Public Review Draft

ENVIRONMENTAL ASSESSMENT

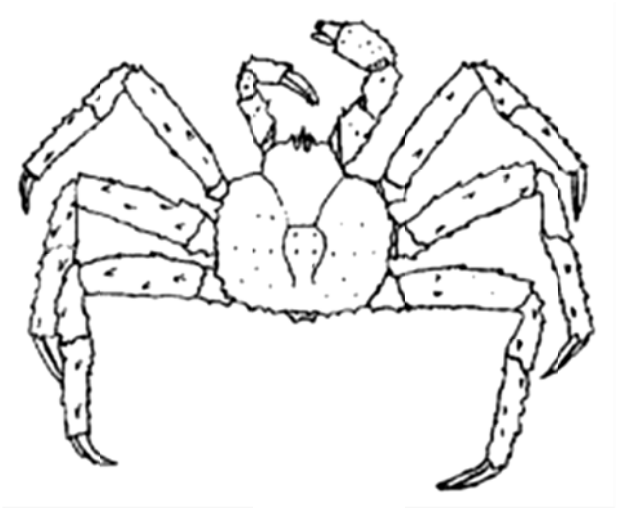
for proposed amendment to the

FISHERY MANAGEMENT PLAN FOR THE BERING SEA AND ALEUTIAN ISLANDS KING AND TANNER CRABS

and the

FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH OF THE BERING SEA AND ALEUTIAN ISLANDS

to revise the rebuilding plan for Pribilof Islands blue king crab.



Abstract

This draft environmental assessment evaluates five proposed alternative rebuilding measures for the Pribilof Islands blue king crab (*Paralithodes platypus*) stock. The Pribilof Islands blue king crab stock remains overfished and the current rebuilding plan has not achieved adequate progress towards rebuilding the stock by 2014. This revised rebuilding plan considers five alternatives. Four of the alternatives are different closure configurations to restrict groundfish fisheries in the areas of the stock distribution. The fifth alternative considers trigger caps and associated area closures in all groundfish fisheries. The impacts of these alternatives on rebuilding the Pribilof Island blue king crab stock as well as the environmental and social/economic impacts of these measures are considered in this analysis.

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Executive Summary

The king and Tanner crab fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) of the Bering Sea and Aleutian Islands (BSAI) off Alaska are managed under the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs (FMP). The FMP establishes a State/Federal cooperative management regime that defers crab fisheries management to the State of Alaska (State) with Federal oversight. State regulations are subject to the provisions of the FMP including its goals and objectives, the Magnuson-Stevens Act, and other applicable Federal laws.

This proposed action is a revised rebuilding plan for the Pribilof Islands blue king crab (PIBKC) stock. The PIBKC stock remains overfished. The purpose of this proposed action is to reduce the risk of overfishing the PIBKC stock by developing an amended rebuilding plan for this stock in compliance with the Magnuson-Stevens Act and the national standard guidelines.

Five alternatives are considered in this analysis. Four of the alternatives consider time and area closures to better protect the PIBKC stock. The fifth alternative considers trigger caps and associated time and area closures in groundfish fisheries which have contributed historically to bycatch of this stock. Alternatives 2-5 retain all of the current protection measures in place for the PIBKC stock and apply additional measures as described in the specific alternatives and options.

Alternative 1 retains the current Pribilof Islands Habitat Conservation Zone (PIHCZ) trawl closure around the Pribilof Islands. Alternative 2 applies the PIHCZ closure additionally to those groundfish fisheries contributing to PIBKC bycatch above a threshold criteria (Option 2a) or to fishing for Pacific cod (*Gadus macrocephalus*) with pot gear (Option 2b). Alternative 3 proposes to apply the existing State of Alaska (State) crab closure areas to those groundfish fisheries contributing to PIBKC bycatch above a threshold criteria(Option 3a) or to fishing for Pacific cod with pot gear (Option 3b). Alternative 4 proposes two closure configurations to cover the distribution of the PIBKC stock. These closures are then proposed to apply to either those groundfish fisheries contributing to PIBKC bycatch above a threshold criteria (Option 4a) or to fishing for Pacific cod with pot gear (Option 4b). Alternative 5 proposes a trigger cap on those groundfish fisheries contributing to PIBKC bycatch above a threshold criteria that, if reached, would close that area to fishing (Options 5a-5d). For each of Alternatives 2-5, there is the option of increasing observer coverage, either to all fisheries to which a cap or closure applies (Option 1), or to specific fisheries (Option 2).

Analysis of the impacts of these closure configurations on the rebuilding potential for the PIBKC stock shows limited effect on rebuilding between the ranges of alternative closures. Final action is scheduled for April 2011.

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1 Introduction

The king and Tanner crab fisheries in the Exclusive Economic Zone (EEZ) (3 to 200 miles offshore) of the Bering Sea and Aleutian Islands (BSAI) off Alaska are managed under the Fishery Management Plan for Bering Sea and Aleutian Islands King and Tanner Crabs (FMP). The groundfish fisheries of the Bering Sea and Aleutian Islands are managed under the Fishery Management Plan for groundfish fisheries of the Bering Sea and Aleutian Islands region. These FMP was developed by the North Pacific Fishery Management Council (NPFMC, or Council) under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

The Crab FMP establishes a State/Federal cooperative management regime that defers crab fisheries management to the State of Alaska (State) with Federal oversight. State regulations are subject to the provisions of the FMP, including its goals and objectives, the Magnuson-Stevens Act, and other applicable Federal laws. The FMP defers much of the management of the BSAI crab fisheries to the State using the following three categories of management measures:

1. Those that are fixed in the FMP and require a FMP amendment to change;
2. Those that are framework-type measures the State can change following criteria set out in the FMP; and
3. Those measures that are neither rigidly specified nor frameworked in the FMP and are at the discretion of the State.

This proposed action is a revised rebuilding plan for the Pribilof Islands blue king crab *Paralithodes platypus* (PIBKC) stock. Management actions proposed under this analysis would amend both the BSAI Crab and the BSAI groundfish FMPs. Management actions for the BSAI groundfish and BSAI crab fisheries must comply with applicable Federal laws and regulations. Although several laws and regulations guide this action, the principal laws and regulations that govern this action are the Magnuson-Stevens Act and the National Environmental Policy Act (NEPA). These alternatives require implementing regulations and, therefore, the Regulatory Flexibility Act applies and review under Executive Order 12866 is required. A RIR/IRFA is included in this analysis.

1.1 Purpose and Need

The PIBKC stock remains overfished. On September 23, 2002, the Secretary of Commerce notified the Council that the PIBKC stock biomass was below the MSST and was overfished. A rebuilding plan was implemented in 2003 including provisions prohibiting directed fishing until the stock was rebuilt. The PIBKC fishery has been closed since 1999 and bycatch in 2009/10 was below the overfishing level. The Council was notified on September 29, 2009 that the current rebuilding plan has not achieved adequate progress to rebuild the stock by 2014. A revised rebuilding plan must be developed for the PIBKC stock and implemented within two years of notification. This plan must be implemented prior to the start of the 2011/12 crab fishing year. To comply with section 304(e)(7) of the Magnuson-Stevens Act, the Council is preparing an amended PIBKC rebuilding plan. The primary rebuilding alternatives address bycatch in groundfish fisheries. Annual Catch Limit (ACL) provisions for the PIBKC stock were considered in a separate analysis.

The purpose of this proposed action is to reduce the risk of overfishing and to rebuild the PIBKC stock by developing an amended rebuilding plan for this stock in compliance with the Magnuson-Stevens Act and the National Standard Guidelines.

The Council's problem statement for this analysis is the following:

> *The Pribilof Islands blue king crab stock remains overfished and the current rebuilding plan has not achieved adequate progress to rebuild the stock by 2014.* In order *to comply with provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) an amended rebuilding plan must be implemented prior to the start of the 2011/2012 fishing season.*
>
> *The directed blue king crab fishery has been closed since 1999 and action has been taken to limit bycatch mortality in other crab fisheries occurring near the Pribilof Islands; however no similar action has been taken for groundfish fisheries. Recent trends in crab bycatch suggest that groundfish fisheries occurring near the Pribilof Islands have the potential to exceed the annual overfishing level and acceptable biological catch for this stock.*
>
> *This action is necessary to facilitate compliance with requirements of the MSA to end and prevent overfishing, rebuild overfished stocks and achieve optimum yield.*

In crafting this problem statement the Council further noted that this problem statement reflects not only the Council's obligation under MSA to rebuild this stock, but also the Council's desire to prevent overfishing on an annual basis and ensure that all fisheries contributing to PIBKC bycatch mortality share in the rebuilding effort.

1.2 Magnuson-Stevens Act and National Standard guidelines

The Magnuson-Stevens Act sets forth ten national standards for fishery conservation and management. National Standard 1 states, "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry." The specification of OY and the conservation and management measures to achieve it must prevent overfishing. The National Marine Fisheries Service (NMFS) published National Standard Guidelines (50 CFR sections 600.310-600.355) to provide comprehensive guidance for the development of FMPs and FMP amendments that comply with the Magnuson-Stevens Act National Standards. The Guidelines provide guidance for status determination criteria and rebuilding overfished stocks, including specifying the time period for rebuilding.

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA, Public Law 109-479) includes provisions intended to prevent overfishing by requiring that FMPs establish a mechanism for specifying ACLs in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability. ACLs and accountability measures (AMs) are required by fishing year 2010 if overfishing is occurring in a fishery, and they are required for all other fisheries by fishing year 2011. Since overfishing is not occurring for any crab stock, all crab fisheries must have ACL and AM mechanisms by the 2011/2012 crab fishing year. The MSRA includes a requirement for the SSC to recommend Annual Biological Catch (ABC) levels to the Council, and provides that ACLs may not exceed the fishing levels recommended by the SSC. These actions were considered under a separate analysis (see NPFMC 2010 Amendment 38 EA). The MSRA also amended section 304(e)(3) of the Magnuson-Stevens Act, which now requires the Council and Secretary to develop and implement a rebuilding plan within two years of receiving notification from the Secretary that a stock is overfished, approaching an overfished condition, or has not made adequate progress towards rebuilding.

1.3 Scope of Analysis

This Environmental Assessment (EA) relies heavily on the information and analysis contained in the Bering Sea Aleutian Islands Crab Fisheries Final Environmental Impact Statement/Regulatory Impact Review/Initial Regulatory Flexibility Analysis/Social Impact Assessment (NMFS 2004a), which is available on the NMFS Alaska Region web site at:
http://www.fakr.noaa.gov/sustainablefisheries/crab/eis/default.htm.

Throughout this analysis, that document is referred to as the Crab Environmental Impact Statement, or "Crab EIS." Additional information concerning the crab fisheries and management under the Crab Rationalization Program (Program), and impacts of these on the human environment are contained in that document.

The Crab EIS provides the status of the environment and analyzes the impacts of the crab fisheries on the human environment. This EA tiers off of the Crab EIS to focus the analysis on the issues ripe for decision and eliminate repetitive discussions. The proposed action would establish ACLs for the crab stocks under the FMP and rebuilding plans for the Eastern Bering Sea (EBS) snow crab and Tanner crab stocks. This EA details the specific impacts of the proposed action.

Chapter 3 of the Crab EIS contains a complete description of the human environment, including the physical environment, habitat, crab life history, marine mammals, seabirds, crab fisheries, a management history, the harvesting sector, the processing sector, and community and social conditions. These descriptions are incorporated by reference.

In addition to the factors discussed in the Crab EIS, this action specifically concerns the annual establishment of ACLs using the Tier system based status determination criteria for the crab stocks under the FMP. Relevant and recent information on each crab stock is contained in the chapter for that species.

The Council on Environmental Quality (CEQ) regulations encourage agencies preparing NEPA documents to, "tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review." Specifically, 40 CFR 1502.20 states the following:

> Whenever a broad environmental impact statement has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action. (40 CFR 1502.20)

This EA also relies heavily on the information and analysis contained in the Council's annual BSAI Crab Stock Assessment and Fishery Evaluation (SAFE) Reports, available from the Council web site at:
http://www.fakr.noaa.gov/npfmc/SAFE/SAFE.htm, or
http://fakr.noaa.gov/npfmc/membership/plan_teams/CPT/CRABSAFE2010_910.pdf

The SAFE Reports contain the status of the crab stocks and the annual stocks assessments for all ten crab stocks.

2 Description of Alternatives

There are five alternatives considered in this analysis. All of the alternatives consider time and area closures to better protect the PIBKC stock, either through year-round closures or trigger caps applied to these closures, while other alternatives consider a prohibited species cap on bycatch in groundfish fisheries. Alternatives 2-5 retain all of the current protection measures in place for the PIBKC stock and apply additional measures as described in the specific alternatives and options. Section 2.7 contains a comparison of the different alternatives. Section 2.10 includes a description of alternatives considered but not carried forward for analysis.

2.1 Alternative 1: Status Quo

Alternative 1 retains the current protections for PIBKC stock. These include a directed fishery closure until the stock is completely rebuilt, and the closure to all trawl gear of the Pribilof Islands Habitat Conservation Zone (PIHCZ) as shown in Figure 10-1.

Amendment 21a to the BSAI groundfish FMP established the PIHCZ, effective January 20, 1995. This closure prohibits the use of trawl gear in a specified area around the Pribilof Islands year-round (Figure 10-1). The intent of this closure was to protect the unique habitat and ecosystem surrounding the Pribilof Islands so the islands could contribute long term benefits to the fisheries surrounding the waters of the Pribilof Islands area (NPFMC, 1994). The Pribilof Islands area provides habitat for commercially important groundfish species, blue king crab, red king crab (*Paralithodes camtschaticus*), Tanner crab (*Chionoecetes bairdi*), snow crab (*Chionoecetes opilio*), juvenile groundfish, Korean hair crab (*Erimacrus isenbeckii*), marine mammals, seabirds, and their prey species.

This area was established based upon the distribution and habitat of the blue king crab in the NMFS annual trawl surveys and on observer data. Blue king crabs do not exist uniformly across the Bering Sea and are instead found in isolated populations. The Pribilof Islands Habitat Conservation Area was intended to protect a majority of the crab habitat in the Pribilof Islands area (NPFMC, 1994). The closure was implemented in January 1995.

2.2 Alternative 2: Modify the current Pribilof Islands Habitat Conservation Zone to apply to select groundfish fisheries and only Pacific cod pot cod fishing.

Under Alternative 2, the existing PIHCZ, as described in Alternative 1 (Figure 10-1), would be modified to apply to additional fisheries (i.e., rather than just to the trawl fisheries as under the status quo).

There are two options under Alternative 2, for year-round closures:

Option 2a: Closure applies to all groundfish fisheries which have contributed greater than a designated threshold to bycatch of PIBKC since 2003. These fisheries and the threshold criteria are described in section 3.2 and Table 11-1.

Option 2b: Closure applies to all fishing for Pacific cod with pot gear. In addition to the existing trawl closure, all Pacific cod pot fishing would also be prohibited in this zone year-round.

2.3 Alternative 3: ADF&G crab closure areas applied select groundfish fishing and just Pacific cod pot fishery.

Under Alternative 3, the existing ADF&G crab closure areas between 168° and170° West longitude, and between 57° and 58° North latitude would be closed to additional fishing effort as described in the options below. The existing closure configuration is indicated in Figure 10-2.

These closures would be enacted year-round for the fisheries listed below.

There are two closure options under Alternative 3:

Option 3a: Closure applies to all groundfish fisheries which have contributed greater than a designated threshold to bycatch of PIBKC since 2003. These fisheries and the threshold criteria are described in section 3.2 and Table 11-1.

Option 3b: Closure area applied only to pot fishing for Pacific cod. Under this option no federal Pacific cod fishing with pot gear would be allowed within the confines of the closures shown in Figure 10-2.

2.4 Alternative 4: Closure that covers the entire distribution of the Pribilof Islands blue king crab stock.

This alternative proposes a new closure configuration as shown in Figure 10-3 (a and b), which covers the entire distribution of the PIBKC stock. The distribution of the entire PIBKC stock is defined in two ways depending upon the data used to establish the entire distribution of the stock. Under the first option (Option 1), the closure area consists of the full distribution of the Pribilof Islands stock aggregated from 1975 to 2009 based on the NMFS EBS bottom trawl survey (Figure 10-3a). The smaller closure area (Option 2) consists of the full distribution of the Pribilof Islands stock aggregated from 1984 to 2009. In 1984, there was a constriction of the PIBKC distribution towards the Pribilof Islands that has persisted until 2009 (Figure 10-3b). It is unknown if this constriction is due to declining population abundances, fishery activities, oceanography, or shifts in production. It is plausible, however, that a rebounding PIBKC stock may only be able to inhabit the smaller area.

There are two closure options under Alternative 4:

Option 4a: Closure applies to all groundfish fisheries which have contributed greater than a designated threshold to bycatch of PIBKC since 2003. These fisheries and the threshold criteria are described in section 3.2 and Table 11-1. Under this option no federal groundfish fishing for those fisheries would be allowed within the confines of the closure shown in Figure 10-3 (a or b).

Option 4b: Closure area applied only to pot fishing for Pacific cod. Under this option no federal Pacific cod fishing with pot gear would be allowed within the confines of the closure shown in Figure 10-3 (a or b).

Under either option the closure would apply year-round.

2.5 Alternative 5: Trigger closures with cap levels established for PIBKC in all groundfish fisheries.

Under Alternative 5, a trigger cap would be established equal to either the OFL, the ABC, or a proportion of the ABC for the crab stock. All bycatch of PIBKC in all groundfish fisheries would accrue towards this trigger cap and those groundfish fisheries which are not exempted would be subject to the closure (Closure applies to all groundfish fisheries which have contributed greater than a designated threshold to bycatch of PIBKC since 2003. These fisheries and the threshold criteria are described in section 3.2 and Table 11-1. There is currently no feedback between catch of PIBKC accrual towards the OFL under the BSAI Crab FMP and any catch restrictions in the groundfish fisheries. This alternative would provide explicit feedback by closing groundfish fisheries when the PSC cap for PIBKC is reached.

Four options are considered for the cap levels (labelled under each closure option as sub-option 1 through 4 considered for each closure).

2.5.1 Sub-option 1: PSC Cap = OFL

Here the aggregate PSC cap would be established at the level of the annual OFL for the PIBKC stock based on the most recent stock assessment. The OFL for PIBKC stock is 0.004 million pounds in the 2010/11 fishing year. The OFL is a total-catch OFL and is computed as the sum of catches by three different sources of removals: (1) the retained legal males in directed (pot) fishery for PIBKC; (2) discards of males and females in the directed fishery;, and (3) bycatch in the groundfish pot and trawl fisheries. The directed fishery for PIBKC has been closed since 1998. Since the implementation of a total catch OFL in 2008, bycatch in crab and groundfish fisheries have been the only catch that has accrued towards the OFL. The OFL was not reached in the 2009/10 fishing year.

Currently the OFL for 2010/11 is established at 0.004 million lbs (0.0018 kt) corresponding to the five year average of bycatch in groundfish and crab fisheries from 1999/2000-2005/2006[1]. While the PIBKC stock is in Tier 4 of the Crab OFL Tier system, it is at stock status 'c' therefore the directed fishery $F_{directed}$ = 0 as $B/B_{MSYprox}$ is < beta and $F_{OFL}<F_{MSY}$ is determined by the PIBKC rebuilding plan. The OFL calculation employs a 'Tier 5" methodology of average catch in crab and groundfish fisheries to determine a bycatch-F_{OFL}. For purposes of this sub-option the cap is considered to be the bycatch component of the OFL. Currently the entire OFL is the bycatch component due to the low stock status in relation to the sloping control rule. Should the biomass of the stock increase above the beta threshold, the OFL would be determined using the true Tier 4 control rule. The stock assessment will include information on the proportion of the total catch OFL anticipated to come from bycatch. This would constitute the bycatch-OFL cap for purposes of determining the annual PSC cap. The current rebuilding plan includes a provision that the directed fishery is closed until the stock is rebuilt (second consecutive year above B_{MSY}). Once the stock is rebuilt the directed fishery could be re-opened. The PSC cap would continue to be annually estimated as the bycatch-component of the OFL. Should the crab fisheries begin to contribute to the bycatch of the stock, an estimate of the groundfish-only component of the OFL would need to be made to appropriately specific the cap level.

2.5.2 Sub-option 2: PSC Cap = ABC

Here the PSC cap would be established at the level of the ABC to be recommended annually by the SSC to the Council. The Council took final action on an ACL analysis (Amendment 38 to the Crab FMP) in

[1] This 4,000 lb OFL was based upon data available in 2008. Since that time the data have been revised slightly and would result in a lower OFL if averaged over the same time period. The OFL has remained at the 4,000 lb level in order to allow for estimated incidental catch needs in groundfish fisheries.

October 2010. The Council's preferred alternative establishes an ABC control rule to be employed annually to determine the maximum permissible ABC, understanding that the SSC may recommend a lower value on an annual basis. The Council's ABC control rule would be established using a P* approach with the recommended P* value = 0.49. Currently for PIBKC as a Tier 4 stock, using P* = 0.49 and employing only model-based (sigma-w) uncertainty this results in an ABC = 99.32% of OFL. This would result in an ABC = 3,973 lbs, or 27 lbs lower than the OFL. Given that the OFL for this stock is not truly assessed using a Tier 4 formula based upon stock status, it seems reasonable to establish an ABC using the Tier 5 ABC formula in the Council's preferred alternative which is that ABC = 90% of OFL. This results in an ABC = 3,600 lbs (or 400 lbs less than the OFL). For analytical purposes this is the cap considered under these alternatives.

2.5.3 Sub-option 3: PSC Cap = 90% of ABC

This sub-option sets the cap equivalent to 90% of the ABC. Given the ABC as specified under sub-option 2 this equates to a cap of 3,240 lbs.

2.5.4 Sub-option 4: PSC Cap = 75% of ABC

This sub-option sets the cap equivalent to 75% of the ABC. Given the ABC as specified under sub-option 2 this equates to a cap of 2,700 lbs.

The following table compares the different cap sub-options in weight (lbs) as well as in numbers of crab (Table 2-1). Here the conversion from pounds to numbers of crab uses the mean observed weight (lbs) for crabs from 7/1/09-6/30/10. This is consistent with annual calculations of bycatch by weight against the OFL by the NMFS RO.

Table 2-1 Comparison of cap sub-options in lbs and numbers of crab. Here the mean observed weight of PIBKC bycatch from 7/9/10 – 6/20/10 was used to calculate the number of crab. The mean weight employed was 2.671 lbs.

Cap sub-option	Cap description	Cap (lbs)	Cap (numbers of crab)
1	OFL	4,000	1,497
2	ABC	3,600	1,348
3	90% ABC	3,240	1,213
4	75% OFL	2,700	1,011

There are 4 closure options under Alternative 5:

Option 5a: The existing PIHCZ, as described in Alternative 1 (Figure 10-1), would be modified to apply to additional fisheries (i.e., rather than just to the trawl fisheries as under the status quo). The fisheries to which this closure would apply are listed in Table 11-1. The closure would be triggered by attainment of a fishery-wise cap set at the options below. Cap options are the following:

Sub-option 1: Cap level = OFL
Sub-option 2: Cap level = ABC
Sub-option 3: Cap level = 90% ABC
Sub-option 4: Cap level = 75% ABC

Option 5b: The existing ADF&G crab closure areas between 168° and170° West longitude, and between 57° and 58° North latitude would be closed to additional fishing effort as indicated in Figure 10-2. The fisheries to which this closure would apply are listed in Table 11-1. The closure would be triggered by attainment of a fishery-wise cap set at the options below. Cap options are the following:

Sub-option 1: Cap level = OFL
Sub-option 2: Cap level = ABC
Sub-option 3: Cap level = 90% ABC
Sub-option 4: Cap level = 75% ABC

Option 5c: The closure area consists of the full distribution of the Pribilof Islands stock aggregated from 1975 to 2009 based on the NMFS EBS bottom trawl survey Figure 10-3A). The fisheries to which this closure would apply are listed in Table 11-1. The closure would be triggered by attainment of a fishery-wise cap set at the options below. Cap options are the following:

Sub-option 1: Cap level = OFL
Sub-option 2: Cap level = ABC
Sub-option 3: Cap level = 90% ABC
Sub-option 4: Cap level = 75% ABC

Option 5d: The smaller closure area (Option 2) consists of the full distribution of the Pribilof Islands stock aggregated from 1984 to 2009. In 1984, there was a constriction of the PIBKC distribution towards the Pribilof Islands that has persisted until 2009 (Figure 10-3B). The closure would be triggered by attainment of a fishery-wise cap set at the options below. Cap options are the following:

Sub-option 1: Cap level = OFL
Sub-option 2: Cap level = ABC
Sub-option 3: Cap level = 90% ABC
Sub-option 4: Cap level = 75% ABC

2.6 Option for Increased Observer Coverage

For each of the Alternatives, and the sub-option of each Alternative that is ultimately selected, apply an option to increase observer coverage requirements. This increase could be applied to all fisheries (Option 1, below) or for a specific fishery (Option 2, below) depending upon the selection of the individual application of an alternative under Alternatives 2-5.

Option1: Apply increased observer coverage to fisheries which contributed to PIBKC bycatch above a threshold criteria since 2003 for which a cap (PSC or trigger) or closure applies;
Option 2: Apply increased observer coverage to specific fisheries.

Sub-option (applies to both options 1 and 2): This would sunset under implementation of the restructured observer program.

Under these options, increased observer coverage would be added to fisheries which contributed to PIBKC bycatch above a threshold criteria since 2003 (as listed in Table 11-1) or to only specific fisheries[2]. Selection of the sub-option would indicate that any mandatory increased observer coverage on

[2] Additional specificity would be required as to which specific fisheries this increased observer coverage would apply.

a fishery would sunset upon implementation of the observer restructuring program. The Council took final action on this analysis in October 2010. The main elements of the Council's preferred alternative as it relates to this are the ability to annually modify coverage in fleets based on fishery management monitoring needs and Council and NMFS priorities. The new program is anticipated to be implemented in 2013.

The Council's motion is available at: http://fakr.noaa.gov/npfmc/current_issues/observer/ObserverMotion1010.pdf. Additional information is available in the public review draft of the analysis for this action: http://fakr.noaa.gov/npfmc/current_issues/observer/Observer_restructuring910.pdf

2.7 Comparison of Alternatives

Alternatives 1-5 all address different closure configurations applied to either the trawl-only fisheries (Alternative 1) or to include additional fisheries such as all groundfish fishing or additionally fishing for Pacific cod with pot gear. A comparison of the relative extent of the closures across these alternatives is shown in Figure 10-5.

2.8 Management and monitoring considerations of alternatives

Under Alternatives 1-4, a designated area would be closed year-round to specific fisheries. This is currently how status quo is specified, with the PIHCZ closed to all trawl gear. Under Alternative 2 this same area would be closed year round to Pacific cod fixed gear fisheries (as the other fisheries listed in Table 11-1 are already excluded as trawl fisheries). Under Alternatives 3 and 4, new year-round closures would be specified for specific fisheries as listed in Table 11-1 (or for Pacific cod pot gear under options 3b and 4b). Here management of these areas as closures would be similar to Status quo management of the PIHCZ, however the closure is specified based upon fisheries and not upon gear type. All trawl gear would remain prohibited within the PIHCZ under all alternatives, however additional overlapping fishery restrictions would apply to the areas specified under these alternatives. Under Alternative 4, these areas are larger than the PIHCZ, thus the entire PIHCZ would contain an additional fishery restriction and the remaining closure outside of it would have a fishery (but not gear-specific) restriction associated with it. For Alternative 3, some of the area overlaps the PIHCZ while the remainder is outside of it. This would entail additional consideration of fishery-specific (i.e., pot gear) restrictions over a portion of the PIHCZ but not the entire area and a different fishery (and gear) restriction for the remaining area outside of the PIHCZ. This would impose an additional burden on NMFS in enforcing the closure.

For Alternative 5 these same area considerations on overlapping fishery and gear restrictions exist, as well as a trigger limit to be monitored and closure notices then issued. Again the PIHCZ closure to all trawl gear would remain year-round under this alternative and any closure would be in addition to this. Here NMFS would issue fishery closures once the overall groundfish fishery limit (as specified under the sub-options 1-4) was reached and the closure would then apply to the selected fisheries. Vessel operators would be prohibited from directed fishing in the area once NMFS closed the area to a fishery.

Enforcement of the area closures would be similar to the process currently used to monitor and issue existing triggered area closures (i.e. the chum salmon savings area closure). NMFS would have to determine whether a vessel was directed fishing for either Pacific cod by gear type or the flatfish fisheries specified under the options when a closure was issued. This would require NMFS to use several different data sources including VMS, catch and effort information from a vessel's catch reports, and observer information.

NMFS currently uses a combination of VMS, industry reported catch information, and observer data to monitor vessel activities in special management areas, such as habitat conservation areas and species-specific savings areas (e.g., salmon savings area). These data sources are used by NMFS on a daily basis to monitor fishery limits. Information from VMS is useful for determining vessel location in relation to closure areas, but it may not conclusively indicate whether a vessel is fishing, transiting through a closed area, or targeting a particular species.

2.9 Additional closure configuration considerations.

In December 2010, the Council moved to consider whether an additional closure configuration to Alternatives 4C and 5e would be more appropriate based upon a combined analysis of both recent bycatch as well as survey distribution. Previous closure alternatives 4C and 5e were based solely on the historical time series of survey biomass. The distribution of survey data was compared to observed bycatch locations of blue king crab in the Pribilof Islands management district in 5 year intervals from 1976 to 2010 Figure 10-6. In broadening this analysis it was also discovered that a substantial bycatch of blue king crab has been observed in the Bristol Bay district to the east of the Pribilof Islands. It was noted that these catches are never observed in the trawl survey and may represent movement by the crab between the survey and the fishery or catches of small crab not encountered in the survey trawl. In the earliest years the bycatch is sparse over the entire distribution while the survey data catches up to 26,000 crab per nm^2 suggests a distribution close to the Pribilof Islands (Figure 10-6A). Mother ship landings and trawl catch accounted for the majority of the bycatch ranging from 1 to 800 crabs per haul (Figure 10-7A). From 1981 to 1990 the concentration of very dense observed catches is located to the north and east of the Pribilof Islands dominated by trawl fisheries (Figure 10-7B and Figure 10-7C) while the survey biomass decreased over this time period from catches around 20,000 crabs per nm^2 to less than than 10 crabs per nm^2 (Figure 10-6C). During this early time period the survey biomass fell within the existing PIHCZ while the bycatch was distributed roughly half inside the alternative 4 option B area and half inside the Bristol Bay District. In 1991 to 1995 the bycatch concentration shrunk back to the Pribilof Islands area surrounding the relatively stable biomass estimates from the trawl survey (Figure 10-6D) and the composition of the bycatch source shifted to more pot and longline gear (Figure 10-7D). From 1996 to 2010 survey biomass plummeted and teh relative contribution of trawl caught bycatch decreased while longline and pot bycatch increased in and around the Pribilof Islands (Figure 10-6E-Figure 10-6G and Figure 10-7E-Figure 10-7G).

To put the changes in survey biomass and bycatch by gear type into context with management efforts both data sources were plotted during years affected by the trawling ban due to the PIKCZ closure in 1995 and the reduction of the OFL and TAC associated with the 2003 declaration of overfished status (Figure 10-8-Figure 10-11). When the PIHCZ was enacted in 1995 the bycatch focused mainly south and east of the Pribilof Islands (Figure 10-8) and was comprised of mostly longline and pot gear (Figure 10-9). The majority of this bycatch would be contained within the alternative 4 option a or b scenarios. Note that a portion of the bycatch was outside of the actual management area for Pribilof Islands blue king crab. After the overfished declaration in 2003 bycatch has continued to mostly come from the pot and longline gear centered within the existing PIHCZ with small catches from the trawl fleet in recent years in the Bristol Bay District.

Due to the lack of temporal clarity and patterns in the bycatch of Pribilof Islands blue king crab, the analysts did not add another closure configuration to the existing alternatives. In the early time series when biomass was at its peak around the Pribilof Islands, it was clear that a substantial amount of trawl bycatch occurred to the north and east. By the time the local trawl ban was enacted in the Pribilof Islands the biomass had decreased and bycatch mortalities shifted to the south of the islands. The existing alternative closures adequately covers this region while also accounting for potentially important habitat north and east of the Pribilof Islands.

2.10 Alternatives considered but not carried forward for analysis.

One alternative that was considered for this analysis but not carried forward for analysis included a gear modification for a slick ramp modification for pot gear to deter blue king crab. Development of this type of modification to pot gear is being researched and may be effective in the future for decreasing mortality of blue king crab when directly fishing Pacific cod. This gear, however, will not be available or field tested for inclusion in this analysis as a viable alternative for consideration within the time frame that a new rebuilding plan must be implemented.

