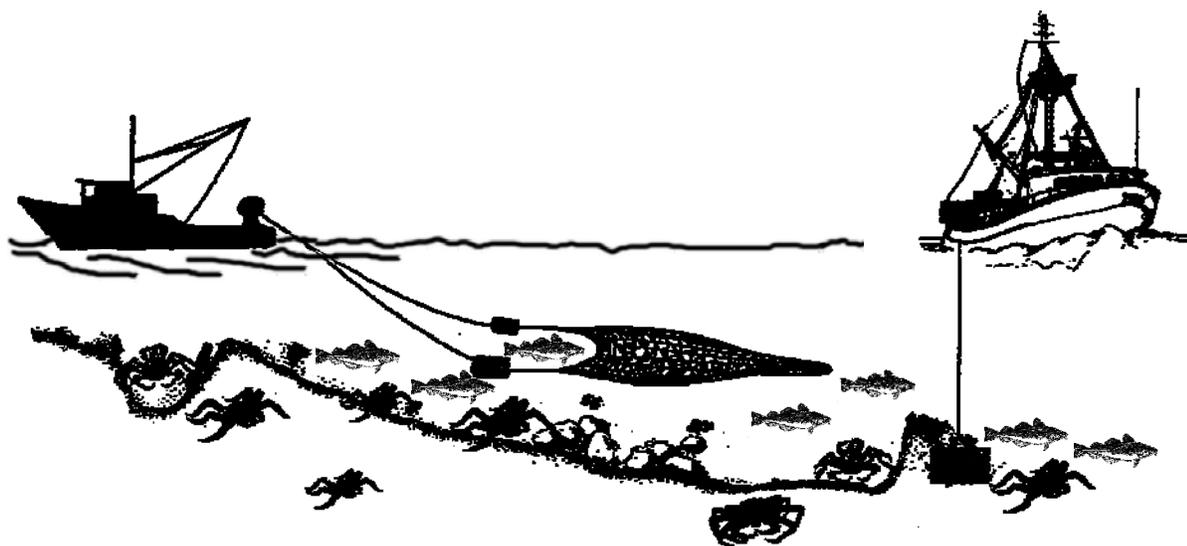


Environmental Assessment/ Regulatory Impact Review/ Initial Regulatory Flexibility Analysis for
Proposed Amendment to the Fishery Management Plan for Groundfish of the Gulf of Alaska

Area Closures for *Chionoecetes bairdi* Crab Protection in Gulf of Alaska Groundfish Fisheries

September 2010

Public Review



Executive Summary

ES.1 Introduction

This document analyzes proposed area closures to protect *C. bairdi* crab around Kodiak Island. Included in the alternatives are options to apply the closures year round or seasonally, and to pot and/or trawl gear types. Additionally, some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement.

ES.2 Purpose and Need

The purpose of this action is to provide additional protection to Gulf of Alaska (GOA) Tanner crab from the potential adverse effects of groundfish fisheries, in order to facilitate rebuilding of Tanner crab stocks. This would be achieved by closing areas around Kodiak Island that are important to the Tanner crab stocks. Areas would be closed to some or all groundfish fishing, depending on the vessel's gear type or gear configuration. An alternative in the analysis would allow a vessel to be exempt from the closures if the vessel carries 100% observer coverage¹. This would provide the Council with a high level of confidence in the assessment of any bycatch caught in the closed area, as a basis for future management action as necessary.

The Council formulated a problem statement in October 2009, to initiate this analysis, and revised it slightly in April 2010:

Tanner crab are a prohibited species bycatch in the Gulf of Alaska (GOA) groundfish fisheries. Directed fisheries for Tanner crab in the GOA are fully allocated under the current limited entry system. No specific conservation measures exist in the GOA to address adverse interactions with Tanner crab by trawl and fixed gear sectors targeting groundfish and low observer coverage in GOA groundfish fisheries limits confidence in the assessment of Tanner crab bycatch in those fisheries, and a greater level of observer coverage in the appropriate areas may provide the Council with a higher level of confidence in the assessment of any bycatch occurring in the designated areas as a basis for future management actions as necessary. Tanner crab stocks have been rebuilding since peak fisheries occurred in the late 1970s. Specific protection measures should be advanced to facilitate stock rebuilding.

ES.3 Alternatives

The alternatives evaluated in this analysis were adopted by the Council in October 2009, and modified during initial review in April 2010.

Alternative 1: Status Quo – No action

Alternative 2: Close the areas specified below to pot and trawl groundfish fisheries.

Component 1: Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

¹ 30% observer coverage required for pot vessels less than 125 ft

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20'W by 57°20' N x 151°20'W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Component 2: Closure timing

Option 1: Year round

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Option 2: Seasonally (January 1 – July 31)

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Alternative 3: In order to fish in the areas specified below, require 100% observer coverage on all trawl groundfish vessels and 30% observer coverage on all pot groundfish vessels less than 125 feet. Note, fishing days and observer coverage in these areas would be separate from and not count towards meeting a vessel's overall 30% groundfish observer coverage requirement.

Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20'W by 57°20' N x 151°20'W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

