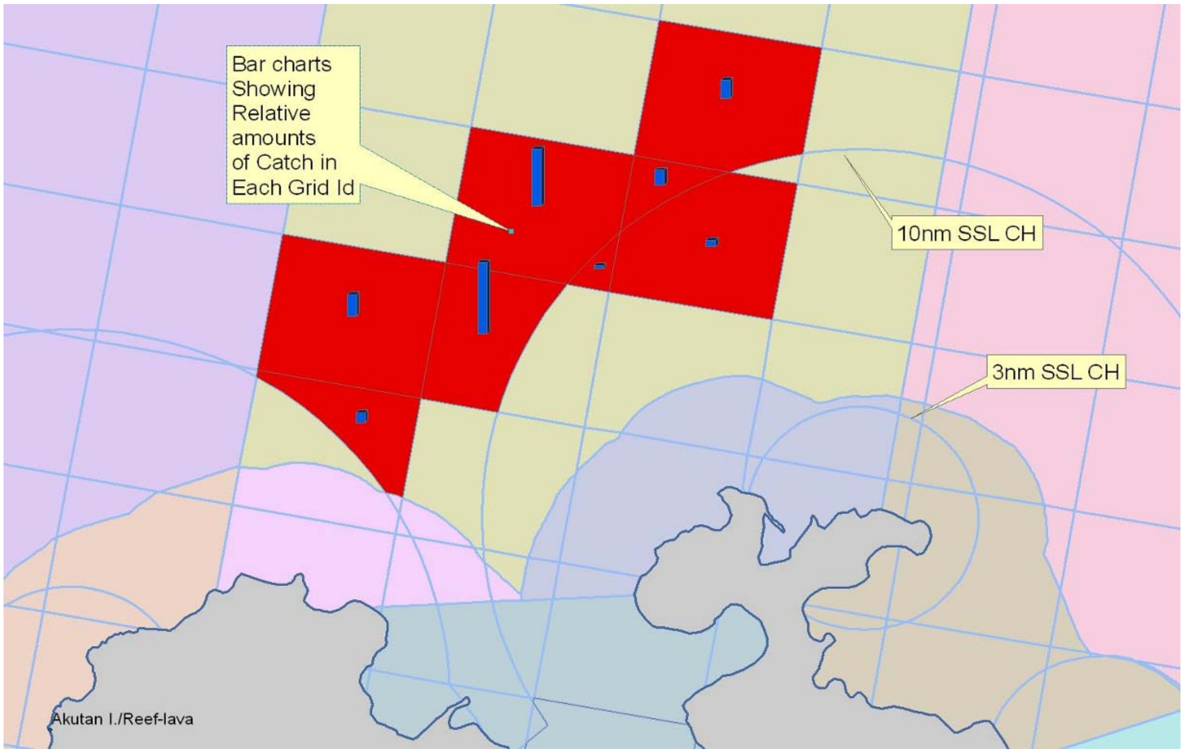
   In 2008, 20,683 tons or 1.19% of the catch was matched in Step 4.; and 6.17% of the catch remained to be matched in the following steps.

The tables below indicate average number of Grid IDs that were captured in Step 4. The 4 criteria for the catcher vessel: speed, dates, fishing area, NMFS Reporting Areas. The average is based on individual trips. The data is shown in two base groups: FMP and FMP and target fishery.

FMP	Avg#Grid IDs
AI	11
BS	13
GOA	8

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs
AI	CV	Pcod	6
BS	CV	Pcod	10
BS	CV	Plck	16
GOA	CV	Pcod	8
GOA	CV	Rock	7
GOA	CV	Plck	8

A graphic illustrating a catcher vessel's trip. Grid IDs captured using the criteria outlined in Step 4. Blue bar charts showing relative amounts of catch based on time the vessel spent inside Grid IDs. Captured grid IDs shown in red - highlighted blocks below.



5) Step 5 addresses unobserved catcher processors who report weekly on their production. Like an unobserved catcher vessel without a state statistical area, four criteria must be met: 1) A vessel must be operating between .9 knots and 4.1 knots; 2) a vessel must not be in an area known not to be a fishing area, e.g., very near ports; 3) a vessel must be operating inside its reported NMFS Reporting Areas; and 4) the date of the VMS point must match the week ending date reported on the catcher processor's weekly production report. In 2009 with additional reporting for unobserved catch processors, the temporal resolution will increase and hence the data for this step. Additionally, some catcher vessels are captured in this step by week ending date rather than by their reported trip dates.

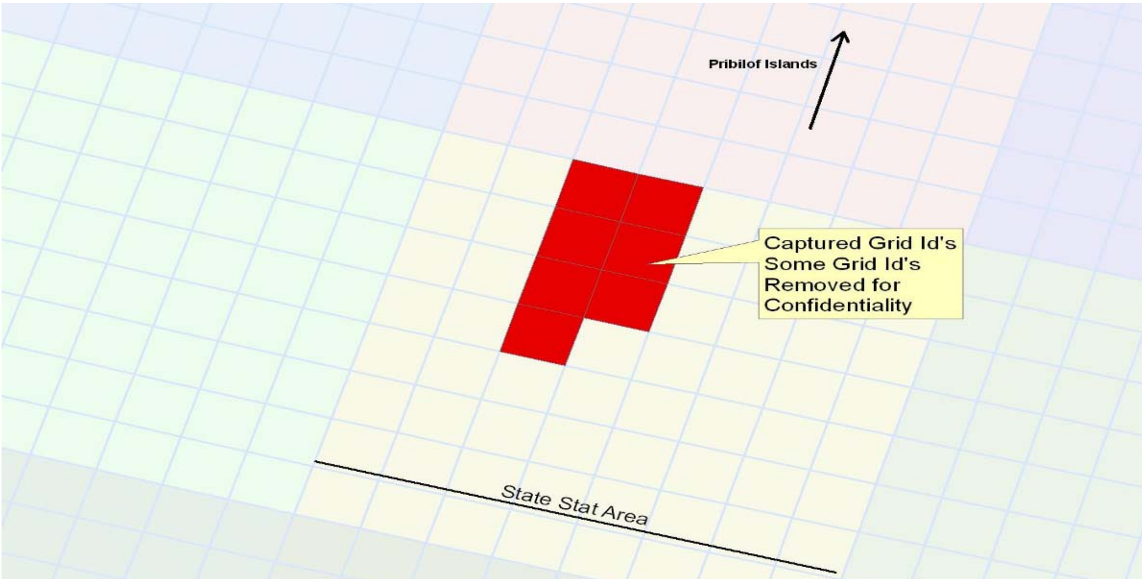
The tables below indicate average number of grid IDs that were captured in Step 5: The four criteria for these unmatched unobserved vessels: speed, week ending date (Saturday), fishing area, and NMFS Reporting Area. The average is based on a week ending date. The data is shown in three base groups: FMP, FMP and harvest sector, and, FMP, harvest sector, and target fishery.

FMP	Avg#Grid IDs
AI	3
BS	4
GOA	3

FMP	Harvest Sector	Avg#Grid IDs
AI	CP	3
AI	CV	2
BS	CP	4
BS	CV	2
GOA	CP	3
GOA	CV	2

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs
AI	CP	Pcod	3
AI	CV	Pcod	2
AI	CV	Plck	2
BS	CP	Pcod	4
BS	CP	Plck	3
BS	CV	Pcod	2
BS	CV	Plck	2
GOA	CP	Pcod	3
GOA	CP	Rock	2
GOA	CV	Pcod	2
GOA	CV	Rock	2
GOA	CV	Plck	2

A graphic illustrating an unobserved weekly trip. These grid IDs were captured using the criteria outlined in Step 5. Captured grid IDs shown in red - highlighted blocks below. Some grid IDs were removed for confidentiality.



Steps 1 through 5 above capture 96.13% (for the 2008 data) of the catch from Catch Accounting inside one of the seven-kilometer grid IDs. The final steps, called Average Vessel, match catch from the previously matched vessels (from steps 1 – 5) to the unmatched vessel records. All but 604 tons (for the 2008 data) of the unmatched catch are matched using this final process.

6) The Average Vessel algorithm groups all previously matched vessels operating in the groupings shown below, and then apportions catch equally to the associated grid IDs for the unmatched records. The first grouping includes vessel ID. Vessel ID is included with week ending date, NMFS Reporting Area, Harvest Sector, Gear, Target, etc., as we assume the best extrapolation is on a vessel operating as itself. We have seen this grouping to be effective when a catcher vessel with multiple trips in a single week may not be captured during a single trip due to a reporting or recording error.

   The following groupings, shown in the table below, were coordinated by such aspects as Management Program Code, Harvest Sector, NMFS Reporting Area, Gear, Target, and Week Ending Date. After matches for all those groupings are found (between the unmatched records in catch accounting and the previously match records in Catch-In-Areas), the grid IDs are compiled for those matched records and the catch is evenly divided among those grid IDs.

   After an average vessel record is apportioned to a set of grid IDs, a transaction ID is created and that vessel record is removed from further matching. The groupings for Average Vessel are then slightly liberalized, and the next groupings are formed, matched and apportioned to grid IDs. As noted above, these steps capture greater than 99.98% of the catch. Catch that is not captured is often groundfish caught by non-federally permitted groundfish catcher vessels.

Match-Groupings for the Iterative Average Vessel Extrapolation Algorithm.

•	Mgt_Prog_Code	HarvestSector	Rpting Area	Target, Gear	WeekEndDate	Vessel ID
•	Harvest Sector	NMFS Area	Gear	Target	WeekEndDate	Processor ID
•	Mgt_Prog_Code	HarvestSector	NMFS Area	Gear	Target	WeekEndDate
•	Mgt_Prog_Code	HarvestSector	NMFS Area	Gear	WeekEndDate	Target
•	Mgt_Prog_Code	NMFS Area	Gear	Target	WeekEndDate	
•	Harvest Sector	NMFS Area	Target	WeekEndDate		
•	Harvest Sector	NMFS Area	Gear	WeekEndDate		
•	NMFS Area	Gear	Target	WeekEndDate		
•	NMFS Area	Target	WeekEndDate			
•	NMFS Area	Gear	WeekEndDate			
•	NMFS Area	Gear	Target	Month	Year	
•	NMFS Area	Target	Month	Year		
•	NMFS Area	Gear	Month	Year		
•	FMPAreaCode	Gear	Target	WeekEndDate		
•	FMPAreaCode	Target	WeekEndDate			
•	FMPAreaCode	Gear	WeekEndDate			
•	FMPAreaCode	Gear	Target	Month	Year	
•	FMPAreaCode	Target	Month	Year		
•	FMPAreaCode	Gear	Month	Year		

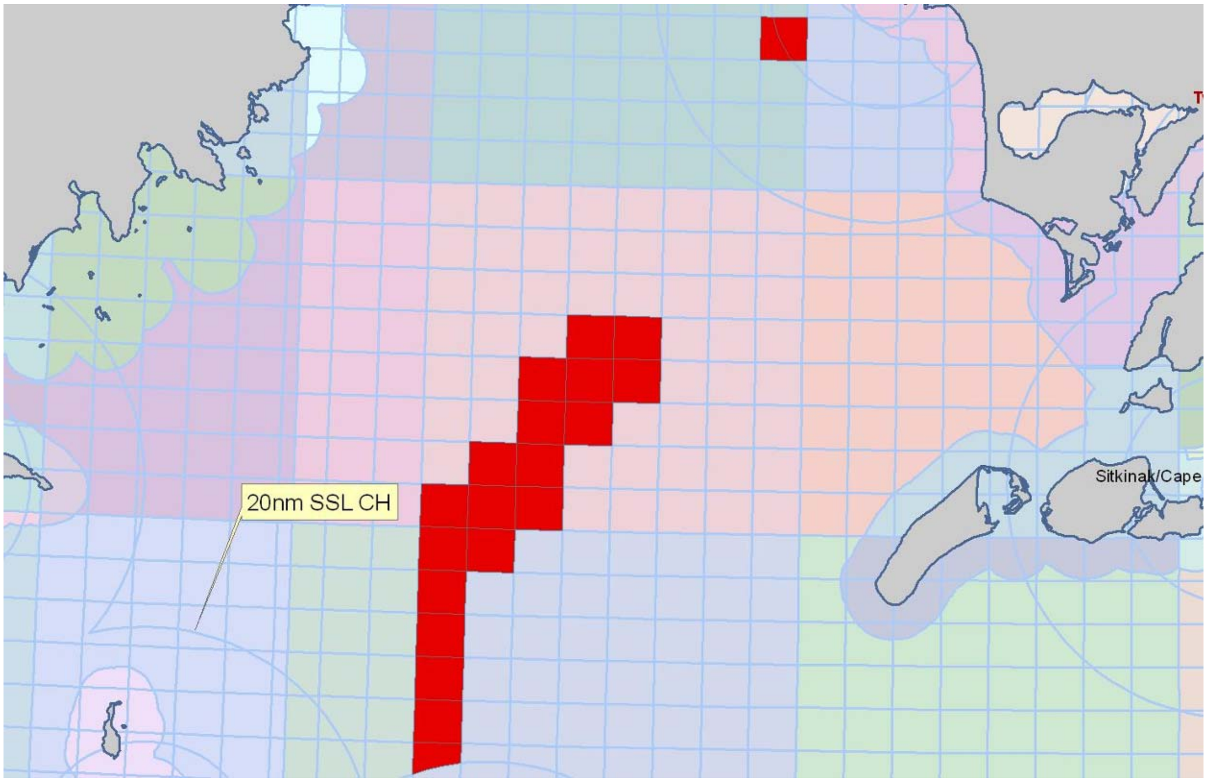
For clarity, the following summary tables aggregate all 19 levels of the Average Vessel extrapolation algorithm into a single set of tables.

FMP	Avg#Grid IDs
AI	33
BS	32
GOA	28

FMP	Harvest Sector	Avg#Grid IDs
AI	CP	36
AI	CV	23
BS	CP	38
BS	CV	30
GOA	CP	33
GOA	CV	28

FMP	Harvest Sector	Example Species Code	Avg#Grid IDs
AI	CP	Pcod	36
AI	CV	Pcod	23
BS	CP	Pcod	39
BS	CP	Plck	24
BS	CV	Pcod	33
BS	CV	Plck	30
GOA	CP	Pcod	34
GOA	CP	Rock	27
GOA	CV	Pcod	28
GOA	CV	Rock	28
GOA	CV	Pcod	13
GOA	CV	Plck	2

This graphic illustrating the Average Vessel Extrapolation Algorithm grid id's that was captured, shown in red - highlighted blocks below. This Average Vessel was grouped and matched on a vessel or group of vessels with the same Harvest Sector, NMFS Reporting Area, Gear Type, Target, and Week Ending Date.



The table below illustrates the amount of catch by each matching method.

Analysis based on 2008			
Matching Method	**Tons Matched**	**% of Total Catch**	**Cumulative % Matched**
VMS-Obs by Time and Obs Trackline	827,140	47.39%	47.39%
OBS Deploy and Retrieve Trackline	219,709	12.59%	59.98%
CV-Stat_Area	569,754	32.65%	92.63%
CV-NMFS_Area	20,683	1.19%	93.82%
CP_NMFS_Area	40,332	2.31%	96.13%
Grouping for Extrapolations for unmatched catch:			
Avg_MgtPrg_HS_RA_Gr_Tgt_WED_Ves	1,321	0.08%	96.20%
Avg_HS_RA_Gr_Tgt_WED_VesID	24	0.00%	96.20%
Avg_HS_RA_Gr_Tgt_WED_PID	32,466	1.86%	98.07%
Avg_MgtPrg_HS_RA_Gr_Tgt_WED	17,701	1.01%	99.08%
Avg_MgtPrg_RA_Gr_Tgt_WED	513	0.03%	99.11%
Avg_HS_RA_Tgt_WED	5,829	0.33%	99.44%
Avg_HS_RA_Gr_WED	4,516	0.26%	99.70%
Avg_RA_Gr_Tgt_WED	166	0.01%	99.71%
Avg_RA_Gr_WED	447	0.03%	99.74%
Avg_RA_Tgt_WED	250	0.01%	99.75%
Avg_RA_Gr_Mnt_Yr	2,534	0.15%	99.90%
Avg_FMP_GrT_Tgt_WED	894	0.05%	99.95%
Avg_FMP_Gr_Mnt_Yr	16	0.00%	99.95%
Avg_FMP_Tgt_WED	582	0.03%	99.98%
Avg_FMP_Gr_WED	23	0.00%	99.98%
Total VOE-CIA by Grid_ID to Catch Accounting	1,744,900		
Total of full Catch Accounting System	1,745,504		

The final dataset includes data from Steps 1 – 5 above, plus data derived from the Average Vessel processes. This creates a geospatial database that matches the Catch Accounting system. Several additional columns of information are added to Catch Accounting that include % in Grid, Weight-In-Grid, Match Source, 'ESA Critical Habitat,' '679 Critical Habitat,' and assorted protection areas. Each area of study resides in a separate column (which may be queried) to insure that catch is not double or triple counted.

Match Source is the metadata column. It provides analysts information as to which step captured the data: Step 1: VMS-Obs, Step 2: OBS, Step 3: CV-Stat_Area, Step 4: CV-NMFS_Area, Step 5: CP_NMFS_Area, or Average Vessel. Average Vessel is further broken down by which groupings were used for the extrapolations. For instance, the first grouping above includes AVG: Harvest Sector-NMFS_Area GEAR Type, Target, Week Ending Date and Vessel Id. The Average Vessel catch can be removed from queries if requested by the analyst.

With the database complete, it can then be joined back to the GIS, or a GIS feature class can be joined to the native database by the grid ID. Other geospatial data that are currently complete and attached to the CIA include distance from aggregated Steller sea lion Critical habitat sites; distance from individual, overlapping SSL sites; and distance from foraging areas and some of the habitat protection and conservation areas.

This table illustrates most of the relevant columns in the VOE-CIA dataset. Note that data can be selected independently or grouped by any of the columns bellow, including, Target Fishery, Gear Type, Vessel ID, Processor, Sector, Management Program, Coop or Group or operating in any of several zones (SSL or Habitat) or management areas.

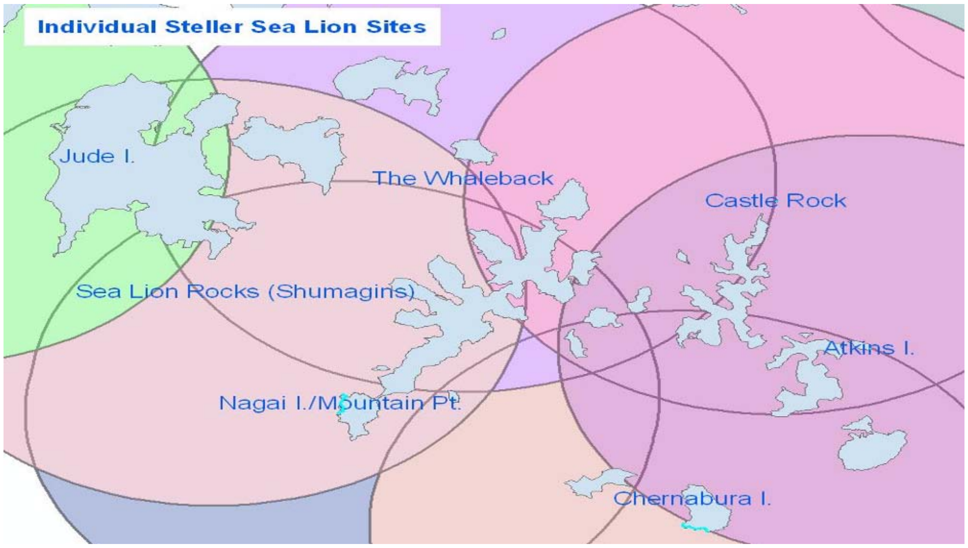
Base Catch Accounting Data
Reporting Area Code
Catch Activity Date
Week End Date
Trip Target Date
Year, Month, Quarter
Catch Report Type Code
CA Reference / Haul-SLog Join
Vessel ID
Gear Type
Harvest Sector
Trip Target Code
Management Program Code
AFA Coop ID
Processor ID
State Waters Flag
FMP Area Code
Species Group Code
BSAI Processing Sector
Vessel Size Catagory
PSCNQ Processing Sector
CDQ Group ID
Agency Species Code
Source Table: Obs, WPR, State
Directed Fishing Flags
Weight Posted

Additional VOE-CIA Columns
7Km Grid ID
Weight In Grid
Match Source: Matching Algorthm
Species Adjusted Weight
ADFG STAT AREA
% in Grid
20Km Grid ID
226 SSL Critical Habitat
679 SSL Critical Habitat
No NPT Areas

Other Distinct VOE-CIA Datasets
Overlapping SSL Sites
PSC: Prohibited Species

Other Datasets: Prohibited Species and Overlapping Steller Sea Lion Site VOE-CIA Datasets

Two separate VOE-CIA datasets have also been created: Prohibited Species (PSC) and Overlapping SSL sites. The overlapping SSL site dataset is by each of the 154 Steller sea lion sites, split out by 3, 10 and 20nautical miles; and, where the individual SSL sites overlap, the catch will overlap. This will give analysts and policy makers the ability to look at individual vessels, fleets, and target fisheries, gears types etc., operating in or around each individual SSL sites. Catch by the overlapping Steller sea lion site cannot be grouped and summed by management areas since catch from the overlapping Steller sea lion sites would be counted several times where the sites overlap.



PSC: The PSC database (PSC) is joined by the associated values to the VOE-CIA and the records divided into Grid ID's in the same proportions that were made with Catch Accounting groundfish database. The noted caveats to this PSC dataset are embedded within the PSC data. These caveats include how the base PSC data was collected and then extrapolated to the non-observed fleets.

Included Prohibited Catch Species:

Blue King Crab
Bairdi Tanner Crab
Chinook
Grenadier
Hake
Golden King Crab
Herring
Halibut
Non Chinook Salmon
Other King Crab
Red King Crab

Use of the VOE-CIA for Analytical Purposes

The VOE-CIA database uses an iterative, ordered process to match VMS records, Observer collected data and VMS/Catch Accounting System indicators to a fishing vessel. This gives analysts the capability to analyze unobserved vessels that may have been transparent when only using earlier analytical tools such as observer data. For example, comparative analysis shows a difference in catch between the VOE-CIA and the Expanded Observer Dataset (extrapolated Observer data, also called the EOD) for the unobserved/small vessel fleet that operates within 3 and 10 nm from unrestricted Steller sea lion sites.

It should be noted that VOE-CIA data only go back as far as 2003. This is due to the unavailability of reliable VMS data and a vessel linked catch accounting system for 2003. Observer data on the other hand goes back to the early 1990s, giving analysts the ability to look at long-term trends in groundfish catch and can relate it to Steller sea lion population trends. Both VOE-CIA and the EOD are utilized in this document to insure the best available data is being used for the appropriate analysis.