Another alternative considered but not carried forward at this time is to establish a PSC cap for the PIBKC stock and to divide this cap by individual groundfish fisheries. Given the lack of sufficient observer coverage in the Pacific cod pot fishery near the Pribilof Islands and other fisheries in this region, the ability to close individual fisheries upon reaching a fishery-specific catch level is problematic.

Two additional alternatives were considered in the preliminary review draft and removed from the analysis at that time. The first was a PSC cap to which bycatch of PIBKC within the 513 reporting area would apply and upon attainment of which all groundfish fishing would cease. This alternative was considered to be unnecessary with the addition of the closure alternatives under Alternative 5 in this analysis as well as ill-conceived in that areas outside of the range of PIBKC stock would close to fishing once the cap was reached. Alternative 5 closures are better representative of the areas under consideration for PIBKC bycatch. Finally, under alternatives 2-5 one of the options would have applied these closures to all groundfish fisheries in the Bering Sea regardless of whether those fisheries have contributed to PIBKC bycatch. Therefore in October 2010, the Council moved to remove from consideration for closures any fisheries which have not contributed to PIBKC bycatch since 2003. The Council in December 2010 further established a threshold criterion of bycatch contribution such that fisheries would be exempted if they caught less than 5% of the ABC or less than 10% of the ABC over that time frame. Based on these criteria, additional fisheries (pollock and Greenland turbot) were excluded from closure consideration.

3 Methodology for Impact Analysis

3.1 Projection Methodology for Pribilof Islands blue king crab stock rebuilding

A four-stage catch-survey assessment (CSA) model was used to estimate size specific PIBKC abundance (Zheng and Kruse 2000, Vining and Zheng 2008). The CSA model uses multiple years of trawl survey and harvest data to estimate abundance in four classes of male crabs: pre-recruit two (105-119 mm CL); pre-recruit one (120-134 mm CL); recruit (new-shell, 135-148 mm CL); and, post-recruit (>148 mm CL and old-shell, 135-148 mm CL). For each stage of crab, the molting portions of crab "grow" into different stages based on a growth matrix, and the non-molting portions of crab remain in the same stage or become post-recruits. The model links the crab abundances in four stages in year t+1 to the abundances and catch in the previous year through natural mortality, molting probability, and the growth matrix:

$$
\begin{aligned}
P2_t^b &= (P2_t e^{-0.5M} - hc2_t e^{-(0.5-y_t)M_t})\, e^{-0.5M_t - st_2 Ft_t - sf_2 Ff_t}(1 - sp_2 Ho_t h),\\
P1_t^b &= (P1_t e^{-0.5M_t} - hc1_t e^{-(0.5-y_t)M_t})\, e^{-0.5M_t - st_1 Ft_t - sf_1 Ff_t}(1 - sp_1 Ho_t h),\\
P2_{t+1} &= P2_t^b[(1-m2_t) + m2_t\ G_{P2,P2}] + N_{t+1},\\
P1_{t+1} &= P1_t^b[(1-m1_t) + m1_t\ G_{P1,P1}] + P2_t^b\ m2_t\ G_{P2,P1},\\
R_{t+1} &= P2_t^b\ m2_t\ G_{P2,R} + P1_t^b\ m1_t\ G_{P1,R},\\
P_{t+1} &= [(P_t + R_t)e^{-0.5M_t} - rc_t e^{-(0.5-y_t)M_t}]e^{-0.5M_t - Ft_t - Ff_t}(1 - Ho_t h),
\end{aligned}
\qquad (1)
$$

Where $P2_t^b$ and $P1_t^b$ are prerecruit-2 and prerecruit-1 abundances after handling mortality in year t, $hc2_t$ and $hc1_t$ are pot bycatch for prerecruit-2s and pre-recruit 1s, st_2, st_1, sf_2, sf_1, sp_2, and $sp1$ are selectivities for pre-recruit 2s and pre-recruit 1s bycatch from groundfish trawling, groundfish fixed gear, and directed pot fisheries, Ho_t is the bycatch mortality rate from other crab fisheries, h is handling mortality rate, $H2^q$ and $H1^q$ are fishery selectivities for pre-recruit 2s and pre-recruit 1s, N_t is new crab entering the model in year t, $m2_t$ and $m1_t$ are molting probabilities for pre-recruit 2s and pre-recruit 1s in year t, $G_{i,j}$ is a growth matrix containing the proportions of molting crab growing from stage i to stage j, M_t is natural mortality in year t, rc_t is estimated commercial catch in year t, and y_t is the time lag from the survey to the mid-point of the fishery in year t. By definition, all recruits become post-recruits in the following year.

The retained catch is estimated to be:

$$rc_t = (P_t + R_t)hr, \tag{2}$$

Where hr is legal harvest rate at the survey time. The pot bycatch from the directed fishery are:

$$\begin{aligned} hc2_t &= sp_2\, hr\, P2_t\, h, \\ hc1_t &= sp_1\, hr\, P1_t\, h. \end{aligned} \tag{3}$$

The bycatch from the groundfish fisheries are computed as:

$$\begin{aligned} tc2_t &= P2_t^b(1-e^{-st_2\, Ft_t}), \\ tc1_t &= P1_t^b(1-e^{-st_1\, Ft_t}), \\ tc_t &= (P_t + R_t)e^{-0.5M_t} - rc_t e^{-(0.5-y_t)M_t}, \\ fc2_t &= P2_t^b(1-e^{-sf_2\, Ff_2}), \\ fc1_t &= P1_t^b(1-e^{-sf_1\, Ff_1}), \\ fc_t &= (P_t + R_t)e^{-0.5M_t} - rc_t e^{-(0.5-y_t)M_t}, \end{aligned} \tag{4}$$

Where $tc2_t$, $tc1_t$, tc_t, $fc2_t$, $fc1_t$ and fc_t are crab bycatch of pre-recruit 2s, pre-recruit 1s, and legals from the trawl and fixed gear fisheries.

The pre-recruit 1, recruit, and post-recruit size classes were combined to provide an estimate of abundance of mature males; the recruit and post-recruit classes were combined to provide an estimate of legal males (Table 11-2). Survey measurement errors were assumed to be log-normally distributed, and a nonlinear least-squares approach that minimizes the measurement errors was used to estimate model parameters. The following model parameters were estimated for male crabs: male mature biomass (MMB, Figure 10-12), recruits to the model each year (Figure 10-13), total abundance in the first year, natural mortality, trawl survey catchabilities for pre-recruits one and two, and molting probabilities for pre-recruits one and two. The CSA model used here was updated to include data for 1975-2009. Fits to observed survey biomass data track well with the overall trend in biomass including a steep decline in the late 1970s, a short rebound in the 1990s and a slow decline to current biomass levels (Figure 10-14). Large inter- annual fluctuations in observed survey biomass are not well fit by the model, however, coefficients of variation of survey MMB for the most recent year is 71.3% and has ranged between 16.8 and 79.9% in since the 1980 peak in biomass.

Data sources for the model include:

Data Component	Years
NMFS bottom trawl survey	1975-2009
ADF&G pot survey	2003, 2005, 2008
Retained catch	1975-2009
Trawl bycatch	1989-2007
Fixed gear bycatch	1996-2007

Survey biomass was included in the model for the entire time series of available data from the NMFS eastern Bering Sea trawl survey. Also, ADFG pot survey data from 2003, 2005, and 2008 were included in the analysis. Spatially the stock is completely covered by the trawl survey and most of the post survey. A growth matrix (for four stages) of probabilities of molting to the next stage was developed based on literature values of size frequency and weight. Selectivity was set at 0.8 and 0.9 for recruit 2 and recruit 1 respectively to account for effect of small size on the directed pot fisheries. Molting probability was set to 0.94, 0.75, 1.0, and 1.0 for pre-recruit 1, pre-recruit 2, recruits, and post-recruits respectively. Handling mortality was set to 0.2, 0.5, and 0.8 for directed pot, other fixed gear, and trawl gear respectively.

Fits of size class stage proportions are better in the earlier years and mid 90s than for the larger fluctuations among years from 2001 to 2009 (Figure 10-18) and residuals of the predicted vs observed trawl survey proportions by stage show a slight trend towards more positive value in more recent years and more, yet inconsistent, variability in the smaller stages (Figure 10-19). Fits of the retained catch biomass were heavily weighted in the analysis and therefore tracked well throughout the time series (
Figure 10-20). Minimal discard bycatch existed in the years with the highest catch biomass between 1,000 and 5,000 t. Total trawl bycatch biomass fit well with observed values ranging from 5 t in 1992, peaking at 42 t in 1993 and then declining to near zero in recent years (
Figure 10-21). Residual fits to predicted vs observed trawl bycatch proportions did not reveal any consistent patterns attributed to cohorts (
Figure 10-22). Total fixed gear bycatch biomass was heavily weighted and therefore fit well with observed values with peaks of 3.5 and 3 t in 1999 and 2008, respectively (
Figure 10-23). Residual fits to predicted vs observed trawl bycatch proportions showed random variability with potential trends difficult to determine with such a small number of data points (
Figure 10-24).

Rebuilding scenarios were started in 2009 and were projected for 50 years where a buffer of 1.0 was applied, each scenario had 1,000 replicates, and it was assumed that no directed fishing would take place. The probability of being overfished was defined as the proportion of replicates where the MMB was below MSST. The probability of being rebuilt was defined as the proportion of replicates where MMB is equal to or above B_{MSY} for two years in a row. Table 11-1 lists summaries of the posterior distributions for the key parameters which determine the productivity of the population for the Beverton-holt and Ricker stock-recruitment relationships. The distributions for F_{MSY} and B_{MSY} are the same for the two stock-recruitment relationships which is expected given the way the values for R_0 and steepness are set. The implications of the alternatives were analysed based on projections from a model based Tier 4 control rule.

The rebuilding projections were for multiple recruitment scenarios:

1. Random recruitment selected from recruitments estimated between 1984 and 2009, inclusive;

2. The Beverton-Holt stock-recruitment relationship was applied; and

3. The Ricker stock-recruitment relationship was applied.

3.2 Evaluation of applicable fisheries for cap and closures

At the December 2010 Council meeting, the Council moved to exempt fisheries from closures if their contribution to bycatch of PIBKC between 2003-2010 was below one of two threshold criteria. The two criteria options are the following:

Option a) less than 5% of the ABC

Option b) less than 10% of the ABC

Based upon the assumption of a Tier 5 calculation for the ABC for this stock (see section 2.5.2 for ABC calculation), the ABC = 3,600 lbs. Option a would result in a threshold level of 180 lbs while option b would result in a threshold of 360 lbs.

In order to evaluate which fisheries have contributed to the bycatch by these threshold levels of PIBKC since 2003, three databases were queried: the NMFS Catch Accounting System (CAS) for prohibited species catch (PSC) estimates of PIBKC (area 513 only), the observer program database (OBS) for actual observed (only) bycatch of PIBKC, and fishtickets (FT) for documented recordings of PIBKC bycatch. The PSC records are only listed to the Federal reporting area scale thus only area 513 was included to avoid overlap with St. Matthew BKC bycatch in area 521. The OBS and FT records include more refined areas based upon State statistical areas defined as representing the Pribilof area. These three databases were then summarized for all incidences of PIBKC bycatch from 2003-2010. Table 11-1 summarizes the results indicating based upon all three databases which fisheries would be included as having had documented bycatch by threshold option of PIBKC between 2003-2010. Figures showing the overlap of the proposed closures and the Federal and State stat areas encompassed by those regions are shown in Figure 10-12 and Figure 10-13. For comparison against the allocation area defined in regulation see Figure 10-14.

While Table 11-1 indicates those fisheries with recorded catch of PIBKC from 2003-2010 above the threshold criteria in the overall allocation area, when compared against those fisheries with recorded bycatch in the Stat areas defined by
Figure 10-12 results were nearly identical with one exception (as noted in Table 11-1).

3.3 Impact Analysis for other marine resources

To assess the effects of the proposed alternatives on groundfish stocks data from observers and data on vessel movements acquired by satellite through the Vessel Monitoring System (VMS) were integrated by NMFS/Alaska Region. This VMS-Observer Enabled Catch-In-Areas (VOE-CIA) database was used to assess the spatial resolution of the observed and unobserved groundfish fisheries in each of the alternative coverages. The VOE-CIA database integrates catch data from the Catch Accounting System (which has the spatial resolution of a NMFS Reporting Area) into a database that resolves the GIS data into polygons with areas of approximately seven kilometers. In an unrestricted area, sixty four grid IDs fit inside one state statistical area.

The VOE-CIA database uses an iterative, ordered process to match VMS records, Observer collected data and VMS/Catch Accounting System indicators to a fishing vessel. This gives analysts the capability to analyze unobserved vessels that may have been transparent when only using earlier analytical tools such as observer data. It should be noted that VOE-CIA data only go back as far as 2003. This is due to the unavailability of reliable VMS data and a vessel linked catch accounting system before 2003.

Data from 2003 to 2009 for each of the proposed closed areas including the target species, management program, harvest sector, gear type, and species were assessed to quantify the potential impacts of the alternatives on groundfish fisheries (see also Economic Effects and the draft RIR/IRFA for this analysis). Table 11-4 through Table 11-7 show the metric tons of groundfish species caught in each proposed closure areas between 2003 and 2009. Appendix 1 shows similar data broken down by target species and gear type (Table A2 through Table A9).

4 Pribilof Islands blue king crab

Blue king crab, *Paralithodes platypus*, are found off Hokkaido in Japan, with disjunct populations occurring in the Sea of Okhotsk and along the Siberian coast to the Bering Straits. In North America, they are known from the Diomede Islands, Point Hope, outer Kotzebue Sound, King Islands, and the outer parts of Norton Sound. In the remainder of the Bering Sea, they are found in the waters off St. Matthew Island and the Pribilof Islands. In more southerly areas as far as southeastern Alaska in the Gulf of Alaska, blue king crabs are found in widely-separated populations that are frequently associated with fjord-like bays. The State divides the Aleutian Islands and eastern Bering Sea blue king crab into the Pribilof Islands and St. Matthew management registration areas (Alaska Department of Fish and Game (ADF&G) 2006). The PIBKC are managed under the Bering Sea king crab Registration Area Q Pribilof District, which has as its southern boundary a line from 54° 36' N lat., 168° W long., to 54° 36' N lat., 171° W long., to 55° 30' N lat., 171° W. long., to 55° 30' N lat., 173° 30' E long., as its northern boundary the latitude of Cape Newenham (58° 39' N lat.), as its eastern boundary a line from 54° 36' N lat., 168° W long., to 58° 39' N lat., 168° W long., to Cape Newenham (58° 39' N lat.), and as its western boundary the United States-Russia Maritime Boundary Line of 1991 (ADF&G 2008).

4.1 Assessment Overview

The PIBKC stock biomass is below its estimated B_{MSY} (9.28 million lbs of mature male biomass, at the time of mating) with survey estimated mature male biomass at mating having increased from 0.25 million lbs in 2008 to 1.13 million lbs in 2009 (Foy and Rugolo 2009; Figure 10-15). Model estimated mature male biomass increased from 1.22 million lbs in 2008 to 1.38 million lbs in 2009 (Figure 10-12). The 2010 survey estimated mature male biomass in the most recent assessment, however, decreased to 0.63 million pounds (Foy 2010). Survey estimates of total biomass were highest at the beginning of the time series with a peak of 176.5 million lbs in 1980, dropped dramatically to 3.3 million lbs, increased again to 29.5 million lbs in 1995 and then steadily decreased to a low of 0.5 million lbs in 2004. Pre-recruit biomass has followed similar patterns as total biomass with no indication of above average recruitment in the past three years although small male and female recruits have been noted.

The 2009 assessment of PIBKC (Foy and Rugolo 2009) is based on survey estimates using area swept methods[3]. Survey abundance in specified length bins is summed across strata defined by single or multiple tows. Weight and maturity schedules are applied to these abundances and summed to calculate biomass.

[3] The analyses of this chapter are based on a new assessment model. The results are therefore not identical to those in Foy and Rugolo (2009).

In 2009, PIBKC were observed in 6 of the 41 stations in the Pribilof District, all of which were in the high-density sampling area (Chilton et al. 2009, Figure 10-16). Legal-sized males were caught at three stations east of St. Paul Island, with a density ranging from 73 to 131 crab/nmi^2. The 2009 abundance estimate of legal-sized males was 0.07 ± 0.08 million crab, representing 15% of the total male abundance and below the average of 0.56 million crab for the previous 20 years (Figure 10-17). Only 4 legal-sized male PIBKC were captured on the survey: one in molting or softshell condition and one in new hardshell condition, while two were in very oldshell condition. Large female PIBKC were caught at three stations in the Pribilof District with an abundance estimate of 0.6 ± 0.9 million crab representing 95% of the total female abundance. Fourteen of the 29 large female PIBKC sampled during the survey were brooding uneyed or eyed embryos. Among sampled mature females, 24% were new hardshell crab all with newly extruded embryos while 76% were oldshell females of which 24% were brooding eyed embryos and 52% had empty egg cases.

The OFL for PIBKC is currently based on the Tier 4 control rule, i.e. the proxy for F_{MSY} is taken to be the product of natural mortality (M) and a scalar, γ (NPFMC, 2008; Figure 10-25). The proxy for B_{MSY} is taken to be the average biomass over a specified time period (currently 1980-1984 and 1990-1997). In the absence of data on an unfished stock, this time period was chosen to represent the potential population biomass that this stock could achieve to support maximum sustainable yield assuming that production during the entire time period was constant. It is noted that data are not currently available on the likely variability in production of this stock nor on the factors that influence crab production in this region. In the current OFL setting process assessment authors have the opportunity to revisit the years used to establish B_{MSY} as new data become available. The OFL is a total-catch OFL and is computed as the sum of catches by three different sources of removals: (a) the retained legal males in directed (pot) fishery for PIBKC, (b) discards of males and females in the directed fishery, and (c) bycatch in the groundfish pot and trawl fisheries.

The harvest strategy has incorporated protection measures for PIBKC due to its overfished status so Total Allowable Catch (TAC) has been zero in recent years. Under the current rebuilding plan (implemented as Amendment 17 to the BSAI Crab FMP), there can be no directed harvest of PIBKC until the stock is rebuilt.

4.1.1 Blue king crab spatial relationship between Pribilof Islands and St. Matthew

To assess the potential relationship between blue king crab in the Pribilof Islands and St. Matthew, the analysts consulted report entitled "Guidelines for determination of spatial management units for exploited populations in Alaskan groundfish fishery management plans" by Spencer et al. (In Prep). Per this document, aspects of blue king crab harvest and abundance trends, phenotypic characteristics, behavior, movement, and genetics will be considered. Also, over 200 samples have been collected to support a genetic study on blue king crab population structure by a graduate student at the University of Alaska. Data from this genetics study will not be available in time for this rebuilding plan but will be incorporated into the stock assessment and considered during the rebuilding period.

Following the methods of Spencer et al. (In preparation), aspects of PIBKC stocks that might lead to a conclusion about the spatial relationship with the St. Matthew stock were discussed (Table 11-15). The items labelled TBD still require analysis (Table 11-15). The data that is available suggests that the environments around the Pribilof Islands and St. Matthew Island are different and likely lead to variable crab production in the two regions. Recent publications looking at snow crab larval advection suggest that the may be physical mechanisms to entrain crab larvae from the south to the north. It is unknown, however, the magnitude (if any) that blue king crab larval drift from the Pribilof Islands may contribute to the total larval production supporting the St. Matthew stock. Further analyses will be considered to compare phenotypic characteristics based on survey data collection.

4.1.2 Spatial relationship between Pribilof Islands blue king crab and red king crab stocks

To address the potential for species interactions between blue king crab and red king crab as a potential reason for PIBKC shifts in abundance and distribution, we compared the spatial extent of both speices in the Pribilof Islands from 1975 to 2009 (Figure 10-26). In the early 1980s when red king crab first became abundant, blue king crab males and females dominated the 1 to 7 stations where the species co-occurred in the Pribilof Islands District (Figure 10-26A). Spatially, the stations with co-occurance were all dominated by blue king crab and broadly distributed around the Pribilof Islands (Figure 10-27A). In the 1990's the red king crab population biomass increased substantially as the blue king crab population biomass decreased. During this time period, the number of stations with co-occurance remained around a max of 8 but they were equally dominated by both blue king crab ands red king crab sugggesting a direct overlap in distribution at the scale of a survey station (Figure 10-26A). Spatially during this time period, the red king crab dominated stations were dispersed around the Pribilof Islands (Figure 10-27B). Between 2001 and 2009 the blue king crab population has decreased dramatically while the red king crab have fluctuated (Figure 10-26B). Interstingly, the number of stations dominated by blue king crab is similar to those dominated by red king crab for both males and females suggesting continued competition for similar habitat (Figure 10-26A). Spatially the only stations dominated by blue king crab exist to the north and east of St. Paul Island (Figure 10-27C). It is noted that although the blue king crab protection measures also afford protection for the red king crab in this region, the red king crab stocks continue to fluctuate even considering the uncertainty in the survey.

4.1.3 Pribilof Island red king crab stock status

Red king crab stocks in the Bering Sea and Aleutian Islands are managed by the State through the federal Fishery Management Plan (FMP) for Bering Sea/Aleutian Islands King and Tanner Crabs (NPFMC 1998). The Alaska Department of Fish and Game (ADF&G) has not published harvest regulations for the Pribilof district red king crab fishery. The king crab fishery in the Pribilof District began in 1973 with blue king crabs being targeted (Figure 10-3). A red king crab fishery in the Pribilof District opened for the first time in September 1993. Beginning in 1995, combined red and blue king crab Guideline Harvest Levels (GHL) were established. Declines in red and blue king crab abundance from 1996 through 1998 resulted in poor fishery performance during those seasons with annual harvests below the fishery GHL. The NPFMC established the Bering Sea Community Development Quota (CDQ) for Bering Sea fisheries including the Pribilof Islands red and blue king crab fisheries which was implemented in 1998. From 1999 to 2008/2009 the Pribilof Islands fishery was not open due to low blue king crab abundance, uncertainty with estimated red king crab abundance, and concerns for blue king crab bycatch associated with a directed red king crab fishery.

Pribilof Islands red king crabs occur as bycatch in the eastern Bering Sea snow crab, eastern Bering Sea Tanner crab, Bering Sea hair crab, and PIBKC fisheries. Many of these fisheries have been closed or recently re-opened so the opportunity to catch Pribilof Islands red king crab is limited. Limited non-directed catch exists in crab fisheries and groundfish pot and hook and line fisheries.

From 1980-2010, the Pribilof Islands red king crab stock exhibited widely varying mature male and female abundances. The estimate of MMB from the 2010 survey was 5.44 million pounds (Figure 10-28). Recruitment is not well understood for Pribilof red king crab. Pre-recruitment indices have remained relatively consistent in the past 10 years, although pre-recruits may not be well assessed with the survey. The point estimates of stock biomass from the survey in recent years has decreased since the 2007 survey with a substantial decrease in all size classes in 2009, but the stock increased in 2010 relative to 2009. The 2010 size frequency for males shows a decrease in the number of old shell and very old shell legal sized males in comparison to 2008 shell conditions, but an increase when compared to 2009. Red king

crab were caught at 13 of the 41 stations in the Pribilof District high-density sampling area in 2010 (Chilton et al. in press, Figure 10-29). Red king crabs have been historically harvested with blue king crabs and are currently the dominant of the two species in this area.

4.2 Bycatch of Pribilof Islands blue king crab by fishery

Between the 2003/04 and 2009/10 crab fishing seasons between 300 lbs (136 kg) and 4,600 lbs (2087 kg) of PIBKC were caught incidentally during crab and groundfish fisheries. Annually, yellowfin sole comprised between 3 and 77%, Pacific cod between 20 and 100%, flathead sole between 1 and 31% of the bycatch, and rocksole 26% of the bycatch in the 2006/07 crab fishing season (Table 11-4). Hook-and-line fisheries accounted for between 1 and 99%, non-pelagic trawls between 1 and 79%, and pot gear between 18 and 95% of the total bycatch (Table 11-5).

Pribilof Islands blue king crab bycatch mortality by gear type and target species are absolute values based on the AKRO catch database as of August 2009 (Table 11-8 and Table 11-9). The total columns are based on a revised database that accounts for a previous discrepancy in how unmeasured crab were apportioned. Unfortunately due to the complexity of this issue, only total values of crab mortality are available in those years. To apportion bycatch mortality to target species and gear type, the relative proportion of bycatch based on the pre-August 2009 database was applied to the total. It is noted that this method assumes that the unmeasured crab errors were equally distributed across gear type and target species. (Mortality rates assume 50% mortality in fixed gear and 80% mortality in trawl gear).

In April 2010, the SSC commented that the rebuilding plan analysis should *"consider likely crab PSC in the halibut fishery. This review should be brought into the analysis to consider the efficacy of the alternatives to achieve stock rebuilding"* (SSC minutes April 2010). This was in response to the indications that fixed gear (specifically long line fisheries) have accounted for a significant proportion of total bycatch of PIBKC in some years (Table 11-5) thus the potential exists for bycatch in the halibut longline fishery operating in the area as well. To assess the potential bycatch of PIBKC in the halibut fishery, data from 2004-2009 halibut fisheries and halibut surveys were provided by the International Pacific Halibut Commission (IPHC). Within the largest proposed area closure (PIBKC75), the IPHC survey occupies approximately 32 stations (Figure 10-33) within 26 IPHC statistical units (Figure 10-34) distributed mostly in and around the Pribilof Islands. From 2004 to 2009 no blue king crab were caught during this survey based on an assessment of the first 20 hooks of each skate in a set. Between 2004 and 2009 a range of 96 to 308 total effective skates were sampled during the survey. An effective skate is an 1800' skate with 100 hooks with hook spacing greater than 4 feet. For comparison to the IPHC survey, logbook data shows that between 5,800 and 7,400 effective skates were fished and caught halibut per year between 2004 and 2008 catching between 486,000 and 966,000 lbs of halibut per year in the area of the largest proposed closure (Table 11-6).

At this time, specific bycatch data on PIBKC (from commercial logbooks) are not available due to confidentiality issues with reporting the data. However, it is noted that that the bycatch encounter rates in the IPHC survey are generally not representative of the commercial fleet. The survey fishes on a standardized spatial layout (10nm x 10nm grid) whereas the commercial fishery is targeting halibut.

In evaluating the data necessary to characterize the initial applicable fisheries for the alternative closures in this analysis (see section 3.2), there were fishticket records from 2007 indicating bycatch of PIBKC in the directed halibut longline fishery[4], however this did not meet the revised criteria and thus is no longer included in the list of fisheries.

[4] Note that the 'target' as listed on these records was other species taken with longline gear.

4.3 Impacts of Alternatives on rebuilding the stock

As described in Chapter 2, there are five alternatives under consideration for rebuilding the PIBKC stock. The impacts of these alternatives are considered by sensitivity analysis for impacts on PIBKC. As noted below however, rebuilding simulations indicate that none of the alternatives rebuild the PIBKC stock in less than 50 years**.**

Distributions of observed PIBKC bycatch by gear type are shown in each of the proposed closure areas for three periods (Figure 10-35 through Figure 10-37Figure 10-37): 2003-2007 to correspond to available data on groundfish fishery impacts, 1995-2007 to correspond to the adoption of Amendment 17 and the creation of the PIHCZ, and 1987-1994 corresponding to pre-PIHCZ. Total observed bycatch ranged from 21 to 57 crabs per year, were mostly females, and included crab with average lengths between 125.5 and 182.1 mm CL (Table 11-10). In 2008/2009, 0.001 million lbs of male and female PIBKC were caught in groundfish fisheries according to the AKRO Catch Accounting System analysis. The catch was mostly in non-pelagic trawls (77%) and longline (23%) fisheries. The targeted species in these fisheries were yellowfin sole (77%), and Pacific cod (23%).

For the purposes of this draft of the PIBKC rebuilding plan, the three recruitment scenarios were compared for status quo groundfish bycatch. The highest observed bycatch was used as a starting point for estimating the impact of levels of bycatch reduction on rebuilding the PIBKC stock. Estimated MMB was similar with the Ricker and Beverton-Holt stock recruit models increasing from 1.5 million lbs to 9.4 and 9.9 million lbs, respectively, over the 50 year projection (Figure 10-29). The MMB using the random recruitment model had lower error in the projected time series but was substantially lower than the other models ranging from 1.5 to 3.3 million lbs. Only the results of the projections using the Ricker stock-recruit relationship were presented for the remaining results.

To assess the impacts of alternatives on rebuilding the PIBKC stock four scenarios were considered where groundfish bycatch was reduced by a specified amount that brackest the reduction in bycatch corresponding to the closure configurations in the analysis:

1. No reduction of PIBKC bycatch in the groundfish fisheries (Alternative 1);
2. 50% reduction in all PIBKC bycatch in the groundfish fisheries;
3. 80% reduction in all PIBKC bycatch in the groundfish fisheries; and
4. 100% reduction in all PIBKC bycatch in the groundfish fisheries (Alternative 4).

The probability of overfishing similarly decreased from 1 to 0.08, 0.07, 0.07, and 0.06 for the status quo, 80% reduction, 50% reduction, and 0% reduction alternatives, respectively (Figure 10-30). A similar decrease was observed for the pot cod only bycatch reduction (option b under each Alternative) (Figure 10-31). For both the options of all groundfish and pot cod only closures, the MMB relative to B_{MSY} increased similarly for each scenario from 0.07 to 0.44 over the 50 year projection (Figure 10-32 and Figure 10-33). For option a (application of closures to all groundfish fisheries), the retained catch increased from 0 to 0.86, 0.87, 0.87, and 0.87 for the status quo, 80% reduction, 50% reduction, and 0% reduction alternatives, respectively (Figure 10-34). The estimated recruitment under option a also increased between 0.1 and 1 million crabs over the projected time series (Figure 10-35).

Alternative 5 would limit the total catch of PIBKC in the groundfish fisheries to the annually specified OFL, ABC or proportion of ABC for PIBKC. Total removals by year from 1991-2009 for both directed crab fisheries as well as groundfish fisheries (by aggregate gear type) are shown in Table 11-14. Currently

as described in Chapter 2, there is no feedback between bycatch in the groundfish fisheries of PIBKC and management measures under the BSAI Crab FMP. Thus, if the OFL for PIBKC were exceeded due to bycatch in the BSAI groundfish fisheries, no in-season management measure would be taken to further restrict bycatch of PIBKC. An 'overfishing' determination would be made the following year in the process of annual status determination for BSAI crab stocks. Absent measures to explicitly establish in-season management measures in the groundfish fisheries to implement a fishery closure should the OFL or ACL for PIBKC be reached, no additional restrictions would be taken to limit bycatch in the groundfish fisheries. Currently crab bycatch in groundfish fisheries is tabulated after the season is over and in time for consideration in the subsequent assessment in accounting for total removals. In order to have a PSC cap towards which catch could accrue from groundfish fisheries in-season, additional catch accounting considerations may be necessary. Considerations include observer coverage in this area, the extent of the PIBKC stock for purposes of bycatch accounting from Federal areas[5], and the management measures that would be enacted to implement a fishery closure should such a limit be reached.

Currently bycatch within Federal Reporting area 513 is counted as bycatch of PIBKC stock. Until a more defined area is specified for bycatch accrual, this is the area that is used to define the spatial extent of this stock. This will be modified in the stock assessment in the future as a more spatially-explicit area can be defined to refine bycatch estimates for accruing towards the OFL (note that Area 513 does not cover the entire distribution of this stock). Not all groundfish fisheries however contribute towards any bycatch of PIBKC. Table 11-14 shows the relative catch by fishery of PIBKC since 2003.

Alternative 5 would trigger a range of area closures when the specified PSC limit of PIBKC in the groundfish fisheries is reached. Bycatch from all fisheries within the PIBKC stock distribution would accrue towards this limit but when reached a specified area (as listed under options a-d) would close to all groundfish fishing. The impacts of closing these areas and the relative extent of groundfish catch in the regions over time are analysed in the RIR.

Four cap levels are considered under this alternative, a PSC limit set at either the OFL (currently 4,000 lbs), the ABC (estimated at 3,600 lbs), 90% of the ABC or 75% of the ABC . In analysing the impacts of closing groundfish fisheries, consideration was given to when the cap itself is reached, triggering area closures as defined in Alternative 5. The only year that the cap was reached historically was in 2007. At that time, the OFL would have been exceeded the week of September 22nd. Likewise the ABC (or ACL) level was also exceeded in the same week-ending date as were both additional cap options. It is not possible to differentiate between the range of cap levels in this impact analysis as both were exceeded historically within the same week thus for analytical purposes these four caps are considered to be equivalent[6]. Nevertheless, while the potential impacts differ on groundfish fisheries across alternative management measures depending upon the time frame for reaching the cap and the impacts (closure of various fisheries from the specified areas) when a cap is reached, none of the alternative management measures themselves differ in their ability to rebuild the stock over the time frame of the simulation.