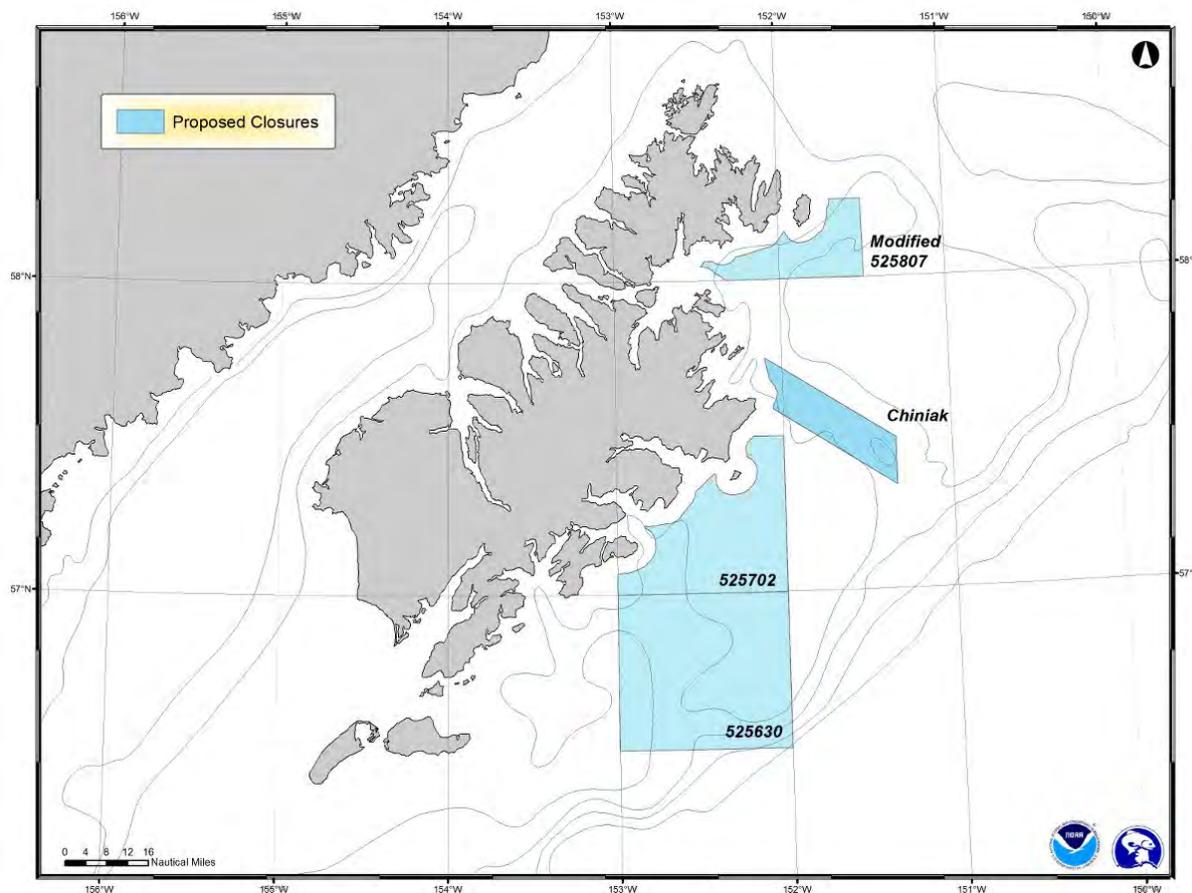
Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Note, the options and suboptions under Alternatives 2 and 3 are not intended to be mutually exclusive, and may be applied in combination. Also, in April 2010, the Council clarified that at final action, they may select closure areas that are smaller than the areas described in the four options under the 'area definition' component.

Figure 1 Area closures around Kodiak Island considered in Alternatives 2 and 3



ES.4 Impacts of the Alternatives

The alternatives were analyzed for their impacts on crab, groundfish and other fish species, marine mammals and seabirds, habitat, and the ecosystem, and for their economic and socio-economic impacts. The impacts on the socio-economic environment are analyzed in the Regulatory Impact Review (Section 6) and the Initial Regulatory Flexibility Analysis (Section 7) and are summarized in the following section.

The proportion of the surveyed abundance of Tanner crab around Kodiak which is taken as bycatch in the groundfish fisheries represents approximately 0.2% of the total abundance of crab. In the Eastside Section, which is identified as an important area for Tanner crab, groundfish bycatch represents a maximum of 0.3% of the Eastside surveyed abundance of Tanner crab, average over 2003-2009. Consequently, groundfish bycatch impacts on the sustainability of Tanner crab in the Kodiak District under the status quo, Alternative 1, are considered as adverse, but are not likely to be significant to the sustainability of the crab population.

Alternative 2, closing the proposed areas to groundfish fishing, would benefit crab stocks by reducing a source of mortality. Benefits to crab would be greatest by closing the areas to nonpelagic trawl fishing, as this gear type is observed to catch most of the crab in these areas. While pot vessels also contribute to the

overall Tanner crab bycatch in reporting area 630, and to some extent in the proposed area closures, observed crab bycatch in the pot fisheries occurred predominantly elsewhere in reporting area 630. Pelagic trawl and hook and line vessels account for very little crab bycatch, and closing the proposed areas to these gear types would provide little benefit to the crab stocks.

The impacts of suboption 3 under Alternative 2, which would exempt vessels from the closures if using approved gear modifications, are difficult to assess as proposed gear modifications have not been tested in the GOA. To the extent that they reduce unobserved mortality of crab, or reduce bycatch, they are likely to be beneficial to crab stocks. Alternative 3, which exempts vessels from the closures if they have 100% observer coverage, does not provide any benefit to crab stocks over the status quo, for those vessels that take advantage of the exemption.

The impact of the alternatives on other resource categories analyzed in the EA, including groundfish and other fish species, marine mammals, seabirds, habitat, and the ecosystem, are not expected to be significant. The timing, general location, and overall level of fishing effort in the GOA groundfish fisheries is not expected to change, as the proposed area closures are small and fishing will likely continue to occur in neighboring areas.

ES.5 Management and Enforcement Considerations

The boundaries of the proposed closure areas under Alternatives 2 and 3 are defined by existing ADF&G statistical areas and by polygons defined by latitude and longitude coordinates. Closure areas defined in this manner are easier for both the regulated industry to understand and comply with, as well as enforcement entities to patrol and enforce. The proposed closure areas present no noteworthy enforcement challenges.

Proposed modified gear requirements under Alternative 2, Suboption 3, such as trawl sweep modifications or pot escapement mechanisms, require a detailed description in regulations of the specific gear modification that would be required to qualify for exemption of the area closures. Such specifications have been discussed in general in this analysis, but no specific gear modifications have been described or widely tested for efficacy in protection of Tanner crab in the GOA fisheries. Therefore, Alternative 2, Suboption 4 should not be included in the preferred alternative as a specific recommended regulatory amendment at this time.

Suboptions 4 and 5 would exempt vessels using pelagic trawl gear from the proposed area closures. There are several areas around Kodiak Island that already are closed to nonpelagic (bottom) trawling. These closure areas overlap with some of the closure areas proposed under Alternative 2. These existing closure areas are regulated through both a prohibition against having nonpelagic trawl gear onboard the vessel. In addition, the “trawl gear performance standard”, which specifies that it is unlawful to possess aboard a vessel, at any point in time, 20 or more crab of any species, with a carapace width of more than 1.5 inches, also applies for vessels directed fishing for pollock. Enforcement of this standard on any vessel (observed or unobserved) is difficult, and it is virtually impossible to monitor and enforce on unobserved vessels.