9.3 Color Figures

LIST OF FIGURES

9.3 Appendix C – Color Figures

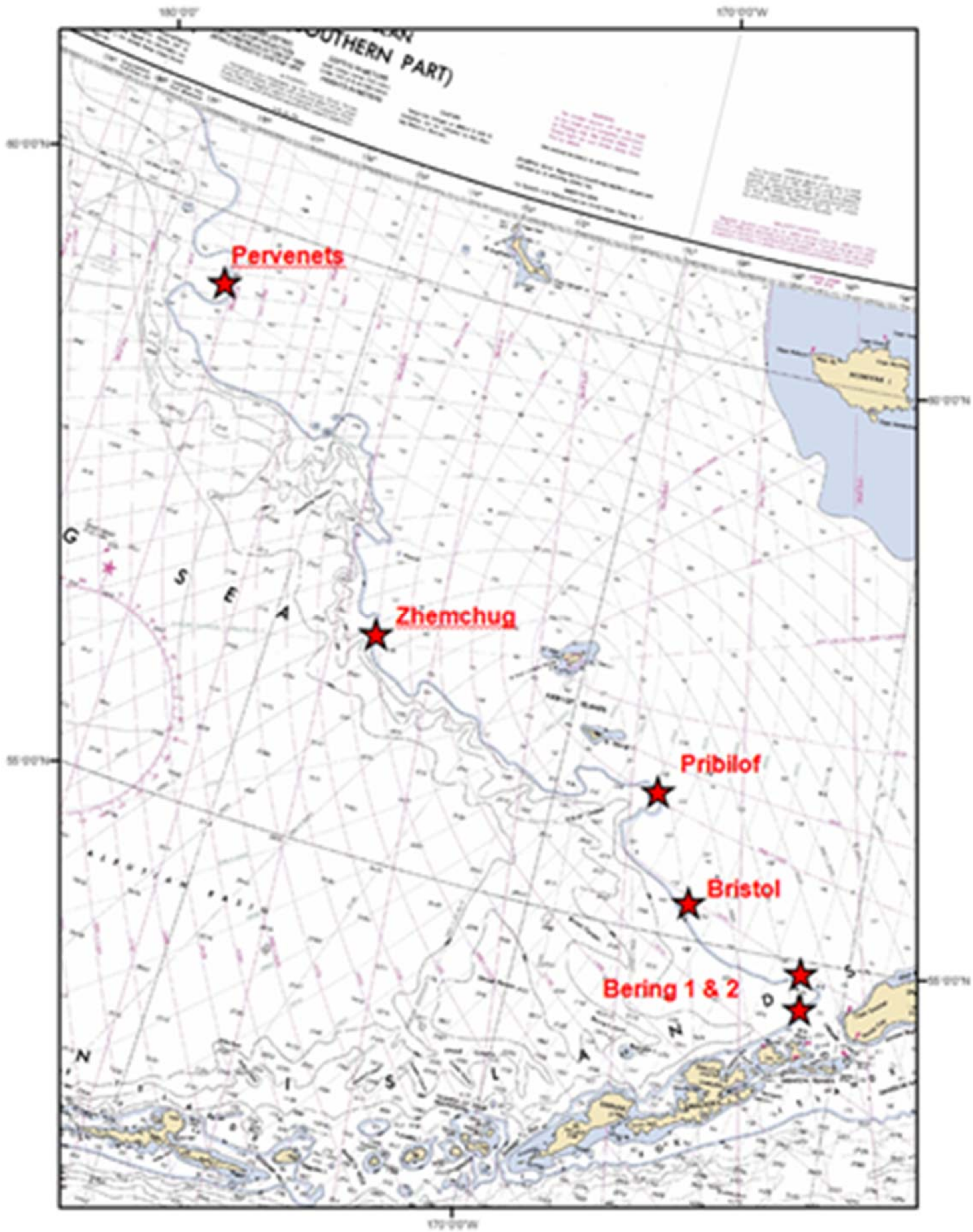


Figure 1. The locations in the eastern Bering Sea of the six proposed skate egg concentration HAPCs. (not to scale).

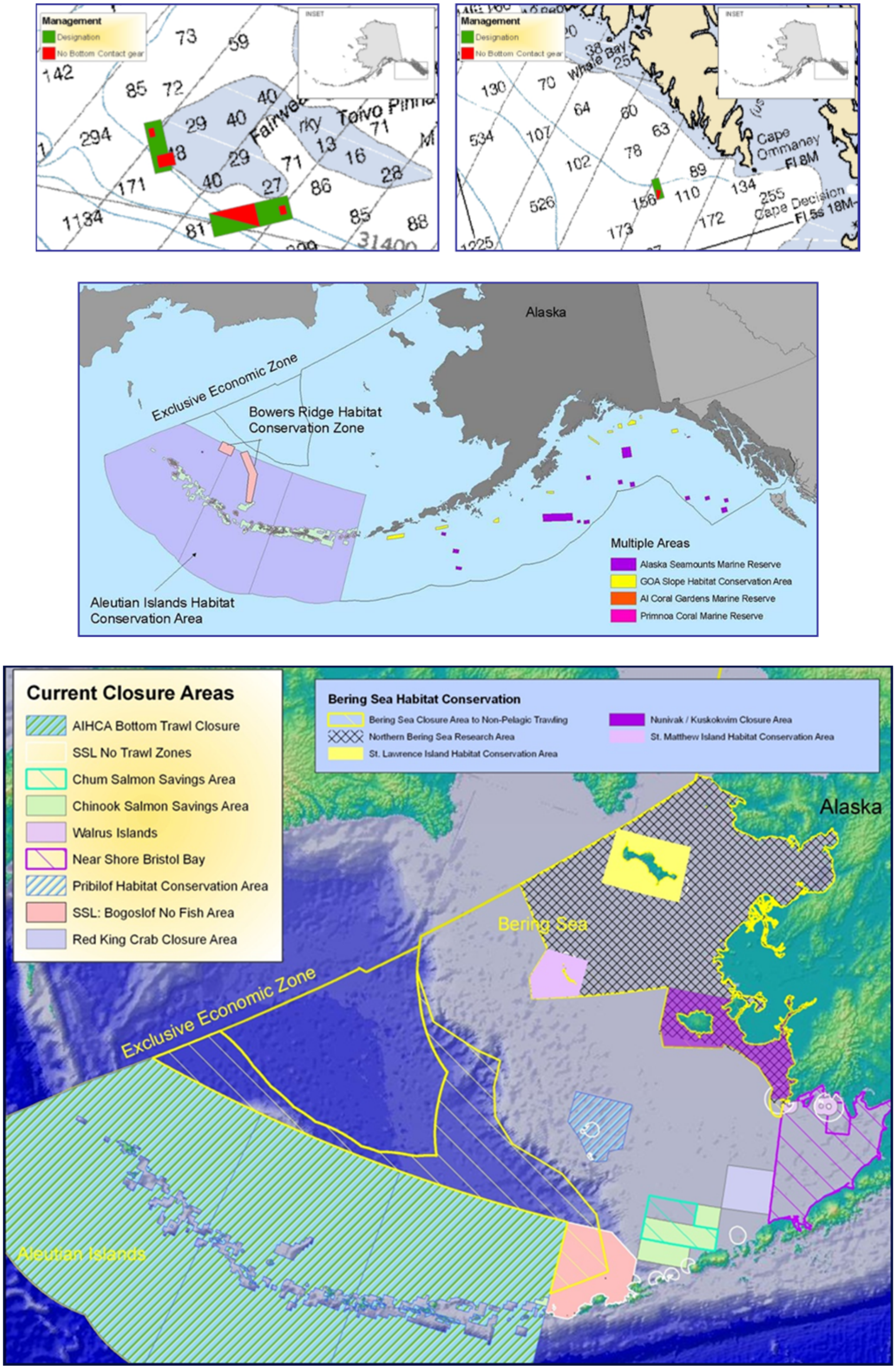


Figure 2. Current HAPC areas and bottom trawl closure areas..

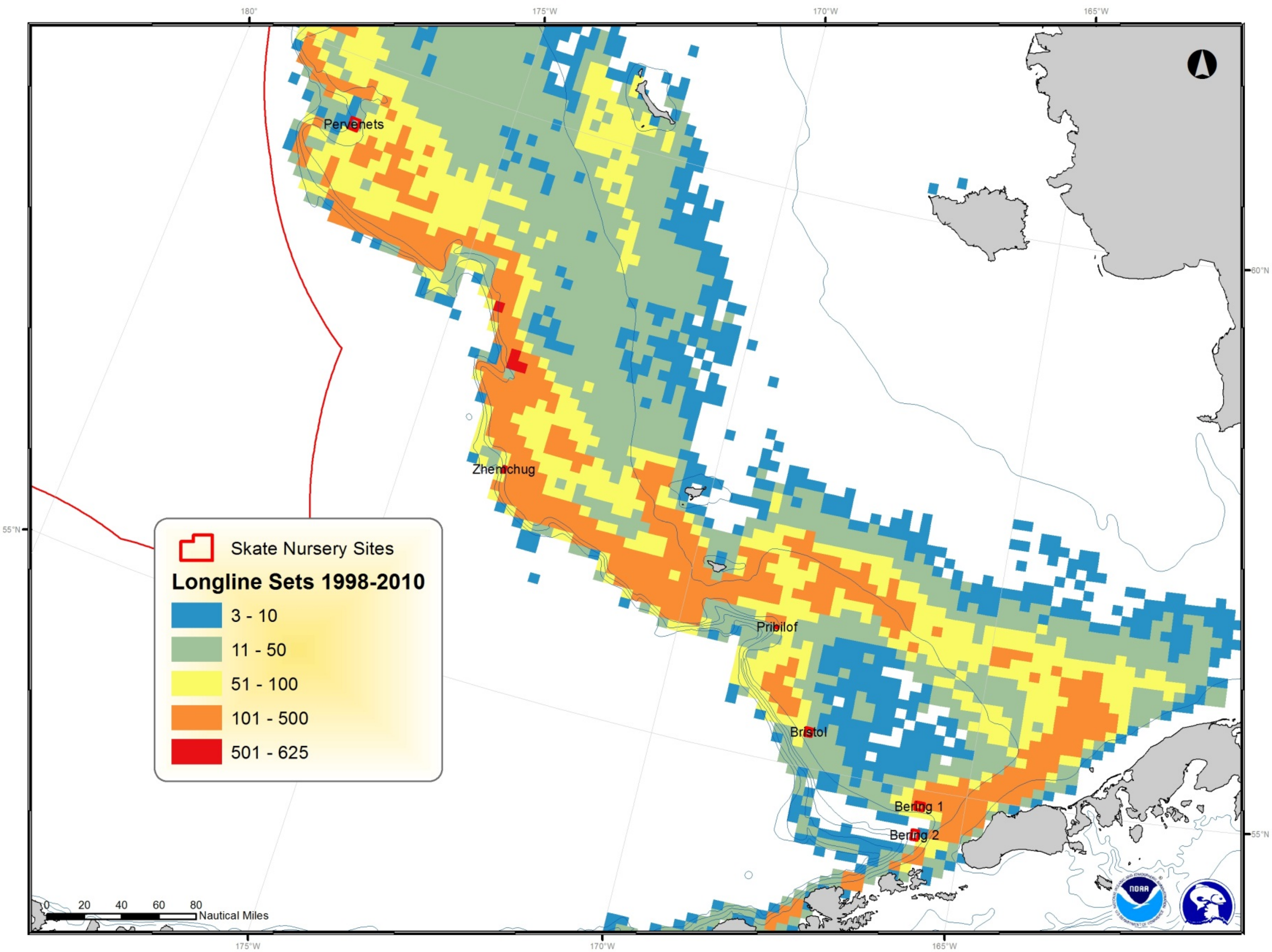


Figure 3. Longline sets in the eastern Bering Sea, during 1998-2010. Source: NMFS HCD.

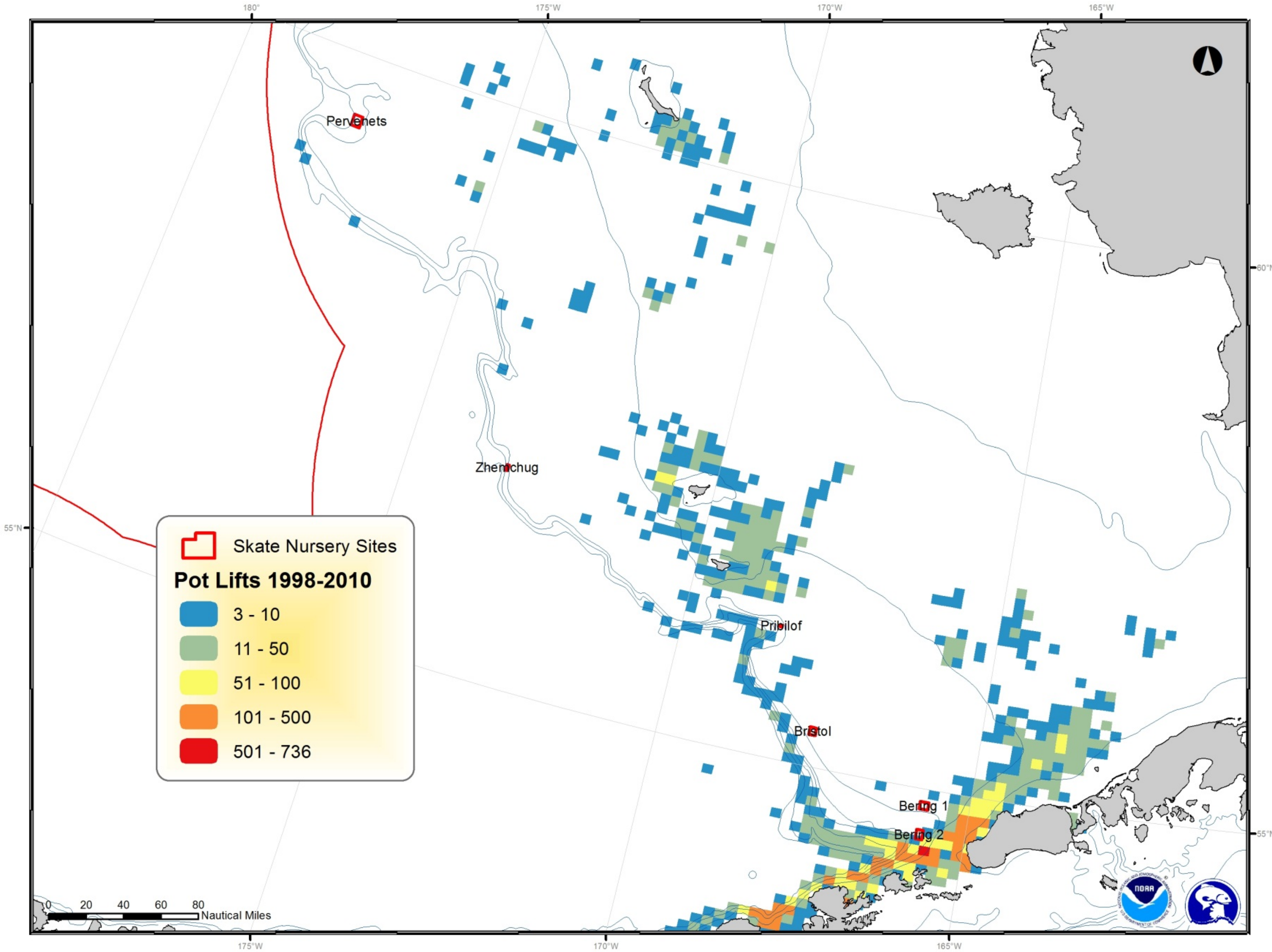


Figure 4. Pot lifts in the eastern Bering Sea, during 1998-2010. Source: NMFS HCD.

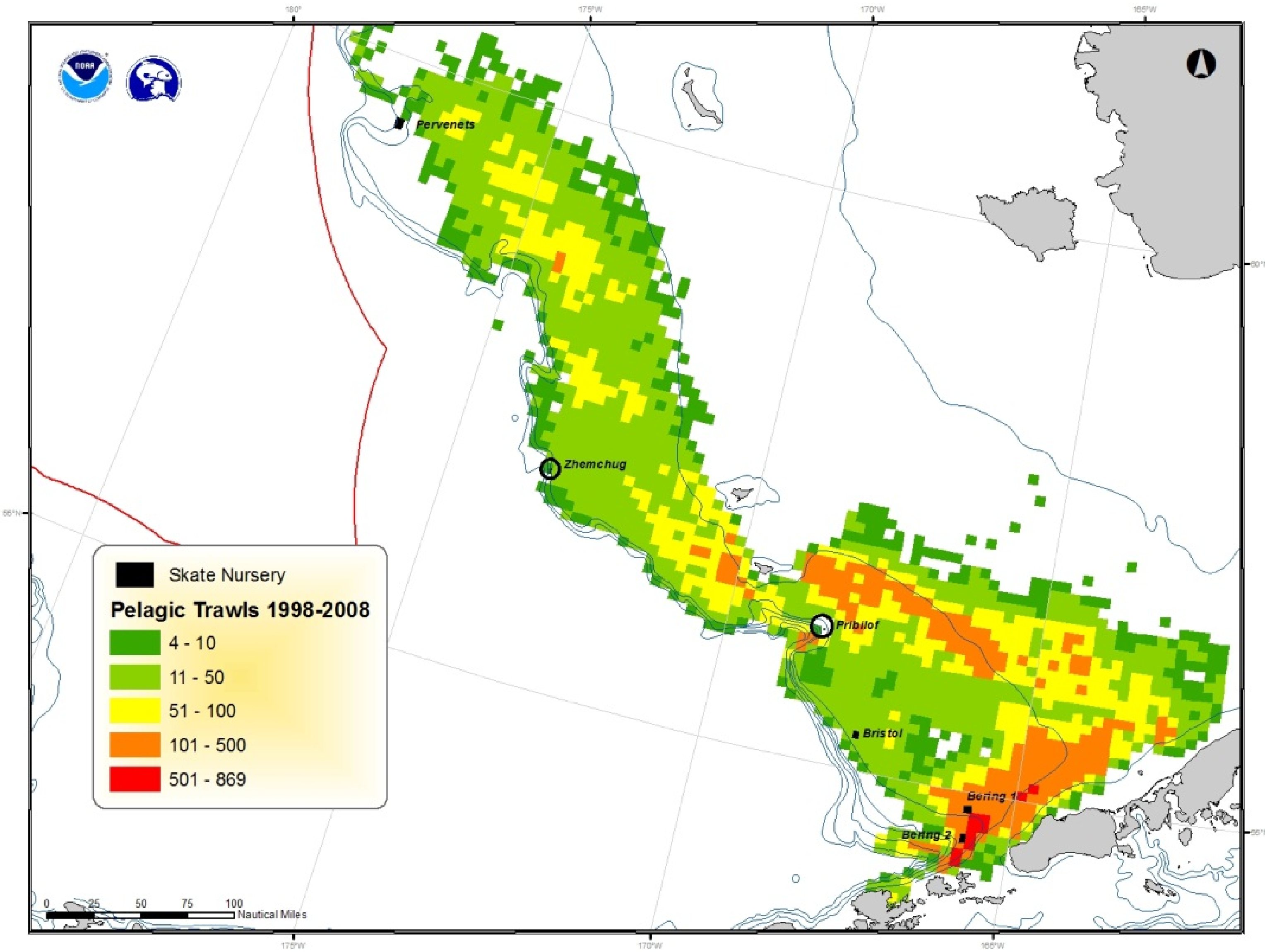


Figure 5. Pelagic Trawls, 1998-2008, and HAPC areas (blocks are 100km^2, which are very large compared to proposed skate egg concentration HAPCs).

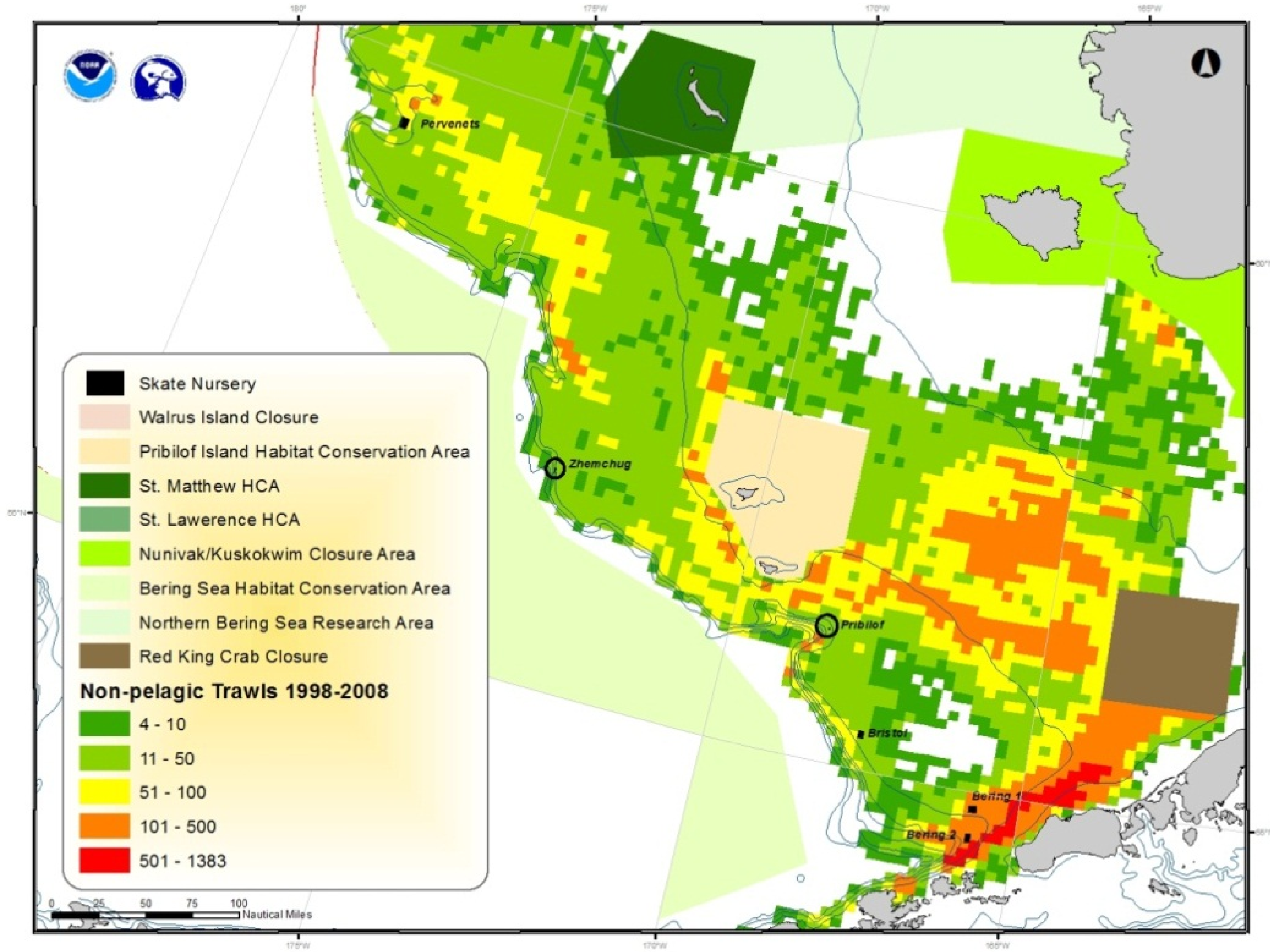


Figure 6. Nonpelagic Trawls, 1998-2008, and proposed HAPC areas (blocks are 100km^2 – very large compared to proposed skate egg concentration HAPCs).

Figure 7. Photograph of the seafloor in a skate nursery site in the eastern Bering Sea, showing seafloor within the nursery. The distance between the locations photographed in Figures 4 and 5 was approximately 500m.

