FINAL ENVIRONMENTAL ASSESSMENT

For Amendment 104 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area

Habitat Areas of Particular Concern (HAPC) Areas of Skate Egg Concentration

December 2014

Abstract: This document analyzes a proposed action that would amend the BSAI FMP to identify six skate egg concentration sites as HAPC. The identification of these sites as HAPCs highlights the importance of this essential fish habitat for conservation and as a subject for consultation on activities such as drilling, dredging and dumping, laying cables, seismic exploration, as well as fishing. In addition, the Council recommended options that would require monitoring of these sites, identification of these sites as a research priority, and housekeeping changes to the BSAI FMP.

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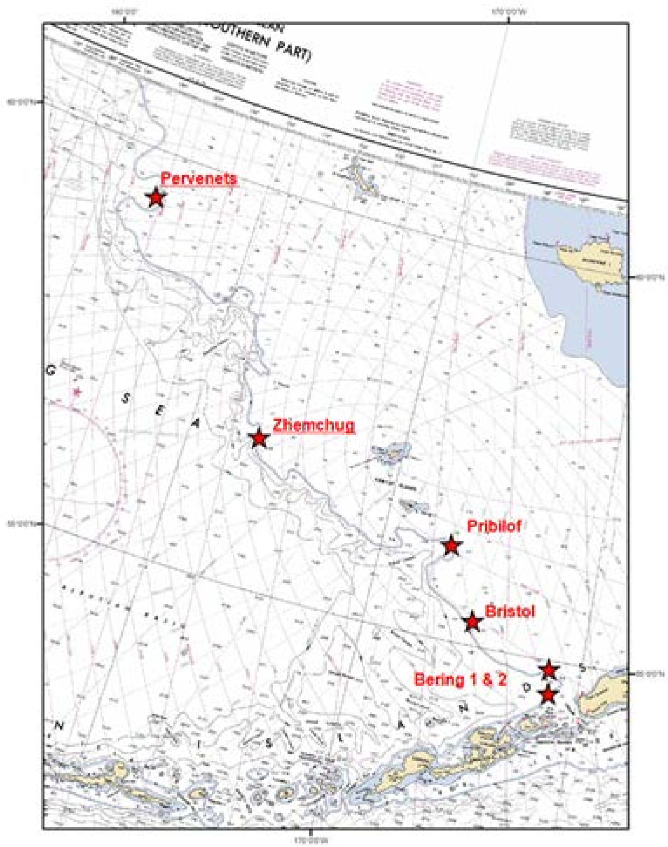
1.0 EXECUTIVE SUMMARY

Habitat areas of particular concern (HAPC) are geographic sites within the distribution of essential fish habitat (EFH) for federally managed species. Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or may be stressed.

In April 2010, the North Pacific Fishery Management Council (Council) set a habitat priority type (skate nurseries) and issued a request for HAPC proposals in conjunction with the completion of its EFH five-year review process. In October 2010, the Council selected a HAPC proposal from the Alaska Fisheries Science Center (AFSC) for further analysis and, on the basis of the preliminary analyses, refined the alternatives options. In February 2013, the Council identified a preferred alternative (Alternative 2, with Options a, d, e).



This document analyzes three alternatives for the identification of skate egg concentration HAPCs and two options (b and c) for gear type prohibitions within those HAPCs. We limit our analysis to those areas of skate egg concentration proposed by the AFSC. Further, the Council has the option to request that the National Marine fisheries Service (NMFS) monitor HAPCs for the effects of fishing (Option a). The Council has the additional options of recommending that research and monitoring of skates be added to its research priority list (Option d) and adopting a housekeeping amendment to the Bering Sea and Aleutian Islands Fishery Management Plan (BSAI FMP) to standardize federal descriptions of Bering Sea habitat conservation measures in FMP Appendix B (Option e).

1.1 Action Alternatives and Options

The problem statement for this action is as follows:

> *HAPCs are geographic sites that fall within the distribution of EFH 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 sea floor 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 deposition 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 sea floor: egg case prongs (or horns) entangle in or cases recruit into the gear. These sites are discrete areas near the shelf/slope break that serve as important spawning and embryonic development areas for skate species. It is therefore important to consider: 1) designating these areas as HAPCs; 2) to consider restricting activities which impact the habitat at these sites; and 3) to monitor the continued utility of these sites for skate spawning and embryonic development, and further study for the relationship between the habitat features of these sites and site selection for skate egg deposition.

To address the issues described in its problem statement, the Council identified three alternatives and five options for analysis, shown below, and added a housekeeping option for the BSAI FMP(Option e). Alternative 2 would amend the BSAI FMP to identify HAPC areas in the Bering Sea. Alternative 3 would amend both the BSAI FMP, and the Alaska Scallop FMP to identify HAPC areas in the Bering Sea and would also implement regulatory changes for Bering Sea groundfish and scallop fisheries.

Alternative 1: Status quo; no action: No measures would be taken to identify, or to identify and conserve, areas of skate egg concentration as HAPCs.

Alternative 2: Identify skate egg concentration areas as HAPC: (Preferred alternative)
Identify six areas of skate egg concentration as HAPCs. At each of the six areas of skate egg concentration, the spatial extent of research bottom trawls containing more than 1,000 egg cases per kilometer squared (km^2) has been established. Boundary lines are then extended outward to the nearest minute of latitude or longitude. The intent of Alternative 2 is to identify these areas as HAPCs.

Under Alternative 2, the six proposed areas of skate egg concentration would be identified as HAPC:

Table 1. Six areas of skate egg concentration proposed for identification as a HAPC under Alternative 2.

Site name[a]	Predominant skate species	Depth of max. egg density (m)	Maximum egg density (eggs/km^2)	Area of HAPC nm^2	Boundaries of HAPC (°N latitude or °W longitude)			
					North	South	West	East
1. Bering 1	Alaska	145	800,406	18.4	54°53′	54°49′	165°46′	165°38′
2. Bering 2	Aleutian	380	62,992	17.5	54°38′	54°33′	165°45′	165°39′
3. Bristol	Bering	156	6,188	13.7	55°21′	55°17′	167°40′	167°34′
4. Pribilof	Alaska	205	16,473	1.2	56°11′	56°10′	168°28′	168°26′
5. Zhemchug	Alaska	217	610,064	3.2	56°57′	56°54′	173°23′	173°21′
6. Pervenets	Alaska, Bering, Aleutian	316	334,163	27.7	59°28′	59°22′	177°43′	177°34′
Total area of the eastern Bering Sea proposed as HAPCs under Alternative 2 = 81.7 nm^2								

[a] The Bering 2 site is south of the Bering 1 site. Sites 3 through 6 run south to north.

Option a: **(Preferred option)** *NMFS would monitor HAPCs for changes in egg density and other potential effects of fishing.*

Alternative 3: Identify and conserve skate egg concentration HAPCs: Identify (individually, severally, or altogether) the areas of skate egg concentration as HAPCs and select conservation and management options for any of these areas. To establish areas that can be effectively enforced, , Alternative 3 sets a minimum size threshold of 5 nm for each side of the core concentration areas to be protected. Where appropriate, the core concentration skate egg areas are enlarged with a buffer of 1 nm beyond the boundary of Alternative 2. Boundaries are then extended outward to the nearest minute of latitude and longitude.

Table 2. Six areas of skate egg concentration proposed for identification as HAPCs under Alternative 3.

Site name[a]	Predominant skate species	Depth of max. egg density (m)	Maximum egg density (eggs/km^2)	Area of HAPC (nm^2)	Boundaries of HAPC (°N latitude or °W longitude)			
					North	South	West	East
1. Bering 1	Alaska	145	800,406	41.8	54°54′	54°48′	165°48′	165°36′
2. Bering 2	Aleutian	380	62,992	40.9	54°39′	54°32′	165°47′	165°37′
3. Bristol	Bering	156	6,188	34.4	55°22′	55°16′	167°42′	167°32′
4. Pribilof	Alaska	205	16,473	28	56°13′	56°08′	168°32′	168°22′
5. Zhemchug	Alaska	217	610,064	27.4	56°58′	56°53′	173°27′	173°17′
6. Pervenets	Alaska, Bering, Aleutian	316	334,163	53.3	59°29′	59°21′	177°45′	177°32′
Total area in the eastern Bering Sea proposed as HAPCs under Alternative 3 = 225.8 nm^2								

[a] The Bering 2 site is south of the Bering 1 site. Sites 3 through 6 run south to north.

This alternative includes two options for gear-types prohibited from use in the areas of skate egg concentrations designated as HAPC.

> ***Option b:*** *Prohibit within skate egg concentration HAPCs the use of "mobile bottom contact"[1] fishing gear: nonpelagic (i.e., bottom) trawl, dredge, and dinglebar gear.*

> ***Option c:*** *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.[2]*

Additional Options

The following options are applicable to ALL alternatives, and with any combination of conservation and management measures:

> **Option d:** **(Preferred option)** *Suggest adding research and monitoring of areas of skate egg concentration to the Council's research priority list.*

This option would incorporate the research and monitoring of skate species into the Council's annual research priority list, to evaluate skate populations, skate egg concentration areas, and their ecology and habitat.

[1] 50 C.F.R. 679.2.
[2] See 50 C.F.R. 679.2 for the particular and intricate components defining "pelagic trawl" fishing gear.

<u>Option e</u>: (Preferred option) *Housekeeping change to FMP Appendix B to add figures to the coordinate pages for the habitat conservation areas adopted with Amendment 89 to the BSAI FMP.*

Option e is a housekeeping amendment to the BSAI FMP, Appendix B, that would consolidate the figures and tables that describe areas in Amendment 89 to the BSAI FMP with the other Bering Sea habitat conservation areas – the Bering Sea Habitat Conservation Area, the Northern Bering Sea Research Area and Saint Lawrence Island Habitat Conservation Area, and the Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area.

1.2 Summary of Environmental Effects

The analysis of direct, indirect, and cumulative effects for the proposed action indicates no significant impacts on the human environment from the three alternatives and any of the possible options for conservation and management. Environmental effects of this proposed action are considered insignificant under all alternatives. These sites are small and discrete areas that have had limited fishing effort in them in the past. No substantial changes in effort re-distribution are anticipated. As such, any effects on habitat, target species, non-target resources, protected species, or the ecosystem would be considered insignificant. Alternatives 2 and 3 are expected to provide some beneficial effects for skates.

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 skate egg concentration areas would likely continue to persist under the current level of fishing effort and distribution. Option d under Alternative 1 would suggest adding areas of skate egg concentration to the Council's annual research priority list. Option e under Alternative 1 would be a housekeeping amendment to the BSAI FMP.

Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as HAPCs. The identification of these sites as HAPCs highlights the importance of this EFH for conservation and as subjects for consultation on activities such as drilling, dredging, laying cables, and dumping, as well as fishing. The impacts of Alternative 2 would be similar in magnitude to Alternative 1 because under Alternative 2 fishing activities are not restricted. However, under Option a, fishing activities in these areas could be more closely monitored through the Ecosystem Stock Assessment and Fishery Evaluation (SAFE) and the EFH five-year review.

Alternative 3 provides for both the identification of skate egg concentration HAPCs and for the conservation of these areas through prohibitions on certain gear types within HAPCs. The impacts of Alternative 3 depend on the option for conservation and management (b and c) selected for each HAPC. , In combination with any skate egg concentration designated as a HAPC, Alternative 3 would limit fishing activities that make contact with the sea floor in these areas by prohibiting the use of certain fishing gears: bottom trawls, scallop dredges, dinglebar gear, and pelagic trawl gear. Options that prohibit trawling in these areas would potentially provide the most protection from direct impacts by fisheries (such as burying or damaging egg cases) and indirect impacts on egg cases (such as dislodgement, movement, siltation, or bycatch mortality). The potential effects of the options on skate populations remain unknown, but insofar as destruction of egg concentrations is avoided, are likely beneficial.

1.3 Summary of Economic Impacts

Economic impacts are expected to be minor under Alternatives 2 and 3, as the proposed HAPC sites are small areas overall and have low levels of fishing effort, particularly the four more northern sites. The most costly option (Alternative 3, Option c) would close these six areas (encompassing a total area of 225.8 nm^2) to all trawl gear.

The economic effects of prohibiting trawling in these sites, under Alternative 3, were approximated by estimating the amount and value of catches that have been recorded in these sites, based on track lines from observed tows from Vessel Monitoring Systems. Data indicated that the catch (and gross ex-vessel value of the catch) varies considerably by site and across the years examined. Two of these sites (Bering 1 and Pervenets) had pollock catches valued at over $1 million in at least one of the years examined. The Bering 1 site had the highest catches of Pacific cod and pollock in 2004, but catches in this area have been very low since then. Bering 2 had the highest catches of pollock in 2004, 2006, and 2007, and the highest catches of other groundfish (arrowtooth flounder) in 2008 and 2009, with almost no catches in other years. In the Bristol site, catches of pollock were made in 2003 and 2004, but almost no catch in other years, and no catch with bottom trawls. Small catches of arrowtooth and pollock have been made in a few years at the Pribilof site. Similarly, small catches of pollock have been made at the Zhemchug site during 2004 through 2006; otherwise it has not been trawled. The Pervenets site had catches of Pacific cod and flathead sole in 2004 and 2008, and pollock from 2007 through 2010. In 2011, the only site that had catches of pollock was Bering 1, and only Bering 2 and Pribilof sites had catches of other groundfish (arrowtooth flounder).

On average, analysis suggests that a closure to pelagic and bottom trawling of these sites (Alternative 3, option c) would result in a maximum foregone gross value of approximately $1,599,000 per year. Of this total, pelagic trawling in the areas could generate a forgone gross value of $1,102,000 per year, and bottom trawling of $497,000, which is the total gross ex-vessel value, divided by the nine years (2003 through 2011) of catch data examined. For comparison, Bering Sea and Aleutian Islands (BSAI) trawl fisheries gross ex-vessel value averaged $515,840,000 over 2006 through 2010 (from the 2011 Economic SAFE, for all trawl species). The average of $1,102,000 per year of estimated forgone pelagic catch gross value equates to approximately 0.21% of an average (2006 through 2010) annual gross value of the BSAI trawl groundfish ($515,840,000). It is likely, however, that the catch would be taken in other nearby areas, so some additional costs to the fleet could be incurred through increased operating costs (increased fuel, lower CPUE, etc.), rather than as a result of forgone catch. Testimony from fishermen has indicated that in addition to these costs, a closure of the Bering 2 site may have the potential to cause crowding of the pollock fleet in years when the fish are holding deeper, resulting in substantial additional costs, gear conflicts, and other effects.

There would be no economic impacts on other fisheries. Although Alternative 3 options prohibit the use of dredge gear and dinglebar gear in the proposed HAPC areas, these gear types have not been used in these areas to date. Other fisheries using pot gear or longline gear would continue to be allowed to fish in these areas and, thus, would be unaffected by the action.

2.0 INTRODUCTION

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 (Magnuson-Stevens Act). Pursuant to the Magnuson-Stevens Act, the North Pacific Fishery Management Council (Council) developed and adopted a fishery management plan (FMP) for the groundifsh fisheries of the Bering Sea and Aleutian Islands (BSAI).

Habitat areas of particular concern (HAPCs) 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 regulations provide a means for the Council to identify HAPCs (50 C.F.R. 600.815(a)(8)) in an FMP. FMPs should identify specific types or areas of habitat within EFH as HAPCs based on one or more of the following considerations:

> (i) The importance of the ecological function provided by the habitat;
> (ii) The extent to which the habitat is sensitive to human-induced environmental degradation;
> (iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type;
> (iv) The rarity of the habitat type. Specific to fishery actions, HAPCs are areas within EFH that are rare and are either ecologically important, sensitive to disturbance, or that may be stressed.

The Council has a formalized process identified in 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 economic, social, 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 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.

Accordingly, the Council has requested that this analysis evaluate six sites of skate egg concentration in the Bering Sea as proposed HAPC sites. This Environmental Assessment (EA) examines the environmental, economic, and socioeconomic aspects of the proposed FMP amendment for the groundfish fisheries in the eastern Bering Sea. The proposed action would designate areas of skate egg concentration as HAPCs in the eastern Bering Sea. The other FMP that could be affected by this action (depending on the alternative and option chosen) is the Scallop FMP.

An 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 socioeconomic and natural or physical environmental impacts are interrelated, the EA must discuss all of these impacts on the quality of the human environment. If an analysis of the relevant considerations determines that impacts of the federal action will be insignificant, then the EA and accompanying finding of no significant impact (FONSI) are the final environmental documents required by NEPA. The EA must have 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. This analysis also addresses the Magnuson-Stevens Act, which is applicable to this proposed action. References and literature cited are included, as well as a list of preparers, 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 Federal waters off Alaska 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, economic, 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 Gulf of Alaska (GOA) and the Aleutian Islands, consisting of seamounts and high density coral areas, were identified as HAPCs in the FMPs: the GOA Groundfish FMP, the BSAI Groundfish FMP, the BSAI Crab FMP, the Alaska Salmon FMP, and the Alaska Scallop FMP. To protect these sites and eliminate environmental impacts due to fishing, the Council prohibited fishing in these areas by gear types that contact the sea floor. These sites and measures became effective in June 2006.

The Alaska Seamount Habitat Protection Area encompasses sixteen named seamounts in fifteen sites in Federal waters off of Alaska; on NOAA charts these seamounts are Bowers, Brown, Chirikof and Marchand (on one site), Dall, Denson, Derickson, Dickens, Giacomini, Kodiak, Odessey, Patton, Quinn, Sirius, Unimak, and Welker. Bottom-contact fishing is prohibited in all of the seamount HAPCs, which encompass a total area of 5,329 nm^2. In Southeast Alaska, three sites with large aggregations ("thickets") of long-lived *Primnoa sp*. 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—are prohibited in these zones, whereas the remainder of the areas are identified as HAPC, but without additional management measures. 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 B – Color Figures 1 and 2, and in the tables below:

Table 3. HAPCs within the NMFS Alaska Region.

HAPC name	Individual HAPCs within	Total Area (approx.)	Fishery Management Application	Specific Regulation
Alaska Seamount Habitat Protection Areas	• Dickens Seamount • Denson Seamount • Brown Seamount • Welker Seamount • Dall Seamount • Quinn Seamount • Giacomini Seamount • Kodiak Seamount • Odessey Seamount • Patton Seamount • Chirikof & Marchand Seamounts • Sirius Seamount • Derickson Seamount • Unimak Seamount • Bowers Seamount	5,300 nm^2	No federally permitted vessel may fish with *bottom contact* gear[3].	Federal Register 50 CFR Part 679 Vol. 71, No. 124 Wednesday, June 28,2006
Bowers Ridge Habitat Conservation Zone	• Bowers Ridge • Ulm Plateau	5,300 nm^2	No federally permitted vessel may fish with *mobile bottom* contact gear[4].	Same as above
GOA Coral Habitat Protection Areas	• Cape Ommaney 1 • Fairweather FS1 • Fairweather FS2 • Fairweather FN1 • Fairweather FN2	14 nm^2	No federally permitted vessel may fish with *bottom contact* gear in portions of the site.	Same as above

[3] "Bottom contact" gear means nonpelagic (i.e., bottom) trawl, dredge, dinglebar, pot, or hook-and-line (i.e., longline) gear (50 C.F.R. 679.2).

[4] "Mobile [bottom] contact" gear means nonpelagic trawl, dredge, or dinglebar gear (50 C.F.R. 679.2).

Table 4. Comparison of existing HAPCs with proposed HAPCs, in terms of area.[5]

HAPC - Current	Area nm^2	Gear Restrictions
Bowers Ridge/Ulm Plateau	5,286	No mobile bottom contact gear
Alaska Seamounts		No moblie bottom contact gear
Dickins	147	
Denson	287	
Brown	167	
Welker	162	
Dall	950	
Quinn	201	
Giacomini	164	
Kodiak	158	
Odessey	210	
Patton	94	
Chirikof & Marchand	2,248	
Sirius	167	
Derickson	218	
Unimak	129	
Bowers	29	
Total	**5,330**	
GOA Coral HPA		No bottom contact gear
Cape Ommaney	0.85	
Fairweather N1	0.77	
Fairweather N2	3.20	
Fairweather S1	7.88	
Fairweather S2	0.86	
Total	**14**	
HAPC Total (current)	**10,630**	
Other EFH HCAs or HPCs		
GOA Slope HPA	1,892	No nonpelagic trawl gear
Aleutian Islands HCA	279,114	No nonpelagic trawl gear
Aleutian Islands Corals HPA	112	No bottom contact gear
Arctic	148,393	No commercial fishing
St Matthew HCA	4,110	No nonpelagic trawl gear
St Lawrence HCA	7,033	No nonpelagic trawl gear
Nunivak/Kuskokwim HCA	9,718	No nonpelagic trawl gear
Bering Sea HCA	47,121	No nonpelagic trawl gear
NBSRA	65,559	No nonpelagic trawl gear
EFH & HAPC Areas Total	**573,682**	

HAPC - Proposed Skate Nursery	Alt 2 - Identify HAPC Area nm^2	Alt 3 - Identify & Conserve HAPC Area nm^2
Bering 1	18.4	41.8
Bering 2	17.5	40.9
Bristol	13.7	34.4
Pribilof	1.2	28
Zhemchug	3.2	27.4
Pervenets	27.7	53.3
Total	**81.7**	**225.8**

Terminology	
EFH	Essential Fish Habitat
HAPC	Habitat Area of Particular Concer
HCA	Habitat Conservation Area
HPA	Habitat Protection Area
HCZ	Habitat Conservation Zone

2.2 HAPC Recommendations for Council Consideration

From 2006 to 2007, the Council considered whether to initiate a HAPC proposal process during discussions related to Bering Sea Habitat Conservation. The Council reviewed the previous 2004 HAPC cycle and determined a review 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 definitions of the HAPC

[5] No bottom contact gear applies to only portions of the GOA Coral HPA sites.

criteria prior to the next Council RFP. Following discussion through a workgroup composed of members of the SSC, NMFS, and the Plan Team, the Council adopted the SSC's recommended revisions to the HAPC criteria. See Appendix A for the Council's revised HAPC determination criteria.

The Council also considered whether to set a HAPC priority for Bering Sea "skate nurseries" (i.e., "areas of skate egg concentration" or "skate egg deposition sites") and for undersea canyons in the Bering Sea. The Alaska Fisheries Science Center (AFSC) was contacted in October 2006, and asked to produce a white paper summarizing current scientific information on the canyons and "skate nurseries" in the eastern Bering Sea. The Council received the paper at its December 2006 meeting. Following public input and review by the Plan Team and SSC, the Council determined that it would be premature to initiate a call for proposals, because there were no identified conservation concerns at that time.

At its April 2010 meeting, the Council set a habitat priority type—"skate nurseries[6]"—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 (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). 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. Council staff initially screened the proposals 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 in a matrix based on the Council's revised and adopted HAPC evaluation criteria. See Appendix A for details on the HAPC evaluation methodology. At the October 2010 meeting, staff presented the preliminary report of screening results to the Advisory Panel and the Council. The Council selected the HAPC proposal from the 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 Advisory Panel, the Ecosystem and the Enforcement Committees, and the Council. The Council selected three alternatives and five options for conservation and management for full analysis.

2.3 Development of a Preferred Alternative

At its February 2012 meeting, the Council moved to expand the analysis and current suite of alternatives and options. The analysis was also reviewed by the Ecosystem and Enforcement Committees. Under the Council's motion, Alternative 2 was revised to include a discussion on potential industry and agency monitoring, reporting, and accountability mechanisms and a statement of intent to discourage adverse fishing activities within the HAPC sites. Alternative 3 was revised to include HAPC area boundaries consistent with the Enforcement Committee's minimum size and buffer recommendations. Option d was reworded to suggest adding research and monitoring of areas of skate egg concentration to the Council's annual research priority list. The expanded analysis also included a lengthier history of fishing activities in the proposed sites; a discussion of the ability to minimize the areas closed to fishing while complying with enforcement requirements; an economic analysis of impacts on the proposed closure sites, including buffers; and reports on the amount of actual bycatch of egg casings, by gear type, in each HAPC site, where known.

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

At its March/April 2012 meeting, the Council eliminated options that would have restricted fishing with fixed gear—pot and hook-and-line (i.e., longline)—that had been determined to have minimal-to-no impacts on the seafloor within the HAPCs; thus a prohibition on those gear types would have offered only marginal conservation benefits. A new option (Option a) was added to Alternative 2 to require NMFS to monitor areas of skate egg concentration for changes in egg density and other potential effects of fishing and to request that industry support collection of data in evaluation of monitoring and management efforts. The Council also moved to expand the analysis to evaluate the use of the most updated Vessel Monitoring System technology, increased polling rates, and geo-fencing to monitor fishing activity. In addition, in accordance with the Council's requests, gear descriptions were updated to reflect the most recent changes in technology, and survey trawls have been differentiated from commercial trawls. A description of the methodology used in determining target catch rates in skate sites has also been added, as well as descriptions of existing fishery closures in the Bering Sea for potential overlap with the HAPCs. This analysis also incorporates recommendations and comments, to the extent practicable, from the SSC and Enforcement Committee.

At the June 2012 meeting, the Council made another initial review of the analysis and recommended revisions to the problem statement and options. The Council selected Alternative 2 and Options a, d, and e as its Preliminary Preferred Alternative, and released the document for public review. In February 2013, following public comment and input from its advisory bodies, the Council took final action and unanimously selected Alternative 2 (with options a, d, and e) as its preferred alternative. In taking this action, the Council noted the following points:

- these six sites meet HAPC criteria, and all six sites were selected;
- there is no requirement for restricting fishing activities in HAPC;
- designation as HAPC provides protection, and prompting serious review and consultation on proposed activities (e.g, drilling, laying cables, seismic exploration, as well as fishing activities) that could potentially effect these special habitat areas;
- there is no evidence of adverse impacts of fishing on skate populations;
- continued monitoring of these sites will allow for additional conservation measures to be taken in the future, if indicated;
- closing areas to fishing increases enforcement costs, and increases economic costs to industry; and
- Alternative 2 clearly addresses the problem statement.

2.4 Summary of Proposed Skate HAPCs

Skates are elasmobranch fishes that reproduce by depositing a small number of large eggs protected by proteinaceous egg cases directly on the sea floor in localized 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, skate species deposit their eggs in highly localized areas, known as "nursery sites," (see Section 2.4.4 on nursery nomenclature) or as areas of skate egg concentration. 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 there is evidence of extended skate embryonic development (greater than three years) and evidence that that eggs cases are vulnerable to being disturbed or removed by bottom-contact fishing.

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 AFSC proposes primary conservation and management measures that prohibit the use of any fishing gear that makes contact with the sea floor within each area of skate egg concentration and require those areas to be monitored.

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 eastern Bering Sea are proposed as HAPCs. 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 the abiotic features of the site that may define EFH. The exception is the Pribilof site, which was mapped using an autonomous underwater vehicle equipped with a high-resolution camera. Additional mapping work has been performed by autonomous underwater vehicles at several of the other sites listed, but those data were not used to delineate the original boundaries of the proposed sites. At each site, the spatial extent of bottom trawls containing more than 1,000 egg cases per km^2 was established.

2.4.1 Research Conclusions, Assumptions, and Remaining Unknowns

Intensive study of a particular biological aspect of a species nearly always leads to additional questions, as well as to conclusions and inferences. In the following list, we identify what we know, what we infer from known facts, and what additional questions we still have about Skates. It goes without saying that there are surely many questions that we not yet knowledgeable enough to ask.

2.4.1.1 Known-Research Conclusions

1) Skates use relatively small distinct areas of the eastern Bering Sea upper continental slope and outer shelf to deposit their eggs in high concentrations.
2) Skate embryos develop into juvenile skates and emerge from the egg cases.
3) Embryo development time is between 3-4 years and a function of environmental temperature.
4) Egg cases are rarely (or in very low concentrations) found outside nursery sites.
5) Skates nursery sites are generally species specific with low overlap in species.
6) Skate embryos are impacted by being brought to the surface by trawling and physical handling.
7) Skates are found in very high densities inside nursery sites in June and July.

2.4.1.2 Inferences from Research and General Biological Principles

1) Skate nursery sites are important for skate reproduction.
2) Skates have low fecundity and rely on high survivorship of juveniles.
3) Exceptional habitat conditions that occur along the upper slope are optimum for skate reproduction success.
4) A single annual spawning event occurs at each site resulting in multiple cohorts developing at any time at each nursery site.
5) Skate nursery disturbances are detrimental to the successful embryo development and hatching process due to the fragile nature of embryos and any reduction in impact to developing embryos can enhance the survivorship of embryos and juvenile skates.
6) Skate nursery sites display evidence of site fidelity, and natal homing and persistence.

2.4.1.3 The Unknown-Future Research or the Unknowable

1) The impact that a trawl has by the physical pressure of the sweeps, foot rope, ground gear and doors on skate eggs lying on the substrate
2) The extent of impact on skate eggs from being removed from the skate nursery site bottom, being brought to the surface and returned to the water
3) The results of prohibition of physical contact with commercial fishing gear to skate eggs and the effect on recruitment and health of skate populations
4) The specific oceanographic and habitat conditions that make the areas of skate nursery sites

2.4.2 Supporting Research

Much of the information used to support these six HAPCs candidate areas comes directly from the AFSC and years-long research effort by Dr. Gerald R. Hoff, an AFSC fishery biologist, to identify, map, and study areas of skate egg concentration in the eastern Bering Sea. Dr. Hoff's work has been supported through NOAA EFH funds and grants from the North Pacific Research Board. In addition, the Council requested that the AFSC produce a white paper summarizing scientific information on "skate nursery areas," or areas of skate egg concentration in the eastern Bering Sea (as well as the 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 for the AFSC. Data collected from NMFS groundfish surveys, directed research trawls, and fisheries observer data were all used to identify potential nursery sites (egg case concentration areas). Directed research trawl surveys examining areas of skate egg concentration, using 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 150m to 375m) 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 more than 100,000 eggs/km^2.

This work and earlier research (Hoff 2008) also identified the presence of multiple cohorts within areas of concentration 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 embryos to predation and disturbance.

Skates exhibit a K reproductive strategy, which is characterized by slow growth, late maturity, large sizes, and extremely low fecundity, when compared to species exhibiting an R reproductive strategy such as pollock. Skates invest a large amount of energy into a small number of offspring and rely on the high survival rate of juveniles for maintaining the strength of populations. This life history strategy is dependent on high recruitment and low embryo mortality during development.

The autonomous underwater vehicle research study conducted in 2009 was also used to obtain estimates of egg production in the four then-known Alaska skate areas of egg concentration, which were then compared to estimates of egg and juvenile abundance from AFSC research trawl surveys and stock assessments (Hoff 2009). This work indicated that the known areas of skate egg concentration probably are not sufficient to sustain the population of Alaska skates and, thus, there are likely to be areas of skate egg concentration not identified.

2.4.3 Expected Sites for Three Skate Species

It is helpful in the current HAPC cycle to produce a reasonable estimate of the expected number of sites in the eastern Bering Sea used by skates for depositing their eggs. Ecologically, this information can help scientists understand how skates partition and use their habitat and which environmental parameters may be the most critical for successful reproduction. Biologically, areas of skate egg concentration shed new light on skate reproduction and what role these areas may play in skate life history strategies. The number, location, and area used for skate egg deposition is useful as a gauge for the economic impact it could have on fishing activity and on enforcement challenges for gear restrictions.

To estimate the expected number of areas of skate egg concentration of the three skate species included in the proposed HAPC designation in the eastern Bering Sea, researchers synthesized data from directed research and the AFSC bottom trawl groundfish surveys. The estimation of the expected number of nursery sites for each species is based on the notion that the number of juvenile skates seen in the AFSC bottom trawl groundfish surveys reflects the egg production from the identified areas of skate egg concentration. The simplest method for estimating an expected number of sites, by species, is a direct comparison of the estimated number of viable eggs present at each nursery site (from the directed skate nursery surveys) to the abundance of young-of-the-year skates estimated in the groundfish surveys. In other words, given the number of viable eggs at the known sites, how many more sites would be required to sustain the population size estimated in the groundfish surveys?

The model used (Equation 1, below) compared the estimated number of viable skate eggs from a single cohort in all confirmed areas of skate egg concentration for each species to the estimated number of young-of-the-year skates of that species in the eastern Bering Sea shelf and slope AFSC groundfish bottom trawl surveys. When young-of-the-year abundance exceeded the total single cohort viable egg counts, researchers estimated the number of average areas of skate egg concentration that could produce the young-of-the-year abundance.

Several important limitations to this approach must be noted. This simple model does not include corrections for such important parameters as trawl escapement of juvenile skates (i.e. selectivity) and post-hatching mortality. Including these parameters would tend to increase the expected demand of viable embryos in the egg concentration sites, thus increasing the expected number of such sites. Reliable estimates of these parameters do not exist and are a priority for future research. The analysis also does not include any estimates of uncertainty, which can be substantial. An age-structured model exists for Alaska skates in the eastern Bering Sea, and young-of-the-year estimates from that model might be expected to be more accurate than the raw survey estimates. However, the Alaska skate model is simple and does not include detailed early life-history information. Therefore, estimates of abundance of young-of-the-year skates in the model were considered to be insufficiently reliable for use in this analysis. The lack of a similar model for the remaining two skate species was also a contributing factor in limiting the analysis to the simple approach outlined above.

The eastern Bering Sea skate population occurs at mid-slope depths with the bulk of its population occurring from about 100 m to 500 m. It also has a moderate population estimate from NMFS trawl surveys. Since it appears as a mid-depth species, it is most likely that it is under-sampled on the eastern Bering Sea shelf from the AFSC trawl survey. A large percentage (22.7%) of the Bering skate biomass encountered during the eastern Bering Sea shelf NMFS trawl survey occurs between 150 m and 200 m. Since the AFSC shelf survey is of fixed-station design, its annual distribution of effort is about two percent of the deepest 50 m (approximately 10 stations annually) with only about 0.07% of the effort between 175 m and 200 m depth (less than one station annually) of a nearly 400-station survey. A large portion of the population is likely to be under-sampled where its density is highest.

2.4.3.1 Model Predictions

As shown in the table below, model results suggest that we know approximately one half of the areas of skate egg concentration for the Alaska, Bering, and Aleutian skates combined with an expected total of 13 to 14 sites for these three species. Variability in the number of expected sites is a function of the egg case density and size of each nursery site and the abundance of juvenile recruitment.

The Alaska skate is the most abundant skate species in the eastern Bering Sea and predominantly a shelf species. The population dynamics are not completely understood for this species, and it demonstrated a remarkable ability to undergo a dramatic population increase during the 1980s. Because of the large population, four additional sites are a minimal estimate for the recruitment observed.

The Aleutian skate is a moderately abundant species along the shelf edge and upper to mid slope; however, it does not deposit its eggs at extremely high densities, and sites are relatively small in area resulting in a relatively high number of additional sites to account for the observed recruitment. Critical to the variance in this estimate is the juvenile escapement under the survey trawl footrope, which can significantly alter the estimate. This has not been studied for the net used for the eastern Bering Sea slope groundfish bottom trawl survey.

The Bering skate deposits its eggs at low densities in many sites. The extrapolations indicate the number of sites known can account for the juvenile production estimates from the shelf and slope bottom trawl groundfish 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 from 150 m to 200 m. It is likely there are many more recruits for the Bering skate and that several additional areas of skate egg concentration are probable.

An important aspect of this estimation in the HAPC process is that it helps to demonstrate how the proposed action would benefit Bering Sea skate populations. The three species, Alaska, Aleutian, and Bering skates compose greater than 90% of the eastern Bering Sea skate biomass and all shelf and upper slope species occurring in heavily fished areas along the outer shelf and slope. Because of their large size, great biomass and low reproductive potential they are vulnerable to increased mortality from habitat disturbances. The estimates described above suggest that the proposed HAPC designation might provide protection for up to perhaps *one half* of the reproductive habitat for these three species.

Equation 1. To estimate the number of areas of skate egg concentration in the Eastern Bering Sea.

$$E = \left(\frac{r}{\Sigma \left(\frac{a\,d\,v}{c} \right)} \right) s$$

Where: E = number of expected sites by species
r = recruitment estimate from AFSC bottom trawl survey
a = approximate area of skate nursery site
d = mean egg density in eggs/km^2
v = viability of eggs (research determined to be 80%)
c = number of concurrent cohorts at each nursery site (research determined 3)
s = number of known sites for that species

Table 5. Egg estimates for each area of concentration and the annual cohort estimate comparing areas of concentration to trawl survey estimates (YOY=young-of-the-year)

Nursery Site	Total Nursery Area (km2)	Egg Density (mean eggs km2)	Total Estimated Eggs	Single Year Viable Eggs	Number of Identified Nursery Sites	YOY Juveniles Survey Estimate	Number of Sites Estimated
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	10	18,000	180,000	48,000	1		
Bristol Canyon	56	65	3,631	968			
Bering Canyon	38	43,496	1,671,775	445,807	1		
Totals	**243**	**34,150**	**8,618,407**	**2,298,242**	**4**	**3,552,698**	**6-7**
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**	**298,113**	**2**	**286,204**	**2-3**
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**	**8-9**
*Based on autonomous underwater vehicle study Note: total sites expected adjusted for double-counting.						**Total sites expected**	**13-14**

Source: AFSC.

2.4.4 Skate Egg Site Nomenclature

This analysis uses the term “skate egg concentrations” to describe these areas where skates deposit their egg cases in mass for the purpose of reproduction. This is synonymous with the term “skate nursery,” which is the term for these areas used in the scientific literature (Hoff 2008, Love et al. 2008, Hoff 2010, Treude et al. 2011, Hunt et al 2011). The terminology was originated for viviparous sharks which gave live birth in distinct nearshore habitats where the young would spend their early life. The term nursery as applied to this behavior has been well vetted and is the most appropriate for this reproductive mode. As with many scientific concepts and terminology, skate life history was detailed following sharks, and many of the established terms applied to skates were previously established for sharks. Our understanding of skate nursery habitat and biology is in its infancy, with just a few publications on the subject outside studies of the Eastern Bering Sea species. Although little work has been done in this field worldwide, areas where skates deposit their egg cases for reproduction are known as skate nurseries. Those identified as potential HAPC areas in the eastern Bering Sea are clearly distinct habitats with unique properties that are advantageous for successful reproduction in skates.

The concept of North Pacific skates using "nursery sites" for egg deposition is not a new one; the terminology of "nursery sites" has traditionally been applied to oviparous species. 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. Many sharks use the classic example of nursery sites where a pregnant female migrates to a particular bay or nearshore area and gives birth to live young. The young sharks then remain in the "nursery" for some period until able to survive in open water. In this case, the area for young to remain for a period where they may need extra nutrients or protection is the well-excepted idea of a nursery area. This terminology has been applied to areas where skates deposit their egg cases in mass; there are fundamental differences, however, in the reproductive strategy of oviparous skates and most viviparous sharks. Primarily skates (Rajidae) in the Northeastern Pacific deposit eggs directly on the substrate and the embryo develops independent of maternal nutrients or care other than what was initially given. Many sharks and true rays (Mylobatidae) have some form of viviparity in which the egg cases and embryos are retained in the female body and provided nutrients by the mother until fully developed and produced into the environment as free swimming juveniles. Sharks and true rays do not go through the extended period in the egg case before hatching, as skates do.

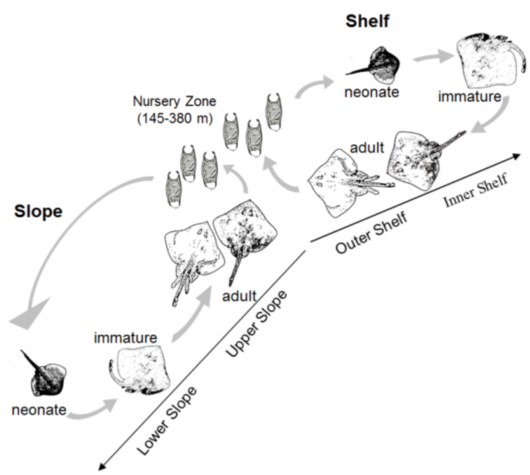


Figure 1. Life cycle with respect to habitat use for skates along the slope (200 to 1200 m) and the shelf (0-200 m) in the eastern Bering Sea.

Research since 2003 on skate reproduction has found that "nursery sites" may not be the optimal terminology for how skates use the habitat. Other terminology follows the concept of "skate nesting sites." Functionally, skate nursery sites operate much like those of marine turtles, which for their reproductive habitat and mode are widely accepted as "nesting sites." To understand how skates use the habitat, researchers 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 throughout the parents' life.

After its deposition, internally the skate egg looks identical to birds and many reptiles. A large yolk mass is 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. The embryo develops 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 areas of skate egg concentration.

2.5 Delineation of HAPCs

Data for the AFSC HAPC proposal and this analysis were collected predominantly from research bottom trawl studies at skate egg concentration sites where an adaptive sampling strategy was applied. The goal was to identify the areas of high concentrations of skate egg cases and subsequently move in all four (or more) directions away from the center to detect the drop in egg case density, and thereby locate the extent of the egg concentration site. In the process, and due to mechanics of trawling, ability to clean the net, and the moderate scattering of empty egg cases out of the area of skate egg concentration, researchers found a slight ‘contamination’ from one research 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 research trawl and during the study was often found to be from a previous tow. Because of the uncertainty of this low level, this threshold has been designated as background levels and not included as part of the egg concentration area. See Appendix B – Color Figures 9-24.

From the annual AFSC groundfish trawl survey of the eastern Bering Sea, researchers have encounters skate eggs frequently at this threshold level (1,000 eggs/km^2), and these encounters do not indicate skate egg concentration in the immediate areas. There are several possible explanations why there may be low level skate eggs widely scattered outside concentration sites:

1) skates may “wander” a certain amount where they deposit eggs randomly away from concentration sites for unknown reasons;

2) skates may be some distance from an area of skate egg concentration when the eggs are ready to deposit and concentration occurs whether inside a concentration site or not;

3) newly maturing skates may have a learning curve to find the appropriate habitat and they may not be successful immediately upon maturation; and

4) there may be scattering out of the concentration site due to currents, predator disturbances, or fishing disturbances. Throughout this analysis, an order of magnitude greater (10,000 eggs/km^2) than background has been used to identify area of skate egg concentration from research and groundfish survey trawls or commercial trawls 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). From this identified area of concentration, the boundaries of the skate egg deposition site are determined by the extent of the threshold level of 1,000 eggs/km^2.

The capture of skate egg cases in trawls depends on the net configuration, such that capture rates in commercial trawls may be substantially different than in research survey nets. The adjacent text box shows the detailed specifications of the 83-112 Eastern Trawl that was used for skate nursery research, the identical net used for the standard eastern Bering Sea shelf AFSC groundfish survey. During the survey this net is towed at 3 knots and 6’ x 9’ V doors weighing 1800 lb and two point attachment tail chains are used. During the skate nursery research the identical net was used with the modifications of using 6’ x 9’ door weighting 2000 lb with four point attachment tail chains, 2 to 2.5 knot towing speed, and in some cases (Bering 1) 200 kg weights were attached to each trawl wing to ensure good bottom contact.

Specifications of the 83-112 Eastern Trawl used in AFSC surveys.

Netting:	Body and wing 4" stretched measure (including length of one knot) 60 T nylon, three strand twist, preshrunk and dyed green. Intermediate and codend - 3½" stretched measure 96 T nylon three-strand, twist, preshrunk and dyed green. Codend liner - 1¼" stretched measure 18 T nylon, three-strand twist, preshrunk and dyed green. Chaffing gear ~ 6", 6-mm polyethylene knotted web.
Headrope:	83' 9" of ½" (6×19) galvanized fiber core wire rope wrapped with d" polypropylene rope. Both eyes have ½" gusseted thimbles. The headrope doesn’t include the length of either eye. Length is measured from the top of the nicro sleeve to the top of nicro at the other end. Top wings are hung over 36'.
Footrope:	111' 9" plus thimbled eyes of e", (6×19) galvanized, fiber core wire rope, wrapped with ½" polypropylene rope. Loops of 5/16" galvanized, proof coil chain, (approx. 170') are tied to wrapped footrope by passing two fathoms of double 21 T nylon twine through every tenth link starting at the top of the nicro forming the eye splice. Chain links are secured to footrope every 8" throughout length of wing forming 76 chain hangings over 50' each wing. Busom has 16 chain hangings equally spaced over 11' 9". There are four bars (2 meshes) per hanging in wings and 4 meshes per hanging in busom, hung with 96 T nylon round braid hanging twine. After the net is hung, split pieces of heavy rubber hose are served around footrope, passing the hose twice between each chain hanging for the length of the footrope.
Breastlines:	½" (6×19) galvanized wire rope wrapped with d" polypropylene rope. Top and bottom breastlines are 8', measured from the top of the nicro press forming one eye through the bearing point of the other eye.
Riblines:	¾" Samson 2 and 1® Duralon braided trawl rope. Riblines are hung at 97% of stretched measure of the gored seam. All measurements are made with 400 lb of tension on rope. Gored seams are attached to riblines using white, untreated 60 T braided nylon hanging twine used to tie a benzel every 16".
Flotation:	Seventeen 8" aluminum side lug floats along each wing and seven 8" floats in center. Total of 41 floats along headrope spaced 24¼" apart. Buoyancy of 6.3 lb each (258 lb total).
Side seams:	Side seams are laced in top and bottom individually gathering 3 meshes (4 knots) using white, double 21 T perma-grip® (or like kind) nylon three-strand twine. Top and bottom panels are then laced together using green, double 21 T perma-grip® (or like kind) nylon three-strand twine.
Codend:	3½" stretched measure (including one knot) nylon, dyed green, 96 T nylon three-strand mesh. Codend is a “double wall” construction. Four panels of 96 T web cut 64 meshes long by 120 meshes deep. Two meshes on each side are laced together, leaving 60 “open meshes” per panel. Gored seams are laced together using 60 T round braid hanging twine and hung to riblines of ¾" Samson 2in1® Duralon braided trawl rope. Riblines in codend are hung at 90% of stretched measurement of gored seams. Riblines are measured under 400 lbs of tension. Codend is closed at aft end using 24-2½" x 5/16" galvanized steel rings. A ¼" Duralon braided rope is passed through 5 selvage meshes and a ring is attached to the rope using a cow hitch every 12" leaving five open meshes between each ring. The bag is then closed using a e" - ¾" hauling clip. A liner of 1¼" three strand twine nylon, 360 meshes long by 200 meshes deep is hung on the inside of the bag 78 meshes up from terminal end.
Doors:	6’ x 9’ V doors weighing 1800 lb with two point tail chain attachment.

Under Alternative 2, the boundary lines are extended to the nearest minute of latitude or longitude away from the center of the area of skate egg concentration. This extension 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.

For effective enforcement and monitoring, and in response to the recommendations of the Enforcement Committee, Alternative 3 establishes minimum size thresholds around the core concentration areas that are at least 5 nm to a side and, where appropriate, enlarged with a buffer of 1 nm beyond the original boundary. Boundaries are then snapped outward to the nearest minute of latitude and longitude. See EA Appendix B – Color Figures 3-8.

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 habitat areas of particular concern (HAPC). 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).

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. (See Section 6.0.)

The proposed action is limited to the eastern Bering Sea. Depending on the alternative selected, the intent is to discourage or prohibit fishing activities that make contact with the sea floor. Effects of this action that are analyzed are therefore limited to the locations of the six sites proposed as a HAPC and to any component of the environment that may be impacted by fishing prohibitions under Options a and b.

3.1 Relevant National Environmental Policy Act (NEPA) Documents

The NEPA documents listed below have detailed information on the Bering Sea and Aleutian Islands (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. The CEQ regulations encourage agencies preparing NEPA documents to incorporate by reference the general discussion from a broader Environmental Impact Statement (EIS) and concentrate solely on the issues specific to the environmental assessment being 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).

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

In June 2004, the National Marine Fisheries Service (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 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. During staff tasking at its February 2012 meeting, the North Pacific Fishery Management Council (Council) discussed the schedule for review of the groundfish PSEIS. Until the current PSEIS is reviewed, revised or supplemented and adopted, the 2004 PSEIS remains the relevant evaluation of alternative groundfish fishery management programs on the human environment.

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 the 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 forth by the PSEIS's 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 Gulf of Alaska (GOA) and the 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.

3.1.2 Alaska Groundfish Harvest Specifications Environmental Impact Statement

In January 2007, NMFS completed the EIS analyzing the impacts of various harvest strategies for the Alaska groundfish fisheries. 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.

3.1.3 Essential Fish Habitat Environmental Impact Statement

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 has revised the EFH sections of its FMPs to address the results of the five-year review through the EFH Omnibus Amendment package adopted in April 2011 (77 FR 66564).

In 2005, NMFS and the Council completed the EIS for Essential Fish Habitat Identification and Conservation in Alaska. 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 HAPCs 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).

3.2 Purpose and Need for the Action

The purpose of this action designating areas of skate egg concentration as HAPCs is to protect habitat for eggs and developing embryos of skate 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 from some fishing gear. In addition, fishing and other human activities 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), conservation and management of skate species need to protect areas of skate egg concentration and limit the potential loss of skates in its early life stages.

3.2.1 Statement of Purpose and Need

The Council adopted the following statement of purpose and need at its June 2012 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 sea floor 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 deposition 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 sea floor: egg case prongs (or horns) entangle in or cases recruit into the gear. These sites are discrete areas near the shelf/slope break that serve as important spawning and embryonic development areas for skate species. It is therefore important to consider: 1) designating these areas as HAPCs; 2) to consider restricting activities which impact the habitat at these sites; and 3) to monitor the continued utility of these sites for skate spawning and embryonic development, and further study for the relationship between the habitat features of these sites and site selection for skate egg deposition.*

3.3 Alternatives

This EA evaluates the impacts of three alternatives, which include a no-action alternative, gear use restriction options, and other options for research and housekeeping. The alternatives and options are not mutually exclusive to the six proposed HAPCs, and any combination may be selected for each area proposed: the options may be chosen in any combination with the alternatives. Three alternatives for the identification of skate egg concentration HAPCs and two options (b and c) for gear type prohibitions within those HAPCs are analyzed in this document and listed below. Consideration of areas of skate egg concentration is limited to the six candidate sites from the AFSC proposal. Further, the Council has the option to request that NMFS monitor HAPCs for the effects of fishing and that industry support those efforts (Option a). In addition, the Council has the options of recommending that research and monitoring of skates be added to its research priority list (Option d) and of adopting an FMP housekeeping amendment to add maps to the coordinate pages in FMP Appendix B for Bering Sea habitat conservation areas (Option e).

In order to address the issues described in its statement of purpose and need, the Council identified three alternatives and five options for analysis, shown below. Both Alternatives 2 and 3, would amend the BSAI FMP to identify HAPC areas in the Bering Sea. Alternative 3 would also amend the Scallop FMP and implement housekeeping changes for BSAI FMP.

In February 2013, the Council identified Alternative 2, Options a, d, and e as its preferred alternative.

3.3.1 Alternative 1: Status quo; no action

No measures would be taken to identify or conserve areas of skate egg concentration as HAPCs.

Alternative 1, the status quo or no-action alternative, involves no measures to identify areas of skate egg concentration as HAPCs or to protect and conserve those areas of skate egg concentration from adverse fishing effects.

None of the skate egg concentration sites overlap with existing marine protected areas. Several sites do fall within established marine managed areas, but offer little in the way of fish habitat protection. For example, the proposed HAPC site at Pervenets canyon falls within the BSAI canyons Opilio Crab Bycatch Limitation Zone, which closes to specified fisheries if a certain bycatch limit of crabs taken in this area is reached in specified fisheries. Similarly, the proposed sites at Bering 1 and Bering 2 fall within the Catcher Vessel Operational Area and the Steller Sea Lion Conservation Area. Pollock catcher processors are prohibited from fishing for pollock in the Catcher Vessel Operational Area during the pollock B-season.

3.3.2 Alternative 2: Identify skate egg concentration HAPCs: (Preferred alternative)

Six areas of skate egg concentration are identified as HAPC. At each of the six areas of skate egg concentration, the spatial extent of research bottom trawls containing more than 1,000 egg cases per kilometer squared (km^2) has been established. Boundary lines are then extended outward to the nearest minute of latitude or longitude. The intent of Alternative 2 is to identify these areas as HAPCs.

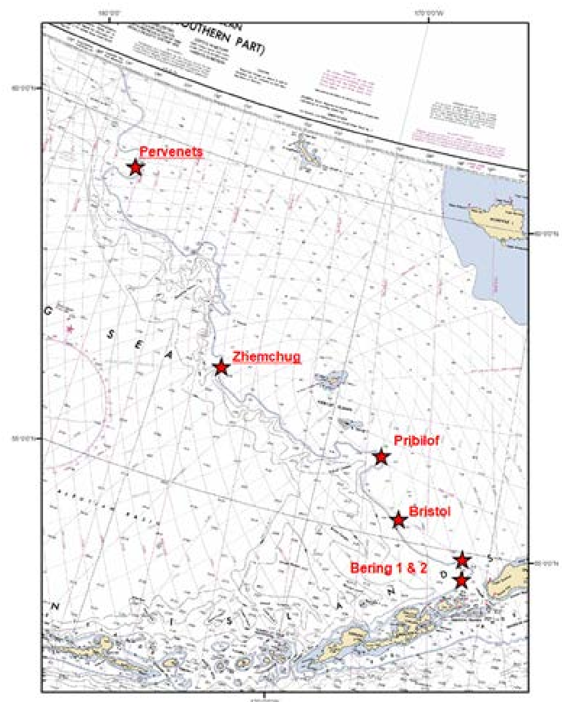
Option a: **(Preferred option)** *NMFS would monitor HAPCs for changes in density of egg case deposition and other potential effects of fishing.*

Under Alternative 2, the six proposed areas of skate egg concentration will be identified as HAPC:

Table 6. Six areas of skate egg concentration proposed for identification as a HAPC under Alternative 2.