4.4 Impacts of Option for increased observer coverage

The options and suboptions contained under Section 2.6 relate to increasing observer coverage on select fisheries. The Council has not yet identified which fisheries would receive increased coverage, however. Presumably, this option would focus on fisheries with less than 100% coverage requirements as

[5] The current system for catch accounting of crab bycatch by stock from Federal reporting areas is being modified to employ smaller statistical areas to better delineate stock-specific boundaries as a result of implementation of total catch OFLs under amendment 24 to the BSAI Crab FMP.

[6] The OFL here is 4,000lbs while under the Tier 5 assumption the ACL is considered to be 3,600lbs, a difference of only 400 lbs. This difference would be even smaller under a 'true' Tier 4 ACL determination using the P* approach of 0.49 established under the Council's preferred alternative.

candidates for increased coverage. All affected fisheries for this action are listed in Table 11-1. Of these fisheries, only non-pollock catcher vessels (CVs) are in the partially covered category with less than 100% coverage (generally CVs 60' – 125' and pot vessels of all sizes have 30% observer coverage requirements). Note that all Bering Sea pollock CVs have at least 100% observer coverage requirements as a result of BSAI Amendment 91, which was effective starting January 2011. Thus, for purposes of identifying candidate fisheries for increased observer coverage under this analysis, pollock CVs are considered adequately covered.

The implementation of Options 1 and 2 under Section 2.6 requires that the Council identify specific fisheries for which increased coverage in these areas is a priority under this analysis. If specific fisheries were recommended for increased coverage, similar cost-benefit assumptions could be made, consistent with the public review draft analysis for observer restructuring.[7] This analysis estimates that the cost of an observer day under the existing service delivery model is $366.[8] Absent identification of the specific fisheries to receive increased observer coverage under the proposed options, one could multiply the number of fishing days for each sector identified for increased observer coverage by $366/day to estimate the total observer costs by sector. The difference between this estimate and the status quo observer costs would be the net increase in observer costs due to Options 1 and 2. The benefit to increased observer coverage is not estimated quantitatively; it would increase the amount of bycatch data for pot and longline fisheries, refining NMFS's understanding of spatial and temporal removals of PIBKC.
The Council took action in October 2010 to restructure the groundfish observer program, such that all vessels and processors included under the new program would pay an ex-vessel value fee on their landings (1.25%) to pay for the cost of deploying observers in those sectors. Under the new program, NMFS would contract directly with observer providers, and NMFS would control when and where observers are deployed, based on a statistically sound sampling plan. This new system would allow NMFS and the Council to deploy observers according to stock and management priorities on an annual basis, significantly increasing flexibility in observer deployment compared to the existing regulatory system.

The observer restructuring action is expected to be implemented in 2013. Should the Council take final action on the PIBKC rebuilding plan in early 2011, it is not anticipated that any cap or closure system under a revised plan could be in place until at least 2012. Thus, if the suboption were selected under Section 2.6, the increased observer coverage requirements would sunset with the new observer program and only be in place for one year.

If the suboption was not selected, the impact of this action is to mandate a certain level of coverage in these partially covered fisheries, which is inconsistent with the objective of increased flexibility in a restructured program. As stated previously, one of the primary objectives of the restructured observer program is to allow NMSF and the Council flexibility to shift coverage among fishery sectors necessitating <100% observer coverage, on an annual basis, in accordance with shifting conservation and management priorities and data needs. For example, if questions arise about catch or bycatch by vessels operating in a specific area or time of year, NMFS would have the ability to develop the sample design such that observers are deployed on vessels during specific times or areas to address those questions. Thus, mandated increased coverage may not be necessary under Section 2.6, as the Council and NMFS could prioritize increased coverage for the fisheries, gear types, and areas at issue under a restructured program, recognizing the tradeoffs in the amount of coverage available in other fisheries. The initial year of deployment under a restructured program anticipated a performance standard of a 30% coverage rate, with the understanding that this rate will change and may vary substantially among fisheries, gear types,

[7]http://www.fakr.noaa.gov/npfmc/current_issues/observer/Observer_restructuring910.pdf
[8]Refer to Appendix 6 of the observer restructuring document for the calculations and assumptions on which this estimate is based.

and areas, as data is collected under the new program. As new, more representative data become available on an iterative basis through a restructured program that employs a randomization scheme for vessel or trip selection, NMFS would be able to determine the sampling effort necessary to achieve desired levels of precision. The proposed program allows for this flexibility on an annual basis.

5 Other Marine Resources

This section considers other marine resources in the Pribilof Islands region and the potential impact on these resources categories of the Alternatives under consideration.

5.1 Groundfish Resources

5.1.1 Overview of groundfish resources

Groundfish fisheries that occur in the same species general distribution as the PIBKC fishery include: Pacific cod, pollock, Arrowtooth flounder (*Atheresthes stomias*), Atka mackerel (*Pleurogrammus monopterygius*), yellowfin sole (*Limanda aspera*), rock sole (*Lepidopsetta bilineata*), flathead sole (*Hippoglossoides elassodon*), skates, and sculpins (NPFMC 1999). Bycatch of blue king crab in these fisheries is low. Since the implementation of the Pribilof Islands Habitat Conservation area, the overlap between the flatfish trawl fisheries and the PIBKC fishery has declined. Very little is known about the trophic interactions of blue king crab, however similar trophic interactions are presumed as for red king crab. A number of fish species are known to feed on larval red king crab, including pollock, Pacific herring (*Clupea pallasii*), sockeye salmon (*Oncorhynchus nerka*), and yellowfin sole. Once the crabs settle on the sea floor, they are prey to a number of commercial and non-commercial fish species, such as most flatfish species, halibut, sablefish (*Anoplopoma fimbria*), skates, sculpins, and other benthic invertebrates, such as sea stars. A high rate of cannibalism by juvenile red king crab on younger crab also exists. Studies have documented that Pacific cod consume soft-shelled female adult red king crab. A discussion of the specific trophic interactions between blue king crab and groundfish and other species is contained in the annual SAFE report chapter for the PIBKC stock (see Foy and Rugolo 2009).

5.1.2 Impacts of Alternatives on groundfish resources

Table 11-4 through Table 11-7 show the total groundfish catches by species and year from 2003 – 2009 from each of the Alternative closure configurations considered in this analysis. Pacific cod and pollock represent the highest removals by weight by year in the PIHCZ, Alternative 1 and 2 (Table 11-4). Pacific cod and yellowfin sole represent the highest removals by weight by year in the ADF&G closures under Alternative 3 (Table 11-5). For Alternative 4, option 1 (distribution based upon 1975-1984 distribution area) and option 2 (distribution based on the 1984-2008 area), the highest removals by weight by year are pollock, Pacific cod and yellowfin sole (Table 11-6, Table 11-7).

5.2 Incidental catch species, marine mammals, and seabirds

Under all proposed alternatives for rebuilding the PIBKC stock, harvest levels in the directed crab fisheries would remain the same (the directed fishery is closed). Further, no changes to the distribution of crab fisheries are anticipated under the proposed Actions. To the extent that crab fishing effort is reduced, and consequently adverse interactions with incidental catch species though bycatch or disturbance are also reduced, there could be some benefit to these species. Any effects on incidental catch species, however, should not be significant under any of the proposed alternatives for the crab fisheries. Changes in effort under Alternatives 2-5 for the groundfish fisheries however may occur and could impact incidental catch.

5.3 Habitat and ecosystem considerations

The marine waters and benthic substrates in the BSAI management area comprise the habitat of all marine species. Additionally the adjacent marine waters outside the EEZ, adjacent State waters inside the EEZ, shoreline, freshwater inflows, and atmosphere above the waters, constitutes habitat for prey species, other life stages, and species that move in and out of, or interact with, the fisheries' target species, marine mammals, seabirds, and the ESA listed species. A detailed discussion of the effects of crab fisheries on essential fish habitat (EFH) is included in the Final EIS for EFH identification and consideration in Alaska (NMFS 2005). That analysis concluded that the impacts of the crab pot fishery on habitat features in the Bering Sea and Aleutian Islands are negligible.

Ecosystem characteristics of the BSAI management areas have been described annually since 1995 in the "Ecosystem Considerations" section of the annual SAFE reports. Given that an overall increase in fishing activity is not expected under the two proposed Actions, the potential effects of the Actions on an ecosystem-wide scale are very limited. As a result, no significant adverse impacts on ecosystem relations are anticipated.

6 Economic Effects

Please refer to the attached RIR.

7 Cumulative Impacts

Analysis of the potential cumulative effects of a proposed Federal action and its alternatives is a requirement of the National Environmental Policy Act (NEPA). Cumulative effects are those combined effects on the quality of the human environment that result from the incremental impact of the proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of what Federal or non-Federal agency or person undertakes such other actions (40 CFR 1508.7, 1508.25(a), and 1508.25(c)). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The concept behind the cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the CEQ guidelines recognize that it is most practical to focus a cumulative effects analysis on only those effects that are truly meaningful.

The Crab Rationalization Environmental Impact Statement (NMFS 2004) and Amendment 24 to the Crab FMP (NPFMC 2008) incorporated into this analysis by reference assess the potential direct and indirect effects of crab fishery harvest levels in combination with other factors that affect physical and biological resource components of the BSAI environment.

The Council took final action on an analysis of implementing Annual Catch Limits (ACLs) for all BSAI crab stocks including the PIBKC stock as well as a revised rebuilding plan for the EBS snow crab stock. No further constraint on crab fisheries are anticipated as a result of those actions[9]. A Tanner crab rebuilding plan is likely to be developed by the Council and NMFS following stock status determination that this stock is below its MSST and a rebuilding plan will be necessary. This rebuilding plan will likely

[9] The Council did not revise the existing rebuilding plan for snow crab at final action. The Council's action thus continues the existing rebuilding plan modified only by changing the definition of 'rebuilt' to be equivalent to a single year of biomass above B_{MSY} as opposed to two consecutive years under the existing plan. No additional changes were recommended in the Council's action from October.

also include alternatives that could further constrain the allowable catch in that crab fisheries. The final analyses for the rebuilding plans will follow the Council's adoption of a preferred alternative on ACLs and so will take into account any reductions in harvest levels attributable to the implementation of ACLs in the discussion of impacts. The Council may also suggest revisions to the Crab Rationalization Program after the Council's five year review concludes in December 2010, which could affect the percentage of the harvest pool distributed as crew shares and could change the distribution and amount of crab landings subject to IPQ and regional landing requirements.

The Council is also considering a discussion paper evaluating crab bycatch in the groundfish fisheries. Currently, there are no hard quotas to cap crab bycatch in the groundfish fisheries, although area closures with associated catch limits are utilized to reduce bycatch. Accountability Measures (AMs) are a required provision of the MSRA in conjunction with provisions for ACL requirements. The intent of AMs are to further protect a crab stock from overfishing by providing for a transparent response mechanism in the event that the established ACLs are exceeded. Without further Council action, crab bycatch in the groundfish fisheries will be accounted for by reducing harvest in the directed crab fisheries. However, the Council did initiate an amendment analysis to consider alternative management measures for bycatch in the groundfish fisheries.

Beyond the cumulative impacts discussed above and documented in the referenced analyses, no additional past, present, or reasonably foreseeable cumulative negative impacts on the biological and physical environment (including fish stocks, essential fish habitat, ESA-listed species, marine mammals, seabirds, or marine ecosystems), fishing safety, or consumers have been identified that would accrue from the proposed actions. None of the Actions and Alternatives change the general manner, timing, or location in which the crab fisheries operate.

8 References

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10 Figures

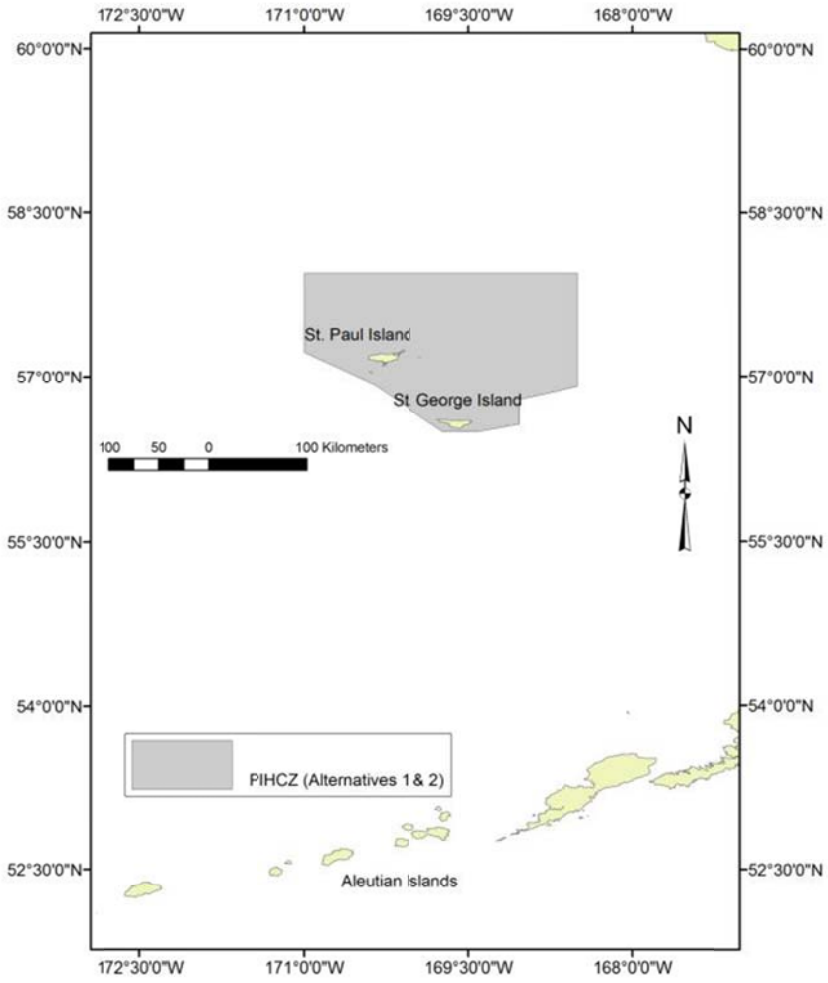


Figure 10-1 Pribilof Islands Habitat Conservation Zone (PIHCZ): Alternatives 1 and 2.

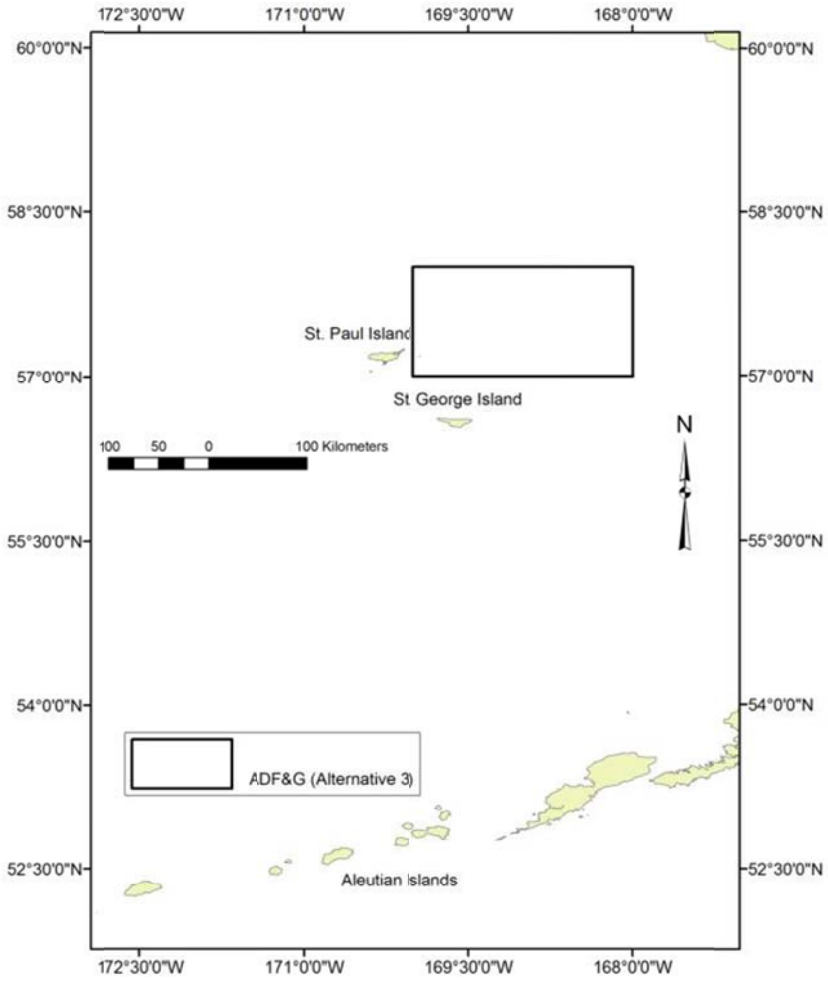


Figure 10-2 Alaska Department of Fish and Game (ADF&G) closure area (Alternative 3).

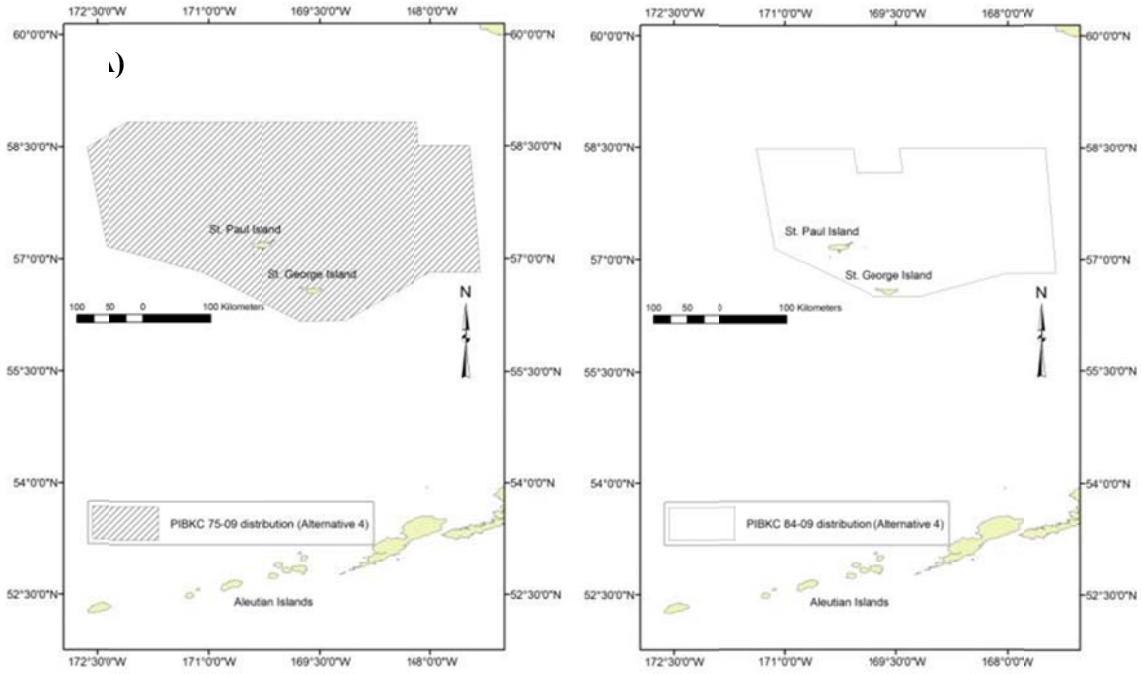


Figure 10-3 Pribilof Islands blue king crab distribution closure area (Alternative 4): A) 1975 to 1983 distribution; B) 1984 to 2009 distribution.

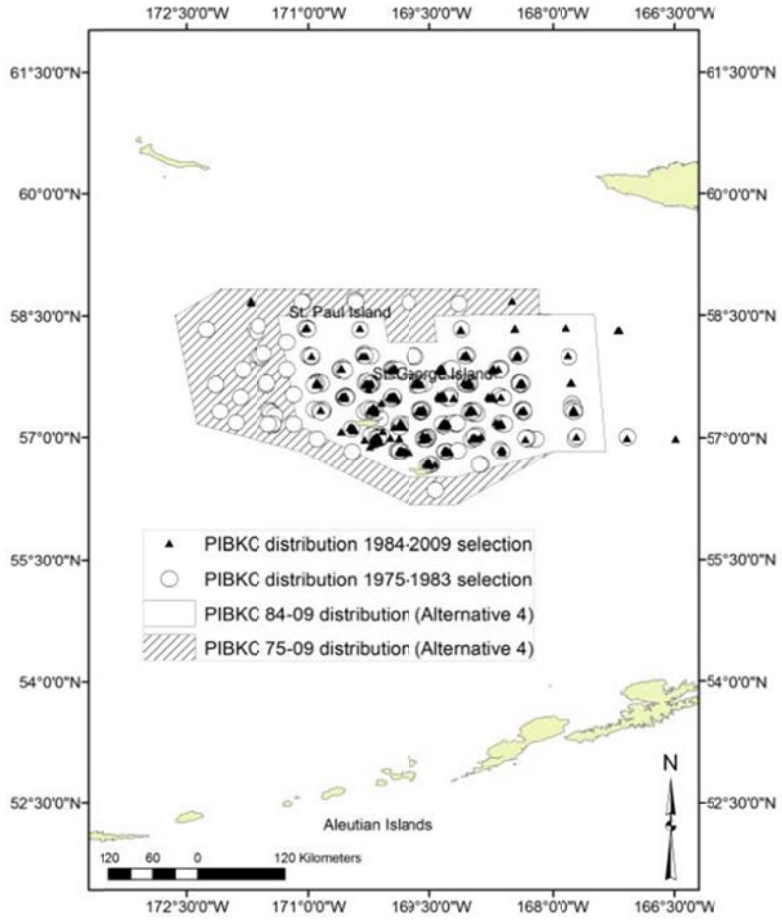


Figure 10-4 Distribution of Pribilof Islands blue king crab (PIBKC) showing the change in relative distribution to the east in 1984.

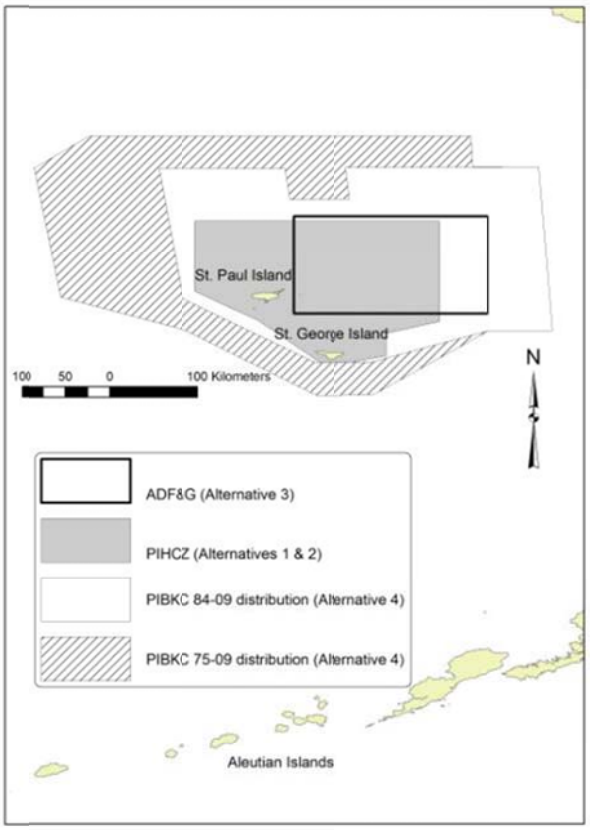


Figure 10-5 A comparison of relative extent of closures under Alternatives 1-4.

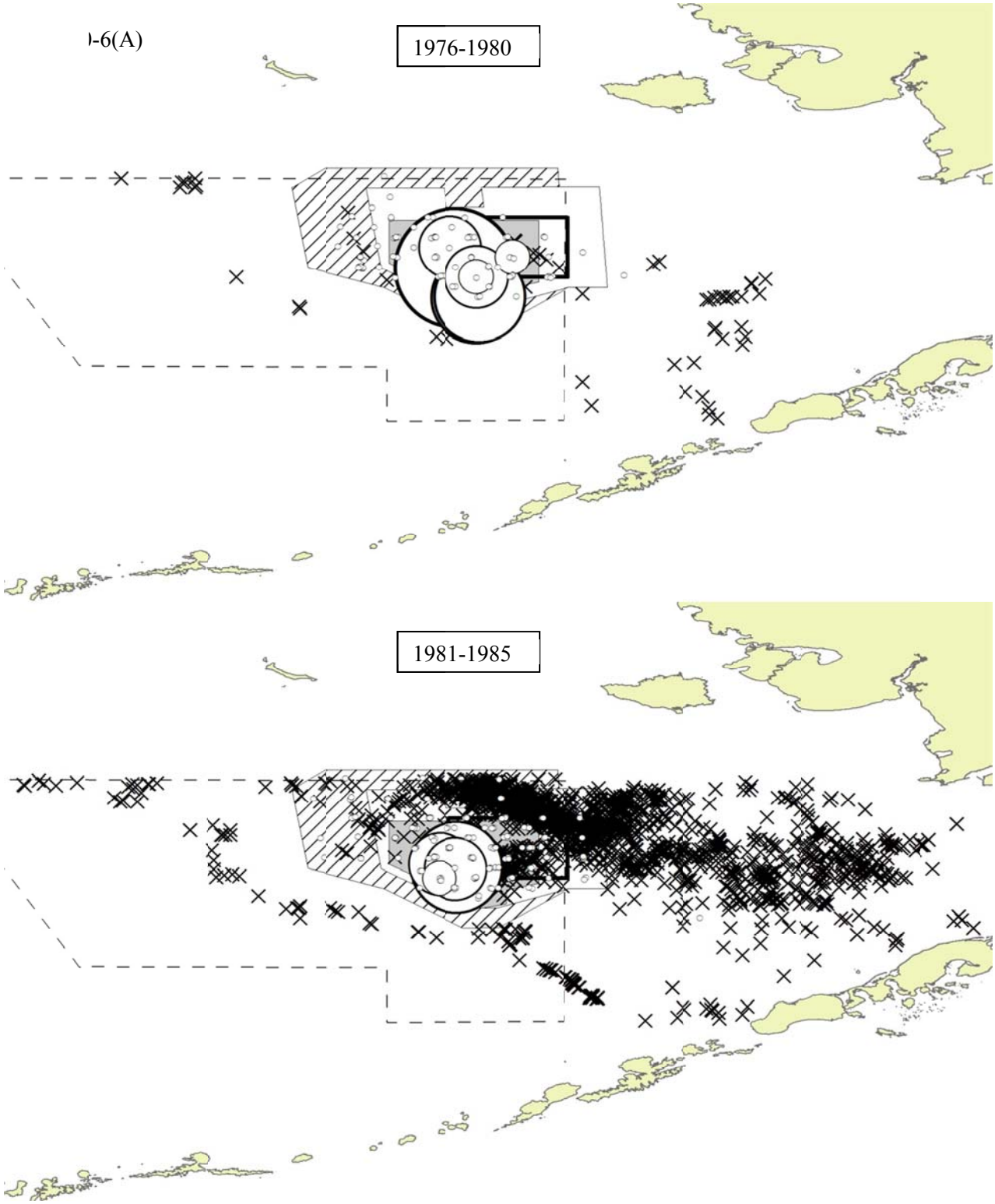
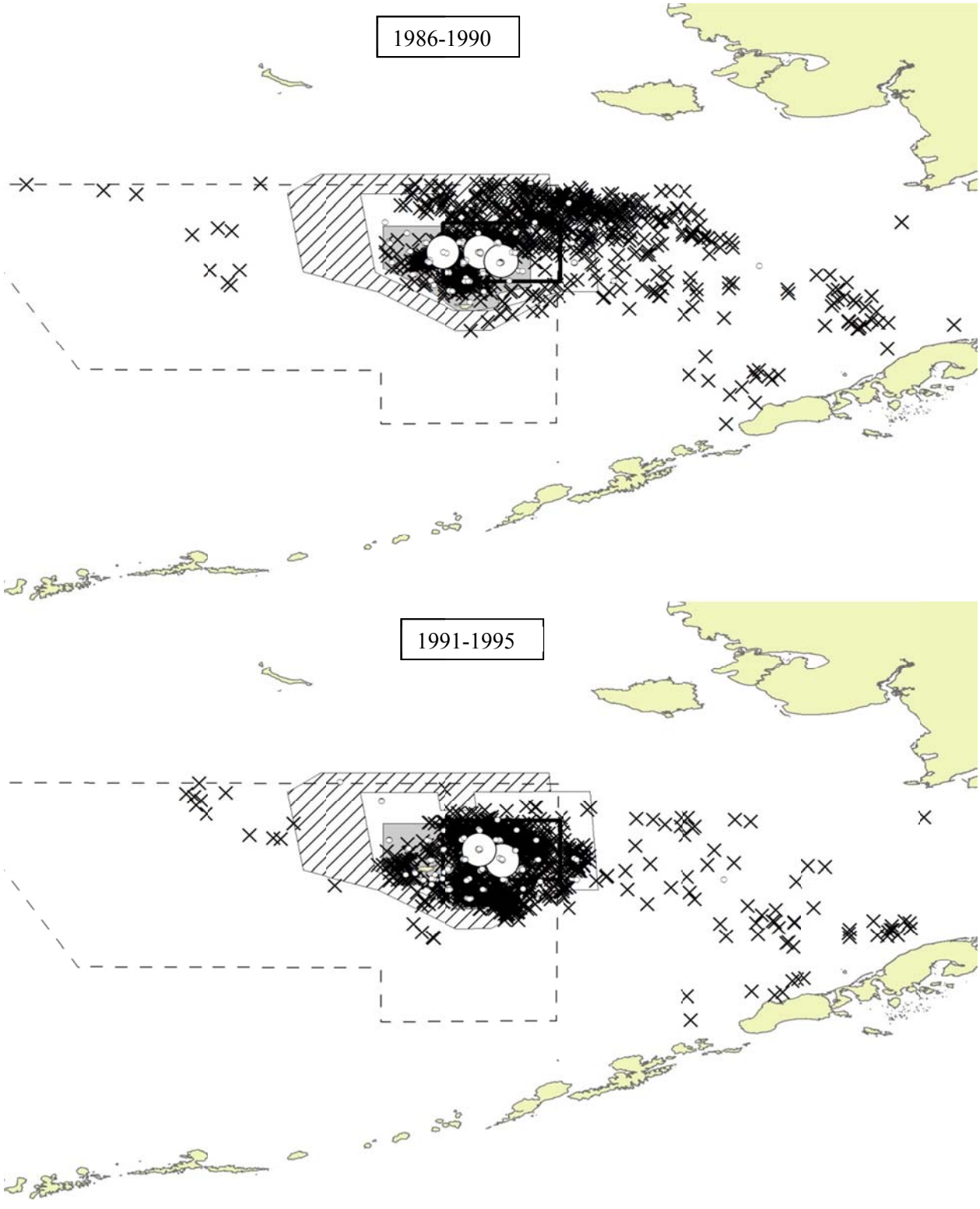
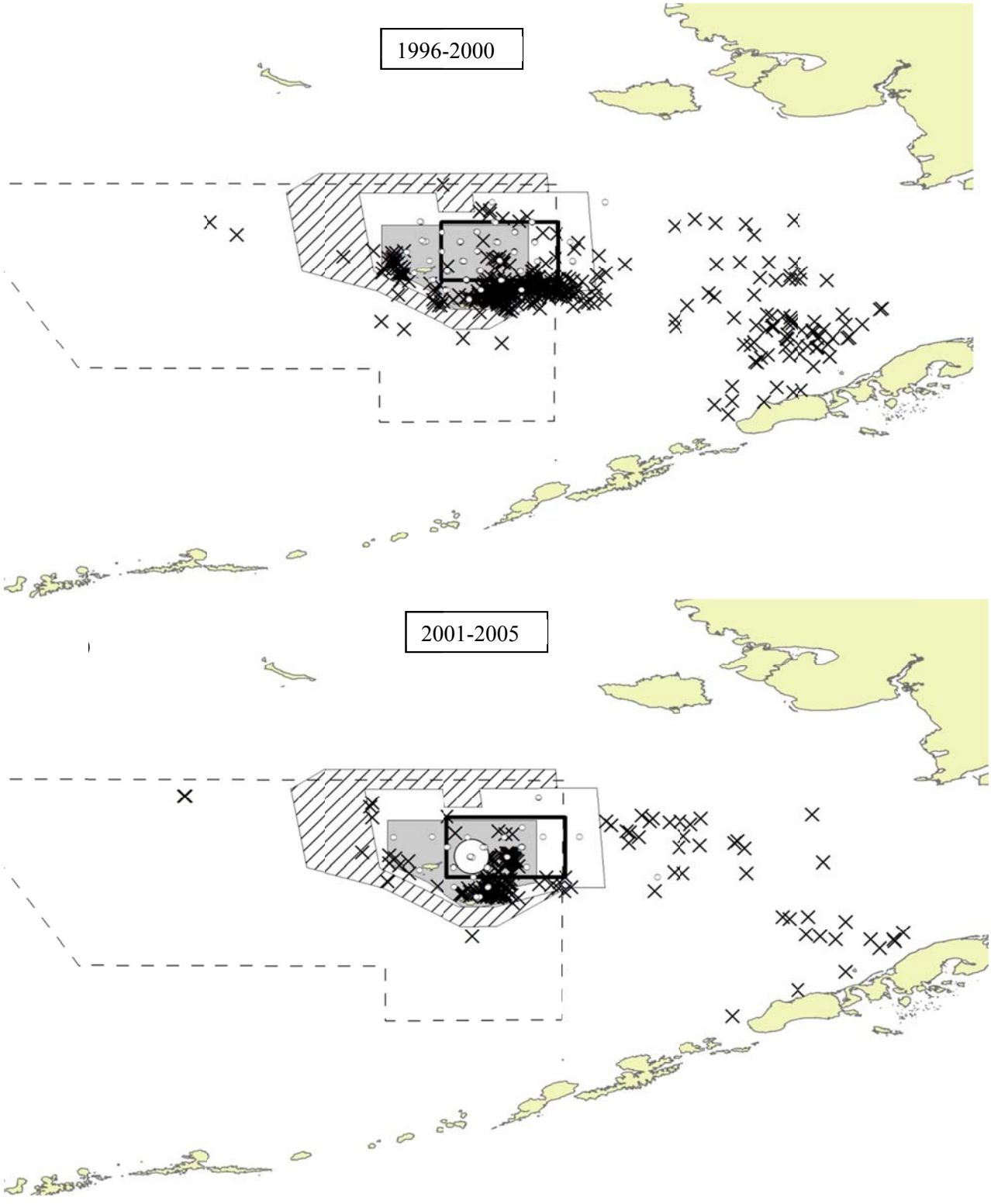
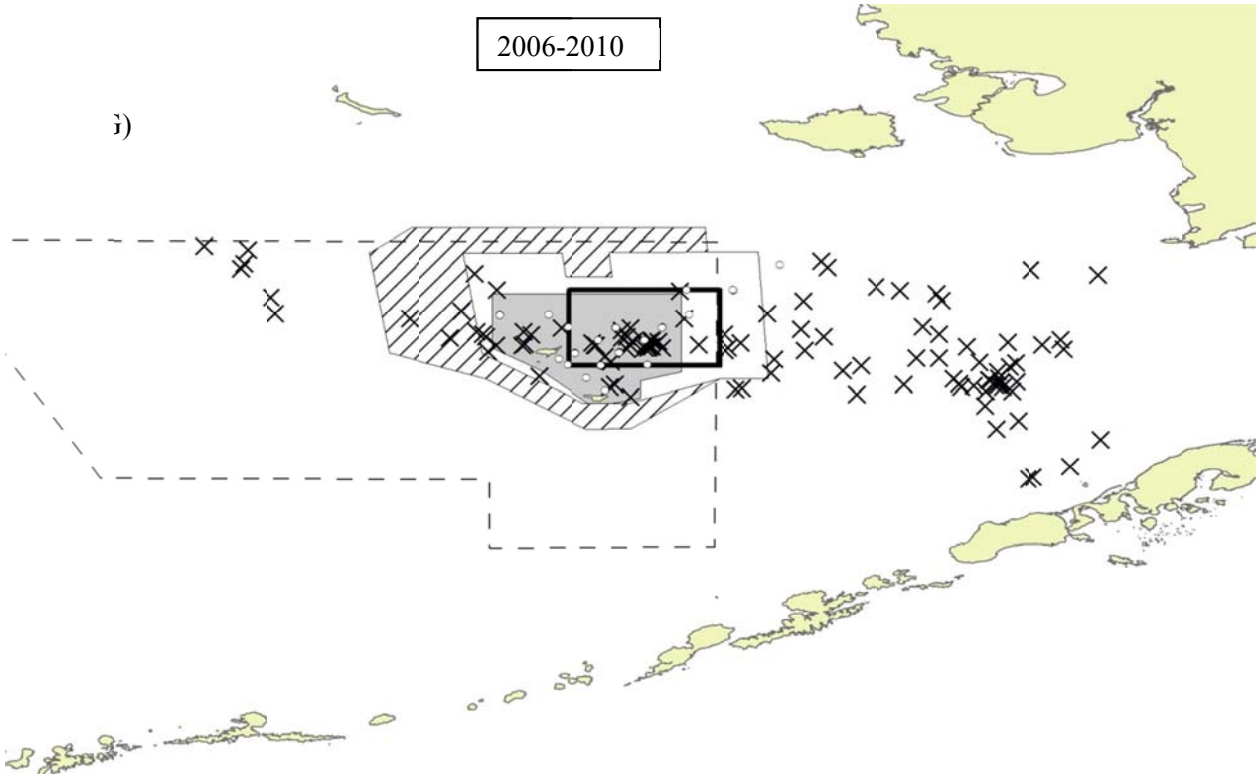