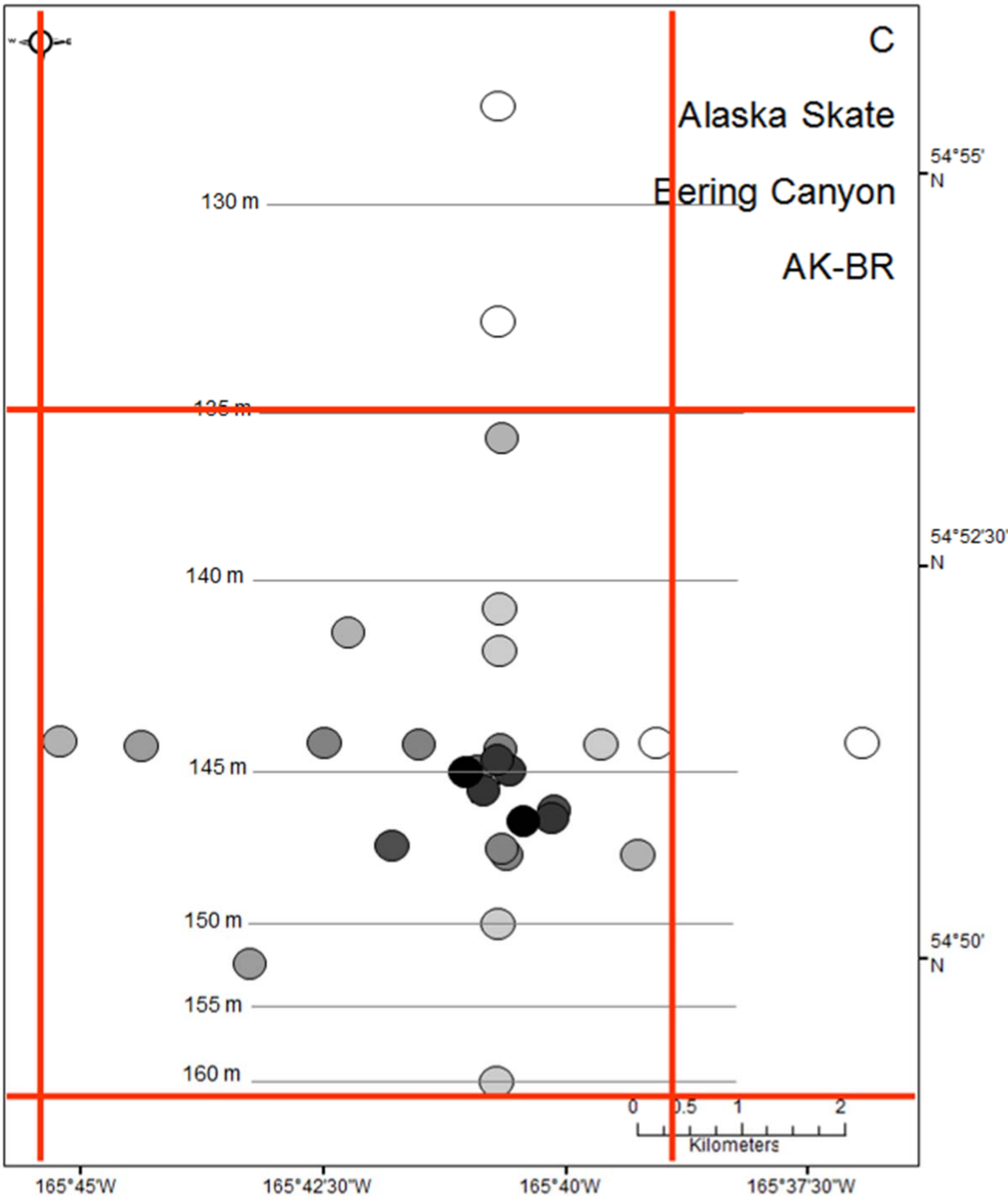


Figure 8. Example of data used to delineate the boundaries of the proposed skate nursery HAPC areas. Red lines indicate the extent of research bottom trawls that contained greater than 1,000 egg cases/ km^2. The boundary lines were then snapped to the next largest/smallest minute of latitude or longitude (i.e. the nearest minute of latitude/longitude <u>away</u> from the center of the nursery).

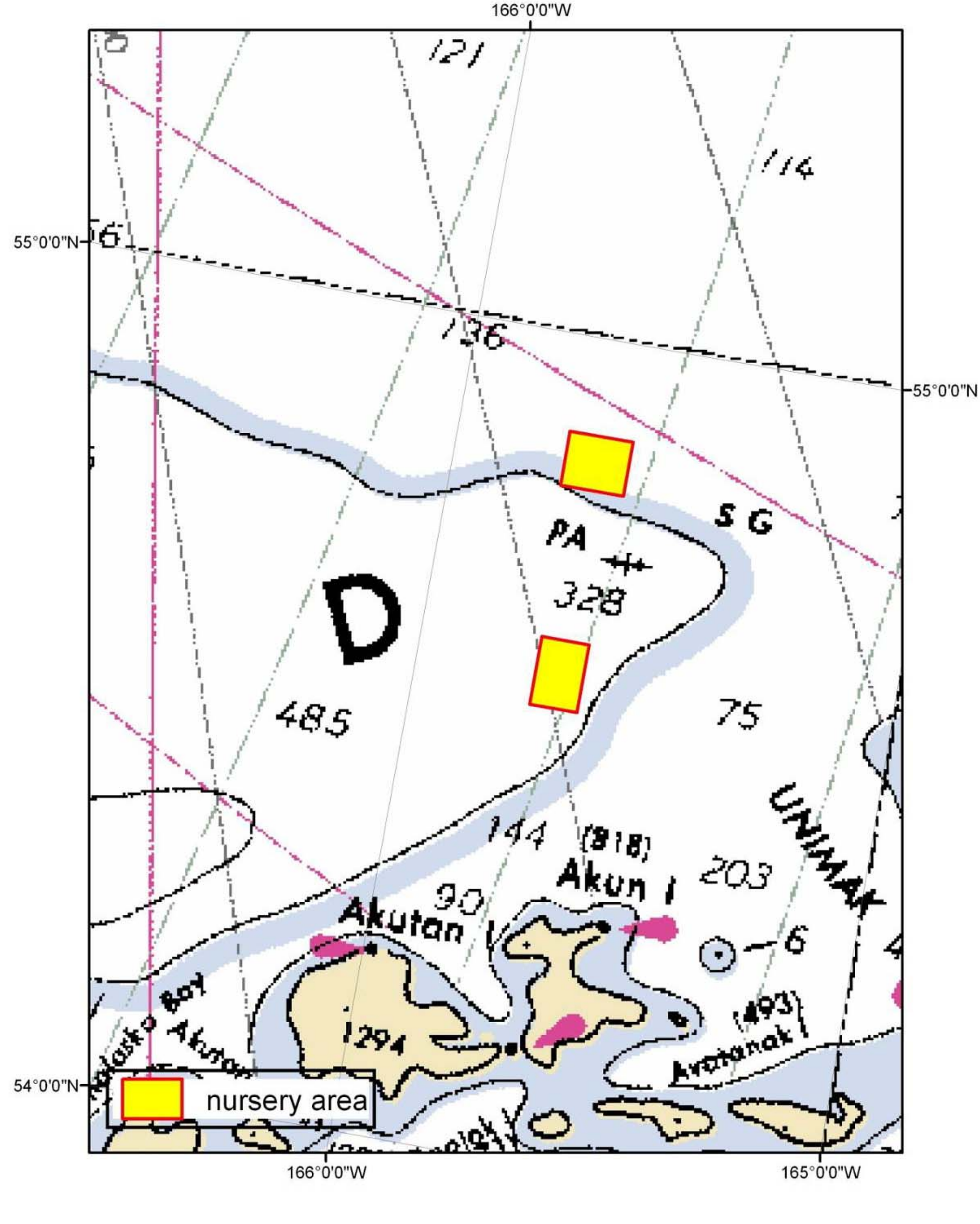


Figure 9. Map detail of proposed HAPC sites "Bering 1" and "Bering 2" in the vicinity of Bering Canyon in the eastern Bering Sea.

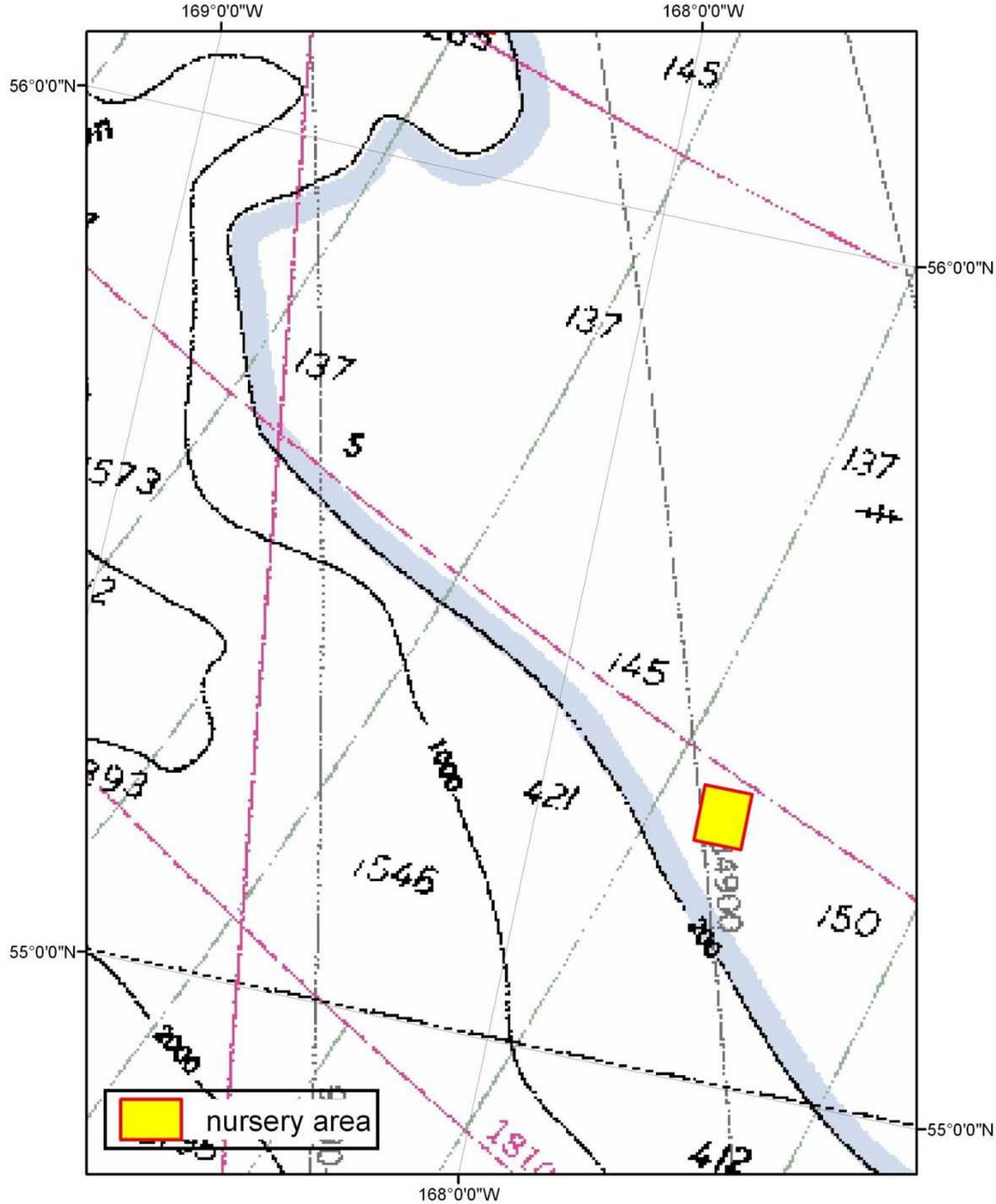


Figure 10. Map detail of proposed HAPC site "Bristol" in the vicinity of Bristol Canyon in the eastern Bering Sea.

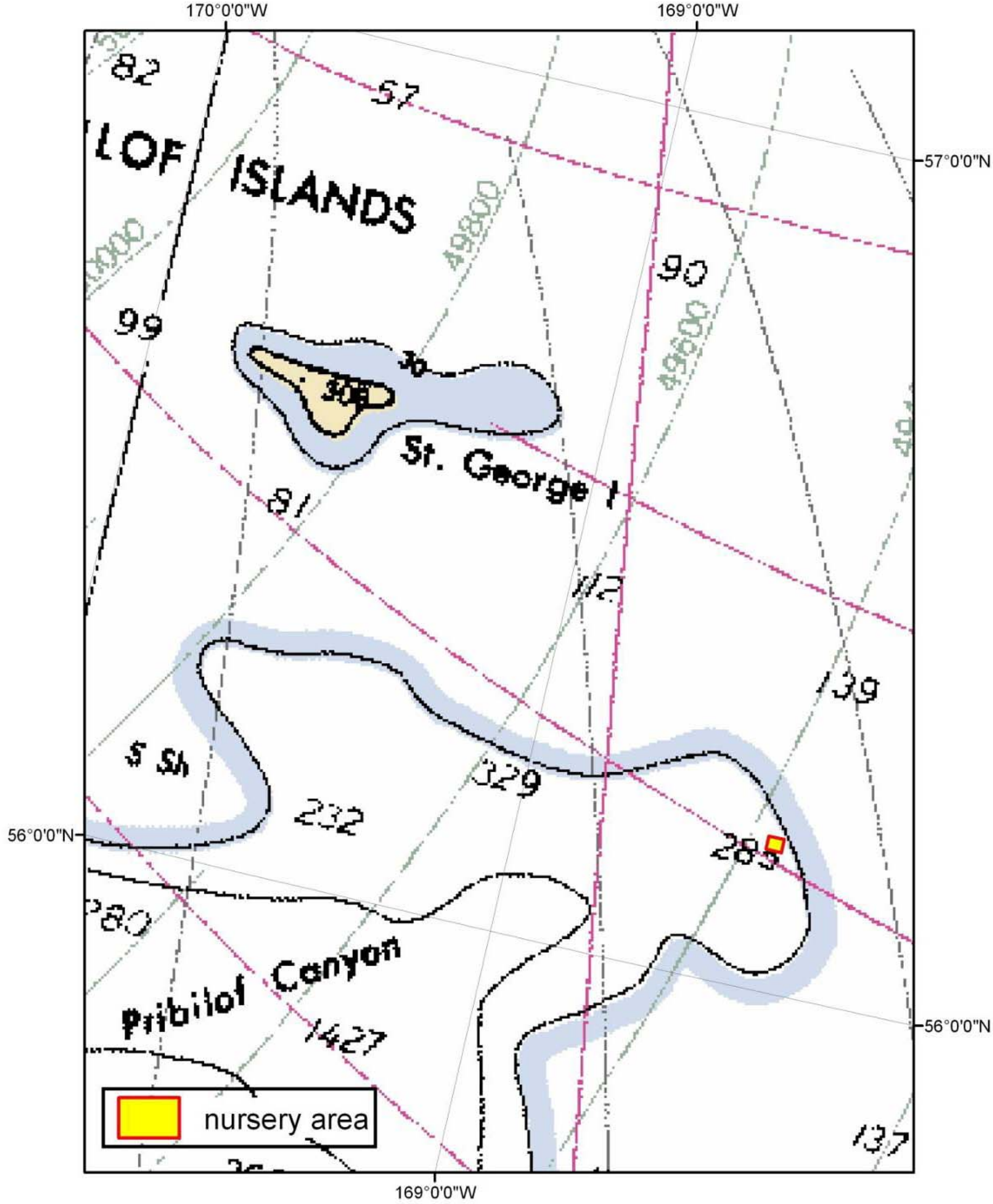


Figure 11. Map detail of proposed HAPC site "Pribilof" in the vicinity of Pribilof Canyon in the eastern Bering Sea.

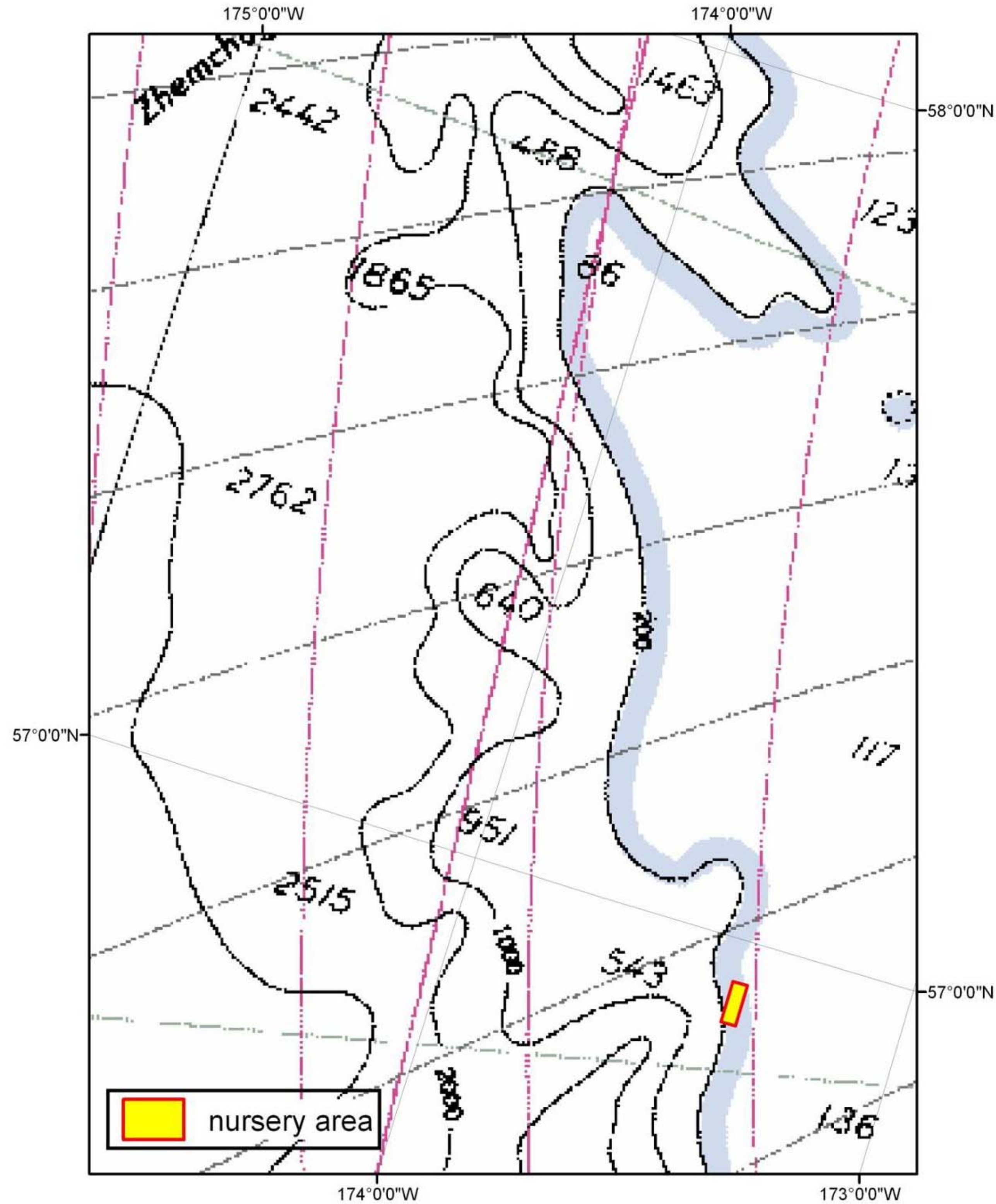


Figure 12. Map detail of proposed HAPC site "Zhemchug" south of Zhemchug Canyon in the eastern Bering Sea.

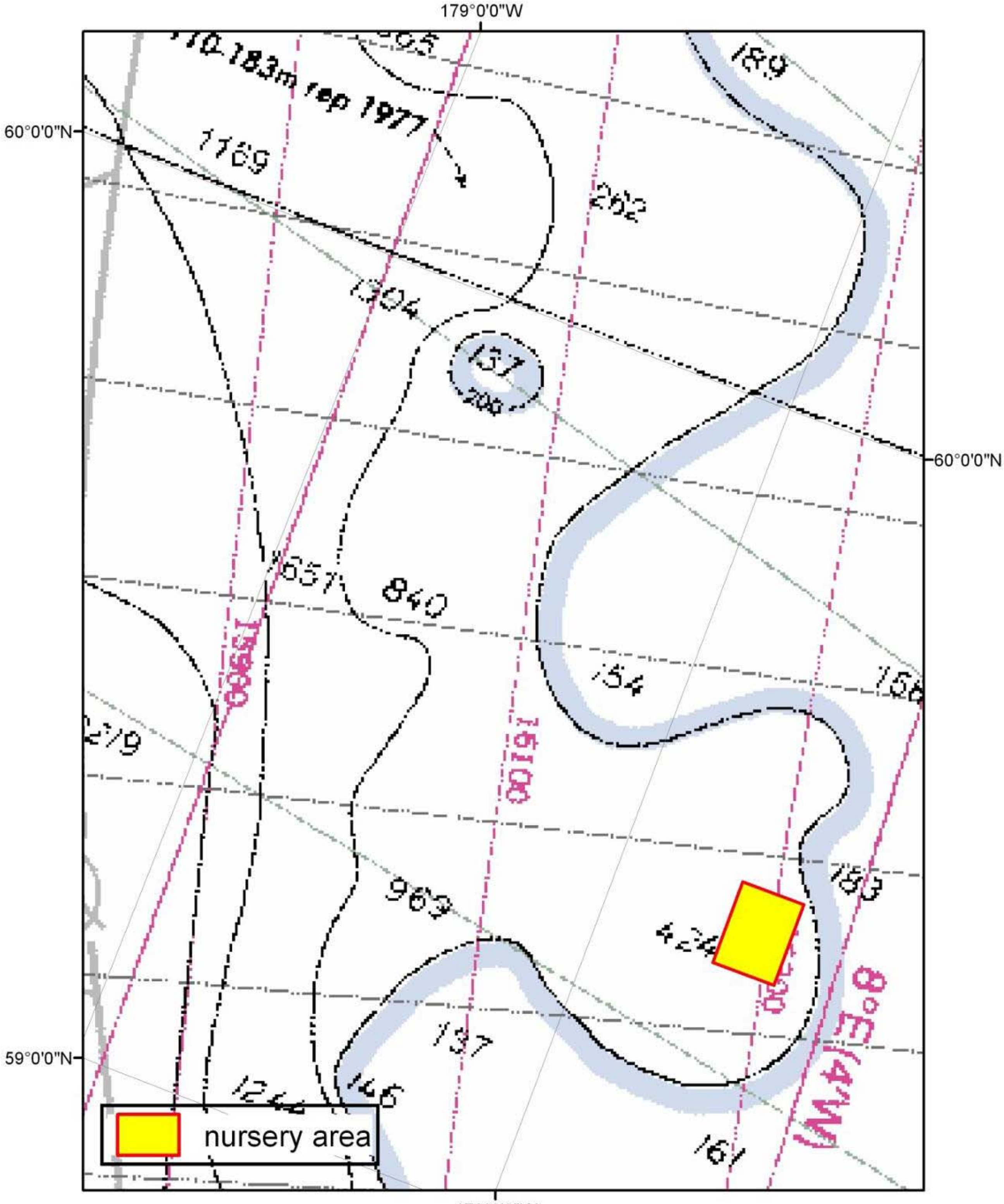


Figure 13. Map detail of proposed HAPC site "Pervenets" in the vicinity of Pervenets Canyon in the eastern Bering Sea.