Site name[a]	Predominant skate species	Depth of max. egg density (m)	Maximum egg density (eggs/km^2)	Area of HAPC nm^2	Boundaries of HAPC (°N latitude or °W longitude)			
					North	South	West	East
1. Bering 1	Alaska	145	800,406	18.4	54°53′	54°49′	165°46′	165°38′
2. Bering 2	Aleutian	380	62,992	17.5	54°38′	54°33′	165°45′	165°39′
3. Bristol	Bering	156	6,188	13.7	55°21′	55°17′	167°40′	167°34′
4. Pribilof	Alaska	205	16,473	1.2	56°11′	56°10′	168°28′	168°26′
5. Zhemchug	Alaska	217	610,064	3.2	56°57′	56°54′	173°23′	173°21′
6. Pervenets	Alaska, Bering, Aleutian	316	334,163	27.7	59°28′	59°22′	177°43′	177°34′
Total area of the eastern Bering Sea proposed as HAPCs under Alternative 2 = 81.7 nm^2								

[a] Counterintuitively, the Bering 2 site is south of the Bering 1 site. Sites 3 through 6 run south to north.



Alternative 2 would identify areas of skate egg concentration as HAPCs without any associated conservation or management measures. The Council may select one or more of the six areas identified as potential skate egg concentration HAPCs (see Table 6). The identification of these sites as a HAPC 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. Under Alternative 2, the Council would not limit fishing activities or prohibit gear types that make contact with the sea floor. With the addition of Option a, the alternative will allow monitoring of the impacts of fishing activities in the proposed HAPC sites, primarily at the population level, and if practicable, the development of additional information on fishery interactions with egg concentrations.

At each site, the spatial extent of bottom trawls containing more than 1,000 egg cases/ eggs/km^2 was initially established. Under Alternative 2, the boundary lines were then extended to the nearest minute of latitude or longitude away from the center of the concentration area. This extension created a buffer region to account for the possibility of additional eggs in un-sampled areas. Using whole minutes also allowed for a simpler boundary line that would be easier to discern by fishing vessels, regulators, and policymakers.

Under Alternative 2 Option a, skate sites would be designated as HAPCs, and NMFS would monitor these sites for changes in egg density and other potential effects of fisheries. Regular analysis of Vessel Monitoring System data on fisheries trawl intensity at each site (as done for this analysis) could be done each year and reported in the annual Ecosystem SAFE report. This would allow the assessment author and the Council to know when there are major changes in trawl fishing effort on HAPC areas and potential impacts to skate eggs. Additionally, trends in fisheries trawl effort, catch of skate eggs of each species, and effort by other gear types could be reported regularly as part of the EFH five-year review. Should a change occur in skate recruitment or overall biomass of a species potentially related to fishing impacts on these HAPC sites, the Council could initiate an analysis to take further action to restrict fishing activities at those sites

3.3.2.1 Option d (Preferred)

This option would incorporate the research and monitoring of skate species into the Council's annual research priority list, to evaluate skate populations, skate egg concentration areas, and their ecology and habitat. Under Option d, the plan teams and the SSC would consider adding areas of skate egg case concentration as a research priority to the Council's annual research priority list, in order to incorporate continuing research into skates, to evaluate skate populations, additional skate egg concentration areas, and their ecology and habitat. Dr. Gerald R. Hoff, AFSC, has compiled the description below of the three most important research priorities, as of February 2012.

In addition, the BSAI skate stock assessment authors have recommended continued study of areas of skate egg concentration to evaluate their importance to population production. Adult skates appear capable of significant mobility in response to general habitat changes, but any effects on the small scale area of skate egg concentration crucial to reproduction could have disproportionate population effects. Eggs are mostly limited to isolated 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. After hatching, juveniles most likely remain in continental shelf and slope waters, but specific distribution is unknown; adults are found across wide areas of the shelf and slope.

3.3.2.2 List of Research Priorities

1) *Develop a clearer picture of the habitat conditions that produce productive skate egg deposition sites.*

In the eastern Bering Sea no fewer than eight nursery sites occur between 135 m and 400 m for the three most abundant skate species. The nursery sites are highly correlated with undersea marine canyons, egg cases are highly concentrated, and sites are persistent for many years. There is evidence of site fidelity by mature adults with protracted embryo development causing multiple cohorts to be present concurrently at any site. A clearer understanding of the specific oceanographic and biological processes common to skate nursery sites across species, bottom types, and major ecosystems will provide a framework for developing a working hypothesis of the habitat conditions necessary for successful recruitment. An understanding of habitat parameters common to skate nurseries will provide estimates of the influence of climate change, habitat disturbance, and ecosystem shifts on these vulnerable species.

2) *Monitoring of known skate sites to determine the effect of protective measures.*

A nursery site for the Alaska skate at the head of Bering Canyon has undergone activity from fishing for at least thirty years. Digital images of this site, when compared to three eastern Bering Sea sites for the Alaska skate, show this site to possess distinct properties with regard to bottom type and egg case distribution. The benthic habitat is soft "fluffy" sediment and egg cases are highly scattered over a broad area when compared to distinctly hard sand and gravel bottom types with areas of highly concentrated egg cases at the three northern sites. Developing a monitoring program that includes frequent studies of this site as to changes in benthic habitat, egg density, and skate population will provide valuable information on the success of protective measures and information on the recovery time for this important habitat. Research for monitoring this habitat would include underwater camera systems and oceanographic equipment.

3) *Examine population structure as determined by site fidelity to skate egg deposition sites.*

Population structure in skates is an important aspect in understanding skate reproduction. In the eastern Bering Sea the Alaska skate has at least four skate nursery sites. There is evidence of site fidelity for egg deposition which potentially may help develop population structure within this large ecosystem. Understanding the specific role skate nursery sites play in successful recruitment and development of populations is key to the successful management of these sensitive species. Research leading to these questions will involve genetic studies and a tagging program to monitor adult behavior at skate nursery sites.

3.3.2.3 Option e (Preferred)

This option would add figures from Section 3.5.2.1.7 of the FMP to the coordinate pages in the FMP's Appendix B that describe the Bering Sea habitat conservation areas from Amendment 89 to the BSAI FMP – the Bering Sea Habitat Conservation Area, the Northern Bering Sea Research Area, the Saint Lawrence Island Habitat Conservation Area, and the Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area.

NMFS has determined that the figures for these areas need to be added to the coordinate pages for these areas in the Appendix B of the FMP. The FMP itself would remain unchanged. Option e would only change Appendix B in the FMP. It is unnecessarily complicated for the public to refer to one page for the map of the area and refer to one or more other pages for the coordinates of the same area. NMFS plans future rulemaking to revise the figures and tables in 50 CFR part 679 for these same habitat conservation areas to consolidate the figures with their area(s) coordinates. The standard format of the 50 CFR Part 679 regulations has one graphic with a figure number to contain both the (a) map and the (b) coordinates that describe the management area(s) shown on the map. This amendment would ensure the FMP is consistent with the format of the regulations when this future rulemaking is completed. Figures 70-72 in Appendix B to this EA shows the closure figures and the associated coordinate tables as they appear in 50 CFR part 679.

3.3.3 Alternative 3: Identify and close skate egg concentration HAPC(s)

Identify areas of skate egg concentration as HAPCs and select different closure options (b or c) for any area identified as a skate egg concentration HAPC. To achieve effective enforcement of these areas, Alternative 3 establishes a minimum size threshold for the core concentration areas to be protected of at least 5 nm to a side and are then, where appropriate, enlarged with a buffer of 1 nm beyond the original boundary under Alternative 2. Boundaries are then extended outward to the nearest minute of latitude and longitude.

This alternative includes two options relative to what gears would be prohibited from use in the areas of skate egg concentrations designated as HAPC.

> **Option b:** *Prohibit within skate egg concentration HAPC(s) the use of "mobile bottom contact"[7] fishing gear: nonpelagic (i.e., bottom) trawl, dredge, and dinglebar gear.*
>
> **Option c:** *Prohibit within skate egg concentration HAPC(s) the use of "mobile bottom contact" and pelagic trawl fishing gear: nonpelagic and pelagic trawl, dredge and dinglebar gear.[8]*

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

Table 7. Six areas of skate egg concentration proposed for identification as a HAPC under Alternative 3.

Site name[a]	Predominant skate species	Depth of max. egg density (m)	Maximum egg density ($eggs/km^2$)	Area of HAPC (nm^2)	Boundaries of HAPC (°N latitude or °W longitude)			
					North	South	West	East
1. Bering 1	Alaska	145	800,406	41.8	54°54′	54°48′	165°48′	165°36′
2. Bering 2	Aleutian	380	62,992	40.9	54°39′	54°32′	165°47′	165°37′
3. Bristol	Bering	156	6,188	34.4	55°22′	55°16′	167°42′	167°32′
4. Pribilof	Alaska	205	16,473	28	56°13′	56°08′	168°32′	168°22′
5. Zhemchug	Alaska	217	610,064	27.4	56°58′	56°53′	173°27′	173°17′
6. Pervenets	Alaska, Bering, Aleutian	316	334,163	53.3	59°29′	59°21′	177°45′	177°32′
Total area in the eastern Bering Sea proposed as HAPCs under Alternative 3 = 225.8 nm^2								

[a] Counterintuitively, the Bering 2 site is south of the Bering 1 site. Sites 3 through 6 run south to north.

Alternative 3 provides for both the identification of areas of skate egg concentration as 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 area of 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. The table below summarizes the gear types that would or would not be allowed in areas of skate egg concentration, based on the option selected.

Table 9. Summary table of gear type prohibited under each option for Alternative 3.

Gear type prohibited	Option b	Option c
Nonpelagic (bottom) trawl	yes	yes
Dredge	yes	yes
Dinglebar	yes	yes
Pelagic trawl	no	yes

Only Alternative 3 requires enforcement considerations. At the February 2012 meeting, the Enforcement Committee received an overview of the three alternatives presented in the analysis. The Enforcement Committee noted that if the Council decided to identify the areas skate egg concentration as HAPCs with associated protection and conservation measures using Vessel Monitoring Systems (VMS), there is a minimum size requirement that would allow for protection given the limitations of VMS polling (once or twice per hour), uncertainty in GPS locations, and the spatial dislocation between the vessel and gear. The Enforcement Committee discussed what the absolute minimum size could be that would still ensure conservation of the resource: an area of 5 nm per side would be an ideal minimum because of the limits of VMS to accurately track a vessel through the area. The Enforcement Committee concluded that with the current VMS technology and protocols, areas smaller than 5 nm per side, though providing some level of protection, would unlikely be successfully enforced.

At its March/April meeting, the Council requested that the analysis be expanded to evaluate the use of the most updated VMS technology to monitor activity in and around skate egg concentration sites. VMS, increased polling rates, geo-fencing, and the use of the Automated Information System AIS are discussed below in chapter 4. Possible reductions in size of all six proposed HAPCs using increased VMS poll rates are shown in Appendix B.

3.3.4 Alternatives & Options Considered but Rejected

Earlier drafts of this analysis included options under Alternative 3 that would have restricted fishing in HAPCs with fixed gear – pot and hook-and-line (i.e., longline) gear. These options were eliminated by the Council and dropped from further consideration after evaluation revealed that this would not be a reasonable alternative. These gear types were determined to have minimal-to-no impacts on the proposed HAPCs, and thus a prohibition would offer only marginal conservation benefits to the action. Regarding enforceability of allowing vessels to fish with these gears within HAPC sites, though prohibiting vessels using other gears, the combination of VMS and the ease of or ability to determine a vessel's gear operations during a U.S. Coast Guard overflight should provide effective enforcement.

The effects of longline gear were determined to be very minimal because: 1) very low levels of longline effort occur in HAPCs; 2) the effects of longlines on skate nursery habitats (sediments, emergent epifauna) are thought to be very low relative to other gears; and 3) the impacts of longlines on the egg cases themselves (through dispersal, unobserved mortality due to gear impacts, silting from gear, and bycatch mortality) have been determined to be very low. Data on longline effort indicated low levels of longline effort in five of the HAPCs, and medium levels at the Bering 1 site during the years 1998 through 2010. The low longline effort, combined with the 2005 EFH EIS findings that longlines would have minimal impacts on benthic sediments—and would not cause silting that could potentially impact skate egg survival—resulting in a determination that longlines would not result in impacts to the proposed HAPC. Further, observer data show that bycatch of skate eggs in longline gear was a relatively rare occurrence. When it did occur, the overall bycatch amounts were small—the highest recorded occurrence was fewer than 1,500 eggs. While dispersal of egg cases tangled in longlines and direct mortality from hooking of skate eggs could occur, the potential for major impacts was considered to be low.

The effects of pot gear on skate egg HAPCs were similarly determined to be very low, having almost no impact. The reasons for this conclusion were: 1) very low levels of pot effort for groundfish or crabs occur in these areas; 2) the effects of pots on skate nursery habitats were thought to be very low relative to other gears; and 3) the impacts of pots on the egg cases themselves (through dispersal, unobserved mortality due to gear impacts, silting from gear, and bycatch mortality) were determined to be very low. The initial analysis had indicated virtually no groundfish pot effort in these areas and very low effort for one species of crab. The EFH EIS had concluded that pot gear would have virtually no impact to benthic habitats (except for epifauna) due to the small footprint of the gear. Relative to direct effects on skate eggs, the initial analysis determined that while unobserved mortality could occur to eggs if a pot landed on them, the potential impacts would be very small given the limited pot fishing effort in the proposed skate HAPC areas.

3.4 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 fifteen species of skates in three genera, *Raja*, *Bathyraja*, and *Amblyraja*, in Alaskan waters, and common from shallow inshore waters to very deep benthic habitats (Eschmeyer et al. 1983, Stevenson et al. 2006). The table below lists the fifteen skate species found in Alaskan waters:

Table 8. Skate species found in Alaskan waters.

Common Name	**Species Nomenclature**
[1234]Alaska skate	*Bathyraja parmifera*
[1234]Aleutian skate	*Bathyraja aleutica*
[124]Bering skate	*Bathyraja interrupta*
[234]deepsea skate	*Bathyraja abyssicola*
[234]Commander skate	*Bathyraja lindbergi*
[234]whiteblotched skate	*Bathyraja maculata*
[3]butterfly skate	*Bathyraja mariposa*
[2]whitebrow skate	*Bathyraja minispinosa*
[3]leopard skate	*Bathyraja panthea*
[23]mud skate	*Bathyraja taranetzi*
[234]roughtail skate	*Bathyraja trachura*
[23]Okhotsk skate	*Bathyraja violacea*
[1234]big skate	*Raja binoculata*
[2]roughshoulder skate	*Amblyraja badia*
[124]longnose skate	*Raja rhina*

1 = Bering Sea shelf, 2 = Bering Sea slope, 3 = Aleutian Islands, 4 = Gulf of Alaska.

The species within the skate assemblage occupy different habitats and regions within the BSAI FMP area: the eastern Bering Sea shelf (less than 200m depth), the eastern Bering Sea slope (greater than 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.

The single dominant species on the eastern Bering Sea shelf is the Alaska skate, composing as much as 95% of shelf skate biomass. While skate biomass is much higher on the eastern Bering Sea shelf than on the slope, skate diversity is substantially greater on the slope where 13 of the 15 species have been found (Stevenson et al. 2006). The dominant species on the slope is the Aleutian skate (*B. aleutica*). A number of other species are found on the eastern Bering Sea 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 eastern Bering Sea slope bottom trawl surveys (Stevenson and Orr 2005). The Okhotsk skate (*B. violacea*), the big skate (Raja binoculata), and the longnose skate (Raja rhina) are also occasionally found on the eastern Bering Sea slope.

The skate complex in the Aleutian Islands (AI) is distinct from the eastern Bering Sea shelf and slope complexes, with two recently described endemic species, the butterfly skate, *Bathyraja mariposa* and the leopard skate (Bathyraja panthera) (Stevenson et al. 2004, Orr et al 2011) and several species notably absent from the AI fauna where common in the eastern Bering Sea and Gulf of Alaska. In the AI, the dominant species is the white blotched skate, *B. maculata*which is found primarily in the eastern and far western Aleutian Islands. Other abundant species include the Aleutian Alaska and mud skates in the AI.
All known area of skate egg concentration in the eastern Bering Sea are associated with several major and minor undersea marine canyons located in the upper low slope areas occurring from 145 to 380 m (see Appendix B). Most likely particular oceanographic conditions are important factors for area selection; however, the specifics of these conditions remain unknown. The nominal six areas of skate egg concentration encompassed in this HAPC proposal include those of the three most abundant skate species in the eastern Bering Sea, which encompasses the dominant species on the shelf (from 20 to 200 m) that is most encountered by fishing activity in the eastern Bering Sea: the Alaska, Aleutian, and Bering skates.

3.4.1 Alaska Skate

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 91percent and 97 percent of aggregate skate biomass estimates since species identification became reliable in 1999. The Alaska skate has the greatest estimated population of all the Alaska skate species and dominates the eastern Bering Sea shelf. Its population has increased dramatically since the 1970s and in recent years, has been encountered at nearly every station throughout the standard eastern Bering Sea trawl survey. It has limited distribution from off Japan throughout the eastern Bering Sea and into the GOA. It occurs in the Aleutians to as far as 180° W, where it is replaced by a very similar species (Leopard skate, *Bathyraja panthera*) once thought to be a conspecific but recently described and documented as a congener. The Alaska skate trends towards having species specific egg case concentration sites with little "contamination" of other species eggs at its sites. Areas of skate egg concentration for the Alaska skate tend to be shallower than others, most likely because it is the shallowest of the skate species in the eastern Bering Sea. Another distinction of Alaska skate areas of egg concentration are their deposition of eggs in very high densities (greater than 500,000 eggs/km^2), an order of magnitude greater than either the Bering or Aleutian skates. This is not surprising given that its population estimates are also an order of magnitude greater than any other eastern Bering Sea species.

3.4.2 Bering Skate

The Bering skate (*Bathyraja interrupta*) is the next most common species in the eastern Bering Sea shelf, and is distributed on the outer continental shelf and upper slope. The Bering skate is an enigmatic species in many respects. It occurs from Japan throughout Alaska and at least as far south as the Mexican border off California. However, it shows a large amount of morphological variation across its range and in fact appears different in each environment where it occurs. Within the eastern Bering Sea, there are a minimum of three morphological types varying with depth and latitude, a fourth type in the GOA and finally along the west coast of Washington, Oregon and California a fifth type appearing distinctly different than those in Alaska. Examination of egg case morphology corroborates the differences seen within the species across its range. Taxonomic resolution of this complex is underway and the results may determine what is currently recognized as a single species may in fact be three to five species. This complicates any life history, habitat, and ecological studies and interpretation of such for the species. However, for this analysis all Bering skates will be considered a single species with the understanding that a conservative approach may be necessary given the dubious status of the species complex.

3.4.3 Aleutian Skate

The Aleutian skate (*Bathyraja aleutica*) has the largest estimated population and biomass along the eastern Bering Sea slope (from 200 to 1200 m). It is one of the most broadly distributed species occurring throughout Alaska, the eastern Bering Sea, AI, and GOA, British Columbia, and south to California. It also has the greatest depth distribution from about 150 m to at least 1200 m. The two known areas of skate egg concentration in the eastern Bering Sea are of moderate to deep depths. However, this is relatively shallow when compared to the depth distribution for the species. The Aleutian skate deposits its egg cases at a relatively low density not found over 100,000 eggs/km^2 and tends to have a fair amount of "contamination" by other species such as the Bering skate, mud skate, and whitebrow skate. The Aleutian skate however, does not appear to deposit its eggs in large numbers other than in its own areas of skate egg concentration and eggs are rarely found widely scattered outside those sites.

3.4.4 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 or more 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 contain embryos that develop for extended periods (in Alaska at least 3 years) 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 and even decades depending on the species. Age and size at maturity and adult size and 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 fifty 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) 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.

3.4.5 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 mortality (Gunderson 1997). Additional work, such as laboratory rearing experiments, is needed to validate these estimates.

Skate eggs are deposited in thick leathery keratin cases on the floor of the continental shelf and slope of the eastern Bering Sea. 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 (see Appendix B – Color Figure 61). The result is that in tropical to temperate waters, oviparous elasmobranchs emerge from the egg case in the range of one to six months after deposition. 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 confirm that at environmental temperatures experienced in the eastern Bering Sea, time to emergence for juvenile skates between three and four years for upper slope skate species (see Appendix B – Color Figure 60).

Considering single spawning 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 B – Color Figure 60 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 egg concentration locations along the slope where sites selected possess relatively warm annual temperatures for any given latitude (Appendix B – Color Figure 59). Due to currents and the strong influence the central eastern Bering Sea cold pool has on the outer shelf waters; for a given depth in the upper 400 m of the slope bottom temperatures are colder with increased latitude. The shelf condition influence dissipates at about 400 m and below this depth all latitudes show similar depth temperature relationships. This phenomenon explains why a single species' concentration sites are continually deeper at increased latitude in the eastern Bering Sea.

3.4.6 Role of Skates in the Ecosystem

This section focuses on the Alaska skate in the BSAI, with all other species found in each area summarized in 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 eastern Bering Sea, 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. 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 eastern Bering Sea are sperm whales, which account for less than 2 percent of total skate mortality and consumed between 500 tons and 2,500 tons of skates annually in the early 1990s. Consumption of eastern Bering Sea Alaska skates by Pacific halibut and cod are too small to be reliably estimated. Similarly, sperm whales account for less than 2 percent of Other Skate mortality in the eastern Bering Sea, but are still the primary predator of Other Skates, consuming an estimated 50 to 400 tons annually. Pacific halibut consume very small amounts of Other Skates in the eastern Bering Sea, 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 tons 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. Dr. Hoff's research on areas of skate egg concentration 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 areas of skate egg concentration. These sources of mortality may be included in future stock assessments.

Diets of skates are derived from food habits collections taken in conjunction with eastern Bering Sea and AI trawl surveys. Skate food habits information is more complete for the eastern Bering Sea than for the AI, but we present the best available data for both systems here. Over 40% of eastern Bering Sea 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 eastern Bering Sea results in an annual consumption estimate of 200,000 to 350,000 tons of pollock annually.

Eastern Bering Sea 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 eastern Bering Sea, 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 eastern Bering Sea, 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 eastern Bering Sea skates. The skate in the AI formerly known as the Alaska skate is opportunistically piscivorous like its eastern Bering Sea 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 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, scientists hope to use diet compositions to make separate consumption estimates for whiteblotched and Aleutian skates along with Alaska skates in the AI. Examining the trophic relationships of eastern Bering Sea 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).

3.5 Environmental Impacts

The proposed action is limited to six locations in the eastern Bering Sea 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. Under Alternative 1, the status quo or no action alternative, no additional environmental impacts would occur. Under Alternative 2, the Council would identify any of the proposed areas of skate egg concentration as HAPCs, but would not adopt any gear type prohibitions or restrict any fishing activities. Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as HAPCs. The identification of these sites as a HAPC highlights the importance of this EFH for conservation and consultation on activities such as drilling, dredging, laying cables, and dumping, as well as fishing. The impacts of Alternative 2 would be similar in magnitude to Alternative 1 because under Alternative 2 fishing activities are not restricted. However under Option a, fishing activities in these areas could be more closely monitored through the Ecosystem Stock Assessment and Fishery Evaluation (SAFE) report and the EFH five-year review.

Under Alternative 3, though, the Council would identify proposed areas of skate egg concentration as HAPCs and would adopt conservation and management measures prohibiting certain gear types within HAPCs. This section describes the criteria by which the impacts of the proposed action are analyzed for each of the following resource categories:

- Habitat
- Target Species (i.e., skates species)
- Non-target species
- Marine mammals and seabirds
- Ecosystem

Evaluation criteria have been developed for each of these categories recently in NMFS's HAPC EA (2006) and in the 2006/2007 Groundfish Harvest Specifications EA. The EFH EIS and five-year review provide recent information on the effects of fishing on EFH. The analysis used in this EA draws upon the evaluations used in the EFH EIS and adopts the significance criteria used in the HAPC EA and the 2006-2007 Groundfish Harvest Specifications EA because of the similar type of action analyzed and the latest information provided by these analyses.

The four ratings used to assess each potential effect are:

- **Significant negative impact**: Significant adverse effect in relation to the reference point. Information, data, and/or professional judgment indicate that the action will cause a significant adverse effect on the resource.
- **Insignificant impact**: Insignificant effect in relation to the reference point. Information, data, or professional judgment suggests that the action will not cause a significant adverse effect on the resource.
- **Significant positive impact**: Significant beneficial effect in relation to the reference point. Information, data, and/or professional judgment indicate that the action will cause a significant benefit to the resource.
- **Unknown**: Unknown effect in relation to the reference point. Information is absent to determine a reference point for the resource, species, or issue and data is insufficient to adequately assess the effect of the action or the direction of the effect of the action. Professional judgment also is not able to determine the effect of the action on the resource.

The reference point condition, where used, represents the state of the environmental component in a stable condition or in a condition judged not to be threatened at the present time. For example, a reference point condition for a fish stock would be the state of that stock in a healthy condition, able to sustain itself, successfully reproducing, and not threatened with a population-level decline. Significance criteria are provided for each of the resource categories listed above, except for socioeconomic effects. Significance findings for social and economic impacts would not by themselves require the preparation of an EIS; see 40 CFR 1508.14. Economic and social impacts are described in Sections 3.8.6 and 4.5. In light of 40 CFR 1508.14, significance determinations are not made for these impacts.

This section will focus on the effects of Alternatives 2 and 3 and the options on fish habitat, target species (i.e., skates species), non-target species, marine mammals and seabirds, ecosystems, and cumulative effects on the human environment. Effects will be compared to the significance criteria for each component and compare the effects to Alternative 1 status quo effects.

3.5.1 Habitat

This section summarizes the effects of commercial fishing gear on habitat in the proposed HAPCs. It is a summary of the more detailed analysis (such as the EFH five-year Review) of the studies most pertinent to the gear and habitats of the Alaska region. The descriptions and research summaries below are organized by gear type, which 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. Research conducted on the effects of commercial fishing gear on benthic habitats broadly recognizes several factors that influence the occurrence and degree of effect. Among these are: a) intensity of commercial fishing; b) frequency of fishing; c) class and specific characteristics of the commercial fishing gear; d) environmental/ habitat characteristics; and e) level of naturally occurring disturbance (Barnes and Thomas 2005). This section summarizes the fishing gears, the literature on the habitat effects of commercial fishing gear relevant to the groundfish fisheries of Alaska, and potential impacts of the alternative on habitat, including essential fish habitat.

3.5.1.1 Bottom and Pelagic Trawl Gear

Bottom trawls are used in the Bering Sea by vessels targeting Pacific cod, rockfish, and flatfish species. The fleets using this gear are the Pacific cod trawlers and the Amendment 80 fleet. Pelagic trawls are used to catch pollock, which are targeted by the American Fisheries Act (AFA) catcher vessels and catcher processors. A description of the gear used by these fleets affected (excerpted from Witherell et al. 2012) is provided below.

AFA Catcher Vessels

All vessels in the AFA fleet target pollock with pelagic otter trawls. To achieve large net openings with a minimum of drag, the mesh sizes are very large, and twine size is relatively small. The trawl nets have meshes in the front end as large as 32 m to 64 m (105 ft to 210 ft) and typically have a headrope to footrope vertical distance rise of 10 fathoms to 30 fathoms (60 ft to 180 ft). The size of the gear used is dependent on the size and horsepower of the vessel, such that the larger and more powerful vessels tow the larger trawls. Net mesh gets smaller towards the intermediate and codend, with the codend typically having 4 to 4.5 inches stretched mesh. Otter boards (or doors), which are used to spread the net and keep it open during towing, are made of steel and range in size from 5 m^2 to 14 m^2. In the pelagic fishery the doors do not come in contact with the ocean floor. Door spread in most fishing depths ranges from 100 m to 180 m (328 ft to 590 ft), and trawl warp/scope to depth ratio is typically 3 to 1. Contact with the seafloor is from weight clumps and the footrope. Long wire rope bridles attach the net to the doors. Unlike other groundfish trawl fisheries, there are no discs attached to the footropes on these trawls. Footropes typically extend 180 m to 450 m (590 ft to 1,475 ft).

Trawl codends are usually made with polyethylene netting attached to four longitudinal riblines. The riblines are typically chain, wire, or synthetic rope. Floats are attached along the length of the codend to counteract the weight of the steel components. Container lines around the circumference are attached along the length of the codend to restrict the expansion of the netting, preventing damage and allowing the codend to be hauled up a stern ramp. Sacrificial chafing gear, typically polyethylene fiber, is attached to the codend to protect it from abrasion on the stern ramp.

Sets are made on schooled or scattered pollock, as indicated by electronics. When set, the codend, net, and sweeps are unwound from a net reel, then the doors are attached. Wire cable attached to each door is let out to a distance approximately three times the depth. Trawl winches are designed to automatically adjust tension and release when necessary. Tow duration in this fishery ranges from 20 minutes to 10 hours (depending upon catch rates), at a speed of 3.5 to 4.5 knots. Tows may be in a straight line, or they may be adjusted to curve around depth contours or to avoid location of hangs and fixed gear. Vessels may turn around while towing and make several passes over the same general area. At haulback, the setting procedure is reversed, and the codend is dumped into the fish-hold below decks. Catcher vessels delivering to the inshore sector have traditionally fished the area north of Unimak Island during the A-season, venturing further north along the shelf break during the B-season.

AFA Catcher Processors

All vessels in this sector use pelagic trawls, with the catcher processors generally using larger gear than many catcher vessels. The trawl gear used has meshes in the front end as large as 32 m to 64 m (105 ft to 210 ft) and typically has a headrope to footrope vertical distance rise of 10 fathoms to 30 fathoms (60 ft to 180 ft). Net mesh gets smaller towards the intermediate and codend, with the codend typically having 4 to 4.5 inches stretched mesh. Doors are made of steel and range in size from 5 m^2 to 14 m^2. Door spread in most fishing depths ranges from 100 m to 180 m (328 ft to 590 ft), and trawl warp/scope to depth ratio is typically 3 to 1. Long wire rope bridles attach the net to the doors, which remain off the bottom. Contact with the seafloor is from weight clumps and the footrope. Unlike other groundfish trawl fisheries, there are no discs attached to the footropes on these trawls. Footropes typically extend 180 m to 450 m.

Fishing operations are the same as for the catcher vessels, with the catch loaded into bins below deck. On catcher processors, the fish are then put through various processing lines (depending on product choices), frozen, boxed, and stored in the freezer compartment until the vessel is offloaded days or weeks later.

Catcher processors generally fish the area north of Unimak Island during the A-season and from areas south of St. George Island northward during the B-season.

Pacific Cod Trawlers

Bottom trawls are used by AFA and non-AFA trawl fleets to target Pacific cod, with trawls typically having a headrope to footrope vertical distance rise of 1 fathom to 5 fathoms (6 ft to 30 ft). Net mesh gets smaller towards the intermediate and codend, with the codend typically having 5.5- to 8-inch stretched diamond mesh. Doors are made of steel and range in size from 4 m to 10 m. Door spread in most fishing depths is typically 100 m (328 ft), and the trawl warp/scope to depth ratio is typically 4 to 1. Trawl codends are usually made with polyethylene netting attached to four longitudinal riblines. The riblines are typically chain, wire, or synthetic rope. Floats are attached along the length of the codend to counteract the weight of the steel components. Container lines around the circumference are attached along the length of the codend to restrict the expansion of the netting, prevent damage and allow the codend to be hauled up a stern ramp. Sacrificial chafing gear, typically polyethylene fiber, is attached to the codend to protect it from abrasion from contact with the stern ramp and the seafloor. Sweeps are made of wire or combination rope, and may be threaded with rubber disks ranging from 4 to 8 inches in diameter. Footropes, constructed of chain or steel cable, typically extend 100 ft to 200 ft and are threaded with rubber discs and larger bobbins, which are 8” to 18” in diameter and are designed to roll along the bottom to limit contact with the bottom and protect the net. The larger diameter bobbins are spaced at intervals of 12 to 48 inches.

Amendment 80 Fleet

The Amendment 80 fleet includes vessels that mainly target flatfish and Pacific cod, or Atka mackerel and Pacific ocean perch, and different bottom trawl configurations are used depending upon the target fishery. All vessels participating in the Bering Sea flatfish fisheries, as well as vessels fishing for groundfish with bottom trawls in the Modified Gear Trawl Zone, are required to use elevating devices on their trawl sweeps to reduce habitat impacts. Research had shown that this gear reduced impacts on benthic invertebrates and reduced crab injury rates to less than 5%. The fleet uses rollers to achieve the minimum clearance of 2.5” with the modified trawl gear. These devices are required to be a minimum of 30’ to 95’ apart, depending upon clearance provided by the elevating devices.

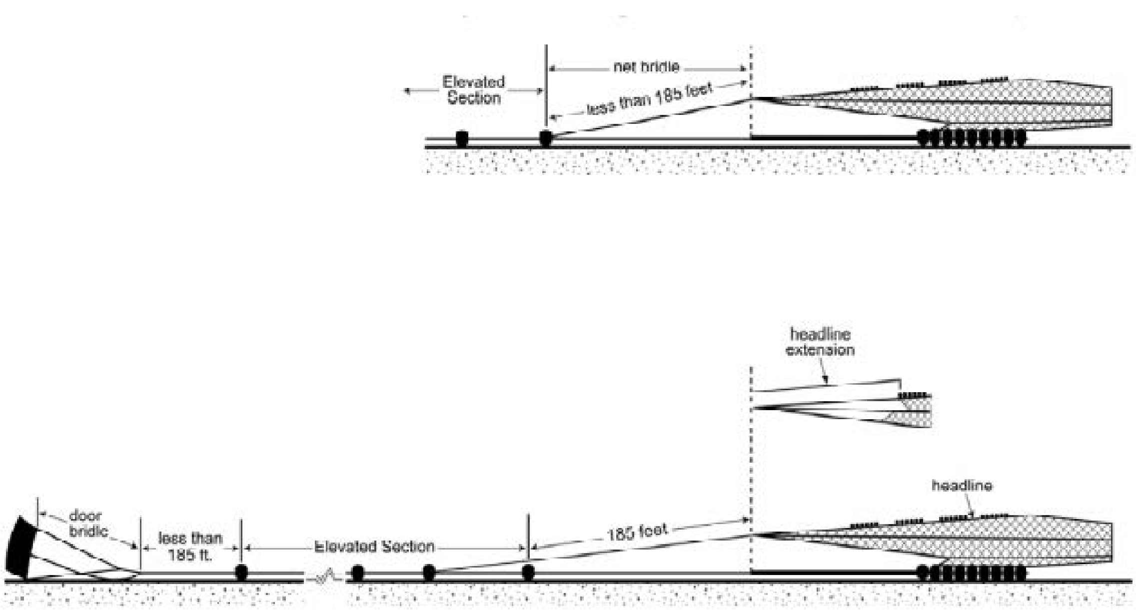


Figure 2. Modified nonpelagic (i.e., bottom) trawl gear (Figure 26 to Part 679).

The figure above shows the location of elevating devices in the elevated section of modified nonpelagic trawl gear, as specified under § 679.24(f). The top image shows the location of the end elevating devices in the elevated section for gear with net bridles less than 180 feet. The bottom image shows the locations of the beginning elevating devices near the doors and the end elevating devices near the net for gear with net bridles greater than 180 feet.

In 2011, a trawl sweep modification requirement was implemented for vessels participating in the Bering Sea flatfish fishery. Elevating devices (e.g., discs or bobbins) are required to be used on the trawl sweeps, to raise the sweeps off the seabed and limit adverse impacts of trawling on the seafloor. Research has demonstrated that this gear modification reduces unobserved mortality of red king crab, Tanner crab, and snow crab. The Council intends for a similar modification to be implemented in the GOA.

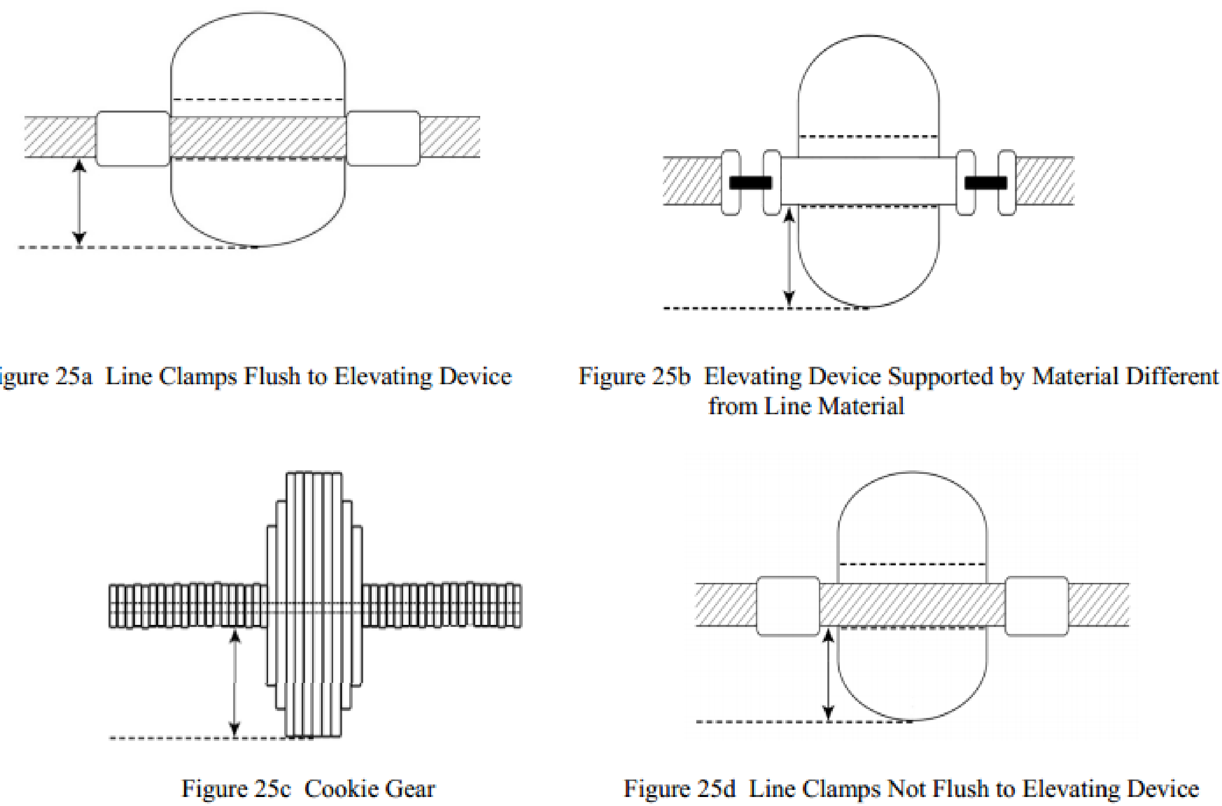


Figure 3. Elevating device clearance measurement locations for modified nonpelagic (bottom) trawl gear.

The figure above shows measuring points for a variety of elevating devices located on the elevated section shown in Figure 26 to Part 679. The measuring location is indicated on each figure by the arrow. The measurement is made from where the line contacts the inside surface of the device.

The flatfish fishery uses a two-seam or four-seam trawl with a relatively low vertical opening (typically 1 fathom to 3 fathoms). Nets are made of polyethylene netting, with codends and intermediates using 5.5- to 8-inch mesh in square or diamond configuration. Trawl codends are usually made with polyethylene netting attached to four longitudinal riblines. The riblines are typically chain, wire, or synthetic rope. Floats are attached along the length of the codend to counteract the weight of the steel components. Container lines around the circumference are attached along the length of the codend to restrict the expansion of the netting, prevent damage and allow the codend to be hauled up a stern ramp. Sacrificial chafing gear, typically polyethylene fiber, is attached to the codend to protect it from abrasion on the stern ramp and contact with the seafloor. Steel trawl doors ranging in size from 5 m^2 to 11 m^2 spread the nets horizontally. Some vessels use off-bottom doors. The door spread varies with fishing depth and rigging style, but generally ranges from 40 m to 200 m (131 ft to 656 ft). The rigging between the net and the doors includes bridles and sweeps (mudgear), ranging in length from 30 m to 400 m (98 ft to 1,312 ft), which herd fish into the path of the trawl. Sweeps are made of steel cable or synthetic combination rope with bobbins to lift the sweep off the bottom. Footropes keep the front of the net off the bottom to protect it from damage. They are made of rubber disks or bobbins strung on chain or wire, with large diameter (12-24 inches) disks or bobbins separated by 18- to -48-inch long sections of smaller disks (4-8 inch diameter). Bobbins are mostly rubber, but sometimes are hollow steel balls designed to roll along the seabed. A design objective for flatfish nets is to herd fish into the net with minimum bottom contact, reducing gear damage and drag and maintaining fish quality by keeping sand out of the catch.

The rockfish and Atka mackerel fisheries are prosecuted with bottom trawls rigged to fish over rougher substrates. The gear used is a four-seam otter trawl with a headrope to footrope vertical distance rise of about 1 fathom to 4 fathoms for mackerel and 4 to 6 fathoms for rockfish. Nets are made of polyethylene. Net mesh is 8-inch diamond in the wings and forward belly and 5.5-inch diamond in the intermediate and codend. Double meshes may be used in the codend, which is equipped with chafing gear. Doors are made of steel and range in size from 6.5 m^2 to 12 m^2. The door spread in most fishing depths and trawl warp/scope combinations is typically 45 m to 50 m (148 ft to 164 ft). Bridles are made of steel cable and are generally 90’ long on each side. Atka mackerel nets use footropes equipped with tire gear, large disk tires (24-inch diameter airplane tires), 21” discs or bobbins, or a combination of these. Footropes typically extend 100’ to 200’, plus an additional 40-foot extension from net wing ends on both sides. Steel cable and chain used for the footrope runs through bobbins or discs spaced at intervals of 24 inches or tires grouped together at the bosom, which is the center 30’ to 80’. Tow durations in this fishery are usually 1 hour to 4 hours, at a speed of 3- 4 knots. Tows are adjusted to curve around depth contours, and to avoid locations of known hangs and fixed gear. At haulback, the setting procedure is reversed, and the codend is unloaded into the fish-hold below deck. Because rockfish and mackerel are fished over rough bottom adjacent to areas with large potential for hangs in some areas, the net is usually fished with very short scope (the ratio of warp to towing depth) to minimize contact with the substrate and to allow the net to be lifted quickly if a hangup is sighted.

3.5.1.2 Dredge Gear

The Alaska weathervane scallop fishery is pursued using a standard “New Bedford style” scallop dredge. 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.

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 length overall (LOA). The number of vessels is less than 4 in most years, and work as a cooperative, 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 6ft 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 15ft. Each dredge is attached to the boat by a single steel cable operated from a deck winch. On average, a 15ft New Bedford dredge weighs approximately 2,600 pounds, and a 6 foot dredge weighs about 900 pounds.

3.5.1.3 Groundfish Dinglebar Gear

In the GOA, troll vessels catch Chinook and coho salmon, and lingcod and rockfish, by moving lures or bait through the water column through feeding concentrations of fish. Dinglebar troll gear is used to target lingcod and rockfish. Dinglebar gear consists of a single line that is retrieved and set with a power or hand troll gurdy, with a terminally attached weight (a cannon ball at 12 pounds), from which one or more leaders with one or more lures or baited hooks are pulled through the water while a vessels is underway. This gear is not used in Bering Sea fisheries to date, but would be prohibited in the future under Alternative 3, option b and option c.

3.5.1.4 Impacts on Habitat

The following is a summary of the effects of bottom trawls, pelagic trawl, and dredge gear on benthic habitat. Following this summary is an evaluation of the effects of the alternatives on habitat.

Effects of Bottom Trawls

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.

Note however, the Amendment 80 fleet vessels have been recently required to use modified trawl sweeps. The sweeps are lifted off of the bottom, which reduces contact to only about 5% of the sweep path (Rose et al. 2010). This effect is illustrated by the shaded areas in the figure below. This reduction in contact would be expected to greatly reduce any direct effects of trawl fishing on habitat. As an additional benefit of these sweeps, is that it can increase herding of several flatfish species during the daytime (Rose et al. 2010; Ryer et al. 2010) thereby increasing catch rates and further reducing fishing impacts per metric ton of fish harvested. Because the Amendment 80 vessels participate in much of the bottom trawling that may occur in the proposed HAPC areas, it is likely that effects on skate egg habitat and EFH for other species may be greatly reduced.

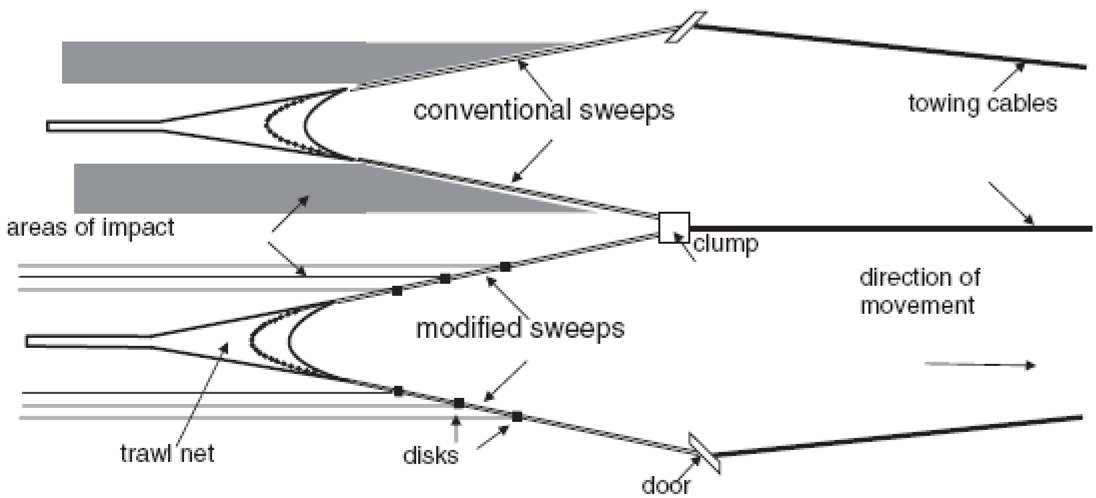


Figure 4. A comparison of the relative bottom contact (shown in the shaded area) made by conventional trawl sweeps, and those using the modified sweeps specified in regulation for flatfish fisheries. Figure from Rose et al., 2010.

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 eastern Bering Sea, 3% for the Aleutians, and 2% for the GOA; in comparison, it is 56% for northeastern United States fisheries.

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.

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

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

- 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 noncontinuous 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 unimpacted 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.

Effects of Pelagic Trawls

Pelagic 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. 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 Eastern Bering Sea is that NMFS surveys the entire eastern Bering Sea 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.

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 eastern Bering Sea, the bottom trawl, which opens only 2 m high, detected more than 95% of the total biomass estimate for pollock more than twoyears 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 eastern Bering Sea 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.

Effects of Scallop Dredges

The magnitude and extent of seabed disturbances by scallop fishing vary according to the gear used and the habitats that are fished. For example, a worldwide trawl and dredge study for the submarine cable industry determined 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).

The weathervane scallop fishery in Alaska occurs in limited but well-defined areas of the GOA and the eastern Bering Sea. 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. 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.

Scallop dredges are designed to disturb the seabed in order to dislodge and capture scallops. The following summaries of scientific research detail physical effects on the sea floor 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. 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). 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.

Evaluation of Alternatives on Habitat

Criteria used in this EA to evaluate effects of the proposed action on habitat are provided in the table below. The reference point against which the criteria are applied is the current size and quality of marine benthic habitat and other essential fish habitat in the Bering Sea and are adopted from the HAPC EA (NMFS 2006b).

Table 9. Criteria used to determine significance of effects on habitat.

Effect	Criteria			
	Significantly Negative (-)	**Insignificant (I)**	**Significantly Positive (+)**	**Unknown (U)**
Habitat complexity: Mortality and damage to living habitat species	Substantial increase in mortality and damage; long-term irreversible impacts to living habitat species.	Likely not to substantially change mortality or damage to living habitat species.	Substantial decrease in mortality or damage to living habitat species.	Information, magnitude and/or direction of effects are unknown.
Habitat complexity: (non-living substrates such as gravel sand and shell hash)	Substantial increase in the rate of removal or damage of non-living substrates.	Likely not to substantially change alteration or damage non-living substrates.	Substantial decrease in the rate of removal or damage of non-living substrates.	Information, magnitude and/or direction of effects are unknown.
Benthic biodiversity	Substantial decrease in community structure from baseline.	Likely not to substantially change community structure.	Substantial increase in community structure from baseline.	Information, magnitude and/or direction of effects are unknown.
Habitat suitability	Substantial decrease in habitat suitability over time.	Likely not to substantially change habitat suitability over time.	Substantial increase in habitat suitability over time.	Information, magnitude and/or direction of effects are unknown.

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 BSAI management area 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 use these areas.

To estimate the potential effects of commercial trawling over the skate egg concentration areas, the amount of recent commercial trawl effort in these areas was examined. At least 50% of each site (not including Pribilof & Zhemchug, which were not commercial fished) has been trawled over the 2003 through 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 FEIS. 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 commercial trawl net (area between doors) has passed over at least once, but does not account for multiple passes.

Under Alternative 2, the Bering 2 site was the most heavily commercial 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 10. Trawl footprint analysis according to available VMS data, of the areas described by Alternative 2.

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

Source: NMFS HCD

Due to the very small size and limited commercial fishing effort in four of these six locations, adjacent areas will likely support the amount of commercial fishing displaced if activities and gear types that make contact with the sea floor were restricted. It is then possible to assume that some commercial fishing grounds would be fished with more frequency, with the potential for increased direct impact. However, it is likely that the increased commercial fishing effort in habitats currently fished would not be much greater than effort that already exists. For other management actions that displaced fishing effort from larger areas, an analysis has sometimes been undertaken to understand how and where the fleets would likely redistribute their effort. For this action, such a complex and time-consuming analysis was not undertaken given the very small amount of effort displaced.

Under Alternative 3, the fleet is likely to be displaced into adjacent areas with similar conditions for fishing, and not necessarily into areas that are more fragile or vulnerable (e.g., coral habitat). Because the maximum potential area closed to certain commercial fishing activities under Options b and c of Alternative 3 is 225.8 nm^2, without any reduction in sizes or buffers from increased polling rates or geo-fencing, 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.

The effects of Alternatives 1 and 2 on habitat are the same, with Alternative 2 being slightly more protective of known skate egg deposition and concentration habitat. Therefore, any potential effects of Alternatives 1 and 2 on habitat are likely insignificant. The identification of these six areas as HAPC may seem insignificant in relation to the vast areas open to commercial 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. Under Alternative 3, a limit on commercial fishing activities that make contact with the sea floor would result in a positive effect on habitat because fishing has already occurred there, and habitat will likely be protected with limits on fishing gear that makes contact with the sea floor. The small amount of effort redistribution would not be expected to occur on more fragile habitats. Thus the effects of Alternative 3 on habitat are insignificant overall, but likely beneficial to skate egg habitat.

3.5.2 Target Species

Target species for the BSAI area are managed in the BSAI FMP. 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 walleye pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, "other flatfish," Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, "other rockfish," Atka mackerel, sharks, skates, sculpins, octopus, and squid. Other non-groundfish targeted FMP species in Federal waters are crab and scallops. Regarding State-managed crab and invertebrates fisheries, no effects on these target species are expected because no fisheries for these species are prosecuted within the six areas of skate egg concentration under the alternatives and options. The significance criteria used to evaluate the effects of this action on target species are listed below. These criteria are adopted from the significance criteria used in the HAPC EA (NMFS 2006a).

Table 11. Criteria used to estimate the significance of effects on FMP-managed target stocks.

Effect	Criteria			
	Significantly Negative (-)	**Insignificant (I)**	**Significantly Positive (+)**	**Unknown (U)**
Stock Biomass: Potential for increasing and reducing stock size	Changes in fishing mortality are expected to jeopardize the ability of the stock to sustain itself at or above its MSST	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself above MSST	Changes in fishing mortality are expected to enhance the stocks ability to sustain itself at or above its MSST	Magnitude and/or direction of effects are unknown
Fishing mortality	Reasonably expected to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Reasonably expected not to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Action allows the stock to return to its unfished biomass.	Magnitude and/or direction of effects are unknown
Spatial or temporal distribution	Reasonably expected to adversely affect the distribution of harvested stocks either spatially or temporally such that it jeopardizes the ability of the stock to sustain itself.	Unlikely to affect the distribution of harvested stocks either spatially or temporally such that it has an effect on the ability of the stock to sustain itself.	Reasonably expected to positively affect the harvested stocks through spatial or temporal increases in abundance such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown
Change in prey availability	Evidence that the action may lead to changed prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action will not lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself.	Evidence that the action may result in a change in prey availability such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown

It was determined in the EFH FEIS (NMFS 2005) that considerable scientific uncertainty remains on the consequences of habitat changes for managed species. Nevertheless, the EIS analysis concluded that the effects on EFH from commercial fishing target species are minimal because no indication exists that continued commercial fishing at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term and no new information exists to the contrary. Therefore, Alternative 1, the no action or status quo alternative, is rated as insignificant for all target species in terms of stock biomass, fishing mortality, spatial and temporal distribution, and change in prey availability. If fish distribution remains the same as status quo, catch of target species is expected to remain the same under all alternatives and options; and no changes in stock biomass, fishing mortality, and prey species availability would be anticipated under any of the alternatives or option. Similarly, under Alternative 2, commercial fishing activity and distribution is expected to remain the same as status quo and the impact would be insignificant. Nevertheless, under Alternative 2, skate populations benefit from the HAPC designation since EFH consultation could result in recommendations that would protect skate nursery sites and improve survival.