Alternative 3 would allow fishing in the proposed closure areas by vessels using trawl gear only if they carry an observer 100% of the days they conducted directed fishing for groundfish in these areas. All vessels using pot gear to directed fish for groundfish would be required to have 30% observer coverage. In addition, observer coverage for fishing inside these closure areas would be separate from and not count towards meeting a vessel’s 30% observer coverage requirements that applied for fishing outside of these closure areas. This last provision was added to the alternative to address the concern NMFS identified in the initial review draft that increased observer coverage requirements inside the proposed closure areas

could decrease the observer data available from fishing outside of the closure areas. While this provision addresses that concern, the other concern identified in the initial review draft about the extrapolation of observer data to generate PSC estimates remains.

NMFS uses observer data and extrapolates prohibited species catch (PSC) sampled on observed trips to similar unobserved trips in the larger federal reporting area (by processing sector, week ending date, target fishery, gear, and federal reporting area). NMFS does not create separate PSC estimates for each ADF&G state statistical area or for catcher vessels fishing inside and outside of closure areas, such as those proposed in this action. It is not known whether data collected from the proposed closure areas would be representative of fishing over the entire reporting area. However, through ongoing work NMFS is working to improve the estimation process in concert with the observer restructuring efforts. The restructured program would enable NMFS to define estimation strata and randomly select trips at a consistent rate within them. Action to increase observer coverage in this one GOA area without modifications to the NMFS catch estimation process could result in estimates which are biased by data from this specific area. Thus NMFS would need to make changes to the current estimation process to accommodate this change in coverage. Likely NMFS would need to handle estimation for this specific area discrete from other areas in the GOA. Modifications to the catch estimation process would be complex and expensive, and would compete with other priorities for additions and improvements to NMFS's catch accounting system.

Some vessels less than 60 feet LOA may have fished in the proposed closure areas in the past. Under Alternative 3, any vessels of this size class would be required to carry observers for at least some of the fishing inside the proposed closure areas (unless they didn't meet the minimum threshold for observer coverage of 3 days per quarter). Although some vessel operators may choose to fish outside the closure areas rather than incur the cost of the required observer coverage, some of these vessels may seek observer coverage. They would be required to comply with existing safety and all other vessel requirements in 50 CFR part 679.50.

If the Council recommends increased observer coverage for vessels fishing with the GOA Tanner crab protection areas under Alternative 3, this would add a third special area with 100% observer coverage requirements to NMFS's current regulations. Existing areas are the Nearshore Bristol Bay Trawl Closure Area and the Red King Crab Savings Area, both in the BSAI management area. These specific requirements for 100% observer coverage within special areas currently are not included in the categories that would require $\geq 100\%$ observer coverage under the observer restructuring alternatives. Therefore, if the Council recommends an observer restructuring alternative that places vessels in the $<100\%$ observer coverage category in a management area under a sampling plan, NMFS would remove the increased observer coverage for the "special areas" in the relevant management area. Vessels in the $<100\%$ observer coverage category would be subject to assignment of observer coverage under a sampling plan as described in the observer restructuring analysis.

The Council's current alternatives for restructuring the observer program could accommodate continuation of 100% observer coverage requirements for all vessels within these special areas. Vessels that are in the $<100\%$ coverage category would pay an exvessel value based fee for observers, and these vessels would be subject to an annual sampling plan developed by NMFS. Should vessels choose to fish in the special areas, the sample design could require that they carry observers 100% of the time they are directed fishing for groundfish in these areas. Thus, even though many of the affected vessels would not have 100% coverage any other time or in any other area, the observer restructuring action allows for flexibility in determining coverage on vessels in the $<100\%$ coverage category. If a group of vessels is determined to need 100% coverage at specific times of the year, seasons, or areas, NMFS could direct observer deployment to accommodate those needs. The fee paid by those vessels would not change, but the coverage amount could be modified to account for those circumstances; this flexibility is part of the

impetus of restructuring. This accommodation in the sampling plan is not currently described in the observer restructuring analysis, as that level of detail by sector was not deemed necessary. Establishing special areas of 100% observer coverage would significantly complicate the current sampling plan and necessarily reduce the amount of coverage days available for other fisheries and management priorities in the GOA. The vessel selection plan currently included in the observer restructuring analysis does not assign observer coverage based on what a vessels intends to do. Instead, it takes parameters such as vessel length and gear type, which are known in advance, and assigns random coverage of trips based on a pre-determined coverage rate. Vessels would call in prior to trips and be selected for coverage or not regardless of where they planned to fish.

ES.6 Regulatory Impact Review

The Regulatory Impact Review is in Section 6 of this document, and describes the economic impacts of the alternatives. Under the closures proposed under Alternatives 2 and 3, groundfish vessels that are subject to the closures will be required to forego fishing in the proposed areas. The impact on these vessels will be proportional to the extent that they rely on the area for target fishing.

Based on observer data, the nonpelagic trawl fishery will be most impacted by the area closures, especially the flatfish fisheries. 65-70% of groundfish caught in the pollock target occurs in the Chiniak and 525702 closures; 50-60% of groundfish in the arrowtooth flounder and flathead sole target occurs in 525702 and 525630; 50% of shallow water flatfish occurs in 525702; and 60-70% of the rex sole target fishing occurs in 525630. For arrowtooth flounder and flathead sole targets, there are areas outside of the proposed closures where a concentration of catch in those targets occurs, however for the shallow water flatfish target fishery, there are few areas outside of the proposed area closures where significant catch occurs. Therefore particularly for shallow water flatfish, it may be difficult to fully harvest the TAC outside the proposed area closures. There are several catcher vessels who derive over 20% of their exvessel revenue from flatfish from the 525702 and 525630, and these vessels would be more impacted than others by the proposed closures. To the extent that flatfish TACs cannot be fully harvested as a result of this alternative, there may also be impacts on the community of Kodiak and processing facilities.