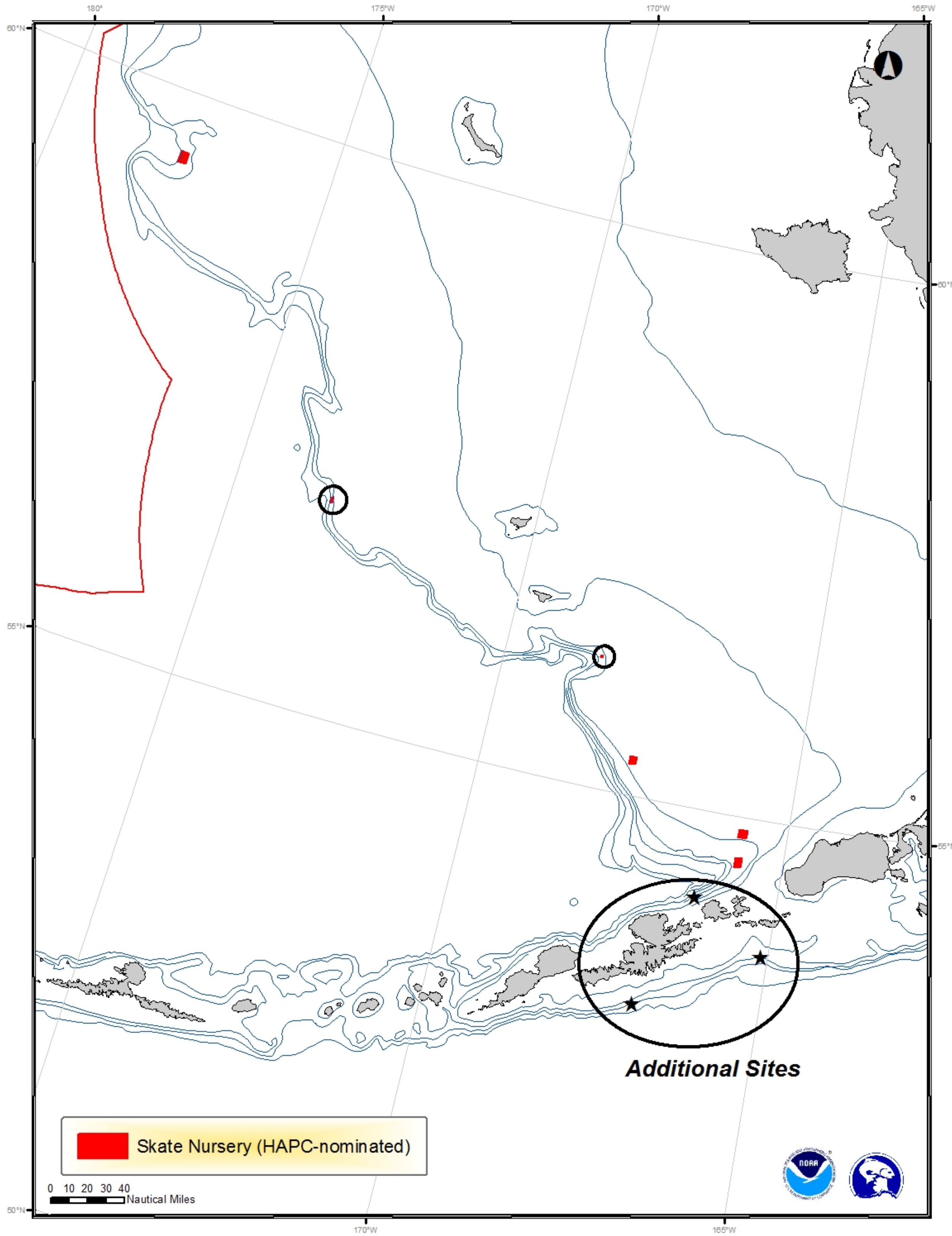


Figure 14. Additional skate nursery locations.

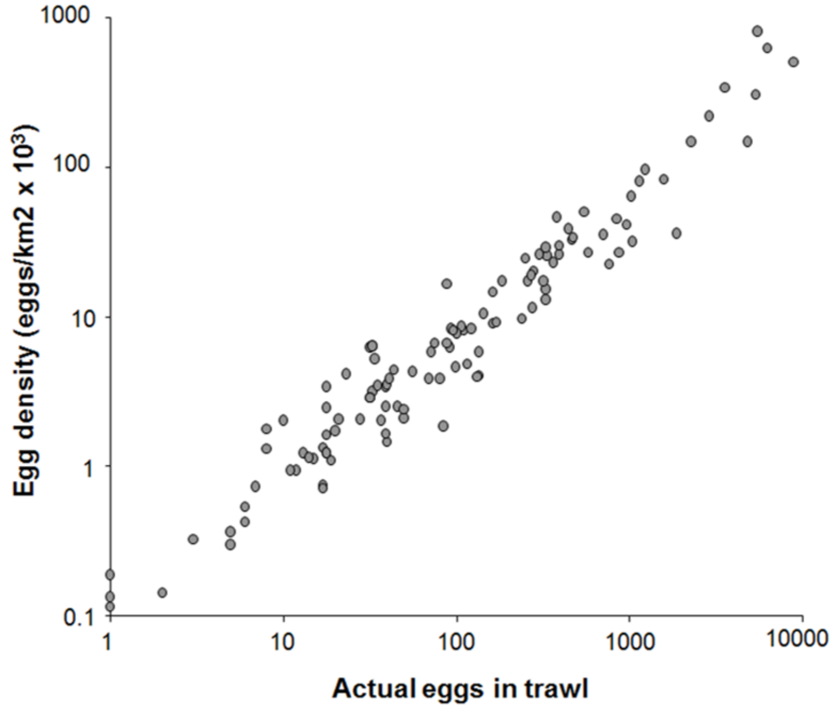


Figure 15. Relationship between skate eggs encountered in the trawl and expansion to egg density.

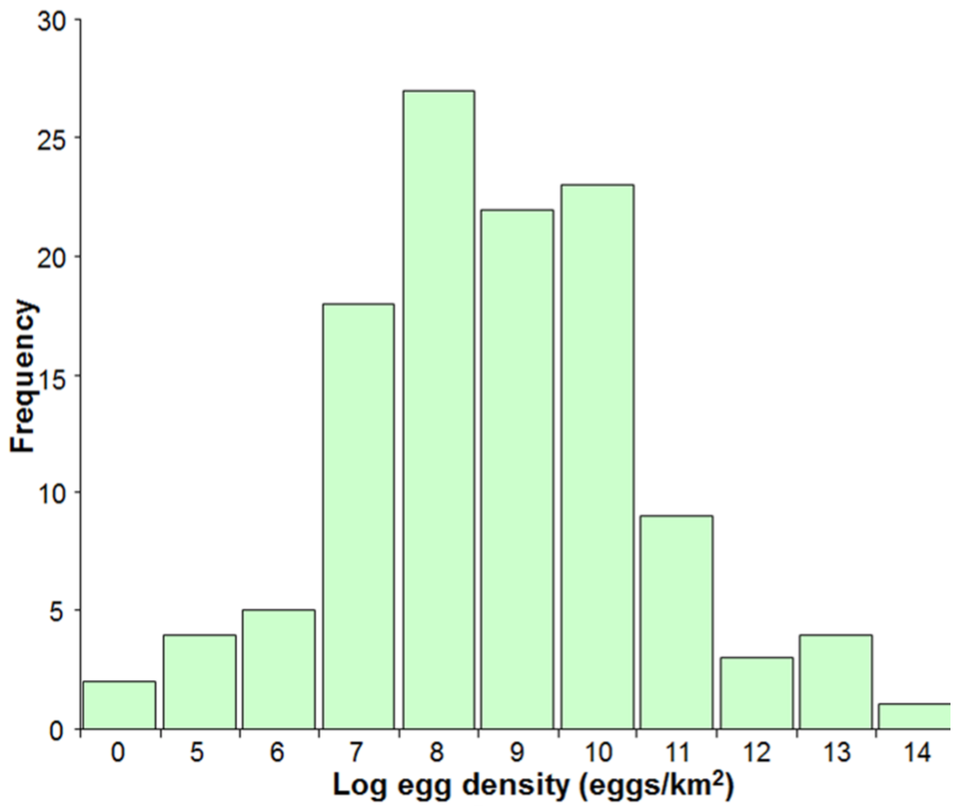


Figure 16. Distribution of egg densities from all nursery trawls.

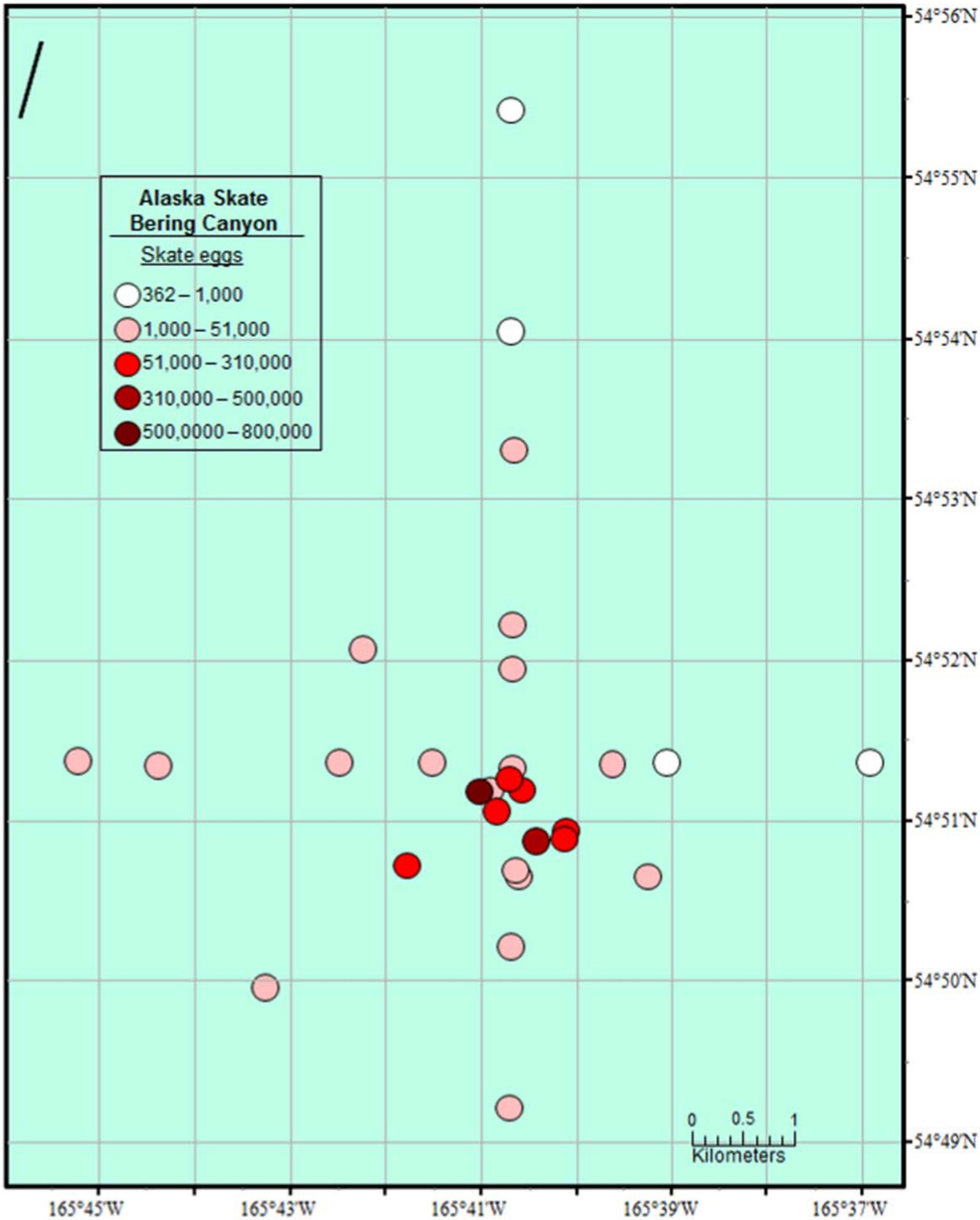


Figure 17. Egg densities at Alaska skate nursery, Bering Canyon site based on trawl data.

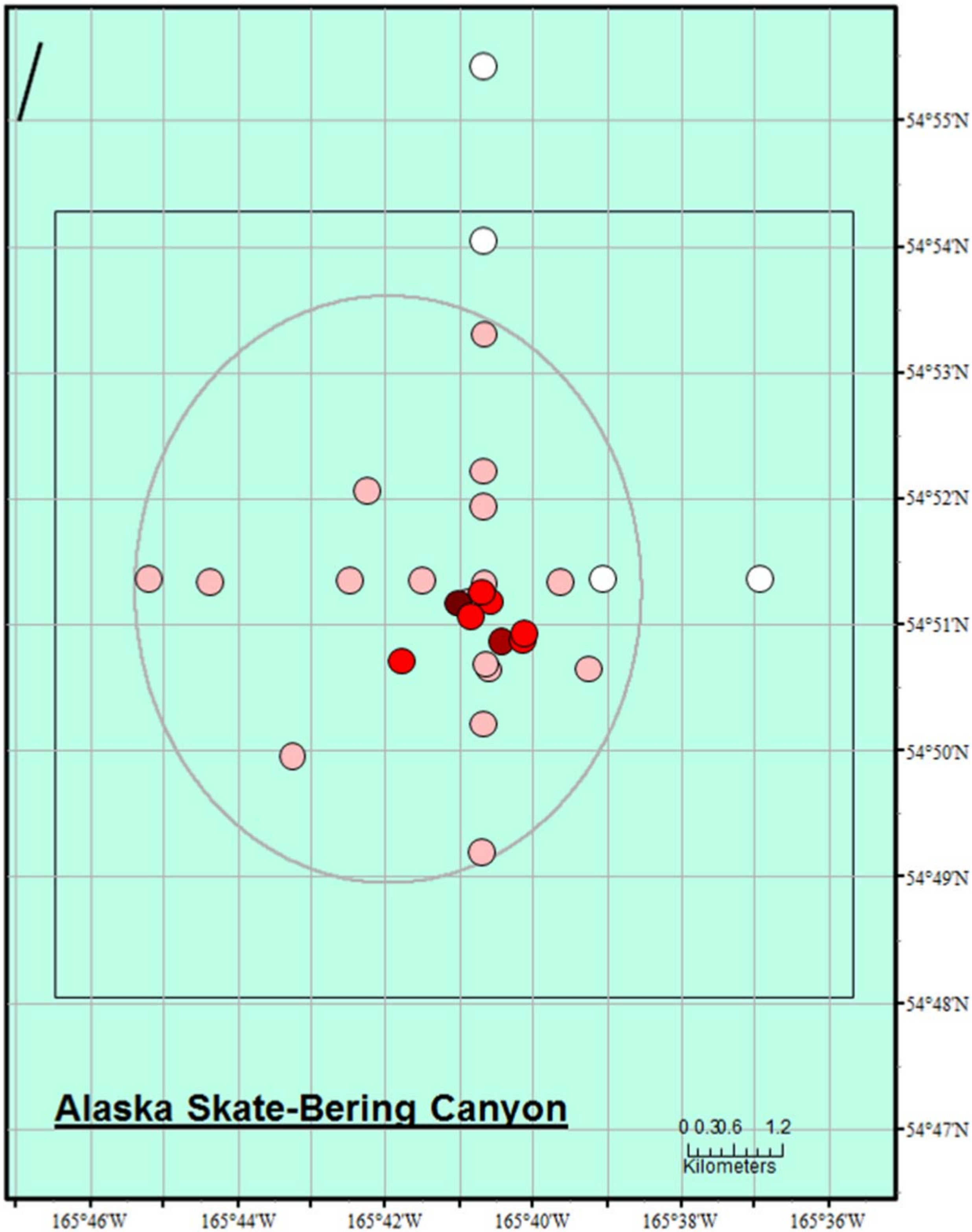


Figure 18. Egg densities at Alaska skate nursery, Bering Canyon site based on trawl data. The ellipse encompasses all locations of >1,000 eggs/km^2. The box is a 10 × 10 km area that would encompass the entire site and include a buffer zone.

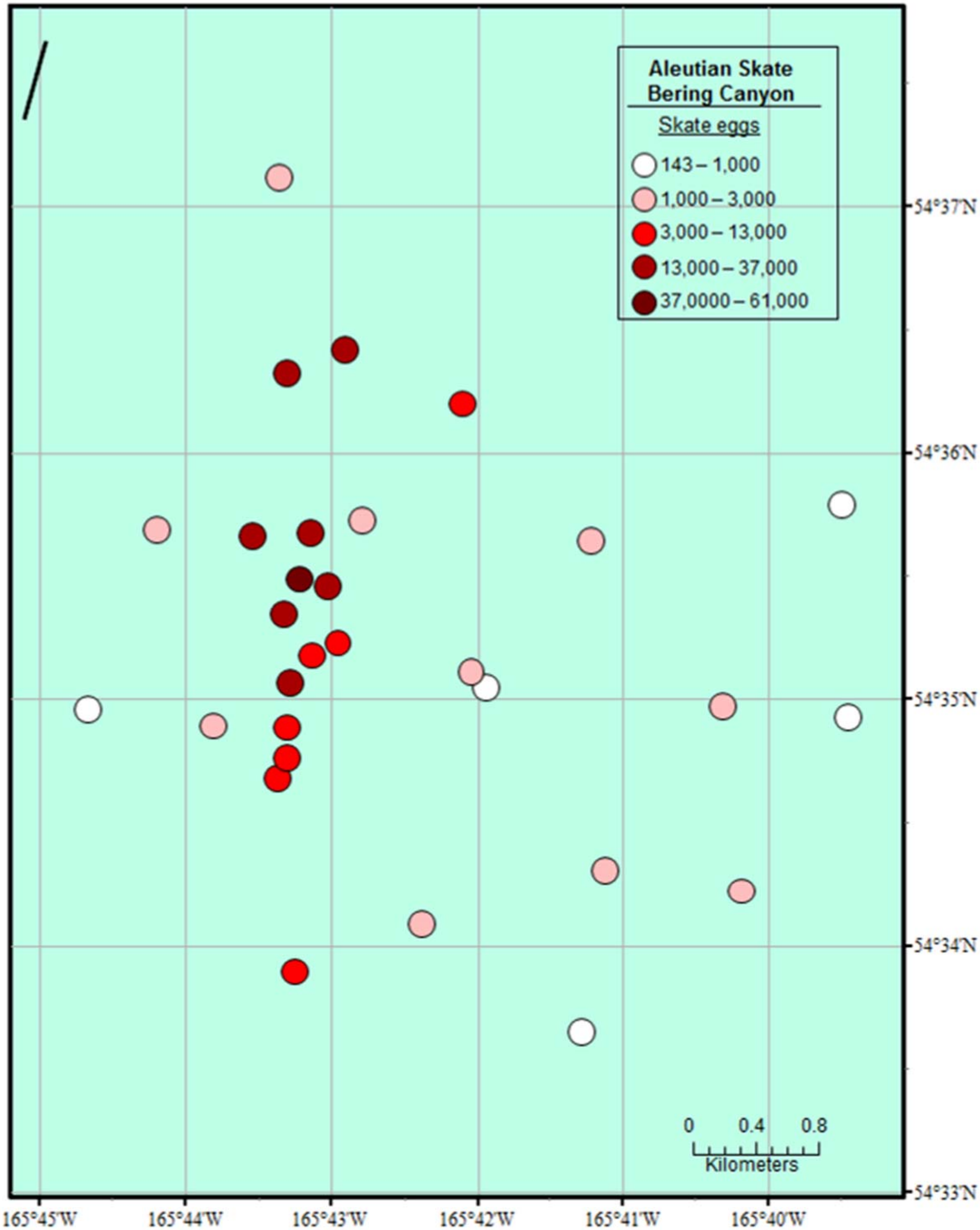


Figure 19. Egg densities at Aleutian skate nursery, Bering Canyon site based on trawl data.

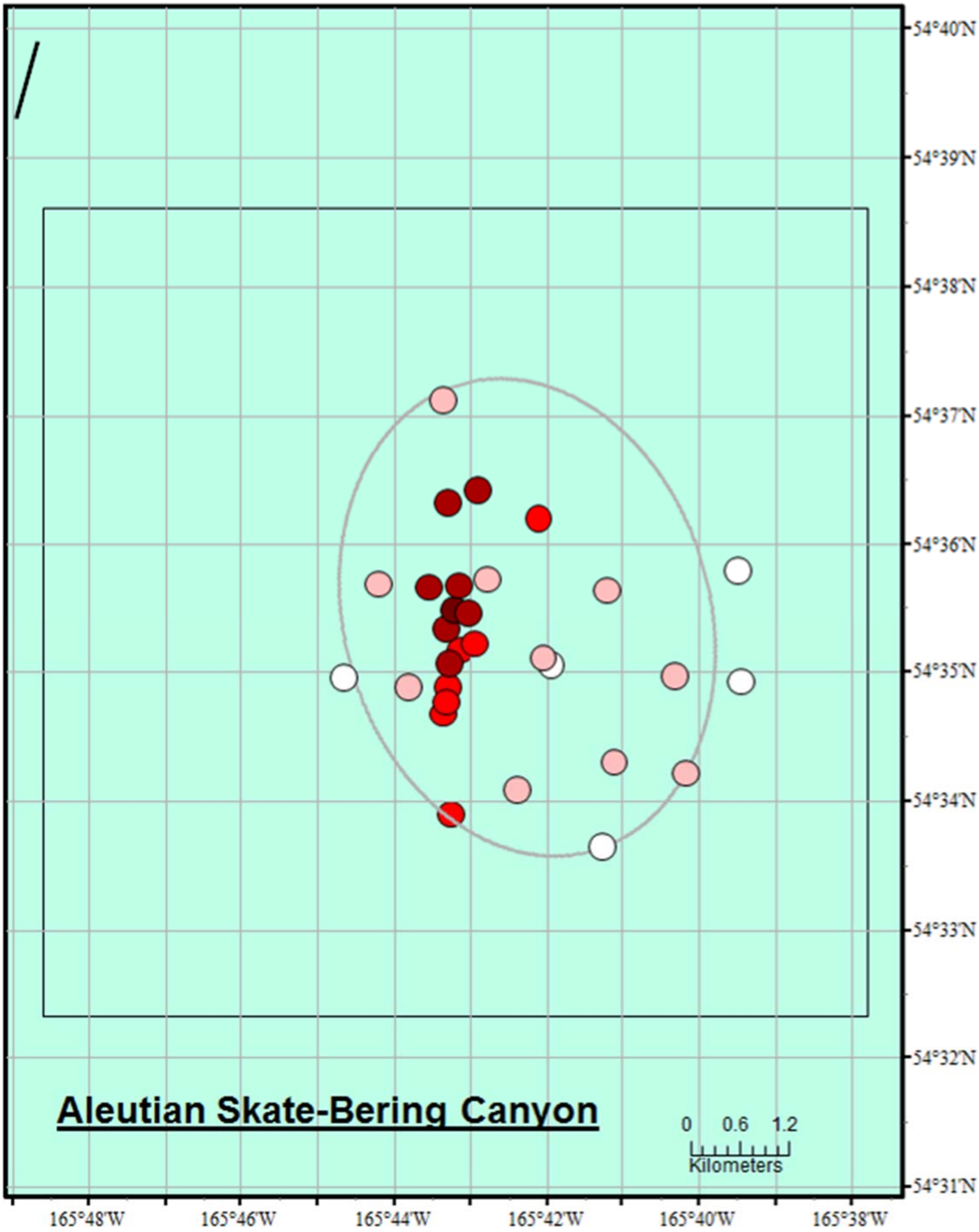


Figure 20. Egg densities at Aleutian skate nursery, Bering Sea site based on trawl data. The ellipse encompasses all locations of >1,000 eggs/km^2. The box is a 10 × 10 km area that would encompass the entire site and include a buffer zone.