Under Alternative 3, prohibitions of certain commercial fishing activities—particularly commercial trawling—could result in a reduction in catch, though it would be expected that the fleet could make up foregone catch in other areas, immediately adjacent to the skate egg site or elsewhere. No substantial changes would be anticipated in stock biomass, fishing mortality, spatial and temporal distribution of catch, or changes in prey availability under Alternative 3. Hence, the effects of this Alternative on target species are expected to be insignificant. Nevertheless, because the action proposed under Alternative 3 would be anticipated to be beneficial to the habitat where skate nurseries occur, there is potential to have positive effects on the survival of skate eggs and skate populations. These issues are explored further in the sections below.

3.5.3 Effects on Skate Population Sustainability and Abundance Trends

The BSAI skate complex is managed in aggregate, with a single set of harvest specifications applied to the entire complex. In 2010, the Council passed amendment 95 to the BSAI FMP, which moved skates from the Other Species complex into the target category. Amendment 96 eliminated the Other Species complex and requires separate annual catch limits for its constituent species groups. Thus, BSAI skates are now managed as an independent complex with its own harvest specifications and annual catch limits (ACLs) are required for skates.

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.

The Alaska skate makes up the vast majority of the skate complex biomass in the BSAI (greater than 90%). An age-structured model exists for Alaska skates, allowing Tier 3 harvest recommendations and the determination of its population status relative to $B_{35\%}$ (a proxy for B_{MSY}). In 2010 female spawning biomass for the Alaska skate was 55,755 t, relative to a $B_{35\%}$ of 36,846 t. Alaska skate spawning biomass is thus substantially greater than the estimated limit of sustainability.

Reliable species-specific biomass estimates for these species have existed only since 2000 due to earlier difficulties with species identification. Total skate biomass in the BSAI has apparently increased since the early 1980s (Ormseth and Matta 2011). However, this information should be evaluated with caution. Biomass estimates from the eastern Bering Sea AFSC groundfish shelf survey, which has been conducted in a consistent fashion over the same time period, suggest that total skate biomass has remained at approximately the same level (with some fluctuation) since a dramatic increase in the mid-1980s. The apparent increase over the 1980-2010 time period occurs mainly in the eastern Bering Sea slope and Aleutian Islands surveys. During this same period, those AFSC groundfish surveys have been irregular and survey methodology has changed over time. In addition skate species are long-lived (ranging from 20 years to 50 or more years), and a ten-year time series of abundance is too short to evaluate trends in population size. As a result it is difficult to interpret any apparent trends in skate biomass. See Appendix B – Color Figures 70 through 74 for recent trends in skate biomass (Ormseth and Matta 2011).

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. An examination of species-specific biomass estimates from 2000-2010 shows no apparent trend in abundances.

There are a number of factors that hinder effective skate management and that strengthen the case for protecting areas of skate egg concentration as a mean of enhancing skate conservation:

1) For all skate species in the BSAI except for Alaska skate, life history data are nonexistent. A mortality rate of 0.1 (an average of estimates from other species in other locations) is assumed for making harvest recommendations. Other data considered essential for population assessment, including maturity-at-age and fecundity, are completely unknown. These factors increase the uncertainty regarding NMFS estimates of OFL and ABC for the skate complex.
2) Skates are demonstrably vulnerable to overfishing due to slow growth, delayed maturation rates, and low fecundity. This sharpens the need for cautious management.
3) NMFS only recently began to monitor skate catches at the species level, primarily due to difficulties in observer identification of skates to species in the past. As a result, NMFS cannot yet evaluate standard metrics such as exploitation rates.

Under Alternative 1, the status quo or no action alternative, no additional environmental impacts would occur. Under Alternative 2, the Council would identify any of the proposed areas of skate egg concentration as HAPCs, but would not adopt any gear type prohibitions or restrict any fishing activities. Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as HAPCs. The identification of these sites as a HAPC highlights the importance of this EFH for conservation and consultation on activities such as: drilling, dredging, laying cables, and dumping, as well as fishing activities. The impacts of Alternative 2 would be similar in magnitude to Alternative 1 because under Alternative 2 fishing activities are not restricted. However under Option a, fishing activities in these areas could be more closely monitored through the Ecosystem SAFE and the EFH five-year review.

Alternative 3 and Options b and c would prohibit some or all trawl and dredge gear from the HAPC skate sites. This proposed HAPC action provides a means of enhancing conservation for a group of species for which the conventional groundfish management approach, though useful, has several shortcomings. Adult skates appear capable of significant mobility in response to general habitat changes, but any effects on the small scale area of skate egg concentration crucial to reproduction could have disproportionate population effects. Eggs are mostly limited to isolated 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 stock assessment authors have recommended continued study of areas of skate egg concentration 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. Alternative 3 is designed to protect the reproductive output of skates, thereby increasing the likelihood that young skates will recruit to the adult population and enhancing the conservation of skate populations.

The table below provides a summary of the proposed HAPC sites, the skate species to be protected and its population trend, the egg casing density and depth at each site, and the fisheries in the site and amount of fish caught in site.

Table 12. Summary table of HAPC sites, skate species, and fisheries

Site Name	Skate Species	Depth of Max. Egg Density		Max. Egg Density (eggs/km^2)	Population Trend[a]	Fisheries	Tons of Catch[b] (mt)
		meters	fathoms				
1. Bering 1	Alaska	145	79	800,406	Stable	PTR Pollock mid-water NPT Atka NPT Pollock NPT Pacific cod NPT other flatfish NPT Flathead sole NPT Other Species NPT Rock sole NPT Arrowtooth	6,576 12 32 677 44 2 347 3 285
2. Bering 2	Aleutian	380	208	62,992	Stable	PTR Pollock, bottom PTR Pollock, mid-water NPT Atka NPT Pollock NPT Pacific cod NPT other flatfish NPT Flathead sole NPT Rock sole NPT Greenland Turbot NPT Arrowtooth NPT Yellowfin	427 7,558 110 35 489 716 298 83 182 5,671 12
3. Bristol	Bering	156	85	6,188	Stable	PTR Pollock, mid-water	5,828
4. Pribilof	Alaska	205	112	16,473	Stable	PTR Pollock, mid-water NPT Arrowtooth	658 25
5. Zhemchug	Alaska	217	118	610,064	Stable	PTR Pollock, mid-water	1,100
6. Pervenets	Alaska, Bering and Aleutian	316	173	334,163	Stable	PTR Pollock, mid-water NPT Pollock NPT Pacific cod NPT Rockfish NPT Flathead sole NPT Greenland Turbot NPT Arrowtooth NPT Yellowfin	14,750 9 205 43 337 48 827 3

[a] Skate stock assessment experts offer population trends for all skate species tend to be stable on the shelf and slope.
[b] Observed PTR and NPT catch data (2003 to 2011) filtered for confidentiality.

3.5.4 Impacts on Skate Eggs

There has been no directed study of the effect of fishing on skates or their eggs at skate nursery sites in the eastern Bering Sea, therefore little is known about how fishing may be interacting with reproduction. Fisheries observers do not (or never have) identified skate egg cases to species or the content state of the eggs (either full or empty). The understanding of skate egg case characters and the development of identification keys to the skate egg cases from Alaska has recently been developed and is used during RACE groundfish surveys but has not yet been expanded to the fisheries.

The question of a viable egg after trawling is difficult to answer. In their natural environment skate eggs can occur in a host of states. Determining the contents of an egg case is a combination of understanding the development process and all the possible states, feeling the weight of the egg case, and closely observing the external and internal state of the egg. Listed are some of the conditions an egg case may be in when brought up in a trawl:

1) New eggs that have recently been deposited. Eggs in this state are often golden yellow-brown and relatively soft with a layer of sticky substance and fibers. They have most likely been deposited on the bottom by the skate in the recent 1-2 weeks. Inside they contain a large yolk mass and a surrounding clear mass with a microscopic embryo still in the multiple cell stage.
2) During normal development eggs can be in any state from light brown to black which is a natural aging process as salt water acts on the keratin material of the egg case. The embryo is developing inside beginning as a small elongated embryo and ending as a miniature version of the adult skate. As the embryo develops it absorbs the large yolk mass, emerging from the egg case when completely absorbed.
3) Eggs that have hatched naturally are generally a dark black, have thin case material, have lost surface structure and most byssal threads for attachment. Often the margin is opened where the juvenile skate has emerged.
4) Eggs can occur in any color state with a sealed margin yet be empty due to snail predation. Early in development snails prey on the yolk mass by drilling a small hole in the case and feeding on the egg contents killing any developing embryo.
5) Eggs can occur in a "gel state" where an egg case is produced with egg albumin but lacks a yolk mass or embryo. This state has been found to occur upwards of 10% of egg cases for the Alaska skate. These eggs generally have a slightly smaller size and unusual shape and can occur in any color state. Gel eggs can only be detected by observations of the internal content.
6) Eggs can appear in a natural state yet (feeling like they have an embryo inside) yet the egg is actually filled with mud or sand when the internal contents are examined.
7) Eggs can appear in a natural state on the outside and contain a mass that indicates a developing embryo, however upon internal examination the contents is deteriorated and rotted or there is a partially deteriorated embryo.
8) In addition to all of the above states, eggs can occur in many various states of damage due to being brought to the surface by fishing gear. Fishing effects can be obvious such as flattened, torn apart or squished eggs to less obvious such as damaged yolks or embryos internally with no sign of external damage. The unknown effect of prolonged periods out of seawater and being brought to the surface and moved from the original deposition location are also to be considered.

The direct impact on skate egg cases from fishing gear has not yet been investigated. Components of commercial bottom trawl gear that would be in direct contact with an egg case are those in direct contact with the sea floor and include the doors, sweep, footrope, and net. Commercial bottom trawl doors are heavy (exceeding 1,000 lbs.) and are designed to contact the sea floor 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 sea floor 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 also recruit egg cases and cases are then considered bycatch. Skate egg cases can entangle on the outside of the net with edge *horns*[9], if present. Thus, entangled cases could be dislodged

[9] *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.

or ‘ride-along’ the net, to then be re-distributed within or outside of the area of skate egg concentration. 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 the egg or increase risk of mortality. Given that the gear, when towed, has some buoyancy and lift supplied by the tow vessel and that skate egg cases are most often in softer substrates, the potential to physically cause injury to the case still exists. But the extent of these effects remains unknown. The table below predicts the impacts of the different gear prohibitions under Alternative 3. Under Alternative 1, the status quo or no action alternative, there are no expected additional environmental impacts. Under Alternative 2, the Council would identify any of the proposed areas of skate egg concentration as HAPCs, but would not adopt any gear type prohibitions or restrict any fishing activities. Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as HAPCs. The identification of these sites as a HAPC highlights the importance of this EFH for conservation and consultation on activities such as: drilling, dredging, laying cables, and dumping, as well as fishing activities. The impacts of Alternative 2 would be similar in magnitude to Alternative 1 because under Alternative 2 fishing activities are not restricted. However under Option a, fishing activities in these areas could be more closely monitored through the Ecosystem SAFE and the EFH five-year review.

The effects of fishing activity at skate nursery sites are currently unknown. However, intuitively, we can assume that any effort to lessen the mortality of recruits and reproductive adults is a positive influence on these species which rely on high survival of offspring and low mortality of reproductive adults for population stability. Since we do not know the historical population levels, because of incomplete fisheries and fisheries independent surveys and pre-fishing observations, we have no baseline for comparison. However, the creation of nursery sites with decreased disturbance can be used as a test study for populations, recruits, and the recovery of the habitat. Close observations of sites such as that of the Alaska skate in Bering Canyon may address the question directly. As the habitat receives fewer disturbances we would expect a recovery process which may be detected with close monitoring. With regard to suspended material (i.e. sand) in the skate nursery due to fishing operations, again this is a question that has not been researched. However, based on what is understood about the biology and the functioning of the skate egg case sedimentation can hinder the functioning of the egg case. During development the egg case opens to seawater and there is a flush of water through the egg across the embryo to bring in oxygen and remove metabolites. The water enters the egg case through four small slits (one on each horn). These slits can be as small as a millimeter wide by several millimeters long depending on the size of the egg case. Sand grains that are deposited on top of egg cases after opening can impact the embryos ability to move water through the case causing stress or death given the severity of the clogging. In general skate nursery sites may be in areas where there is sufficient current flow to facilitate the movement of sediments off the eggs and prevent the build-up. In areas where there is an excessive amount of sedimentation the currents may not be sufficient to prevent the build-up of sediment on the egg cases.

Table 13. Summary table of potential impacts of fishing gear on skate eggs.

Gear type	Exposure	Potential Impacts on skate eggs	Summary
Nonpelagic trawl (bottom trawl)	Low effort at Bering 1, Pervenets; medium effort at Bering 2	Unknown, but possible dispersal of egg cases, unobserved mortality due to gear impacts, silting from sweeps and footropes, bycatch mortality	Bottom trawls could potentially impact skate egg concentrations at exposed sites.
Pelagic trawl	Low effort at Bering 1, Bering 2, and Bristol; medium effort at Pervenets	Unknown, but possible dispersal of egg cases entangled in netting when net fished on bottom	Pelagic trawls could potentially impact skate egg concentrations at exposed sites.
Dredge	None	Unknown, but possible dispersal of egg cases, unobserved mortality due to gear impacts, silting due to dredging, bycatch mortality	Scallop dredges have no impact on these skate egg concentration sites.
Dinglebar	None	Unknown, but possible direct mortality if weight encounters an egg case	Dinglebar gear is not used in the BSAI and thus no impacts on these sites.

3.5.5 Non-Target Resources

Non-target resources include groundfish species taken as bycatch in the targeted groundfish 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, with a small proportion taken in bottom trawl fisheries.

The significance criteria used in the 2006-2007 Groundfish Harvest Specifications EA/RIRs for non-specified species and prohibited species is applicable to this analysis of the effects (NMFS 2006b). The specification analysis provided the rationale for 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. 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.

Table 14. Criteria used to estimate the significance of effects on forage and non-specified species.

Insignificant Impact	The fishery would have insignificant impact on non-specified fish stocks if it did not change sustainable non-target species biomass.
Adverse impact	A substantial reduction in the sustainable biomass of non-target species stocks would be an adverse impact.
Beneficial impact	An increase in stocks above the levels they would reach in the absence of the fishery (perhaps due to the harvest of groundfish that compete for non-specified species prey) would be a beneficial impact.
Significantly adverse impact	Non-target species bycatches that were not consistent with sustainable non-specified species populations would be a significantly adverse impact. For the purpose of this analysis, the bycatch of non-target species will be assumed to be proportional to the sum of fishery TACs. A 50% increase in the harvest of target species from the baseline level is used as a proxy for an adverse significant threshold for non-target species
Significantly beneficial impact	No benchmark is available for a significantly beneficial impact, and this is not defined in this instance.
Unknown impact	Insufficient information available to predict target fish harvest change.

Table 15. Criteria used to estimate the significance of impacts on prohibited species.

	Halibut	Herring	Salmon and Steelhead	Crab
No impact	No incidental take of the prohibited species in question.			
Adverse impact	There are incidental takes of the prohibited species in question			
Beneficial impact	Natural at-sea mortality of the prohibited species in question would be reduced – perhaps by the harvest of a predator or by the harvest of a species that competes for prey.			
Significantly adverse impact	Fisheries are subject to operational constraints under PSC management measures. Groundfish fisheries without the PSC management measures would be a significantly adverse effect.			
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the prohibited species, and significantly beneficial impacts are not defined for these species.			
Unknown impact	Not applicable			

At present no active management and only limited monitoring of species in the other species and non-specified species occur. 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. Overall, the proportion of non-target species (non-specified, forage fish, and PSC) removed is thought to be small in relationship to the entire management area.

Under all alternatives, the total harvest or target species and associated PSC are expected to be the same because fishing would likely be nearby, and thus have similar PSC catch rates. 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. No change in potential takes of ESA-listed salmon is expected with this action, because no changes in overall harvest amounts are anticipated, and only minimal redistribution of fishing effort to avoid HAPC areas is anticipated. Therefore the effects of Alternative 3 would also be considered insignificant.

Under Alternative 1, the status quo or no action alternative, no unforeseen or additional environmental impacts would occur. Thus, the environmental impacts of Alternative 1 would be considered insignificant.

Under Alternative 2, the Council would identify any of the proposed areas of skate egg concentration as HAPCs, but would not adopt any gear type prohibitions or restrict any fishing activities. Therefore, the effects of Alternative 2 on prohibited species and non-target species are expected to be the same as for the no action alternative, and thus be considered insignificant.

Alternative 3 would redistribute fishing effort slightly in a few small areas of the eastern Bering Sea. In terms of bycatch of non-target species, it not expected that any negative incremental changes will occur from Alternative 3 because the amount of effort in these sites is low.

3.5.6 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.

Table 16. ESA listed and candidate species that range into the BSAI groundfish management area.

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 disperses in the ocean, settles to the sea floor, or washes 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 undocumented mortalities may occur to these species. Vessel strikes of mammals and sea birds also may occur, unknown to the vessel operator or unreported. Thus there likely are some unrecorded mortalities to marine mammals and seabirds from ship strikes;

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.

3.5.6.1 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, marine mammals are not likely to be affected by the HAPC designation or protection actions of Alternatives 2 or 3. Thus, the effect would be insignificant under any of the alternatives. None of the alternatives would 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 2014). Harvest of prey species would be similar under all alternatives.

Table 17. Criteria for determining significance of impacts to marine mammals.

	Incidental take and entanglement in marine debris	Harvest of prey species	Disturbance
Adverse impact	Mammals are taken incidentally to fishing operations, or become entangled in marine debris	Fisheries reduce the availability of marine mammal prey.	Fishing operations disturb marine mammals
Beneficial impact	There is no beneficial impact.	There are no beneficial impacts.	There is no beneficial impact.
Insignificant impact	No substantial change in incidental take by fishing operations, or in entanglement in marine debris	No substantial change in competition for key marine mammal prey species by the fishery.	No substantial change in disturbance of mammals.
Significantly adverse impact	Incidental take is more than PBR or is considered major in relation to estimated population when PBR is undefined.	Competition for key prey species likely to constrain foraging success of marine mammal species causing population decline.	Disturbance of mammal or such that population is likely to decrease.
Significantly beneficial impact	Not applicable	Not applicable	Not applicable
Unknown impact	Insufficient information available on take rates	Insufficient information as to what constitutes a key area or important time of year	Insufficient information as to what constitutes disturbance.

3.5.6.2 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 2014), the following species or species groups may possibly be affected by commercial fishing: 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 of waste and offal may also affect seabirds. ESA-listed seabirds are under the jurisdiction of the USFWS. Past Biological Opinions (2003) for the groundfish fisheries and the setting of annual harvest specifications 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 trawling (bottom trawling) could occur if sand lance habitat is adversely impacted. This negative habitat effect on sandlance could 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 limited 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. The proposed HAPC sites are in waters deeper than used by seabirds for benthic feeding. Further, any redistribution of effort due to these closures would be expected to be minimal and mostly occur in areas adjacent to the closure areas, and thus not change the incidental take or bycatch of seabirds. Therefore, Alternatives 2 and 3 have insignificant impacts on seabirds.

Table 18. Criteria used to determine significance of impacts on seabirds.

	Incidental take	Prey availability	Benthic habitat
Insignificant	No substantive change in bycatch of seabirds during the operation of fishing gear.	No substantive change in forage available to seabird populations.	No substantive change in gear impact on benthic habitat used by seabirds for foraging.
Adverse impact	Non-zero take of seabirds by fishing gear.	Reduction in forage fish populations, or the availability of forage fish, to seabird populations.	Gear contact with benthic habitat used by benthic feeding seabirds reduces amount or availability of prey.
Beneficial impact	No beneficial impact can be identified.	Availability of offal from fishing operations or plants may provide additional, readily accessible, sources of food.	No beneficial impact can be identified.
Significantly adverse impact	Trawl and hook-and-line take levels increase substantially from the baseline level, or level of take is likely to have population level impact on species.	Food availability decreased substantially from baseline such that seabird population level survival or reproduction success is likely to decrease.	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird population level survival or reproductive success is likely to decrease. (ESA listed eider impacts may be evaluated at the population level).
Significantly beneficial impact	No threshold can be identified.	Food availability increased substantially from baseline such that seabird population level survival or reproduction success is likely to increase.	No threshold can be identified.
Unknown impacts	Insufficient information available on take rates or population levels.	Insufficient information available on abundance of key prey species or the scope of fishery impacts on prey.	Insufficient information available on the scope or mechanism of benthic habitat impacts on food web.

3.5.7 Ecosystem

Fisheries can potentially 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. All alternatives would likely have the same insignificant effects on diversity because of the small changes in catch and effort between the alternatives and the same types of species and amounts expected to be harvested

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 under any of the alternatives. Therefore the effects on energy flow and balance under all alternatives are the same and insignificant.

Table 19. Significance thresholds for fishery induced effects on ecosystem attributes.

Effect	Criteria			
	Significantly Negative (-)	**Insignificant (I)**	**Significantly Positive (+)**	**Unknown (U)**
Predator-prey relationships	A decline outside of the natural level of abundance or variability for a prey species relative to predator demands.	No observed changes outside the natural level of abundance or variability for a prey species relative to predator demands	Increases of abundance or variability for a prey species relative to predator demands	Magnitude and/or direction of effects are unknown
Energy flow and balance:	Long-term changes in system biomass, respiration, production or energy cycling, due to removals.	No observed changes in system biomass, respiration, production or energy cycling, due to removals.	Increases in system biomass, respiration, production or energy cycling, due to lack of removals.	Magnitude and/or direction of effects are unknown
Ecosystem Diversity	Removals from area decreases either species diversity or the functional diversity outside the range of natural variability. Or loss in one or more genetic components of a stock that would cause the stock biomass to fall below minimum biologically acceptable limits	No observed changes outside the natural level for species diversity, functional diversity or genetic components of a stock.	Non-removal from the area increases the species diversity or functional diversity or improves the genetic components of a stock.	Magnitude and/or direction of effects are unknown

3.6 Cumulative Impacts

Analysis of the potential cumulative effects of a proposed action and its alternatives is a requirement of NEPA. An environmental assessment or environmental impact statement must consider cumulative effects when determining whether an action significantly affects environmental quality. The CEQ's regulations for implementing NEPA define cumulative effects as:

> The impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

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 incorporated by reference. These include the PSEIS (2004), the EFH FEIS (2005) and the harvest specifications EIS and most recent BSAI groundfish harvest specifications (2011b). 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.

3.6.1 Reasonably Foreseeable Future Actions (RFFA)

The most recent analysis of RFFAs for the groundfish fisheries is in the harvest specifications EIS and most recent BSAI groundfish harvest specifications (2011a). The RFFAs are described in the Harvest Specifications EIS section 3.3, 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 20. 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

RFFA that may affect target and prohibited species are shown in the table above. 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 Alternative 2, Alternative 3 gear prohibition options, or other options. 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. An increase in extraction of target species could be offset by federal management.

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. 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. An increase in extraction of target species could be offset by federal management.

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.

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 any mammals and seabirds listed under the Endangered Species Act 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.

3.6.2 Climate Change

Changes in the Bering Sea due to global climate change may be of a concern to the organisms that live in this environment. The release of carbon to the atmosphere from the burning of fossil fuels likely contributes to global warming. The impacts of global warning in the Bering Sea can include a rise in sea surface temperature, retreat of sea ice and acidification of marine waters.

The following information is from the January 9, 2007 Federal Register notice regarding the proposed listing of polar bears (72 FR 1064). This is a recent, general description of the potential changes in sea ice and the marine ecosystem due to Arctic warming.

> All models predict continued Arctic warming and continued decreases in the Arctic sea ice cover in the 21st century (Johannessen 2004, p. 328) due to increasing global temperatures, although the level of increase varies between models. Comiso (2005, p. 43) found that for each 1° Centigrade (C) (1.6 °F) increase in surface temperature (global average) there is a corresponding decrease in perennial sea ice cover of about 1.48 million km^2 (.57 million mi^2). Further, due to increased warming in the Arctic region, accepted models project almost no sea ice cover during summer in the Arctic Ocean by the end of the 21st century (Johannessen et al. 2004, p. 335). More recently, the National Snow and Ice Data Center cautioned that the Arctic will be ice-free by 2060 if current warming trends continue (Serreze and Rigor 2006, p. 2). The winter maximum sea ice extent in 2005 and 2006 were both about 6 percent lower than average values, indicating

significant decline in the winter sea ice cover. In both cases, the observed surface temperatures were also significantly warmer and the onset of freeze-up was later than normal. In both years, onset of melt also happened early (Comiso in press). A continued decline would mean an advance to the north of the 0 °C (32 °F) isotherm temperature gradient, and a warmer ocean in the peripheral seas of the Arctic Ocean. This in turn may result in a further decline in winter ice cover. Predicted Arctic atmospheric and oceanographic changes for time periods through the year 2080 include increased air temperatures, increased precipitation and run-off, and reduced sea ice extent and duration (ACIA 2005, tables on pp. 470 and 476).

A recent study of the Bering Sea, one of the most productive marine ecosystems on the planet, concluded ''[a] change from arctic to subarctic conditions is underway in the northern Bering Sea'' (Grebmeier et al. 2006, p. 1461). This is being caused by warmer air and water temperatures, and less sea ice. ''These observations support a continued trend toward more subarctic ecosystem conditions in the northern Bering Sea, which may have profound impacts on Arctic marine mammal and diving seabird populations as well as commercial and subsistence fisheries'' (Grebmeier et al. 2006, p. 1463).

With the increase in atmospheric carbon dioxide, additional carbon dioxide may be absorbed by marine waters resulting in acidification (The Royal Society 2005). The acidification may have an impact on those organisms that depend on calcium carbonate for skeletal structure, such as copepods, pteropods, and clams. Human inputs of carbon into the atmosphere may acidify marine waters, which may impact benthic organisms that depend on calcium carbonate for skeletal structure. This potential effect in combination with the potential effects of nonpelagic trawling on benthic habitat may result in cumulative adverse impacts for organisms depending directly and indirectly on the benthic habitat. The effects of acidification and ocean warming may be widespread while nonpelagic trawling effects would be limited to locations where trawling occurs. It is not possible to predict the level of impact the combined effect may have because the level of acidification and the organisms' responses are not clearly understood. No evidence exists that a significant cumulative impact is occurring at this time, but additional studies should be encouraged to provide a better understanding of future impacts.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

4.0 ECONOMIC IMPACTS

This chapter analyzes the economic impacts of the alternative on harvesters. The effects of the alternatives and options on processors and communities would be expected to be insignificant, due to the relatively small catches from the proposed habitat areas of particular concern (HAPC), and the likelihood that the catch can readily be made up elsewhere.

4.1 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. . In other words, all the skate species are combined into a single TAC. 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.

The current target fishery for skates in the BSAI began in 2011. Most skates are caught incidentally in the hook-and-line/longline 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 through 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 and 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 21. Aggregate 2011 through 2013 harvest recommendations for the BSAI skate complex.

Quantity				
	2011	2012	2013	2014
OFL (t)	37,817	37,169	45,800	44,100
ABC (t)	31,523	32,600	38,800	37,300

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 2013 and 2014 are those recommended by the Council.

Table 22. 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	24,700	23,291
2013	629,000	45,800	38,800	n/a	n/a

The year 2011 was the first year that the skate complex was managed outside the context of the former “other species” complex. The Alaska skate portions of the 2013 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 totaled 32,600 t and 38,800 t, respectively, and OFLs for 2012 and 2013 totaled 39,100 t and 45,800 t, respectively.

4.2 Incidental Catch and Discards

Most skates before 2011 have been caught incidentally in the longline fishery for Pacific cod and in the bottom trawl fisheries for pollock and flatfish. Retention rates ranged from 30%to 40% of the total observed skate catch during 2003 through 2009, primarily consisting of Aleutian and Alaska skates; 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 eastern Bering Sea pollock fishery, skate bycatch nearly doubled in 2008 compared to 2007, but declined to just over one thousand metric tons in 2010. In the Aleutian Islands Atka mackerel fishery, the bycatch of skates has averaged 158 mt in the last 3 years (2007 through 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. In addition, the Atka mackerel target fishery has been substantially curtailed as a result of recent Steller sea lion limitations, reducing the potential for adverse impacts on skates taken historically in this fishery.

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 incidental catch is in the hook and line (a.k.a, longline) 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. 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 to 2006. More skates were retained in the eastern Bering Sea 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 are relatively large-bodied skates.

Historically, skates were almost always recorded as "skate unidentified" 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 in the years 2004 through 2006. Recent observer data indicate that only about one half 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 hook as un-retained incidental catch, it cannot be identified to species by the observer (approximately 80 percent of longline-caught skates are unidentified, and longline catch accounts for the majority of observed skate catch). Changes made to the observer manual have resulted in a large increase in skate length measurements beginning in 2008.

In 2005, observers were encouraged to identify skates to genus that were dropped off of longlines, 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 percent) 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 (eastern Bering Sea 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 eastern Bering Sea.

4.3 Effects on Harvesters

Potential effects of the alternatives on harvesters were estimated from catch data. Trawl data were obtained from the VMS-enabled Catch-in-Areas database. The query selected trawl effort (2003 through 2011) inside any of the six areas of skate egg concentration identified 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 percent pollock, and bottom pollock as predominantly, but less than 90 percent pollock. Two sites, Zhemchug and Pribilof, showed no trawl effort. Using this methodology, all catch from any tow passing through a proposed HAC accrued towards the total, and, thus, overestimates actual catch of each tow taken from within site boundaries. Individual tows can extend many miles (e.g., a 4 hour tow at 4 knots covers 16 nautical miles) outside of a proposed skate egg site. The overestimate of the total catch from these tows is offset and reduced to some degree by the proportion of tows examined (less than 100% are observed).

4.3.1 Alternative 1

There would be no additional effects, beyond status quo, to any harvesters under Alternative 1.

4.3.2 Alternative 2

<u>Bottom Trawlers</u>

Nonpelagic (i.e., bottom) trawl effort in areas of skate egg concentration, as defined under Alternative 2, targeted arrowtooth flounder, Pacific cod, and flathead sole. A total of 5,881 metric tons of groundfish were taken in observed hauls intersecting the Bering 1, Bering 2, Pribilof, and Pervenets HAPC sites during the years 2003 through 2011 in the areas as defined under Alternative 2. The value of this catch was crudely estimated using annual catch, by species, and annual gross ex-vessels prices, from the 2011 Economic SAFE Reports. If all this reported catch had been retained and processed, which it was not, it is estimated that the gross ex-vessel value of this catch could have totaled $2,657,000, over the nine years.

Thus, on average, vessels using bottom trawls in these prospective HAPC areas could have earned approximately $356,000 per year (the total gross ex-vessel value divided by the nine years (2003 through 2011) of data) if it was retained and processed. Because Alternative 2 does not restrict fishing activities in the sites, and the fact that skates are not generally retained, however, the economic impacts would be expected to be nil.

<u>Pelagic Trawlers</u>

Under Alternative 2, a total amount of 23,898 mt of groundfish (virtually all pollock, with *de minimis* amounts of other groundfish) were taken in observed hauls intersecting those intersecting the Bering 1, Bering 2, Pribilof, and Pervenets proposed HAPCs during the years 2003 through 2011. If all catch had been retained and processed, it is estimated that the gross ex-vessel value of this catch could have been $7,127,000. Thus, on average, the value of groundfish caught by vessels using pelagic trawls in these areas may have been $792,000 per year (the total ex-vessel price divided by the nine years (2003 through 2011) of catch data collected). Because Alternative 2 does not restrict fishing activities in the sites, economic impacts would be expected to be nil.

<u>Scallop Vessels and Vessels Using Other Gears</u>

Designation of HAPC sites under Alternative 2 would not be expected to have any impacts on vessels fishing scallops with dredge gear, or vessels fishing any other non-trawl gear.

4.3.3 Alternative 3

<u>Bottom Trawlers</u>

Bottom trawling would be prohibited in HAPC sites under Alternative 3, Options b and c. The following is a summary of the effects of Alternative 3 on vessels using this gear-type.

Nonpelagic trawl effort in areas of skate egg concentration, as defined under Alternative 3, between 2003 and 2011 was focused on Bering 1, Bering 2, and the Pervenets sites, with no effort in the Bristol, Pribilof, or Zhemchug sites, as shown in Table 23. Approximately one half of the total catch in areas of skate egg concentration was in Bering 2, targeting on arrowtooth flounder. Pacific cod and flathead sole were the other two species with substantial catches, although six other species were identified as targets in the three fished sites.

Note that the catches can vary considerably among sites and from year to year within sites. For example, in 2003 and 2004, Bering 1 site had catches of Pacific cod > 100 mt, whereas in other years, cod catch was nil. Bering 1 had catches > 1,000 mt of arrowtooth flounder in 2008 and 2009. Pervenets had catches of arrowtooth > 500 mt in 2008. Overall, Bering 2 had the most catch of groundfish taken with non-pelagic trawls (up to 1,696 mt in 2009, worth an estimated $542,000 at gross ex-vessel).

A total amount of 10,495 metric tons of groundfish was taken in hauls intersecting the Bering 1, Bering 2~~,~~ and the Pervenets proposed HAPC sites, under Alternative 3, during the years 2003 through 2011. The value of potentially foregone catch was estimated using annual catch by species, and annual gross ex-vessels prices from the 2011 Economic SAFE Report. For Greenland turbot, first gross wholesale value was used, rather than gross ex-vessel price, because turbot were only taken by catcher processors. If all 10,495 mt of groundfish catch had been retained and processed, it is estimated that the gross ex-vessel value of this catch could have been somewhat less than $4,477,000 (total over the nine year period and noting that the exvessel price of Greenland turbot would be less than the gross wholesale value),, as shown by Table 24. Thus, on average, a closure to bottom trawling only of these sites (Option b) could have resulted in a maximum foregone value of about $497,000 per year, which is the total gross ex-vessel value divided by the nine years (2003 through 2011) of catch data collected. This average of $497,461 per year of estimated forgone bottom trawl value equates to approximately 0.09% of an average (2006 to 2010) annual gross value of the BSAI trawl groundfish (up to $515,840,000).

Pelagic Trawlers

Pelagic trawling would be prohibited in HAPC sites under Alternative 3, Option c. The following is a summary of the effects of Alternative 3 Option c on vessels using pelagic trawl gear.

Pelagic trawl effort in areas of skate egg concentration from 2003 to 2011 was focused on the Bering 1 and 2, Bristol, and Pervenets sites, as shown in Table 25. In these sites, effort has shifted between areas, with some areas being relatively more important than other areas through the years. The target of the pelagic trawl fishery was pollock in all cases. Approximately one half of all pollock catch from areas of skate egg concentration 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 fished by pelagic trawlers since 2007.

A total of 36,290 metric tons of pollock was taken in commercial pelagic trawl hauls intersecting four of the six proposed HAPC sites (defined by Alternative 3 boundaries) during the years 2003 through 2011. If all catches were retained, it is estimated that the approximate gross ex-vessel value of this catch over nine years, and from all proposed HAPC sites, would have been $9,919,000. Thus, on average, a closure to pelagic trawling of these sites under Alternative 3, Option c, could have resulted in maximum foregone gross revenues of $1,102,000 per year, which is the approximate total gross ex-vessel value divided by the nine years (2003 to 2011) of catch data collected. The average of $1,102,000 per year of estimated forgone pelagic catch equates to approximately 0.21% of an average (2006 to 2010) annual gross value of the BSAI trawl groundfish ($515,840,000).

Catch varies greatly across sites and years. The highest catches were observed as follows. For Bering 1, catches of less than 4,000 mt were observed in 2004. In Bering 2, catches less than 4,000 mt were taken in 2007. In the Bristol site, catches less than 2,000 mt were taken in 2003 and 2004. At the Pervents site, catches less than 3,000 mt were taken in 2007, 2008, and 2010. In all other years, and at other sites, catches of pollock was relatively low or non-existent.

In previous years (1990 to 2005), the Bering 2 site appears to have been important to the pollock fishery, as compared to more recent data (2003 to 2011). From the longer set of data, it is estimated that the Bering 2 site experienced an average of 5,470 mt to 13,037 mt of catch per year, which is the total observed pelagic trawl catch, 87,517 mt to 208,599 mt, divided by sixteen years (1990 to 2005). It would be expected that the fleet could make up this foregone catch in other areas, adjacent or elsewhere. However, moving the fleet elsewhere to make up foregone catch may require vessels to fish outside of their preferred zone and could cause some increased operation costs (e.g., lower CPUEs, higher PSC rates, longer trip times, etc.).

There may be socioeconomic impacts of Alternative 3 beyond what is provided by the quantitative analysis discussed above. The following is a description of public testimony on the implementation of gear prohibitions in the proposed HAPC sites. Public testimony during the February 2012 Council meeting focused on the Bering 1 and Bering 2 sites. Specifically, the Bering 1 site was important to industry during the years 1986 to 1999, which is earlier than the data the analysis considered (2003 to 2011) and years without VMS effort data. The Bering 2 site continues to be of high importance to those vessels fishing for pollock, and the inshore fleet could incur significant impacts during the B season from any trawl restrictions. The Bering 2 site encompasses a narrow fishing lane used by the pollock CV fleet during the summer months, particularly in July and August. The Bering 2 site is also in an area where the bathymetry slopes rapidly from relatively shallow depths, at the southeast edge, to much deeper waters along the northwest edge. Thus, in years when pollock (or cod) are aggregated at the deeper end of the Bering 2 site, vessels line up and tow very closely to one another, in order to catch pollock (or cod) along a particular depth contour in the area known as "the horseshoe." Consequently, a prohibition on pelagic trawl gear within the Bering 2 site would be in the middle of this fishing lane, in the worst case, and could act as a roadblock to traffic, pinching the flow of vessels into a narrower corridor. This obstacle could hinder pollock and cod fishing, increase trip time, cause gear conflicts, and potentially render the adjacent areas unfishable.

Testimony further suggested that the impacts on forgone harvest could be higher than what is predicted by the expanded catch data—i.e., from 1998 to 2010 versus from 2003 to 2011. In addition, the potential displacement of the fleet could be greater than originally anticipated, which could result in higher PSC rates (e.g., halibut, salmon). If the pollock trawl fleet is unable to fully prosecute the fishery during the summer months in the "horseshoe," it may try to make up the difference later into the B season. This may result in "trading off" salmon PSC, since Chinook PSC rates are highest in the early season, while chum PSC is higher in the late season. Also, the Bering 2 is a relatively deep water trawl and chum salmon PSC is lower in deep water – if the fleet is pushed into shallower waters, chum PSC could increase.

<u>Scallop Vessles and Vessels Using Other Gears</u>

Dredge effort for scallops 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. 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 m to 120 m, 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. Designation of HAPC sites (and prohibiting fishing with trawl and dredge gear) under Alternative 3, would not have any impacts on vessels fishing any other non-trawl gear.

<u>Economic Impacts of Alternative 3, Option c</u>

On average, analysis suggests that a closure to pelagic <u>and</u> bottom trawling of these sites (Alternative 3, option c) could result in a *maximum* foregone gross value of approximately $1,599,000 per year. Of this total, pelagic trawling in the areas could represent forgone gross value of $1,102,000 per year, and bottom trawling $497,000, which is the total ex-vessel value (noting that this overestimate of wholesale value of turbot was used)divided by the nine years (2003 through 2011) of catch data examined. For comparison, BSAI trawl fisheries' gross ex-vessel value averaged $515,840,000, over 2006 through 2010 (from the 2011 Economic SAFE, for all trawl species). The average of $1,102,000 per year of estimated forgone pelagic value, attributable to HAPC closures, equates to approximately 0.21% of an average (2006 through 2010) annual gross value of the BSAI trawl groundfish (up to $515,840,000). Also, recall that the methodology used to generate these estimates of forgone catch and value, includes all catch from any tow passing through a proposed HAC accrued towards the total, and, thus, overestimates actual catches (and value) taken from observed hauls within site boundaries. Additionally, it is likely that these catch amounts, characterized as "foregone", would be taken in other nearby areas. Assuming that operators are being excluded from their "preferred" grounds, additional costs to the fleets may be incurred (e.g., increased fuel, lower CPUE, crowding effects, gear conflicts, etc.), rather than gross revenue losses from forgone catch.

There would be no economic impacts on other fisheries. Although Alternative 3 options include prohibition on the use of dredge gear and dinglebar gear in the proposed HAPC areas, these gear types have not been used in these areas to date. Other fisheries using pot gear or longline gear would continue to be allowed to fish in these areas, and, thus, would be unaffected by the action.

Table 23. Bottom trawl catch (mt) per year, under Alternative 3. Sites not listed experienced no catch in the years examined.

HAPC Area and Year	Species catch, in metric tons (mt)											
	Atka Mackerel	Pollock – Bottom	Pacific Cod	Other Flatfish	Rockfish	Flathead Sole	Other Species	Rock Sole	Turbot	Arrowtooth	Yellowfin	Total
1. Bering 1	**12**	**32**	**677**	**44**	**0**	**2**	**347**	**3**	**0**	**285**	**0**	**1,402**
2003	7	0	171	0	0	0	347	0	0	108	0	633
2004	0	0	476	44	0	0	0	3	0	0	0	522
2005	6	0	30	0	0	0	0	0	0	136	0	172
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	2	0	0	0	38	0	41
2009	0	13	0	0	0	0	0	0	0	0	0	13
2010	0	20	0	0	0	0	0	0	0	3	0	22
2011	0	0	0	0	0	0	0	0	0	0	0	0
2. Bering 2	**110**	**35**	**489**	**716**		**298**		**83**	**182**	**5,671**	**12**	**7,595**
2003	15	0	332	95	0	5	0	0	121	188	0	756
2004	0	0	128	365	0	170	0	83	39	620	0	1,406
2005	95	0	4	243	0	123	0	0	22	580	12	1,078
2006	0	0	25	0	0	0	0	0	0	397	0	422
2007	0	0	0	7	0	0	0	0	0	171	0	178
2008	0	17	0	4	0	0	0	0	0	1,382	0	1,403
2009	0	9	0	0	0	0	0	0	0	1,687	0	1,696
2010	0	9	0	1	0	0	0	0	0	391	0	401
2011	0	0	0	0	0	0	0	0	0	255	0	255
4. Pribilof	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**25**	0	**25**
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	5	0	5
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	14	0	14
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	6	0	6
6. Pervenets	**0**	**9**	**205**	**0**	**43**	**337**	**0**	**0**	**48**	**827**	**3**	**1,473**
2003	0	0	0	0	0	8	0	0	48	0	0	55
2004	0	0	187	0	0	209	0	0	0	0	3	399
2005	0	0	0	0	0	0	0	0	0	118	0	118
2006	0	0	18	0	0	0	0	0	0	19	0	37
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	112	0	0	0	573	0	684
2009	0	0	0	0	0	9	0	0	0	117	0	126
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	9	0	0	43	0	0	0	0	0	0	53
Total (mt)	**122**	**77**	**1,371**	**759**	**43**	**637**	**347**	**86**	**230**	**6,808**	**15**	**10,495**

Source: NMFS HCD and NPFMC.

Table 24. Gross ex-vessel value of nonpelagic (i.e., bottom trawl) trawl catch per year, under Alternative 3. Sites not listed experienced no catch in the years examined.

HAPC Area and Year	Species catch, in metric tons (mt)											Total	Average value/year
	Atka Mackerel	Pollock - Bottom	Pacific Cod	Other Flatfish	Rockfish	Flathead Sole	Other Species	Rock Sole	Turbot	Arrowtooth	Yellowfin		
1. Bering 1	**3,045**	**10,987**	**345,387**	**15,883**	**0**	**940**	**109,776**	**1,086**	**0**	**109,071**	**0**	**596,175**	**66,242**
2003	1,545	0	100,933	0	0	0	109,776	0	0	34,257	0	246,510	
2004	0	0	229,216	15,883	0	0	0	1,086	0	0	0	246,186	
2005	1,500	0	15,237	0	0	0	0	0	0	59,206	0	75,944	
2006	0	0	0	0	0	0	0	0	0	0	0	0	
2007	0	0	0	0	0	0	0	0	0	0	0	0	
2008	0	0	0	0	0	940	0	0	0	14,730	0	15,671	
2009	0	5,206	0	0	0	0	0	0	0	0	0	5,206	
2010	0	5,781	0	0	0	0	0	0	0	877	0	6,658	
2011	0	0	0	0	0	0	0	0	0	0	0	0	
2. Bering 2	**28,332**	**14,367**	**278,193**	**273,456**	**0**	**116,696**	**0**	**30,055**	**401,045**	**2,070,286**	**5,137**	**3,217,566**	**357,507**
2003	3,514	0	195,633	30,114	0	1,581	0	0	266,046	59,574	0	556,462	
2004	0	0	61,903	132,421	0	61,751	0	30,055	86,792	225,209	0	598,131	
2005	24,817	0	2,048	105,978	0	53,365	0	0	48,206	252,451	5,137	492,002	
2006	0	0	18,608	0	0	0	0	0	0	174,639	0	193,247	
2007	0	0	0	2,913	0	0	0	0	0	70,729	0	73,642	
2008	0	7,914	0	1,618	0	0	0	0	0	532,119	0	541,650	
2009	0	3,829	0	0	0	0	0	0	0	538,044	0	541,873	
2010	0	2,624	0	411	0	0	0	0	0	131,534	0	134,570	
2011	0	0	0	0	0	0	0	0	0	85,988	0	85,988	
4. Pribilof	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8,705**	**0**	**8,705**	**967**
2003	0	0	0	0	0	0	0	0	0	0	0	0	
2004	0	0	0	0	0	0	0	0	0	0	0	0	
2005	0	0	0	0	0	0	0	0	0	0	0	0	
2006	0	0	0	0	0	0	0	0	0	2,244	0	2,244	
2007	0	0	0	0	0	0	0	0	0	0	0	0	
2008	0	0	0	0	0	0	0	0	0	0	0	0	
2009	0	0	0	0	0	0	0	0	0	4,510	0	4,510	
2010	0	0	0	0	0	0	0	0	0	0	0	0	
2011	0	0	0	0	0	0	0	0	0	1,951	0	1,951	
6. Pervenets	**0**	**2,744**	**103,550**	**0**	**0**	**124,069**	**0**	**0**	**105,437**	**317,735**	**1,174**	**654,708**	**72,745**
2003	0	0	0	0	0	2,397	0	0	105,437	0	0	107,834	
2004	0	0	89,906	0	0	75,894	0	0	0	0	1,174	166,974	
2005	0	0	0	0	0	0	0	0	0	51,581	0	51,581	
2006	0	0	13,643	0	0	0	0	0	0	8,375	0	22,019	
2007	0	0	0	0	0	0	0	0	0	0	0	0	
2008	0	0	0	0	0	43,029	0	0	0	220,457	0	263,486	
2009	0	0	0	0	0	2,749	0	0	0	37,321	0	40,071	
2010	0	0	0	0	0	0	0	0	0	0	0	0	
2011	0	2,744	0	0	0	0	0	0	0	0	0	2,744	
Grand Total	**31,376**	**28,098**	**727,129**	**289,339**	**0**	**241,705**	**109,776**	**31,141**	**506,482**	**2,505,795**	**6,311**	**4,477,153**	**497,461**

Table 25. Pelagic trawl catch, in tons of groundfish (pollock) per year, in areas designated by Alternative 3.

HAPC Area and Year	Pollock – Bottom (mt)	Pollock – Midwater (mt)	Grand Total (mt)	Max. Est. Gross Ex-vessel Value[a]
1. Bering 1	**0**	**6,575**	**6,575**	**1,678,264**
2003	0	381	381	89,687
2004	0	4,328	4,328	1,009,290
2005	0	39	39	10,725
2006	0	46	46	12,954
2007	0	246	246	69,815
2008	0	0	0	0
2009	0	275	275	114,345
2010	0	0	0	0
2011	0	1,260	1,260	371,448
2. Bering 2	**427**	**7,558**	**7,986**	**1,487,372**
2003	23	211	234	55,084
2004	322	1,369	1,691	394,341
2005	0	0	0	0
2006	42	1,262	1,303	366,925
2007	41	4,616	4,657	624,360
2008	0	101	101	46,662
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
3. Bristol	**0**	**5,828**	**5,828**	**1,380,484**
2003	0	3,543	3,543	834,022
2004	0	2,016	2,016	470,131
2005	0	0	0	0
2006	0	5	5	1,408
2007	0	264	264	74,923
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
4. Pribilof	**0**	**658**	**658**	**184,115**
2003	0	0	0	0
2004	0	0	0	0
2005	0	216	216	59,400
2006	0	329	329	92,646
2007	0	113	113	32,069
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
5. Zhemchug	**0**	**1,100**	**1,100**	**269,088**
2003	0	0	0	0
2004	0	856	856	199,619
2005	0	213	213	58,575
2006	0	19	19	5,350
2007	0	0	0	0
2008	0	12	12	55,44
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
6. Pervenets	**0**	**14,570**	**14,570**	**4,919,662**
2003	0	0	0	0
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	6,178	6,178	1,753,316
2008	0	3,556	3,556	1,642,872
2009	0	806	806	335,135
2010	0	4,031	4,031	1,188,339
2011	0	0	0	0
Total	**4270**	**36,290**	**36,290**	**9,918,985**

Source: NMFS HCD.

5.0 MANAGEMENT AND ENFORCEMENT CONSIDERATIONS

Enforcement considerations of the proposed alternatives and options, and a discussion of the effects the action on management and enforcement, depend on the specific alternative and option selected. Briefly, if the Council wishes to identify HAPC areas around skate egg concentration sites *and* wishes to enforce protections through gear prohibitions (i.e., Alternative 3), the Council must adopt HAPC areas of a minimum size to allow effective VMS tracking for enforcement. The Council must also consider establishing HAPC boundaries along latitude and longitude lines, where practical. Currently, the minimum thresholds are generally a buffer of at least 1 nm beyond the boundary of the area to be protected in order to account for current VMS capabilities, potential GPS error, and the dislocation between vessels and deployed gear. Should the council decide to implement trawl gear restrictions for these areas, the Enforcement Committee has recommended prohibition of all trawl activity in these areas. The minimum size threshold may be reduced with the implementation of increased VMS poll rates and geo-fencing, which is discussed in Section 5.3.

At the February 2012 Council meeting, the Enforcement Committee received an overview of the three alternatives presented in the analysis. During discussion, the Committee noted that if the Council wished to identify these skate egg concentration areas and to protect them using VMS monitoring, then there would be a minimum size requirement that would allow for protection, given the limitations of VMS polling (twice per hour), uncertainty in GPS locations, and the possible spatial dislocation between the vessel and gear. The Committee was informed that there was concern at the SSC about increasing a buffer beyond the distribution of the egg concentration site. However, while the Committee recognized the desire to use biological data (egg concentrations) to identify the sites, NMFS Enforcement would need a larger buffer, to limit vessel activity to ensure conservation of the biological resource.

The Committee stated that an area 5 nm per side would be the ideal minimum, because of the limits of VMS to accurately track a vessel through the area. With areas smaller than 5 nm per side, although providing some level of protection to the site, the likelihood of successful enforcement goes down substantially. There could be additional complications in implementing changes in how VMS operates in Alaska, and the Committee would be hesitant to recommend tweaking VMS, before current concerns can be addressed. The Committee's final recommendation to the Council was to design areas to accommodate current VMS limitations, rather than attempting to change VMS to accommodate smaller areas. The Committee also discussed the desire to align sides of areas with latitude and longitude, to the greatest extent practicable. It is more practical for enforcement personnel and USCG pilots to quickly determine whether a vessel is inside or outside of a protected area with margins along latitude and longitude lines, than an irregularly shaped area.

Due to the size of the BSAI 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 the regulatory definitions of gear types, 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.

In addition to being monitored by surveillance by aircraft, a vast majority of trawlers active in the groundfish fisheries in these areas carry observers 100% of the time. An observer physically present on the deck at haul-back represents a significant disincentive for use of illegal trawl gear. While fishery observers are not enforcement agents and should not be placed in that role, it nonetheless seems reasonable that an observer's mere presence during the setting and retrieving of the trawl gear, given the very obvious physical differences between bottom and pelagic configurations, could be a compelling and effective deterrent to potential violators. A more considered examination of the ‘risk’ of detection incurred by a would-be violator of a trawl-type restriction might alter the relative advantage of alternatives that contemplate banning one, as opposed to both, trawl configurations in the proposed HAPC areas.

One additional, possible mitigating factor, at least for aerial surveillance, would be to have vessels declare what they are targeting and what gear they are using through their vessel monitoring systems (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. The Enforcement Committee has noted that the Bering Sea trawl fleet is one of the most highly observed fishing fleets in the world, and the observer position reports, reviewed by enforcement personnel, could provide another potential information source.

The Enforcement Committee has 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. This clarity also benefits fishing vessels in avoiding or inadvertently entery of a closed area. There have been no cases based solely on VMS data that have stood up in court, unless a cutter or aircraft was able to verify that fishing gear was in the water, (i.e., 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).

If the Council wishes to protect the proposed skate egg concentration HAPCs, and VMS is the mechanism used to monitor closures of these areas, then the ideal *minimum* size, according to the USCG and NOAA, is approximately 5 nm to a side. This is the minimum size that would provide sufficient buffer space in order to use VMS, as it is currently deployed and at current polling rates, 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 U.S. Coast Guard 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 is protected.