For pelagic trawl, the biggest impact would result from closing 525702, where the western and central portions of the statistical area are important for pollock trawling. Approximately 25% of the groundfish catch in the pollock pelagic trawl target fishery occurred within the Marmot, Chiniak, and 525702 closures, on average between 2007 and 2009. However, the pelagic trawl pollock fishery is prosecuted in other areas within reporting area 630, which would remain open to fishing.

For pot vessels, the proposed area closures have a smaller impact on groundfish fishing because, according to observer data, the area is not as much fished as other parts of reporting area 630. However, there appear to be a higher proportion of pot vessels using the proposed area closures that are unobserved, so observer data may be less reliable for this gear type. Fish ticket data identify that an average of 42% of exvessel revenue from pot vessels came from the combined 525702 and 525630 statistical areas.

Under Option 2, the seasonal closure, adverse impacts from the area closures on groundfish fishers would be reduced compared to Option 1, as vessels could fish in the areas for the remainder of the year.

Alternative 3 would increase costs to the owners of any vessel that continued to fish in the closure areas that are not already required to have 100% or greater observer coverage. The category of vessels that could incur increased costs are (1) vessels less than 60' LOA currently required to have no observer coverage, and (2) vessels currently required to have 30% observer coverage. The estimated total increase in costs for 60' - 125' trawl catcher vessels under Alternative 3 is the full cost of 100% observer coverage inside these areas (\$558,882 or an average of \$17,465 per vessel). The estimated increase in cost under

Alternative 3 for vessels using pelagic trawl gear is a total of \$30,744 or about \$900 per vessel. Because most of the 37 vessels using trawl gear in these areas in 2009 used both nonpelagic and pelagic trawl gear, the total cost of the increased observer coverage requirements for many trawl vessels between 60' and 125' LOA would be the sum of the cost estimates for nonpelagic and pelagic trawl gear (\$589,626 or an average of \$15,936 for the 37 vessels between 60' and 125' LOA using trawl gear). For vessels less than 60 ft using pot gear, the total cost for that observer coverage is estimated at \$33,764 (average per vessel of \$2,814). For 60' - 125' pot catcher vessels, is estimated to be \$22,948, an average of \$2,086 per vessel. NMFS estimates that each day of additional observer coverage costs the agency \$130. Based on 2009 data, we may expect an increase in cost of approximately \$277,000, a cost that is not currently identified in NMFS's budget.

ES.7 Initial Regulatory Flexibility Analysis

This action could directly regulate all pot and trawl vessels participating in Federal groundfish fisheries around Kodiak Island in the Central Gulf of Alaska. From 2003 to 2009, there were 74 nonpelagic trawl vessels, 53 pelagic trawl vessels, and 129 pot vessels with reported Tanner crab bycatch, participating in one or multiple years in the groundfish fisheries in reporting area 630. Of the vessels fishing in reporting area 630, from 2003-2009, with reported Tanner crab bycatch, 26 nonpelagic trawl vessels, 12 pelagic trawl vessels, and 97 pot vessels are considered small for RFA purposes. A complete discussion of significant alternatives will be included in this section once the Council has finalized their recommendation to the Secretary of Commerce.

ES.8 Organization of the Document

There are four required components of an environmental assessment. The need for the proposal is described in Section 1, and the alternatives in Section 2. Section 4 discusses the environmental impacts of the proposed action and alternatives. A list of agencies and persons consulted is included in Section 10.2.

Management and enforcement considerations are addressed in Section 5. A Regulatory Impact Review (Section 6) discusses economic impacts of the action, and an Initial Regulatory Flexibility Analysis (Section 7) evaluates the impact of the action on small businesses. Sections 8 and 9 discuss the alternatives with respect to other analytical considerations.

Color figures mapping the distribution of bycatch and groundfish catch are included at the end of the document, in Appendix A Color Figures.

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1 Introduction and purpose

This document analyzes proposed area closures to protect *Chinocetes bairdi* Tanner crab around Kodiak Island. Included in the alternatives are options to apply the closures year round or seasonally, and to pot and/or trawl gear types. Additionally, some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement.

This document is an Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA). An EA/RIR/IRFA provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), the economic benefits and costs of the action alternatives, as well as their distribution (the RIR), and the impacts of the action on directly regulated small entities (the IRFA). This EA/RIR/IRFA addresses the statutory requirements of the MSA, the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and Regulatory Flexibility Act (RFA). An EA/RIR/IRFA is a standard document produced by the Council and the NMFS Alaska Region to provide the analytical background for decision-making.

1.1 Purpose and Need

The purpose of this action is to provide additional protection to Gulf of Alaska (GOA) Tanner crab from the potential adverse effects of groundfish fisheries, in order to facilitate rebuilding of Tanner crab stocks. This would be achieved by closing areas around Kodiak Island that are important to the Tanner crab stocks. Areas would be closed to some or all groundfish fishing, depending on the vessel's gear type or gear configuration. An alternative in the analysis would allow a vessel to be exempt from the closures if the vessel carries 100% observer coverage². This would provide the Council with a high level of confidence in the assessment of any bycatch caught in the closed area, as a basis for future management action as necessary.

1.2 Council's problem statement

The Council formulated a problem statement in October 2009, to initiate this analysis, and revised it in April 2010:

Tanner crab are a prohibited species bycatch in the Gulf of Alaska (GOA) groundfish fisheries. Directed fisheries for Tanner crab in the GOA are fully allocated under the current limited entry system. No specific conservation measures exist in the GOA to address adverse interactions with Tanner crab by trawl and fixed gear sectors targeting groundfish and low observer coverage in GOA groundfish fisheries limits confidence in the assessment of Tanner crab bycatch in those fisheries, and a greater level of observer coverage in the appropriate areas may provide the Council with a higher level of confidence in the assessment of any bycatch occurring in the designated areas as a basis for future management actions as necessary. Tanner crab stocks have been rebuilding since peak fisheries occurred in the late 1970s. Specific protection measures should be advanced to facilitate stock rebuilding.