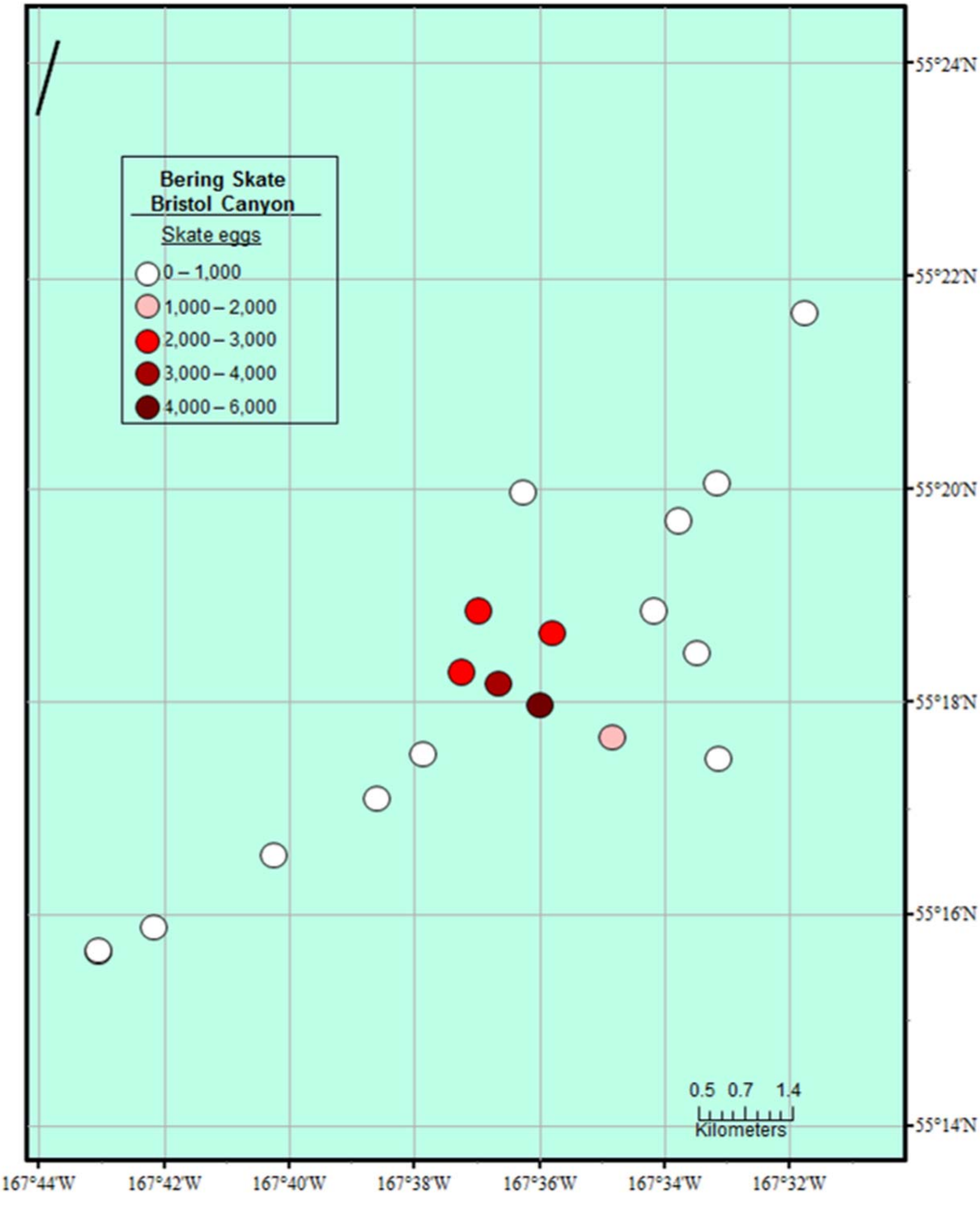


Figure 21. Egg densities at Bering skate nursery, Bristol Canyon site based on trawl data.

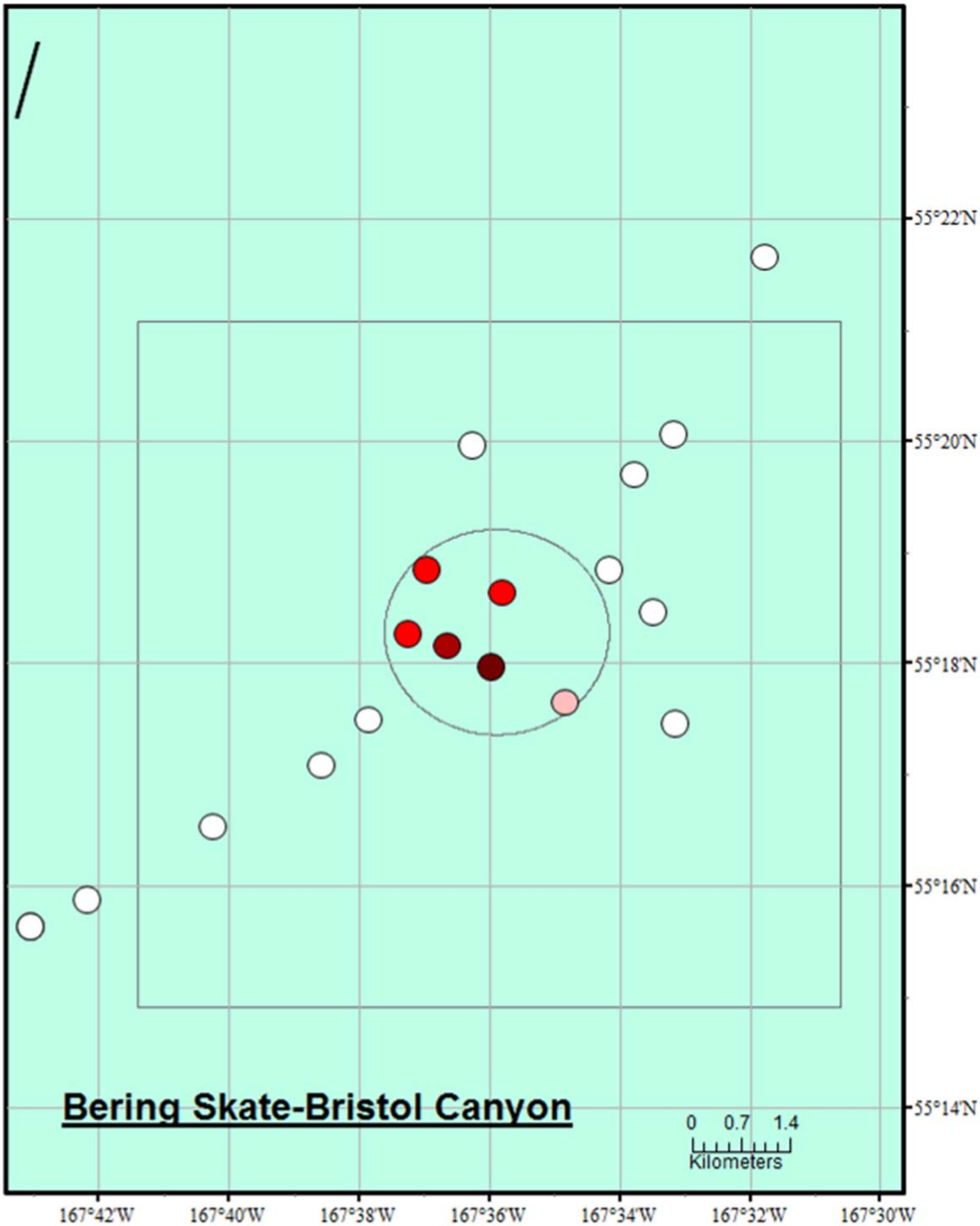


Figure 22. Egg densities at Bering skate nursery, Bristol Canyon site based on trawl data. The ellipse encompasses all locations of >1,000 eggs/km^2. The box is a 10 × 10 km area that would encompass the entire site and include a buffer zone.

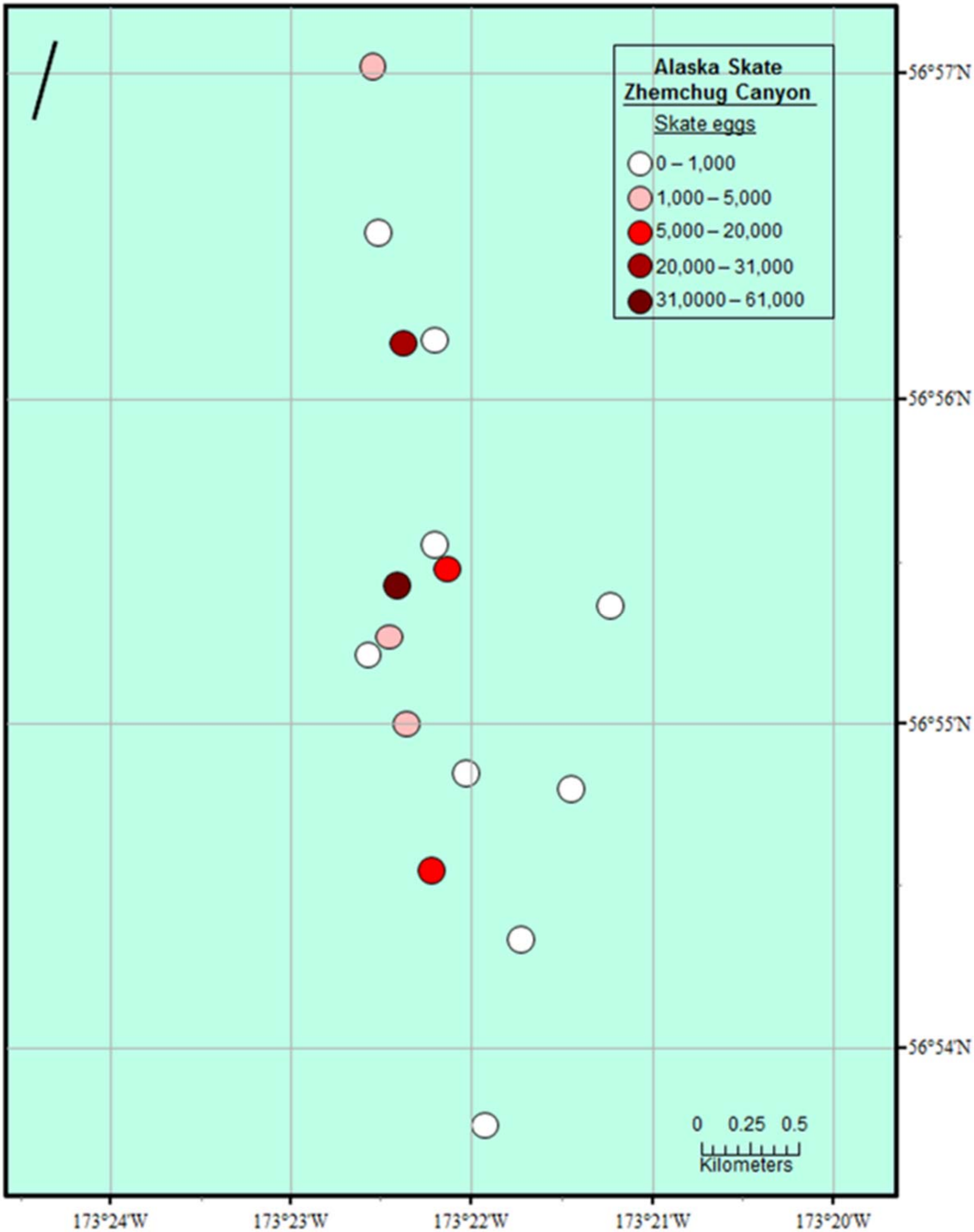


Figure 23. Egg densities at the Alaska skate nursery, Zhemchug Canyon site based on trawl data.

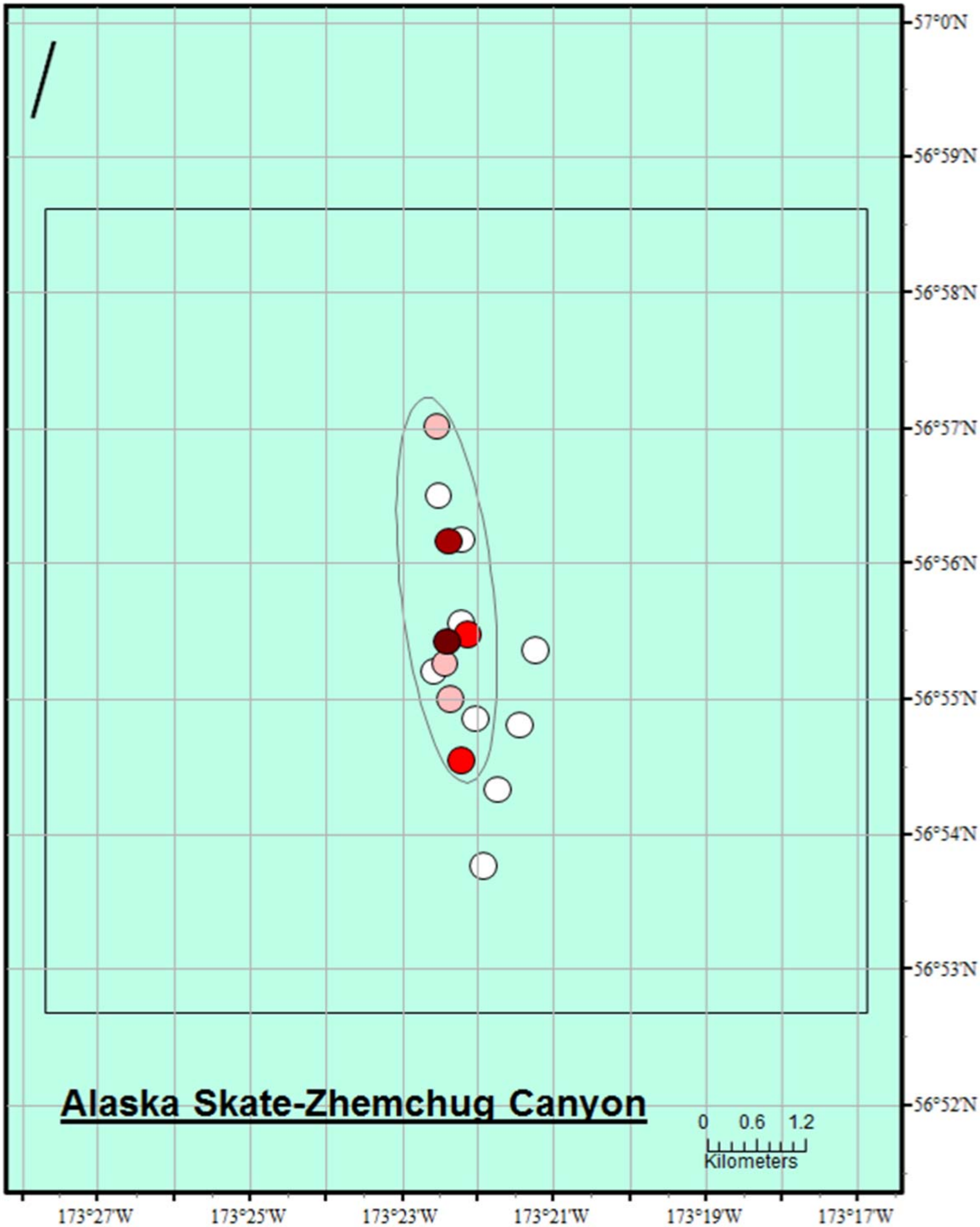


Figure 24. Egg densities at the Alaska skate nursery, Zhemchug Canyon site based on trawl data. The ellipse encompasses all locations of >1,000 eggs/km^2. The box is a 10 × 10 km area that would encompass the entire site and include a buffer zone.

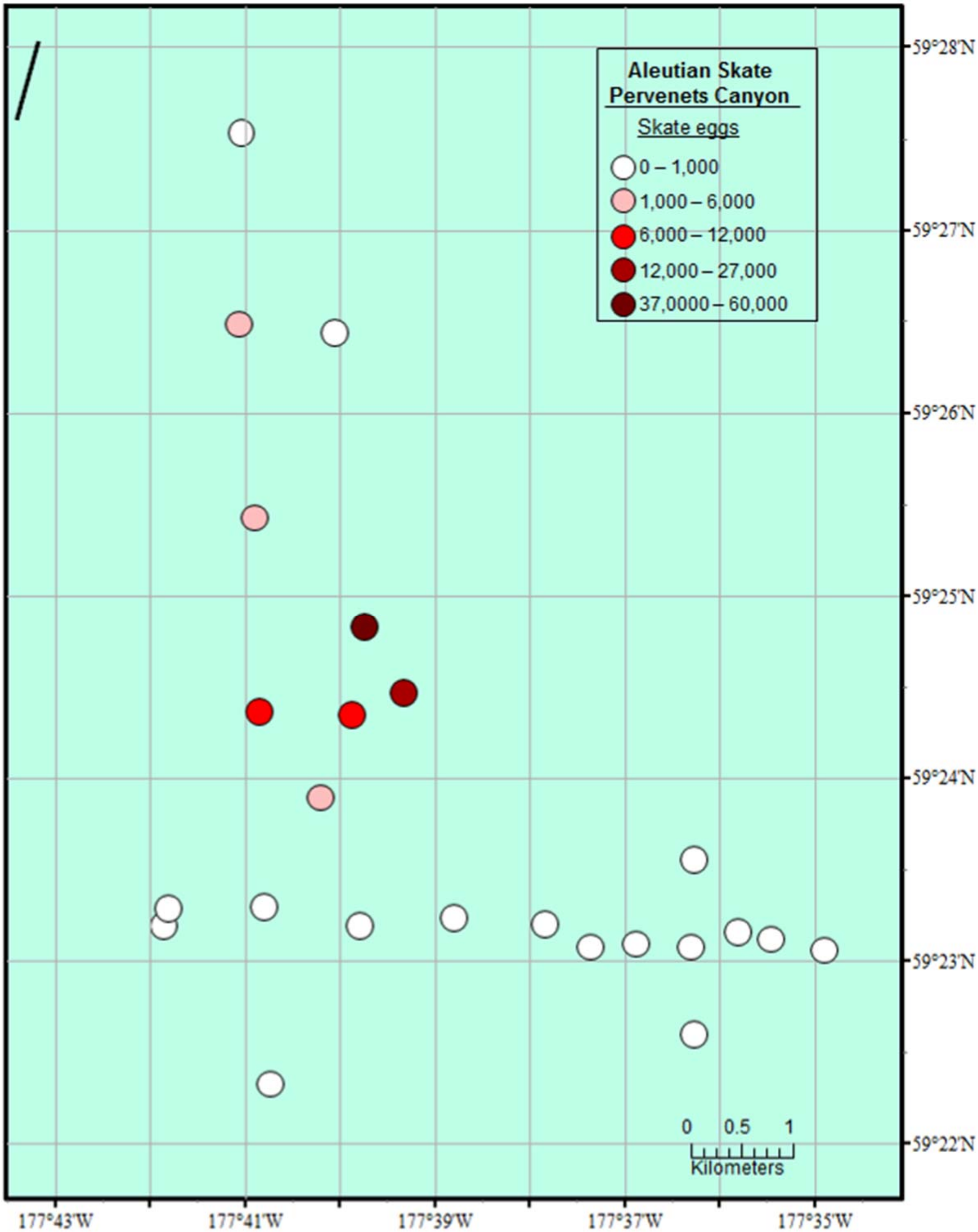


Figure 25. Egg densities at the Aleutian skate, Pervenents Canyon nursery site based on trawl data.

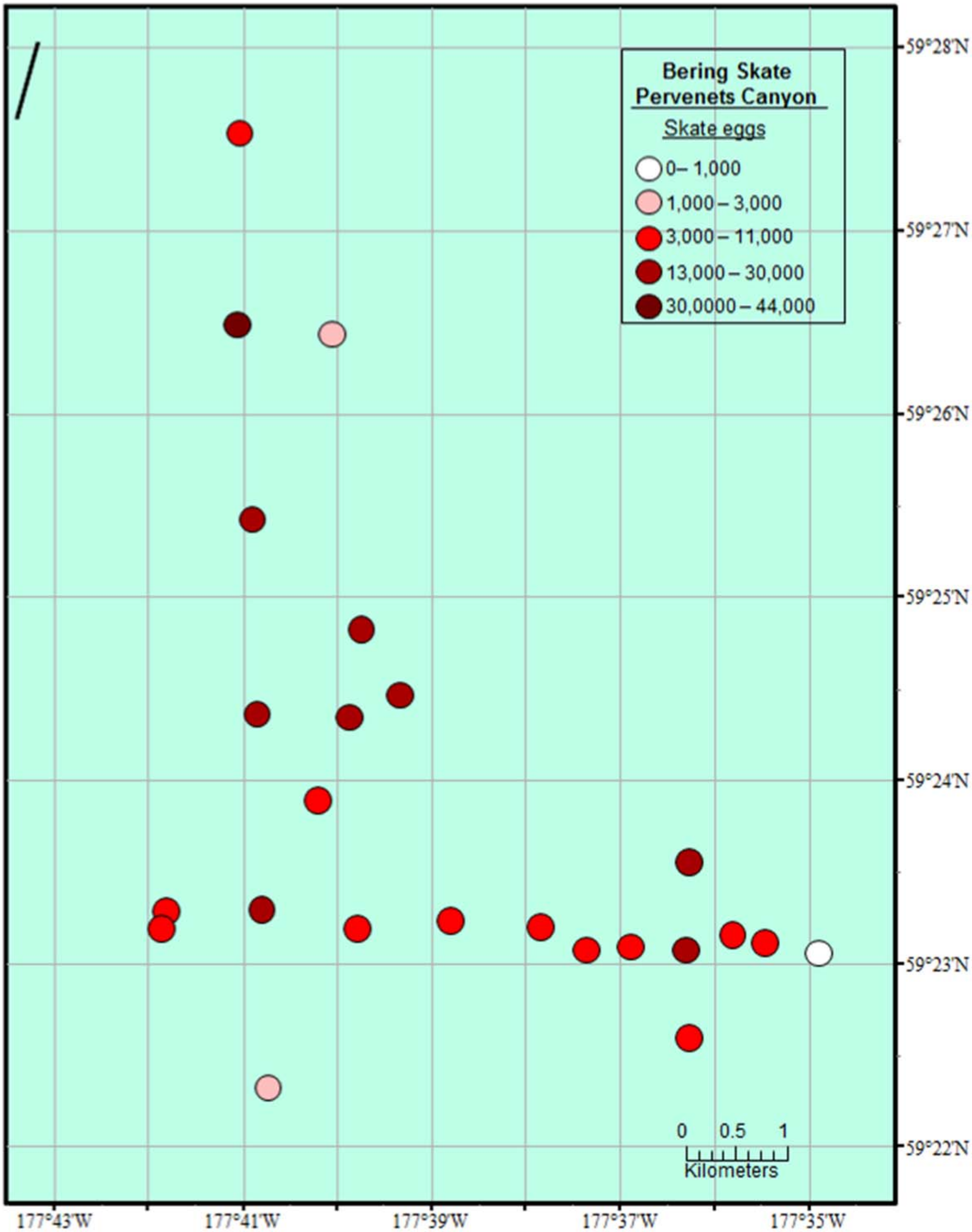


Figure 26. Egg densities at the Bering skate, Pervenets Canyon nursery site based on trawl data.