The distribution maps at each site of skate egg concentration (Appendix B – Color Figures 11 through 26) display two possible alternatives to determine the extent of the area, based on Alternatives 2 and 3. The red boundary is based on the distribution of trawl sites where skate eggs were greater than 1,000 per 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 habitat area and providing a small buffer around the site that produces a manageable area and shape to facilitate enforcement. The black boundary line expands the areas to comply with the recommendations of the Enforcement Committee.

5.1 Vessel Monitoring Systems (VMS)

At its February 2012 meeting, the Council followed the Enforcement Committee’s recommendations to achieve effective enforcement of the HAPC areas and modified Alternative 3 to establish a minimum size threshold for the areas to at least 5 nm to a side for areas smaller than 3 nm per side. For HAPC areas with at least 3nm per side, a buffer of 1 nm was added to the boundaries established in Alternative 2 in order to provide enough distance to allow VMS, as currently established in regulation, to be used as a tool to determine activity in the protected area in a legal setting; this despite information that a buffer of ***less*** than 5 nm was insufficient for this purpose. Notwithstanding the possibility that the proposed addition of 1 nm to an area smaller than 4 nm on a side fails to meet the necessary minimum dimension for effective monitoring, the purported intent of this modification to Alternative 3 was to allow for effective VMS tracking for enforcement.

VMS in Alaska is a relatively simple system, involving a tamperproof VMS unit, set to report a vessel identification and location at fixed 30-minute intervals to the NOAA Fisheries Office of Law Enforcement (OLE). Some of these units allow NOAA OLE to communicate with the unit and modify the reporting frequency to longer or shorter invervals. 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 are 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.

All of the trawl vessels that would be potentially affected by closures under Alternative 3 are required to have VMS. Fleets currently without VMS units (halibut IFQ, halibut CDQ, GOA sablefish IFQ, and jig), are not regulated by this action, thus, monitoring the proposed HAPC sites with VMS may hold some promise.

5.2 Vessel Speed and Distance Traveled

A simple speed calculation helps relate how far a vessel may travel, at a set speed, given a certain measure of time. Distance traveled (in nautical miles) equals the speed (knots) of the vessel times the number of minutes traveled, divided by 60.

Equation 2. The relationship between distance and vessel speed.

$$d = s*t/60$$

For different speeds, different distances are traveled (see table below). Generally, fishing vessels transit at speeds of seven knots or faster, tow fishing nets at speeds averaging roughly four knots (some vessels tow faster, however six knots is rarely exceeded when towing), and haul fixed fishing gear at slow speeds usually not to exceed one to two knots.

Table 26. Relationship of time, speed and distance for VMS polling rates.

t = time (min)	3 knots	4 knots	6 knots	10 knots
	d = distance (nm)	d = distance (nm)	d = distance (nm)	d = distance (nm)
0	0.00	0.00	0.00	0.00
5	0.25	0.33	0.50	0.83
10	0.50	0.67	1.00	1.67
15	0.75	1.00	1.50	2.50
20	1.00	1.33	2.00	3.33
25	1.25	1.67	2.50	4.17
30	1.50	2.00	3.00	5.00
35	1.75	2.33	3.50	5.83
40	2.00	2.67	4.00	6.67
45	2.25	3.00	4.50	7.50
50	2.50	3.33	5.00	8.33
55	2.75	3.67	5.50	9.17
60	3.00	4.00	6.00	10.00

Source: NMFS HCD.

Current regulations require vessels to transmit data two times per hour via VMS (polling rate). In order to establish a vessel track line, two back-to-back positions are needed to create a vessel track line. By calculating time, speed, and distance, a vessel traveling at a speed of four knots would travel four nautical miles (nm) in one hour (60 minutes) or 2nm in one-half hour (30 minutes)[10]. Thus, a vessel traveling at four knots transmits a VMS position twice every hour or once every 2nm. This is creates a polling rate of two times per hour. The result is the polling rate sets a minimum distance to establish a two position track line.

Distance traveled calculations are plotted for each HAPC site (see figures below). A strong correlation exists between the size of the HAPC area and the polling rate needed to establish the two position track line within each site. This creates a level of confidence in order to be certain any conservation measures, such as gear restrictions, are monitored and enforceable. Specifically, Bering 2 and Pervenets HAPC sites are large areas and the current polling rate of two times per hour allows for a vessel track line to be established over the majority of the HAPC.

[10] For this analysis, the speed of 4 knots is used to represent the speed of a vessel towing trawl gear.

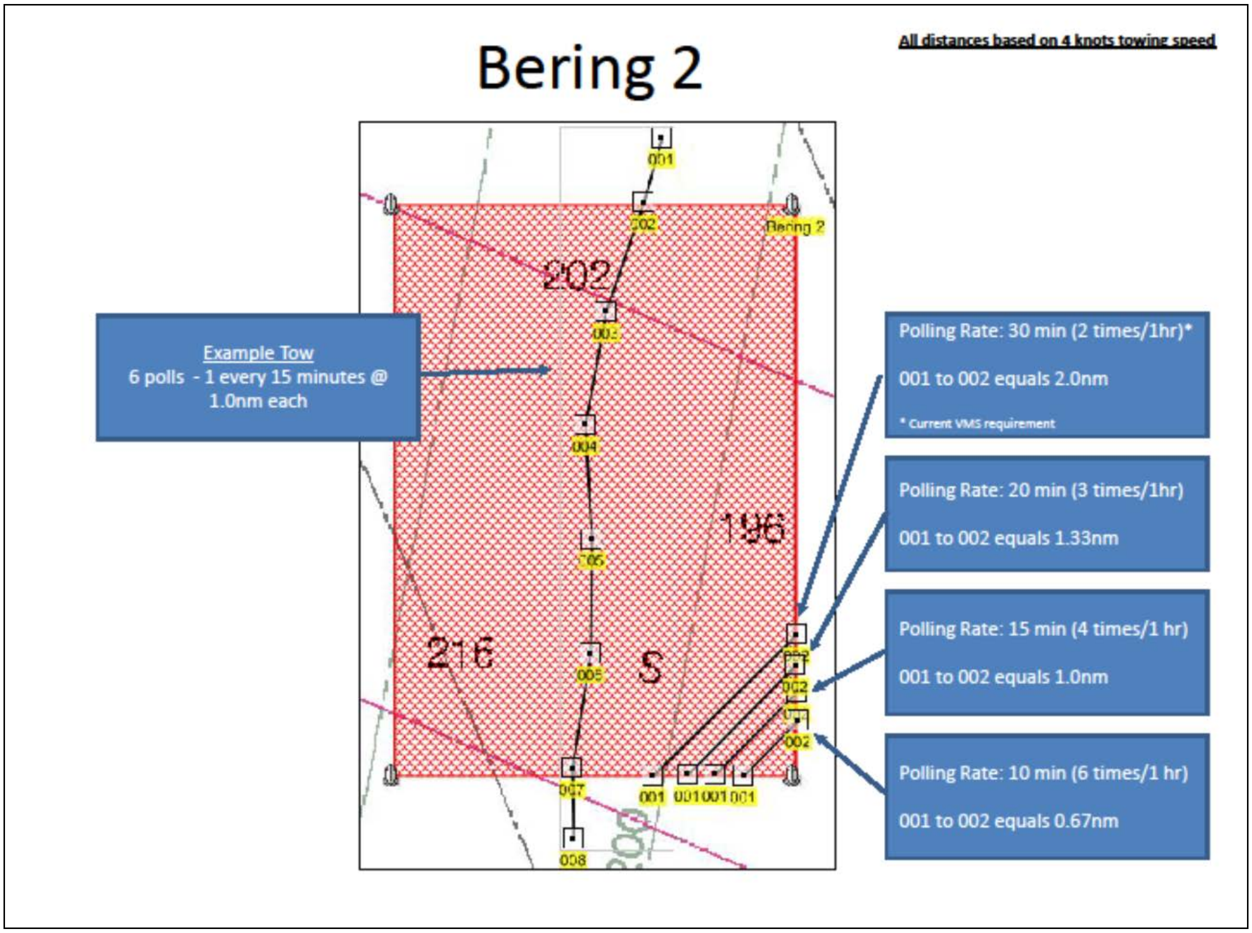


Figure 5. Illustration of the effects of different VMS polling rates relative to the Bering 2 site, with boundaries described under Alternative 2.

Using the same polling rate, the Pribilof and Zhemchug HAPCs are small and the two times per hour rate is not adequate to confidently establish a two position track line within the HAPC. In these smaller areas, a polling rate of once every ten minutes (6 times per hour) would provide similar confidence as compared to the larger areas.

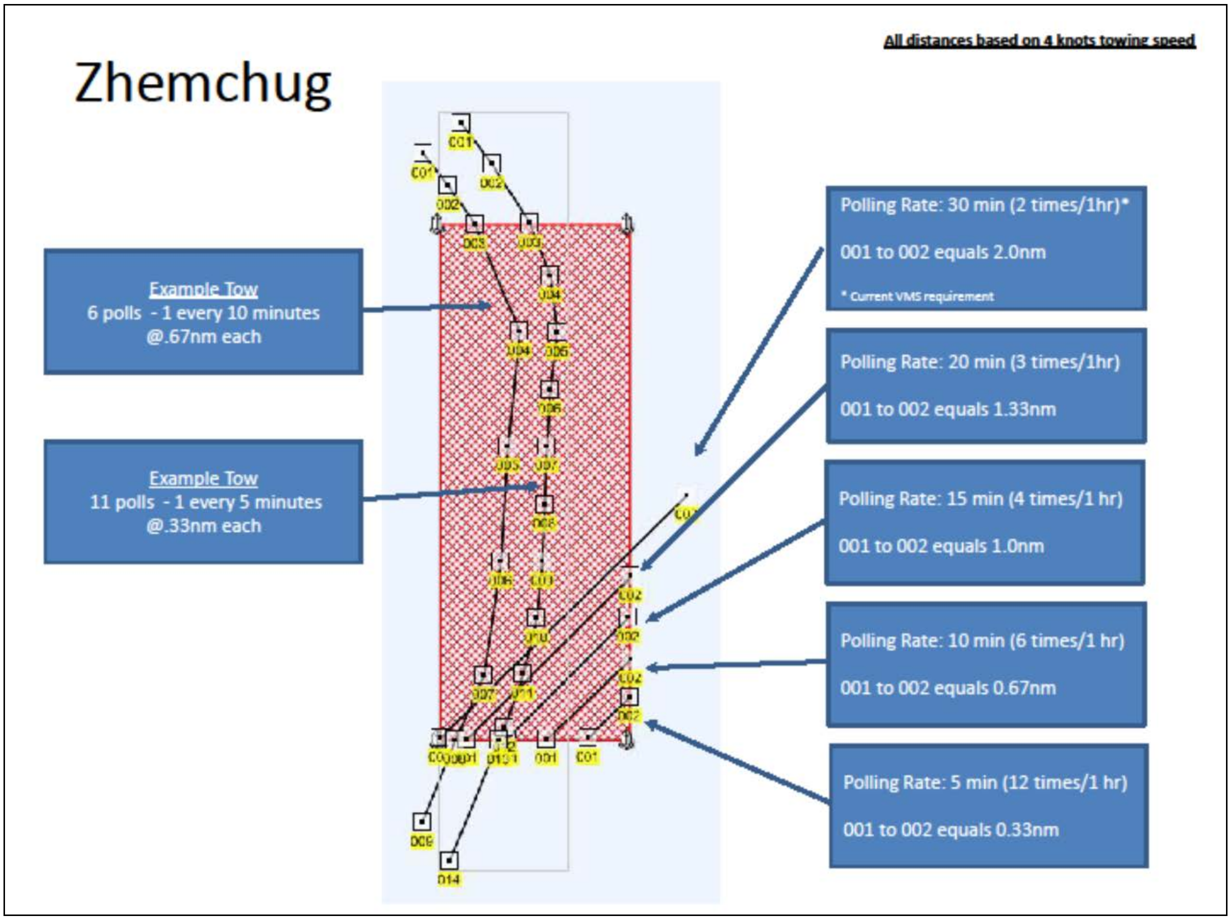


Figure 6. Illustration of the effects of different VMS polling rates relative to the Zhemchug site, with boundaries described under Alternative 2.

The Bering 1, Bering 2, and Bristol HAPCs are medium in size. The two times per hour polling rate would establish a two position track line, however the confidence is less. For these HAPCs, a polling rate of once every fifteen minutes (4 times per hour) would provide similar confidence as compared to the larger areas.

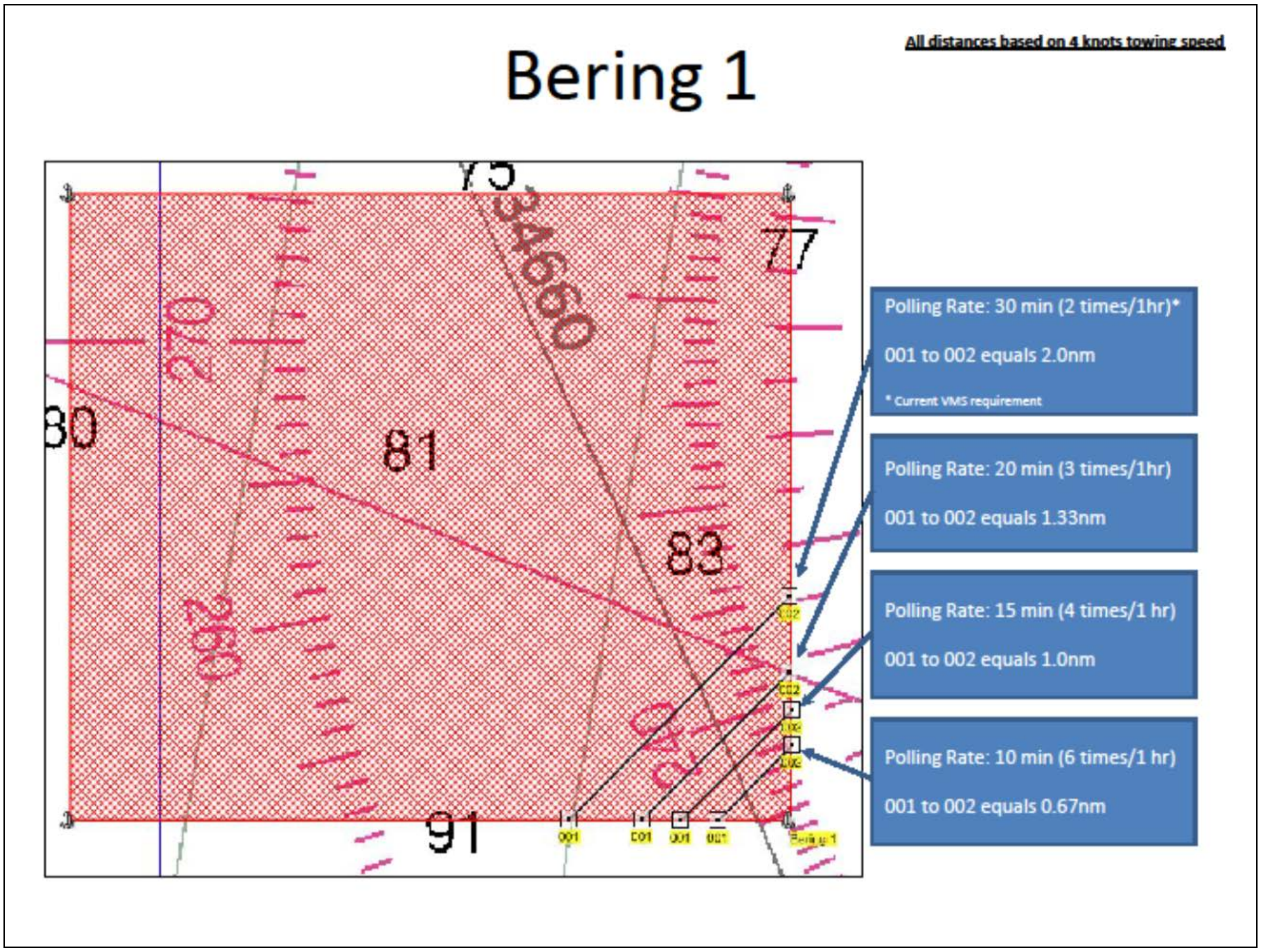


Figure 7. **Illustration of the effects of different VMS polling rates relative to the Bering 1 site, with boundaries described under Alternative 2.**

In summary, an increased polling rate would be needed to adequately monitor smaller and medium sites, should VMS be used for monitoring. In all cases, an increase in the polling rate creates greater confidence to establish vessels activities in the HAPCs.

Costs of increased polling rates can be calculated as follows, given:

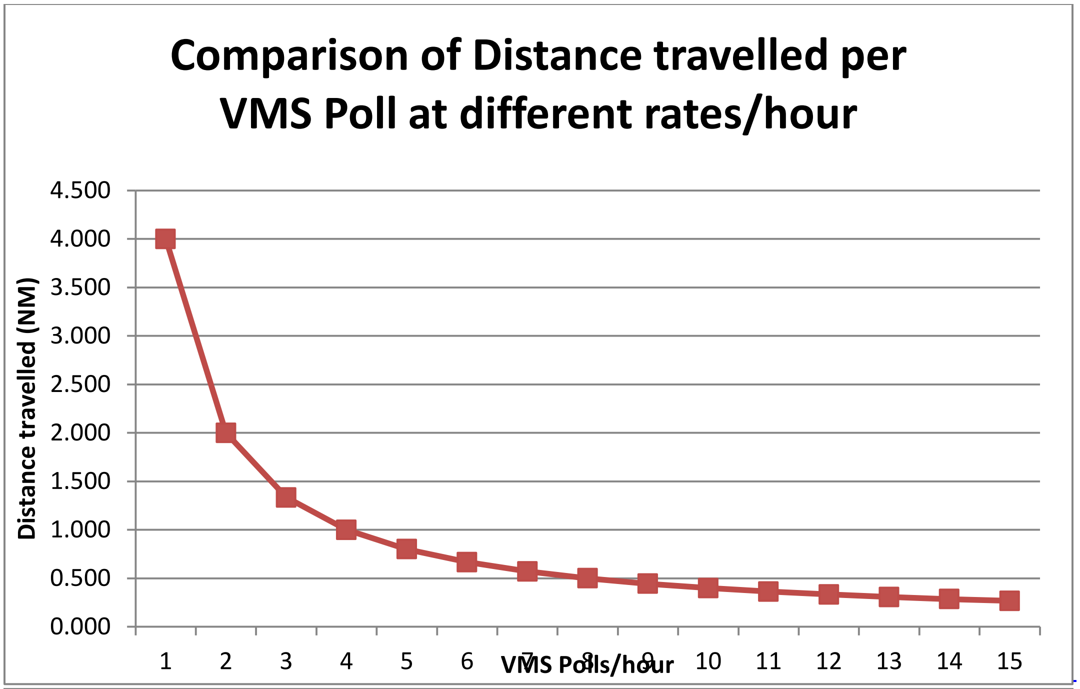
1) Trawl Speeds of 4 knots
2) General horizontal accuracy of GPS systems is 100 meters for land based mobile objects
3) Accuracy of GPS units at sea is decreased by the movement of the vessel in 3 dimensions (Pitch and Roll)
4) Costs are based upon the average change for between 1 and 2 polls/hr, and are extrapolated out at $25.88 per additional poll per month.

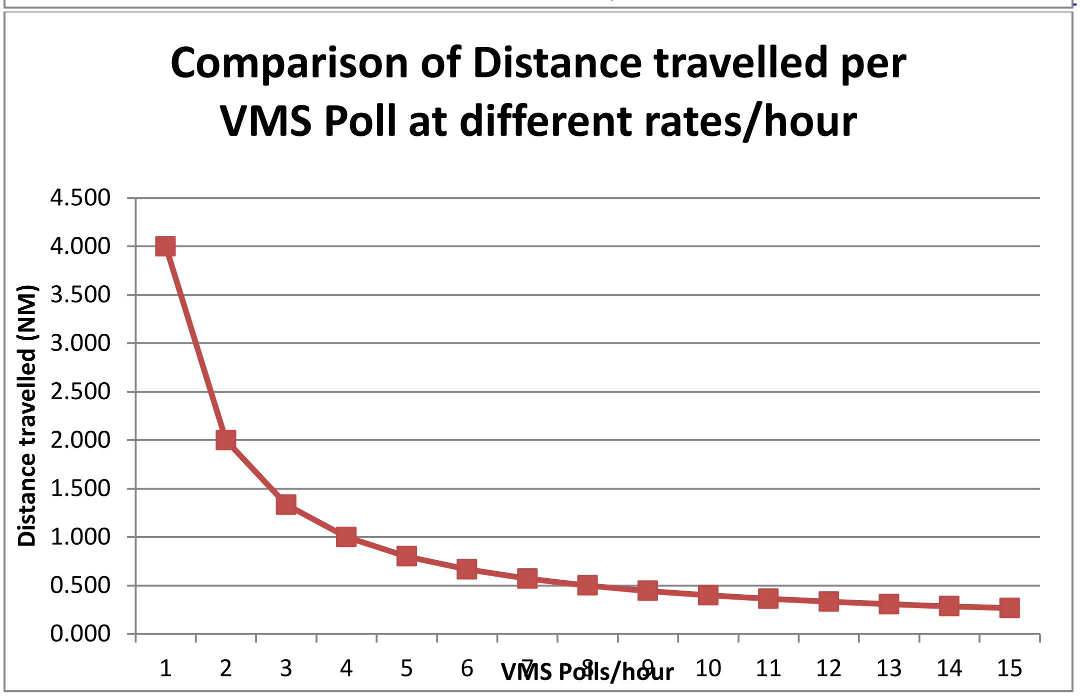
Once a point is attained where the GPS error is equal to or greater than the change in distance travelled between polls, any additional benefit is negligible (see Table 27).

Table 27. Increased VMS poll rates – distances and costs.

Poll Rate/hr	Distance Travelled (NM)	Distance (yds)	Change in Distance (NM)	Change (yds)	AVG Monthly Cost to Industry	AVG Annual Cost	Minutes between polls
1	4.000	8000			$42.00	$504.00	60.00
2	2.000	4000	2.000	4000	$67.88	$814.56	30.00
3	1.333	2667	0.667	1333	$93.76	$1,125.12	20.00
4	1.000	2000	0.333	667	$119.64	$1,435.68	15.00
5	0.800	1600	0.200	400	$145.52	$1,746.24	12.00
6	0.667	1333	0.133	267	$171.40	$2,056.80	10.00
7	0.571	1143	0.095	190	$197.28	$2,367.36	8.57
8	0.500	1000	0.071	143	$223.16	$2,677.92	7.50
9	0.444	889	0.056	111	$249.04	$2,988.48	6.67
10	0.400	800	0.044	89	$274.92	$3,299.04	6.00
11	0.364	727	0.036	73	$300.80	$3,609.60	5.45
12	0.333	667	0.030	61	$326.68	$3,920.16	5.00
13	0.308	615	0.026	51	$352.56	$4,230.72	4.62
14	0.286	571	0.022	44	$378.44	$4,541.28	4.29
15	0.267	533	0.019	38	$404.32	$4,851.84	4.00

Source: USCG.





Source: USCG.

Figure 8. Relationship between the distances a vessel travels (nm) and increasing VMS polls per hour.

5.3 Geo-fence Application for HAPC Sites

A geo-fence is a virtual perimeter for a real-world geographic area. When used in conjunction with VMS, geo-fencing allows enforcement to create an area which, when entered by a vessel equipped with VMS, will trigger an increased polling rate. When the vessel exits this area, the polling rate will be reduced to the normal rate. Geo-fencing also allows for alerts (generally email or text message) to be sent to the agency or VMS user if deemed necessary. Increased polling as well as email alerts would result in higher VMS costs that would be borne by industry using these areas.

Geo-fencing is a spatial management application not currently used in Alaska. However, its application has potential to regulate EFH and HAPC conservation areas. Currently, VMS is used to monitor fishing activities within EFH and HAPC conservation areas (71 FR 36694 June 28 2006). Vessels required to use VMS transmitters report vessel characteristics two times every hour. A geo-fence creates an electronic spatial extension of specific area (not a physically structured fence). The fence monitor (receiver) is triggered when the electronic transmitter crosses the ‘fence’ or boundary line. For use in fishery conservation management, the geo-fence would be triggered when a vessel required to transmit via VMS crosses a spatially explicit management boundary. Importantly, more than one parameter can be linked to an individual VMS transmitter, including position, vessel characteristics, type, and speed. Not all vessel behaviors warrant a closer look within an area. A closer look is triggered when a vessel of a certain type enters a geo-fence and exhibits certain behavior, such as reduced speeds for fishing. In this instance, the vessel’s speed is at slower than normal transit speed (approximately 4 knots). Vessel type and behavior would alert OLE VMS observers for further investigation, if warranted. Lastly, the geo-fence would be activated when a vessel carrying VMS first crosses the boundary line and then at specific intervals, depending on the size of the area and the confidence level chose with which to adequately monitor vessel activities in each area, until the vessel departs the geo-fenced area.

5.4 Automatic Identification System (AIS)

An alternative tool to VMS is the site-based Automated Information System (AIS). This alternative to VMS could provide some of the location information that is provided by VMS. AIS is a shipboard broadcast system that functions similarly to a transponder, operating in the VHF maritime band, and has a capacity 4,500 or more reports per minute. AIS can update as often as every two seconds, utilizing Self-Organizing Time Division Multiple Access (SOTDMA) technology to meet this high broadcast rate. The Marine Exchange has installed AIS receivers at many locations throughout Southeast Alaska. State of Alaska grant funds are being used to extend the Alaska Maritime Safety Net, which is currently comprised of at least 75 sites from Prudhoe Bay, west to Adak, and south to Ketchikan

Each AIS system consists of one VHF transmitter, two VHF TDMA receivers, one VHF DSC receiver, and standard marine electronic communications links to shipboard display and sensor. Position and timing information is normally derived from an integral or external global navigation satellite system (e.g., GPS) receiver. Other information broadcast is electronically obtained from shipboard equipment through standard marine data connections. Heading information and course and speed over ground would normally be provided by all AIS-equipped ships. Other information, such as rate of turn, angle of heel, pitch and roll, and destination and ETA could also be provided.

The AIS transponder normally works in an autonomous and continuous mode, regardless of whether it is operating in the open seas or coastal or inland areas, to avoid overlap of transmissions. Although only one radio channel is necessary, each station transmits and receives over two radio channels to avoid interference problems, and to allow channels to be shifted without communications loss from other ships. The system provides for automatic contention resolution between itself and other stations, and communications integrity is maintained even in overload situations.

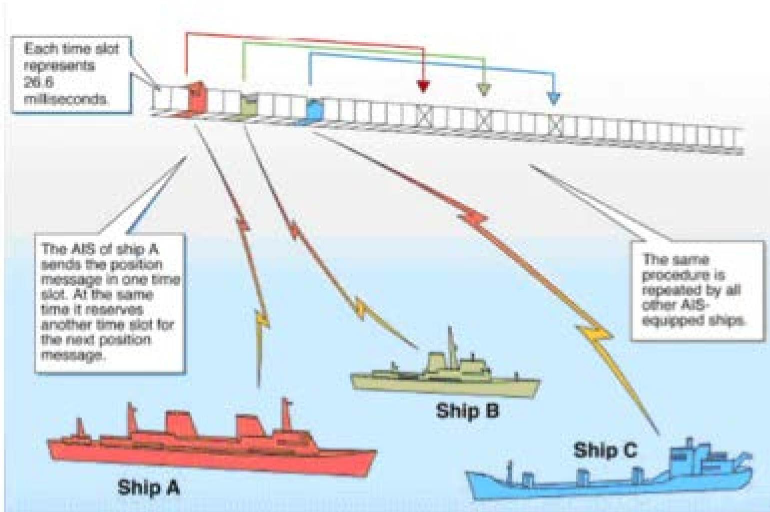


Figure 9. Schematic of time slots and vessel communication under AIS.

AIS coverage range is similar to other VHF applications, essentially depending on the height of the antenna. Its propagation is slightly better than that of radar, due to the longer wavelength, so it is possible to "see" around bends and behind islands if the land masses are not too high. A typical value to be expected at sea is nominally 20 nautical miles.

There are significant issues with this system as the information is not protected. Because anyone can get access to AIS information, many fishermen turn their AIS unit off while they are fishing, to protect their fishing locations from their competitors. In addition, AIS is not a satellite based system, so it is contingent upon line of sight communications and receive locations. There are currently not enough AIS receivers around the state to provide accurate fishing locations. U.S. Coast Guard type approved AIS units range in price from $500 for an AIS Class B transponder to $4,000 for an AIS Class A transponder, not including installation. Costs vary greatly for installation due to the differences in vessel configuration and level of integration necessary for other shipboard systems.

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 Fishery Conservation and Management Act (Magnuson-Stevens Act), and Executive Order (EO) 12866.

6.1 Environmental Analysis Conclusions

One of the purposes of an environmental assessment (EA) is to provide the 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 will not, therefore, require further analysis in an EIS. 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. 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 eastern Bering Sea 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 eastern Bering Sea 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 adverse 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 eastern Bering Sea 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. Alternatives 2 and 3 would 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. 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 is not expected to be any change in overall harvests, none of the alternatives are 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 through 3. Alternative 3 would provide protection to biodiversity and ecosystem function by creating area closures in the eastern Bering Sea, 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 through 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 eastern Bering Sea 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 eastern Bering Sea. 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. 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. Historical shipwrecks are identified in nautical charts and avoided by fishermen.

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 HAPCs, implementing conservation and management measures, and research and monitoring these areas in the eastern Bering Sea. 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, HAPC 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.

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.

6.2 The Ten National Standards

Below are the ten National Standards as contained in the MAGNUSON-STEVENS ACT and a brief discussion of the consistency of the proposed alternatives with each of those National Standards, as applicable (MAGNUSON-STEVENS ACT 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 eastern Bering Sea or of groundfish in the BSAI. The alternatives would also not impact, on a continuing basis, the ability to achieve the optimum yield from eastern Bering Sea 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. The National Standard Guidelines for FMPs require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP. Applicable here and used in this analysis is the December 2011 SAFE for the *Groundfish Resources of the Bering Sea/Aleutian Islands Regions* The SAFE report summarizes the best available scientific information concerning the past, present, and possible future condition of the stocks (here, skates), marine ecosystems, and fisheries that are managed under Federal regulation. It provides information to the Councils for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs.

In addition, this analysis incorporates policies from the 2004 PSEIS for the groundfish fisheries management programs that are ecosystem-based and more precautionary when faced with scientific uncertainty. During staff tasking at its February 2012 meeting, the Council discussed the schedule for review of the groundfish PSEIS. Until the current PSEI is reviewed, revised or supplemented, and adopted, the 2004 PSEIS remains the best scientific information available to evaluation of alternative groundfish fishery management programs on the human environment.

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 eastern Bering Sea.

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 eastern Bering Sea 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 potential impacts on participants in the BSAI groundfish 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.

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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 28. 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[11] for managed species.	Habitat resilient (not sensitive).	Habitat not subject to developmental stress.
1	N/A	Habitat provides little structure[12] 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.

[11] 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.

[12] "Structure" refers to three-dimensional structure.

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 29. 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 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 30. HAPC Evaluation Criteria

	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 sea floor. 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 autonomous underwater vehicle was used to map parts of four nurseries using a high-resolution camera (Hoff *et al* 2010).

Table 31. 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 – Color Figures

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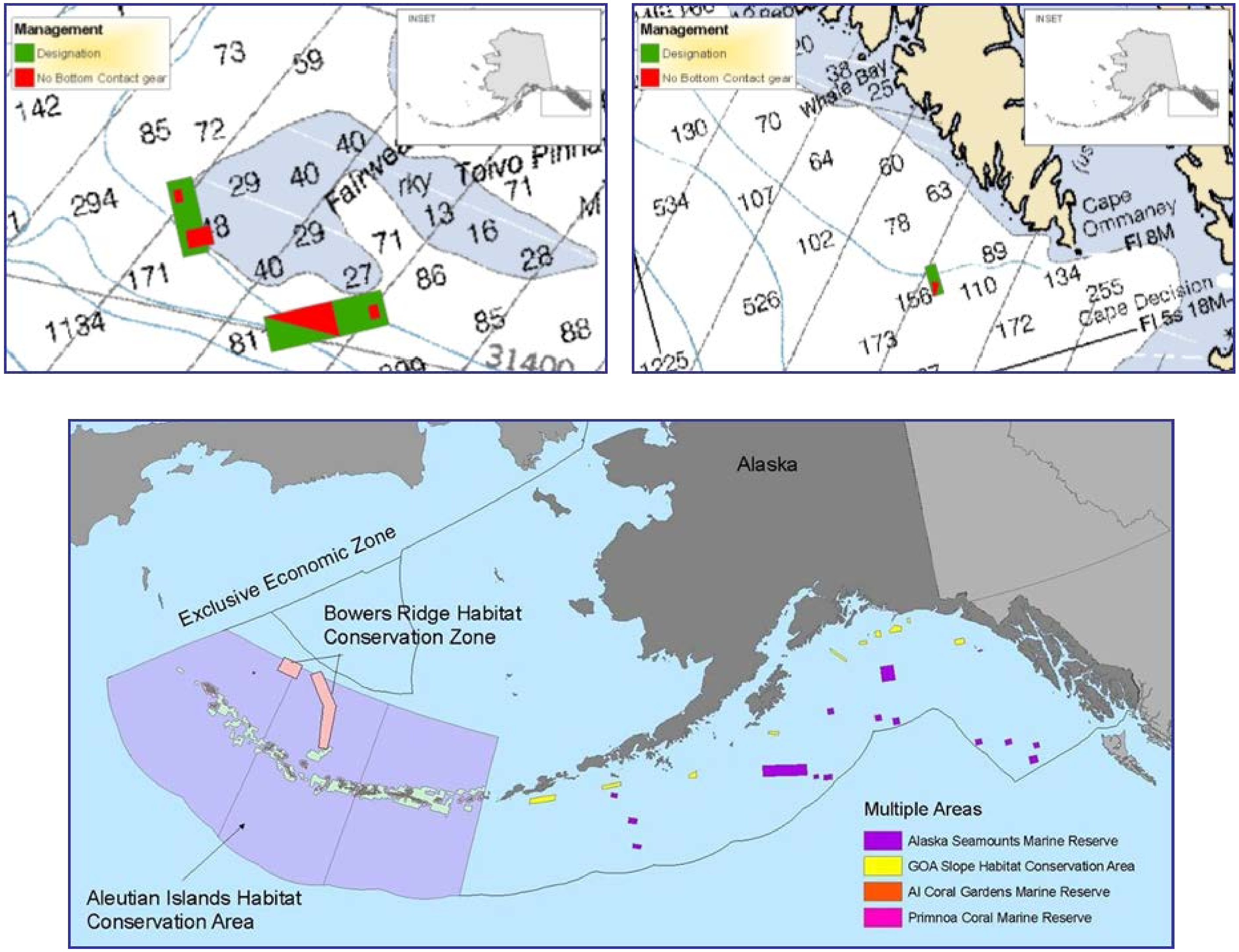

Figure 10. Locations of current HAPC areas.

Source: NPFMC.

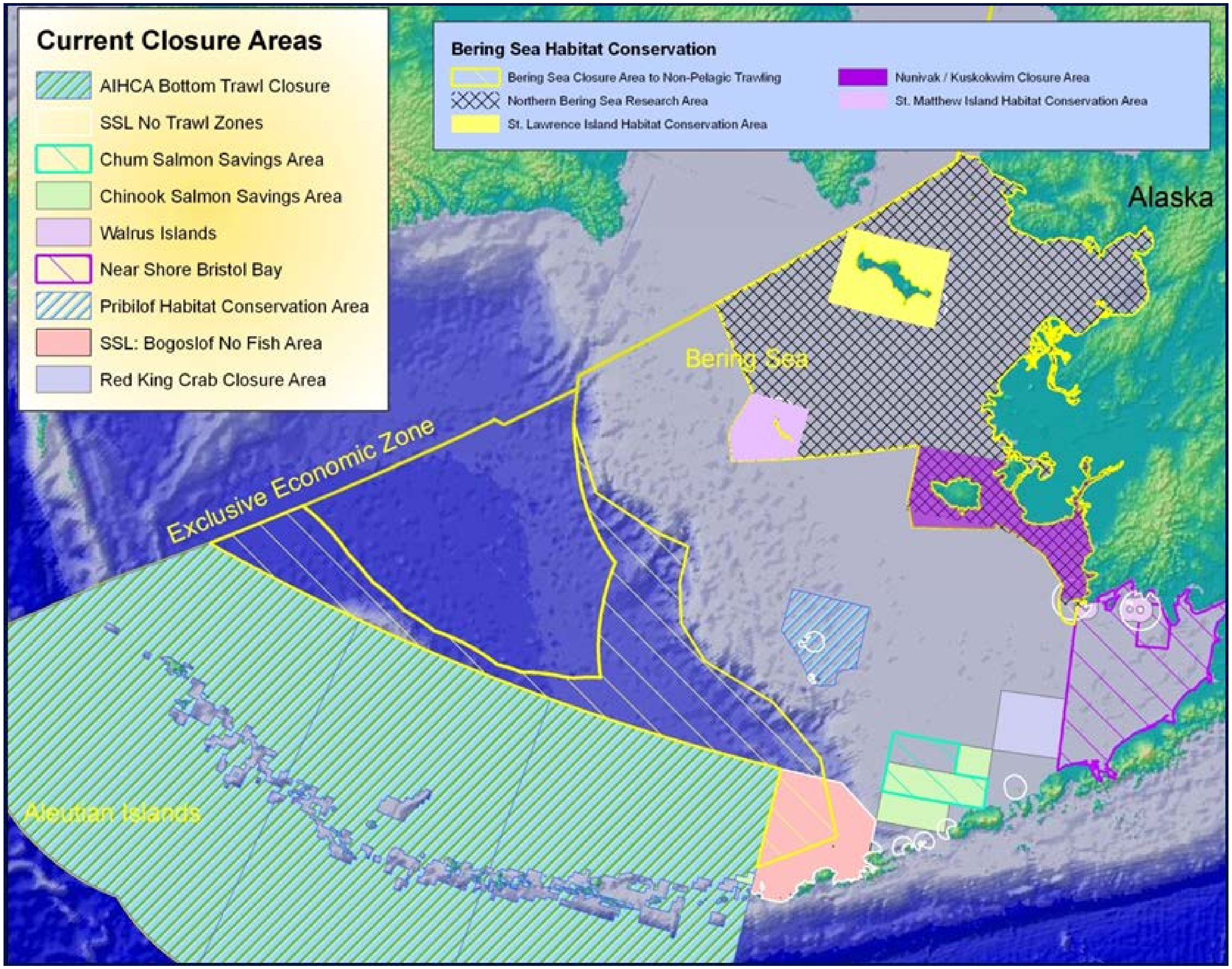

Figure 11. Current Eastern Bering Sea habitat conservation and bottom trawl closure areas.

Source: NPFMC.

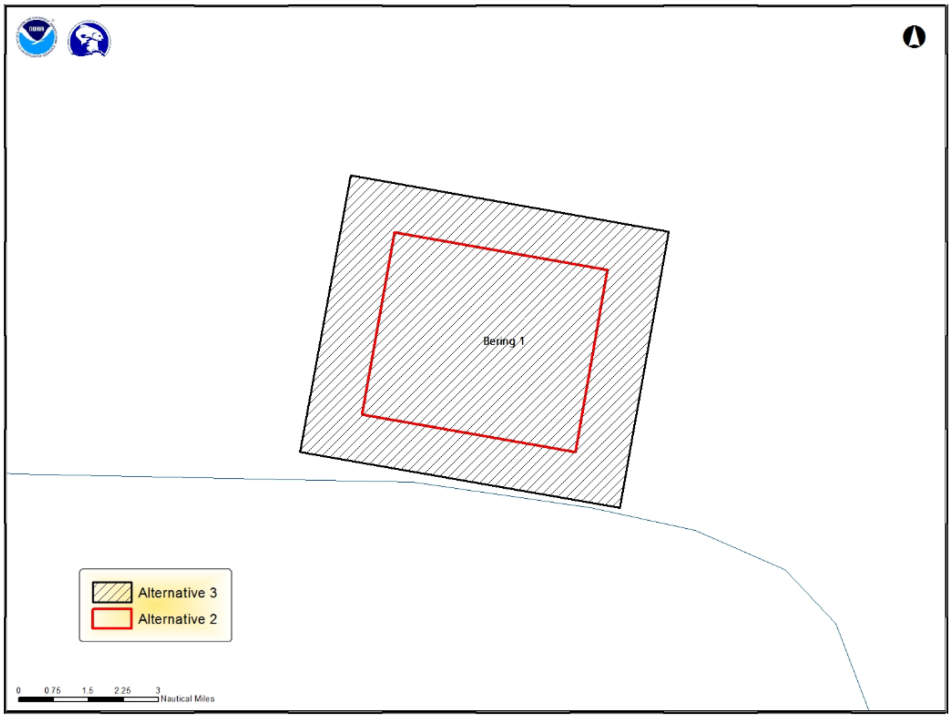

Figure 12. Bering 1 site under Alterantive 2 (18.4 nm^2, red boudary) and Alternative 3 (41.8 nm^2, black boundary).

Source: NMFS HCD.

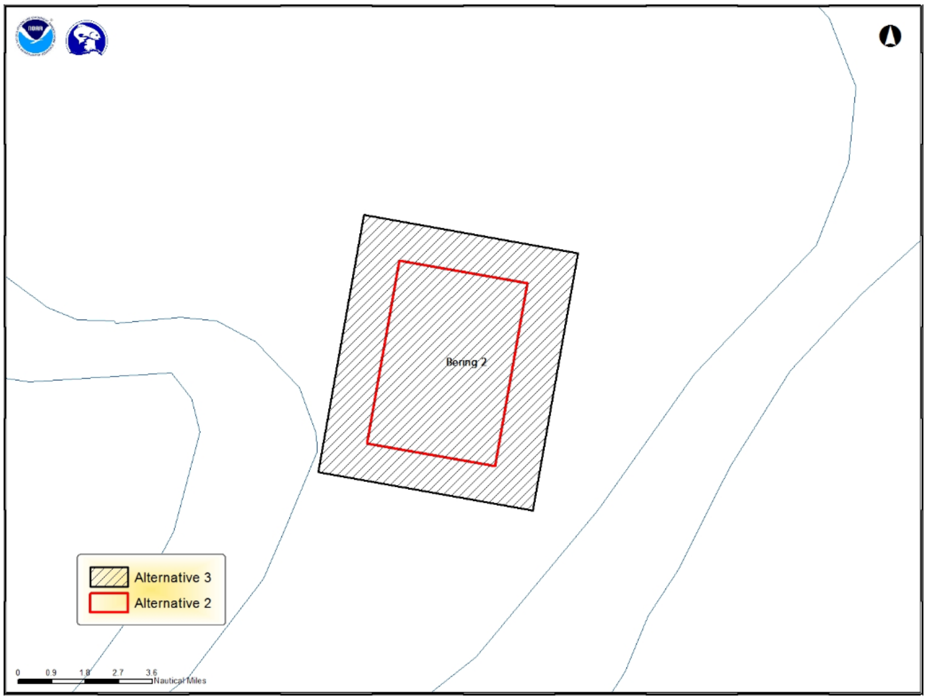

Figure 13. **Bering 2 site under Alternative 2 (17.5 nm^2, red boudary) and Alternative 3 (40.9 nm^2, black boundary).**

Source: NMFS HCD.

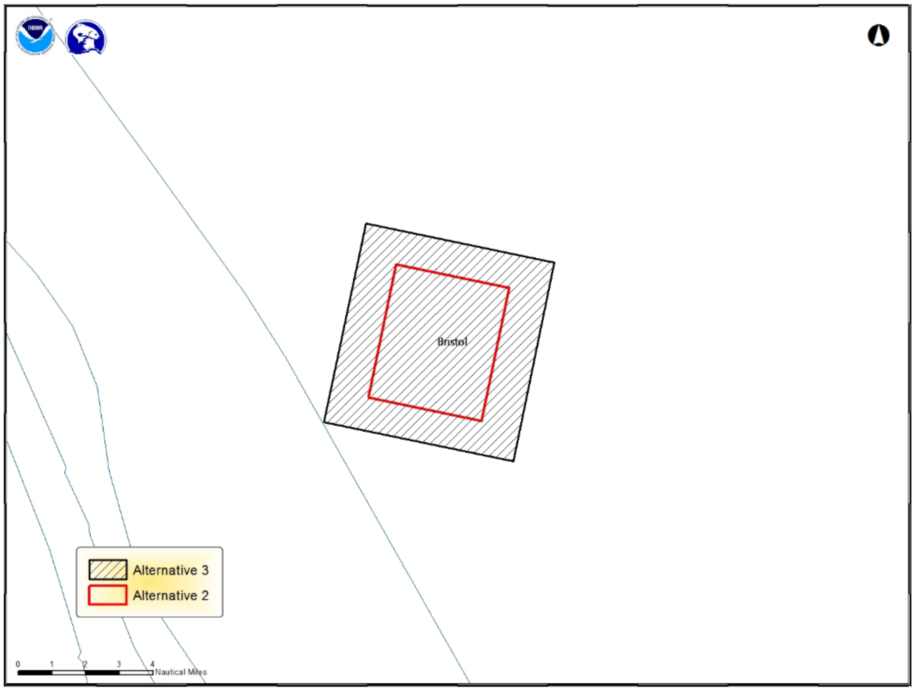

Figure 14. **Bristol site under Alternative 2 (13.7 nm^2, red boundary) and Alternative 3 (34.4nm^2, black boundary).**

Source: NMFS HCD.

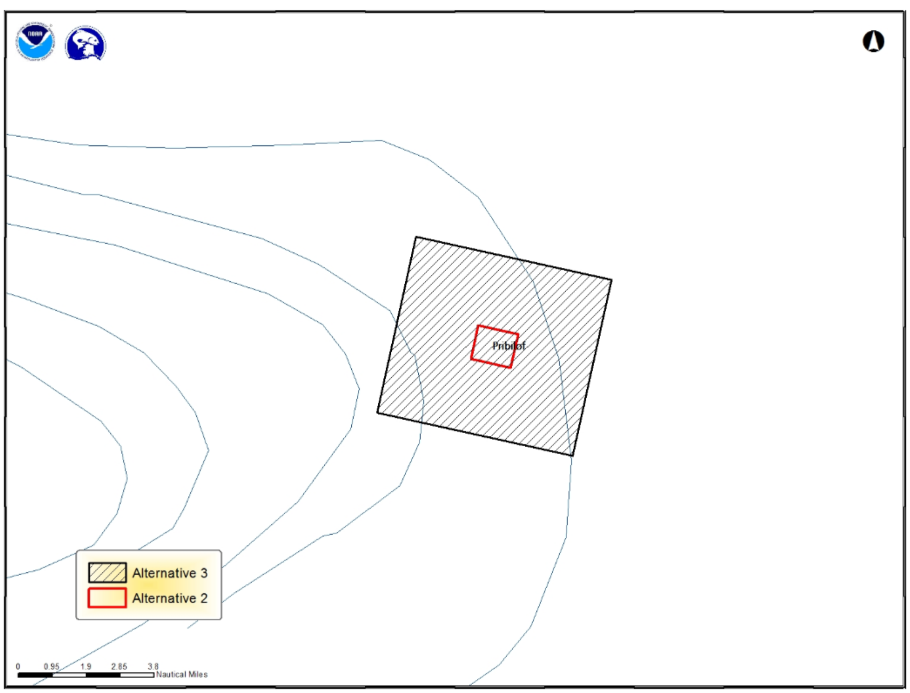

Figure 15. **Pribilof site under Alternative 2 (1.2 nm^2, red boundary) and Alternative 3 (28nm^2, black boundary).**

Source: NMFS HCD.

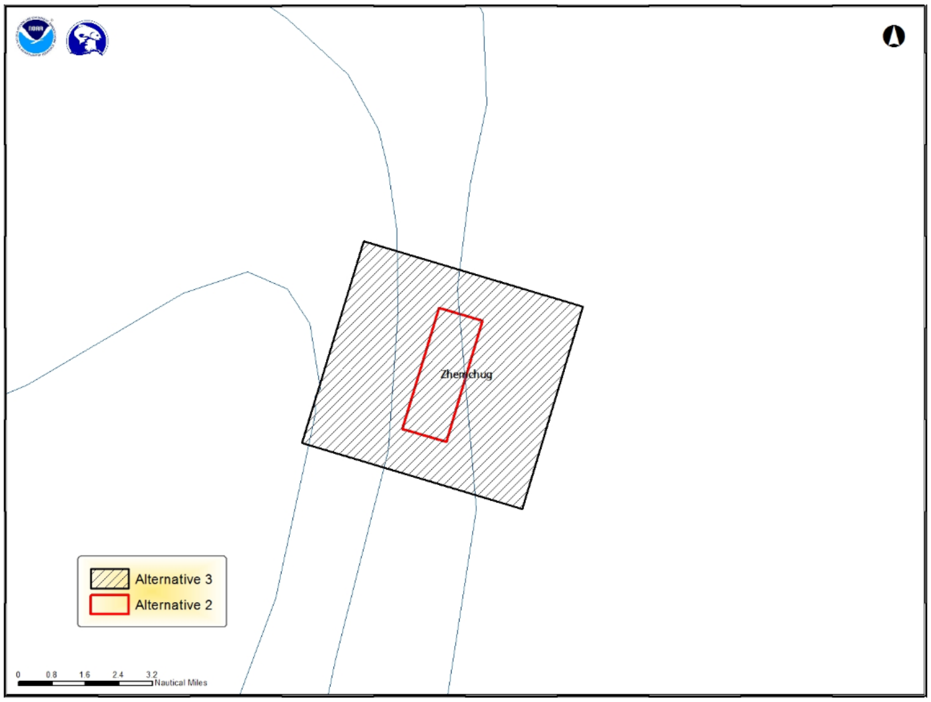

Figure 16. **Zhemchug site under Alternative 2 (3.2 nm^2, red boundary) and Alternatiuve 3 (27.4 nm^2, black boundary).**

Source: NMFS HCD.

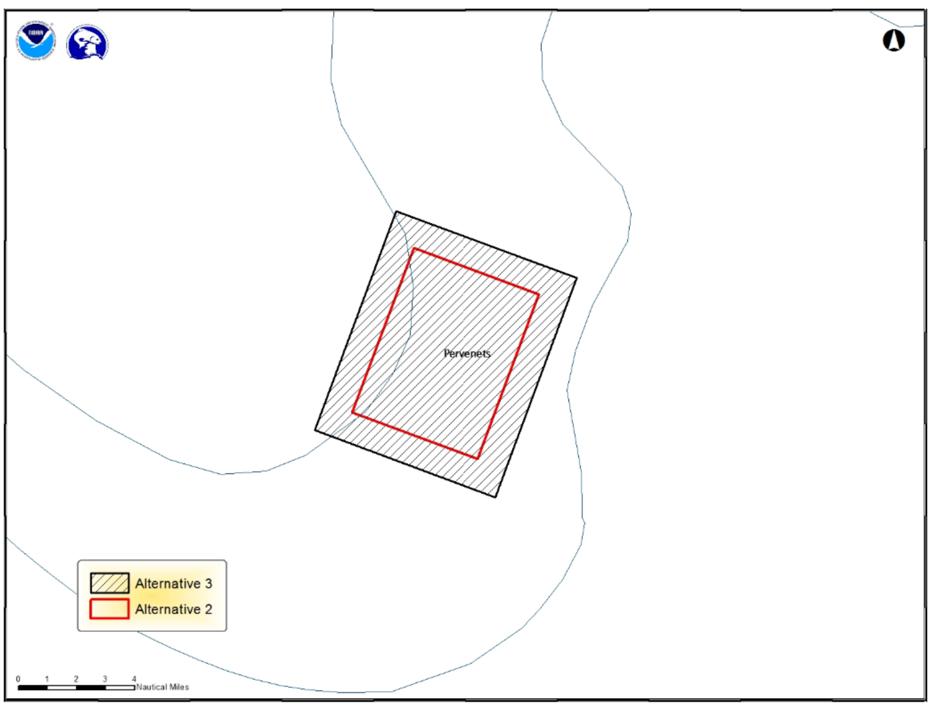

Figure 17. **Pervenets site under Alternative 2 (27.7 nm^2, red boundary) and Alternative 3 (53.3 nm^2, black boundary).**

Source: NMFS HCD.