1.3 History of this action

Since the implementation of the groundfish fishery management plans for Alaska, the North Pacific Fishery Management Council (Council) has adopted measures intended to control the bycatch of species taken incidentally in groundfish fisheries. Certain species are designated as 'prohibited' in the groundfish

² 30% observer coverage required for pot vessels less than 125 ft

fishery management plans, as they are the target of other domestic fisheries. Catch of these species and species groups must be avoided while fishing for groundfish, and when incidentally caught, they must be immediately returned to sea with a minimum of injury³. These species include Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, king crab, and Tanner crab.

To further reduce the bycatch of these prohibited species, various bycatch control measures have been instituted in the Alaska groundfish fisheries (a history is provided in NMFS 2004, Appendix F.5). In the Gulf of Alaska (GOA) groundfish fisheries, halibut bycatch limits (which close the groundfish target fisheries after the limits are reached) and bottom trawl seasonal and permanent closure areas to protect red king crab have been established. To date, no bycatch control measures have been implemented for other crab or salmon species taken incidentally in GOA groundfish fisheries.

The Council has at various times in the past several years requested that staff prepare and update discussion papers examining the scope of crab and salmon bycatch in the GOA groundfish fisheries, and proposing management options that might be considered to regulate such bycatch. During this process, the Council focused the scope on two species and two areas with potentially high bycatch levels: Chinook salmon (*Oncorhynchus tshawytscha*) and *Chionoectes bairdi* Tanner crab, in the central and western GOA. In October 2009, the Council chose to initiate this specific analysis, addressing protection measures for Tanner crab in the central GOA. Initial review occurred in April 2010, when the Council modified the problem statement and the alternatives.

³ Except when their retention is authorized by other applicable law, such as the Prohibited Species Donation Program.

2 Description of alternatives

The alternatives evaluated in this analysis were adopted by the Council in October 2009, and modified during initial review in April 2010.

Alternative 1: Status Quo – No action

Alternative 2: Close the areas specified below to pot and trawl groundfish fisheries.

Component 1: Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Component 2: Closure timing

Option 1: Year round

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Option 2: Seasonally (January 1 – July 31)

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Alternative 3: In order to fish in the areas specified below, require 100% observer coverage on all trawl groundfish vessels and 30% observer coverage on all pot groundfish vessels less than 125 feet. Note, fishing days and observer coverage in these areas would be separate from and not count towards meeting a vessel's overall 30% groundfish observer coverage requirement.

Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

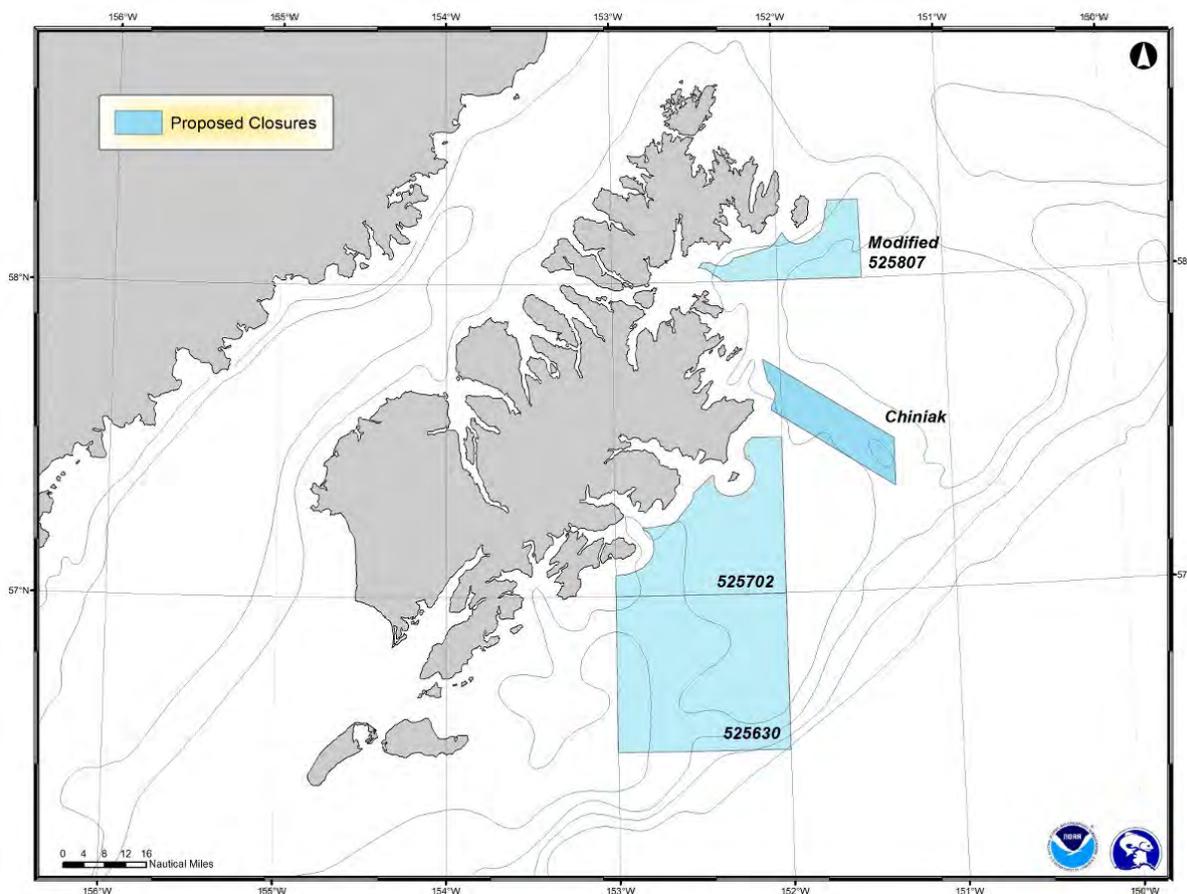
Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Note, the options and suboptions under Alternatives 2 and 3 are not intended to be mutually exclusive, and may be applied in combination. Also, in April 2010, the Council clarified that at final action, they may select closure areas that are smaller than the areas described in the four options under the 'area definition' component.