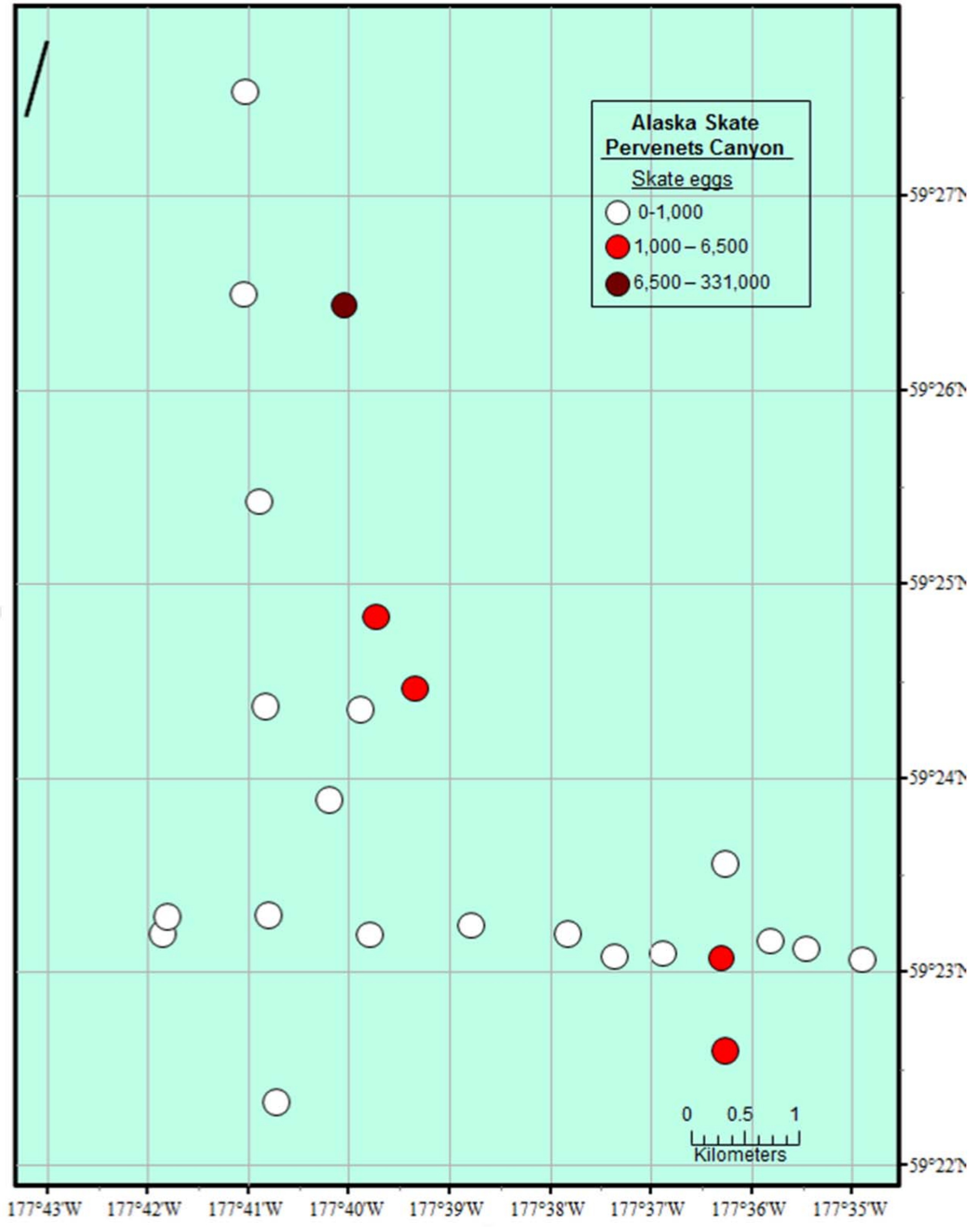


Figure 27. Egg densities at the Alaska skate, Pervenets Canyon nursery site based on trawl data.

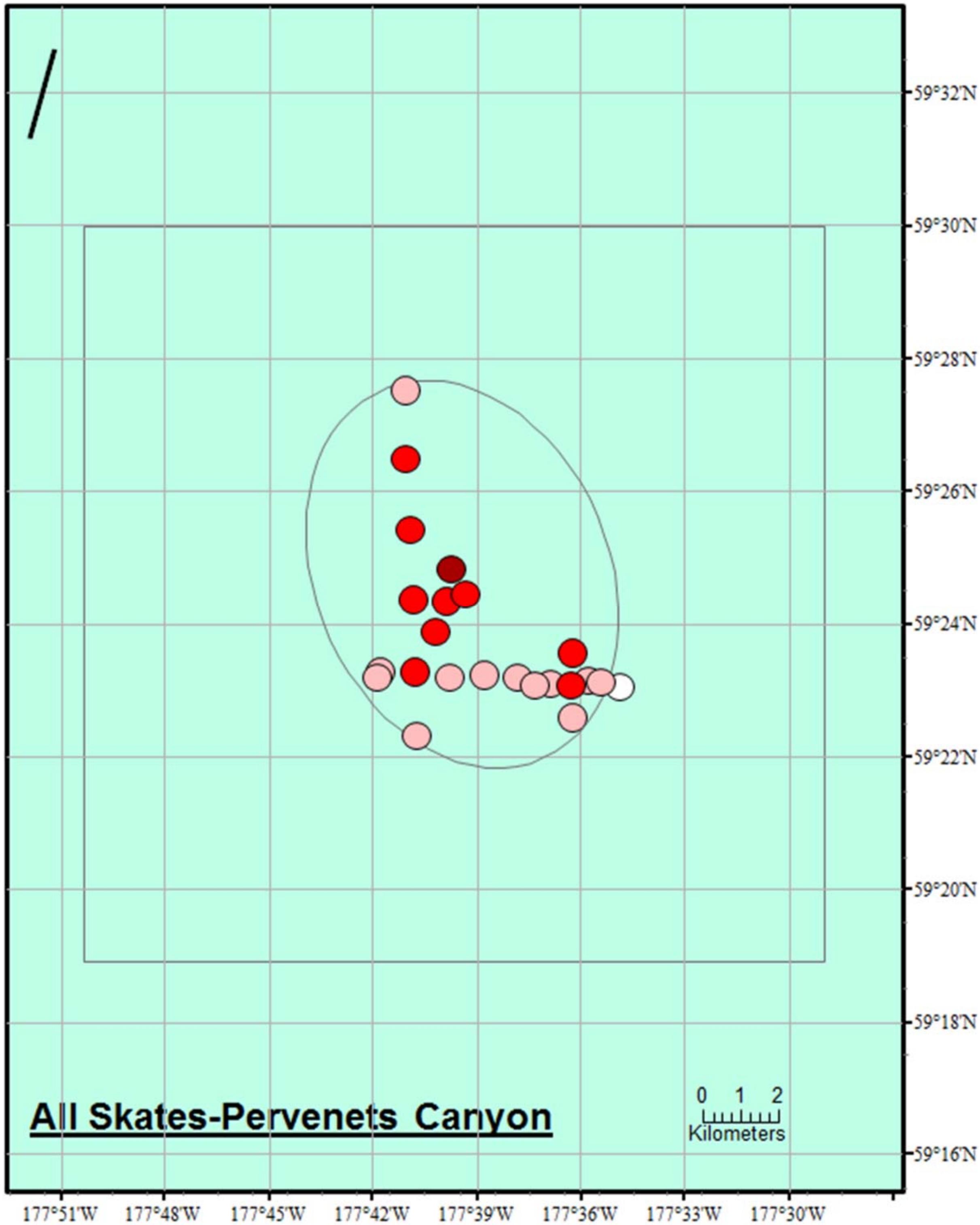


Figure 28. Egg densities at all skates, Pervenets Canyon nursery sites based on trawl data. The ellipse encompasses all locations of >1,000 eggs/km^2. The box is a 10 × 10 km area that would encompass the entire site and include a buffer zone.

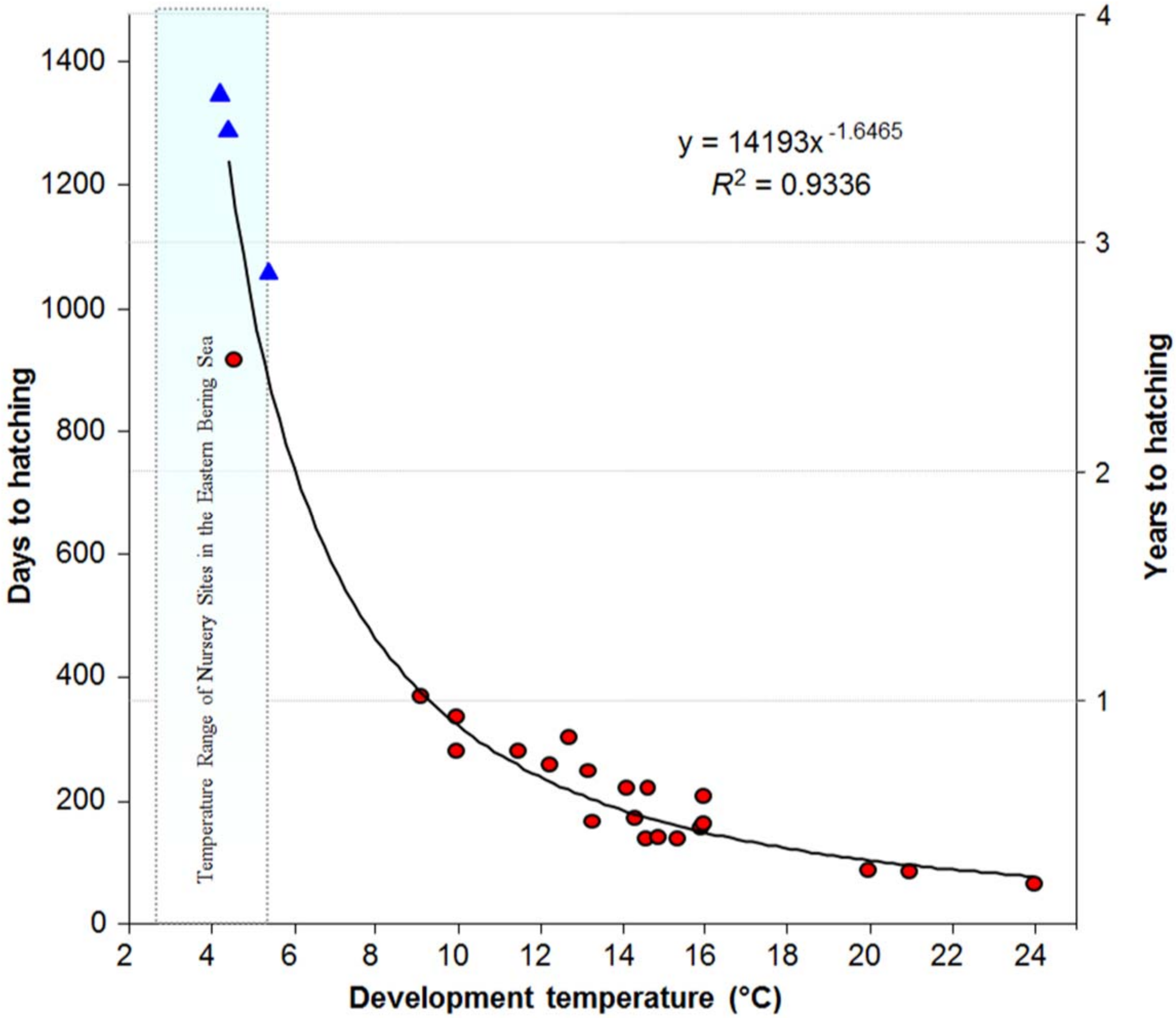


Figure 29. Relationship between development time and temperature for oviparious elasmobranchs from published literature values (red dots) and from studies on the Alaska skate from the eastern Bering Sea (blue diamonds).

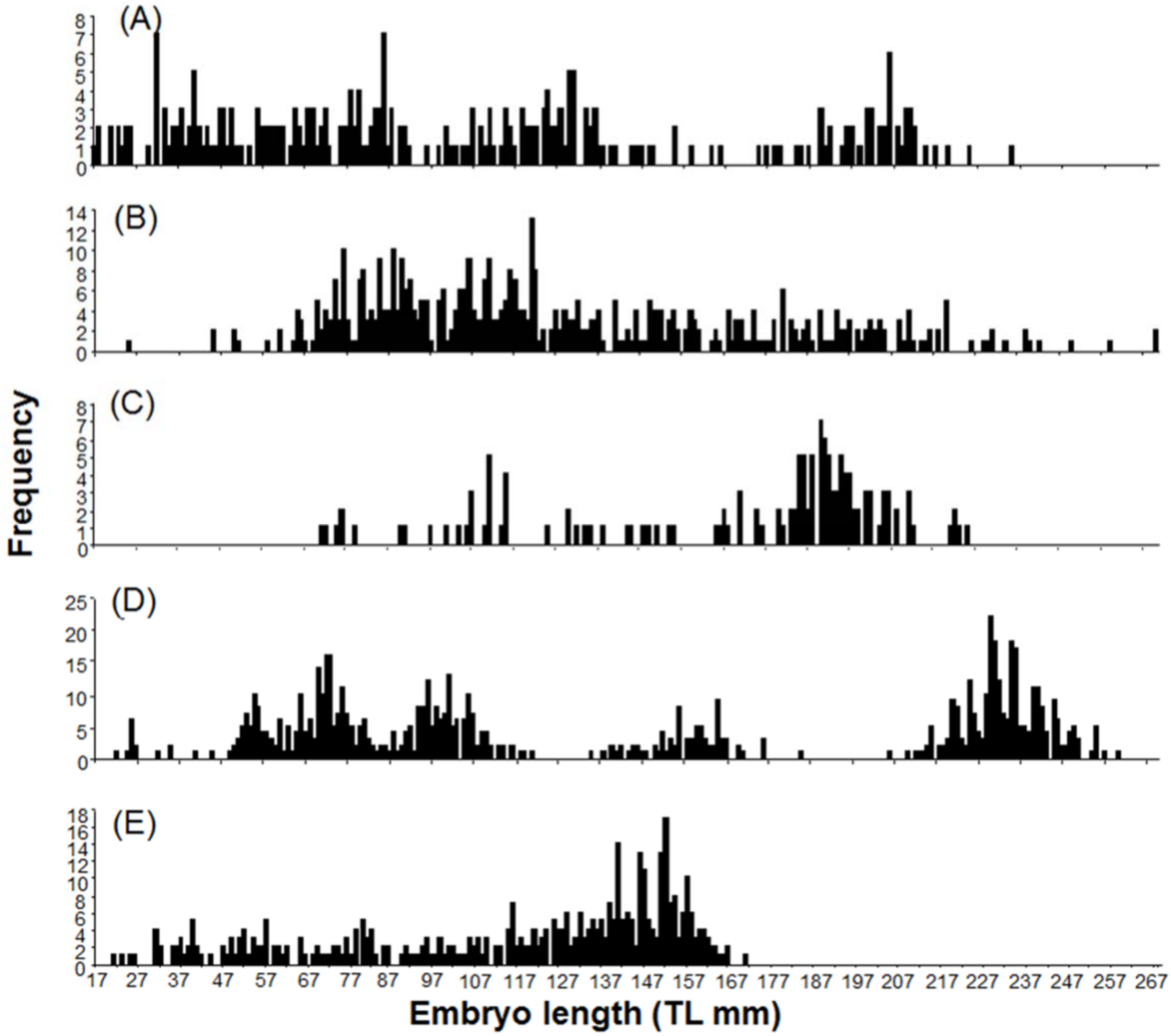


Figure 30. Embryo length frequencies from 5 nursery sites for three skate species in the eastern Bering Sea. A) Alaska skate-Bering Canyon; B) Alaska skate-Pervenets Canyon; C) Aleutian skate-Bering Canyon; D) Aleutian skate-Pervenets Canyon; E) Bering skate-Pervenets Canyon.

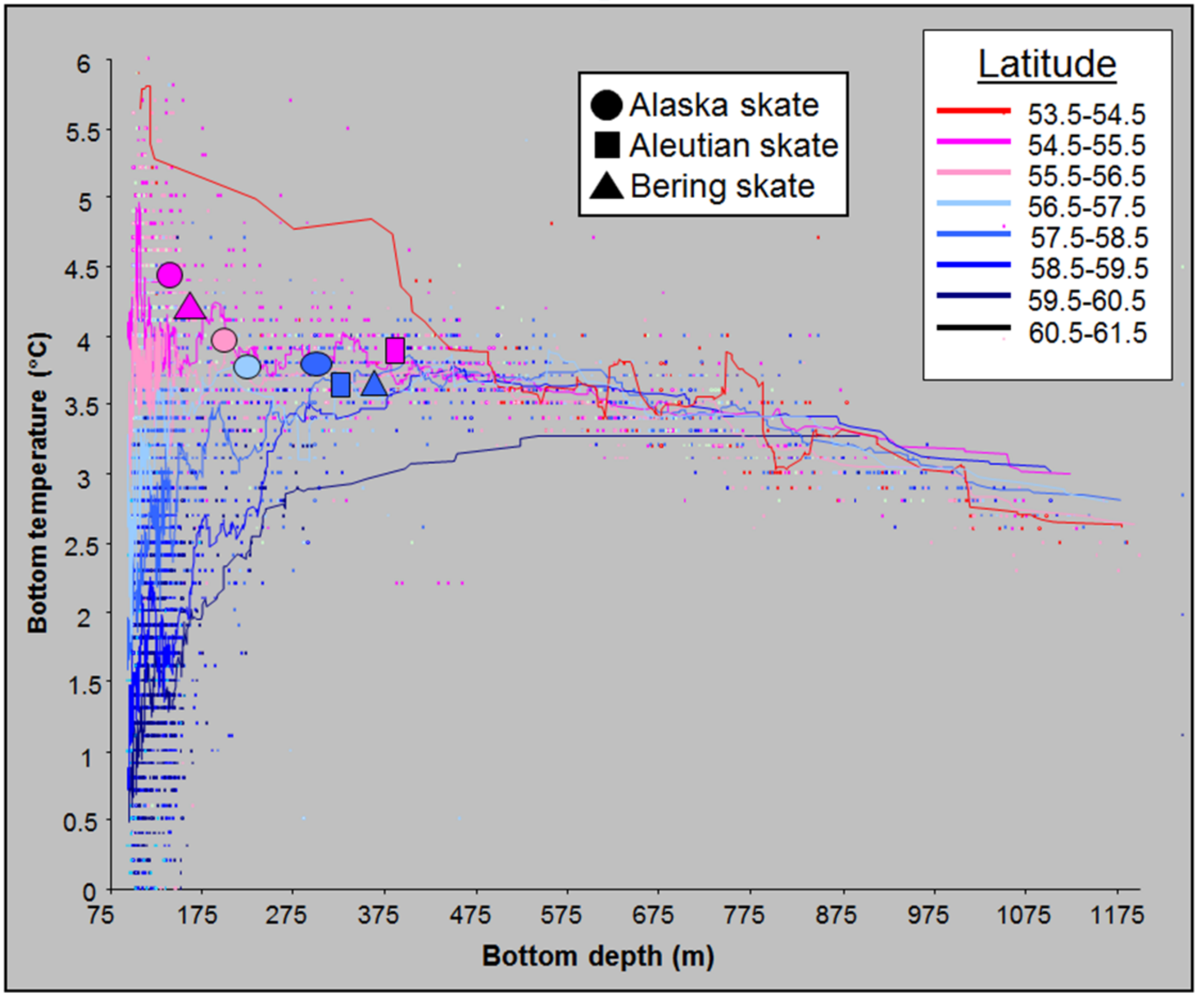


Figure 31. Depth temperature relationship with latitude in the eastern Bering Sea. Each line represents the running mean of that latitudes bottom temperature across the shelf and slope. Skate nursery sites are plotted at their depth and mean temperature, symbol coded for species and color coded for latitude.

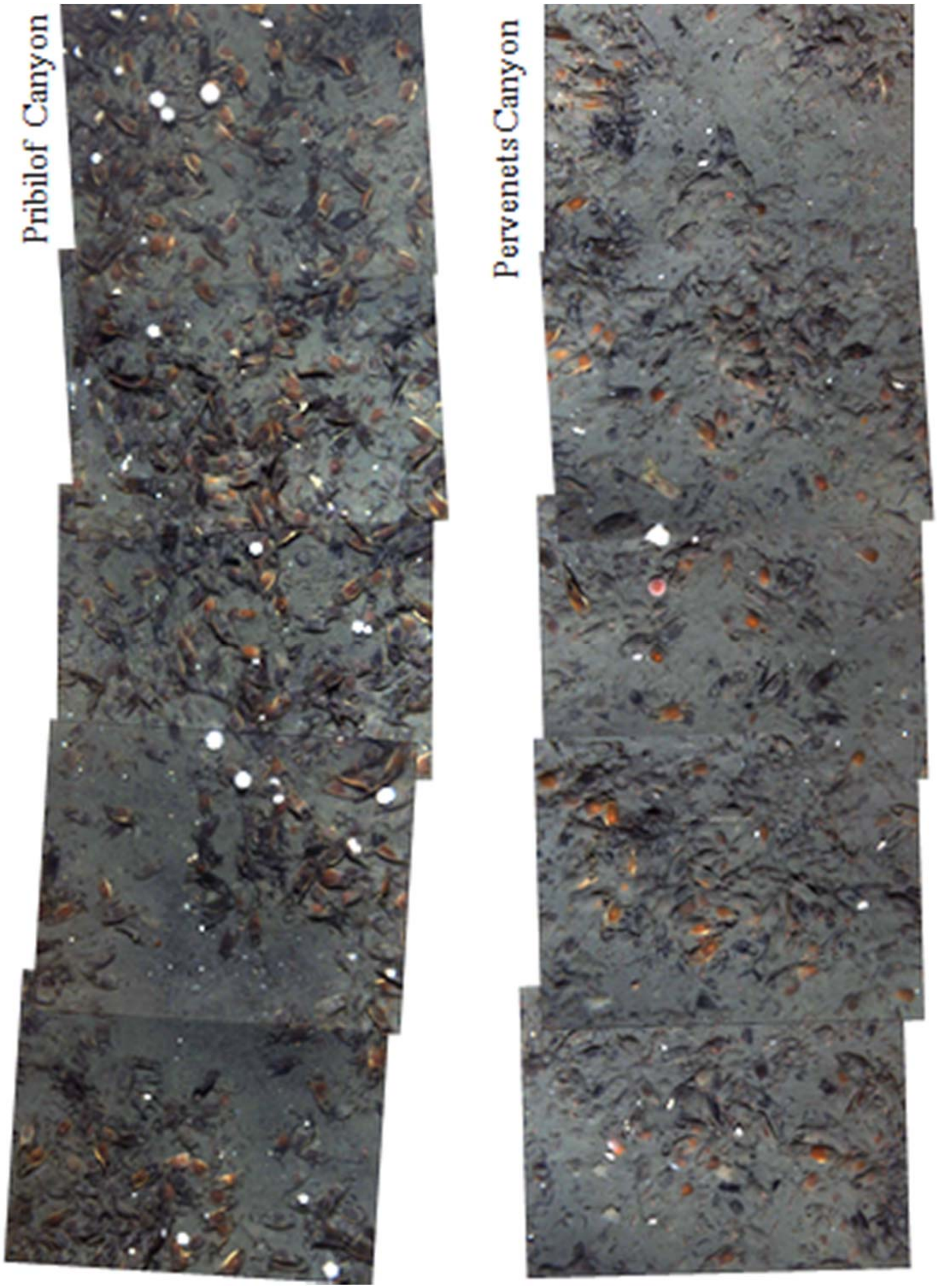


Figure 32. Images of sea floor in the propsed skate egg concentration HAPCs in the Pribilof and Pervenents Canyon locations.