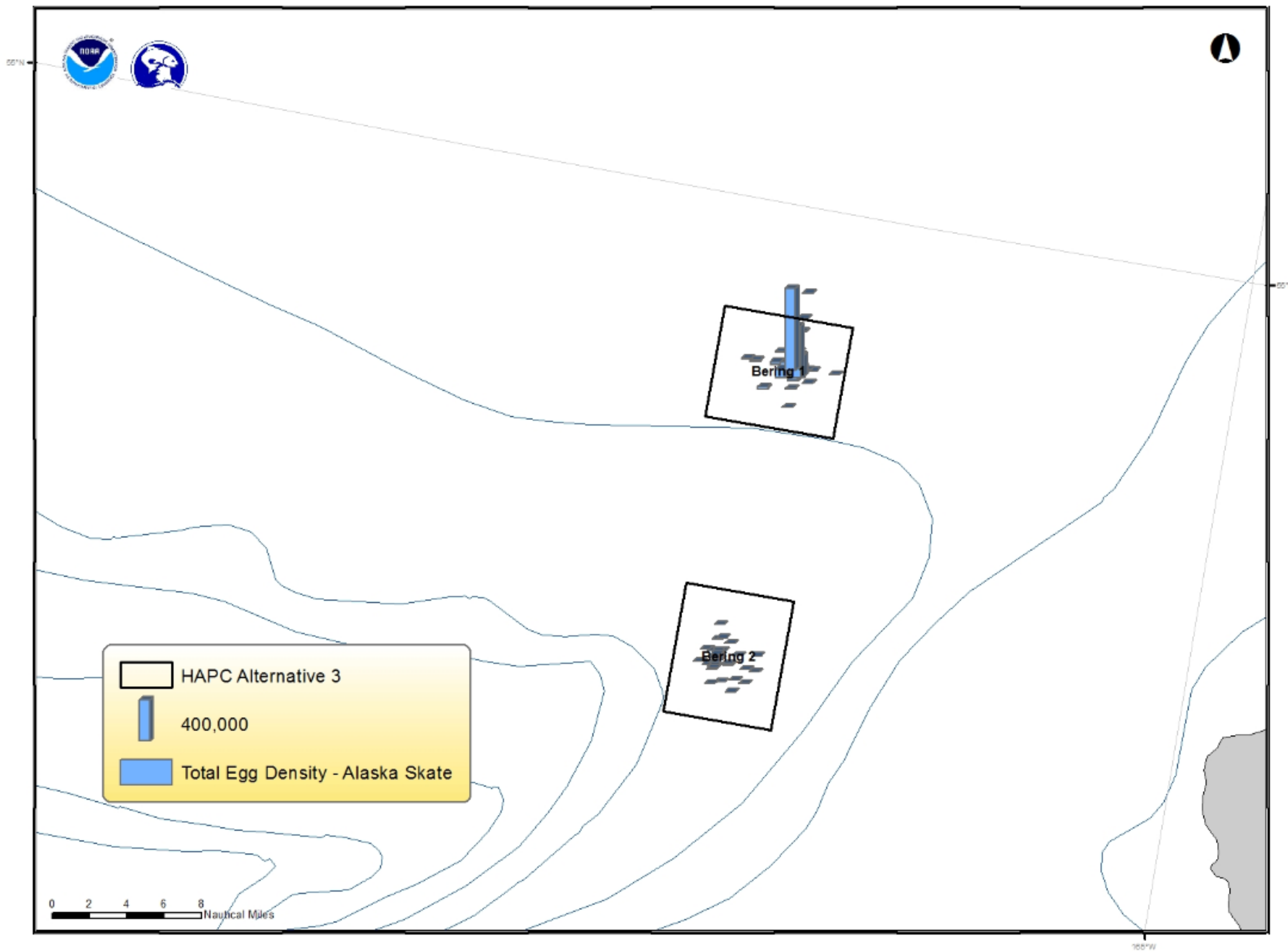

Figure 18. **Total Alaska skate egg density/km^2 in the Bering 1 and 2 sites under Alternative 3.**

Source: NMFS HCD and AFSC.

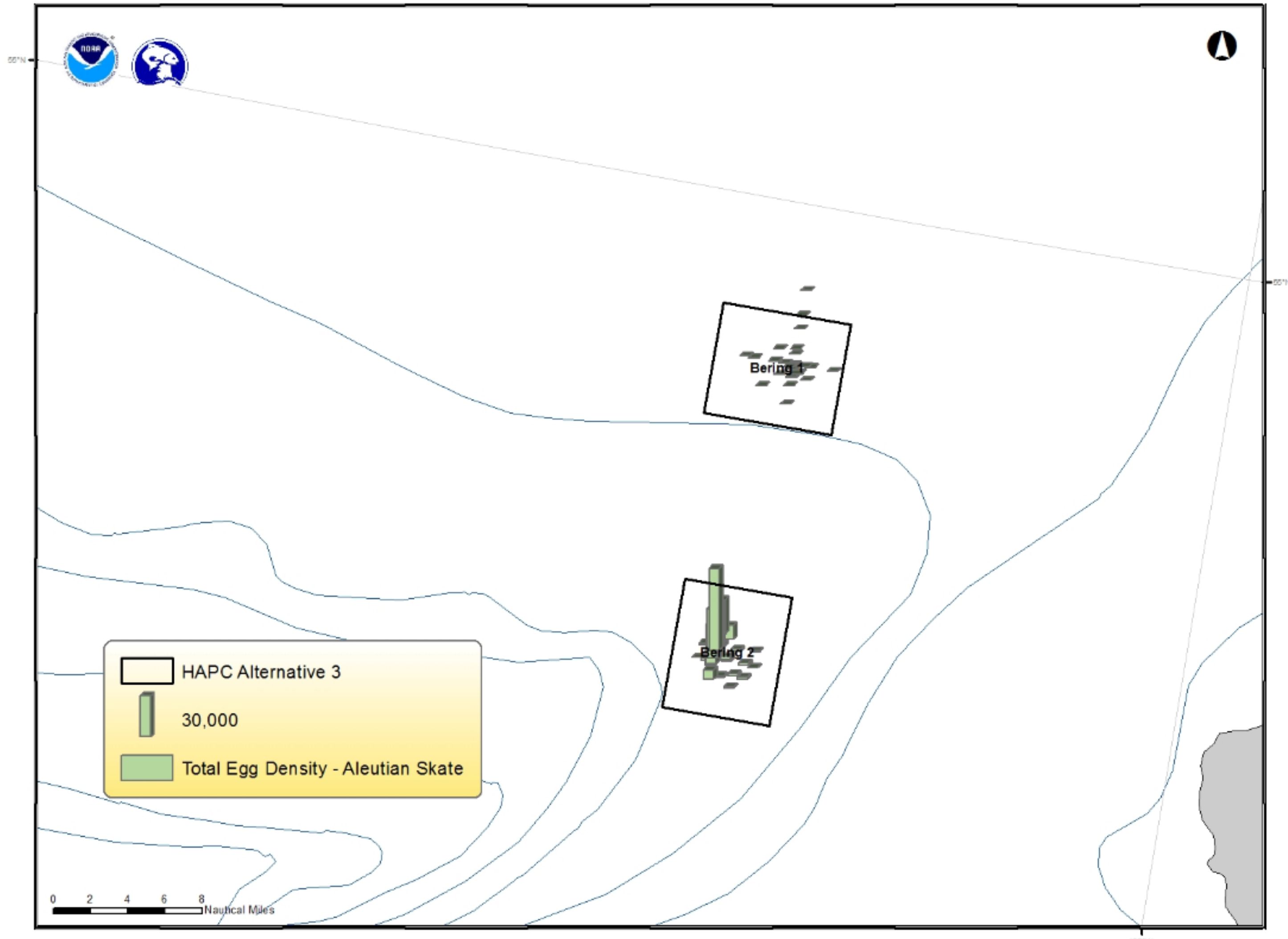

Figure 19. Total Aleutian skate egg density/km^2 in the Bering 1 and 2 sites under Alternative 3.

Source: NMFS HCD and AFSC.

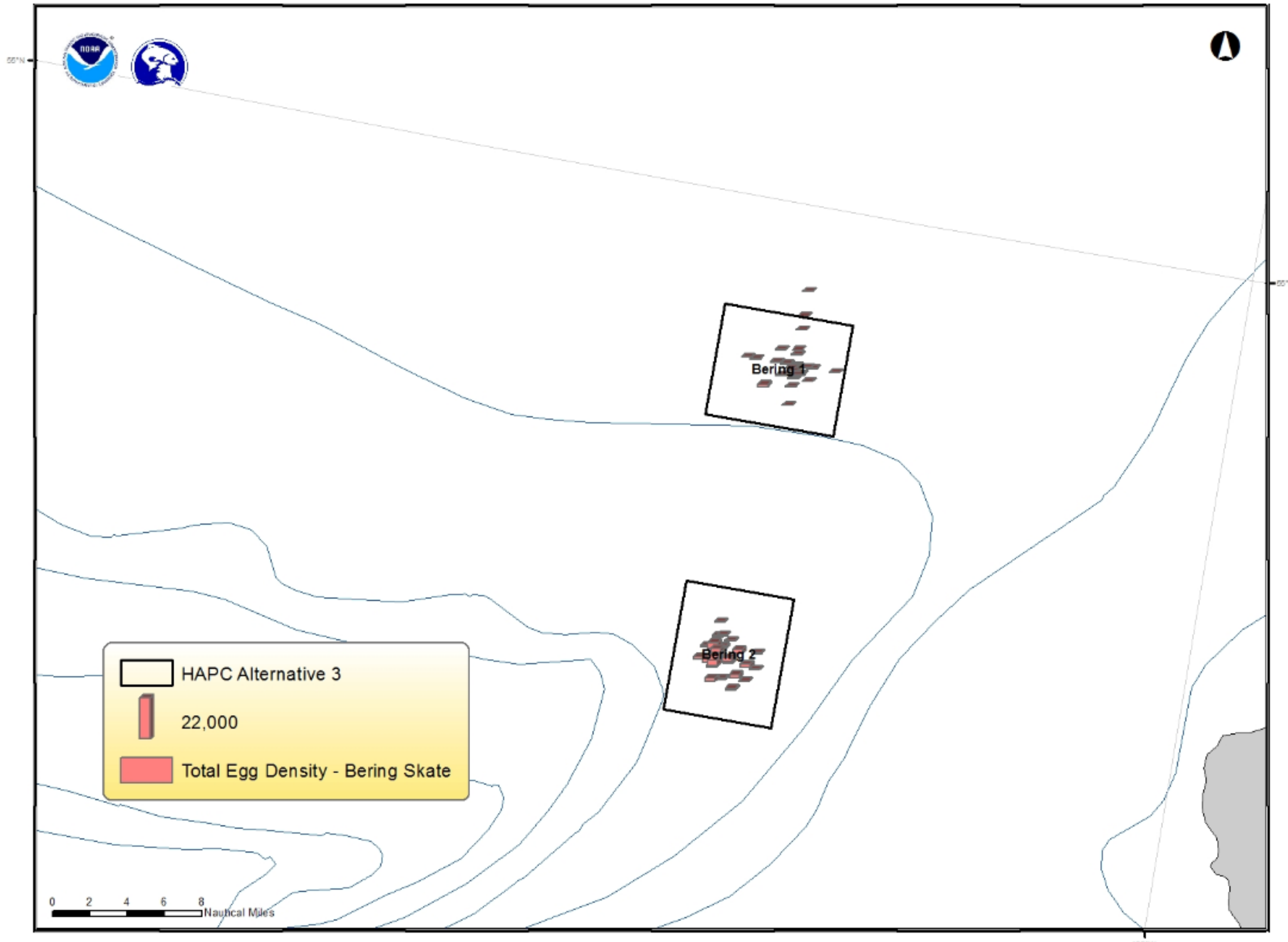

Figure 20. Total Bering skate egg density/km^2 in the Bering 1 and 2 sites under Alternative 3.
Source: NMFS HCD and AFSC.

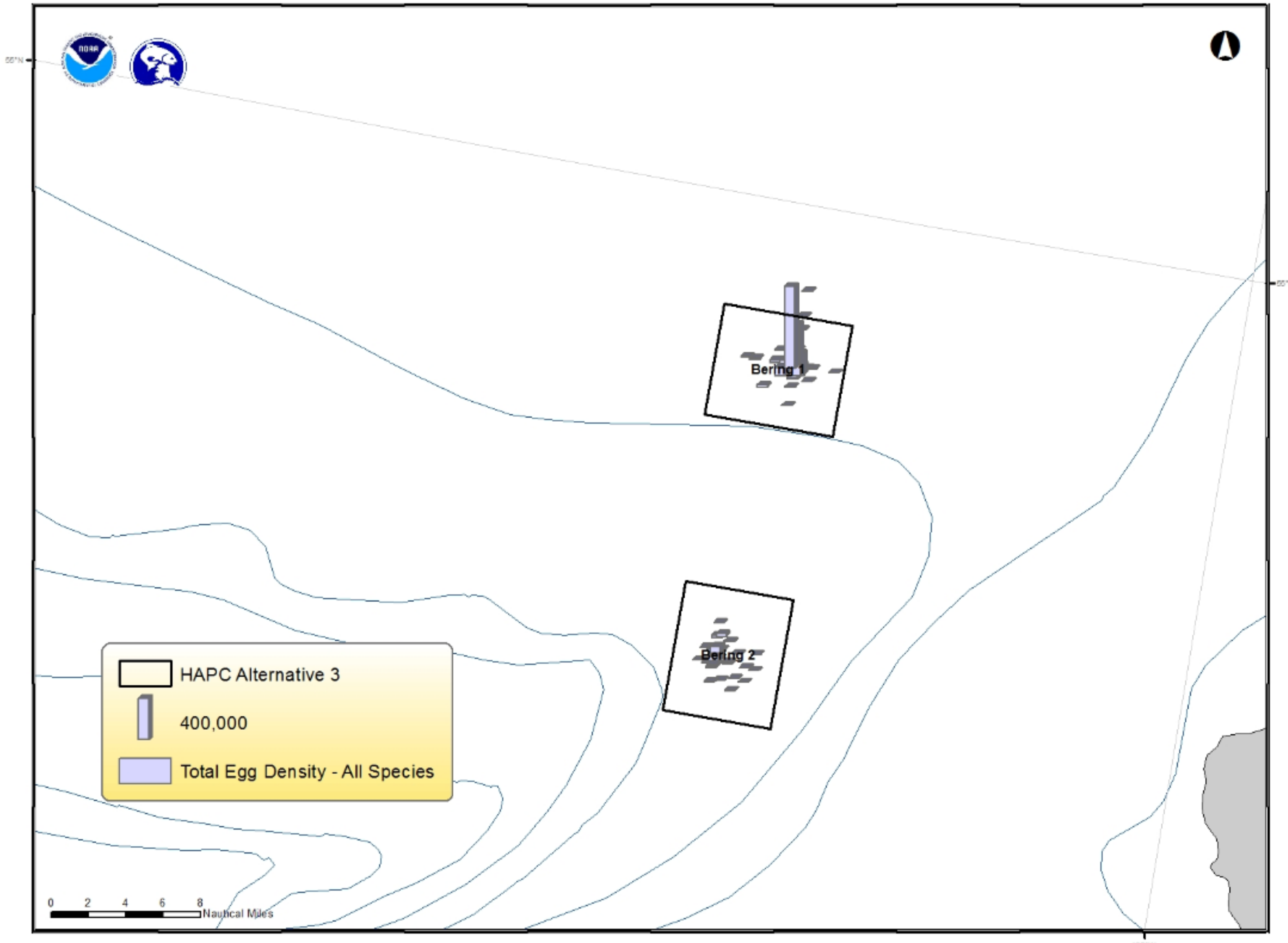

Figure 21. Total skate egg density/km^2, for all skate species, in the Bering 1 and 2 sites under Alternative 3.

Source: NMFS HCD and AFSC.

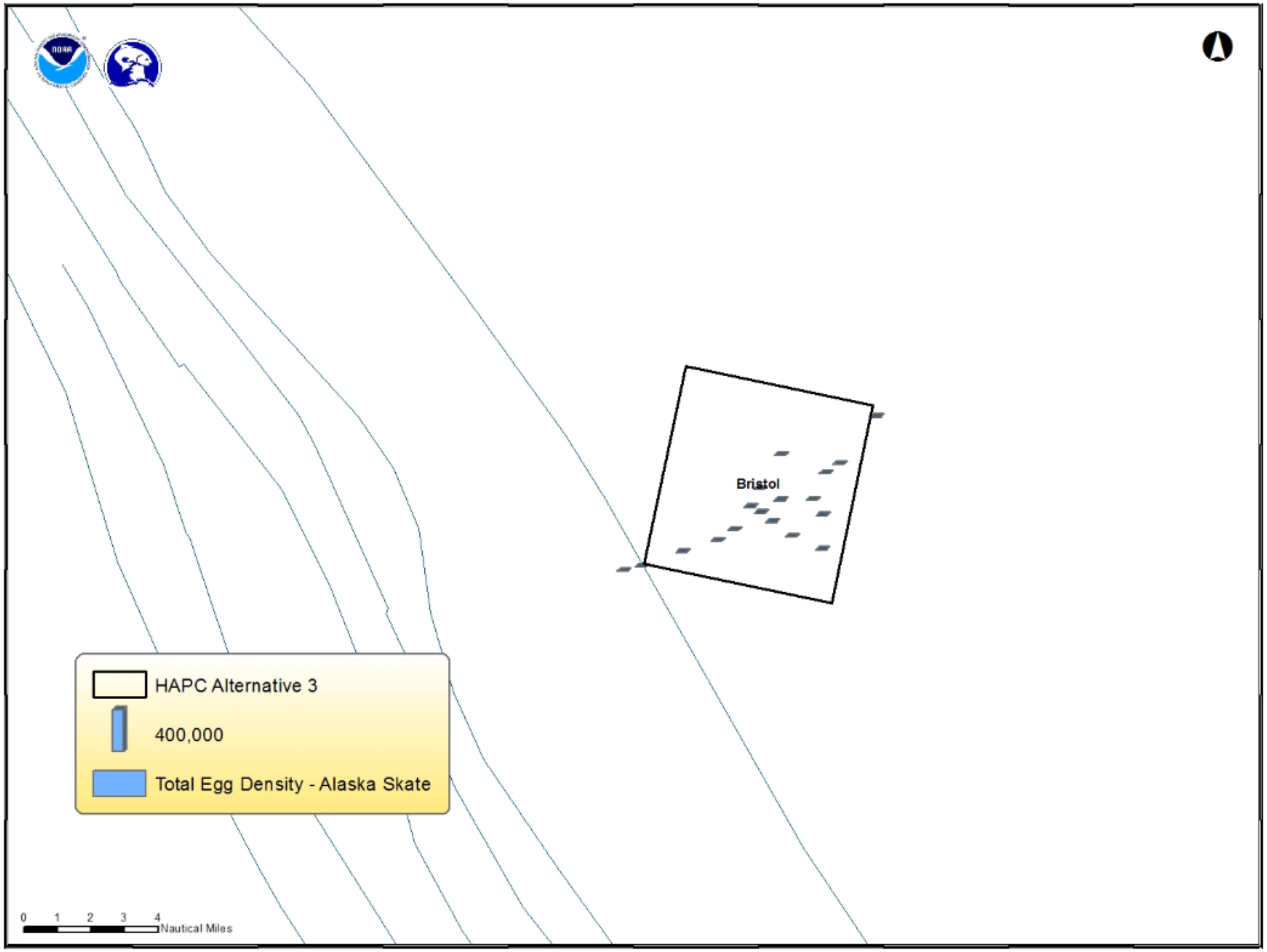

Figure 22. Total Alaska skate egg density/km^2 in the Bristol site under Alternative 3.

Source: NMFS HCD and AFSC.

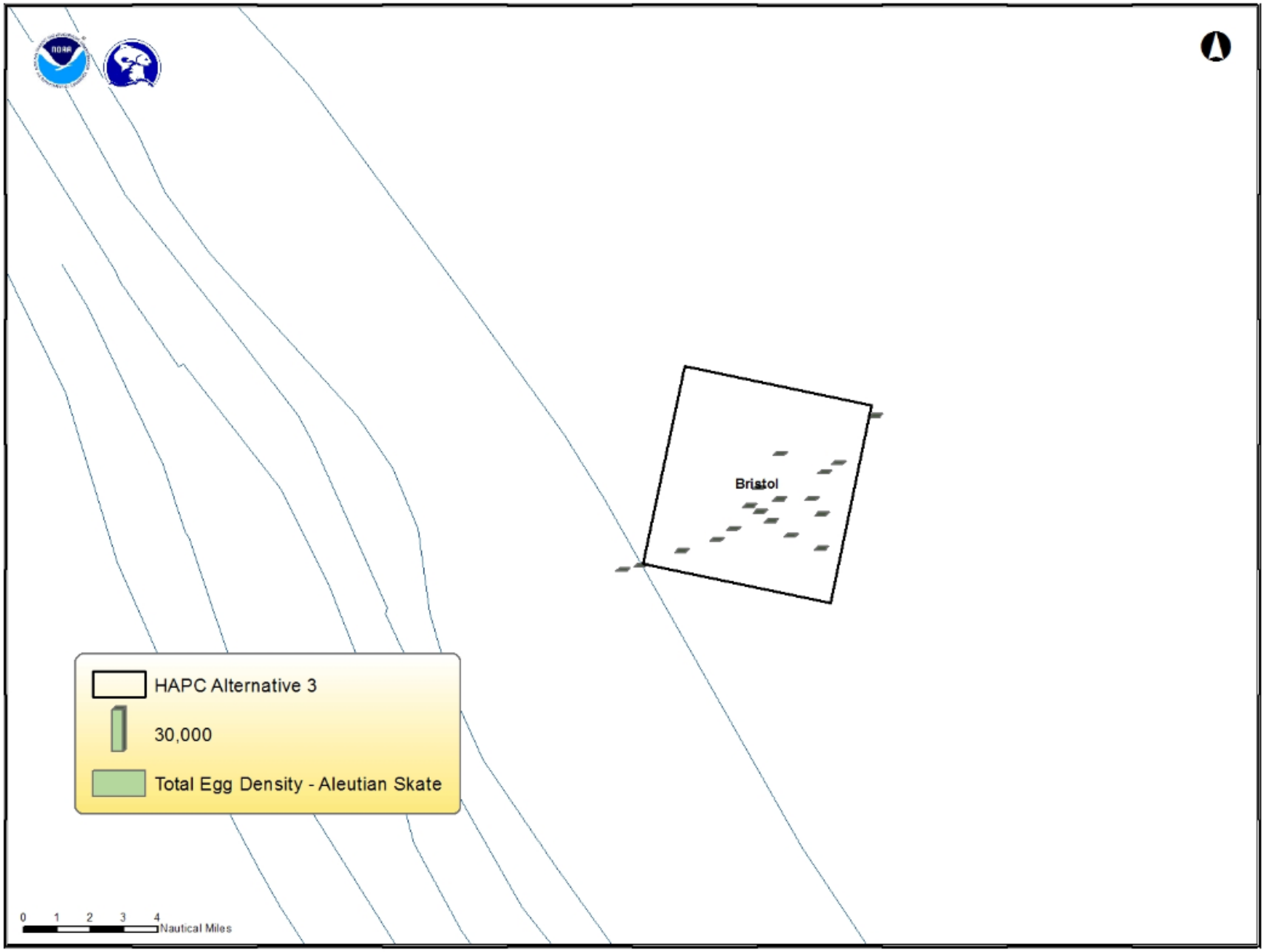

Figure 23. Total Aleutian skate egg density/km^2 in the Bristol site under Alternative 3.

Source: NMFS HCD and AFSC.

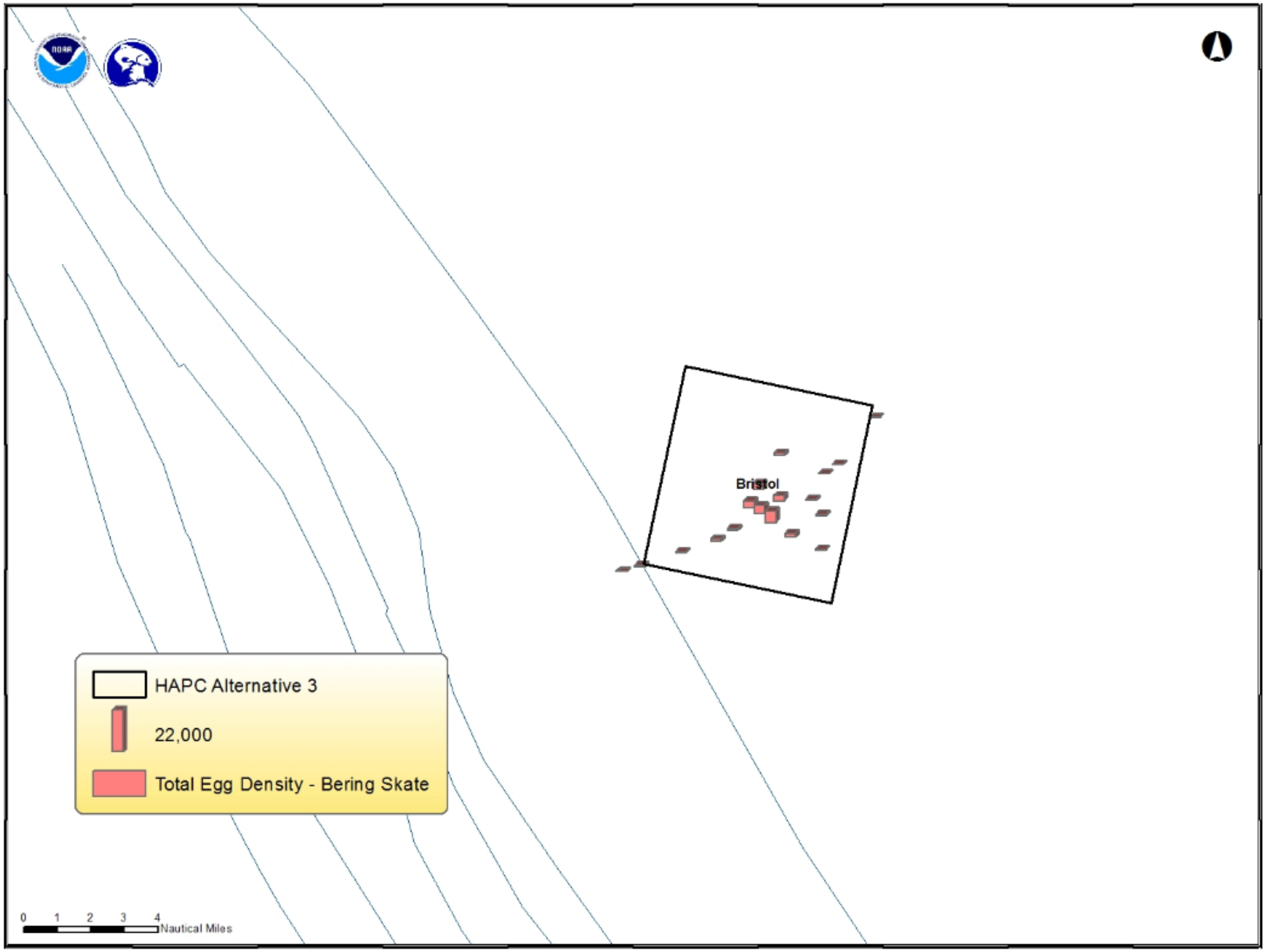

Figure 24. **Total Bering skate egg density/km^2 in the Bristol site under Alternative 3.**
Source: NMFS HCD and AFSC.

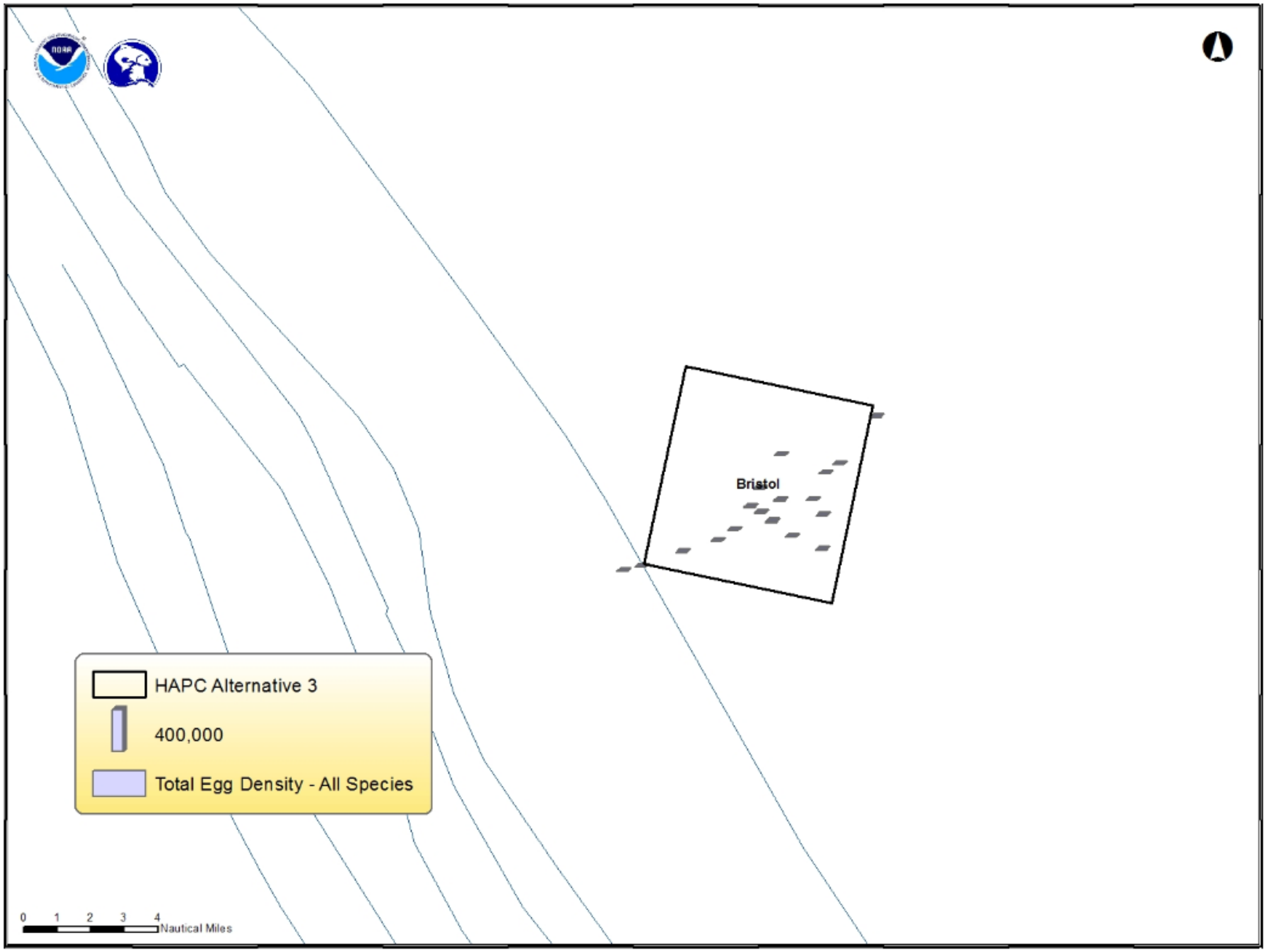

Figure 25. Total skate egg density/km² for all skate species in the Bristol site under Alternative 3.
Source: NMFS HCD and AFSC.

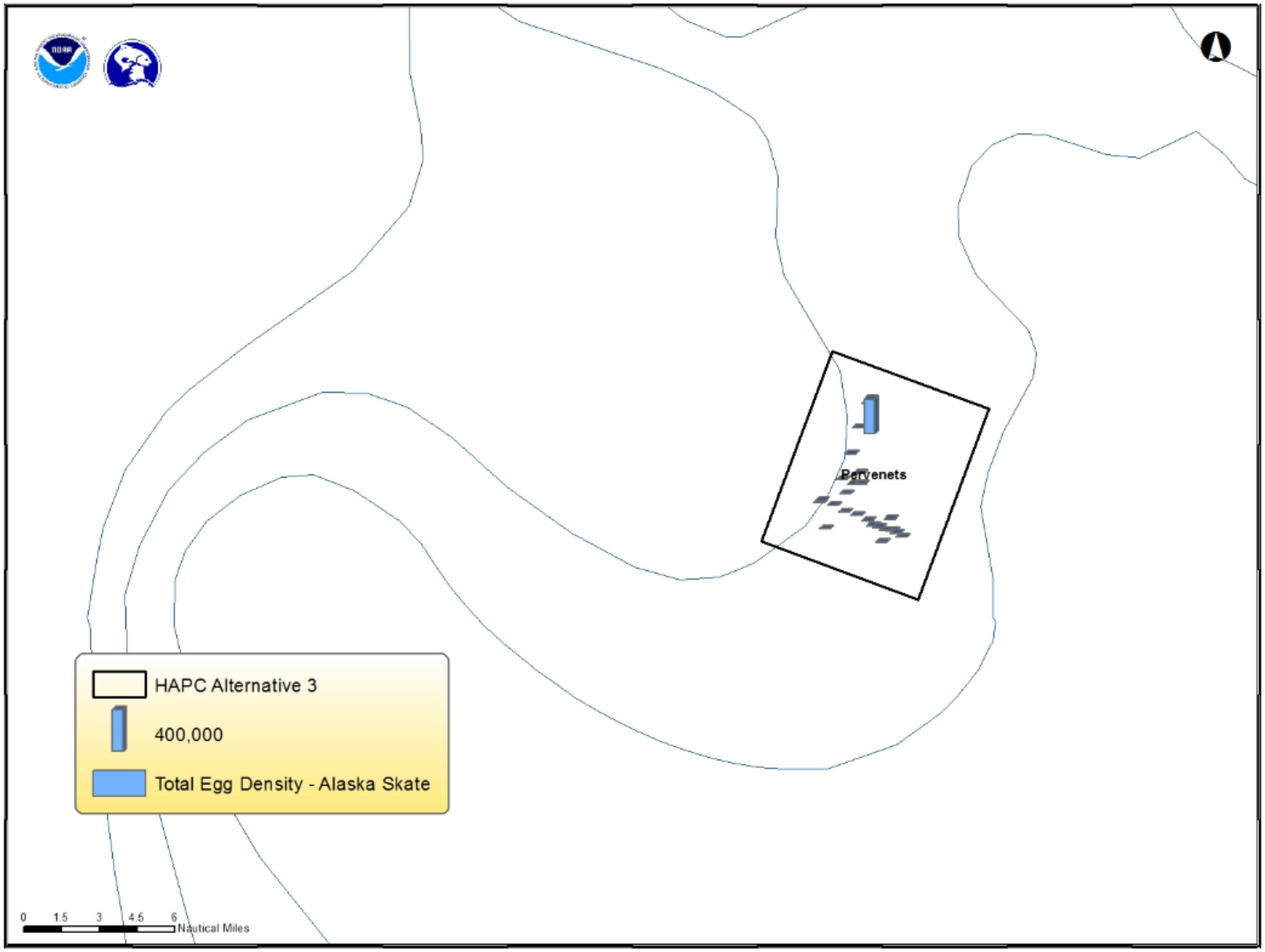

Figure 26. Total Alaska skate egg density/km^2 in the Pervenets site under Alternative 3.
Source: NMFS HCD and AFSC.

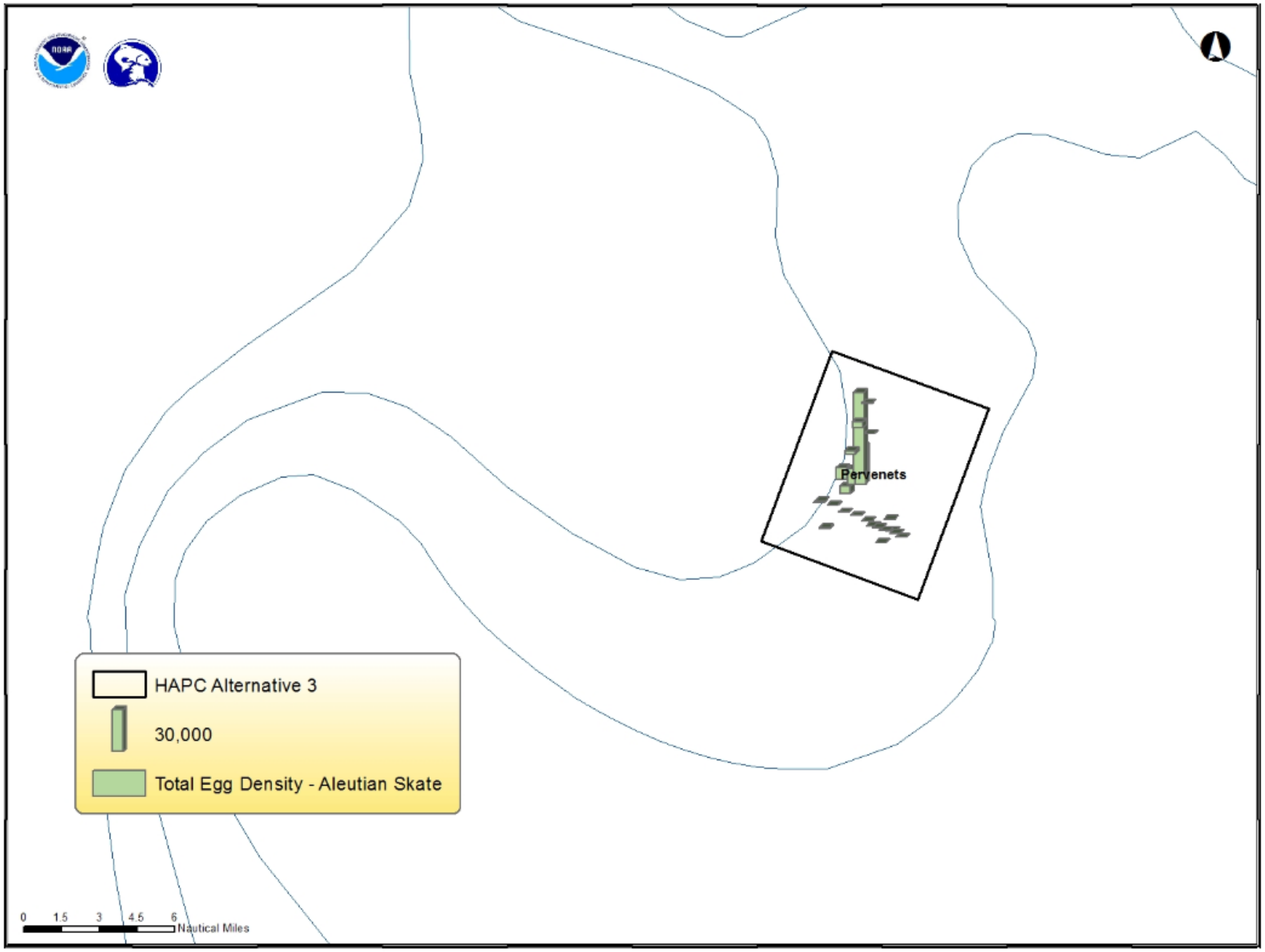

Figure 27. Total Aleutian skate egg density/km^2 in the Pervenets site under Alternative 3.
Source: NMFS HCD and AFSC.

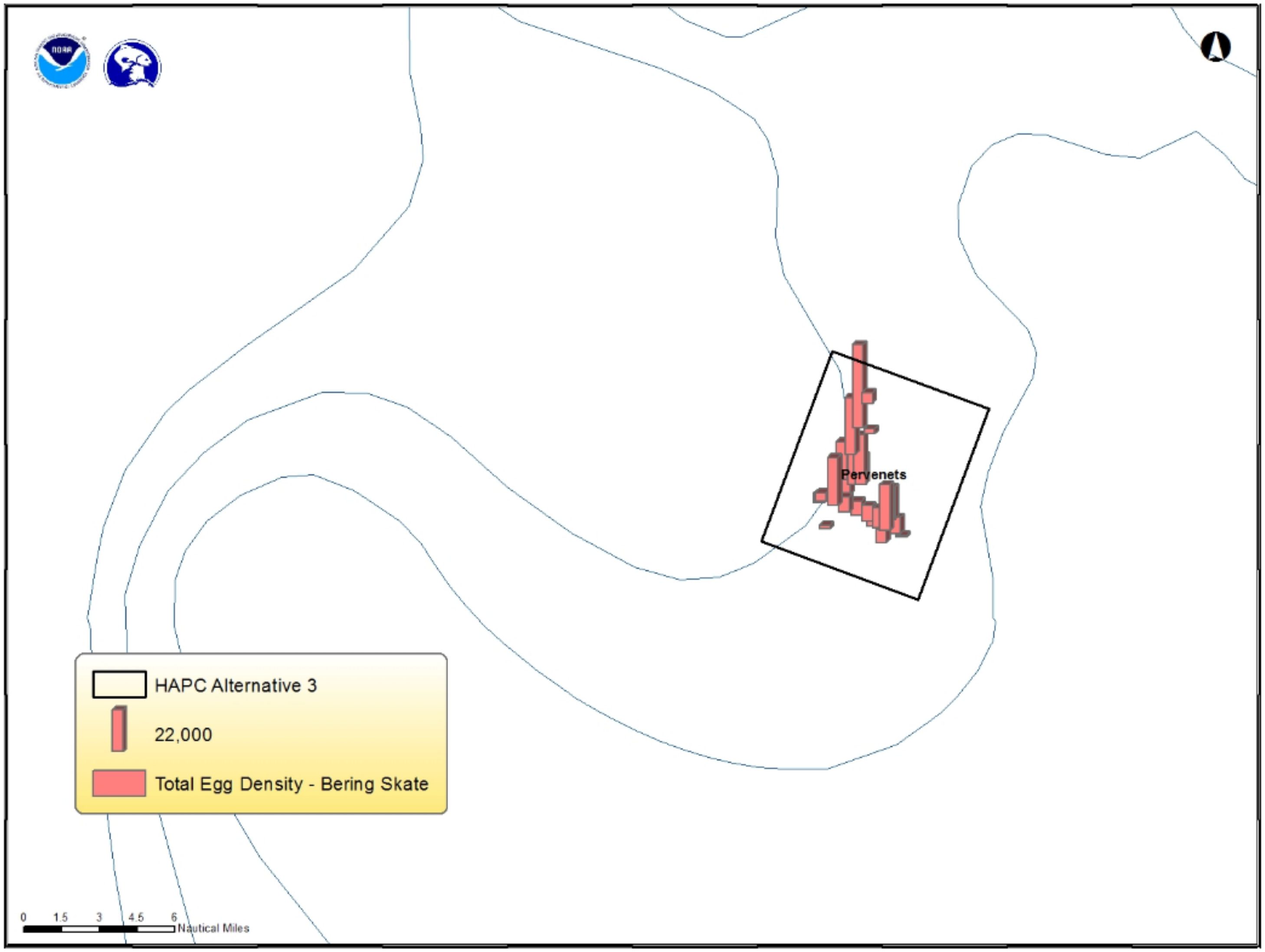

Figure 28. Total Bering skate egg density/km^2 in the Pervenets site under Alternative 3.
Source: NMFS HCD and AFSC.

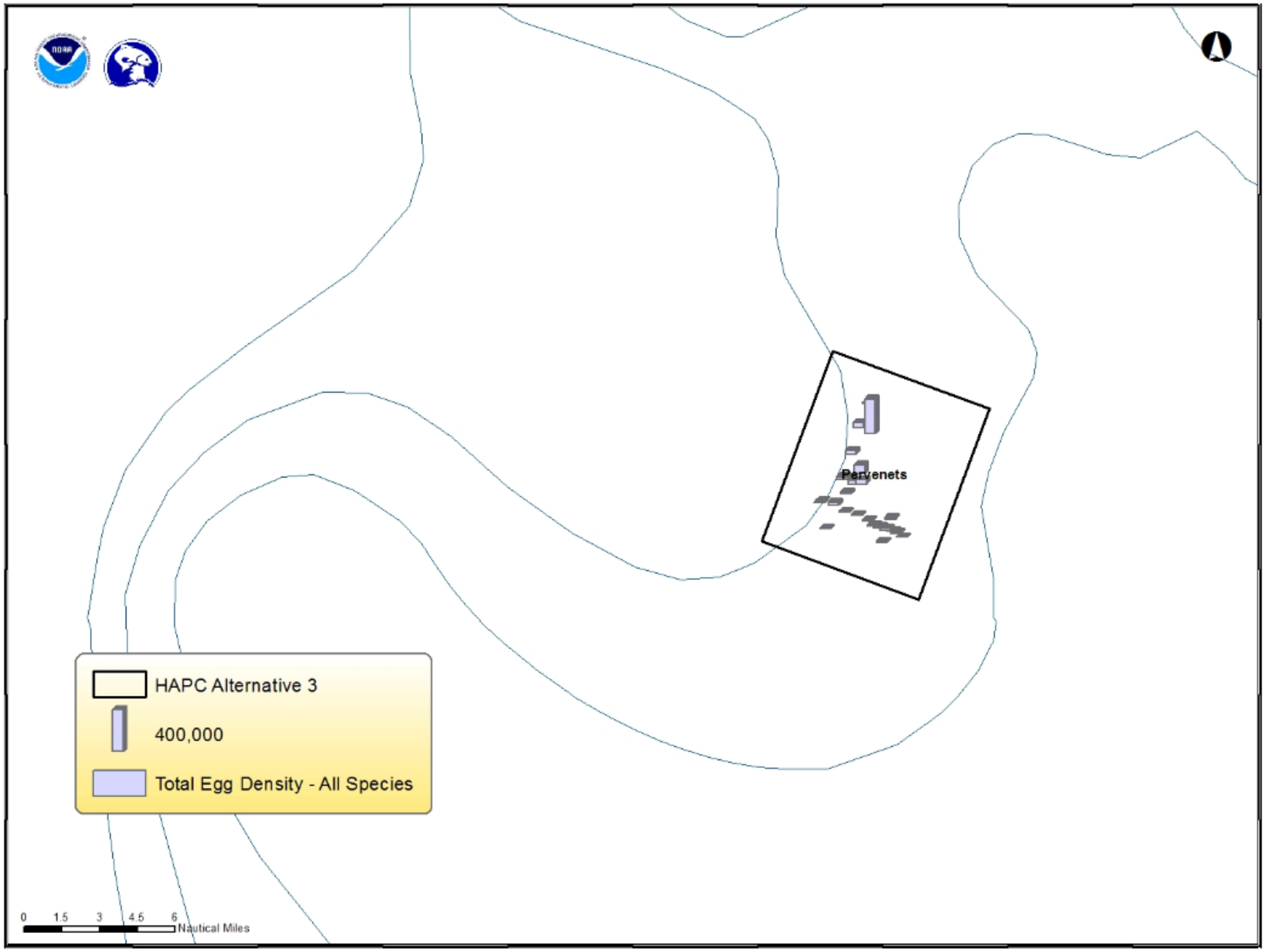

Figure 29. Total skate egg density/km^2 for all skate species in the Pervenets site under Alternative 3.

Source: NMFS HCD and AFSC.

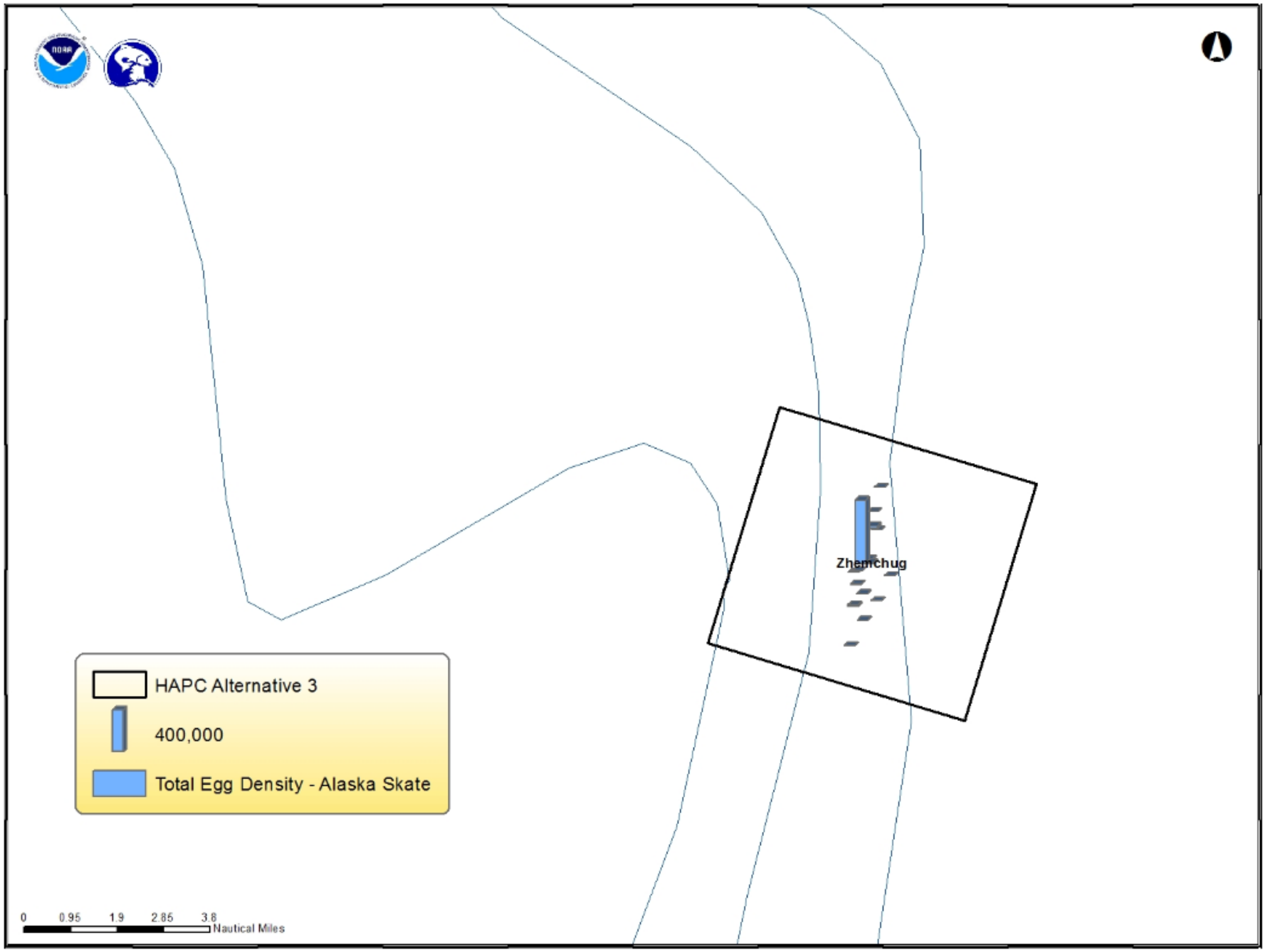

Figure 30. Total Alaska skate egg density/km^2 in the Zhemchug site under Alternative 3.
Source: NMFS HCD and AFSC.

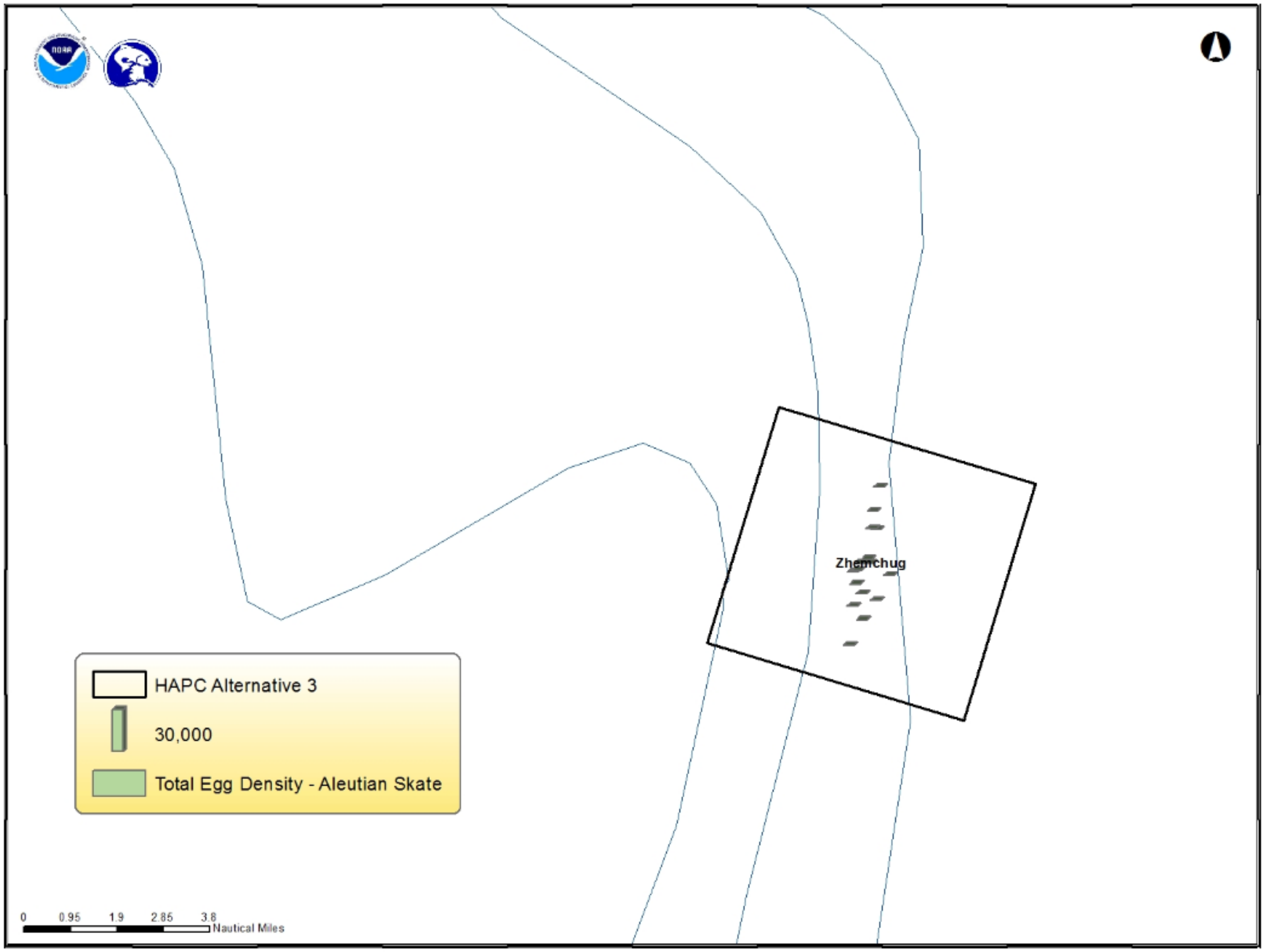

Figure 31. Total Aleutian skate egg density/km^2 in the Zhemchug site under Alternative 3.
Source: NMFS HCD and AFSC.