Figure 10-6 The distribution of survey data (open circles: smallest=30-5,000 crab/nm2; largest=21,000-26,000 crab/nm2) and observed bycatch locations (X) of blue king crab in the Pribilof Islands management district (dashed region) and the Bristol Bay District to the east in 5 year intervals from 1976 to 2010 (A-G). Also shown are the four alternative regions.


1986-1990
1991-1995


1996-2000
2001-2005


2006-2010

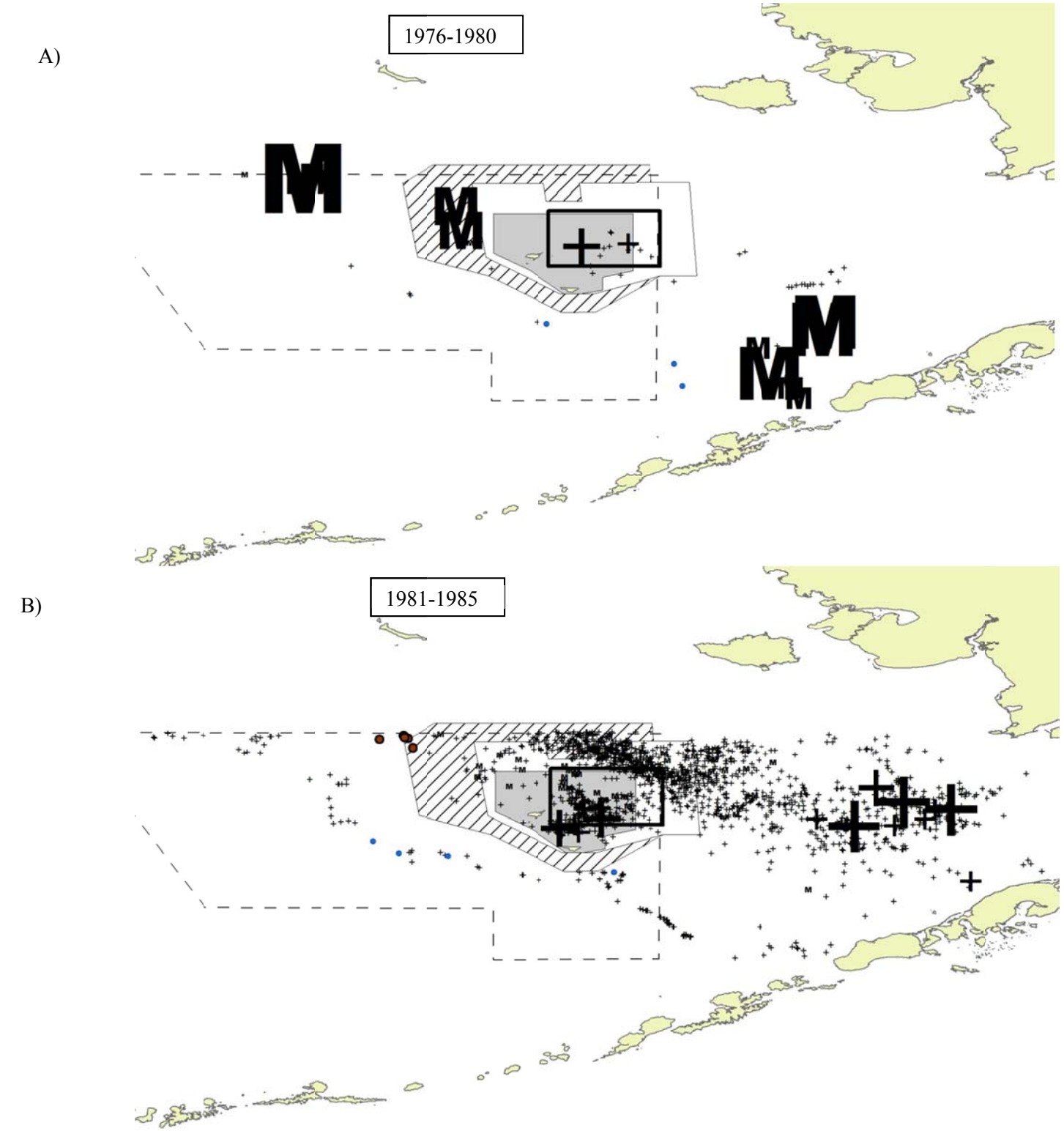
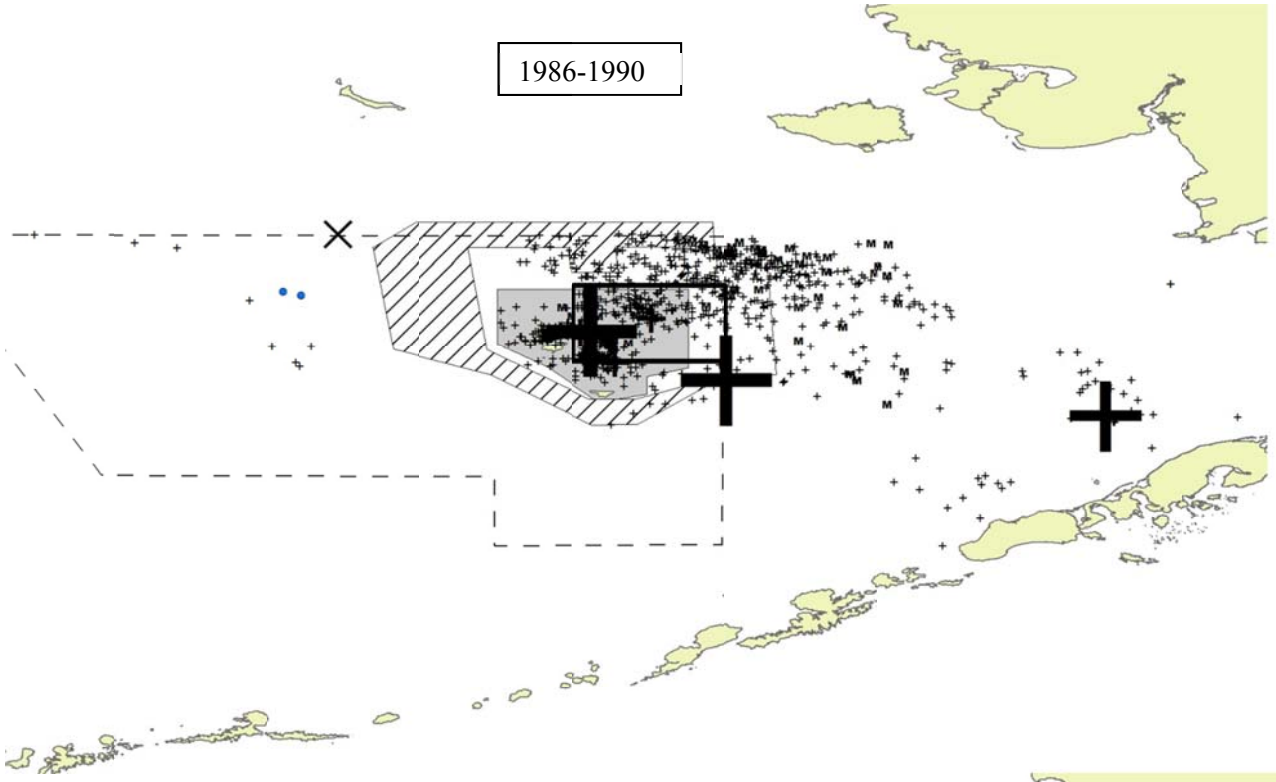


Figure 10-7 **The distribution of observed bycatch of blue king crab in the Pribilof Islands management district (dashed region) and the Bristol Bay District to the east in 5 year intervals between 1976 and 2010 (A-G) by gear type (longline=circles, non-pelagic trawl=cross, pelagic trawl=x, pot=triangle) where the smallest symbol equals 1-200 observed crabs and the largest symbol equals 800-1000 observed crabs. Between 1976 and 1990, gear type data is unavailable so vessel type is used to discern gear used. In these years M refers to mothership.**



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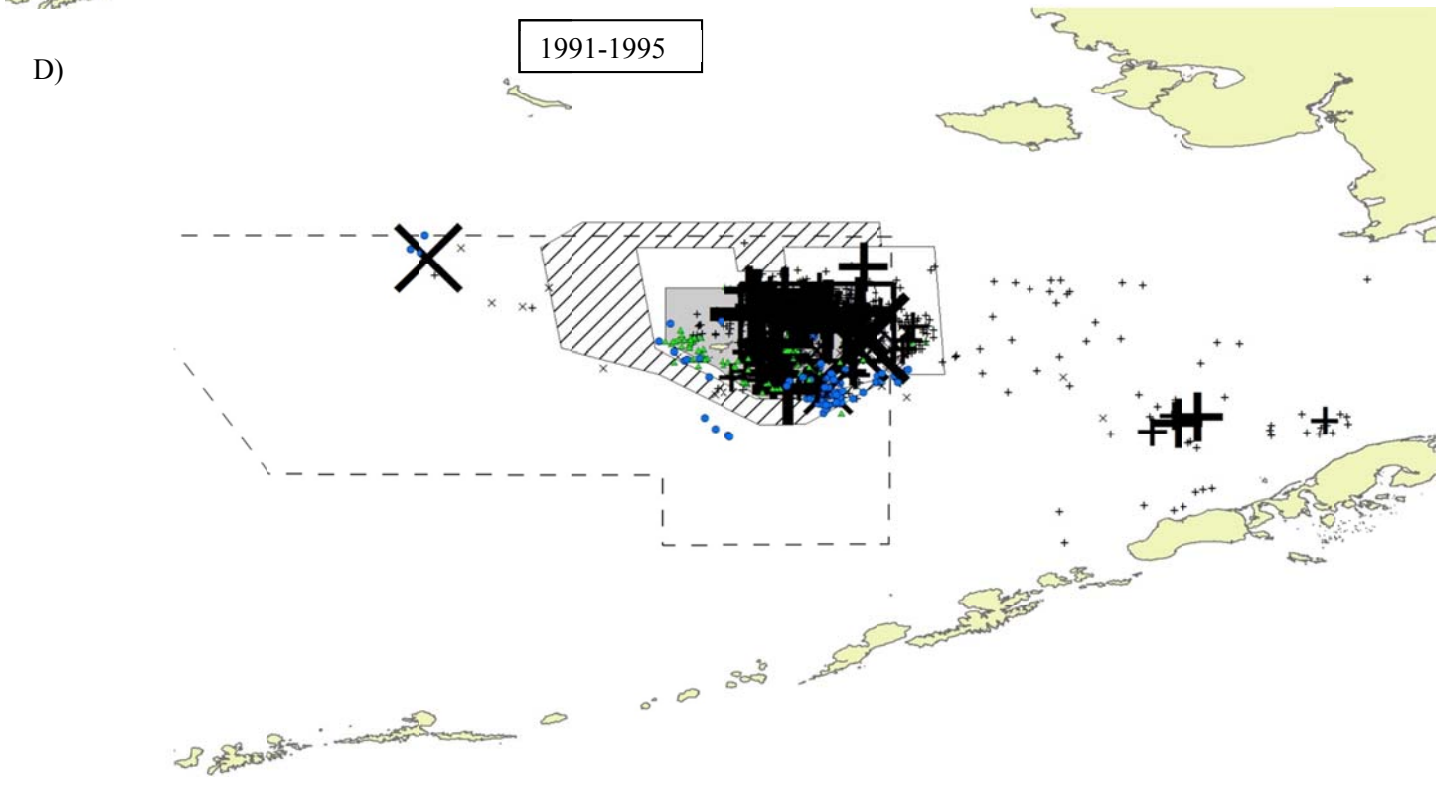

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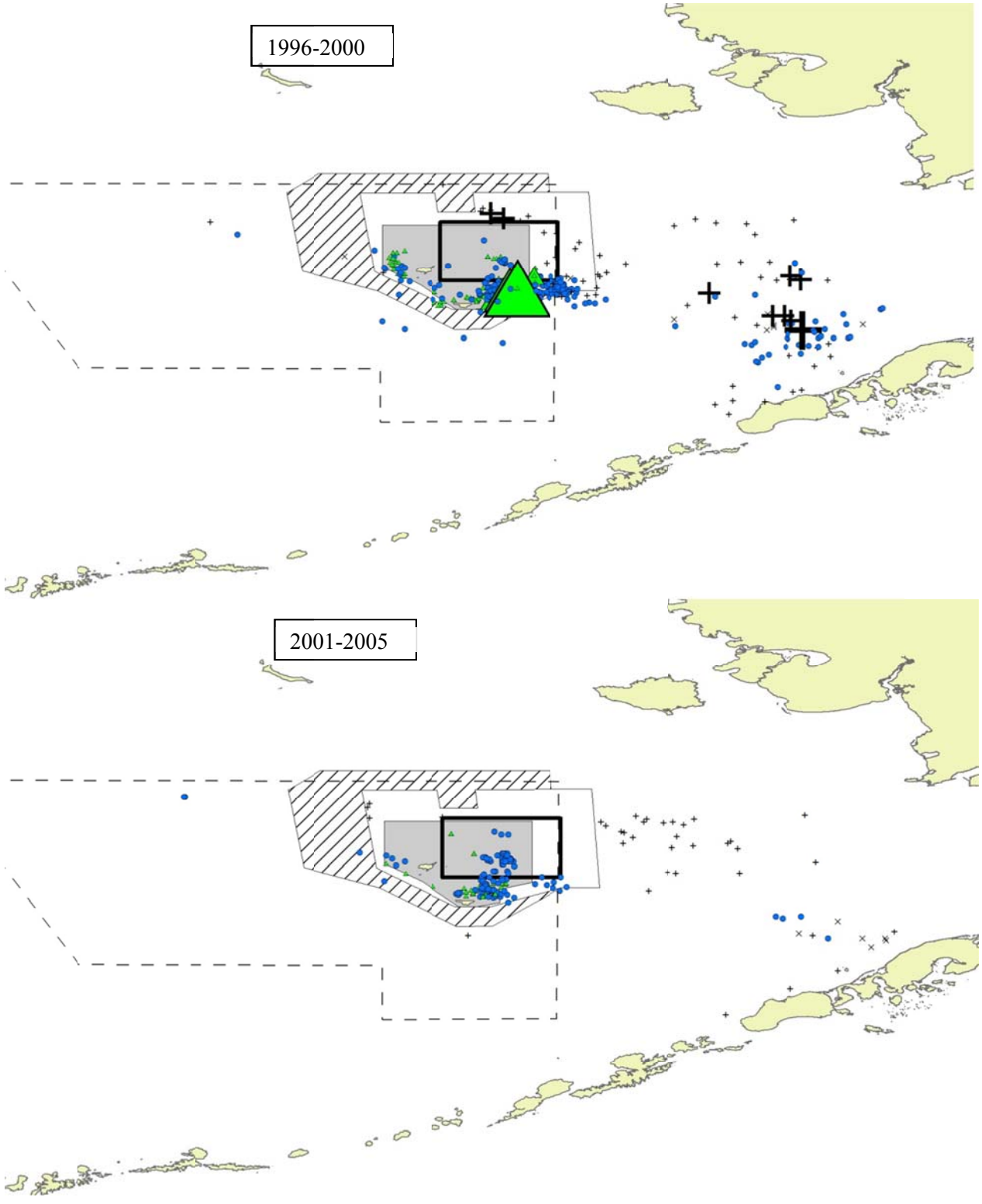

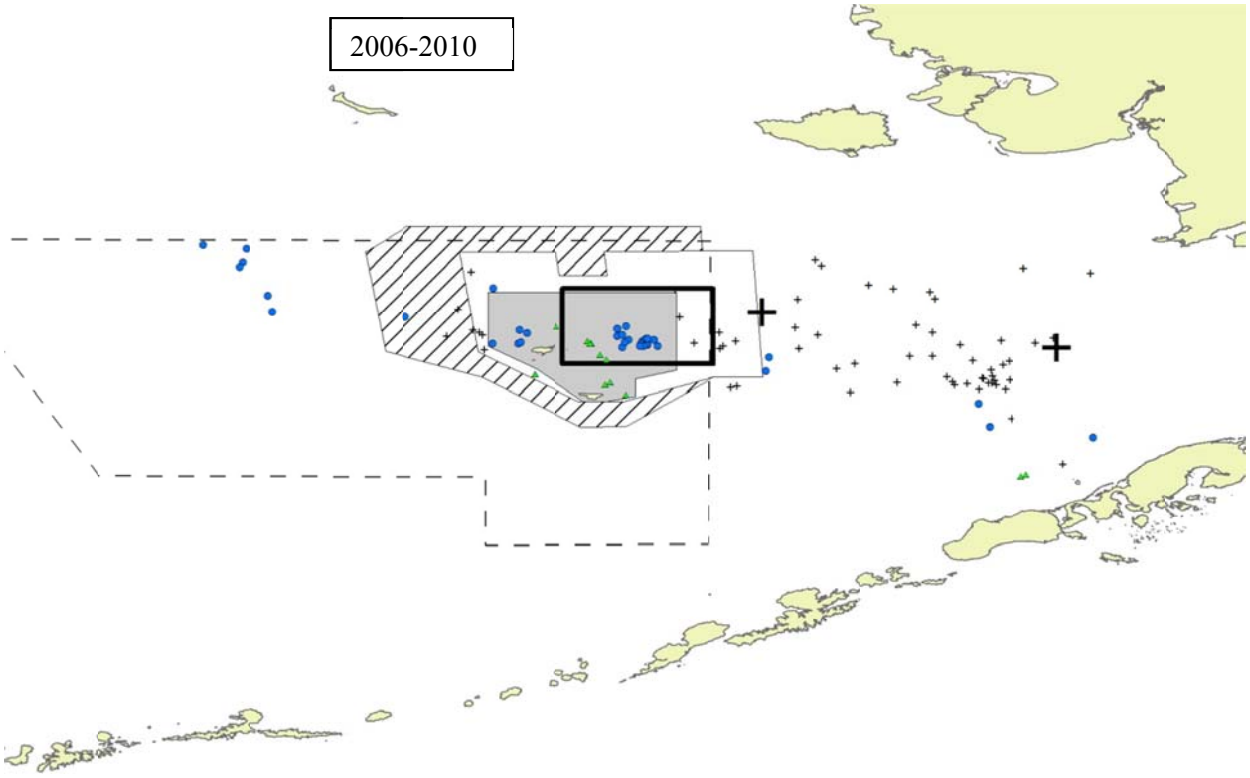
2006-2010

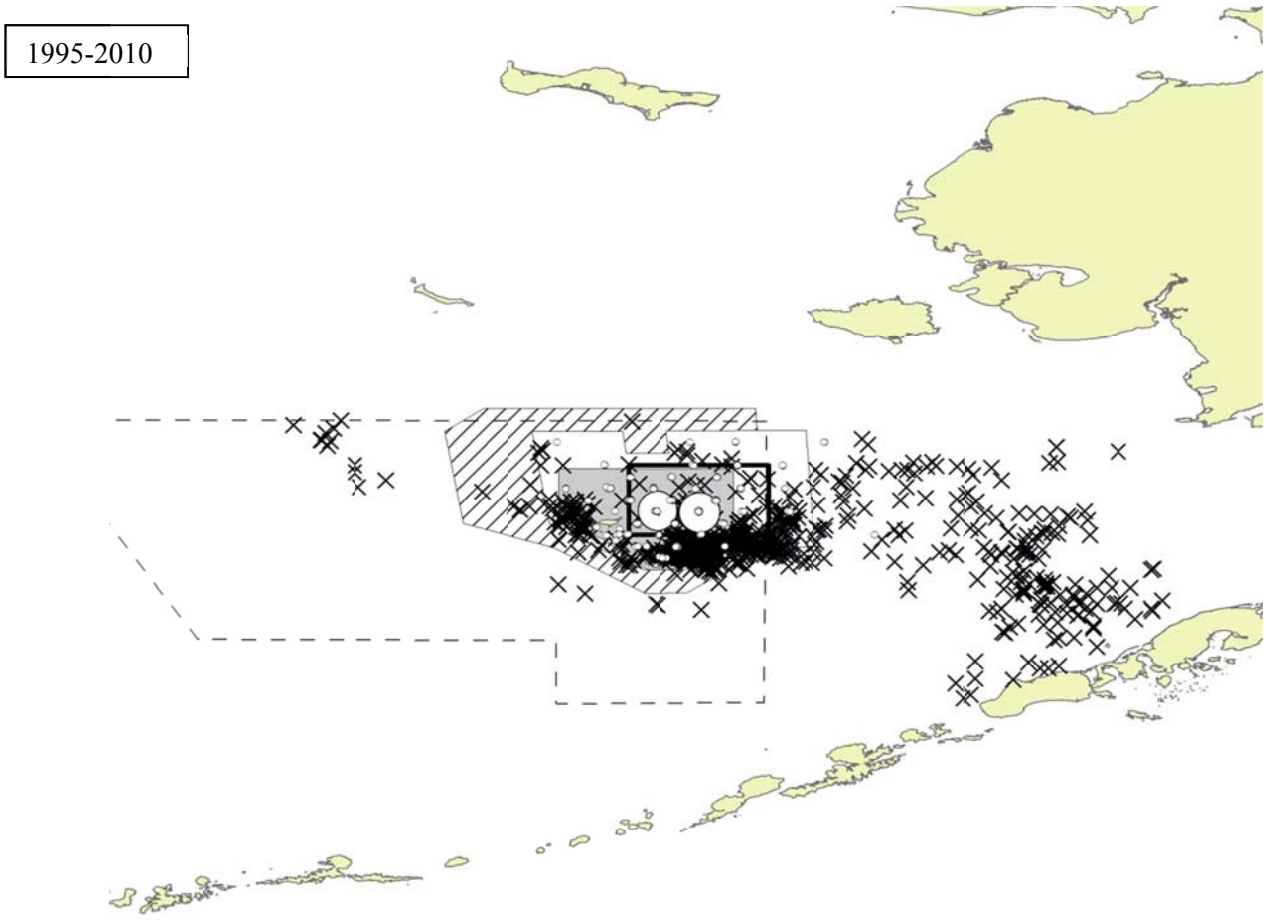

Figure 10-8 The distribution of survey data (open circles: smallest=30-5,000 crab/nm^2; largest=21,000-26,000 crab/nm^2) and observed bycatch locations (X) of blue king crab in the Pribilof Islands management district (dashed region) and the Bristol Bay District to the east between 1995 and 2010, years after the PIHCZ no trawl zone was implemented.

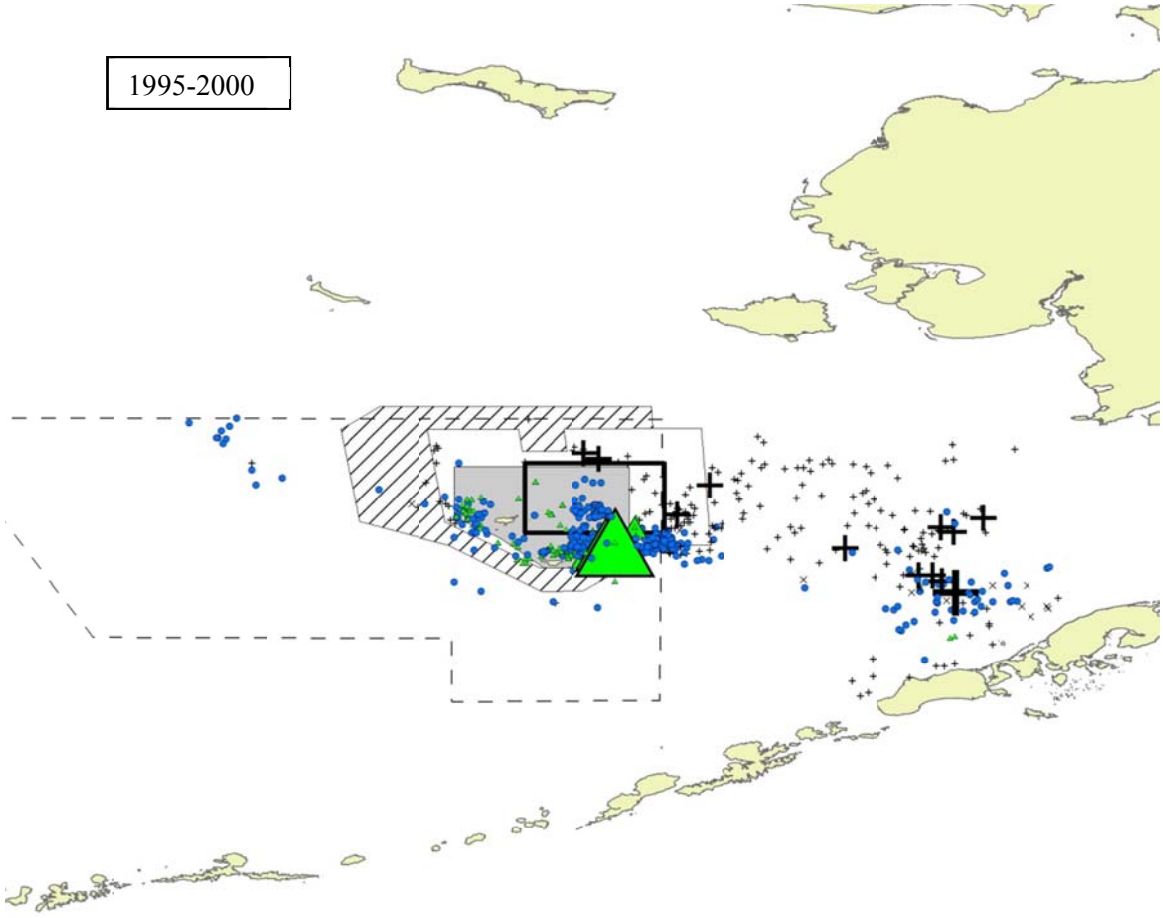

Figure 10-9 **The breakdown of the observed bycatch by gear type (longline=circles, non-pelagic trawl=cross, pelagic trawl=x, pot=triangle) where the smallest symbol equals 1-200 observed crabs and the largest symbol equals 800-1000 observed crabs. The data is aggregated from the time of the trawling ban in the PIHCZ from 1995 to 2010.**

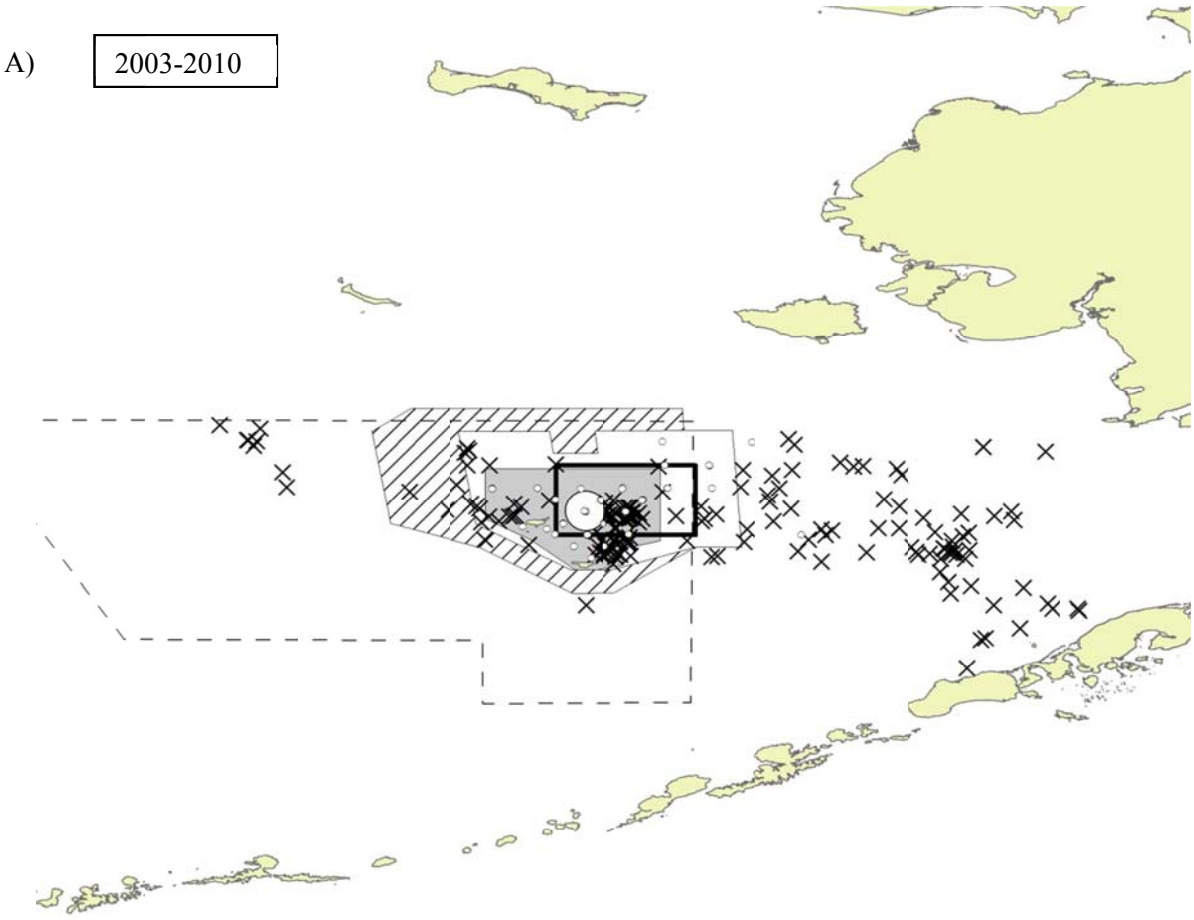

Figure 10-10 The distribution of survey data (open circles: smallest=30-5,000 crab/nm^2; largest=21,000-26,000 crab/nm^2) and observed bycatch locations (X) of blue king crab in the Pribilof Islands management district (dashed region) and the Bristol Bay District to the east between 2003 and 2010, years after the Pribilof Islands blue king crab stock was declared overfished.