Figure 2 Area closures around Kodiak Island considered in Alternatives 2 and 3



2.1 Alternatives considered but not carried forward

The discussion paper reviewed by the Council prior to the development of this analysis suggested several other management measures that could be implemented to address Tanner crab bycatch. All of these other management measures presented concerns for the Council, and they were not included in the current analysis. The management measures can be found in the discussion paper reviewed by the Council in October 2009, which can be accessed at http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/GOAbycatch909.pdf. Alternatives in the discussion paper included establishing bycatch limits for Tanner crab, for various groundfish fisheries, which would trigger closure areas to that fishery; year-round closures by gear type; and a voluntary bycatch cooperative for bycatch management. Staff identified various strawman area closures that could be considered for either triggered or year-round closures, based on areas of high bycatch or high bycatch rates, by gear type. However, due to limitations in the current rates of observer coverage in GOA groundfish fisheries, the Council identified concerns about proceeding with alternatives that rely either on establish bycatch limits, or basing closure areas on observed bycatch. Instead, the Council initiated the current analysis and suite of alternatives, which identify closures based on Tanner crab abundance rather than on groundfish bycatch patterns.

Initially, the March 2010 analysis contained alternatives to close the proposed areas to longline, pot, and trawl gear. Jig gear was excluded from the gear types considered as bycatch of Tanner crab in the jig fishery is considered to be very low. During initial review, in April 2010, the Council removed from the alternatives the option to apply the closures to longline vessels, as the analysis identified that Tanner crab bycatch by longline vessels is also very low.

3 Affected Environment

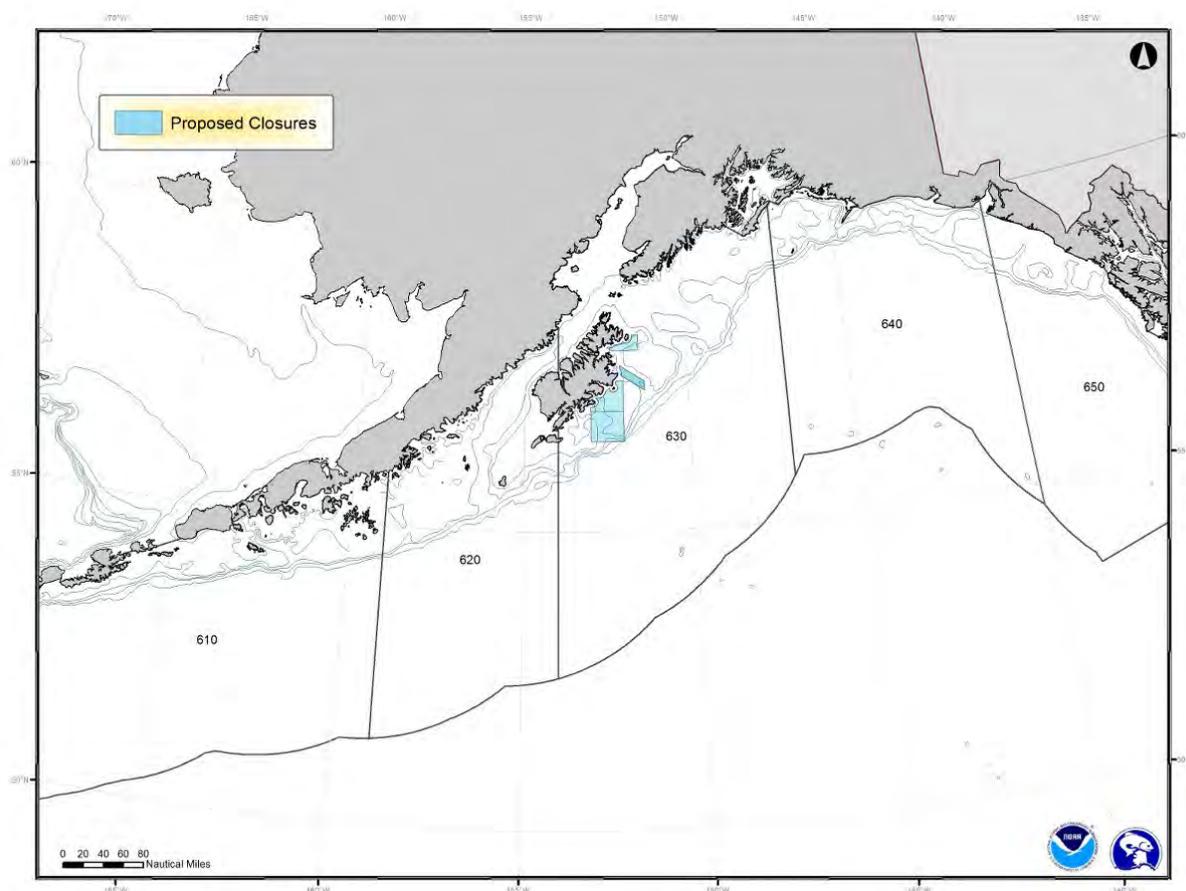
This section provides background information relevant to the analysis of this action.