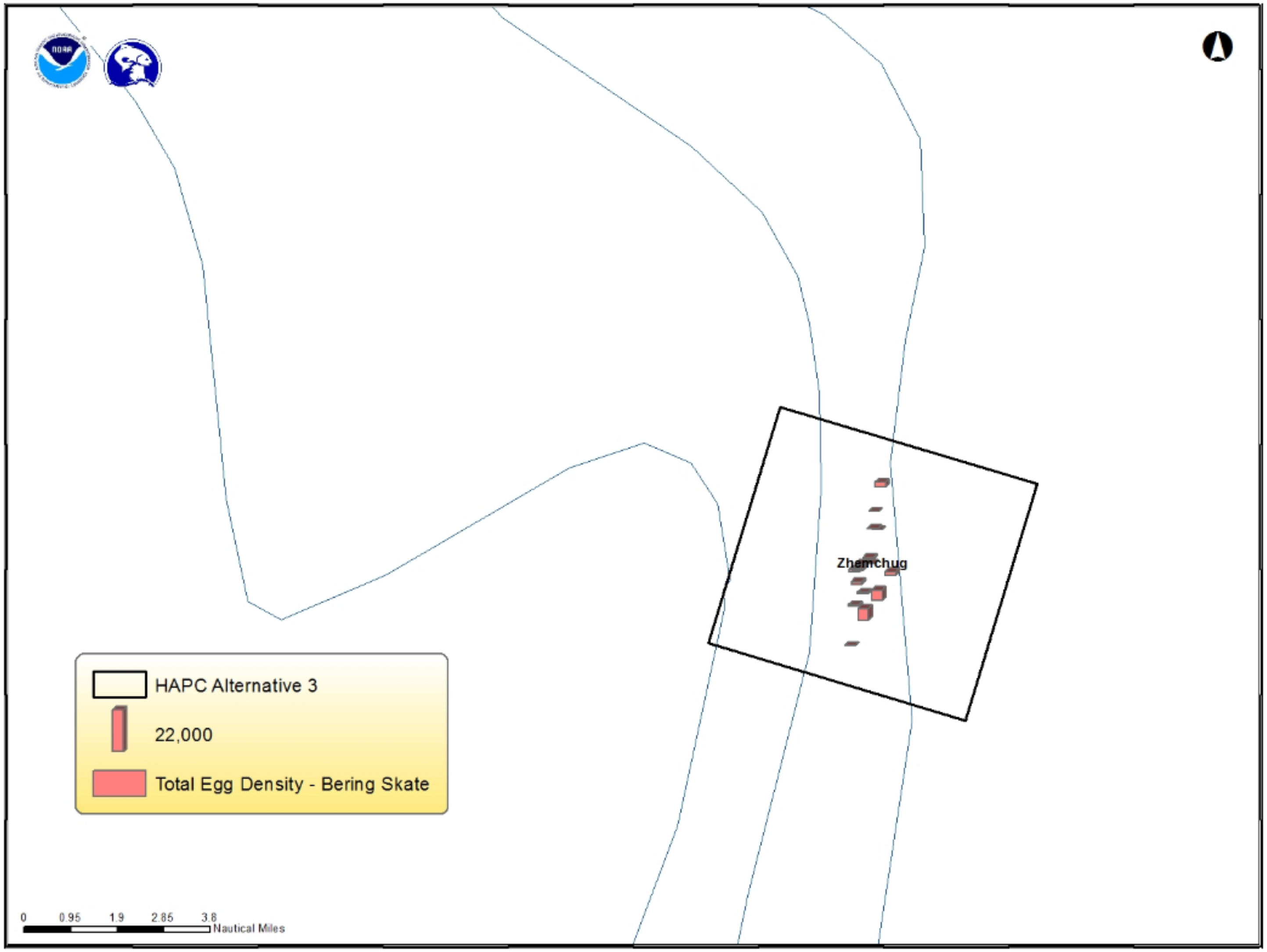

Figure 32. Total Bering skate egg density/km^2 in the Zhemchug site under Alternative 3.

Source: NMFS HCD and AFSC.

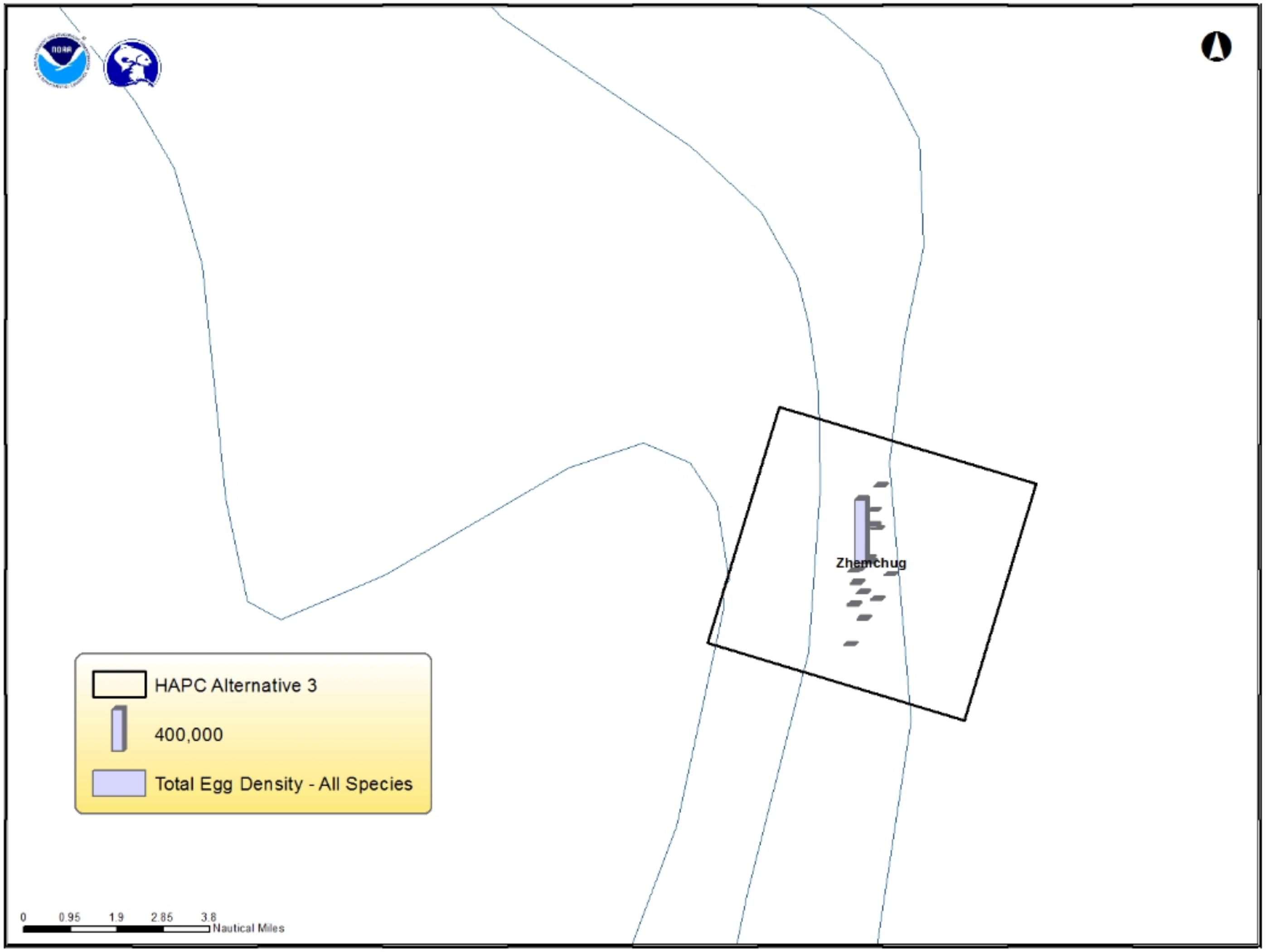

Figure 33. Total skate egg density/km² for all skate species in the Zhemchug site under Alternative 3.
Source: NMFS HCD and AFSC.

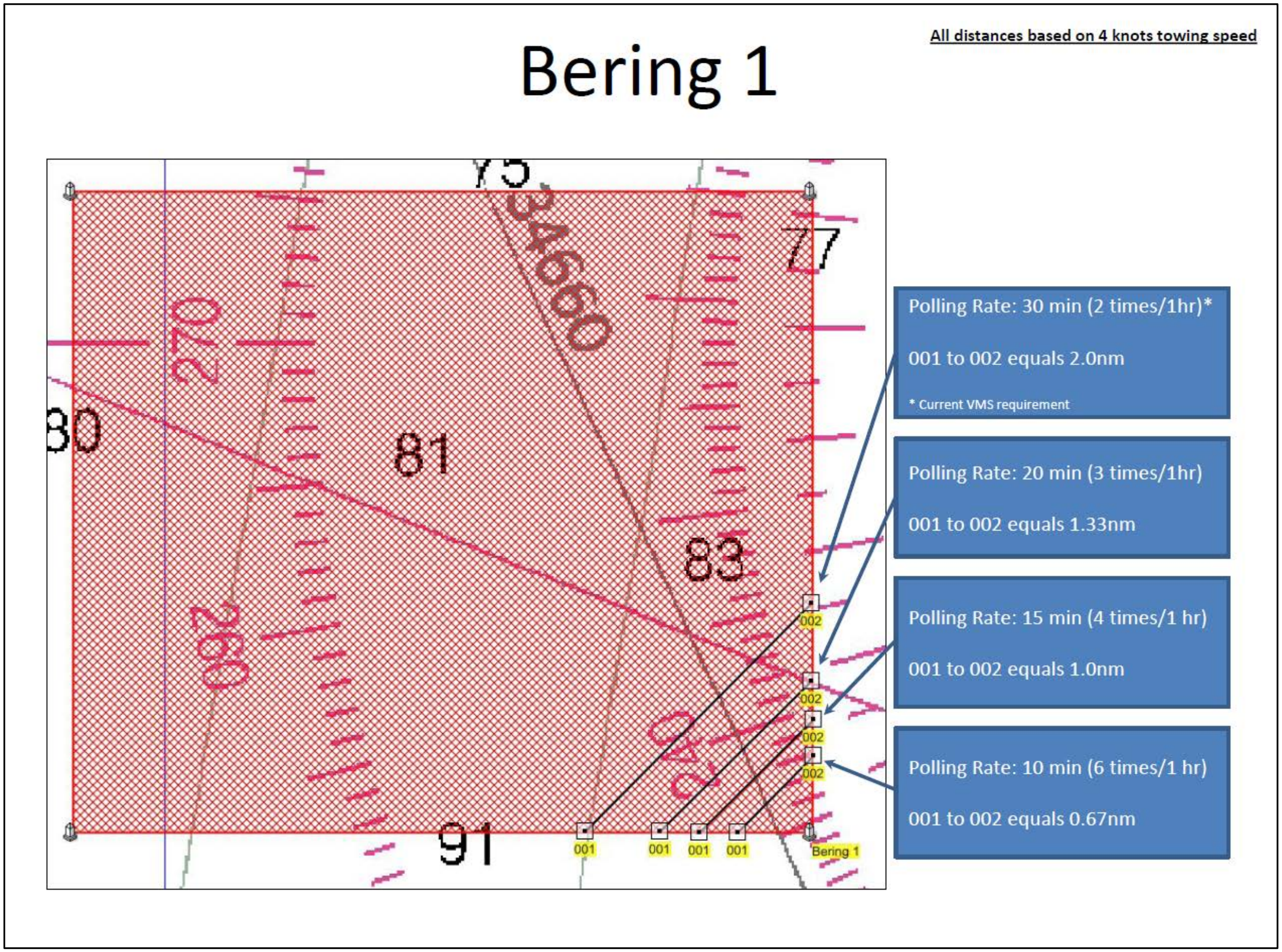

Figure 34. Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Bering 1 HAPC.

Source: NMFS HCD.

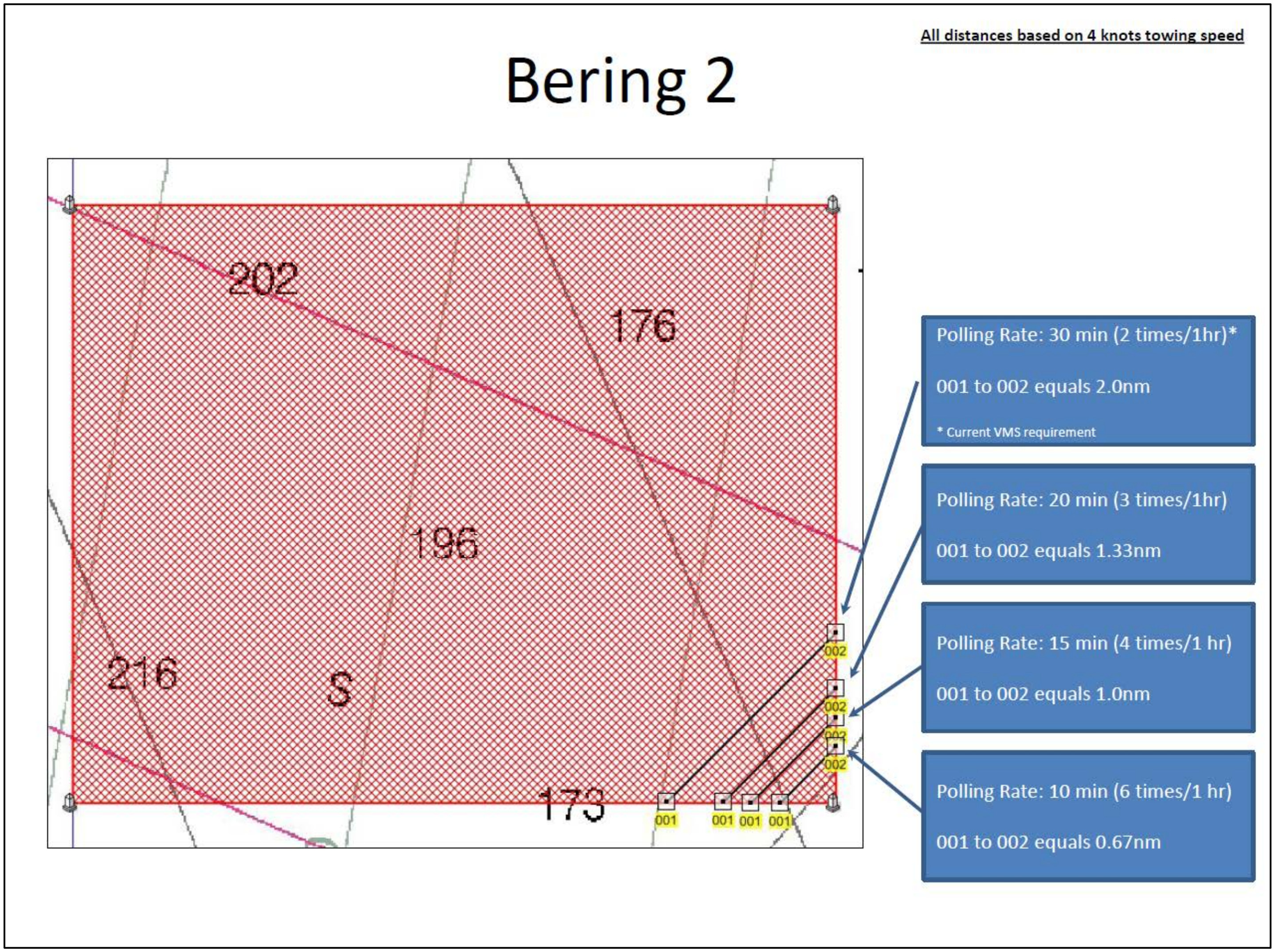

Figure 35. Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Bering 2 HAPC.

Source: NMFS HCD.

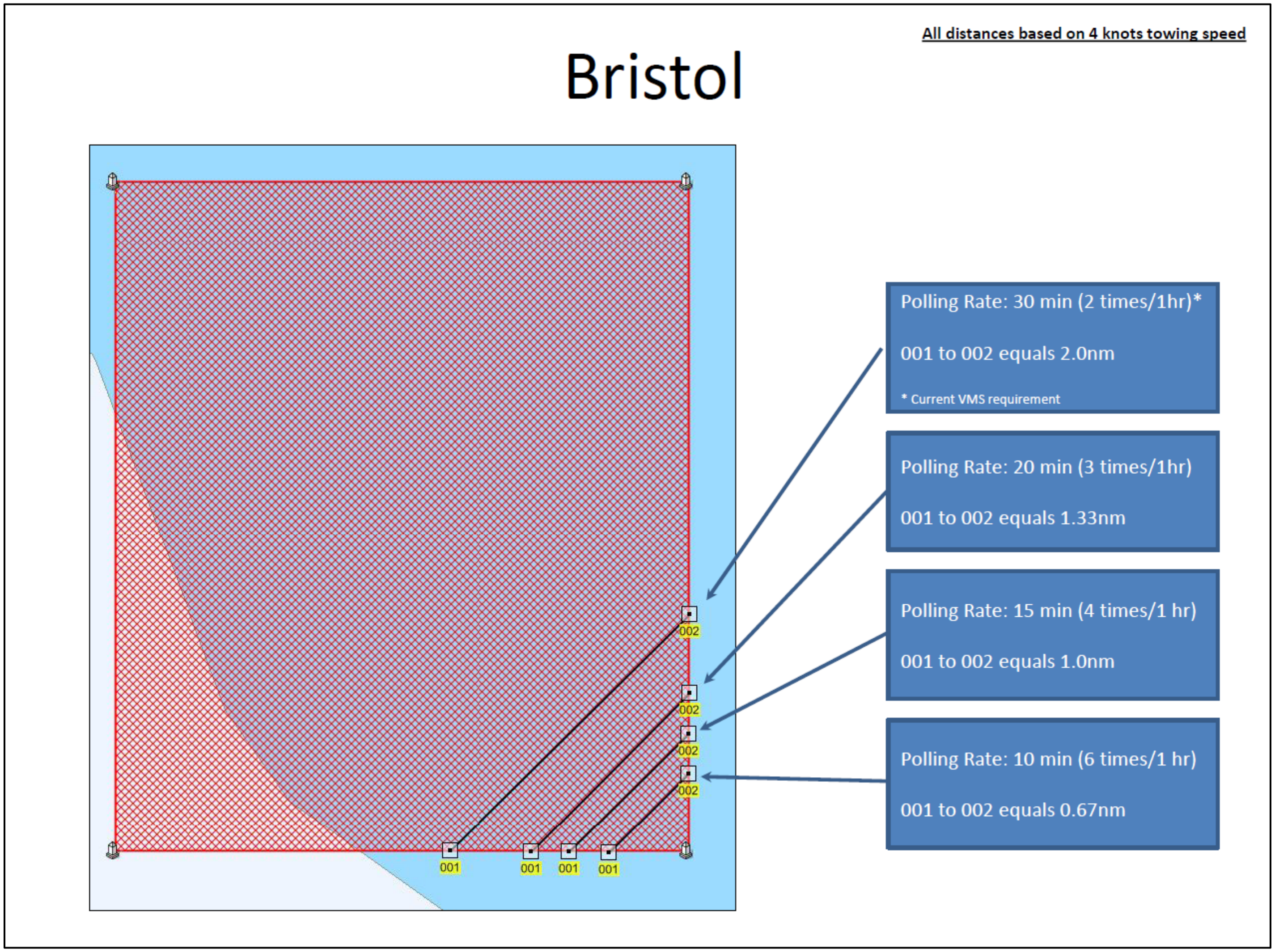

Figure 36. **Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Bristol HAPC.**

Source: NMFS HCD.

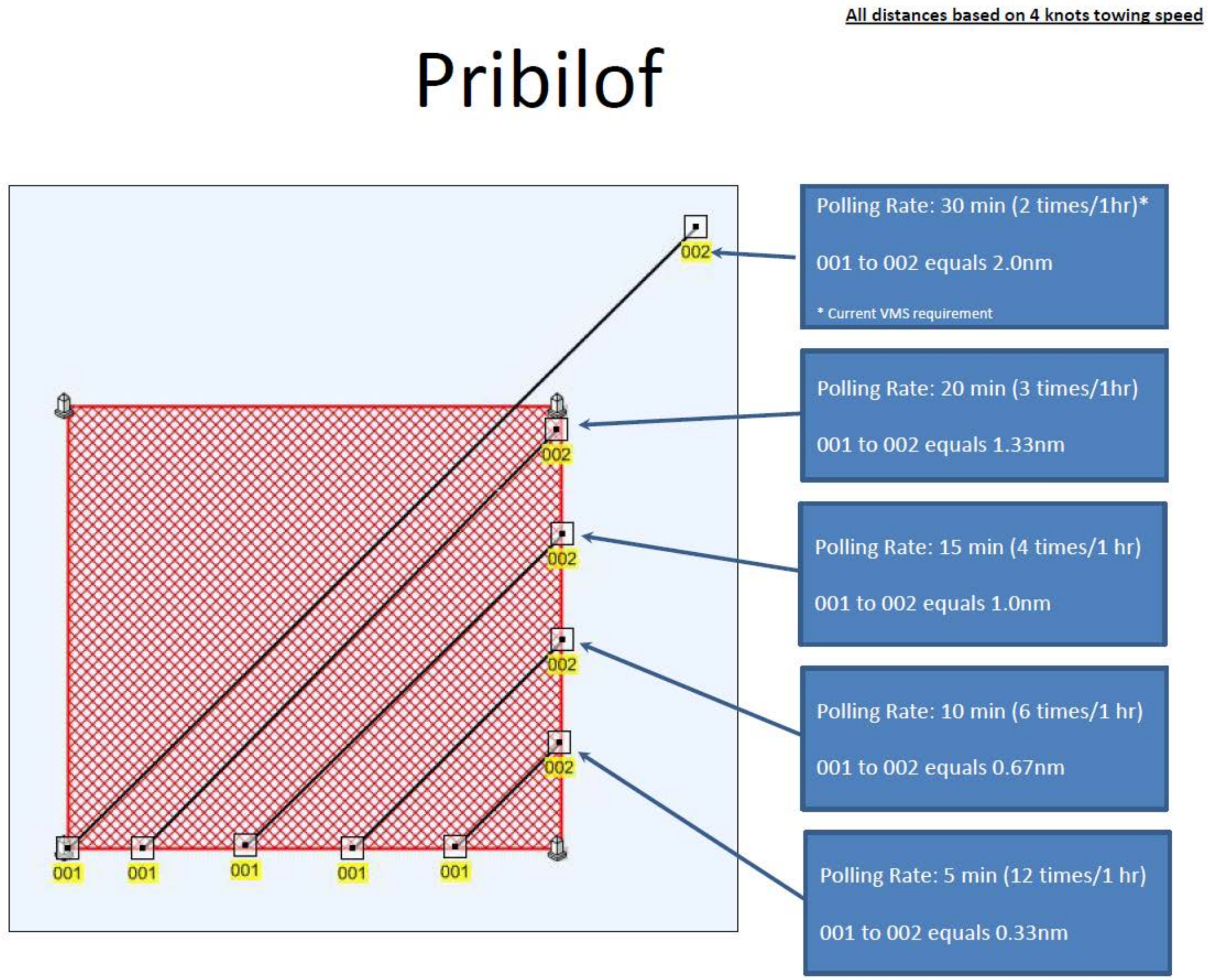

Figure 37. Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Pribilof HAPC.

Source: NMFS HCD.

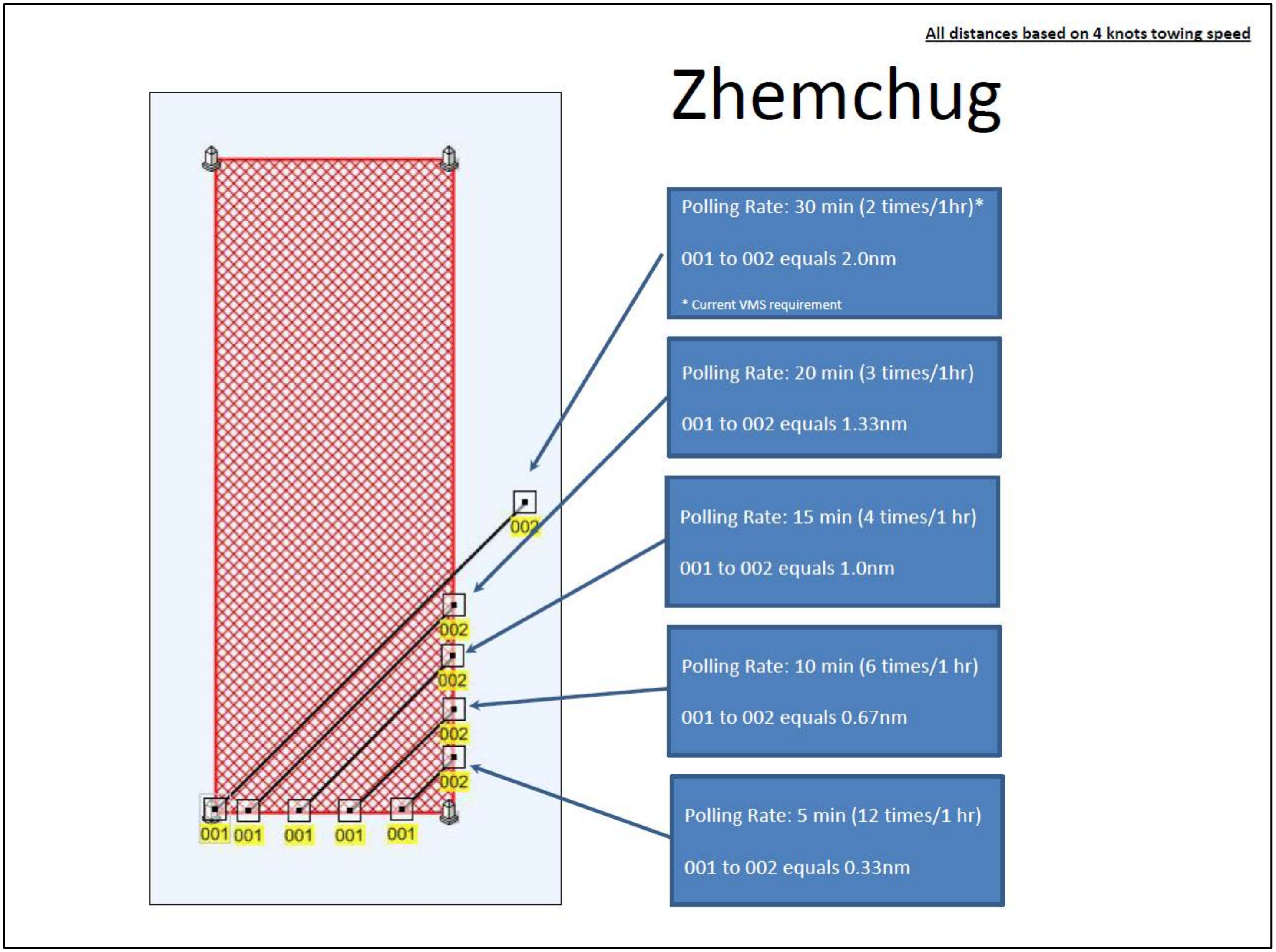

Figure 38. **Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Zhemchug HAPC.**

Source: NMFS HCD.

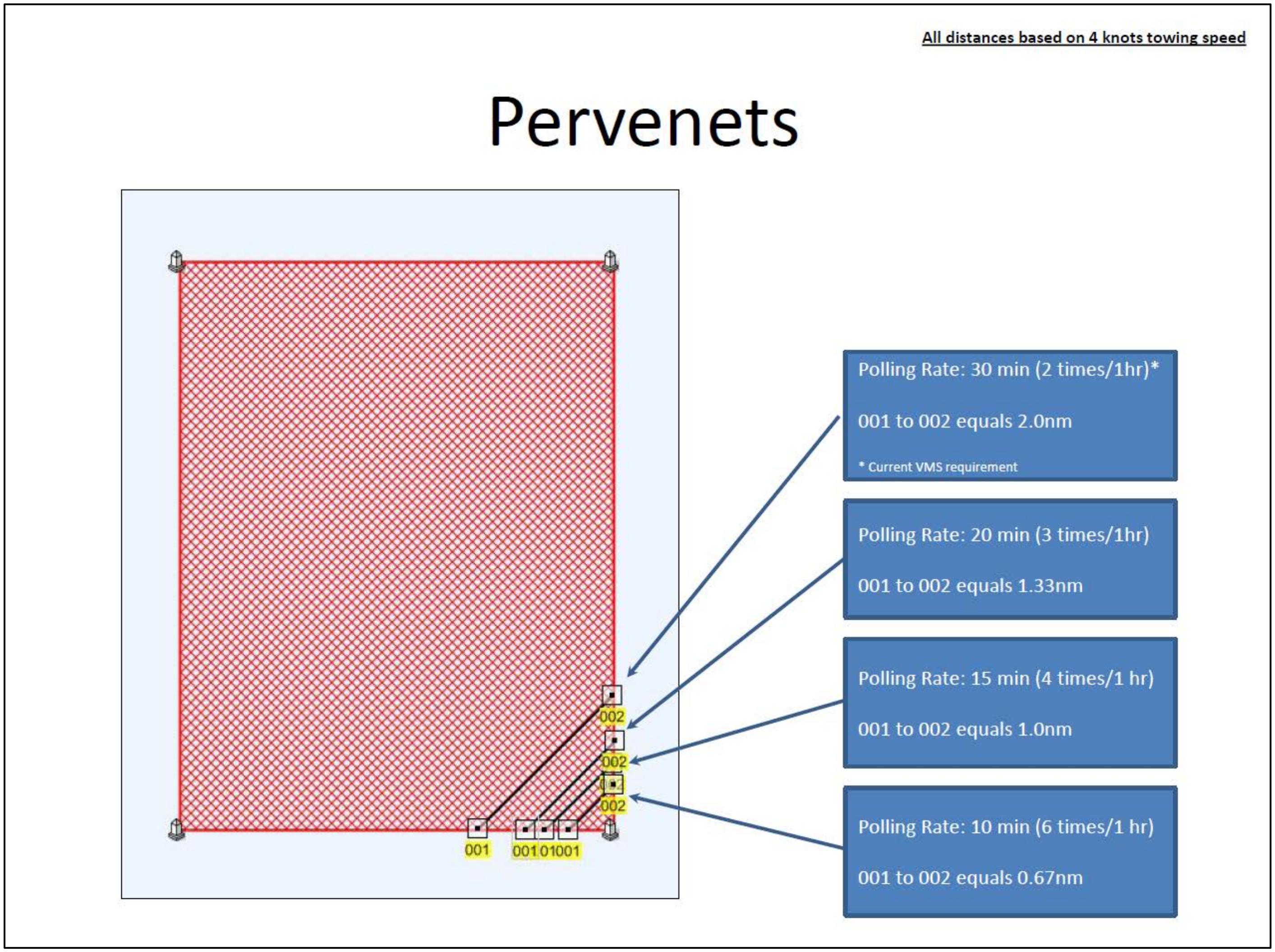

Figure 39. Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Pervenets 1 HAPC.

Source: NMFS HCD.

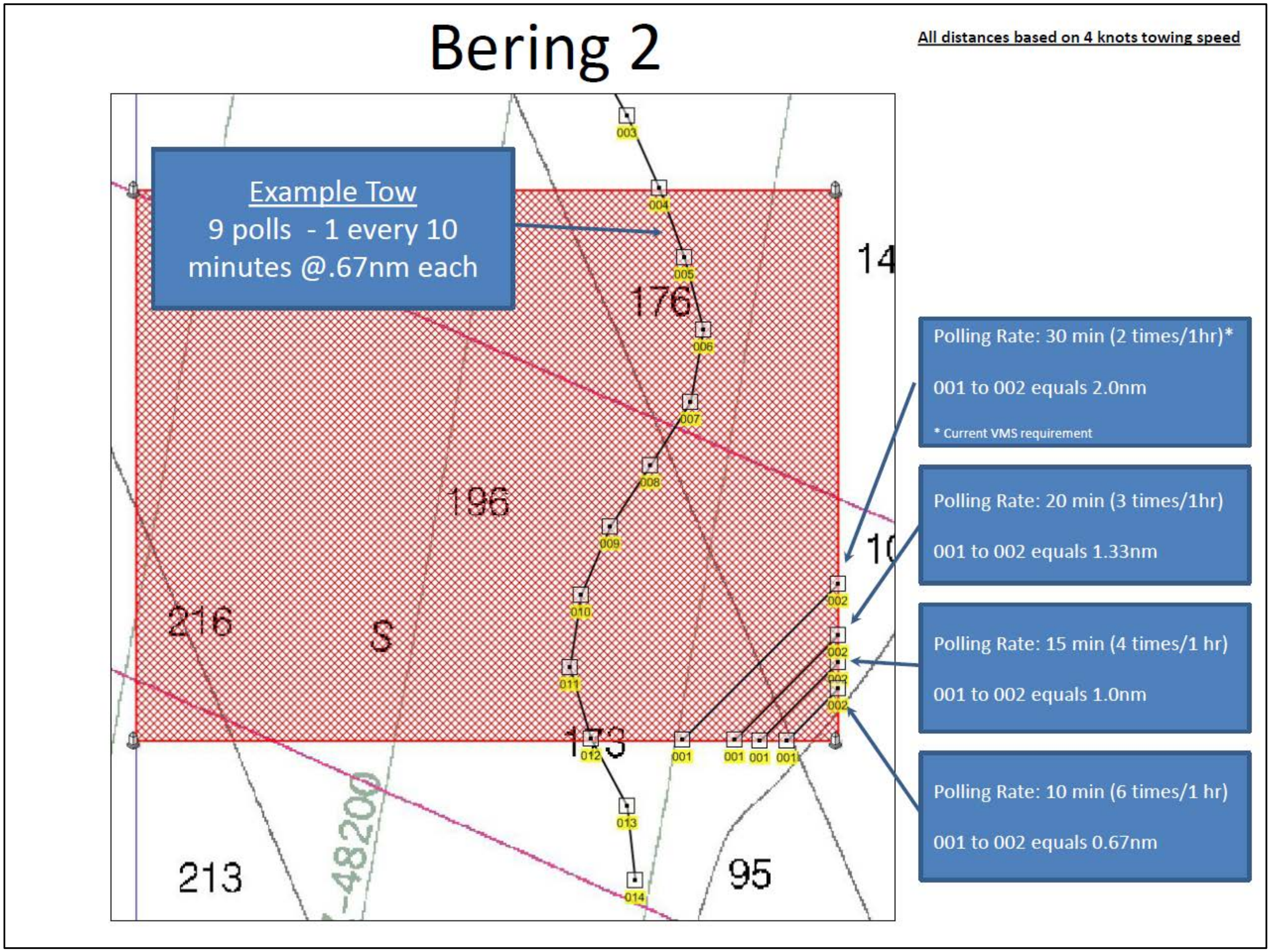

Figure 40. **Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Bering 2 HAPC.**

Source: NMFS HCD.

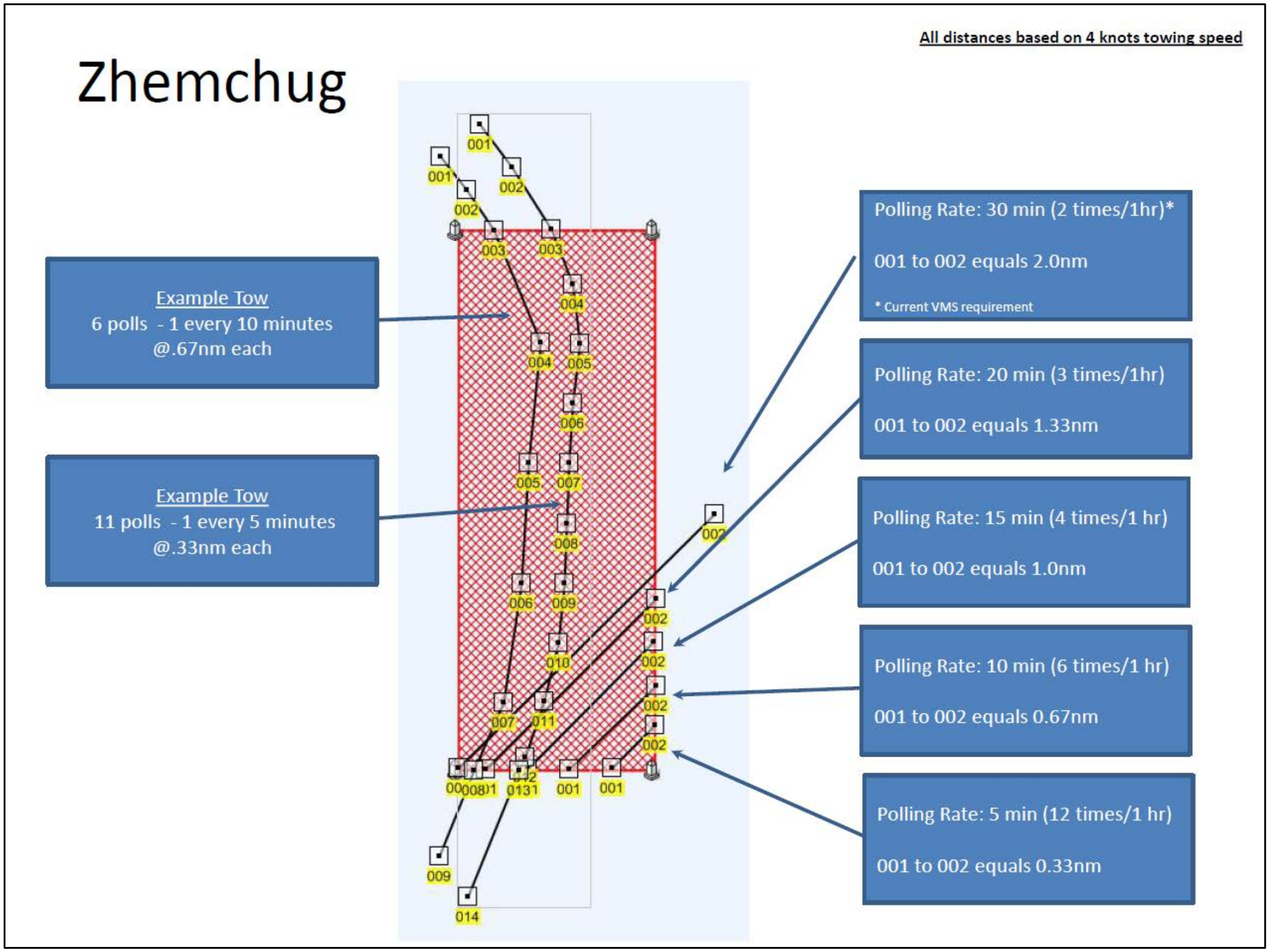

Figure 41. Evaluation of different VMS polling rates relative to skate site boundaries described by Alternative 2 for the Zhemchug HAPC.

Source: NMFS HCD.

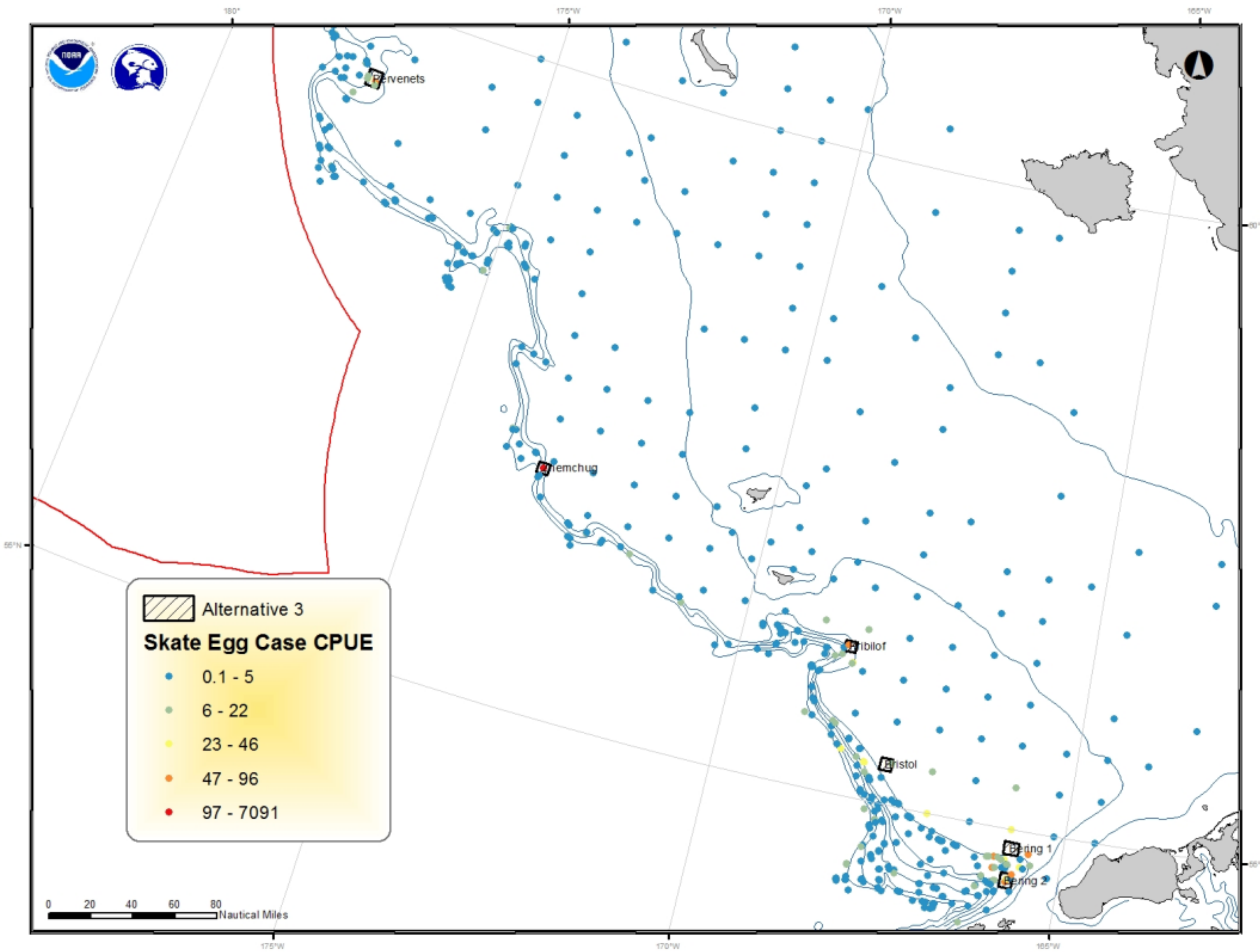

Figure 42. Skate egg concentration areas with RACE survey CPUE of skate egg cases under Alternative 3.
Source: NMFS HCD.

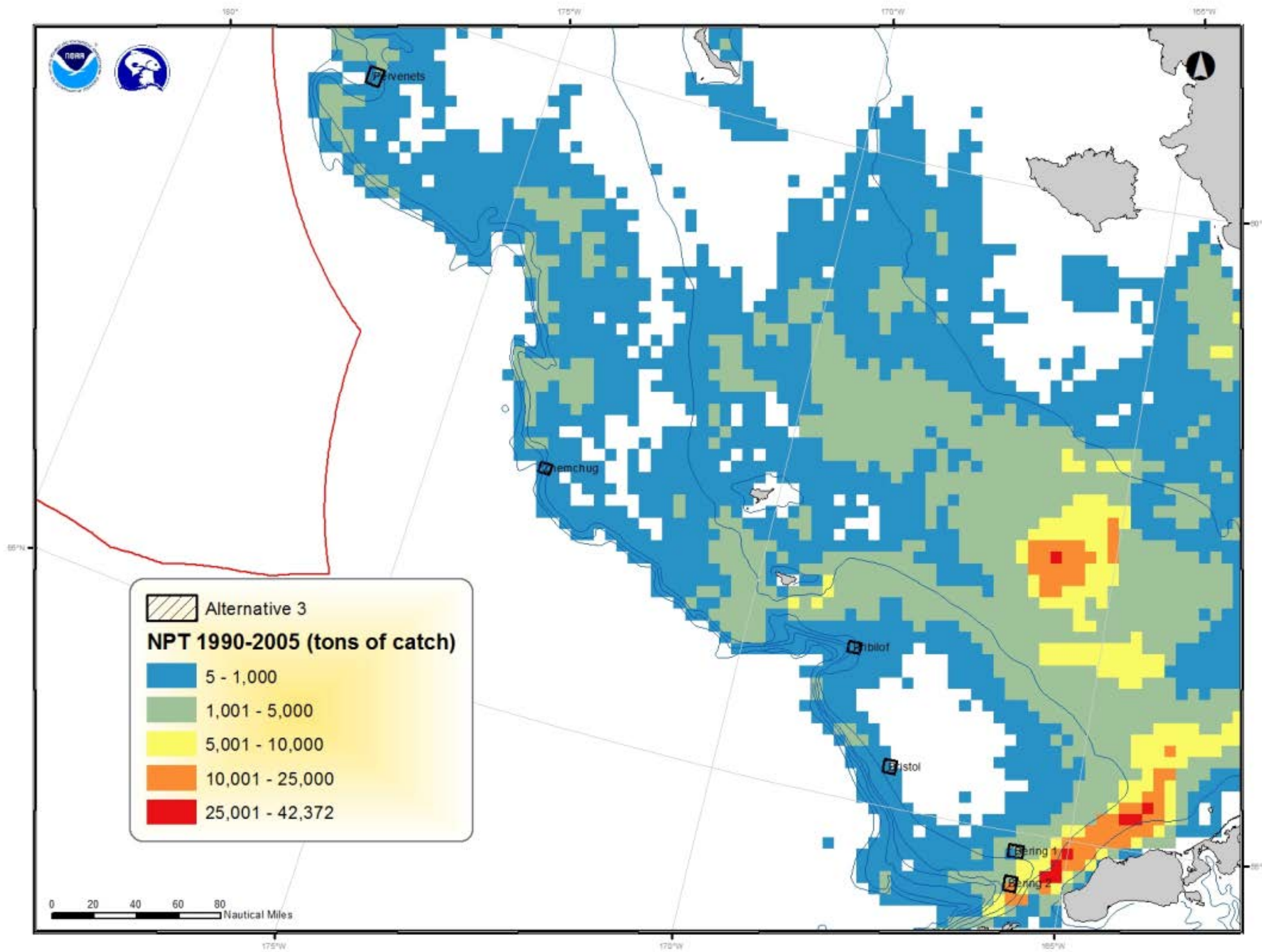

Figure 43. Skate egg concentration areas with observed nonpelagic trawl (NPT) in tons of catch from 1990 to 2005 under Alternative 3.

Source: NMFS HCD.

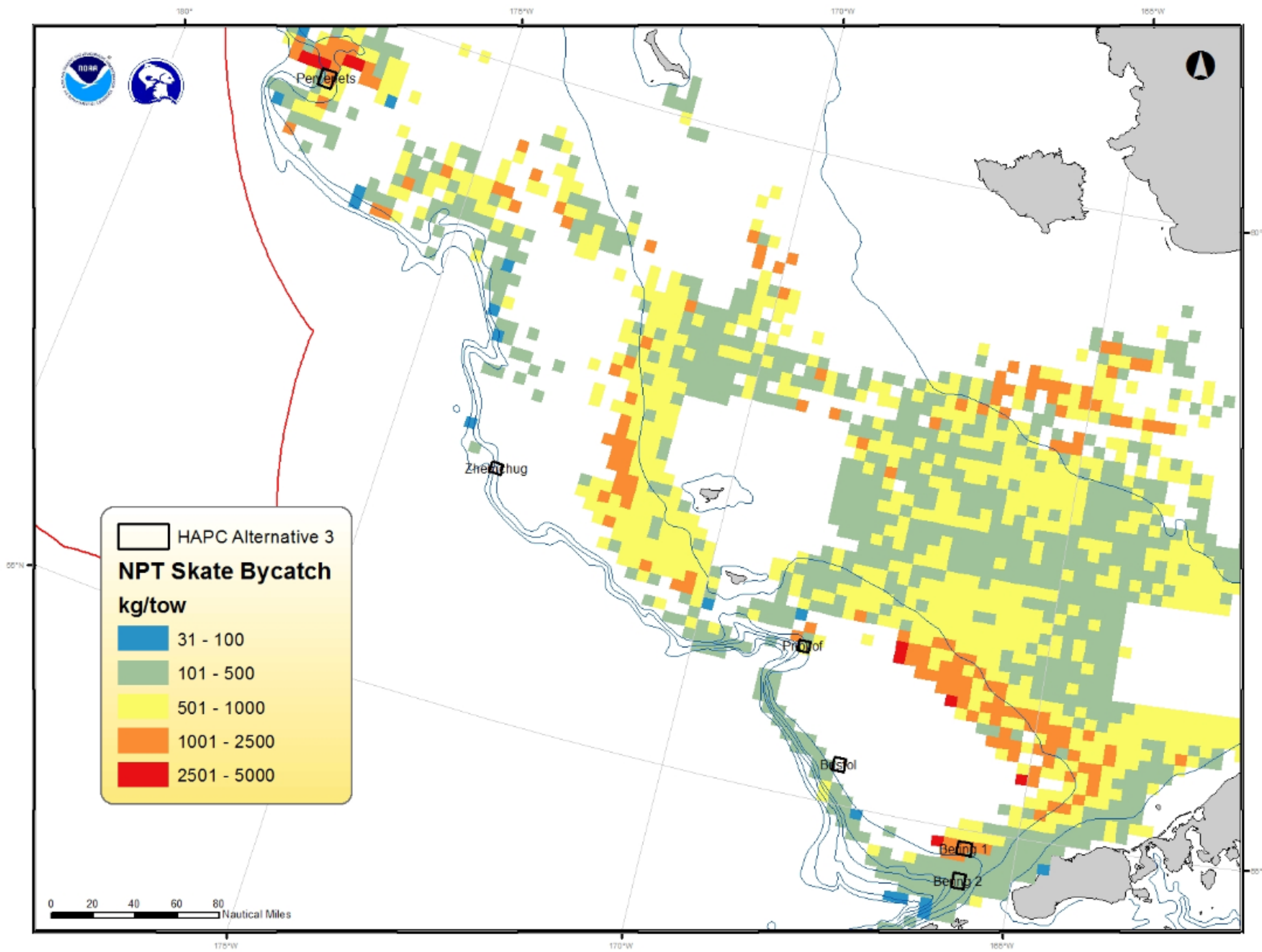

Figure 44. **Observed nonpelagic trawl (NPT) skate bycatch from 2000 to 2011 based on tows with observed skate bycatch only.**
Source: NMFS HCD.

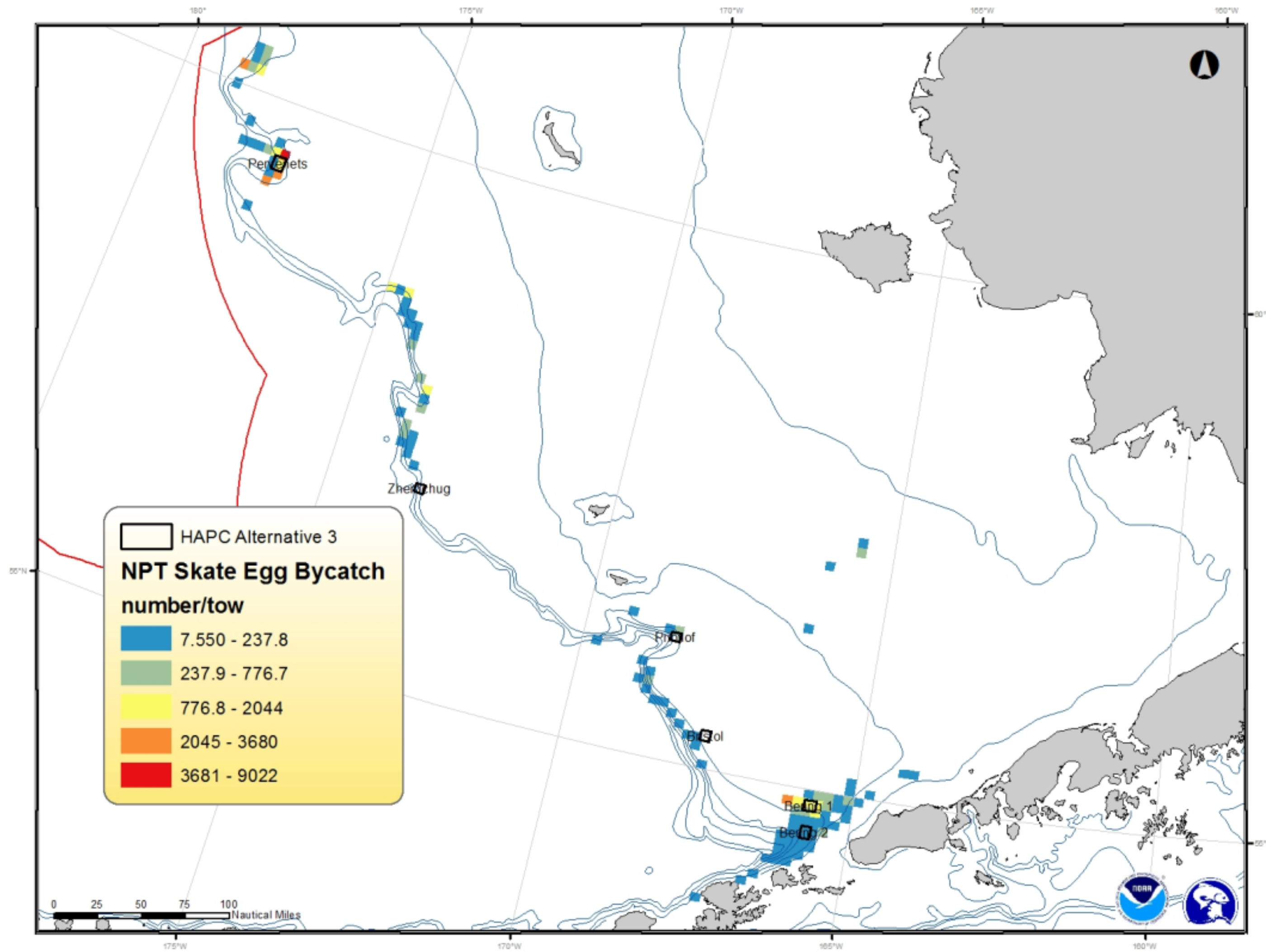

Figure 45. **Observed nonpelagic trawl (NPT) skate egg bycatch from 2000 to 2011 based on tows with observed skate egg bycatch only.**

Source: NMFS HCD.