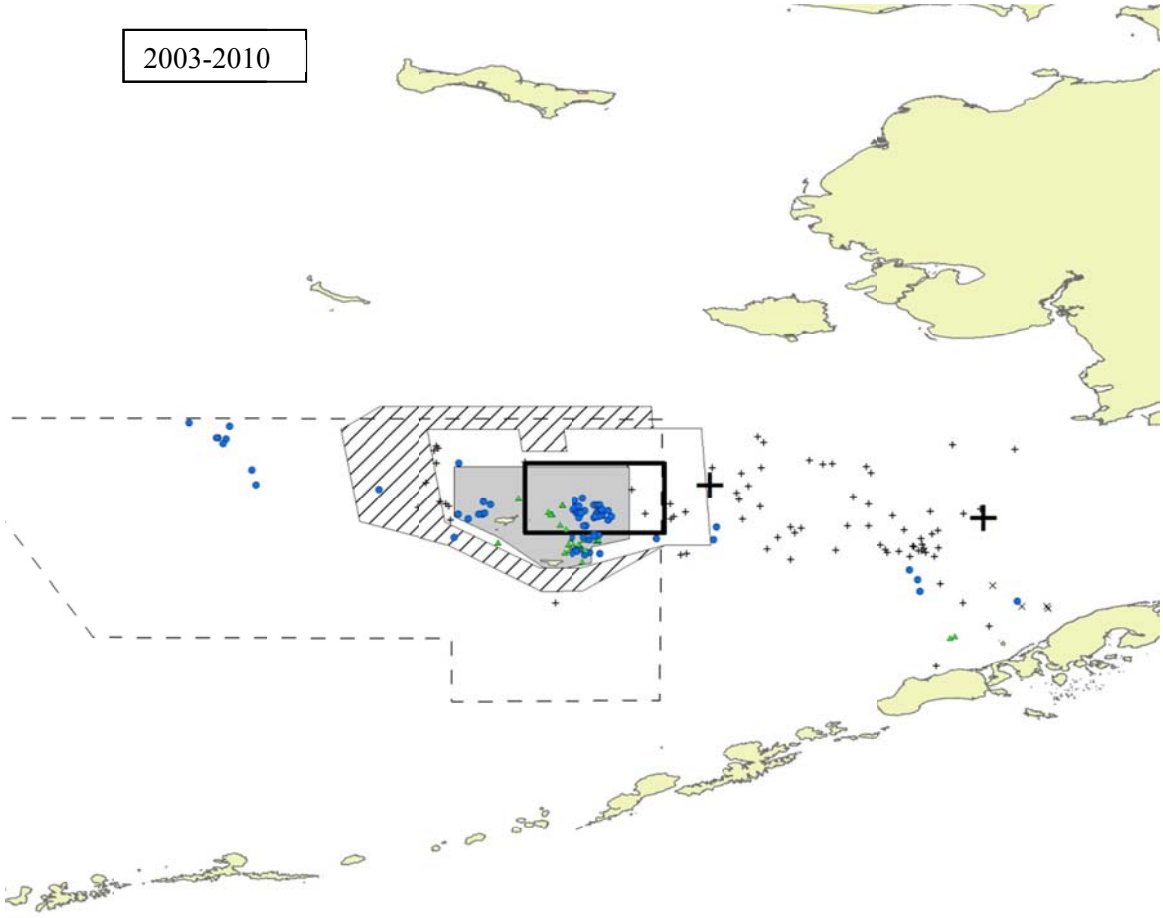

Figure 10-11 The breakdown of the observed bycatch by gear type (longline=circles, non-pelagic trawl=cross, pelagic trawl=x, pot=triangle) where the smallest symbol equals 1-200 observed crabs and the largest symbol equals 800-1000 observed crabs. The data is aggregated from the time of the overfished declaration for Pribilof Islands blue king crab 2003 to 2010.

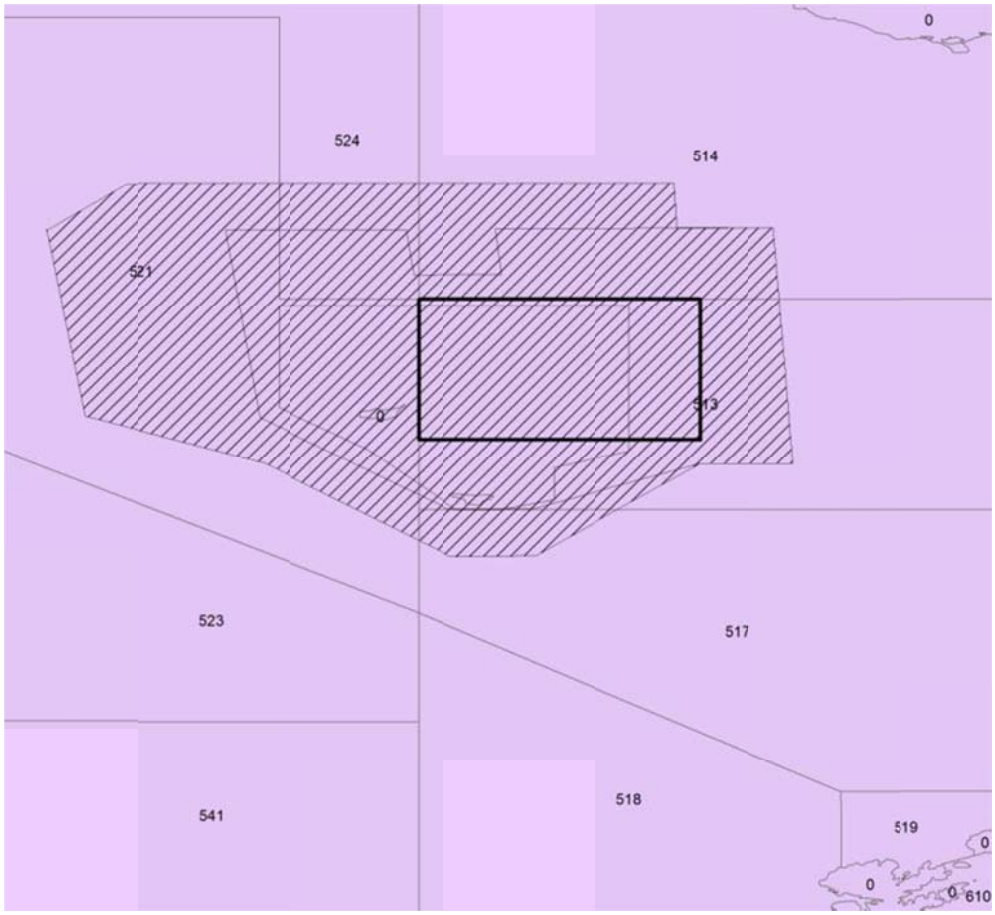

Figure 10-12 Proposed closures overlaid on National Marine Fisheries Service federal reporting areas. Note as an interim measure for the assessment determination of overfishing annually for bycatch accrual currently only Area 513 is counted.

Figure 10-13 Proposed closures overlaid on Alaska Department of Fish and Game Stat areas.

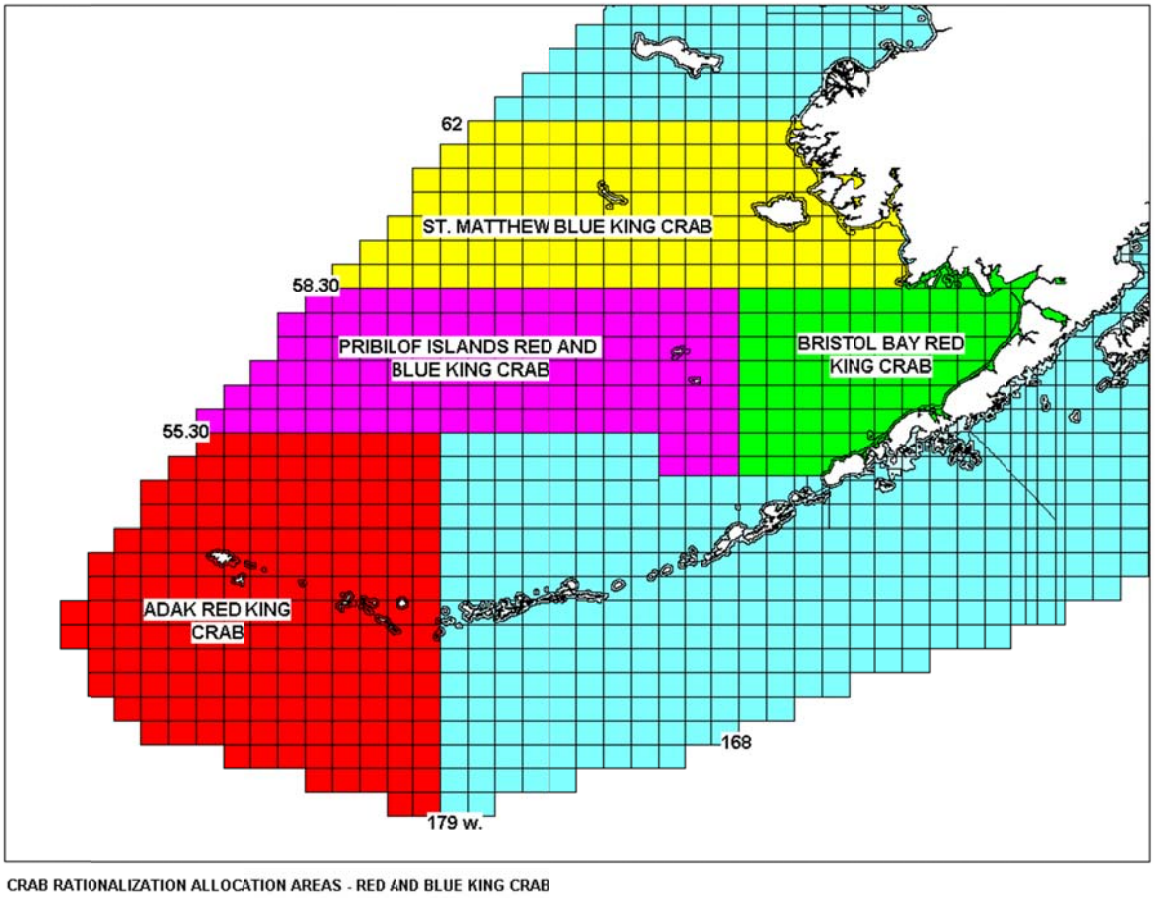

Figure 10-14 Crab Rationalization Allocation areas showing geographic extent of Pribilof Islands stocks in regulation.

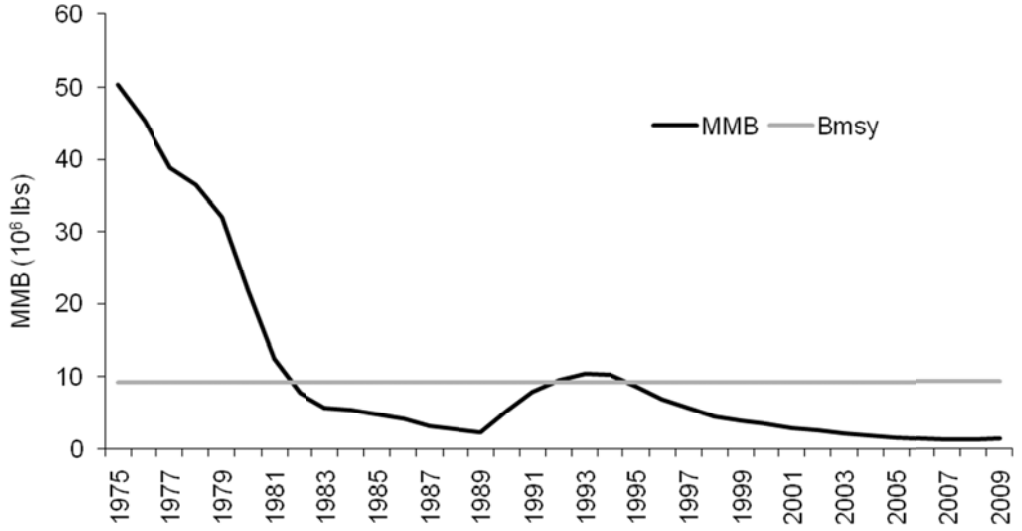

Figure 10-15 Estimated mature male biomass (MMB) time series relative to the current B_{MSY} based on mean mature male biomass from 1980-1984 and 1990-1997.

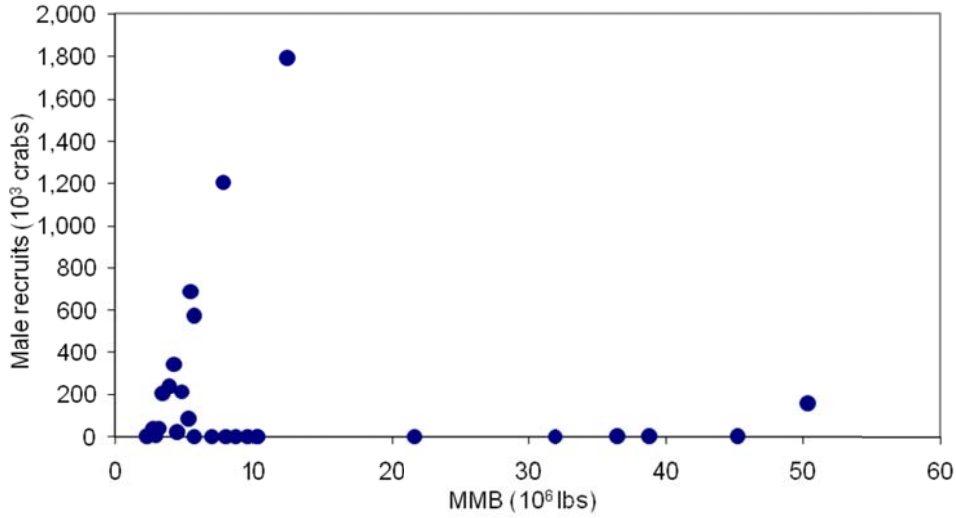

Figure 10-16 Model estimated male recruits relative to mature male biomass (MMB) from 1975 to 2009.

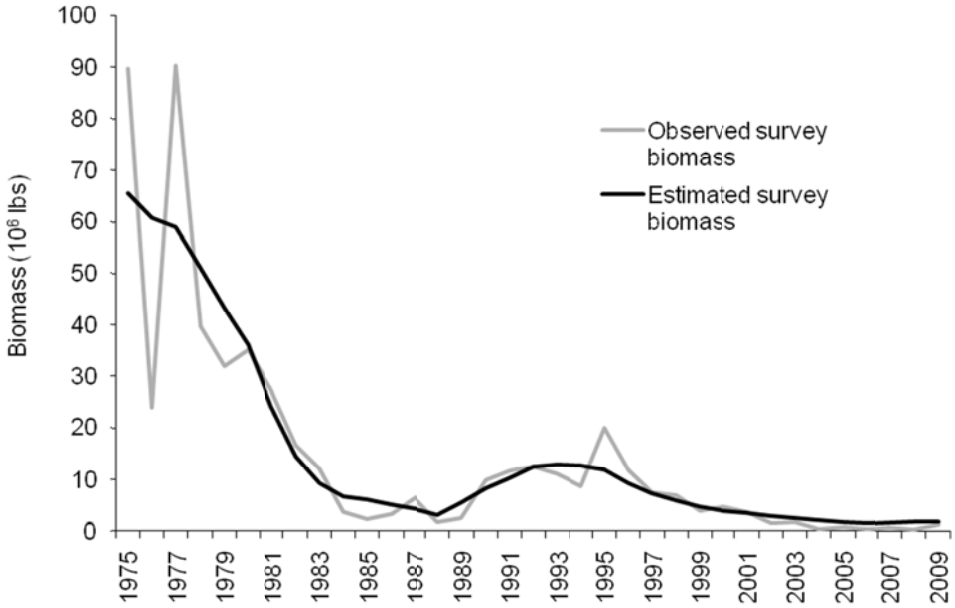

Figure 10-17 Time series comparison of estimated survey biomass from the Catch Survey Assessment model and observed survey biomass based on area swept estimate.

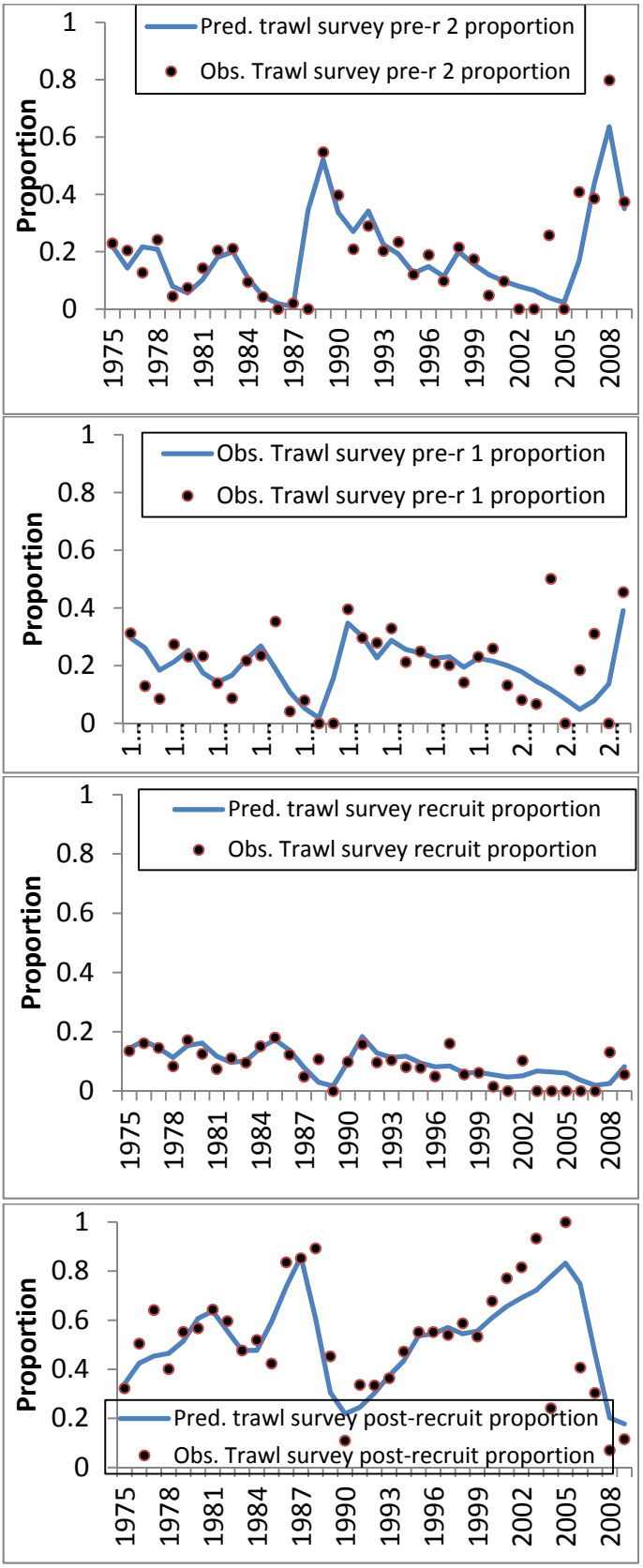

Figure 10-18 Predicted and observed time series of bottom trawl survey size class stage proportions from 1975 to 2009.

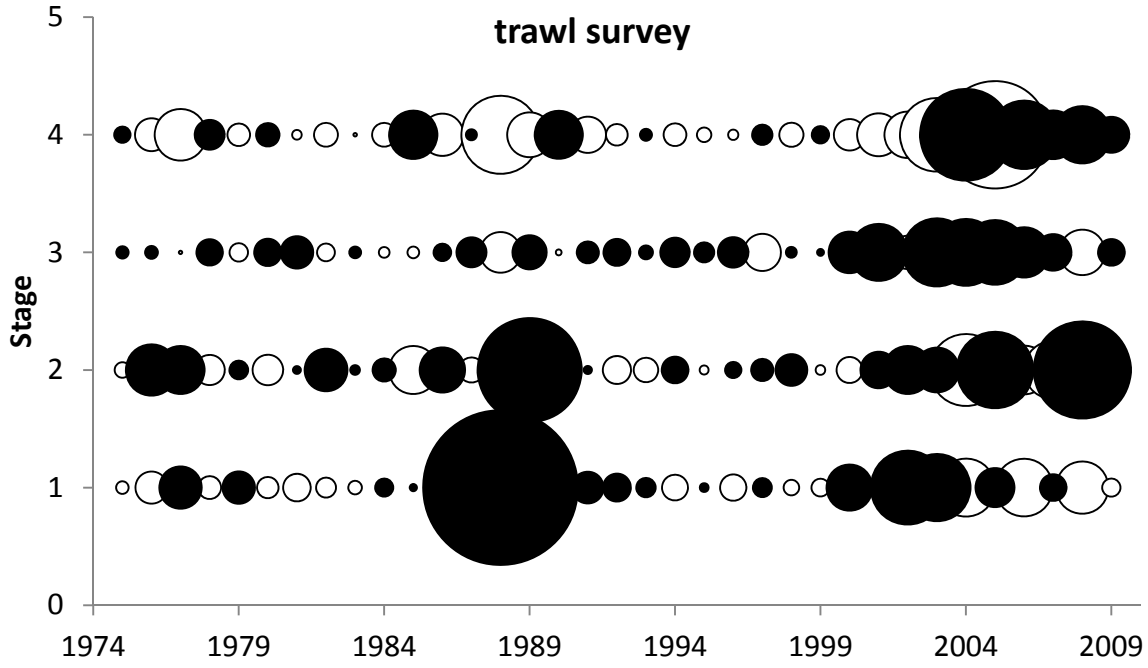

Figure 10-19 Residuals of predicted and observed time series of bottom trawl survey size class stage proportions from 1975 to 2009.

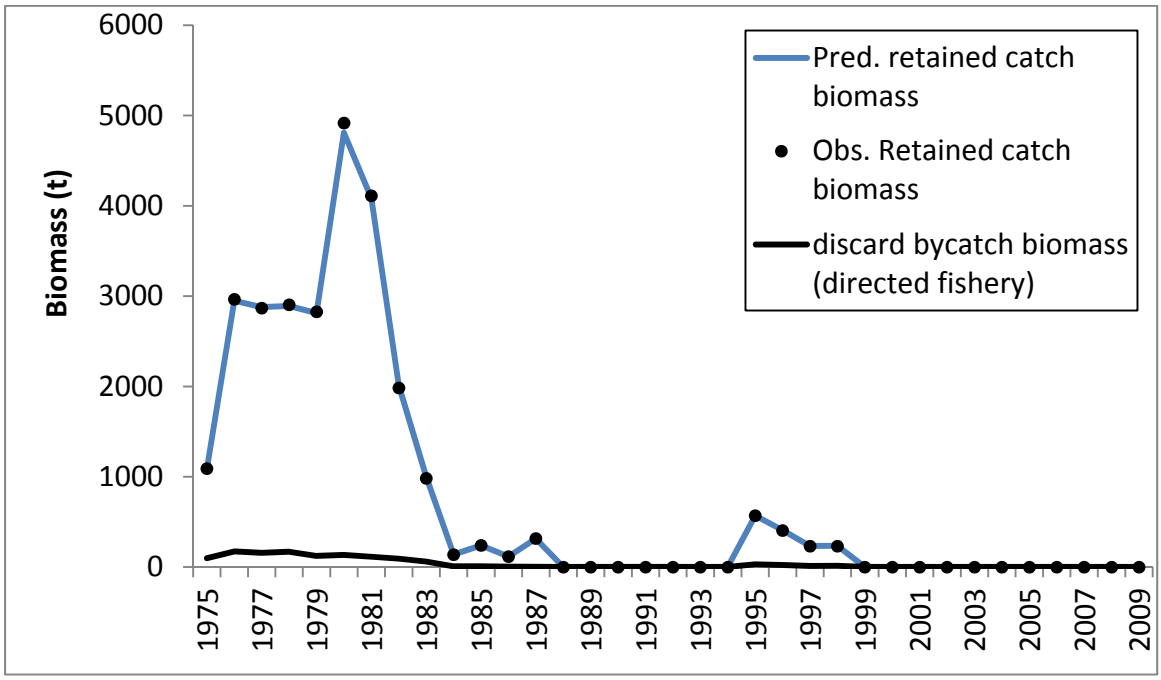

Figure 10-20 Predicted and observed time series of total retained catch biomass from 1975 to 2009. Discard bycatch biomas suring the retained fishery also included for comparison.

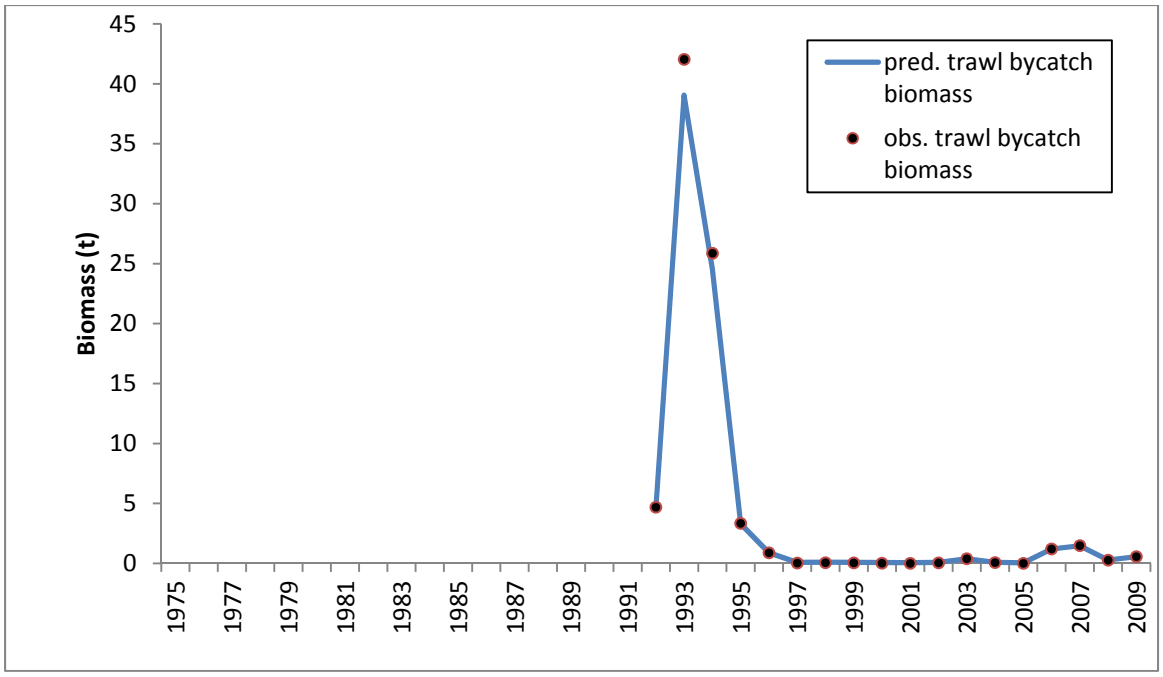

Figure 10-21 Predicted and observed time series of bottom trawl bycatch total biomass from 1992 to 2009.

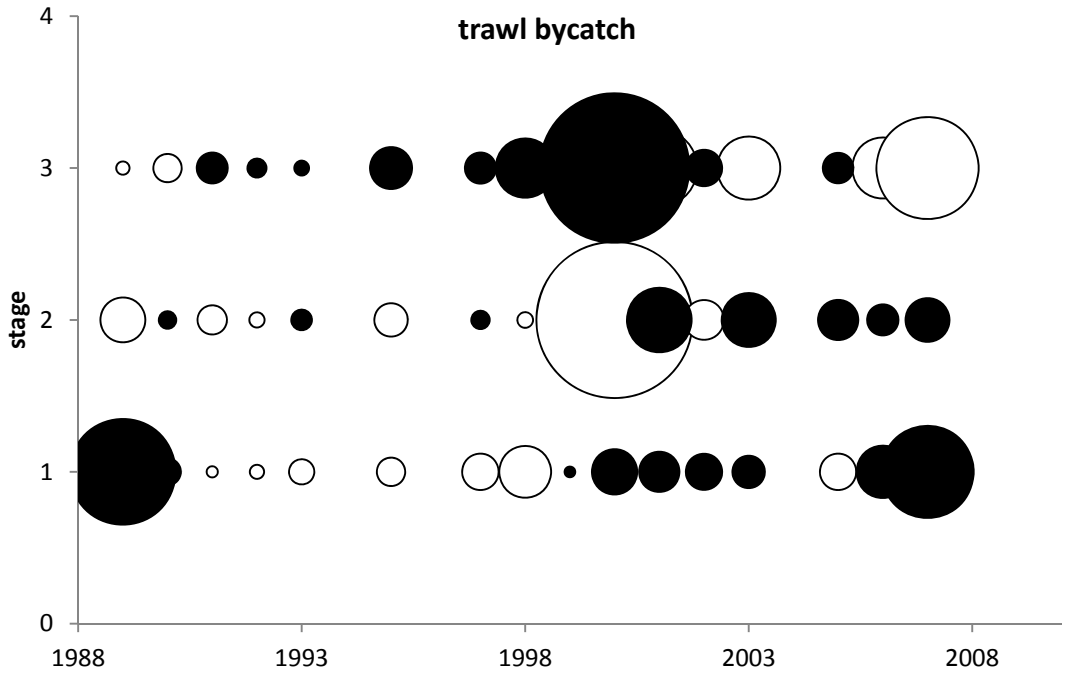

Figure 10-22 Residuals of predicted and observed time series of bottom trawl bycatch size class stage proportions from 1989 to 2009.