3.1 Description of proposed area closures

3.1.1 Proposed area closures and groundfish management boundaries

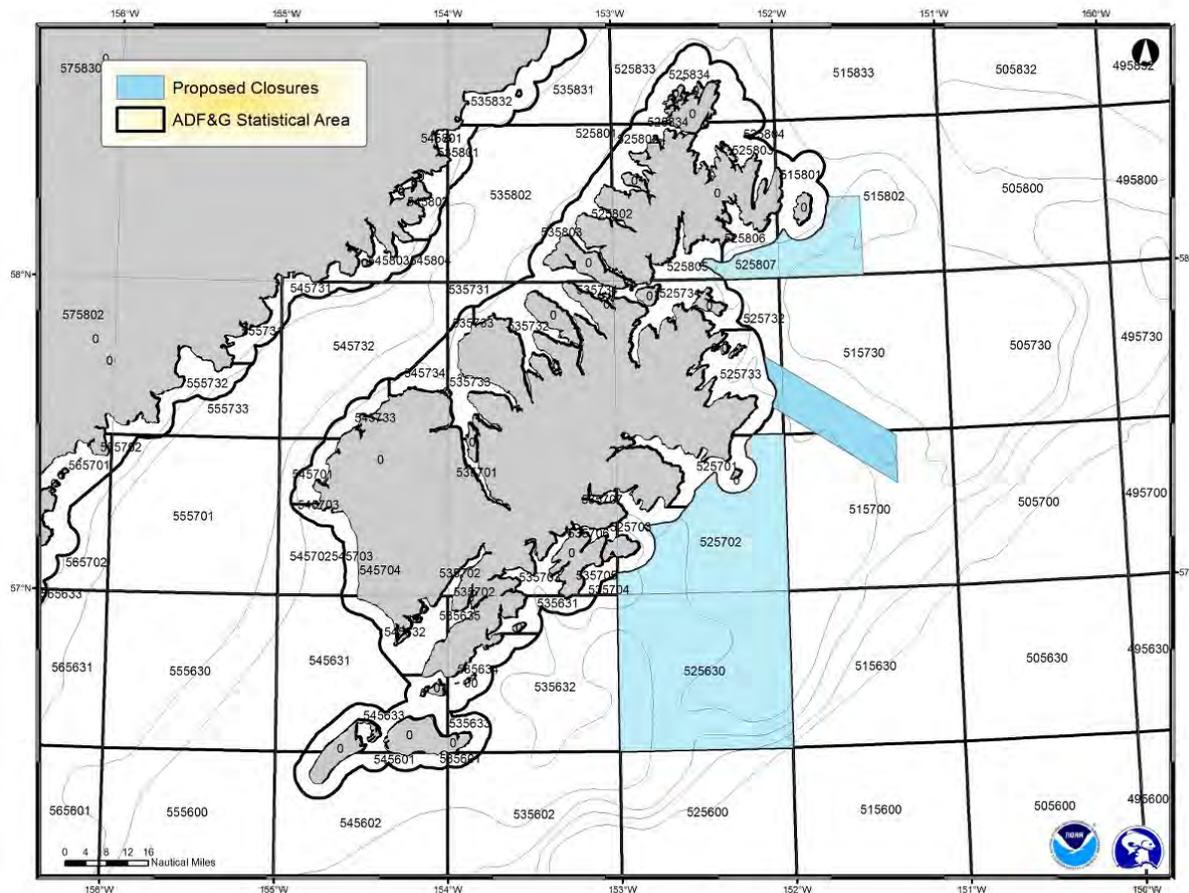
The proposed closed areas have been identified based on areas of high Tanner crab abundance. The closures are exclusively in Federal waters. All of the closures fall within Federal reporting area 630, which is used for managing the Federal groundfish fisheries (Figure 3).

Figure 3 Proposed area closures and Federal management areas



Although the proposed closure areas were identified based on areas of crab abundance, in some cases, the specific boundaries of the closed areas were chosen because they represent areas that are defined in existing regulations (in this case, ADF&G statistical areas), which also encompass the areas of crab abundance. The Chiniak closure, and to a lesser extent the Marmot closure, provide some exception to this methodology, as their boundaries are not entirely those of the ADF&G statistical areas (Figure 4).

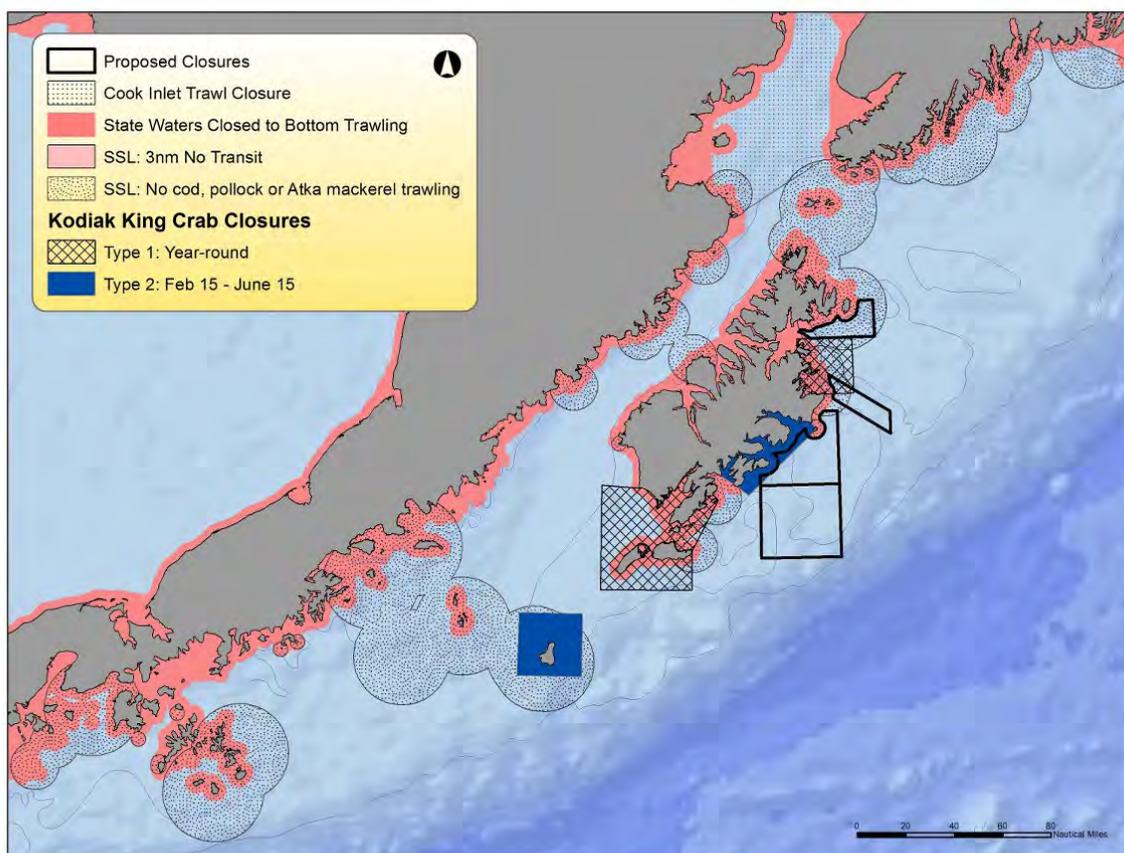
Figure 4 Proposed area closures and State of Alaska statistical areas



3.1.2 Other closures in effect for groundfish fisheries in the central GOA

There are already seasonal and permanent area closures that have been implemented for the GOA groundfish fisheries, many of which were instituted to reduce bycatch or interactions with Steller sea lions. It is important to consider the development of new spatial controls to reduce bycatch within the context of existing time and area closures. The various State and Federal closures affecting the GOA groundfish fisheries are described below, along with their intended purpose. The year the closure was implemented is noted in parentheses. Figure 5 maps the existing closures in the central regulatory area, in which the area closures that are focus of this analysis are situated.