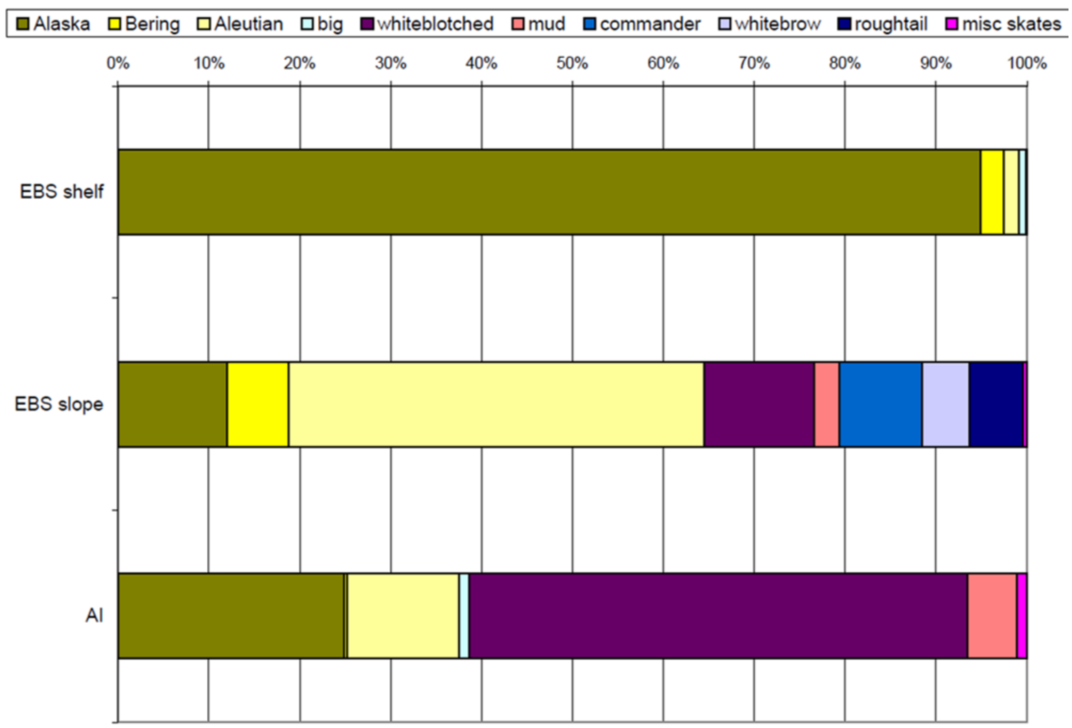


Figure 33. Skate species composition (by weight) by BSAI subregion, from surveys conducted in each region in 2010. "Misc skates" contains longnose, deepsea, and unidentified skates.

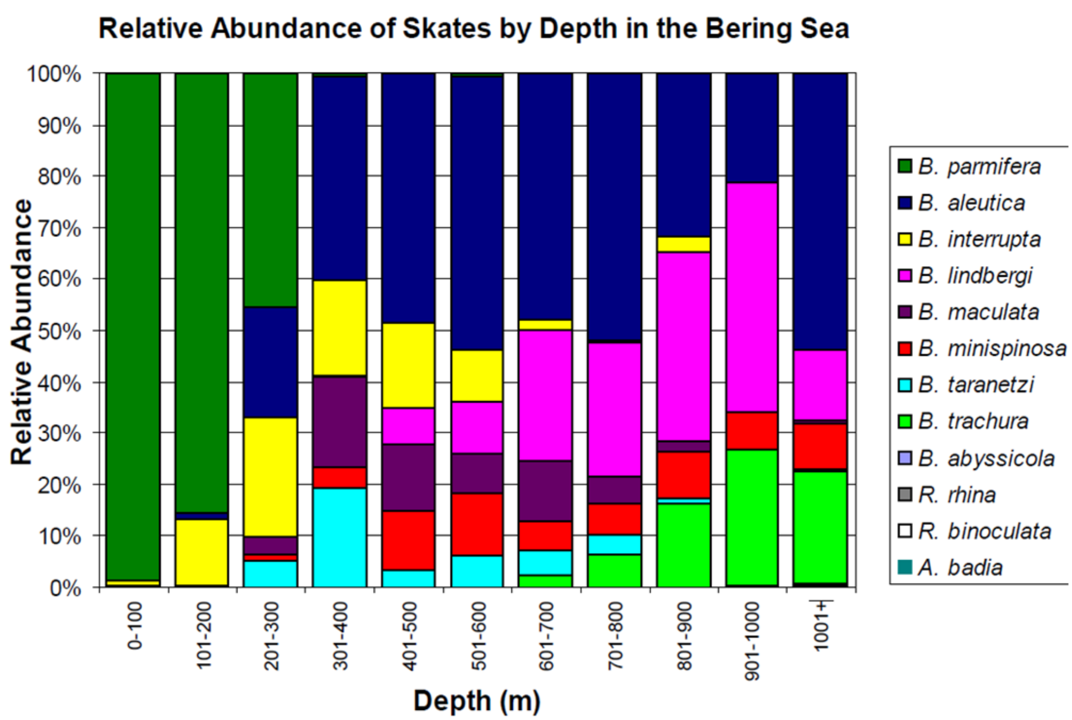
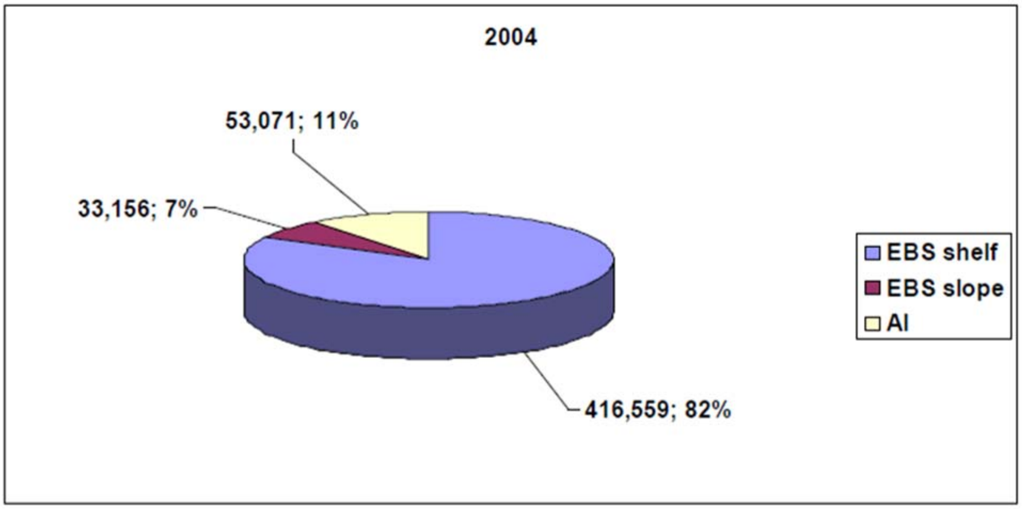


Figure 34. Relative abundance of skate species in the EBS by depth. (Source: Stevenson et al. 2006.)



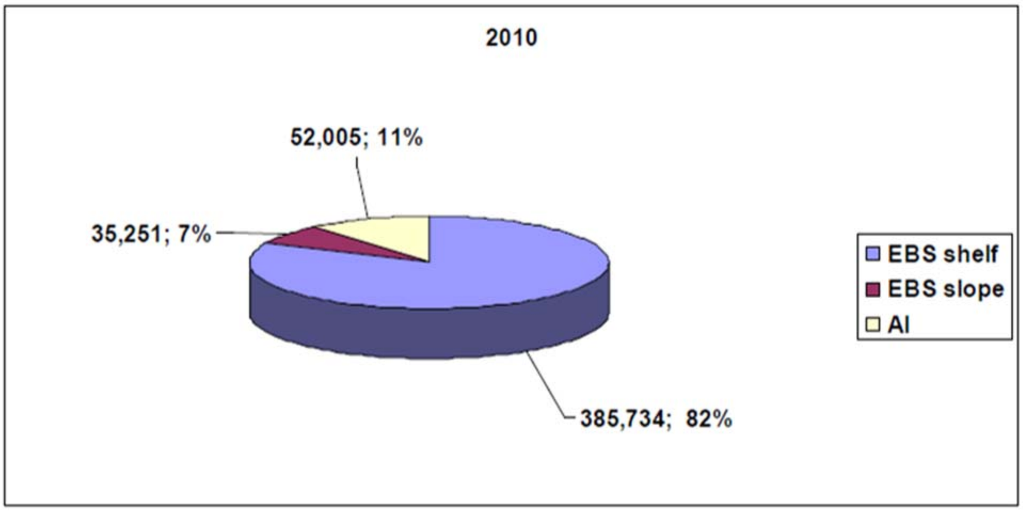


Figure 35. Distribution of skate biomass in the 3 subregions of the BSAI, 2004 and 2010. Data are biomass estimates from AFSC groundfish surveys.

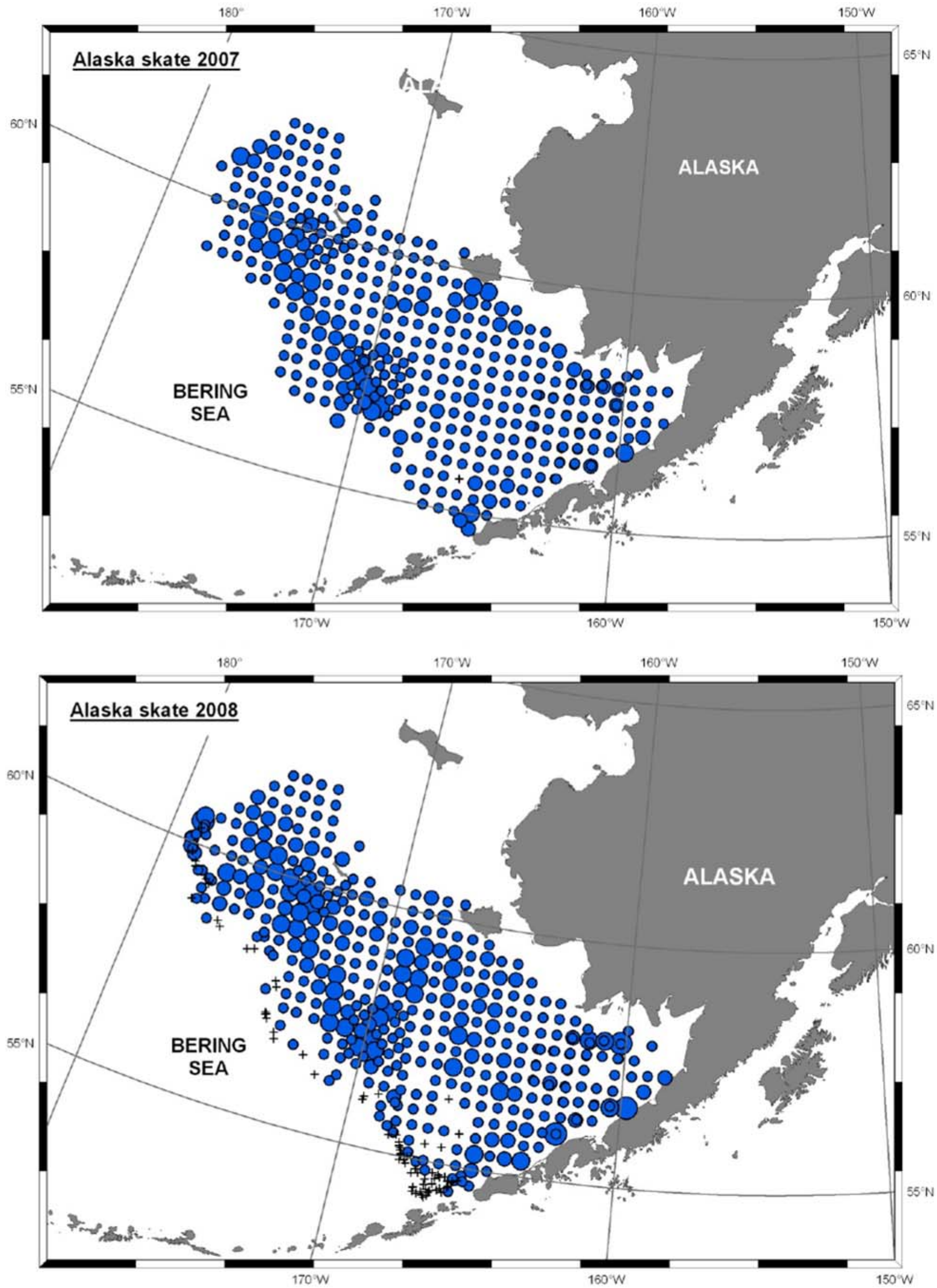


Figure 36. AFSC bottom trawl survey catches of Alaska skate in 2007 & 2008. Symbol size is proportional to total catch at each survey station. Data from 2008 include the 2008 slope survey. Crosses indicate no catch of Alaska skate at that station.

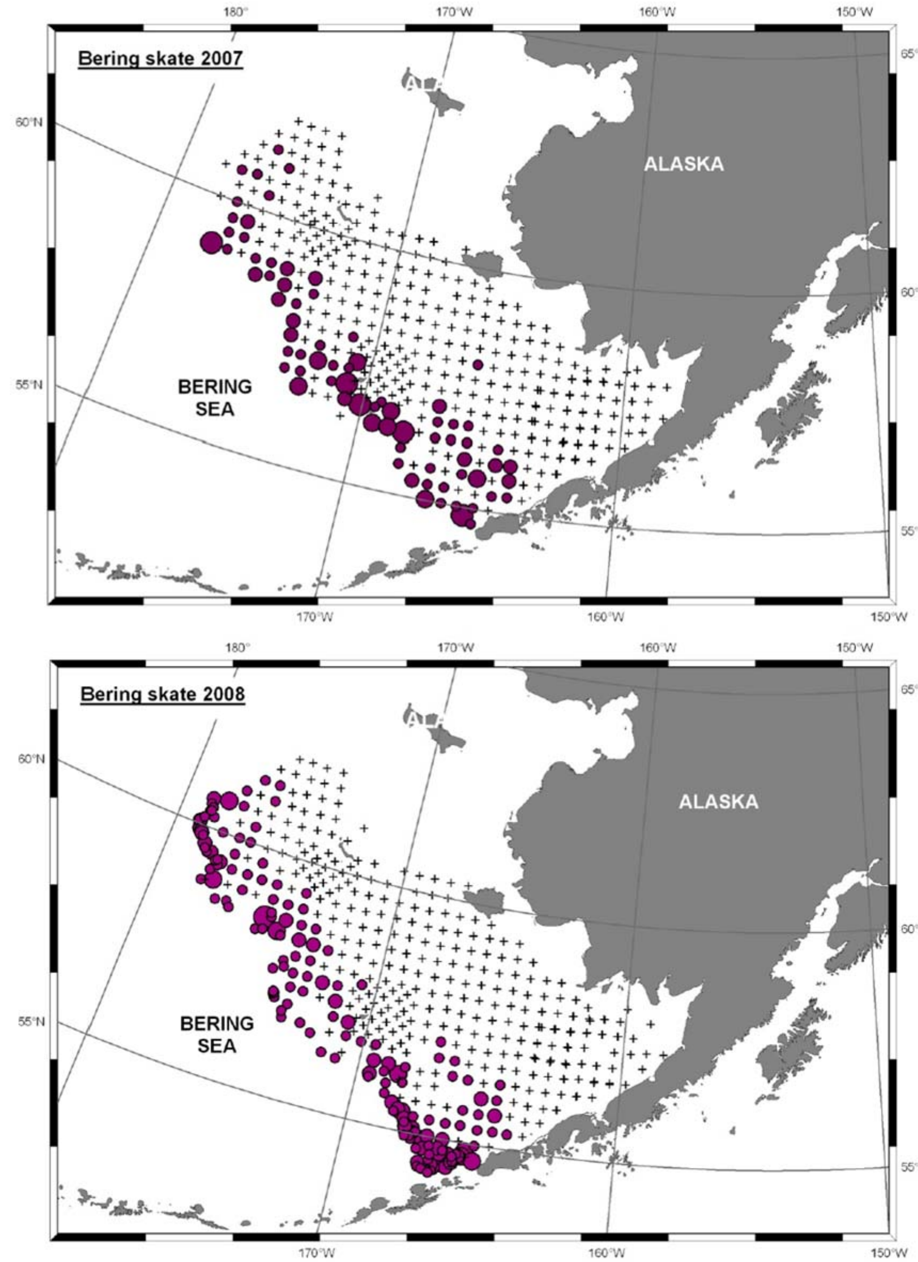


Figure 37. AFSC bottom trawl survey catches of Bering skate in 2007 & 2008. Symbol size is proportional to total catch at each survey station. Data from 2008 include the 2008 slope survey. Crosses indicate no catch of Bering skate at that station.

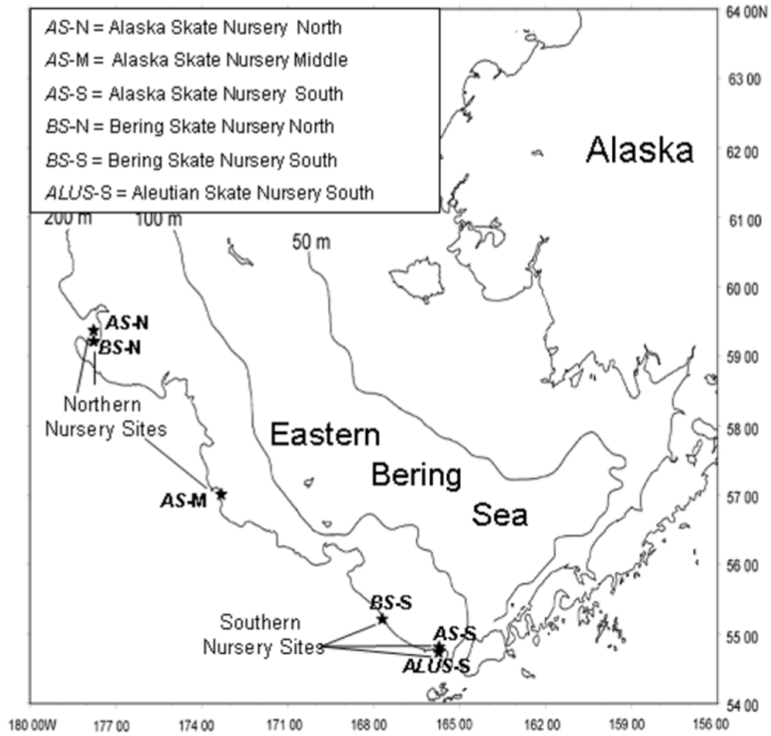


Figure 38. Map of the eastern Bering Sea with the six known skate nursery site locations and designations as a northern or southern nursery site. (See the legend for nursery site designation.) Source: Gerald Hoff, AFSC, unpublished data.

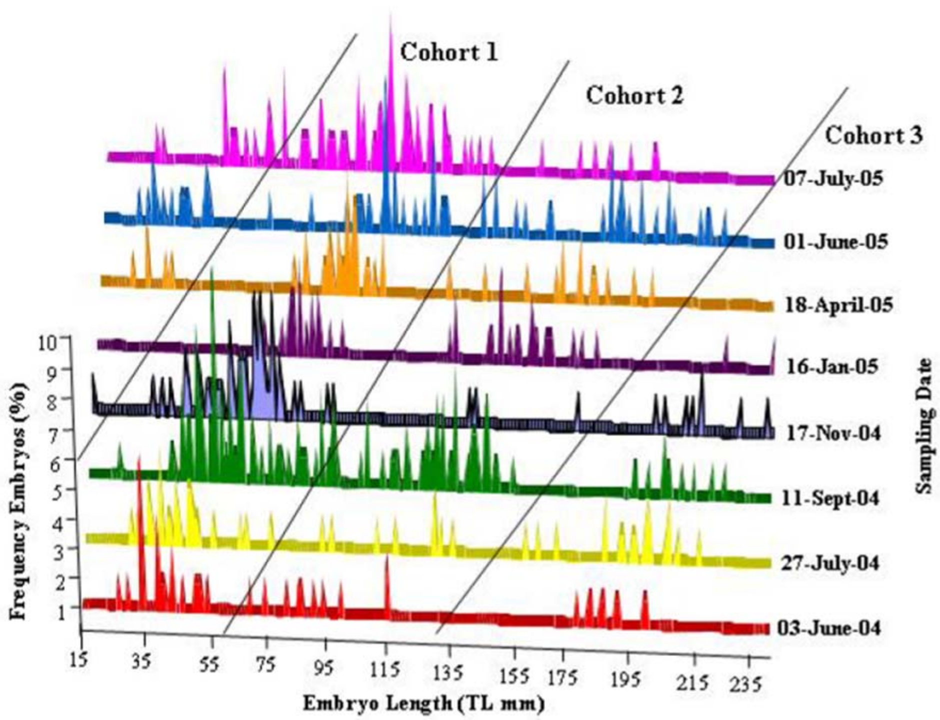


Figure 39. Embryo length composition data used in a cohort analysis of embryo development time.

Figure is from G. Hoff (pers. comm.).

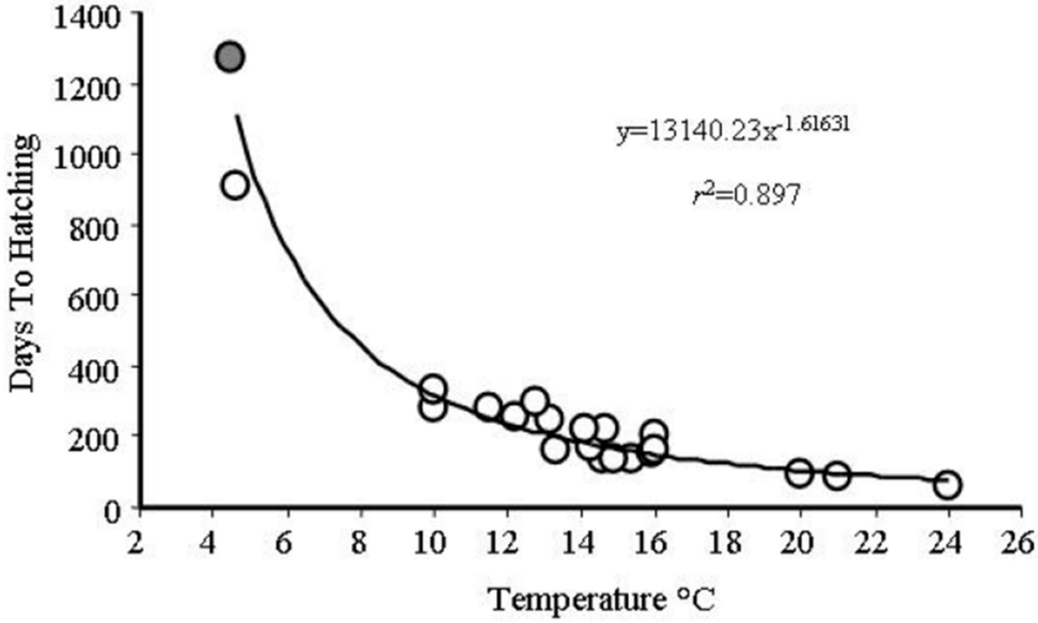


Figure 40. Ocean temperature versus embryo development time for 21 skate species. Dark grey circle is the Alaska skate. Equation and R2 are the values of the fitted relationship. Figure is from G. Hoff, AFSC, pers. comm.