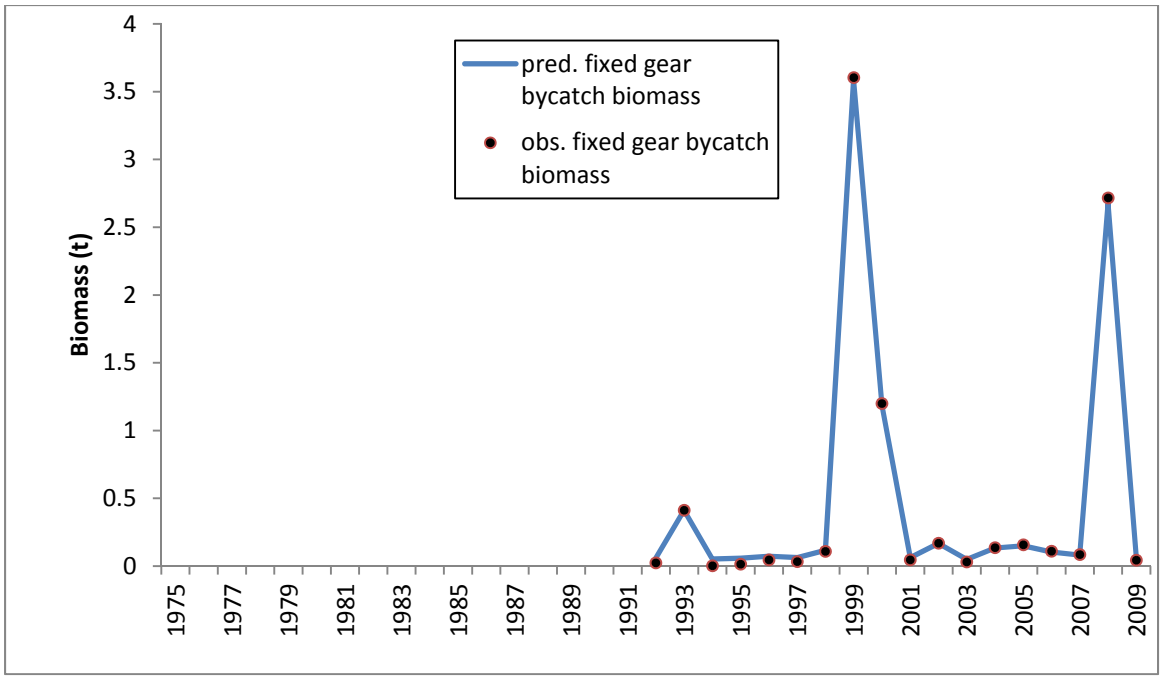

Figure 10-23 Predicted and observed time series of fixed gear bycatch total biomass from 1992 to 2009.

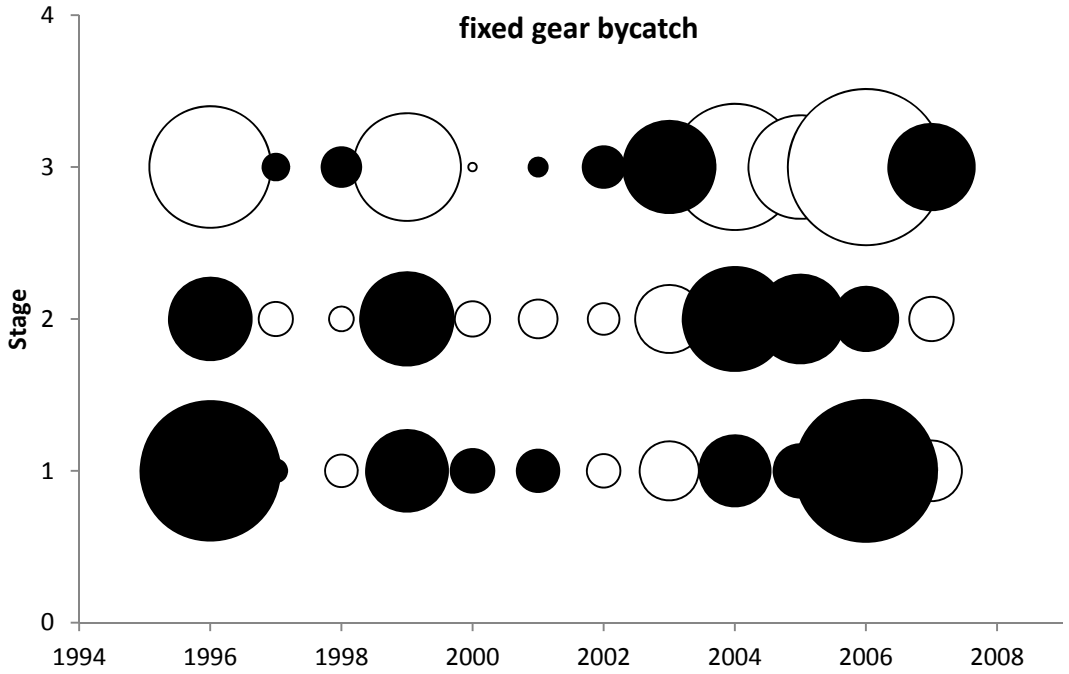

Figure 10-24 Residuals of predicted and observed time series of fixed gear bycatch size class stage proportions from 1996 to 2009.

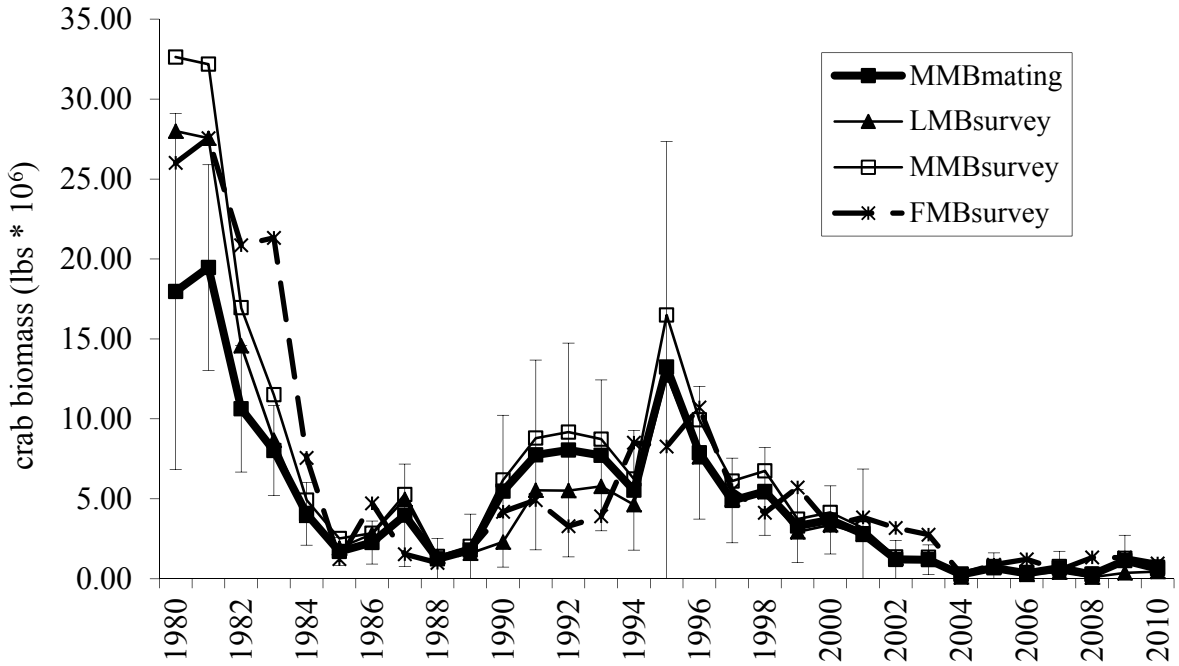

Figure 10-25 Historical trends of Pribilof Islands blue king crab mature male biomass (MMB, 95% CI), mature female biomass (FMB), and legal male biomass (LMB) estimated from the NMFS annual EBS bottom trawl survey.

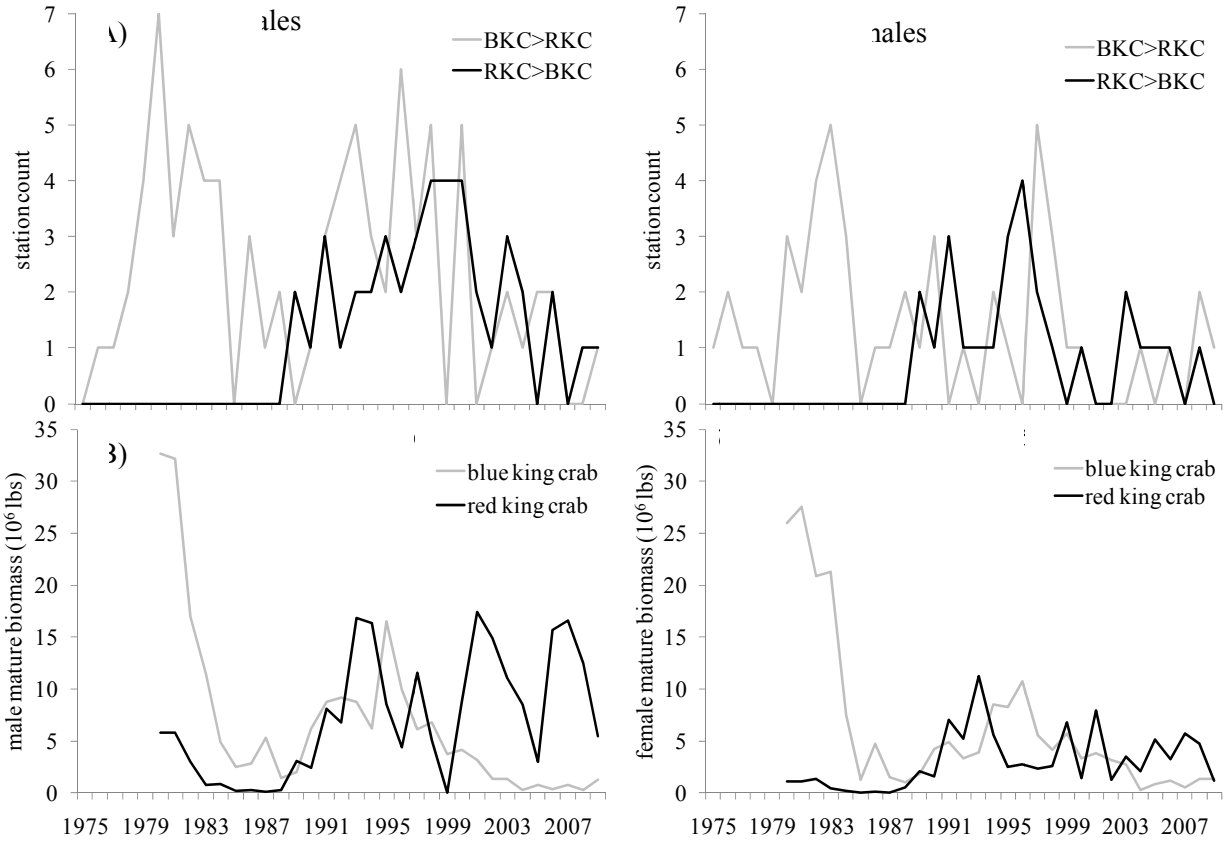

Figure 10-26 Time series of overlap between blue king crab and red king crab for males and females in the eastern Bering Sea showing A) the number of stations with blue king crab (BKC) or red king crab (RKC) as the dominant species and B) the mature biomass of both species.

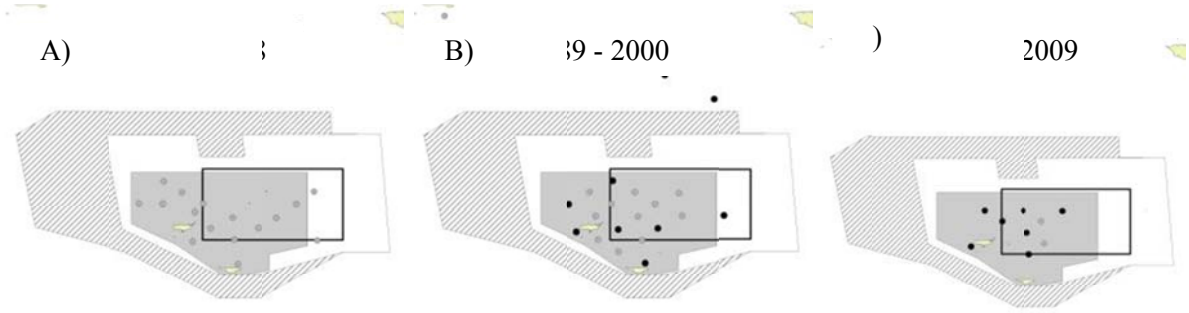

Figure 10-27 Spatial distribution of stations where there is overlap between blue king crab and red king crab males showing the dominant species (blue king crab=gray circles; red king crab=black circles) corresponding to time periods of major changes in biomass of both species.

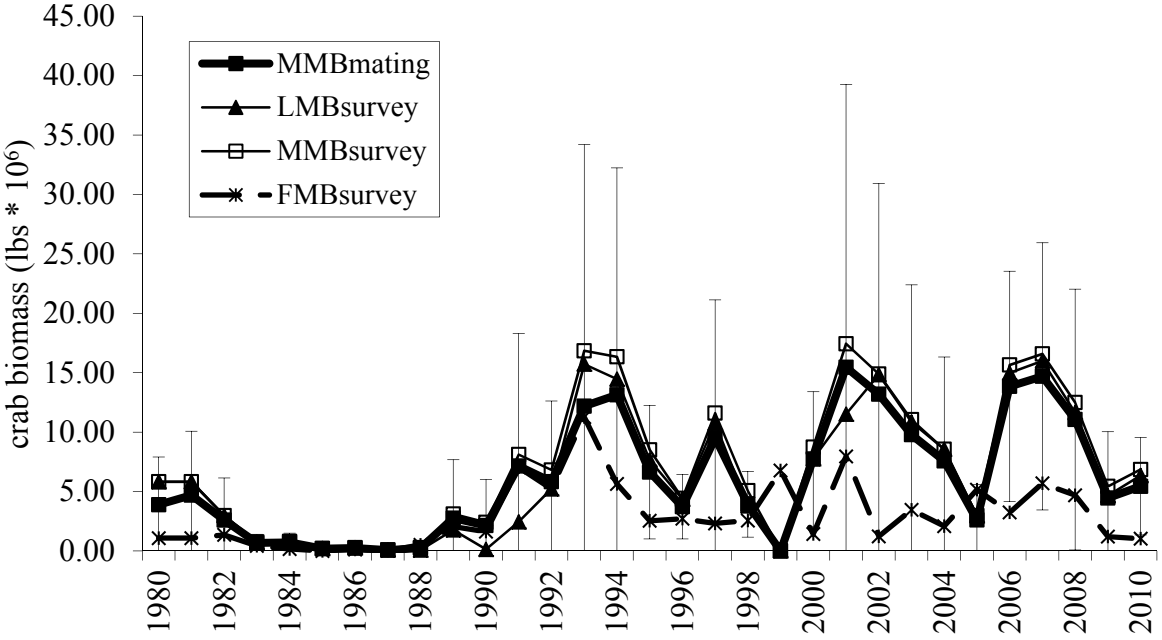

Figure 10-28 Historical trends of Pribilof Island red king crab mature male biomass (MMB, 95% C.I.), mature female biomass (FMB), and legal male biomass (LMB) estimated from the National Marine Fisheries Service annual eastern Bering Sea bottom trawl survey.

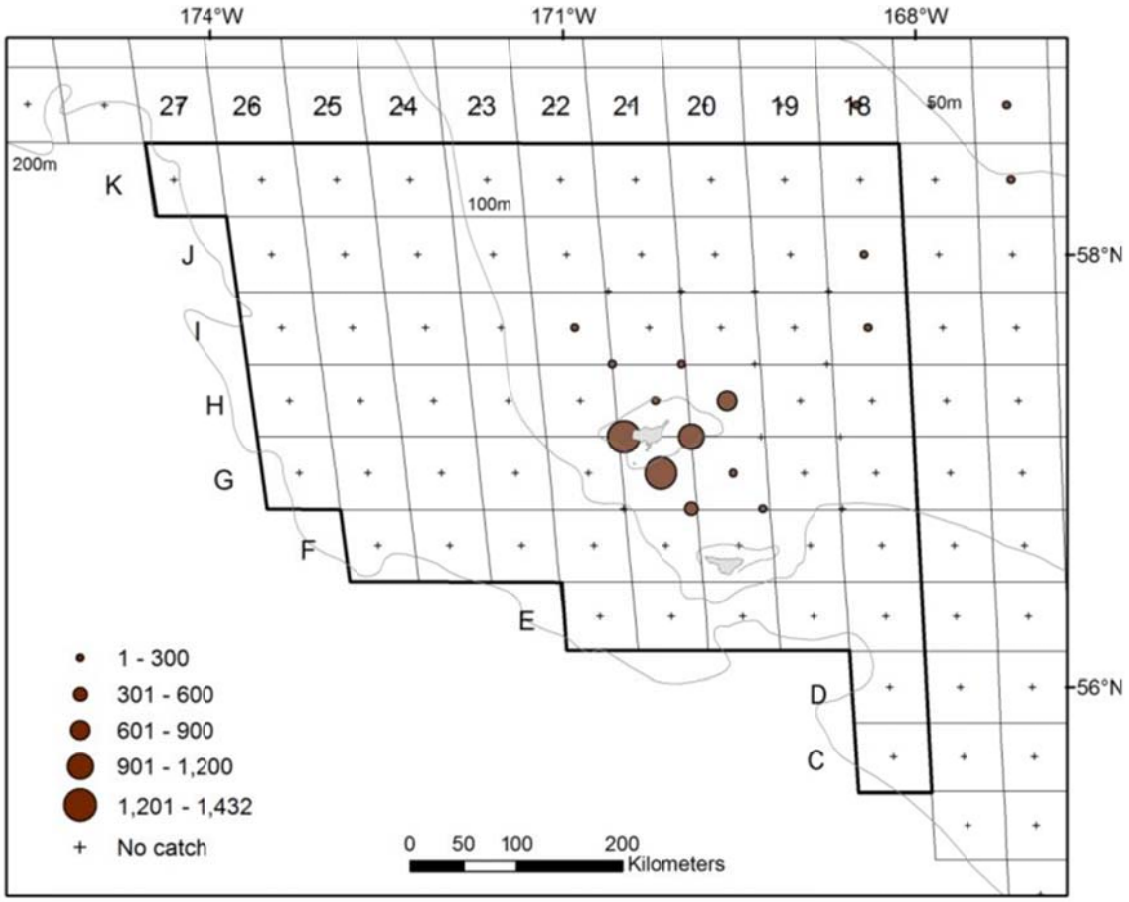

Figure 10-29 Total density (number/nm^2) of red king crab in the Pribilof District in the 2010 eastern Bering Sea bottom trawl survey.

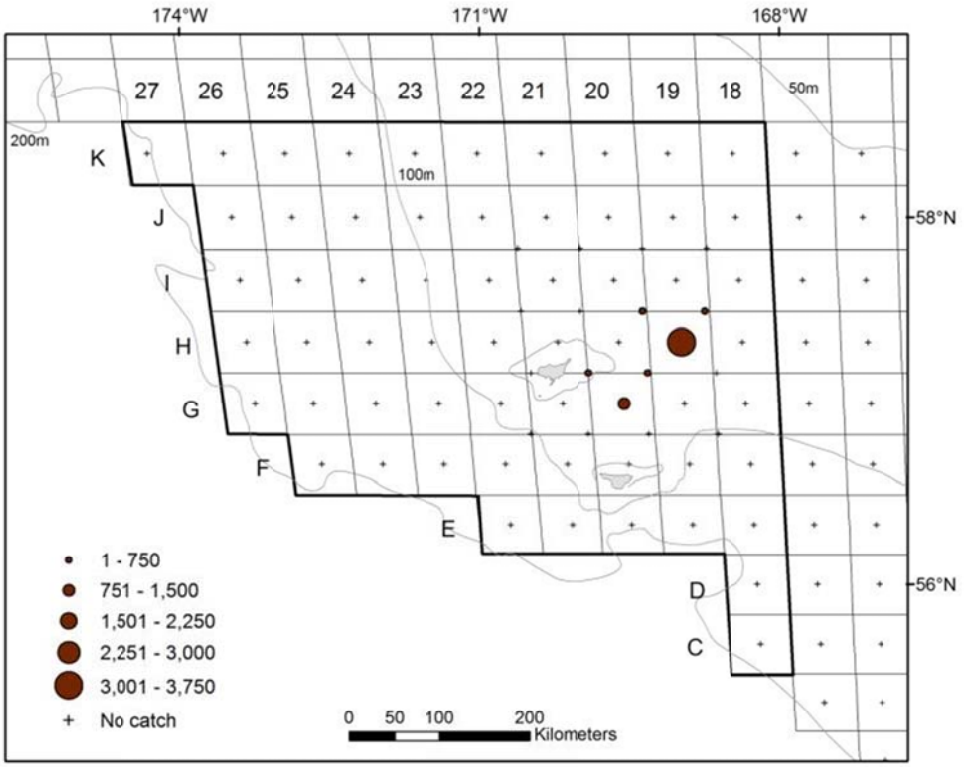

Figure 10-30 Total density (number/nm^2) of Pribilof Islands blue king crab in the 2009 eastern Bering Sea bottom trawl survey.

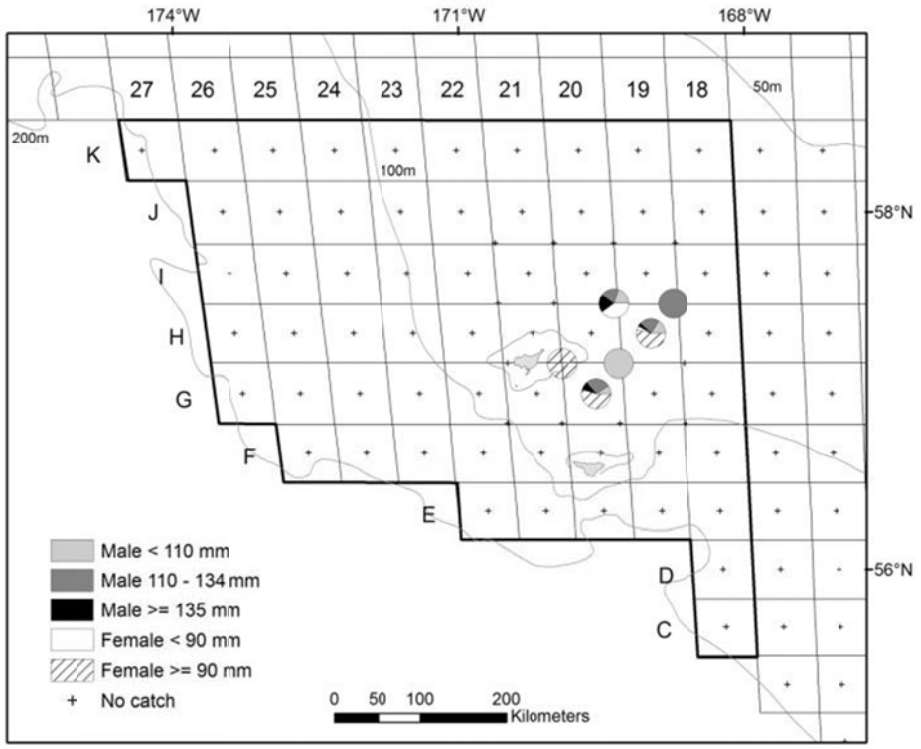

Figure 10-31 2009 eastern Bering Sea bottom trawl survey size class distribution of Pribilof Islands blue king crab.

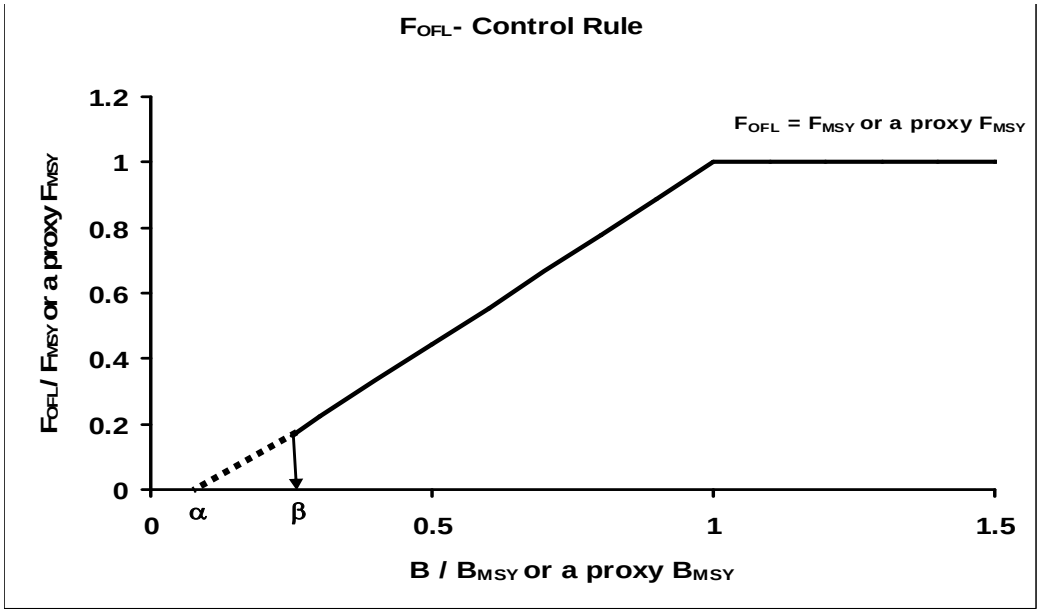

Figure 10-32 F_{OFL} Control Rule for Tier 4 stocks under Amendment 24 to the Bering Sea Aleutian Islands King and Tanner Crabs fishery management plan. Directed fishing mortality is set to 0 below β.

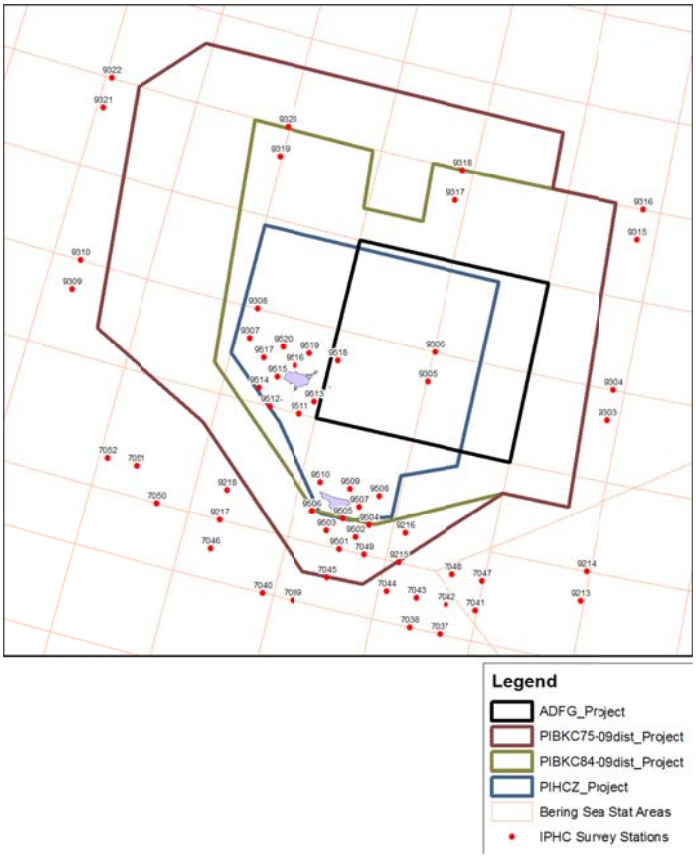

Figure 10-33 International Pacific Halibut Commission survey stations located within the proposed closure areas around the Pribilof Islands.

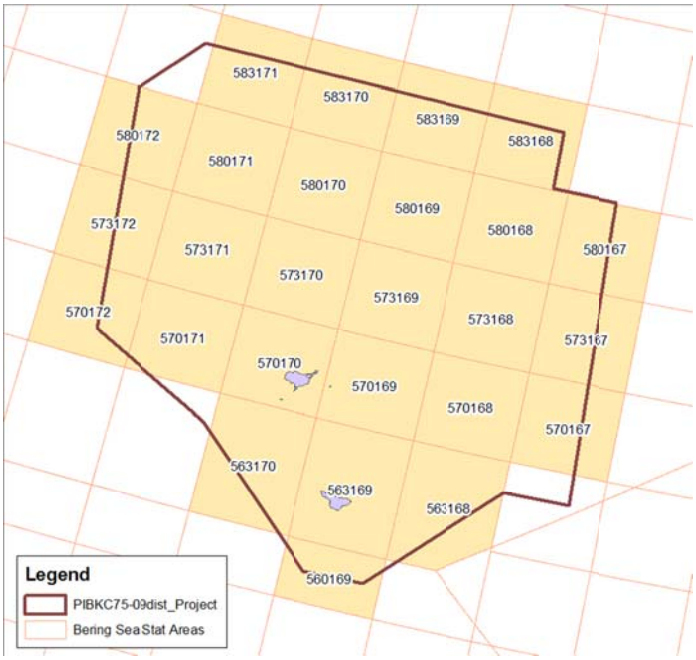

Figure 10-34 International Pacific Halibut Commission statistical areas located within the proposed closure areas around the Pribilof Islands.

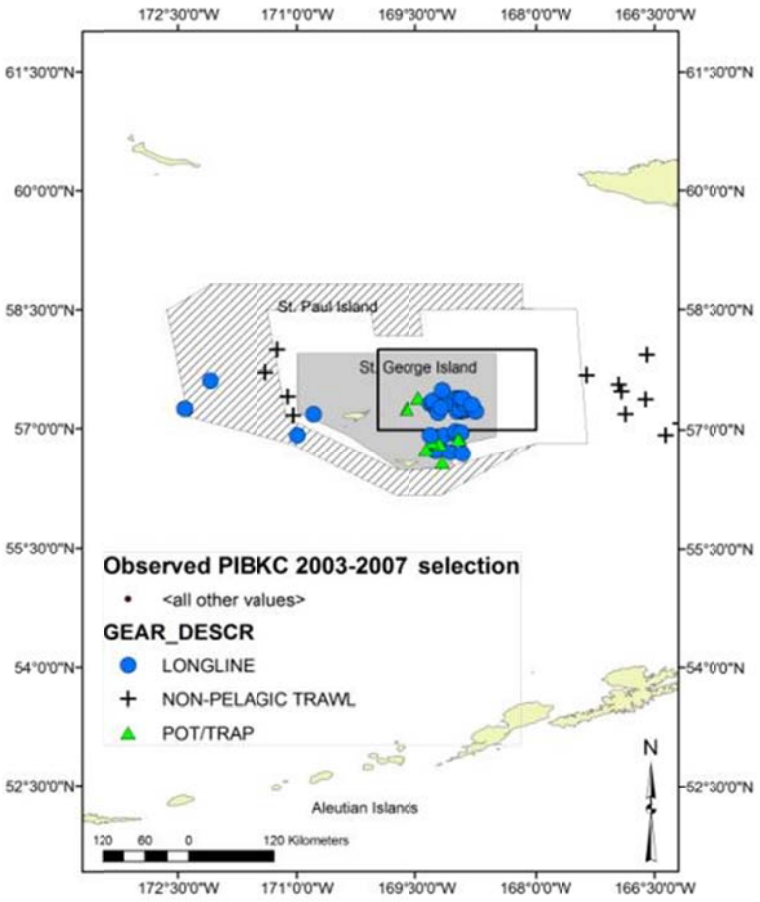

Figure 10-35 Distribution of 2003-2007 Pribilof Islands blue king crab (PIBKC) catches in groundfish fisheries relative to the four proposed closure areas based on alternatives.

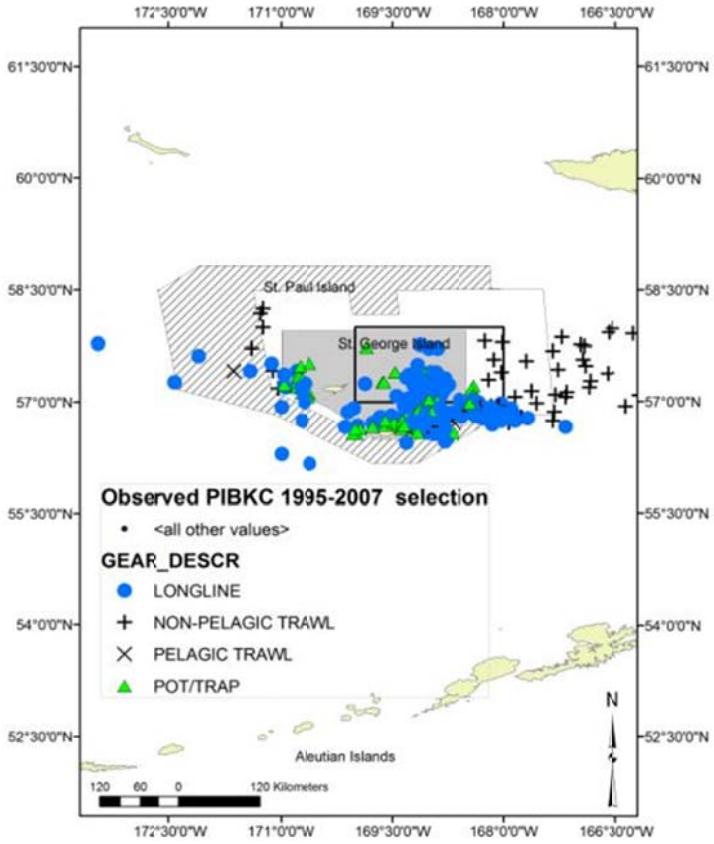

Figure 10-36 Distribution of 1995-2007 Pribilof Islands blue king crab (PIBKC) catches in groundfish fisheries relative to the four proposed closure areas based on alternatives.