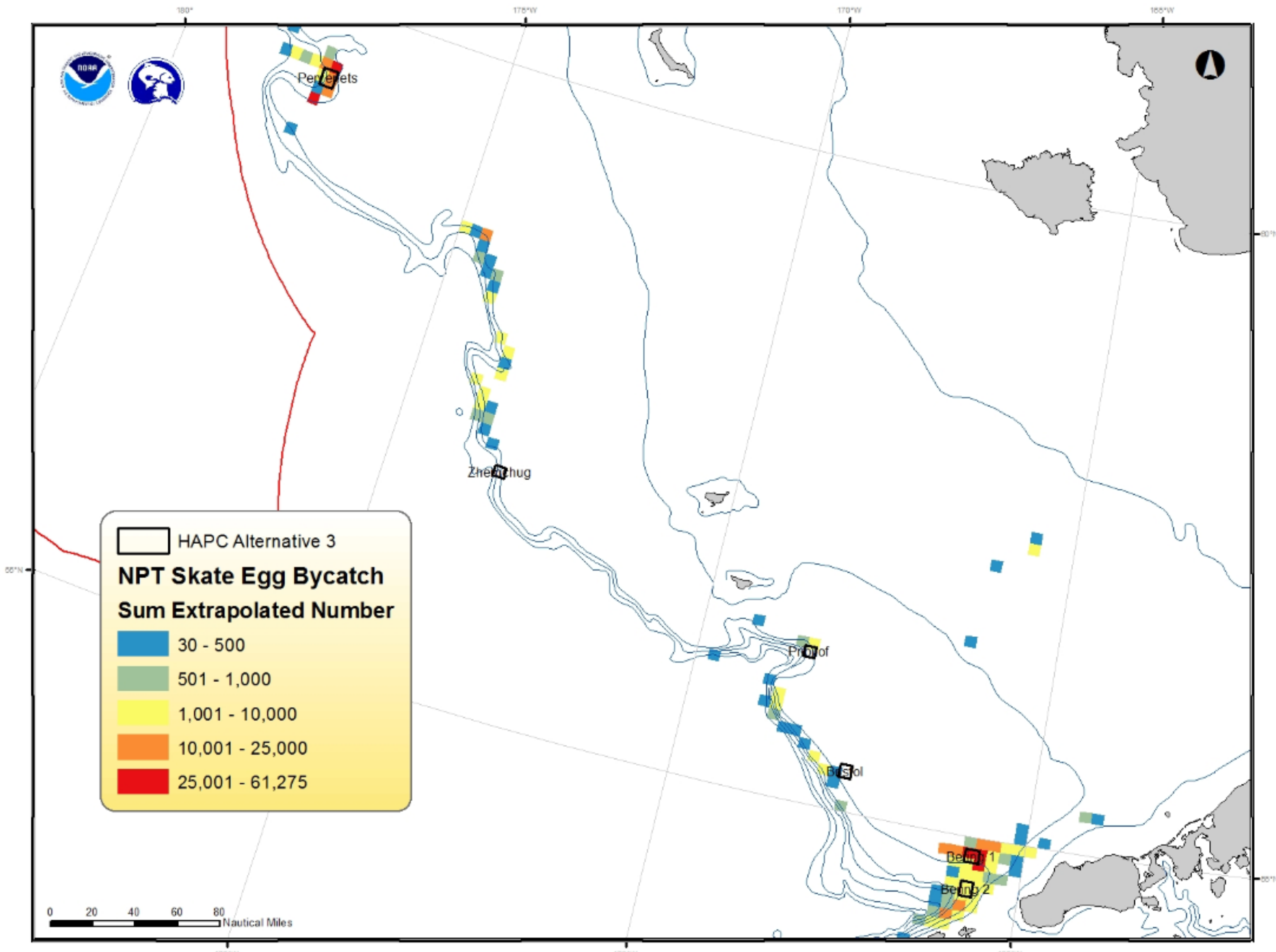

Figure 46. **Observed nonpelagic trawl (NPT) skate egg bycatch from 1998 to 2011 in extrapolated numbers.**
Source: NMFS HCD.

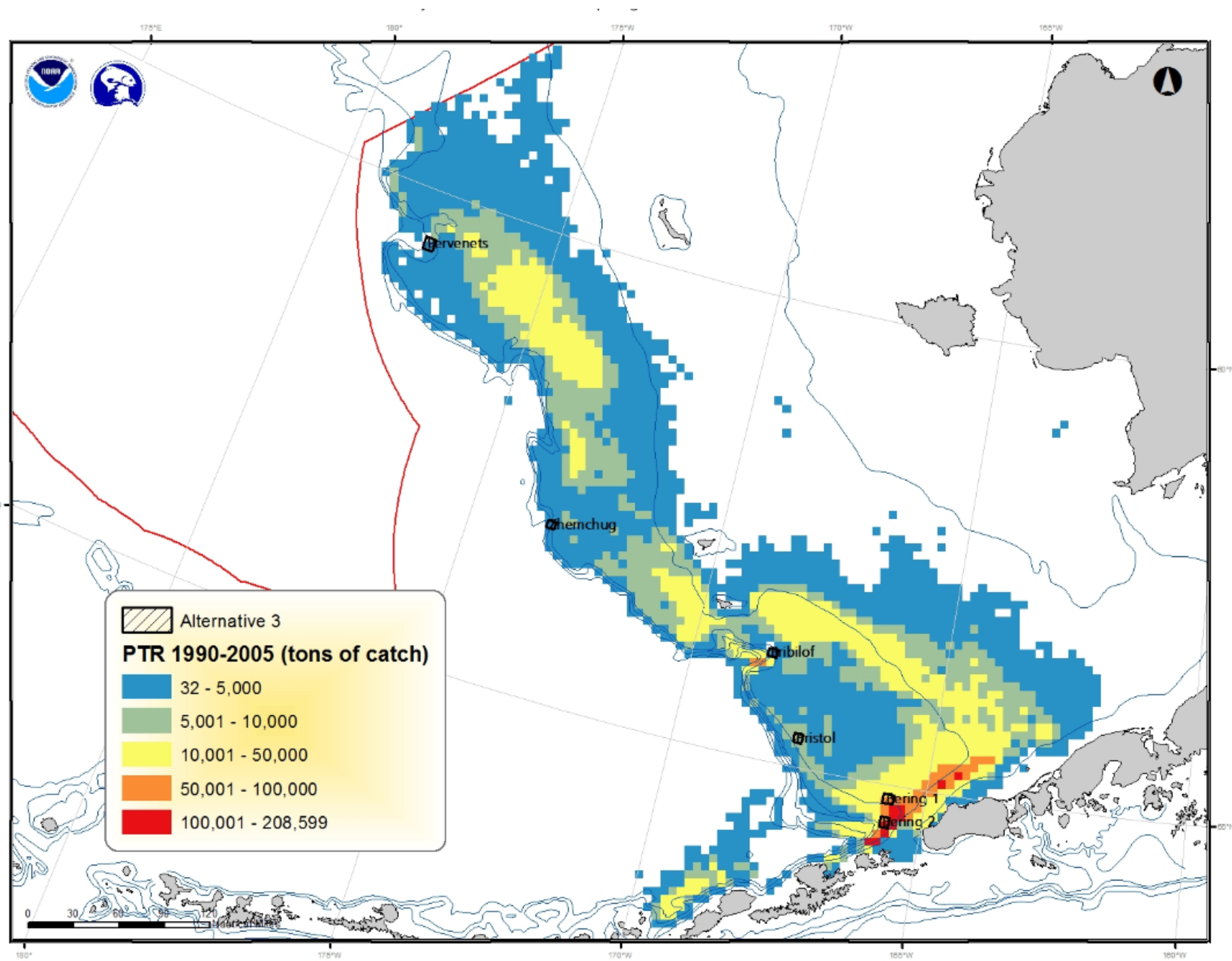

Figure 47. **Skate egg concentration areas with observed pelagic trawl (PTR) in tons of catch from 1990 to 2005 under Alternative 3.** Source: NMFS HCD.

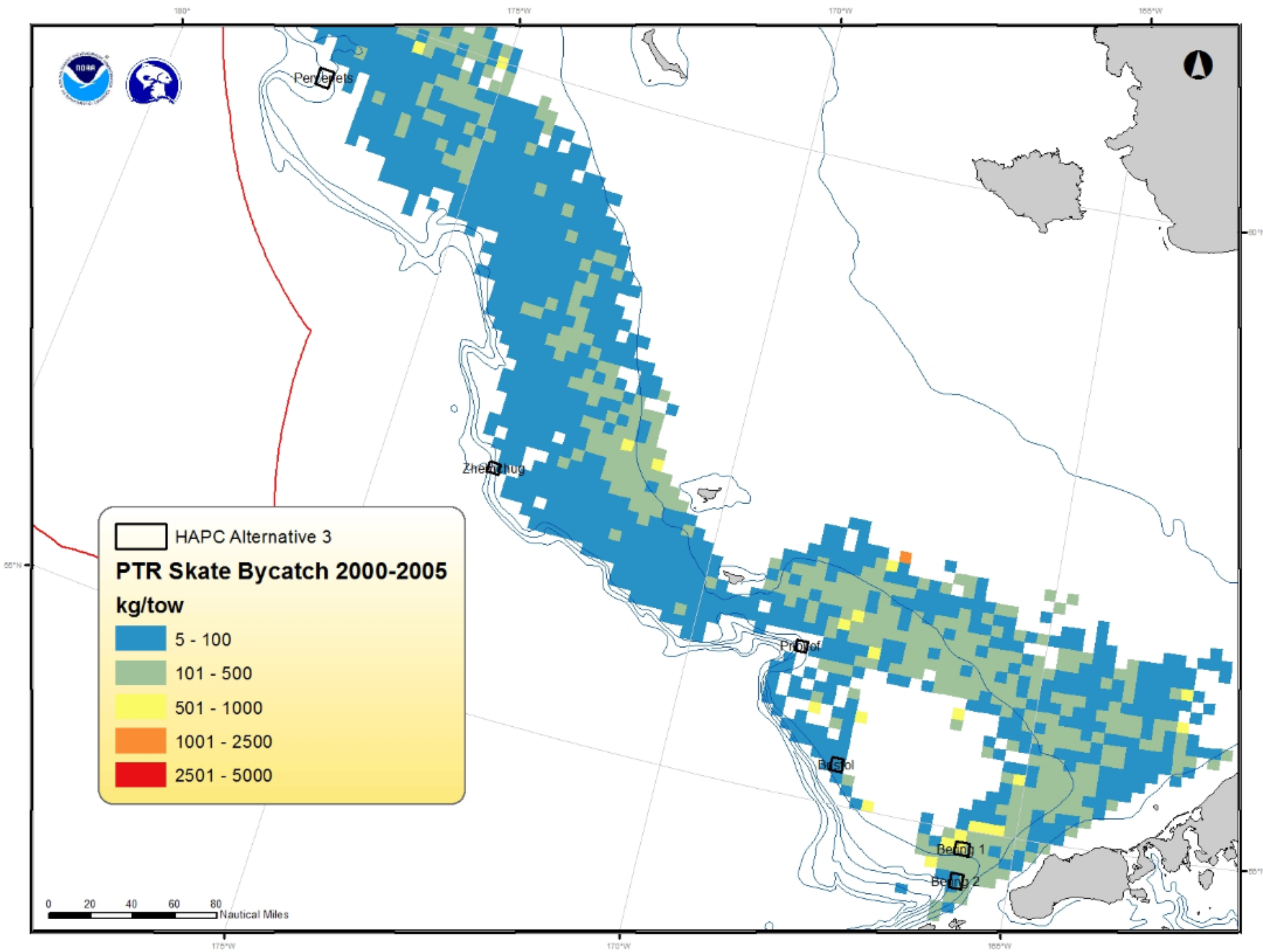

Figure 48. **Observed pelagic trawl (PTR) skate bycatch from 2000 to 2005 based on tows with observed skate bycatch only.**

Source: NMFS HCD.

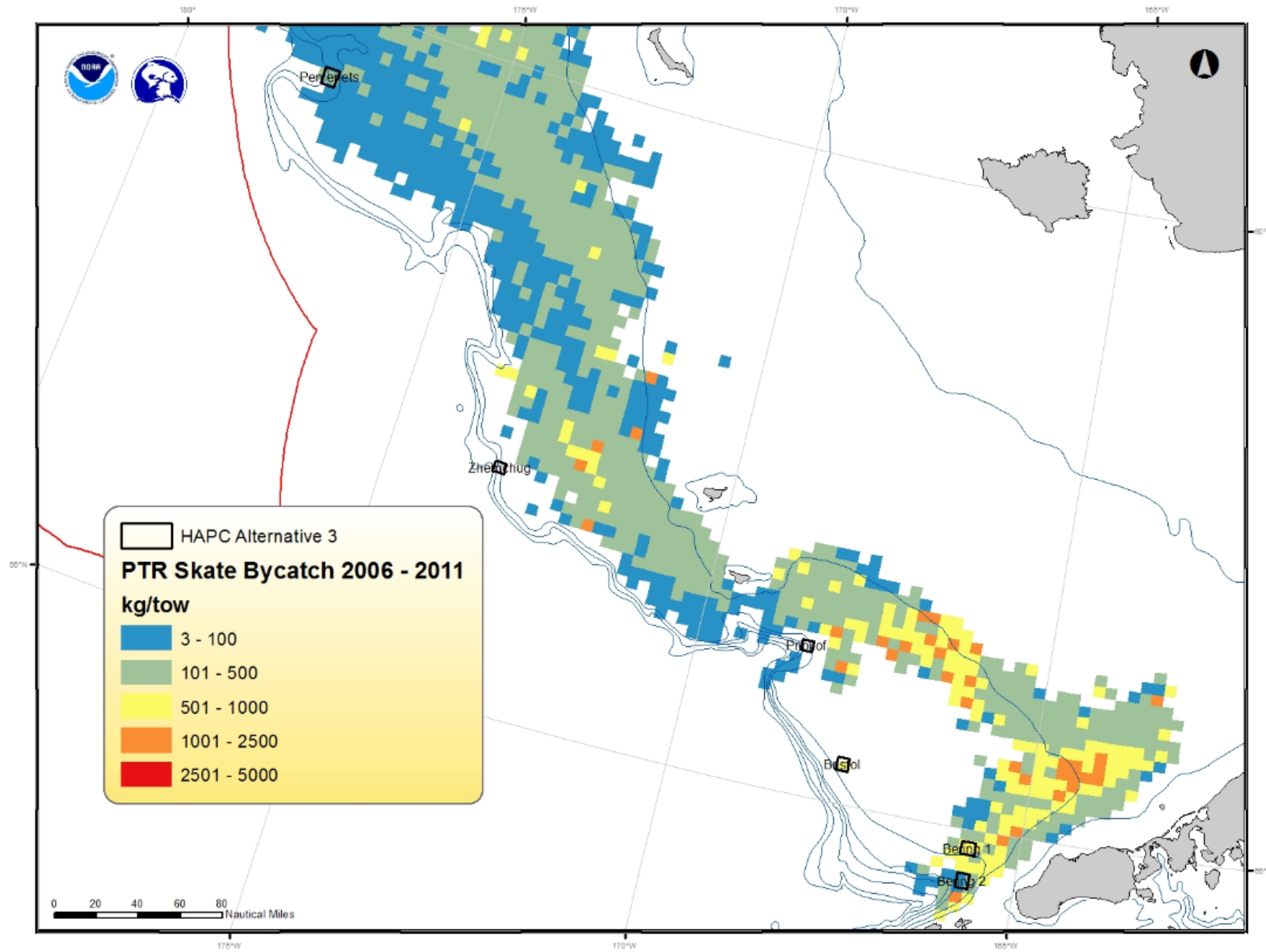

Figure 49. Observed pelagic trawl (PTR) skate bycatch from 2006 to 2011 based on tows with observed skate bycatch only.

Source: NMFS HCD.

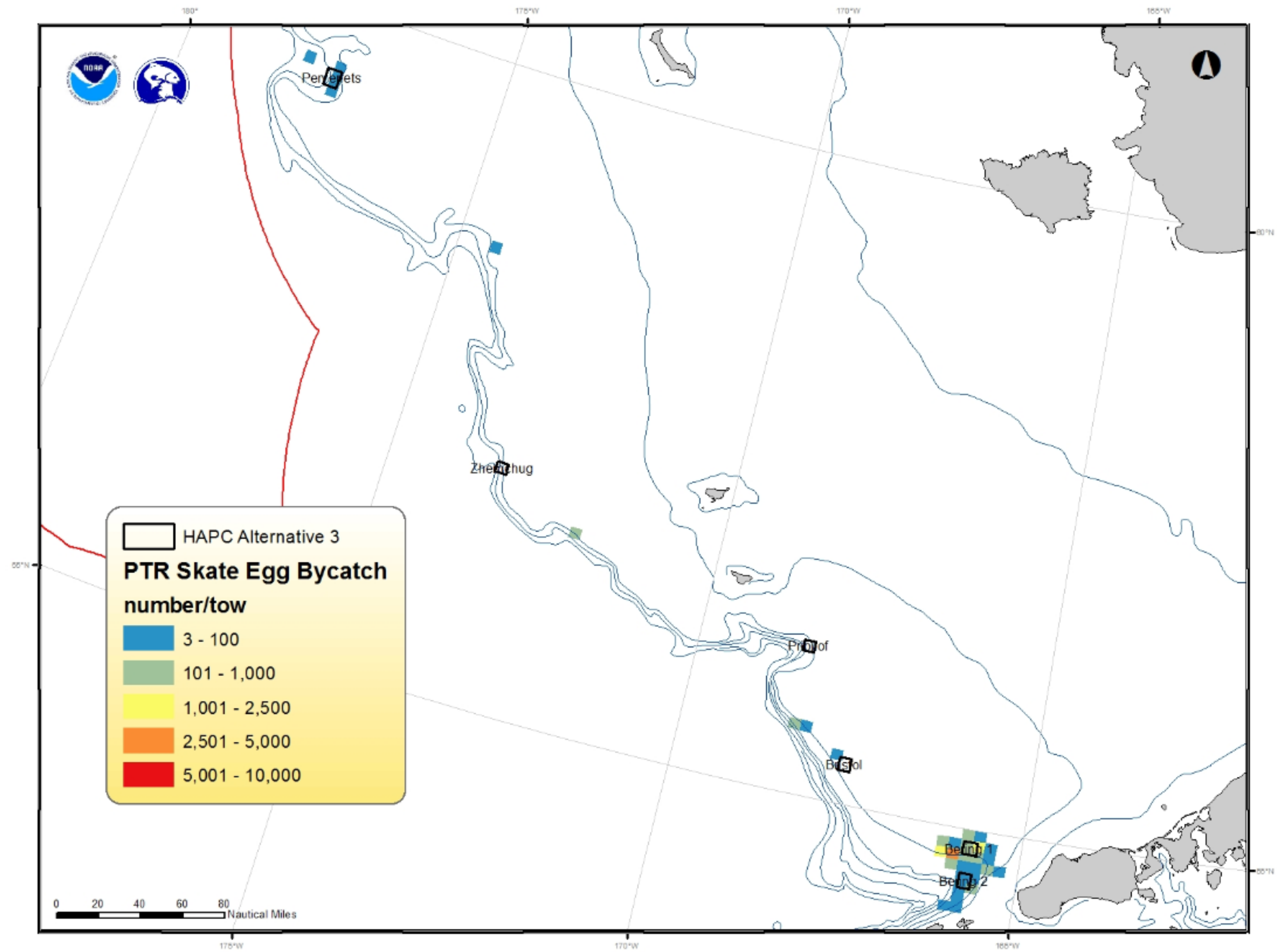

Figure 50. Observed pelagic trawl (PTR) skate egg bycatch from 1998 to 2011 based on tows with observed skate egg bycatch only. Source: NMFS HCD.

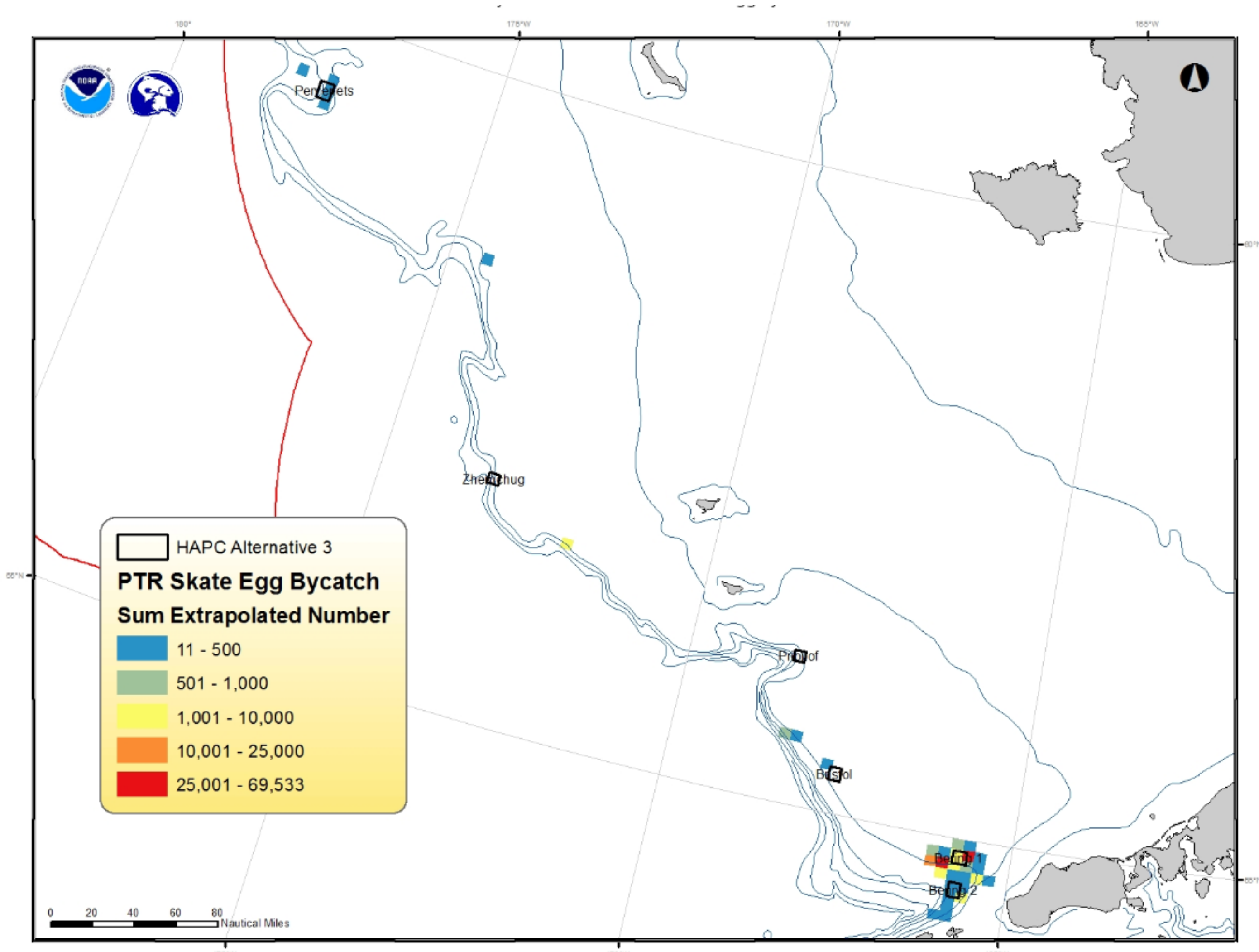

Figure 51. Observed pelagic trawl (PTR) skate egg bycatch from 1998 to 2011 in extrapolated numbers.

Source: NMFS HCD.

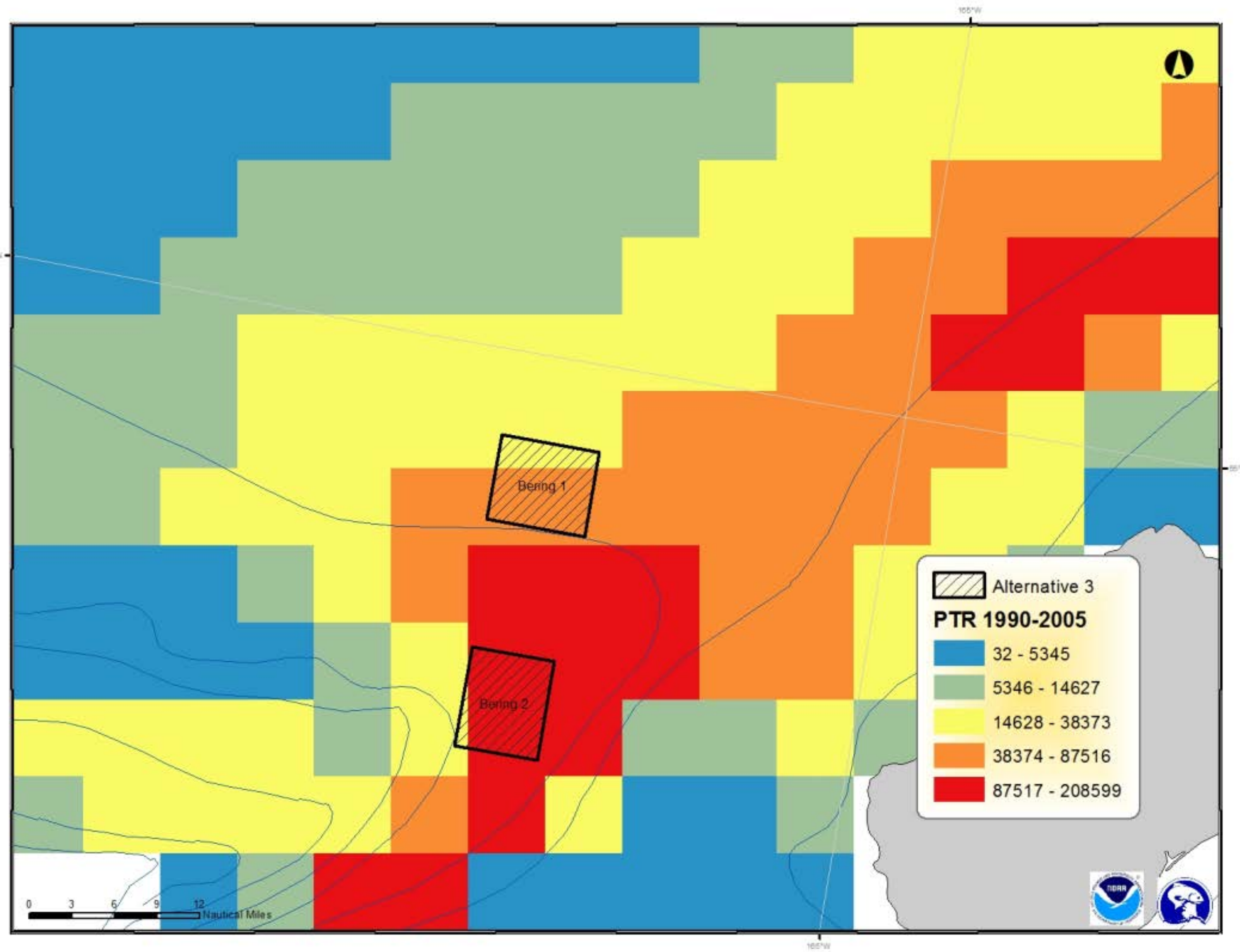

Figure 52. Observed pelagic trawl (PTR) in tons of catch from 1990 to 2005 for the Bering 1 and 2 HAPC sites under Alternative 3.
Source: NMFS HCD.

Figure 53. Photograph of the seafloor in an area of skate egg concentration showing the seafloor within the site.
Source: AFSC.

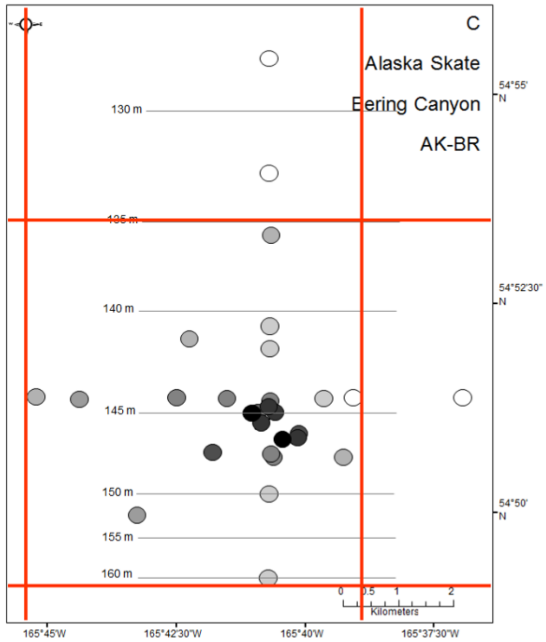

Figure 54. **Example of delineation of boundaries under Alternative 2. Red lines indicate extent of bottom trawls greater than 1,000 egg cases/ km^2. Boundary lines were then snapped outward to next minute of latitude or longitude.**

Source: AFSC.

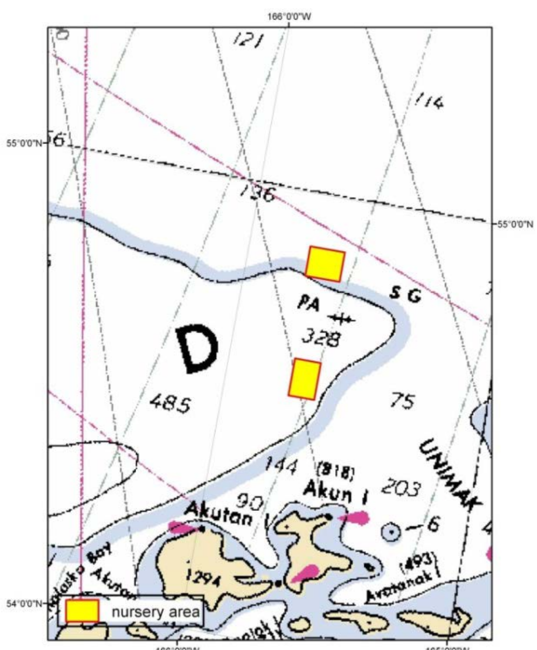

Figure 55. **Map detail of the Bering 1 and Bering 2 HAPC sites in the vicinity of the Bering Canyon under Alternative 2.**

Source: AFSC.

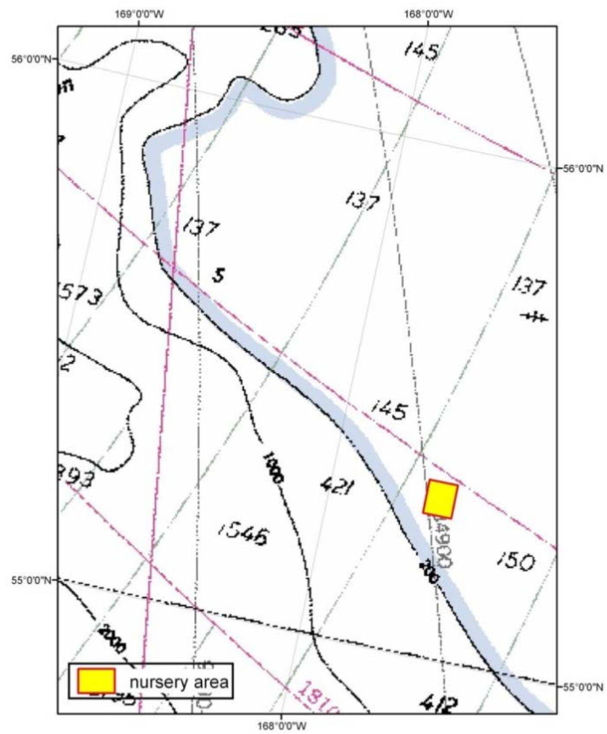

Figure 56. Map detail of the Bristol HAPC site in the vicinity of the Bristol Canyon under Alternative 2.

Source: AFSC.

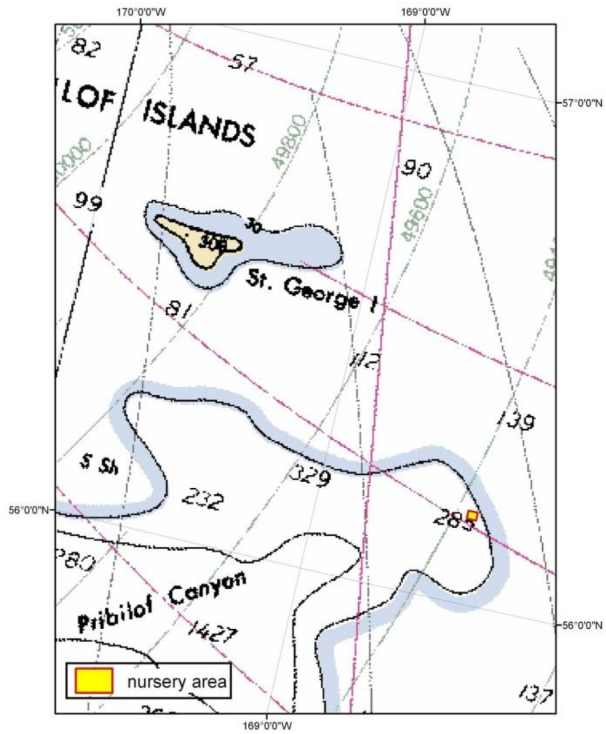

Figure 57. Map detail of the Pribilof HAPC site in the vicinity of the Pribilof Canyon under Alternative 2.

Source: AFSC.

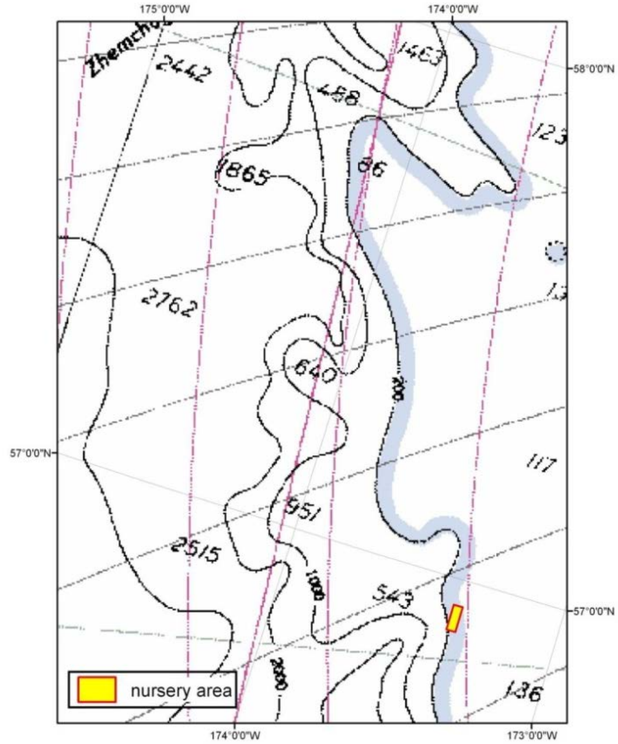

Figure 58. Map detail of the Zhemchug HAPC site south of the Zhemchug Canyon under Alternative 2.

Source: AFSC.

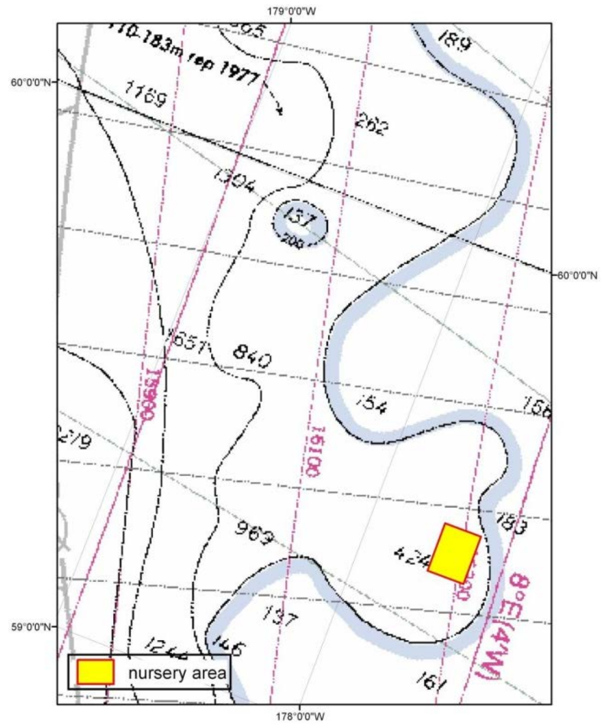

Figure 59. Map detail of the Pervenets HAPC site in the vicinity of the Pervenets Canyon under Alternative 2.

Source: AFSC.

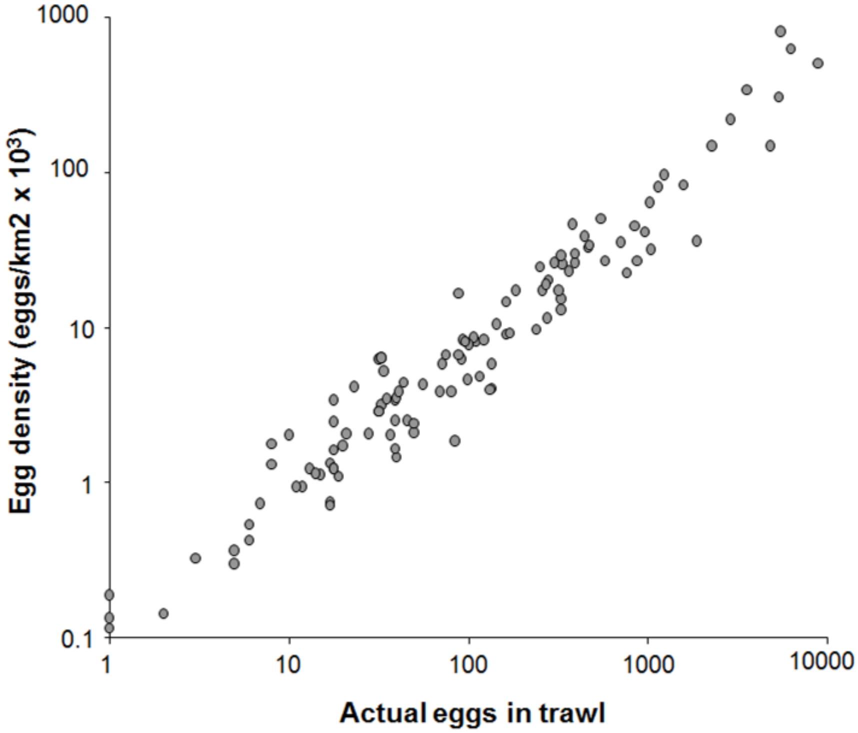

Figure 60. **Relationship between skate eggs encountered in the trawl and expansion to egg density.**

Source: AFSC.

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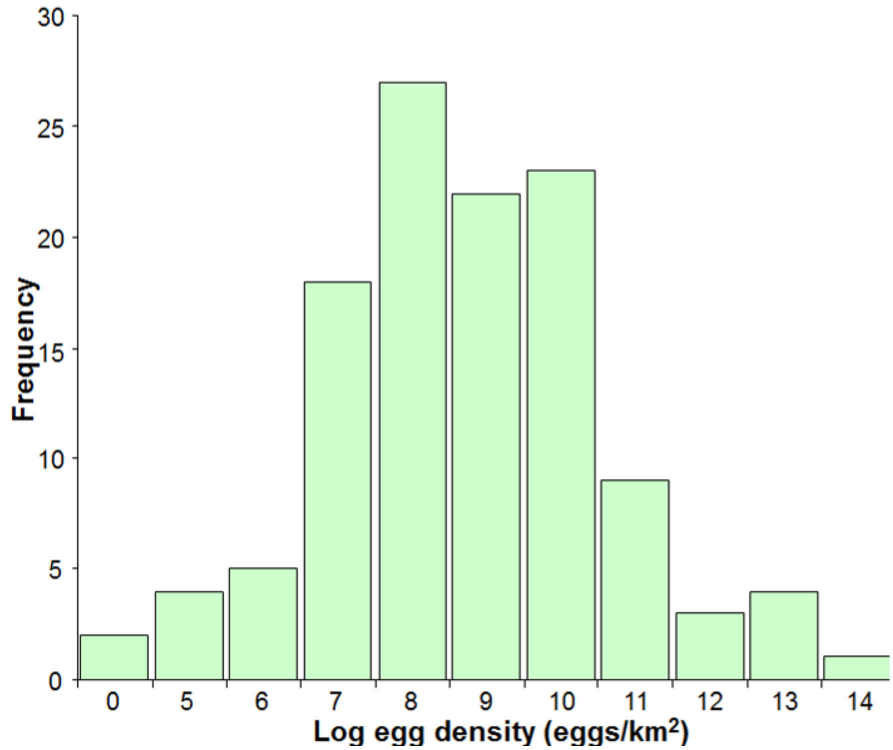

Figure 61. **Distribution of egg densities from all trawls in areas of skate egg concentration.**
Source: AFSC.

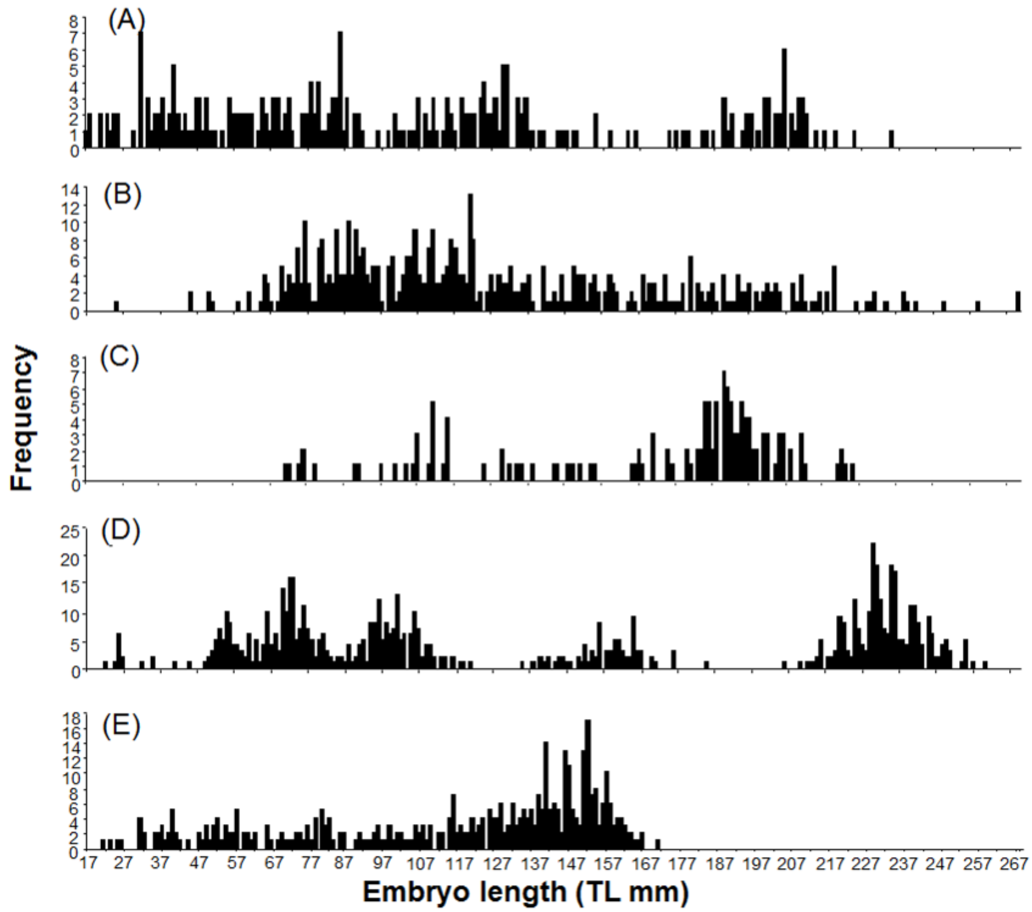

Figure 62. **Embryo length frequencies from five areas of skate egg concentration for three skate species in the eastern Bering Sea: A) the Alaska skate-Bering Canyon; B) the Alaska skate-Pervenets Canyon; C) the Aleutian skate-Bering Canyon; D) the Aleutian skate-Pervenets Canyon; and E) the Bering skate-Pervenets Canyon.**

Source: AFSC.

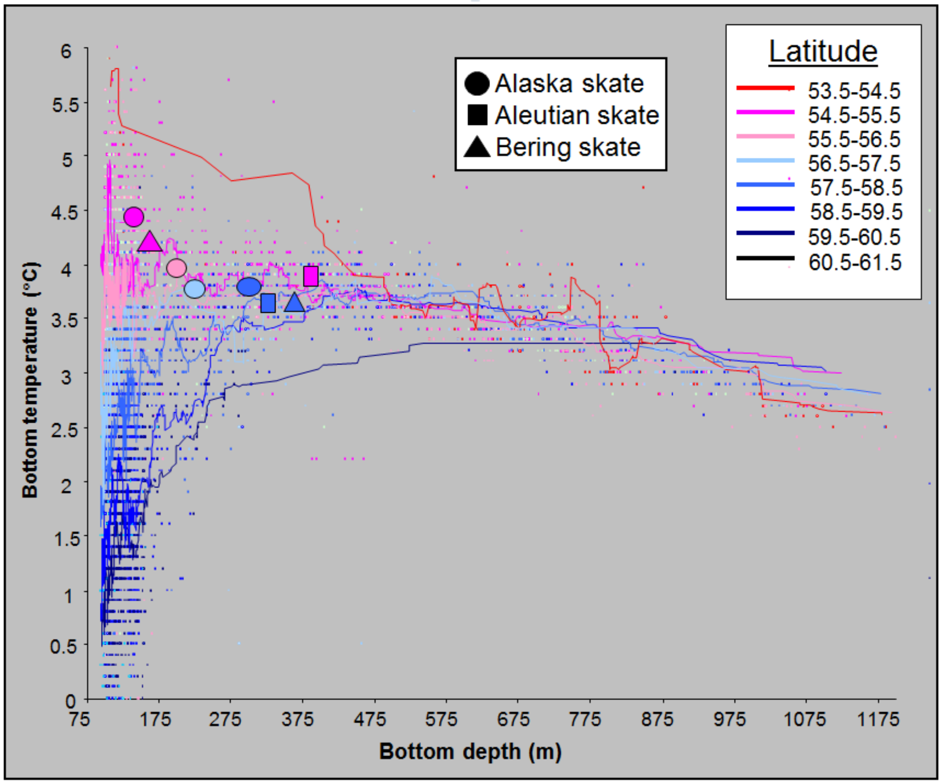

Figure 63. **Depth temperature relationship with latitude in the eastern Bering Sea. Each line represents the running mean of that latitudes bottom temperature across the shelf and slope. Areas of skate egg concentration are plotted at their depth and mean temperature, symbol coded for species, and color coded for latitude.**

Source: AFSC.

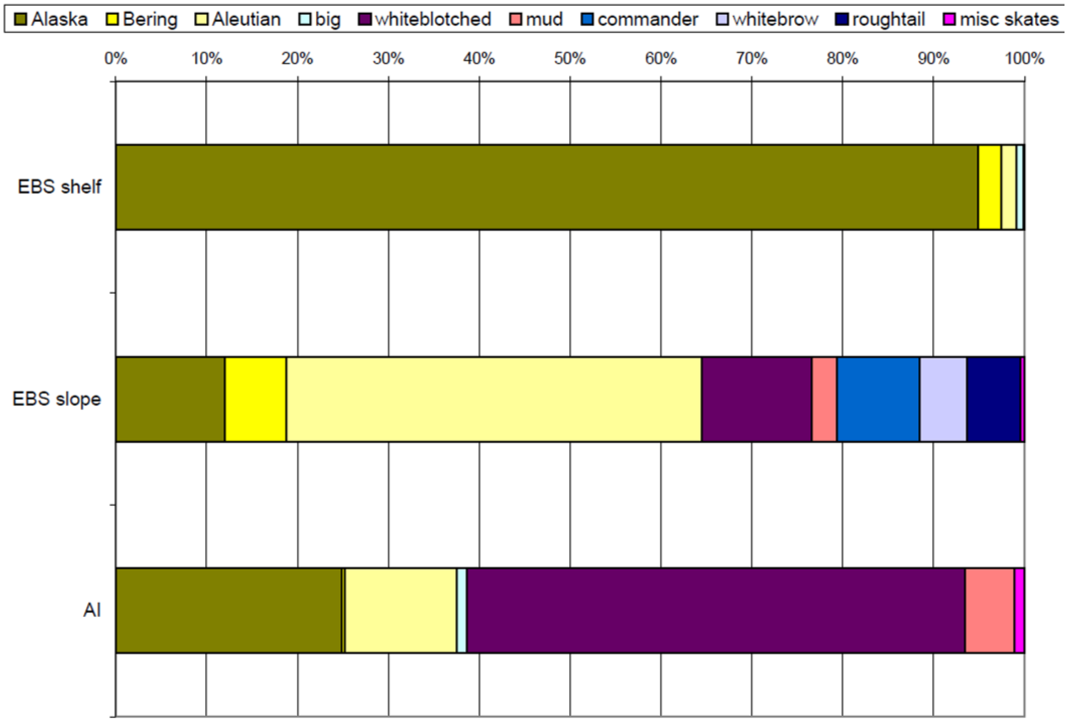

Figure 64. **Skate species composition (by weight) by BSAI subregion, from surveys conducted in each region in 2010. "Misc. skates" contains longnose, deepsea, and unidentified skates.**

Source: AFSC.

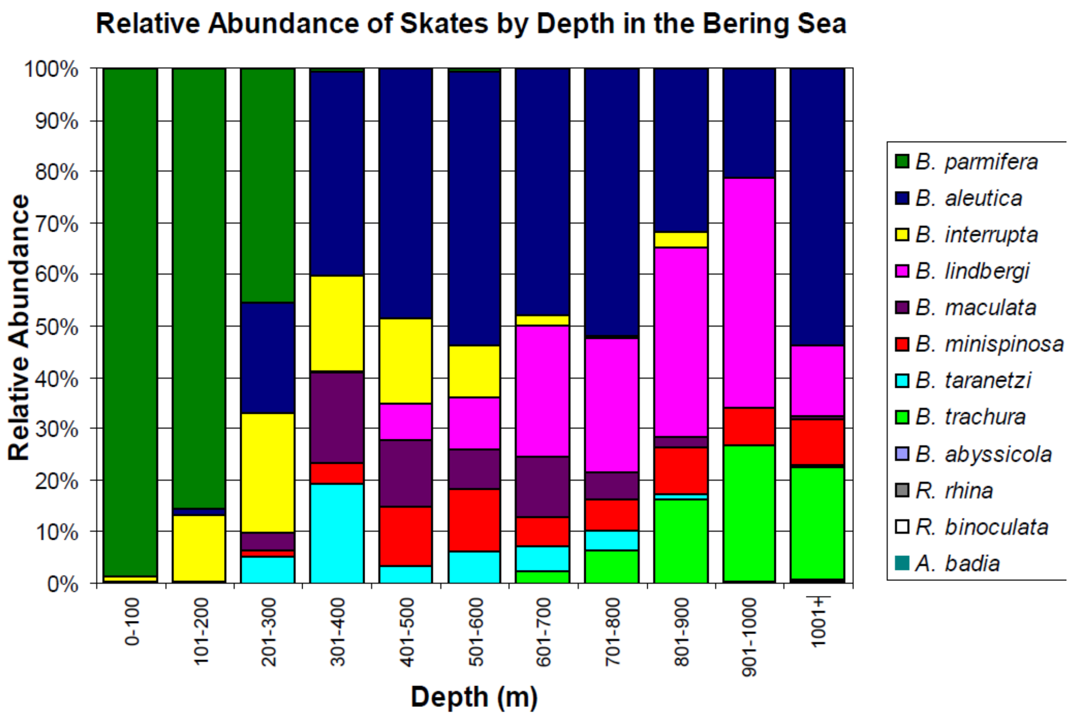

Figure 65. **Relative abundance of skate species in the Bering Sea by depth.**
Source: Stevenson et al. 2006.