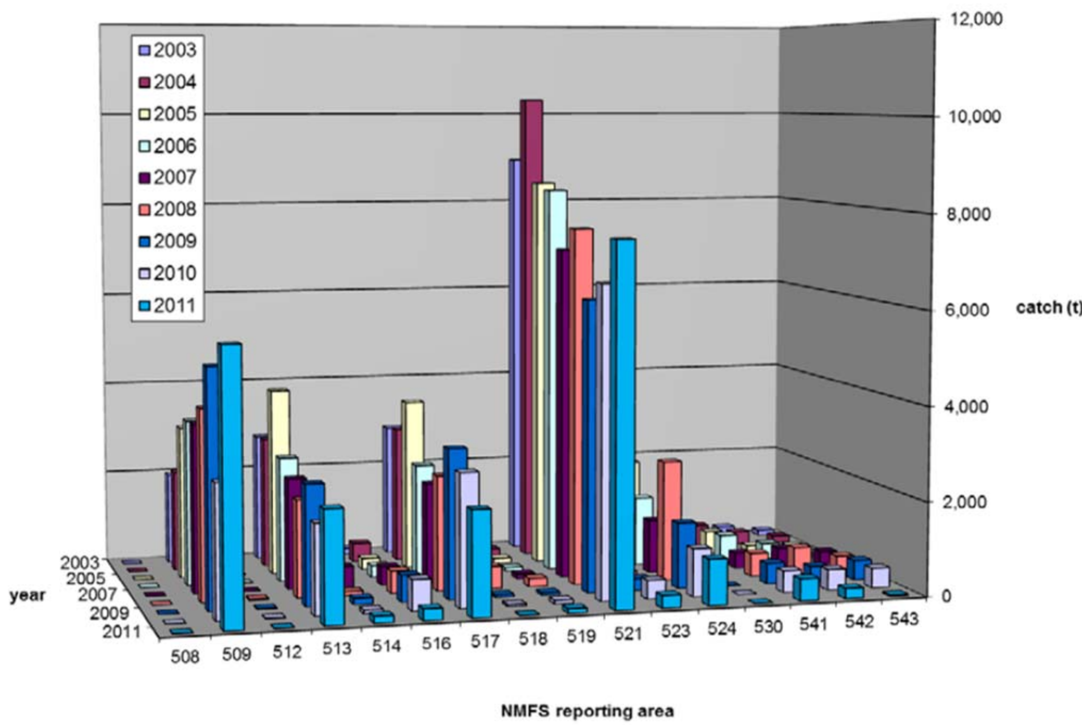


Figure 41. Total skate catch (all species combined) by FMP reporting area for both the EBS and the AI, 2003-2011. Source: AKRO CAS. 2011 data incomplete; reported as of November 3, 2011.

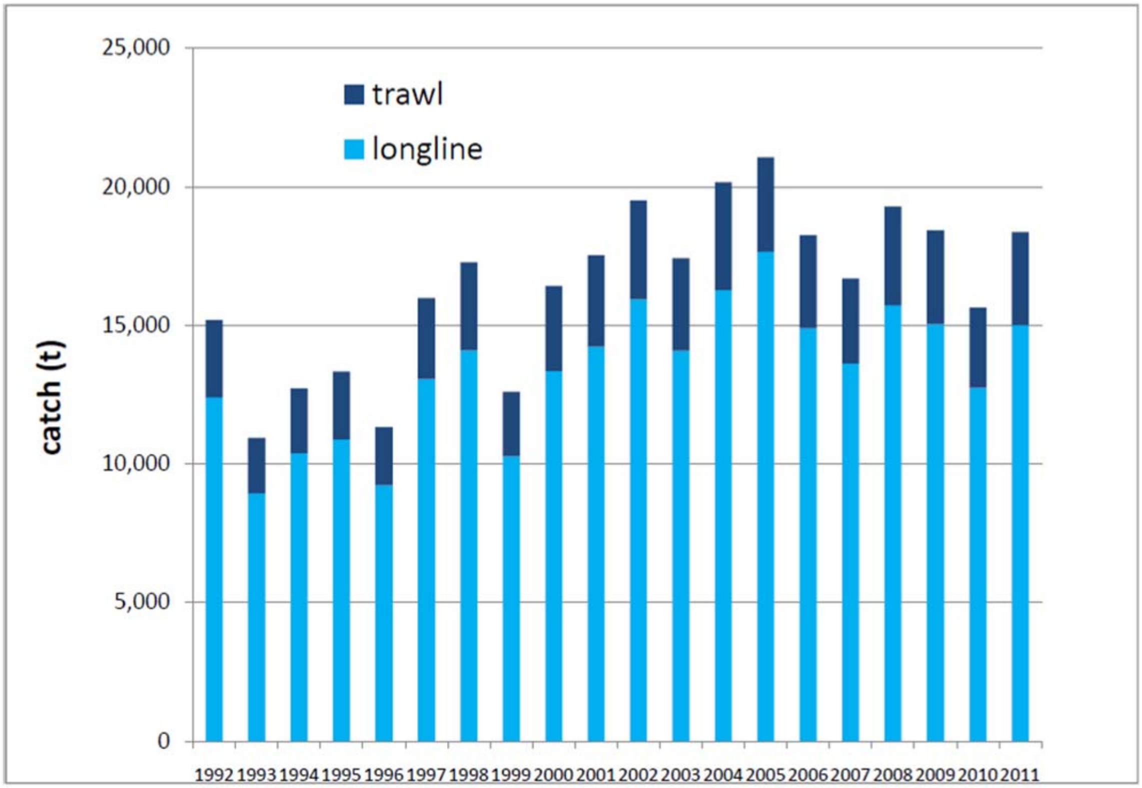
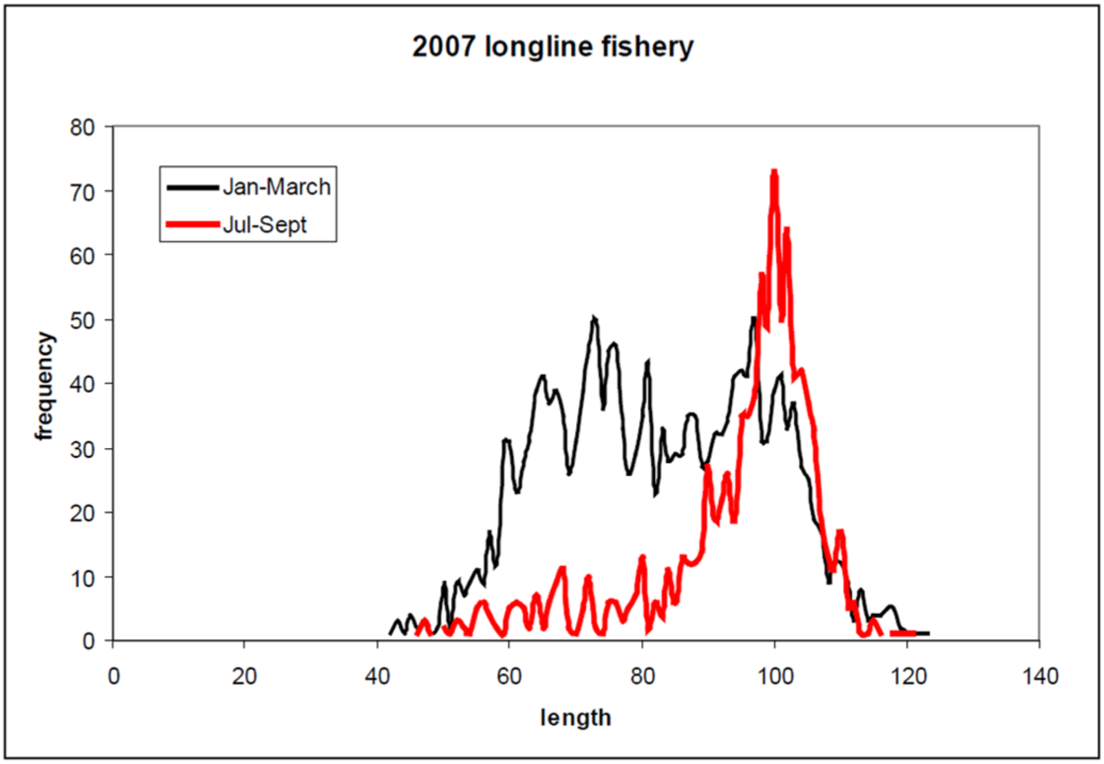


Figure 42. Estimated catch of Alaska skates (t) in the BSAI used in the model, 1992 to 2011. Data were obtained from the Blend system and AKRO CAS. 2011 catch is as reported through November 3, 2011.



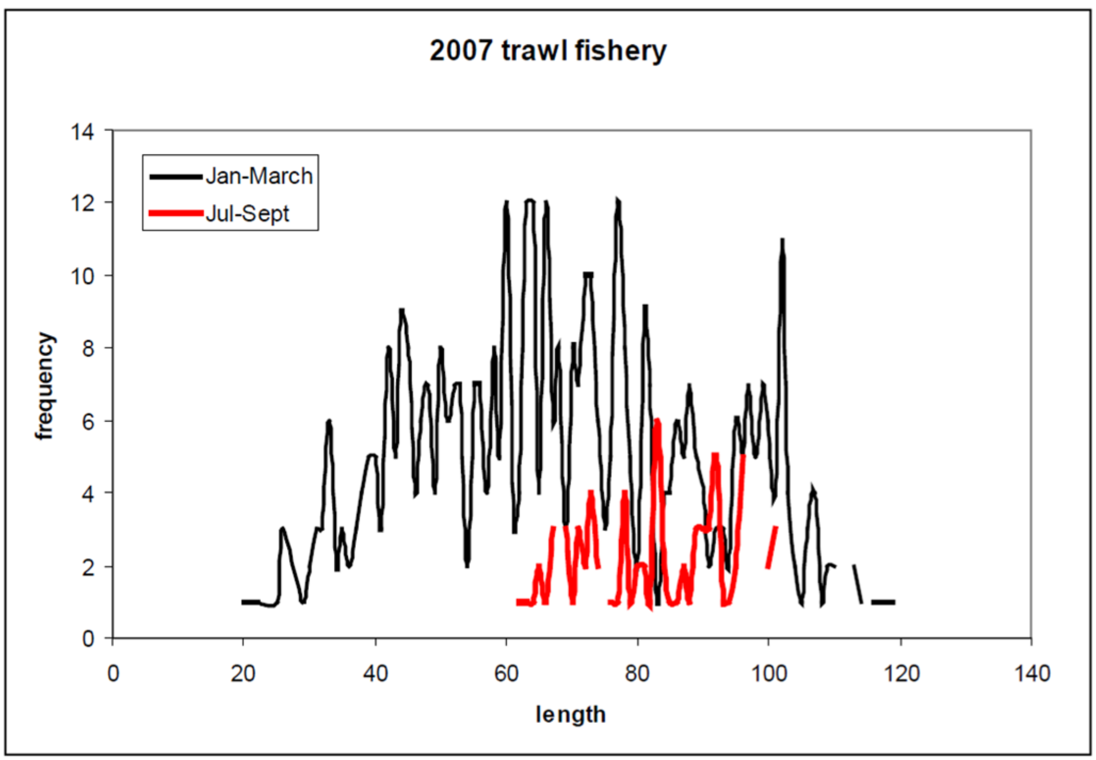


Figure 43. Fishery length compositions by quarter (unbinned data) for Alaska skates during 2007 in the longline and trawl fisheries.

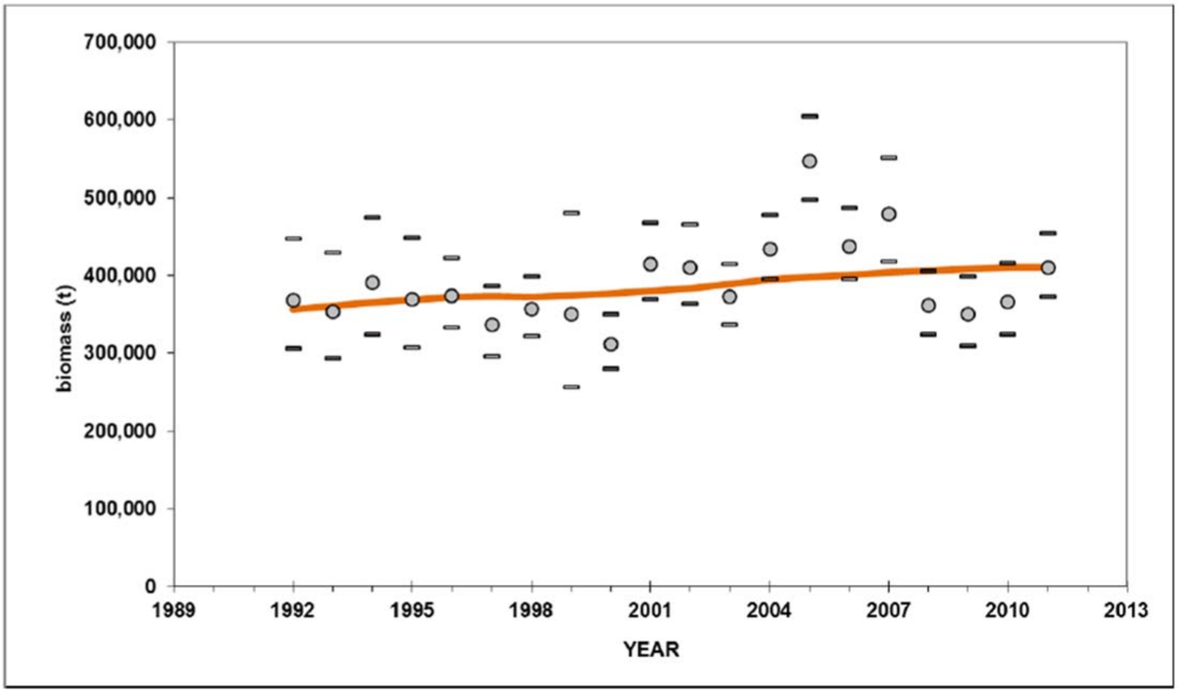


Figure 44. Observed biomass (circles) from EBS shelf surveys 1992-2011, with approximate confidence intervals (± 2 SE), and predicted survey biomass from the model (orange line). – SEPCIES??

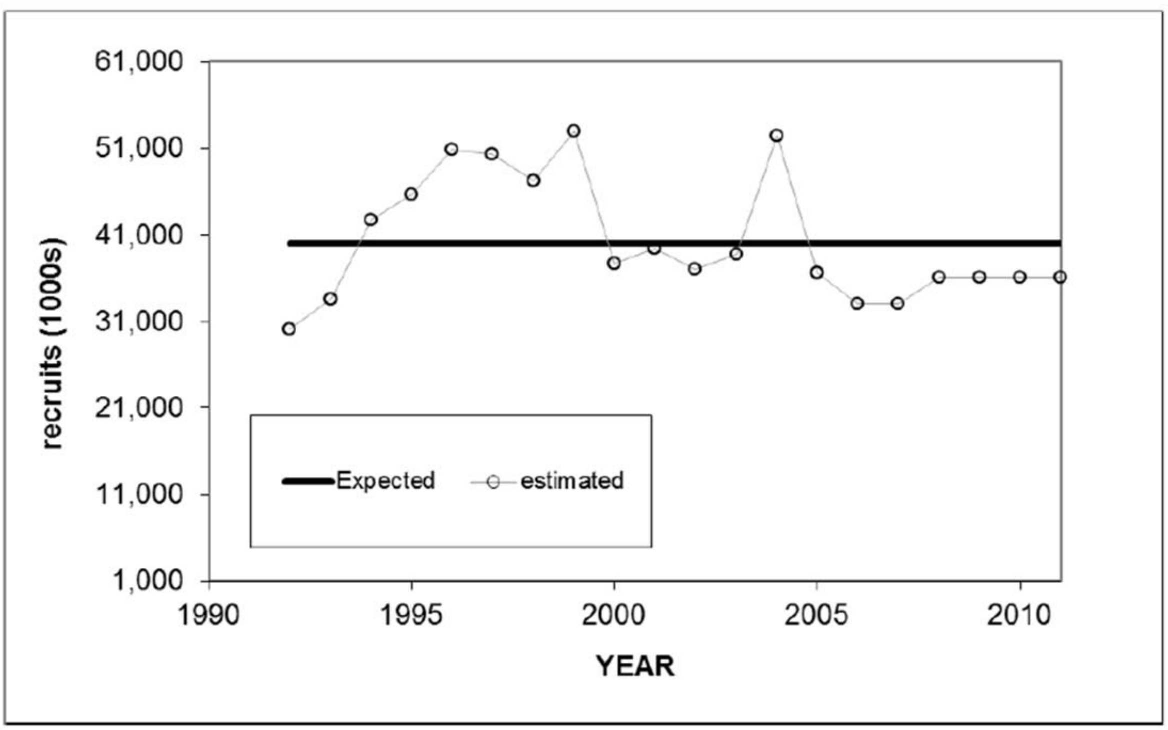


Figure 45. Time series of expected recruitment (in thousands of age 0 fish), with the time series of individual year class estimates predicted by the model and the expected Beverton-Holt stock-recruit relationship with a steepness of 1.0.

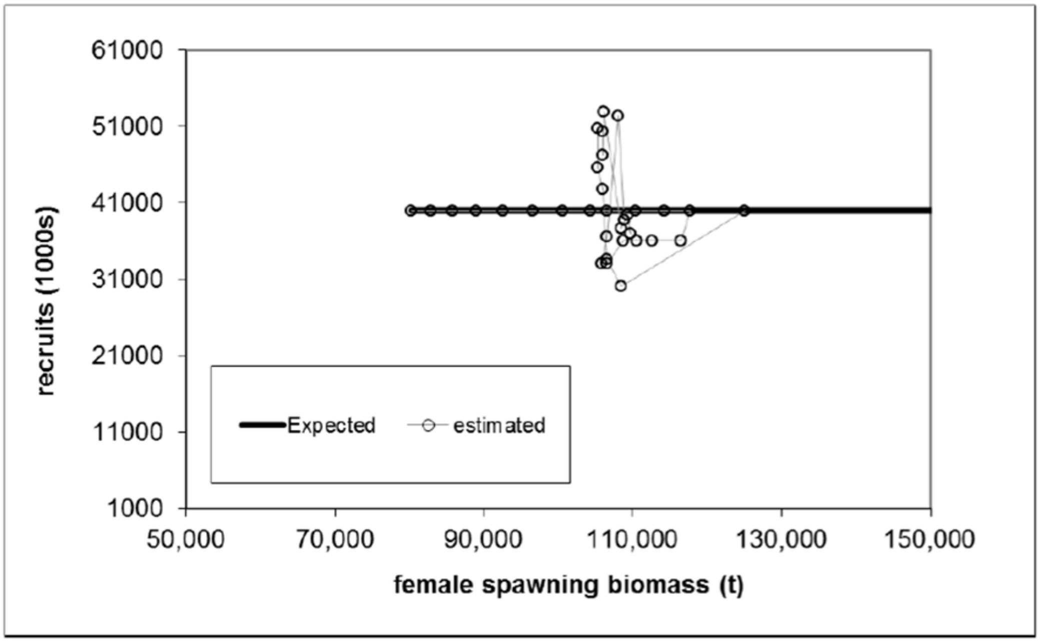


Figure 46. Relationship between female spawning biomass (t) and the number of age 0 recruits (in thousands of fish). Time series of individual year class estimates from SS2 is shown with a Beverton- Holt stock-recruit relationship with a steepness of 1.0.

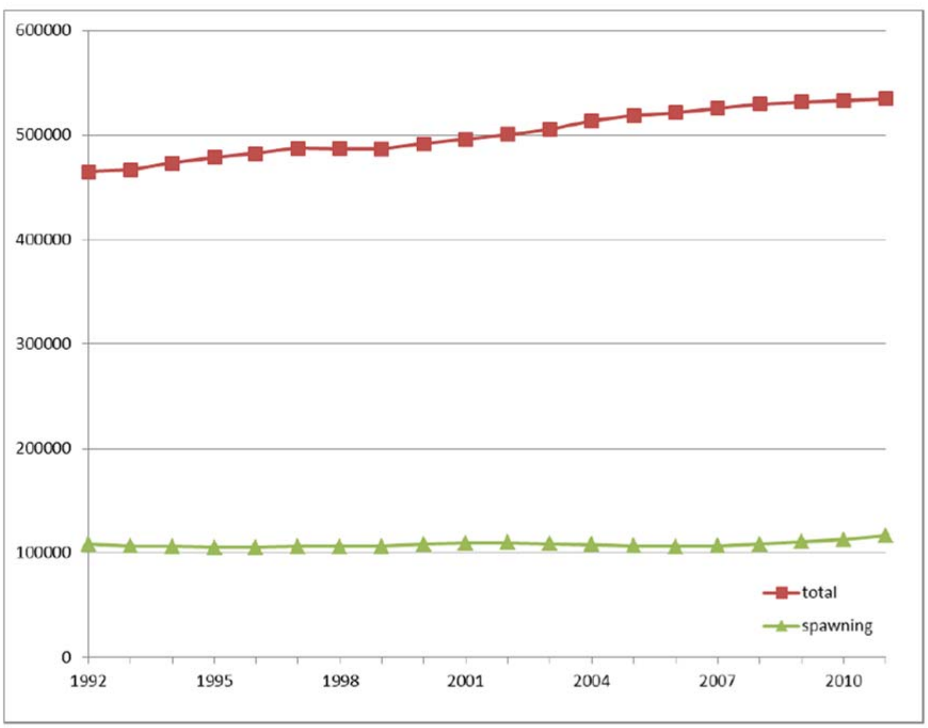


Figure 47. Time series of model estimates for total (age 0+) biomass (t) and female spawning biomass (t).

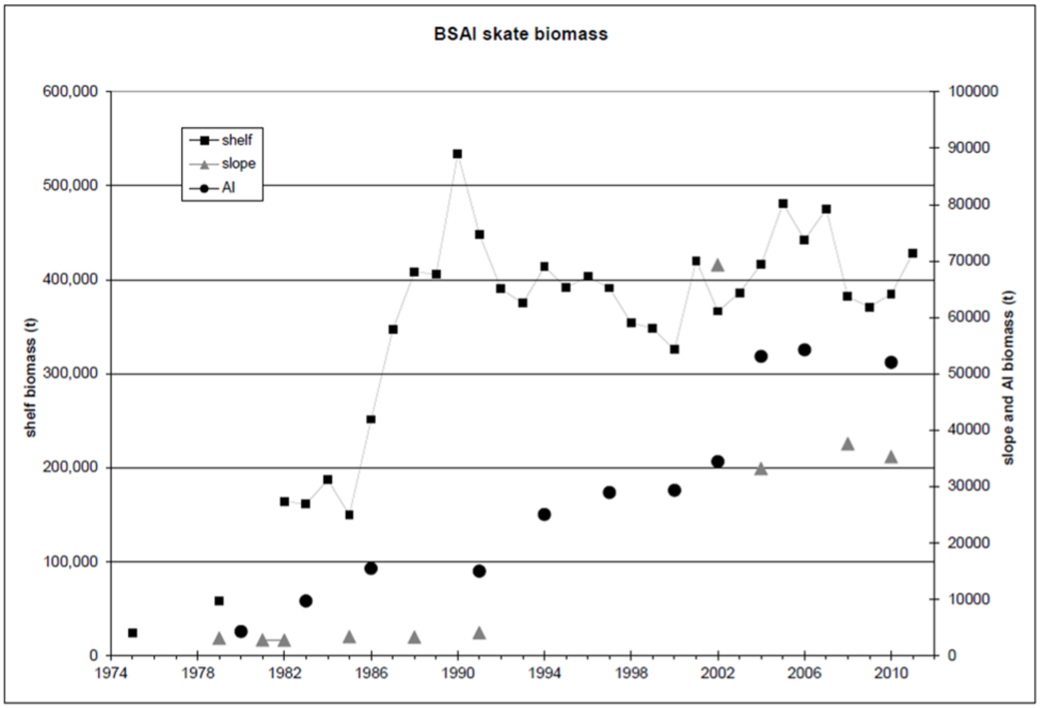


Figure 48. Aggregated skate biomass (metric tons) estimated from RACE bottom trawl surveys in each of the three major habitat areas (1975 – 2011). Note that slope and AI estimates are much smaller and pertain to the secondary y-axis.