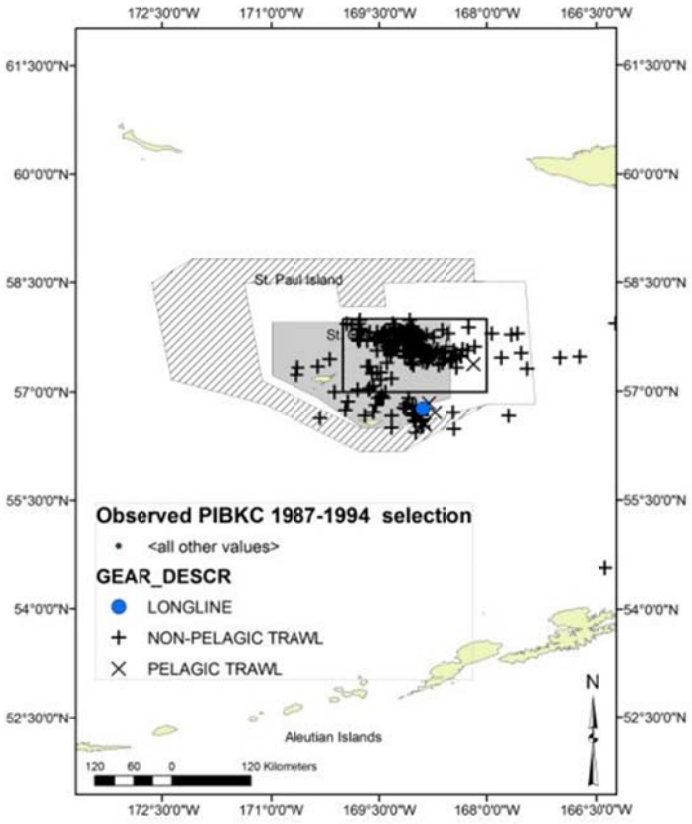

Figure 10-37 Distribution of 1987-1994 Pribilof Islands blue king crab (PIBKC) catches in groundfish fisheries relative to the four proposed closure areas based on alternatives.

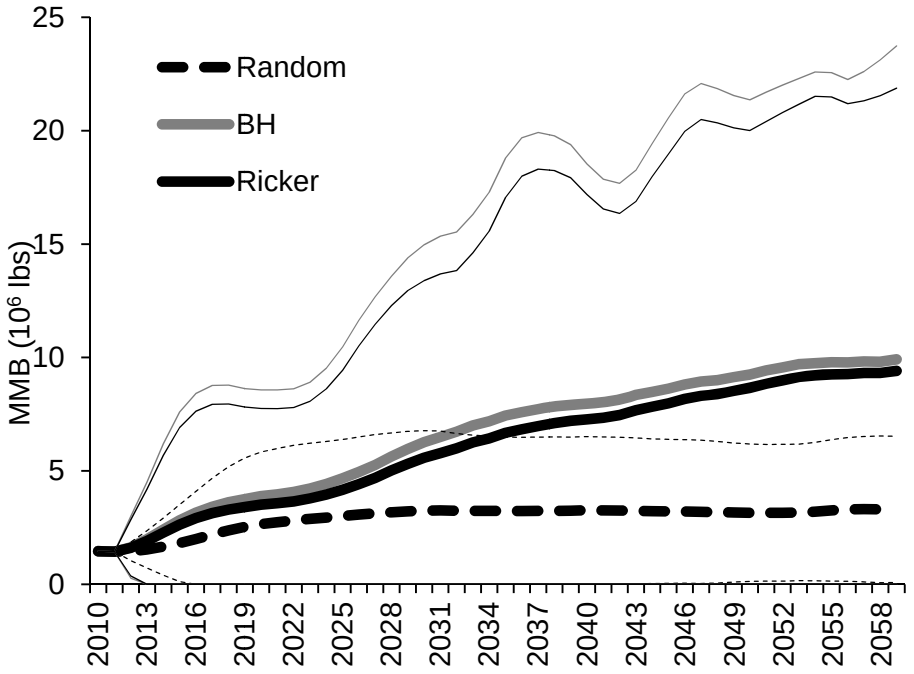

Figure 10-38 Projection estimates (± CI) of mature male biomass (MMB) based on random, Ricker, and Beverton-Holt (BH) recruitment models for the status quo reduction in groundfish bycatch of Pribilof Islands blue king crab.

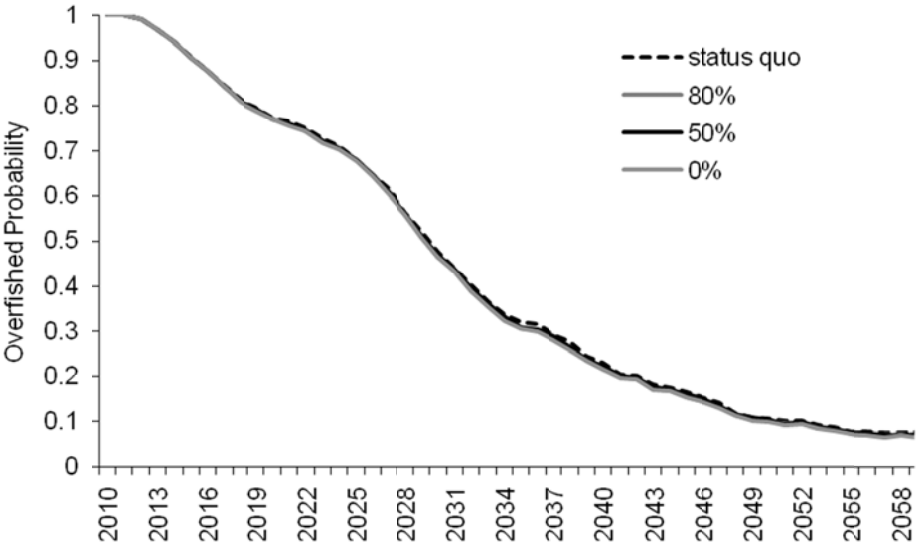

Figure 10-39 Projection estimates of the probability of overfishing based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option a for all groundfish fisheries.

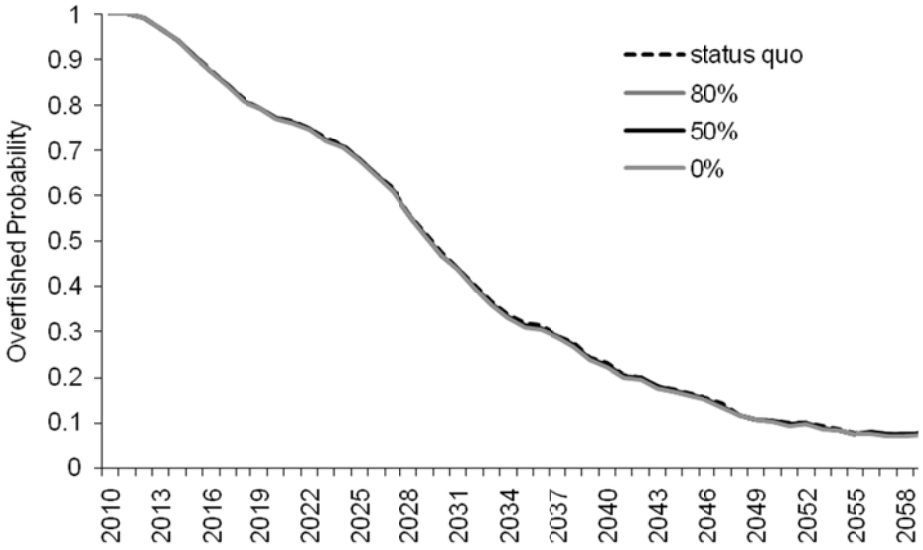

Figure 10-40 Projection estimates of the probability of overfishing based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option b for Pacific cod pot fisheries.

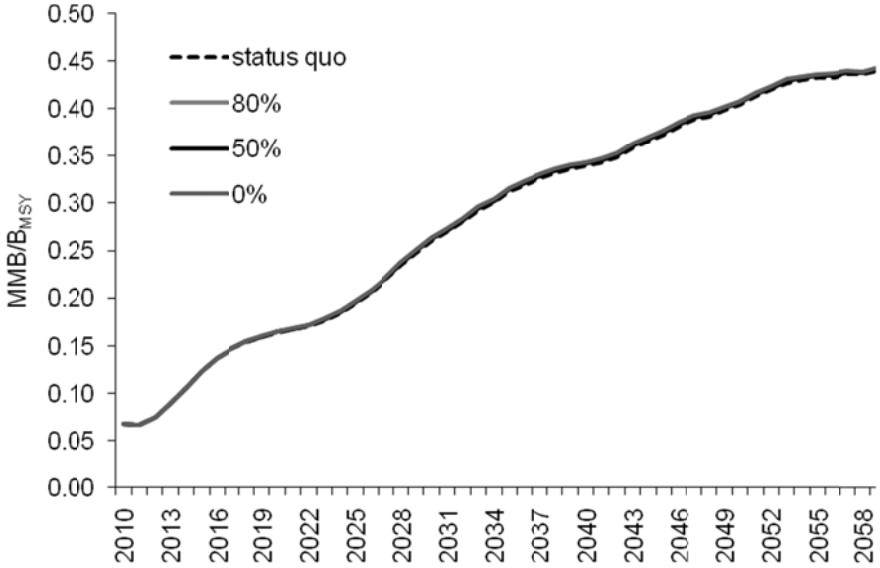

Figure 10-41 Projection estimates of MMB relative to B_{MSY} based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option a for all groundfish fisheries.

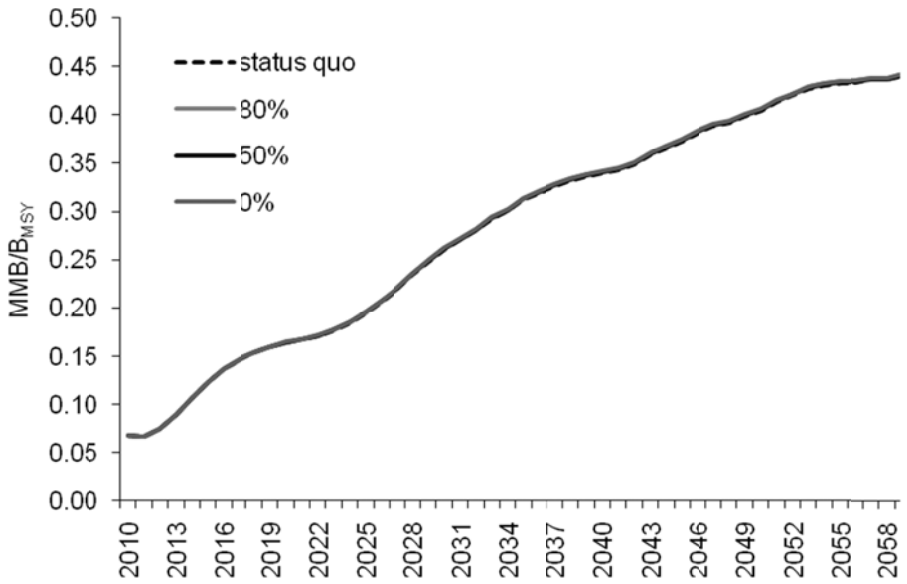

Figure 10-42 Projection estimates of mature male biomass (MMB) relative to B_{MSY} based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option b for Pacific cod pot fisheries.

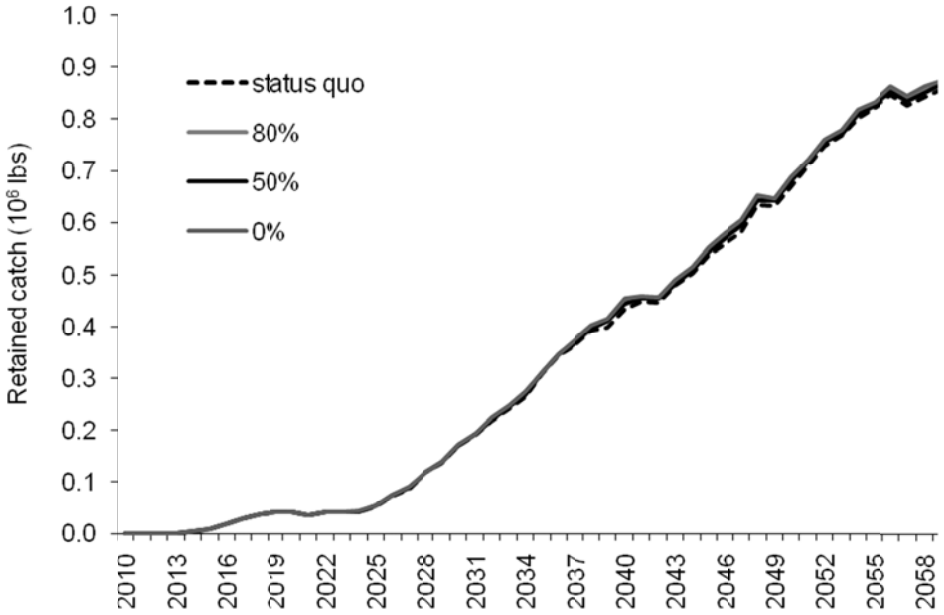

Figure 10-43 Projection estimates of retained catch based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option a for all groundfish fisheries.

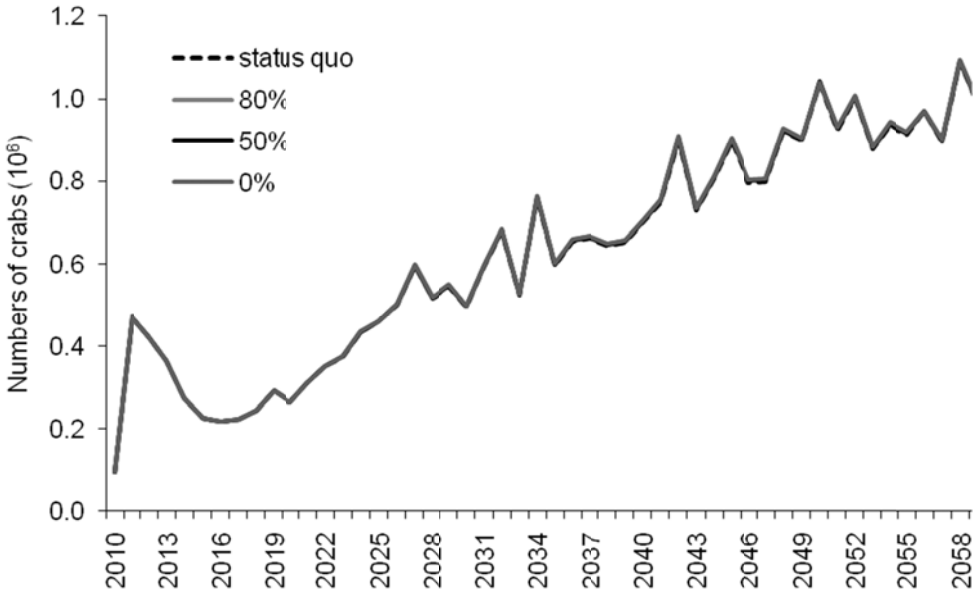

Figure 10-44 Projection estimates of recruitment based on a Ricker recruitment function for each groundfish reduction of Pribilof Islands blue king crab bycatch scenario under option a for all groundfish fisheries.

11 Tables

Table 11-1 List of fisheries and gear types with recorded bycatch of Pribilof Islands blue king crab in the area shown in Figure 10-14, 2003-2010 by threshold option as described in Section 3.2 (as of 12/15/2010).

The records column indicates the datasource where a record of bycatch since 2003 was used. PSC = NMFS RO estimates (from CAS in area 513 only), OBS = Observer data and FT = Fishticket from Alaska Department of Fish and Game Stat areas used to define the Pribilof area.

Target	Gear	Records	Threshold option (a,b)
Pacific cod	Pot	PSC, FT, OBS	a
	Hook and Line	PSC, FT, OBS	a
Rock Sole	Trawl	PSC	a,b
Flathead Sole	Trawl	PSC, FT, OBS[10]	a,b
Yellowfin sole	Trawl	PSC, OBS	a
Other Flatfish	Trawl	OBS	a

[10] When smaller areas are included per Figure 8 the Flathead sole NPT fishery also has an observed record of PIBKC bycatch.

Table 11-2 Estimated Pribilof Islands blue king crab stock abundances (millions of crab).

Year	Pre-recruit 2	Pre-recruit 1	Recruits	Post-Recruits	Legals	Matures
1975	4.54	4.40	1.91	4.54	6.45	10.85
1976	2.41	3.57	1.29	5.14	6.43	9.99
1977	5.82	2.40	1.28	4.66	5.94	8.34
1978	2.64	3.03	0.92	4.26	5.19	8.22
1979	0.96	2.19	1.32	3.68	5.00	7.20
1980	0.50	1.19	0.94	3.50	4.44	5.63
1981	0.63	0.63	0.46	2.47	2.93	3.57
1982	0.70	0.47	0.23	1.40	1.63	2.10
1983	0.47	0.43	0.16	0.84	1.00	1.42
1984	0.20	0.34	0.16	0.59	0.75	1.08
1985	0.07	0.21	0.16	0.59	0.75	0.95
1986	0.02	0.09	0.10	0.56	0.66	0.76
1987	0.01	0.04	0.05	0.52	0.57	0.60
1988	0.00	0.01	0.02	0.39	0.41	0.42
1989	1.80	0.00	0.01	0.34	0.35	0.35
1990	1.62	1.01	0.06	0.29	0.35	1.36
1991	1.06	1.10	0.55	0.32	0.86	1.97
1992	1.15	0.87	0.43	0.74	1.17	2.04
1993	0.76	0.79	0.31	0.98	1.29	2.08
1994	0.72	0.63	0.26	1.08	1.34	1.96
1995	0.45	0.53	0.16	1.12	1.28	1.82
1996	0.33	0.41	0.09	0.92	1.00	1.42
1997	0.22	0.32	0.07	0.73	0.79	1.11
1998	0.24	0.24	0.04	0.60	0.64	0.89
1999	0.16	0.20	0.03	0.47	0.50	0.70
2000	0.12	0.16	0.02	0.42	0.44	0.60
2001	0.09	0.13	0.01	0.37	0.38	0.51
2002	0.07	0.10	0.01	0.32	0.33	0.43
2003	0.05	0.08	0.01	0.27	0.28	0.37
2004	0.04	0.07	0.01	0.24	0.25	0.31
2005	0.03	0.05	0.01	0.21	0.21	0.27
2006	0.04	0.04	0.01	0.18	0.19	0.23
2007	0.27	0.03	0.01	0.16	0.16	0.20
2008	0.36	0.08	0.01	0.14	0.15	0.23
2009	0.21	0.14	0.03	0.12	0.15	0.29

Table 11-3 Posterior means and 90% intervals for key parameters of the Pribilof Islands blue king crab population dynamics model used for projection purposes.

Parameter	Distribution
Beverton-Holt stock-recruitment relationship	
Virgin MMB	27.0 (25.3, 28.6)
Steepness, h	0.250 (0.501, 0.538)
F_{MSY} ($F_{35\%}$)	0.18
B_{MSY} ($B_{35\%}$)	9.0 (8.5, 9.4)
σ_R	10.1 (7.7, 12.5)*
Ricker stock-recruitment relationship	
Virgin MMB	21.2 (20.1, 22.4)
Steepness, h	0.543 (0.519, 0.564)
F_{MSY} ($F_{35\%}$)	0.18
B_{MSY} ($B_{35\%}$)	9.0 (8.5, 9.4)
σ_R	10.1 (7.6, 12.5)*

* σ_R was set to 1.5 for the projections

Table 11-4 Proportion of the Pribilof Islands blue king crab bycatch among target species between 2003/04 and 2009/10 crab fishing seasons. Total mortality is the total bycatch multiplied by the handling mortality (50% fixed gear, 80% trawl gear).

Crab fishing season	Yellowfin sole %	Pacific cod %	Flathead sole %	Rocksole %	Total Mortality million lbs	TOTAL (# crabs)
2003/04	47	22	31		0.0008	252
2004/05		100			0.0009	259
2005/06		97	3		0.0028	757
2006/07	54	20		26	0.0003	96
2007/08	3	96	1		0.0046	2,950
2008/09	77	23			0.0010	295
2009/10	51	39	10		0.0013	487

[1] Here total number of crab calculated using the average weight over all gears in a given Crab Fishing Year from the Observer database (NMFS RO).

Table 11-5 Proportion of the Pribilof Islands blue king crab bycatch among gear types between 2003/04 and 2009/10 crab fishing seasons. Total mortality is the total bycatch multiplied by the handling mortality (50% fixed gear, 80% trawl gear).

Crab fishing season	hook and line %	non-pelagic trawl %	pot %	TOTAL million lbs	TOTAL[1] (# crabs)
2003/04	21	79		0.0008	252
2004/05	99	1		0.0009	259
2005/06	18	3	79	0.0028	757
2006/07	20	20		0.0003	96
2007/08	1	3	95	0.0046	2,950
2008/09	23	77		0.0010	295
2009/10	21	61	18	0.0013	487

[1] Here total number of crab calculated using the average weight over all gears in a given Crab Fishing Year from the Observer database (NMFS RO).

Table 11-6 Pacific halibut catch from 2004 to 2008 in International Pacific Halibut Commission areas that overlap with Pribilof Islands blue king crab 1975-1984 distribution area.

	Log Data			Ticket Data	
Year	Net wt (lbs)	Effective skates hauled	Distinct # of vessels	Net wt (lbs)	Distinct # of vessels
2004	602,063	6,867	25	965,598	40
2005	473,426	6,180	21	534,876	23
2006	401,420	5,785	17	486,359	20
2007	439,683	7,071	15	546,842	21
2008	597,274	7,448	25	791,283	32

Table 11-7 Groundfish catches (t) in the Pribilof Islands Habitat Conservation Zone between 2003 and 2009. C represents a confidential value. Species code names found in Appendix Table A1.

Species	2003	2004	2005	2006	2007	2008	2009
AKPL	49.15	2.12	2.8	27.22	46.42	16.35	2.71
AMCK	0.01	7.65	0.11	0.01	0.06	0.15	0.04
ARTH	92.3	67.78	26.74	46.07	192.3	27.17	33.38
DEM1	3.53						
DFL4	0.27						
FLO5	3.48	16.08	4.35	2.25	8.43	0.92	0.37
FSOL	313.46	153.58	55	102.19	293.59	173.25	139.15
GTRB	0.75	0.16	0.15	0.79	0.18	0.04	0.30
NORK	0.13	0.28	0.2	0.08	0.03	0.07	0.10
OTHR	429.03	580.7	818.82	503.51	519.74	278.65	233.74
PCOD	3392.04	5847.39	7833.58	4640.75	4083.36	2563.44	1295.97
PEL7	0.04						
PLCK	2742.45	6540.28	2554.52	1315.92	736.78	339.29	
POPA	0.22	0.02	C	0.02	1.03		0.07
REYE		0.02	C			0.01	C
ROCK	0.58	0.99	0.34	0.05	0.06	0.12	0.10
RSOL	57.52	44.12	31.23	53.55	155.21	57.94	25.61
SABL	109.24	C	0.32	C	C	0.03	C
SFL1	0.38						C
SQID	0.15	0.12	0.09	C	C	C	0.21
SRKR		0.43	C	C		0.08	
SRRE	4.78						
THDS	6.11						
USKT			C				
YSOL	144.93	19.41	37.53	97.06	270.67	54.41	26.33

Table 11-8 Bycatch mortality by fishery 2003/04-2009/10

Crab fishing season	yellowfin sole	pacific cod	flathead sole	rocksole	TOTAL (mill lbs)	TOTAL[1] (# crabs)
2003/04	0.0004	0.0002	0.0002		0.0008	252
2004/05		0.0009			0.0009	259
2005/06		0.0027	0.00008		0.0028	757
2006/07	0.0002	0.0001	0.0000	0.0001	0.0003	96
2007/08	0.0001	0.0044	0.00005		0.0046	2,950
2008/09	0.0008	0.0002	0.0000		0.0010	295
2009/10	0.0007	0.0005	0.0001		0.0013	487

Table 11-9 Bycatch mortality by gear type 2003/04-2009/10

Crab fishing season	hook and line	non-pelagic trawl	pot	TOTAL (mill lbs)	TOTAL[1] (# crabs)
2003/04	0.0002	0.0006		0.0008	252
2004/05	0.0009			0.0009	259
2005/06	0.0005	0.0001	0.0022	0.0028	757
2006/07	0.0001	0.0001		0.0003	96
2007/08	0.00005	0.0001	0.0044	0.0046	2,950
2008/09	0.0002	0.0008		0.0010	295
2009/10	0.0003	0.0008	0.0002	0.0013	487

[1] Here total number of crab calculated using the average weight over all gears in a given Crab Fishing Year from the Observer database (NMFS RO).

Table 11-10 Groundfish catches (t) in the ADF&G closure area between 2003 and 2009. C represents a confidential value. Species code names found in Appendix Table A1.

Species	2003	2004	2005	2006	2007	2008	2009
AKPL	46.7	2.2	81.5	8.6	457.9	437	3.27
AMCK		0	C	C			
ARTH	3.9	7.5	9.6	21.6	4.9	71	3.06
FLO5	3	2	4.1	1.7	108.1	69	0.76
FSOL	8	24.3	13.4	26.6	46.2	184.6	1.23
GTRB			C	C			
NORK		0					
OTHR	189.7	108.6	410.4	272.9	409.3	245.4	66.99
PCOD	1132.8	1757.5	4749.8	1973.9	1970.8	955	269.21
PLCK	646.7	3429.7	1041.1	2046.7	167	215.8	20.12
POPA					C		C
ROCK		C			C		C
RSOL	266.5	24.5	275.3	83.7	154.2	280.8	5.26
SABL			C				
USKT			C				
YSOL	1589	57.1	541.3	80.8	3687.8	5575.8	7.925399

Table 11-11 Groundfish catches (t) in the Pribilof Islands blue king crab 1975 to 1984 distribution area (Alternative 4) between 2003 and 2009. C represents a confidential value. Species code names found in Appendix Table A1.

Species	2003	2004	2005	2006	2007	2008	2009
AKPL	2811.06	2045.68	5230.71	6144.12	6648.04	3052.31	3068.79
AMCK	26.08	48.78	146.71	80.93	1.58	5.37	0.70
ARTH	2230.63	2128.19	919.34	1211.98	1736.82	814.67	518.96
BSKT					C		
DEM1	3.53						
DFL4	0.27						
FLO5	68.3	178.22	207.04	91.76	292.25	95.98	20.17
FSOL	6505.89	6639.13	3494.26	4175.13	5498.23	4659.14	2949.39
GTRB	20.3	30.95	3.52	9.13	45.31	6.16	9.36
NORK	12.67	4.91	15.34	25.59	12.94	7.84	5.18
OTHR	3943.18	4952.31	4752.88	4787.51	4508.9	2876.37	2402.20
PCOD	20441.1	25625.09	27050.89	23805.02	16817.21	16084.11	11326.55
PEL7	0.39		C				C
PLCK	156257.6	135226.8	171928.5	110899.7	114518.4	98157.62	109329.87
POPA	30.49	31.98	29.5	38.03	61.68	6.38	16.40
REXS			C				
REYE		0.45	0.1	0.11	0.01	0.16	0.42
ROCK	7.99	8.78	4.16	5.04	7.89	4.2	1.56
RSOL	3065.19	4273.2	5955.45	3587.82	3491.96	1681.15	1659.25
SABL	111.84	1.57	2.16	11.28	0.81	8.39	43.25
SFL1	0.38		C		C		C
SQID	22.76	13.19	28.41	32.11	31.39	14.14	2.25
SRKR		10.93	4.92	0.29	1.12	2.46	2.38
SRRE	8.38						
THDS	6.11						2.30
USKT			4.76		C		0.44
YSOL	18626.66	20670.73	50288.53	23257.97	34578.35	18457.86	14628.91

Table 11-12 Groundfish catches (t) in the Pribilof Islands blue king crab 1984 to 2008 distribution area (Alternative 4) between 2003 and 2009. C represents a confidential value. Species code names found in Appendix Table A1.

Species	2003	2004	2005	2006	2007	2008	2009
AKPL	2096.72	1021.31	4073.45	2440.17	1882.07	2585.37	930.4366
AMCK	8.18	44.59	114.46	16.67	0.12	0.45	0.14
ARTH	1045.58	1036.87	531.97	565.26	1090.16	490.76	203.50
BSKT					C		
DEM1	3.53						
DFL4	0.27						
FLO5	40.85	101.67	136.09	46.53	233.21	87.81	6.57
FSOL	2802.2	2782.98	1858.87	1499.6	2674.1	2487.75	1132.59
GTRB	10.64	6.58	1.88	2.56	1.44	1.55	1.10
NORK	0.28	0.83	12.43	0.81	0.06	0.18	0.42
OTHR	2003.05	2067.34	2867.57	1974.07	1922.39	1676.59	933.06
PCOD	10413.82	12741.2	18184.63	12493	9414.95	7341.05	3727.89
PEL7	0.39						
PLCK	38058.53	75092.87	46230.32	18850.34	21793.93	17508.1	13679.10
POPA	8.59	18.84	23.47	0.85	15.54	0.03	0.84
REXS			C				
REYE		0.05	C	C	C	0.02	0.00
ROCK	4.77	2.82	0.77	0.4	0.13	0.2	0.19
RSOL	1902.29	1811.81	4333.92	1183.77	1621.72	1011.36	702.91
SABL	110.07	0.56	1.58	C	0.09	0.04	C
SFL1	0.38				C		
SQID	0.74	1.02	0.41	0.46	0.34	0.25	0.15
SRKR		0.92	C	C	C	0.09	0.35
SRRE	4.85						
THDS	6.11						
USKT			C		C		
YSOL	14461.82	11625.25	30371.47	10753.54	10902.81	16752.7	3947.835

Table 11-13 The count and mean length of observed Pribilof Islands blue king crab catches by sex for each alternative proposed closure area between 2003 and 2007.

		2003		2004		2005		2006		2007	
Alternative		count	mean length	count	mean length	count	mean length	count	mean length	count	mean length
	Female	24	130.1	18	143.3	38	140.3	17	147.4	19	125.5
1 & 2	Male	7	163.7	5	167.0	17	180.7	4	153.0	5	128.0
	Total	31	139.2	23	149.0	55	155.1	21	148.5	24	126.1
	Female	0		4	124.3	38	140.3	15	146.9	19	125.5
3	Male	0		1	158.0	17	180.7	4	153.0	5	128.0
	Total	0		5	131.0	55	155.1	19	148.3	24	126.1
	Female	25	126.0	18	143.3	39	139.5	17	147.4	19	125.5
4	Male	7	163.7	6	171.3	17	180.7	5	164.0	5	128.0
(1984-2009)	Total	32	135.8	24	151.0	56	154.2	22	151.3	24	126.1
	Female	25	126.0	18	143.3	39	139.5	18	144.5	19	125.5
4	Male	7	163.7	6	171.3	18	182.1	6	163.0	5	128.0
(1975-2009)	Total	32	135.8	24	151.0	57	155.3	24	149.3	24	126.1

Table 11-14 Non-retained total catch mortalities from directed and non-directed fisheries for Pribilof Islands District blue king crab.

Handling mortalities (pot and hook/line= 0.5, trawl = 0.8) were applied to the catches. (Bowers et al. 2008; D. Pengilly, ADF&G; J. Mondragon, NMFS). NMFS Area 513 only.

	Crab Pot Fisheries			Groundfish Fisheries	
	Legal non-retained 10^6 lbs	Sublegal male 10^6 lbs	All Female 10^6 lbs	All Pot 10^6 lbs	All Trawl 10^6 lbs
1991	0	0	0	0.0001	0.0109
1992	0	0	0	0.0010	0.1072
1993	0	0	0	<0.0001	0.0604
1994	0	0	0	<0.0001	0.0121
1995	0	0	0	0.0001	0.0023
1996	0	0.001	0	<0.0001	0.0001
1997	0	0	0	0.0016	0.0002
1998	0.003	0.001	0.004	0.0218	0.0001
1999	0.004	0.005	0.002	0.0009	<0.0001
2000	0	0	0	0.0001	<0.0001
2001	0	0	0	0.0009	0.0001
2002	0	0	0	0.0001	0.0005
2003	0	0	0	0.0004	0.0004
2004	0	0	0	0.0009	<0.0001
2005	0	0	0.0001	0.0004	0.0024
2006	0	0	0.0001	0.0002	0.0001
2007	0	0	0.0001	0.0044	0.0002
2008	0	0	0	0.0002	0.0008

Table 11-15 Preliminary assessment of the potential relationship between blue king crab in the Pribilof Islands and St. Matthew. Factors and criterion were based on information contained in Spencer et al. (In Prep).