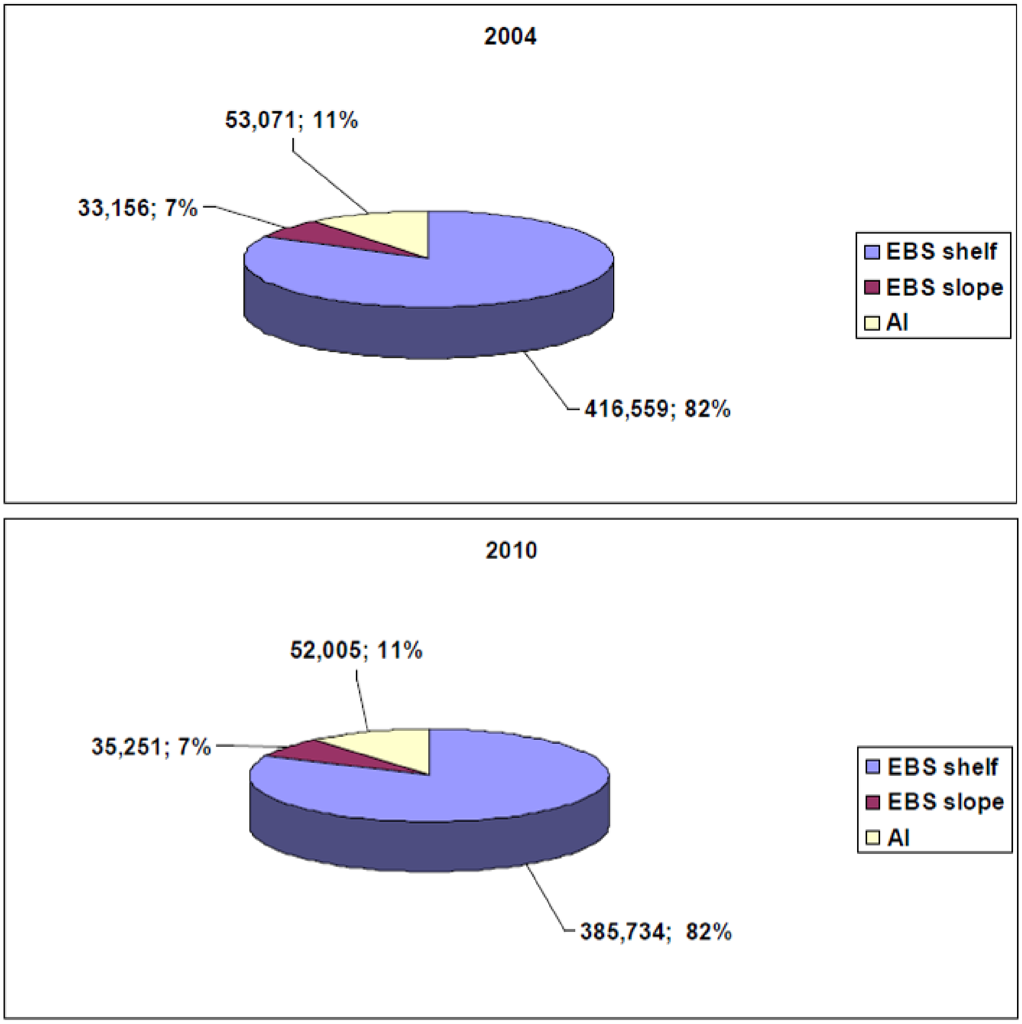

Figure 66. **Distribution of skate biomass in the three sub-regions of the BSAI (Eastern Bering Sea shelf and slope, and the Aleutian Islands) from 2004 to 2010. Data are biomass estimates from the annual AFSC groundfish surveys.**

Source: AFSC and NPFMC.

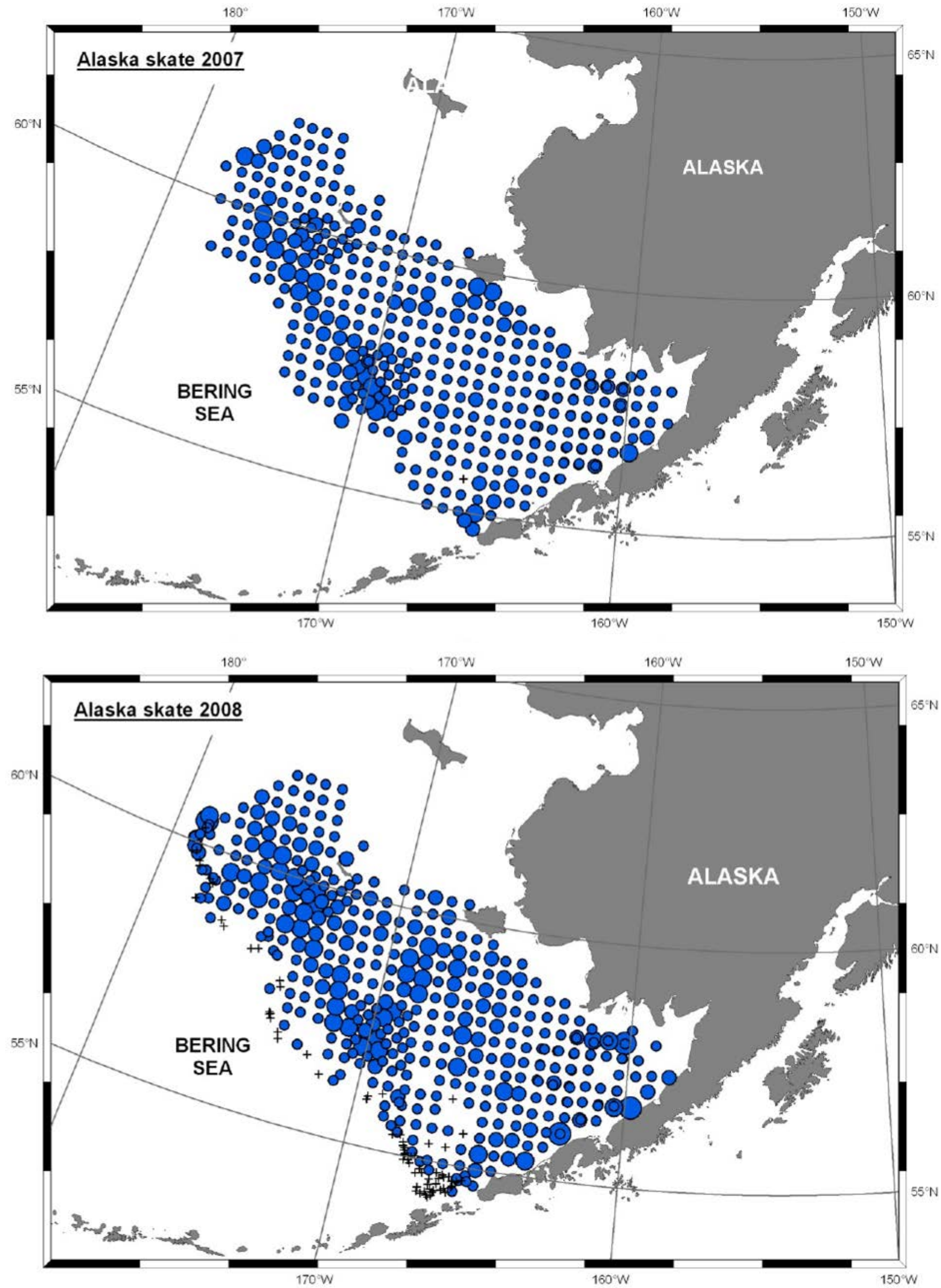

Figure 67. **AFSC bottom trawl survey catches of Alaska skate in 2007 and 2008. Symbol size is proportional to total catch at each survey station. Data from 2008 include the 2008 slope survey. Crosses indicate no catch of Alaska skate at that station.**

Source: AFSC.

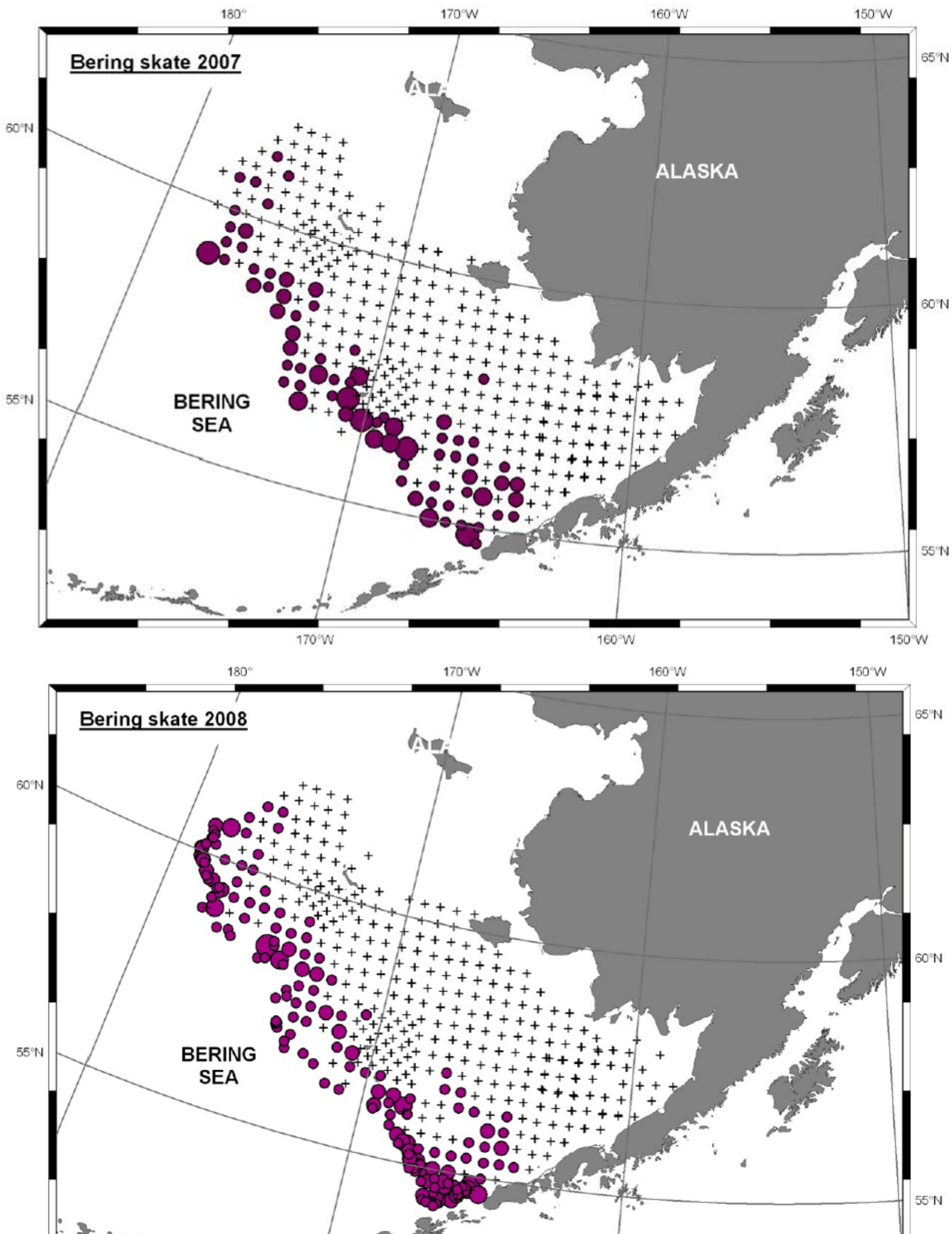

Figure 68. **AFSC bottom trawl survey catches of Bering skate in 2007 and 2008. Symbol size is proportional to total catch at each survey station. Data from 2008 include the 2008 slope survey. Crosses indicate no catch of Bering skate at that station.**

Source: AFSC.

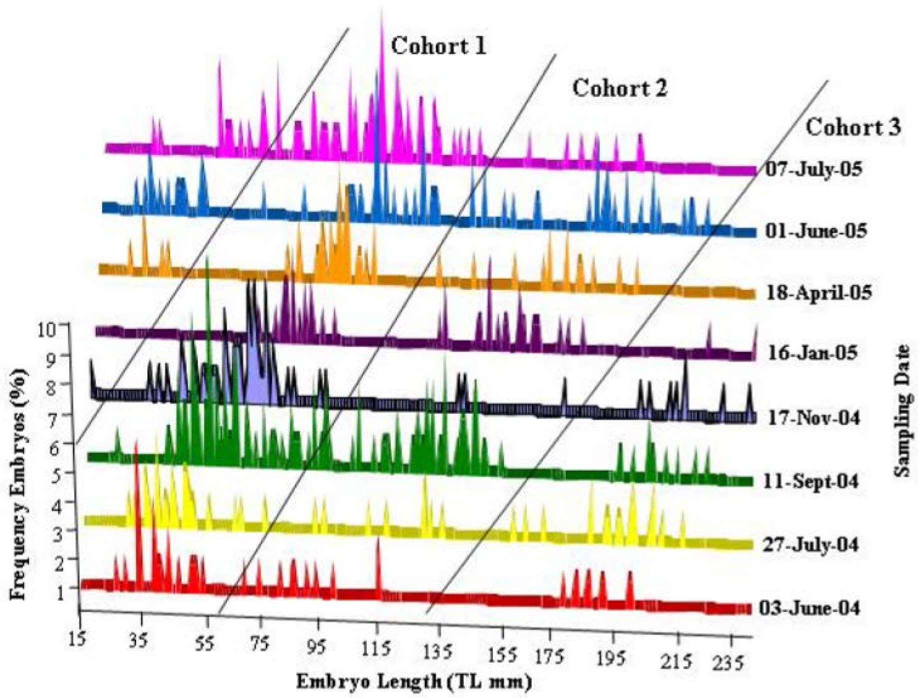

Figure 69. Embryo length composition data used in a cohort analysis of embryo development time.

Source: AFSC.

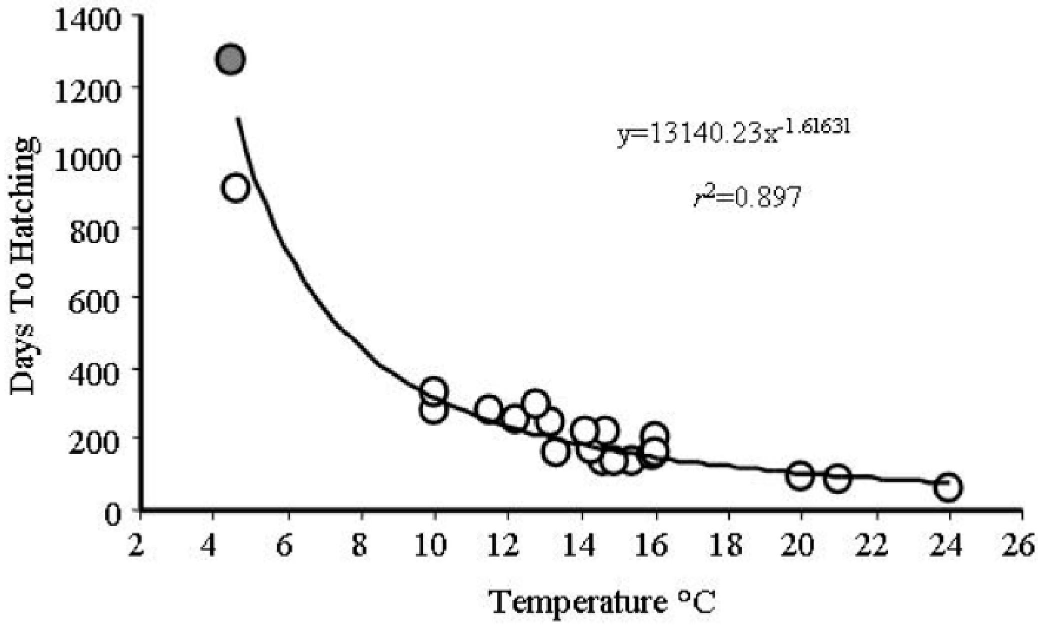

Figure 70. Ocean temperature versus embryo development time for 21 skate species. The shaded circle is the Alaska skate. Equation and r2 are the values of the fitted relationship.

Source: AFSC.

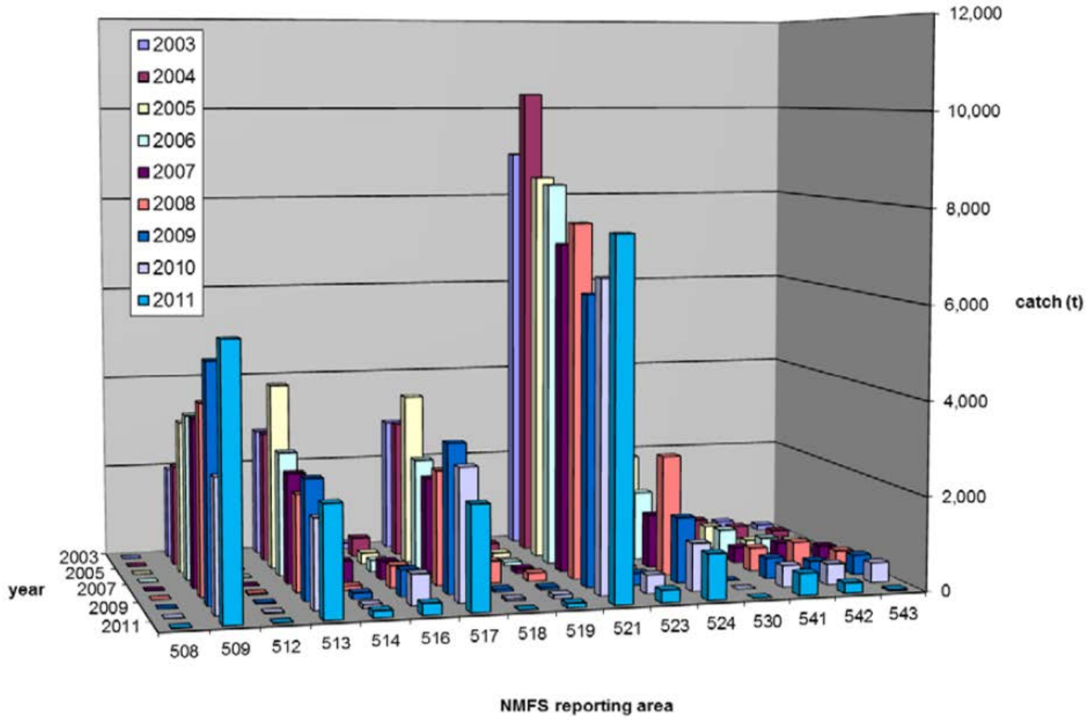

Figure 71. Total skate catch (all species combined) by FMP reporting area for both the eastern Bering Sea and the Aleutian Islands, from 2003 to 2011.

Source: AKRO CAS. 2011 data incomplete; reported as of November 3, 2011.

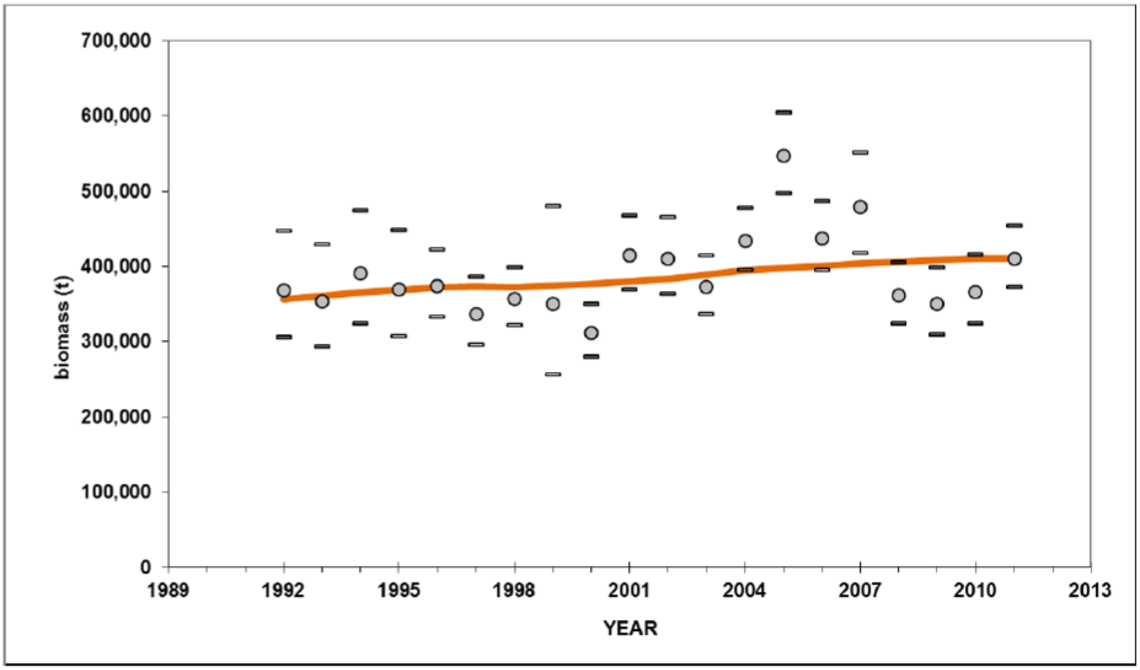

Figure 72. **Observed biomass (circles) from eastern Bering Sea shelf surveys from 1992 to 2011, with approximate confidence intervals (± 2 SE), and predicted survey biomass from the model (orange line).**

Source: AFSC.

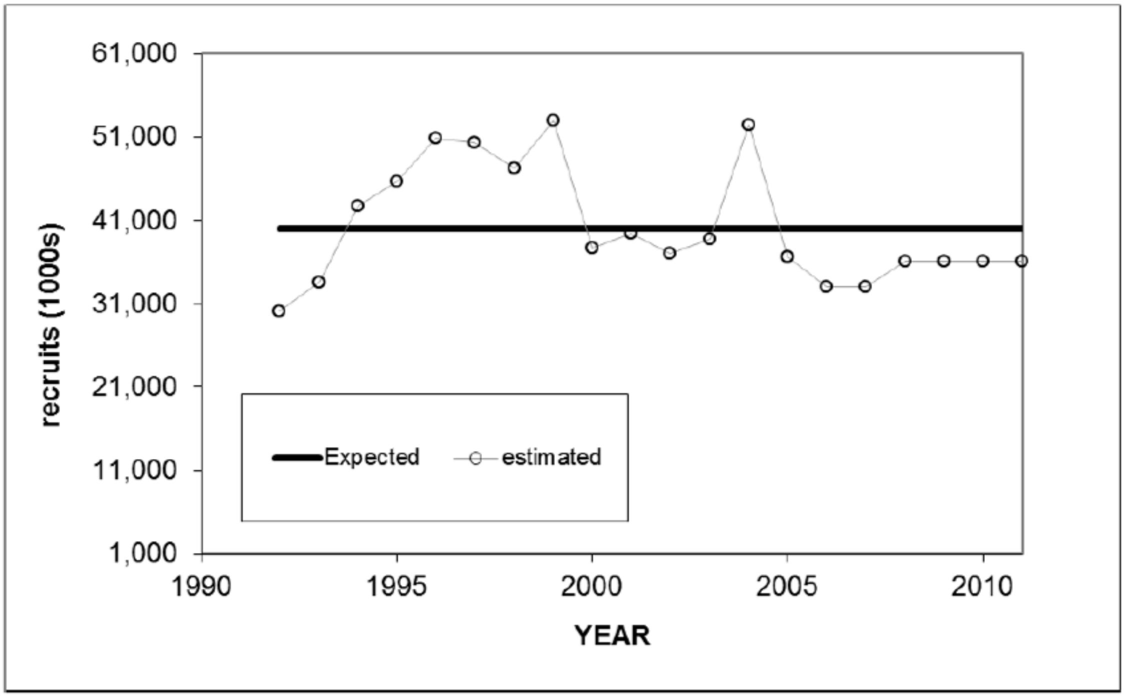

Figure 73. **Time series of expected recruitment (in thousands of age 0 fish), with the time series of individual year class estimates predicted by the model and the expected Beverton-Holt stock-recruit relationship with a steepness of 1.0.**

Source: AFSC.

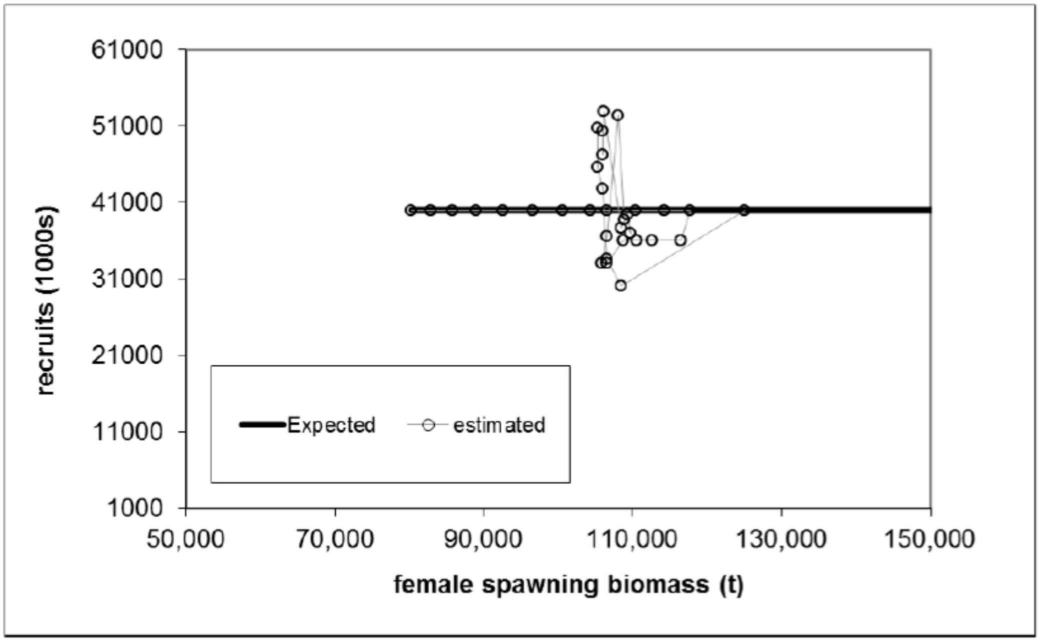

Figure 74. Relationship between female spawning biomass (t) and the number of age 0 recruits (in thousands of fish). Time series of individual year class estimates from SS2 is shown with a Beverton-Holt stock-recruit relationship with a steepness of 1.0.

Source: AFSC and NPFMC.

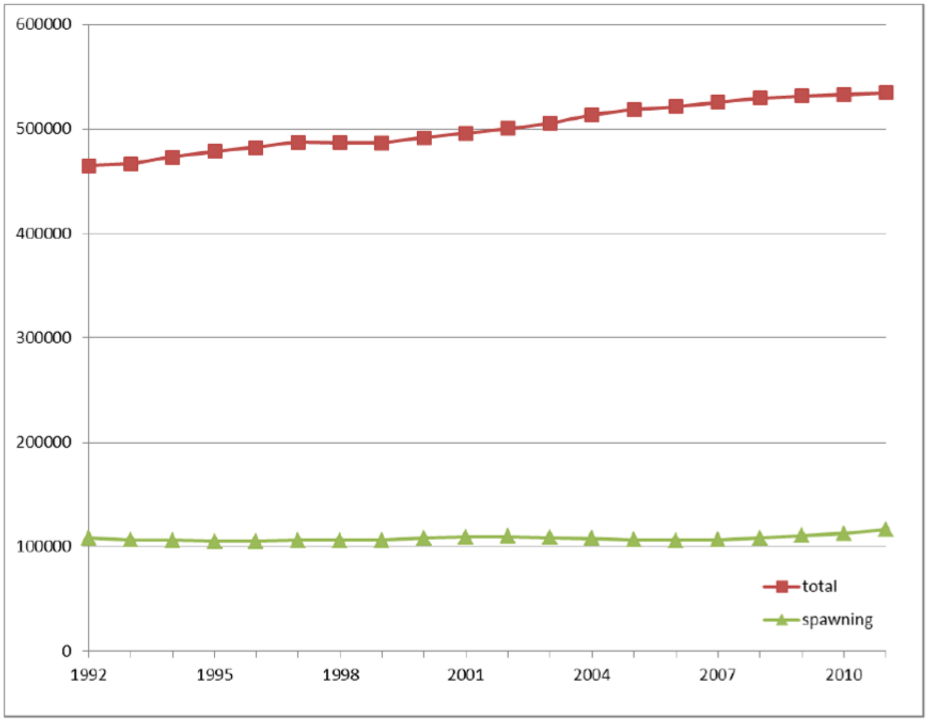

Figure 75. Time series of model estimates for total (age 0+) biomass (t) and female spawning biomass (t).

Source: AFSC.

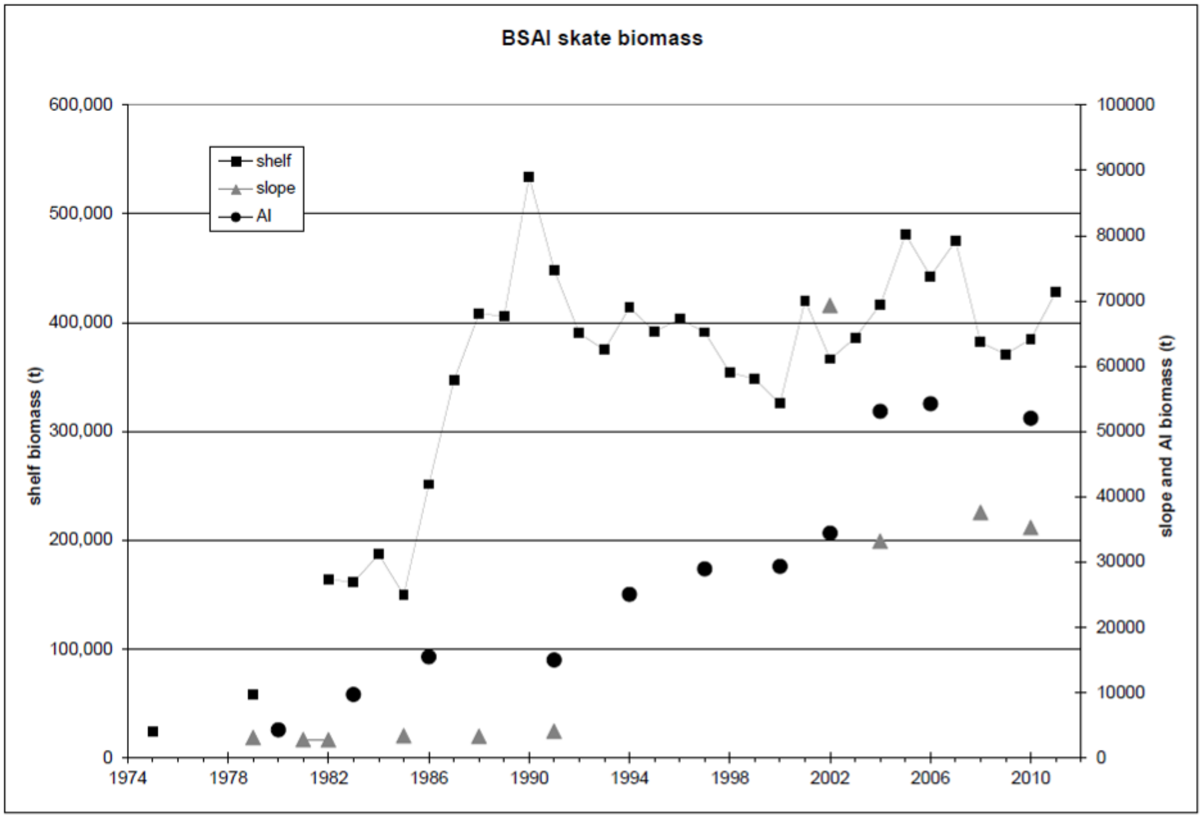

Figure 76. **Aggregated skate biomass (mt) estimated from RACE bottom trawl surveys in each of the three major habitat areas in the eastern Bering Sea, from 1975 to 2011. Note that slope and AI estimates are much smaller and pertain to the secondary y-axis.**

Source: AFSC.

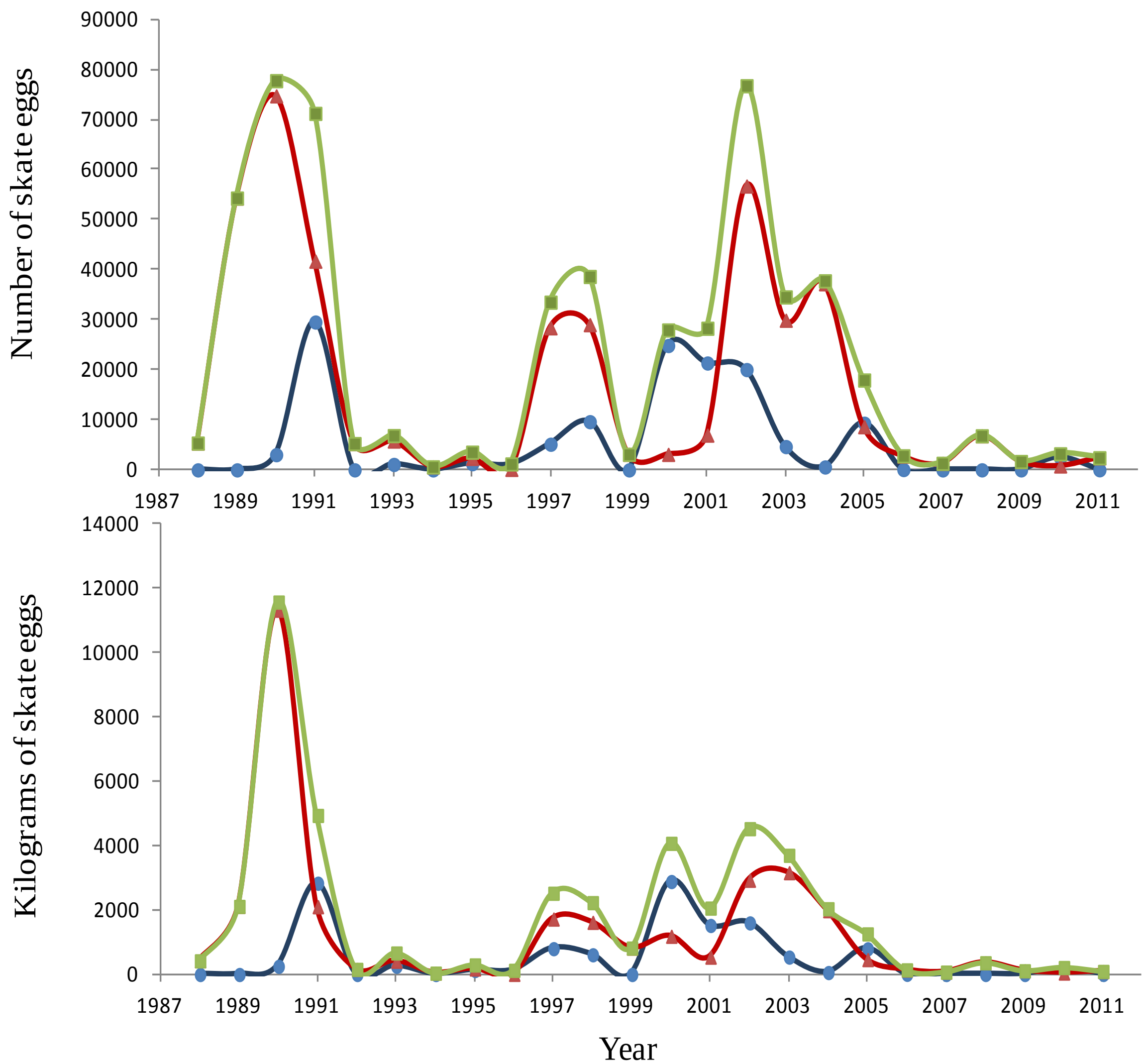

Figure 77. **Estimated skate egg numbers and weight taken by year from the Bering canyon skate nursery sites for observed hauls only. Longline (blue circles); bottom trawl (red triangles); longline and trawl combined (green squares).**

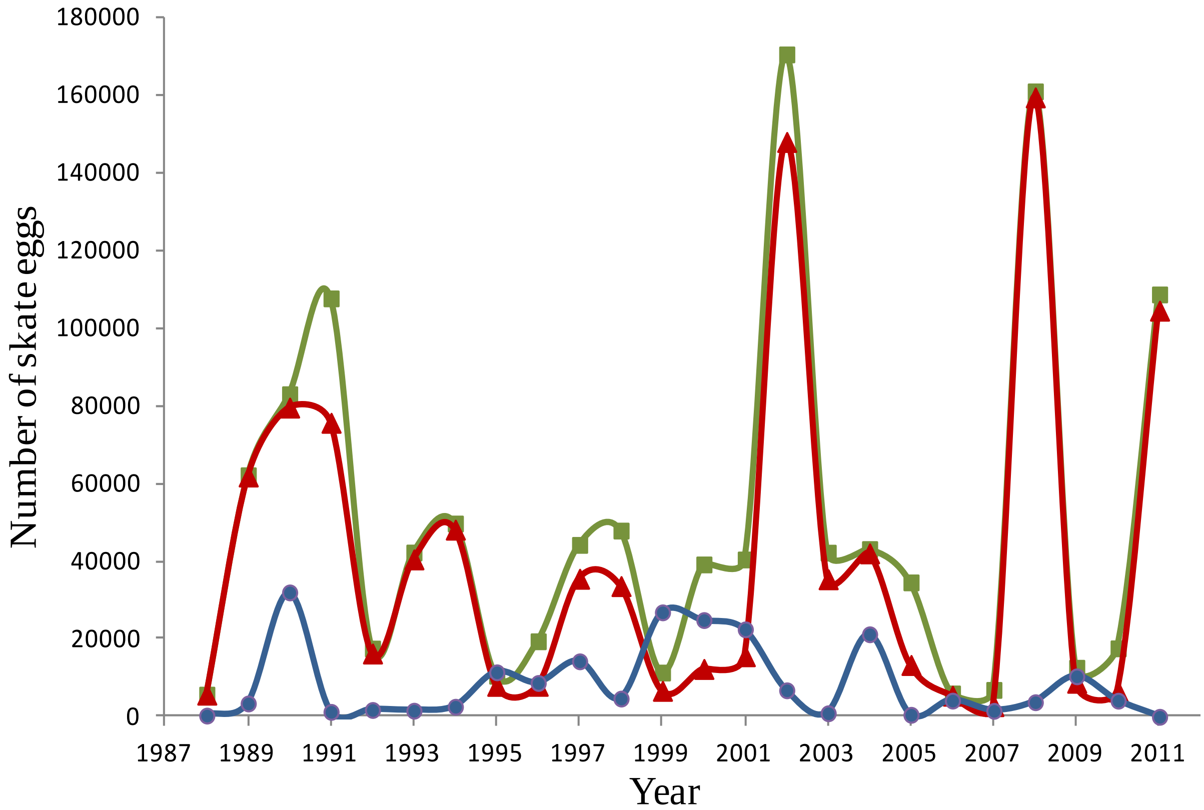

Figure 78. **Estimated skate egg numbers taken by year from the entire eastern Bering Sea for observed fisheries hauls only. Longline (blue circles); bottom trawl (red triangles); longline and trawl combined (green squares).**

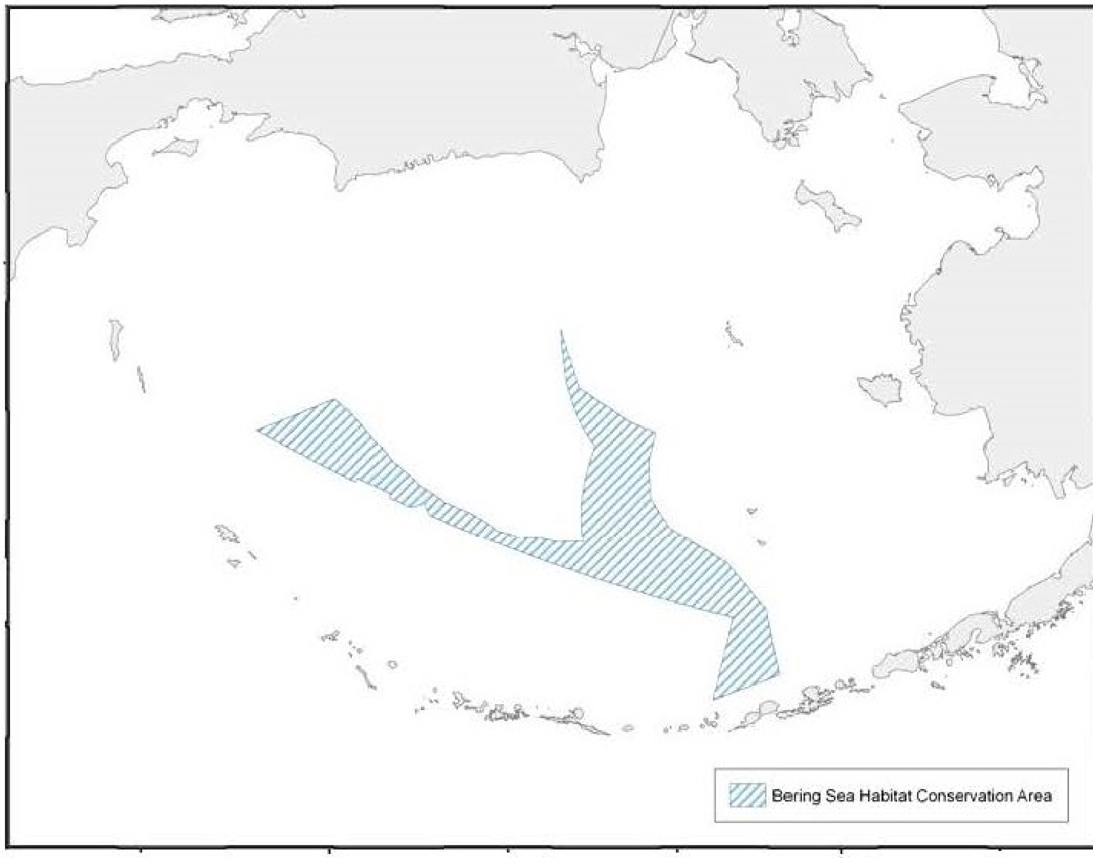

Figure 16 to Part 679--Bering Sea Habitat Conservation Area

(Table 42 To Part 679. Bering Sea Habitat Conservation Area)	
Longitude/Latitude	
179° 19.95'W	59° 25.15'N
177° 51.76'W	58° 28.85'N
175° 36.52'W	58° 11.78'N
174° 32.36'W	58° 08.37'N
174° 26.33'W	57° 31.31'N
174° 00.82'W	56° 52.83'N
173° 00.71'W	56° 24.05'N
170° 40.32'W	56° 01.97'N
168° 56.63'W	55° 19.30'N

168° 00.08'W	54° 05.95'N
170° 00.00'W	53° 18.24'N
170° 00.00'W	55° 00.00'N
178° 46.69'E	55° 00.00'N
178° 27.25'E	55° 10.50'N
178° 06.48'E	55° 00.00'N
177 ° 15.00'E	55° 00.00'N
177 ° 15.00'E	55° 05.00'N
176° 00.00'E	55° 05.00'N
176° 00.00'E	55° 00.00'N
172° 06.35'E	55° 00.00'N
173° 59.70'E	56° 16.96'N

Note: The area is delineated by connecting the coordinates in the order listed by straight lines. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.

Figure 79. Bering Sea Habitat Conservation Area

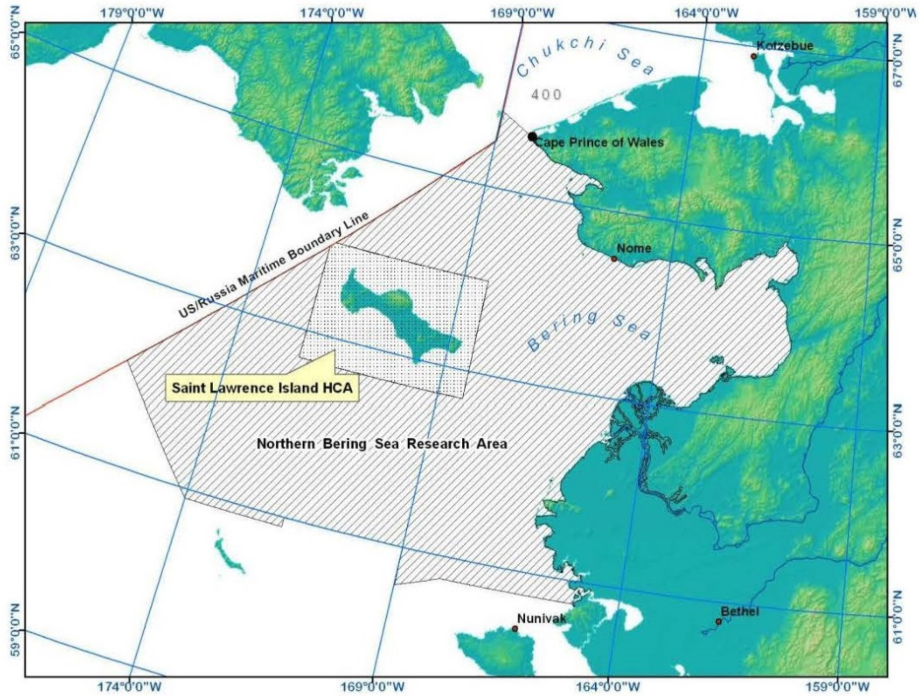

Figure 17 to Part 679 – Northern Bering Sea Research Area and Saint Lawrence Island Habitat Conservation Area (HCA)

Table 43 to Part 679 – **Northern Bering Sea Research Area**	
Longitude	Latitude
168°07.41 W	**65°37.91 N***
165°01.54 W	60°45.54 N
167°59.98 W	60°45.55 N
169°00.00 W	**60°35.50 N**
169°00.00 W	**61°00.00 N**
171°45.00 W	**61°00.00 N**
171°45.00 W	**60°54.00 N**
174°01.24 W	**60°54.00 N**
176°13.51 W	62°06.56 N
172°24.00 W	63°57.03 N
172°24.00 W	62°42.00 N
168°24.00 W	62°42.00 N
168°24.00 W	64°00.00 N
172°17.42 W	64°00.01 N
168°58.62 W	65°30.00 N
168°58.62 W	**65°49.81 N****

Table 45 To Part 679 -- **St. Lawrence Island Habitat Conservation Area**	
Longitude	Latitude
168° 24.00 W	64° 00.00 N
168° 24.00 W	62° 42.00 N
172° 24.00 W	62° 42.00 N
172° 24.00 W	63° 57.03 N
172° 17.42 W	64° 00.01 N

Table 43 Note: The area is delineated by connecting the coordinates in the order listed by straight lines except as noted by * below. The last set of coordinates for the area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.

* This boundary extends in a clockwise direction from this set of geographic coordinates along the shoreline at mean lower-low tide line to the next set of coordinates.

**** Intersection of the 1990 United States/Russia maritime boundary line and a line from Cape Prince of Wales to Cape Dezhneva (Russia) that defines the boundary between the Chukchi and Bering Seas, Area 400 and Area 514, respectively.**

Figure 80. Northern Bering Sea Research Area and Saint Lawrence Island Habitat Conservation Area (HCA)

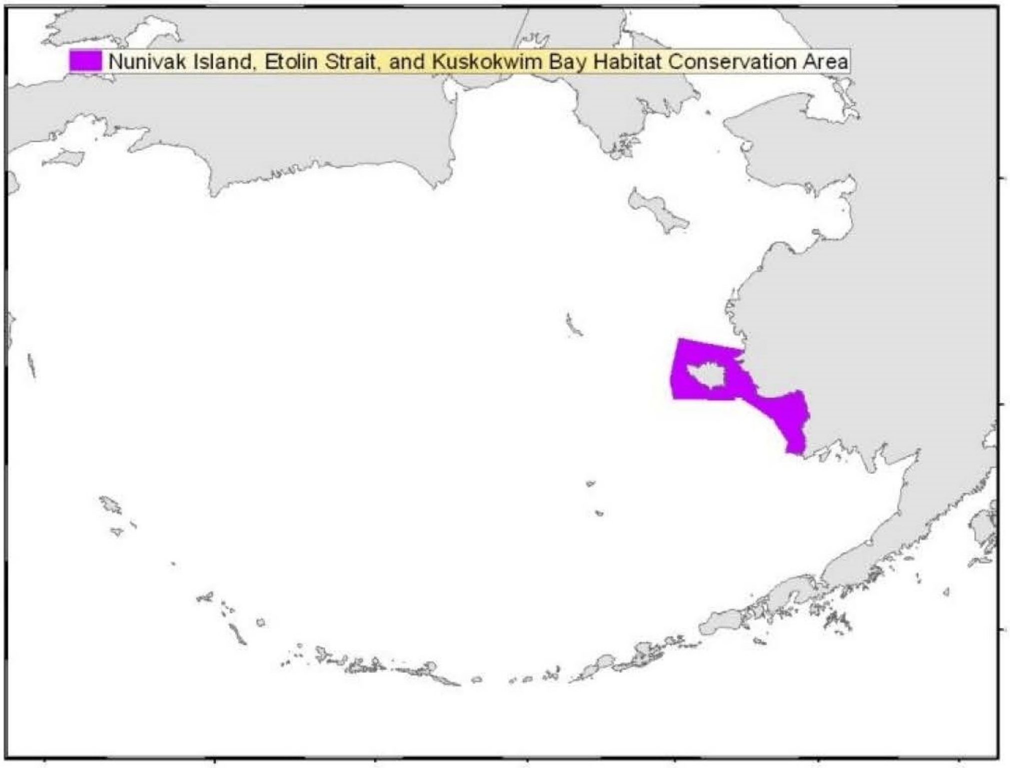

Figure 21 to Part 679--Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area

(Table 44 To Part 679—Nunivak Island, Etolin Strait, And Kuskokwim Bay Habitat Conservation Area)	
Longitude/Latitude	
165 1.54W	60 45.54N*
162 7.01W	58 38.27N
162 10.51W	58 38.35N
162 34.31W	58 38.36N
162 34.32W	58 39.16N
162 34.23W	58 40.48N
162 34.09W	58 41.79N
162 33.91W	58 43.08N
162 33.63W	58 44.41N
162 33.32W	58 45.62N
162 32.93W	58 46.80N
162 32.44W	58 48.11N
162 31.95W	58 49.22N
162 31.33W	58 50.43N
162 30.83W	58 51.42N
162 30.57W	58 51.97N
163 17.72W	59 20.16N
164 11.01W	59 34.15N
164 42.00W	59 41.80N
165 0.00W	59 42.60N
165 1.45W	59 37.39N
167 40.20W	59 24.47N
168 0.00W	59 49.13N
167 59.98W	60 45.55N

Note: The area is delineated by connecting the coordinates in the order listed by straight lines, except as noted by * below. The last set of coordinates for each area is connected to the first set of coordinates for the area by a straight line. The projected coordinate system is North American Datum 1983, Albers.

* This boundary extends in a clockwise direction from this set of geographic coordinates along the shoreline at mean lower-low tide line to the next set of coordinates.

Figure 81. Nunivak Island, Etolin Strait, and Kuskokwim Bay Habitat Conservation Area

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Finding of No Significant Impact for Habitat Areas of Particular Concern (HAPC)
Areas of Skate Egg Concentration
RIN 0648-XD287

National Marine Fisheries Service

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

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 adverse impacts on target species were identified for Alternative 2 (the preferred alternative). No changes in overall amount or timing of harvest of target species are expected with the proposed action, and the general location of harvest is also likely to be similar to the status quo. Therefore, no adverse impacts on the sustainability of any target species are expected. (Environmental Assessment [EA] Section 3.5.2)

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

No. Potential effects of Alternative 2 on non-target and prohibited species are expected to be insignificant and similar to status quo because no overall harvest changes to target species are expected. Because no overall changes in target species harvests are expected, Alternative 2 is not likely to jeopardize the sustainability of any non-target species. (EA Section 3.5.5)

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

No. No adverse impacts were identified for Alternative 2 on ocean or coastal habitats or EFH. Alternative 2 provides some degree of protection for vulnerable benthic skate egg habitat by identifying areas of skate egg concentration as Habitat Areas of Particular Concern (HAPC). The identification of these sites as HAPC highlights the importance of this EFH for conservation and consultation on activities such as drilling, dredging, laying cables, dumping, and fishing. Under Alternative 2, fishing activities in these areas would be more closely monitored through the Ecosystem Stock Assessment and Fishery Evaluation and the EFH five-year review, and these HAPC areas would be a research priority. (EA Section 3.5.1)

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. Alternative 2 would 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 (EA Section 6.2).

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

No. 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 Endangered Species Act (ESA) consultations for Steller sea lions and their critical habitat. Because there is not expected to be any change in overall harvests or changes in locations of harvest, none of the alternatives are likely to adversely affect ESA-listed species or their designated critical habitat. (EA Section 3.5.6)

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 Alternative 2. No significant effects are expected on biodiversity, the ecosystem, marine mammals, or seabirds. (EA Section 3.5.7)

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

No adverse social or economic impacts were identified for Alternative 2, and no social or economic impacts were identified that were interrelated with natural or physical environmental effects. (EA Section 3.6 and 4.3.)

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 eastern Bering Sea (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. (EA Sections 3.2 and 6.1)

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 specified harvest levels, and the alternatives provide protection to EFH and ecologically critical areas at the heads of undersea canyons. (EA Section 3.1)

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 high level of existing knowledge about 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). (EA Section 3.1 and 6.1)

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

No. 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 components analyzed and are therefore not significant. (EA Section 3.6)

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. Historical shipwrecks are identified in nautical charts and avoided by fishermen. (EA Sections 3.1 and 6.1)

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. (EA Sections 3.1 and 6.1)

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 HAPCs in the EBS and provide research and monitoring of these areas. 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, HAPC designation has been used as a management tool for the protection of marine resources in the Alaska groundfish fisheries. Pursuant to the National Environmental Policy Act, for all future actions, appropriate environmental analysis documents (EA or Environmental Impact Statement [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. (EA Section 3.1.3 and 6.1)

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. (EA Section 6.2)

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. (EA Section 3.6)

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting EA prepared for the identification of HAPC Areas of Skate Egg Concentration, it is hereby determined that the identification of HAPC Areas of Skate Egg Concentration will not significantly impact the quality of the human environment as described above and in the supporting EA. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of a supplementary EIS for this action is not necessary.

12-24-14

James W. Balsiger, Ph.D. for JB Date
Administrator, Alaska Region