Harvest and Trends	
Factor and criterion	**Justification**
Fishing mortality (5-year average percent of F_{max})	Fishing mortality rates are low in the Pribilof Islands and although rates near St. Matthew have increased in the past two years, they are much lower than F_{max}.
Spatial concentration of fishery relative to abundance (Fishing is focused in areas << management areas)	Harvests in the St. Matthew stock are concentrated south of St. Matthew likely due to the accessibility of the stock. Since much of the stock biomass is north of St. Matthew localized depletion may be an issue.
Population trends (Different areas show different trend directions)	Population trends are very different between St. Paul and St. Matthew stocks suggesting different productivities or better recruitment conditions.

Barriers and phenotypic characters	
Generation time (e.g., >10 years)	Generation time in <10 years.
Physical limitations (Clear physical inhibitors to movement)	No apparent physical barriers to adult dispersal but larval dispersal may be affected by local oceanography (see Parada et al. 2010).
Growth differences (Significantly different LAA, WAA, or LW parameters)	Unknown although warmer temperatures in the Pribilof Islands likely lead to higher growth rates.
Age/size-structure (Significantly different size/age compositions)	TBD
Spawning time differences (Significantly different mean time of spawning)	Unknown
Maturity-at-age/length differences (Significantly different mean maturity-at-age/ length)	TBD
Morphometrics (Field identifiable characters)	Unknown
Meristics (Minimally overlapping differences in counts)	Unknown

Behavior and movement	
Spawning site fidelity (Spawning individuals occur in same location consistently)	Unknown
Mark-recapture data (Tagging data may show limited movement)	TBD
Natural tags (Acquired tags may show movement smaller than management areas)	Unknown

Genetics	
Isolation by distance (Significant regression)	No apparent isolation by distance.
Dispersal distance (<<Management areas)	Not available
Pairwise genetic differences (Significant differences between geographically distinct collections)	TBD

12 Appendix: Groundfish catch by closure area, target species and gear type 2003-2009

Table A1 Species codes in groundfish catch tables.

Species code	Common name
PCOD	Pacific Cod
ARTH	Arrowtooth Flounder
RSOL	Rock Sole
YSOL	Yellowfin Sole
GTRB	Greenland Turbot
POPA	Pacific Ocean Perch
HLBT	Halibut
PLCK	Pollock
SABL	Sablefish
SQID	BSAI Squid
RKCR	Red King Crab
BTCR	Bairdi Tanner Crab
OTCR	Opilio Tanner (Snow) Crab
HERR	Herring
STLH	Steelhead Trout
BKCR	Blue King Crab
GKCR	Golden (Brown) King Crab
CHNK	Chinook Salmon
CHUM	Chum Salmon
COHO	Coho Salmon
PINK	Pink Salmon
SOCK	Sockeye Salmon
AMCK	Atka Mackerel
NCHN	Non-Chinook Salmon
AKPL	BSAI Alaska Plaice
NORK	Northern Rockfish
GREN	Grenadier
HAKE	Pacific Hake
REYE	BSAI Rougheye Rockfish
SRKR	BSAI Shortraker Rockfish
FSOL	Flathead Sole
FLO5	BSAI Other Flatfish
PEL7	GOA Pelagic Shelf Rockfish
ROCK	Other Rockfish
NONQ	Non-Quota species
OTHR	Other Species

Table A2 Groundfish catches (t) in the Pribilof Islands Habitat Conservation Zone between 2003 and 2009.

C represents a confidential value. Targets: C= Pacific cod, I=halibut, K=rockfish, S=sablefish, and W=arrowtooth flounder. CDQ=Community Development Quota, OA=Open Access, IFQ=Individual Fishing Quota. CV=catcher vessel, and CP=catcher processor.

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
C	CDQ	CP	HAL		50.04	1110.83	192.91	196.95	129.31	349.92
C	OA	CP	HAL	3405.58	3994.91	4926.2	3352.41	2055.74	1304.8	892.20
C	OA	CP	POT	C	1881.55	C	C	1423.65	C	303.10
C	OA	CV	HAL	C		C				
C	OA	CV	JIG		0.14					C
C	OA	CV	POT	C	533.1	991.78	733.78	731.88	794.98	C
I	CDQ	CV	HAL				C	C		
I	IFQ	CV	HAL	4	0.48	C			1.61	
I	OA	CV	HAL		C	C				
K	IFQ	CV	HAL	0.37						
K	OA	CP	HAL	C						
K	OA	CV	HAL	1.38						
K	OA	CV	JIG	C						
NULL	OA	CP	POT		C				C	
O	OA	CP	HAL				C			
O	OA	CV	HAL	C	C					
S	IFQ	CV	HAL	32.18				C		
S	OA	CP	HAL	18.42						
S	OA	CV	HAL	74.7						
T	OA	CP	HAL	1.65						
W	OA	CP	HAL					C		

Table A3 Groundfish catches (t) in the Pribilof Islands Habitat Conservation Zone between 2003 and 2009.

C represents a confidential value. Species code names found in Appendix 1, Table A1.

Gear	Species	2003	2004	2005	2006	2007	2008	2009
HAL	AKPL	C		0.03	C	C		C
HAL	AMCK		0.03	C		C		0.04
HAL	ARTH	14.74	12.28	16.1	14.01	6.59	8.73	8.96
HAL	DEM1	3.52						
HAL	DFL4	0.27						
HAL	FLO5	3.15	2.38	3.94	2.03	7.76	0.79	0.09
HAL	FSOL	5.56	13.27	14.69	19.33	10.16	11.9	7.10
HAL	GTRB	0.74	0.14	0.15	0.06	C	0.03	0.25
HAL	NORK	0.1	0.08	0.14	0.08	0.03	C	0.06
HAL	OTHR	360.64	516.47	789.24	434.47	395.11	215.06	218.95
HAL	PCOD	2913.59	3381.84	5072.66	2990.94	1763.68	1172.93	980.21
HAL	PEL7	0.03						
HAL	PLCK	105.64	104.22	96.35	47.62	51.39	20.45	20.73
HAL	POPA			C	C			C
HAL	REYE		0.02	C			0.01	C
HAL	ROCK	0.58	0.99	0.34	0.05	0.04	0.08	0.10
HAL	RSOL	1.21	1.46	19.96	2.46	0.43	0.29	0.50
HAL	SABL	109.24	C	0.32	C	C	0.03	C
HAL	SFL1	0.38						
HAL	SQID						C	
HAL	SRKR		0.19	C	C		0.08	0.21
HAL	SRRE	4.78						
HAL	THDS	6.11						
HAL	USKT			C				
HAL	YSOL	10.91	12.05	23	35.15	19.72	5.35	6.84
JIG	DEM1	C						
JIG	PCOD		0.14					
JIG	PEL7	C						
JIG	ARTH							C
JIG	FSOL							C
JIG	OTHR							C
JIG	PCOD							C
JIG	PLCK							C
POT	AKPL	C						
POT	AMCK		C		C	0.04	C	
POT	ARTH		C		C		C	C
POT	FLO5		C		C		C	
POT	FSOL	C	C	0.03	C	C	0.01	
POT	GTRB				C		C	C
POT	NORK		C			C	0.07	C
POT	OTHR	8.76	17.18	14.1	36.81	45.6	22.69	3.45
POT	PCOD	378.61	2392.89	2742.12	1600.95	2096.1	1363.52	291.10
POT	PLCK	2.43	1.97	1.73	1.84	0.51	0.16	C
POT	ROCK		C			C	0.04	C
POT	RSOL	C	0.03	0.07	C	C	0.01	
POT	YSOL	C	2.52	10.97	4.06	11.55	1.84	C

Table A4 Groundfish catches (t) in the Alaska Department of Fish and Game closure area between 2003 and 2009.

C represents a confidential value. Targets: C= Pacific cod, I=halibut, K=rockfish, S=sablefish, and W=arrowtooth flounder. CDQ=Community Development Quota, OA=Open Access, IFQ=Individual Fishing Quota. CV=catcher vessel, and CP=catcher processor.

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
B	CDQ	CP	PTR			C				
B	OA	CP	NPT				C			
B	OA	CP	PTR			C				
C	CDQ	CP	HAL		C	C	C	C	C	C
C	OA	CP	HAL	1134.6	785	3182.2	1983.4	1828.8	515.2	313.22
C	OA	CP	NPT	C	C		C			
C	OA	CP	POT		C	C	C	C	C	C
C	OA	CV	HAL			C				
C	OA	CV	POT	C		123.1				
I	CDQ	CV	HAL					C		
L	OA	CP	NPT		82.4	C		C	C	C
P	AFA	CV	PTR		C			C		
P	CDQ	CP	PTR		278.9		C			
P	CDQ	CV	PTR		C	C				
P	OA	CP	PTR	C	3054.7	468.6	1501.9			C
P	OA	CV	PTR	C		C				
R	CDQ	CP	NPT		C			C		
R	CDQ	CV	NPT					C		
R	OA	CP	NPT	C	C	507.4	C			C
W	OA	CP	HAL					C		
Y	CDQ	CP	NPT					C	C	
Y	CDQ	CV	NPT					C		
Y	OA	CP	NPT	2388.6	40.1	612.4	20.5	3226.4	7072.2	C
Y	OA	CV	NPT				C		C	

Table A5 Groundfish catches (t) in the Alaska Department of Fish and Game closure area between 2003 and 2009.

C represents a confidential value. Species code names found in Appendix 1, Table A1.

Gear	Species	2003	2004	2005	2006	2007	2008	2009
HAL	AKPL	C		C	0	C		
HAL	AMCK		C					
HAL	ARTH	2.7	1.3	3	2.9	1.2	1.3	2.33
HAL	FLO5	2.7	1.8	0.2	0.6	1.5		0.02
HAL	FSOL	2.4	2.4	2.1	1.8	0.6	0.5	0.62
HAL	GTRB			C	C			
HAL	NORK		C					
HAL	OTHR	131.5	91.2	370.1	218.5	321.7	67.4	65.18
HAL	PCOD	950.9	664.1	3067.3	1737.3	1381.1	426	245.14
HAL	PLCK	37.6	18.5	85.9	59.2	94	20.7	6.46
HAL	ROCK		C					0.02
HAL	RSOL	0.1	0.1	0.9	0.1	0.2	0	C
HAL	SABL			C				
HAL	USKT			C				
HAL	YSOL	6.7	6.9	25.5	32.6	34.2	6.7	1.90
NPT	AKPL	46.7	2.2	81.4	8.6	457.9	437	3.27
NPT	ARTH	1.2	6.2	6.6	C	3.7	69.7	C
NPT	FLO5	C	C	3.9	1.1	106.7	69	C
NPT	FSOL	5.6	21.4	11.2	23.4	44.3	184.1	0.56
NPT	OTHR	58.1	10.5	32.8	47.8	86.7	178	1.06
NPT	PCOD	180.6	17.1	97.6	80.9	82	461.8	1.39
NPT	PLCK	590.2	15.1	111.8	223.7	66.9	195.1	4.16
NPT	POPA					C		C
NPT	RSOL	266.4	15.8	270.9	83.3	154	280.8	5.17
NPT	YSOL	1582.3	48.7	508.1	47.7	3653.5	5569.1	4.44
POT	FLO5		C					
POT	FSOL			0		C		
POT	OTHR	C	C	5.4	C	C	C	C
POT	PCOD	C	C	1563.7	C	C	C	C
POT	PLCK	C	C	1.5	C	C		C
POT	ROCK					C		
POT	RSOL		C	0	C	C		
POT	YSOL	C	C	7.7	C	C	C	C
PTR	AKPL		0		0			C
PTR	AMCK		0	C	C			
PTR	ARTH	C	0	C	0.2	C		C
PTR	FLO5		0		C	C		C
PTR	FSOL	C	0.6	0.1	1.3	C		C
PTR	OTHR	C	2.4	2.1	0.8	C		C
PTR	PCOD	C	11.8	21.3	14.9	C		C
PTR	PLCK	C	3395.2	842	1763.5	C		C
PTR	RSOL	C	8.5	3.5	0.2	C		C
PTR	YSOL	C	0.3		0.3			

Table A6 Groundfish catches (t) in the Pribilof Islands blue king crab 1975 to 1983 distribution area (Alternative 4) between 2003 and 2009.

C represents a confidential value. Targets: C= Pacific cod, I=halibut, K=rockfish, S=sablefish, W=arrowtooth flounder, P=pollock (midwater), Y=yellowfin sole, B=Pollock (bottom), E=Alaska plaice, F=other flatfish, L=flathead sole, O=other, R=rock sole, T=Greenland turbot.

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
A	OA	CP	NPT	C	93.95	254.01	C			
B	AFA	CV	PTR	215.12	C	C	C	938.47	1175.29	3260.21
B	CDQ	CP	PTR		C	C			C	717.34
B	CDQ	CV	PTR						38.56	C
B	OA	CP	NPT	C			54.47			
B	OA	CP	PTR	C	C	C	1878.35	2076.02	4192.13	5231.55
B	OA	CV	PTR	C					C	C
C	CDQ	CP	HAL		1133.55	2085.45	905.89	848.79	494.88	1182.05
C	OA	CP	HAL	18787.57	21600.46	21571.45	20492.55	11350.53	10280.79	8069.22
C	OA	CP	NPT	1490.2	3364.94	1030.32	2712.02	1419.34	270.37	190.56
C	OA	CP	POT	C	1923.93	C	2043.33	2175.05	C	C
C	OA	CV	HAL	5.83	C	C	C	C	C	C
C	OA	CV	JIG	0.07	0.71	C	C	C	C	C
C	OA	CV	NPT	91.59		C	C	380.85	499.08	145.74
C	OA	CV	POT	612.57	642.36	1193.16	740.31	981.29	3084.24	C
C	SMPC	CV	JIG				C			
E	OA	CP	NPT					C	78.11	
F	OA	CP	NPT		C	C	C	31.12		
I	CDQ	CV	HAL			C	C	0.02	0.26	
I	IFQ	CV	HAL	4.11	3.27	0.32	C	0.17	3.11	2.35
I	OA	CP	HAL		C					
I	OA	CV	HAL	C	C	C			C	
I	OA	CV	JIG					C		
K	IFQ	CV	HAL	0.37						
K	OA	CP	HAL	C						
K	OA	CP	NPT	C	C		C			
K	OA	CV	HAL	1.38						
K	OA	CV	JIG	C						
L	CDQ	CP	NPT					C		C
L	OA	CP	NPT	11214.05	14733.56	5450.35	8933.11	10883.38	8218.46	5073.54
NULL	OA	CP	HAL	C			C	C		
NULL	OA	CP	NPT		C		C			
NULL	OA	CP	POT		C			C	C	
O	OA	CP	HAL				C			
O	OA	CP	NPT	C	C		C	C		
O	OA	CV	HAL	C	C					
O	OA	CV	POT		C					
P	AFA	CV	NPT							C
P	AFA	CV	PTR	52356.7	29907.04	70920.58	27943.73	40579.23	55029.57	40400.39
P	CDQ	CP	PTR	4.11	14663.86	15454.28	15491.98	15382.35	7540.1	15059.84
P	CDQ	CV	PTR	C	C	C	C	C	C	C
P	OA	CP	NPT			C				
P	OA	CP	PTR	79024.89	76781.63	66316.76	50981.59	44931.98	21427.06	32040.36
P	OA	CV	PTR	19010.35	2595.12	10193.83	7996.13	4840.29	5245.33	8835.83
R	CDQ	CP	NPT		C	C	C	C		C
R	CDQ	CV	NPT					C		
R	OA	CP	NPT	1176.47	2585.5	4897.1	2456.5	1357.38	389.7	731.49
S	CDQ	CV	POT						C	
S	IFQ	CV	HAL	32.2		C	12.5	C	C	C
S	IFQ	CV	POT	C		C	C		C	
S	OA	CP	HAL	C				C		
S	OA	CV	HAL	75.44						

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
T	OA	CP	HAL	3.42	C					
T	OA	CP	POT		C					
W	CDQ	CP	NPT			C		C		
W	OA	CP	HAL					C		
W	OA	CP	NPT	73.91	C	21.06	51.01	C	24.69	18.23
W	OA	CP	POT		C					
Y	CDQ	CP	NPT		C			C	C	
Y	CDQ	CV	NPT					C		
Y	OA	CP	NPT	27864.8	23079.97	64580.73	32310.66	45366.73	23404.11	20034.37
Y	OA	CV	NPT		C	C	364.35		C	

Table A7 Groundfish catches (t) in the Pribilof Islands blue king crab 1975 to 1983 distribution area (Alternative 4) between 2003 and 2009.

C represents a confidential value. Species code names found in Appendix 1, Table A1.

Gear	Species	2003	2004	2005	2006	2007	2008	2009
HAL	AKPL	0.03	0.09	0.07	0.1	C	0.01	C
HAL	AMCK	0.06	0.79	0.47	C	C	C	0.05
HAL	ARTH	132.39	125.99	98.13	97.29	59.57	94	158.82
HAL	BSKT					C		
HAL	DEM1	3.52						
HAL	DFL4	0.27						
HAL	FLO5	20.36	22.57	16.26	18.55	21.98	3.18	2.28
HAL	FSOL	74.19	129.82	87.15	127.49	50.23	56.23	30.15
HAL	GTRB	3.43	3.1	0.82	0.82	0.95	0.71	4.49
HAL	NORK	1.47	2.18	2.61	1.21	0.42	0.44	1.00
HAL	OTHR	2229.13	2994.95	3007.27	2554.46	1710.22	1486.39	1202.12
HAL	PCOD	15494.49	18662.36	19938.44	18133.72	9984.07	8799.33	7584.86
HAL	PEL7	0.38		C				C
HAL	PLCK	767.95	623.62	364.62	375.42	312.3	301.51	261.70
HAL	POPA	C	0.02	C	C		C	0.03
HAL	REYE		0.44	0.08	C	C	0.13	0.41
HAL	ROCK	2.91	6.64	3.1	1.45	0.56	1.48	1.27
HAL	RSOL	3.74	10.48	22.4	7.11	1.51	1.06	1.10
HAL	SABL	110.97	0.98	0.76	10.11	0.79	2.32	42.88
HAL	SFL1	0.38		C		C		C
HAL	SQID						C	
HAL	SRKR		2.17	C	C	0.1	0.39	2.31
HAL	SRRE	6.45						
HAL	THDS	6.11						2.30
HAL	USKT			C		C		0.44
HAL	YSOL	73.2	154.04	112.3	109.93	56.06	35.16	17.64
JIG	DEM1	C						
JIG	PCOD	0.07	0.71	C	0.33	2.01	C	C
JIG	PEL7	C						
JIG	PLCK							C
NPT	AKPL	2807.32	2044.36	5228.72	6142.57	6647.65	3044.64	3064.89
NPT	AMCK	24.84	46.63	137.64	49.97	0.37	0.7	0.15
NPT	ARTH	2069.07	1988.09	803.49	1088.76	1530.78	696.45	276.78
NPT	FLO5	45.03	143.15	162.8	69.15	259.82	90.12	14.18
NPT	FSOL	6044.58	6217.67	3014.21	3852.51	5020.85	4299.22	2408.32
NPT	GTRB	15.66	27.37	2.26	7.29	43.72	3.9	4.16
NPT	NORK	C	1.39	12	8.76	0.07	0.08	C
NPT	OTHR	1527.54	1726.49	1540.7	2066.6	2602.32	1108.05	862.84
NPT	PCOD	3208.07	3698.68	3164.23	2374.52	3197.06	2345.87	1169.52
NPT	PLCK	5115.69	4363.94	6378.9	4964.34	4858.42	2950.7	3590.40
NPT	POPA	21.91	21.64	23.26	12.87	25.81	3.06	0.26
NPT	REXS			C				
NPT	REYE		C		C		C	C
NPT	ROCK	4.48	1.68	C	3.02	C	1.79	0.03
NPT	RSOL	2826.44	3888.28	5714.59	3439.74	3381.52	1470.3	1136.57
NPT	SABL	0.78	C	1.37	1.03	C		
NPT	SQID	C				C	C	C
NPT	SRKR		C		C			C
NPT	SRRE	C						
NPT	USKT			C				
NPT	YSOL	18391.28	20348.81	50163.12	22994.17	34435.5	18354.07	14515.54
POT	AKPL	C						

Gear	Species	2003	2004	2005	2006	2007	2008	2009
POT	AMCK	C	C		0.01	0.1	3.61	
POT	ARTH	C	0.08	C	0.03		1.3	C
POT	FLO5		C		C		0	C
POT	FSOL	C	C	0.03	C	C	0.2	
POT	GTRB	C	C	C	0.44		C	C
POT	NORK		C			C	0.72	C
POT	OTHR	21.33	19.49	16.81	49.36	61.95	75.12	14.54
POT	PCOD	1126.17	2541.5	3058	2724.97	3069.84	4123.26	1599.20
POT	PLCK	3.79	2.01	1.8	4.04	1.3	0.9	1.22
POT	POPA				C		0.01	C
POT	REYE		C				C	
POT	ROCK	C	0.02	C	C	C	0.43	C
POT	RSOL	C	0.04	0.08	0.01	C	0.12	C
POT	SABL	C	C	C	C		C	
POT	SRKR			C				
POT	SRRE	C						
POT	YSOL	1.27	2.94	11.86	4.78	21.41	6.77	24.03
PTR	AKPL	3.7	1.23	1.91	1.45	0.38	7.65	3.88
PTR	AMCK	1.18	1.06	8.61	30.88	1.08	0.98	0.49
PTR	ARTH	29.16	14.03	17.72	25.9	146.47	22.92	83.33
PTR	FLO5	2.9	12.46	27.98	4.05	10.45	2.69	3.71
PTR	FSOL	387.11	291.63	392.87	195.13	425.57	303.5	510.92
PTR	GTRB	1.21	0.31	0.44	0.59	0.63	1.48	0.65
PTR	NORK	6.27	1.33	0.74	15.63	12.44	6.6	4.17
PTR	OTHR	165.18	211.39	188.11	117.09	134.41	206.82	322.57
PTR	PCOD	612.31	721.83	890.22	571.49	564.23	815.65	970.85
PTR	PLCK	150107.94	129856.34	164630.23	105945.18	108331.17	94072.01	105476.34
PTR	POPA	8.56	10.32	6.23	25.12	35.87	3.3	16.02
PTR	REYE		C	0.02	C	0.01	0.01	C
PTR	ROCK	0.6	0.44	0.61	0.57	0.59	0.5	0.23
PTR	RSOL	234.99	374.41	218.39	140.95	108.82	209.67	521.57
PTR	SABL	0.06	0.01	0.01	C	0.01	C	0.37
PTR	SQID	22.44	13.19	28.41	32.11	31.29	14.12	2.21
PTR	SRKR		8.68	4.86	0.15	1.02	2.07	
PTR	SRRE	1.85						
PTR	YSOL	160.92	164.94	1.25	149.09	65.38	61.85	71.71

Table A8 Groundfish catches (t) in the Pribilof Islands blue king crab 1984 to 2008 distribution area (Alternative 4) between 2003 and 2009.

C represents a confidential value. Targets: C= Pacific cod, I=halibut, K=rockfish, S=sablefish, W=arrowtooth flounder, P=pollock (midwater), Y=yellowfin sole, B=Pollock (bottom), E=Alaska plaice, F=other flatfish, L=flathead sole, O=other, R=rock sole, T=Greenland turbot.

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
A	OA	CP	NPT	C	C	C	C			
B	AFA	CV	PTR	192.87	C	C		788.42	247.01	303.87
B	CDQ	CP	PTR		C	C			C	
B	CDQ	CV	PTR						C	C
B	OA	CP	NPT	C			34.44			13.95
B	OA	CP	PTR		C	C	224.06	C	3152.18	2798.90
B	OA	CV	PTR	C					C	C
C	CDQ	CP	HAL		243.44	1500.27	555.57	380.45	297.13	655.26
C	IFQ	CP	HAL							C
C	OA	CP	HAL	9079.69	9797.25	13288.89	10408.49	6328.07	4518.5	2519.85
C	OA	CP	JIG							C
C	OA	CP	NPT	1168.28	1340.57	901.78	1073.94	524.82	259.24	177.42
C	OA	CP	POT	C	1888.95	C	C	1813.22	C	C
C	OA	CV	HAL	1		C				C
C	OA	CV	JIG		0.63		C			
C	OA	CV	NPT	C		C	C	C		139.85
C	OA	CV	POT	406.67	619.35	1193.16	733.78	809.17	1323.23	C
C	SMPC	CV	JIG				C			
E	OA	CP	NPT					C	77.77	
F	OA	CP	NPT		C	C	C	C		
I	CDQ	CV	HAL				C	C	0.07	
I	IFQ	CV	HAL	4	0.73	C			1.8	
I	OA	CV	HAL		C	C			C	
K	IFQ	CV	HAL	0.37						
K	OA	CP	HAL	C						
K	OA	CP	NPT	C			C			
K	OA	CV	HAL	1.38						
K	OA	CV	JIG	C						
L	CDQ	CP	NPT					C		
L	OA	CP	NPT	4749.4	6462.16	3377.2	3324.72	6035.57	3993.03	1852.00
NULL	OA	CP	HAL	C				C		
NULL	OA	CP	NPT		C		C			
NULL	OA	CP	POT		C				C	
O	OA	CP	HAL				C			
O	OA	CP	NPT	C	C		C			
O	OA	CV	HAL	C	C					
O	OA	CV	POT		C					
P	AFA	CV	NPT							C
P	AFA	CV	PTR	13564.61	19227.29	16308.59	843.23	7550.59	2307.08	5806.50
P	CDQ	CP	PTR	C	9667.97	2054.47	2674.17	2521.01	2318.83	452.91
P	CDQ	CV	PTR		C	C	C	C	C	C
P	OA	CP	NPT							C
P	OA	CP	PTR	16130.58	37963.98	15607.62	10431.98	7118.82	6563.29	2383.01
P	OA	CV	PTR	4942.15	940.58	6615.79	C	C	1443.94	1006.77
R	CDQ	CP	NPT		C	C	C	C		C

Target	Program	Sector	Gear	2003	2004	2005	2006	2007	2008	2009
R	CDQ	CV	NPT					C		
R	OA	CP	NPT	1011.65	1145.52	4526.38	1169.02	530.45	287.65	459.23
S	IFQ	CV	HAL	32.2				C		
S	OA	CP	HAL	C						
S	OA	CV	HAL	74.7						
T	OA	CP	HAL	C						
W	CDQ	CP	NPT					C		C
W	OA	CP	HAL					C		C
W	OA	CP	NPT	C	C	C	C	C	C	
Y	CDQ	CP	NPT		C			C	C	
Y	CDQ	CV	NPT					C		
Y	OA	CP	NPT	21054.68	12795.84	39631.84	13724.74	12766.67	20750.77	5475.28
Y	OA	CV	NPT		C	C	61.61		C	

Table A9 Groundfish catches (t) in the Pribilof Islands blue king crab 1975 to 1983 distribution area (Alternative 4) between 2003 and 2009.

C represents a confidential value. Species code names found in Appendix 1, Table A1.

Gear	Species	2003	2004	2005	2006	2007	2008	2009
HAL	AKPL	0.01	C	0.07	0.07	C	C	C
HAL	AMCK		0.14	0.21	C	C		0.05
HAL	ARTH	40.05	50.41	33.44	35.55	21.12	26.06	24.90
HAL	BSKT					C		
HAL	DEM1	3.52						
HAL	DFL4	0.27						
HAL	FLO5	14.49	12.02	10.22	12.16	12.34	1.37	0.12
HAL	FSOL	43.7	65.77	51.22	62.25	27.96	31.22	15.20
HAL	GTRB	1.18	0.37	0.21	0.16	0.14	0.1	0.33
HAL	NORK	0.18	0.33	0.3	0.51	0.05	C	0.11
HAL	OTHR	1050.98	1257.55	1820.42	1146.3	1029.72	793.28	543.77
HAL	PCOD	7536.01	8296.81	12523.68	9415.77	5346.48	3727.06	2509.22
HAL	PEL7	0.38						
HAL	PLCK	344.37	263.35	241.27	190.61	211.99	209.73	69.11
HAL	POPA	C	C	C	C		C	0.01
HAL	REYE		0.04	C	C		0.02	0.00
HAL	ROCK	0.6	2.35	0.54	0.3	0.05	0.1	0.14
HAL	RSOL	1.93	5.11	21.04	4.08	0.9	0.52	0.58
HAL	SABL	109.28	C	0.64	C	C	0.04	C
HAL	SFL1	0.38				C		
HAL	SQID						C	
HAL	SRKR		0.21	C	C		0.09	0.35
HAL	SRRE	4.85						
HAL	THDS	6.11						
HAL	USKT			C		C		
HAL	YSOL	57.43	86.91	84.38	99.12	52.73	27.89	13.43
JIG	ARTH							C
JIG	DEM1	C						
JIG	FSOL							C
JIG	OTHR							C
JIG	PCOD		0.63		C			C
JIG	PEL7	C						
JIG	PLCK							C
NPT	AKPL	2096.56	1021.04	4073.28	2439.95	1881.81	2585.31	930.04
NPT	AMCK	C	43.84	114.18	15.6	C	0.18	0.09
NPT	ARTH	990.07	981.61	493.06	526.07	1017.47	458.06	159.42
NPT	FLO5	25.62	83.9	121.21	34.19	220.42	85.68	6.03
NPT	FSOL	2641.87	2596.81	1713.97	1402.41	2510.38	2397.83	1047.46
NPT	GTRB	9.39	6.15	1.62	1.96	1.27	1.4	0.70
NPT	NORK	C	0.19	C	C	C	C	C
NPT	OTHR	904.29	672.26	978.51	764.28	806.21	764.36	307.85
NPT	PCOD	1954.52	1502.67	2307.49	882.25	1382.96	1215.16	343.45
NPT	PLCK	3243.37	2407.07	4400.36	1702.96	2058.52	1541.9	1022.34
NPT	POPA	7.78	18.8	C	C	15.52	C	0.16
NPT	REXS			C				
NPT	ROCK	C	C	C	C	C		0.01
NPT	RSOL	1845.44	1577.93	4215.51	1133.28	1586.49	870.84	517.57
NPT	SABL	0.78	C	0.93	C			

Gear	Species	2003	2004	2005	2006	2007	2008	2009
NPT	SQID	0.32				C		C
NPT	SRKR				C			
NPT	USKT			C				
NPT	YSOL	14384.46	11474.03	30274.19	10608.67	10775.59	16722.05	3912.18
POT	AKPL	C						
POT	AMCK	C	C		C	0.06	0.22	
POT	ARTH		0		C		0.11	C
POT	FLO5		C		C		C	
POT	FSOL	C	C	0.03	C	C	0.12	
POT	GTRB				C		C	C
POT	NORK		C			C	0.12	C
POT	OTHR	13.62	18.94	16.32	41.63	51.58	31.8	10.20
POT	PCOD	717.94	2484.21	3051.23	2082.65	2553.82	2069.47	647.96
POT	PLCK	2.69	2	1.79	3	0.93	0.4	C
POT	POPA						C	C
POT	ROCK		C			C	0.07	C
POT	RSOL	C	0.04	0.08	C	C	0.08	C
POT	YSOL	0.85	2.85	11.83	4.22	14.28	2.59	22.08
PTR	AKPL	0.16	0.25	0.1	0.15	0.24	0.04	0.39
PTR	AMCK	0.46	0.38	0.07	1.06	0.03	0.04	0.00
PTR	ARTH	15.46	4.85	5.46	3.62	51.56	6.53	19.17
PTR	FLO5	0.74	5.71	4.66	0.17	0.45	0.77	0.42
PTR	FSOL	116.62	120.4	93.65	34.94	134.17	58.57	69.93
PTR	GTRB	0.07	0.05	0.05		0.03	C	0.03
PTR	NORK	0.1	0.31	0.13	0.29	0.01	0.01	0.30
PTR	OTHR	34.17	118.58	52.32	21.85	34.88	87.15	71.23
PTR	PCOD	205.35	456.89	302.23	112.32	131.69	329.35	227.02
PTR	PLCK	34468.11	72420.45	41586.89	16953.77	19522.5	15756.07	12587.14
PTR	POPA	0.8	0.04	0.8	0.46	0.02	C	0.62
PTR	REYE		C	C		C		C
PTR	ROCK	0.04	0.03	C	0.02	0.03	0.03	0.03
PTR	RSOL	54.92	228.73	97.29	46.39	34.23	139.91	184.75
PTR	SABL	0.01				C		
PTR	SQID	0.42	1.02	0.41	0.46	0.24	0.24	0.14
PTR	SRKR		C	C		C		
PTR	YSOL	19.07	61.47	1.07	41.52	60.21	0.17	0.14