Figure 5 Locations of existing trawl fishery and crab protection closures in the Central Gulf of Alaska, and proposed closures of this analysis



Kodiak red king crab closures: Type 1 and Type II (1993). **Nonpelagic trawl closure areas**, designed to protect Kodiak red king crab because of the poor condition of the king crab resource off Kodiak and because trawl bycatch and mortality rates are highest during the spring months when king crab migrate inshore for reproduction. The molting period off Kodiak begins around February 15 and ends by June 15. Type I areas have very high king crab concentrations and, to promote rebuilding of the crab stocks, are closed all year to all trawling except with pelagic gear. Type II areas have lower crab concentrations and are only closed to nonpelagic gear from February 15 through June 15. In a given year, there may also be Type III areas, which are closed only during specified ‘recruitment events’, and are otherwise opened year-round. Regulations governing these closures are in 50 CFR part 679 (§ 679.22(b)). These regulations state that “no person may trawl” in these areas “from a vessel having any trawl other than a pelagic trawl either attached or on board”. **There is some overlap between these closures and the proposed area closures included in this analysis.**

A research study was conducted in 1998 and 1999 at two specific sites on the boundaries of the Kodiak crab closure areas (Stone et al. 2005). The study was not able to determine the effect of the closures on their intended target, red king crab, as the species has not recovered. However, the study noted that juvenile Tanner crab were fairly common within the study areas, and were “significantly more abundant in areas closed to trawling”. The paper concludes that it is possible that habitat closures may provide benefits to Tanner crab.

Steller Sea Lion (SSL) 3 nautical mile (nm) no transit zone (2003). **Groundfish fishing closures** related to SSL conservation establish 3-nm no-transit zones surrounding rookeries to protect endangered Steller sea lions.

SSL no-trawl zones for pollock and cod (2003). **Pollock and Pacific cod trawl fishing closures** related to SSL conservation establish 10- to 20-nm fishing closures surrounding rookeries to protect endangered Steller sea lions. **There is some overlap between these closures and the proposed area closures included in this analysis.**

Cook Inlet bottom trawl closure (2001). **Prohibits nonpelagic trawling** in Cook Inlet to control crab bycatch mortality and protect crab habitat in an areas with depressed king and Tanner crab stocks.

State Water no bottom trawling (2000). **Prohibits commercial bottom trawling** in all state waters (0–3 nm), year-round, to protect nearshore habitats and species. However, specific areas in the Shelikof Straits along the west side of Kodiak Island are open to bottom trawling from January 20 to April 30 and October 1 to November 30, and areas around Shumagin and Sanak Islands are open year round.

3.1.3 Physical characteristics of proposed area closures

Figure 6 identifies the bathymetry within the four closure areas. Not much information is available about bottom sediment in the GOA, however what sediment information is available for the proposed area closures is mapped in Figure 7. Sediment in the proposed closure areas is variable, with similar sand and gravelly sand substrates, but also gravelly mud and silty clay areas.

Figure 6 Bathymetry within proposed area closures (depth in fathoms)

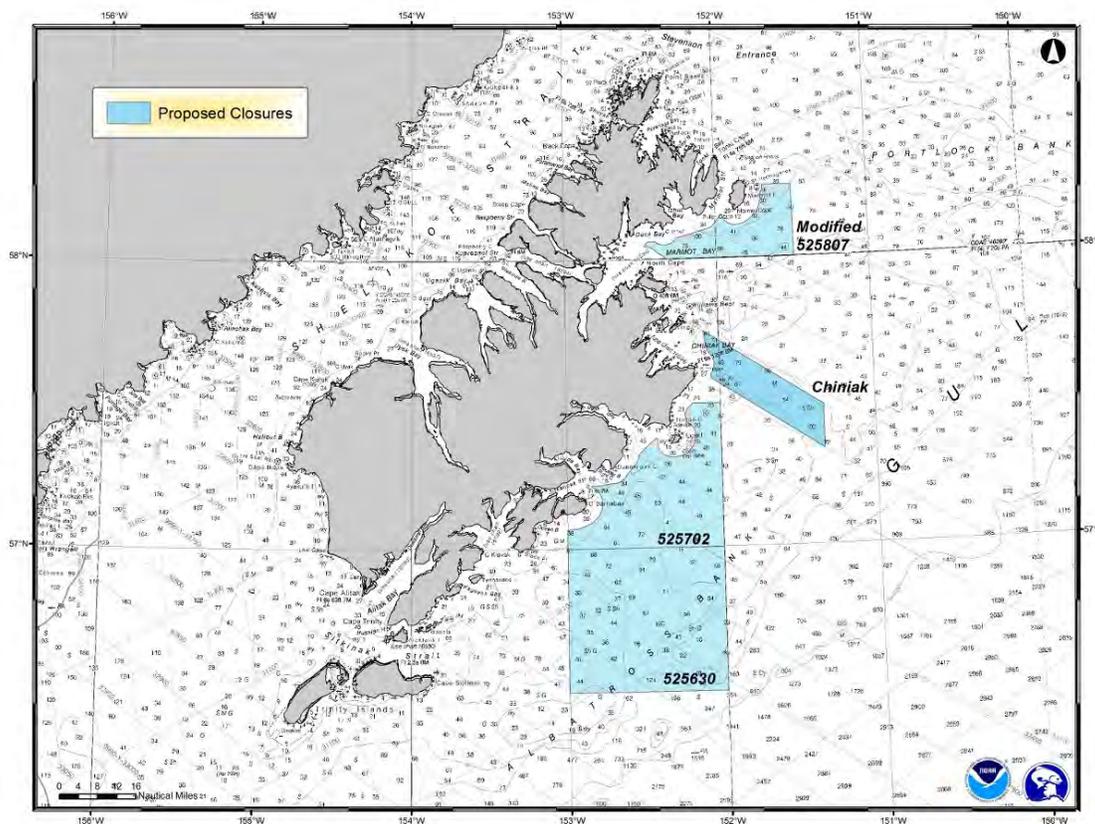
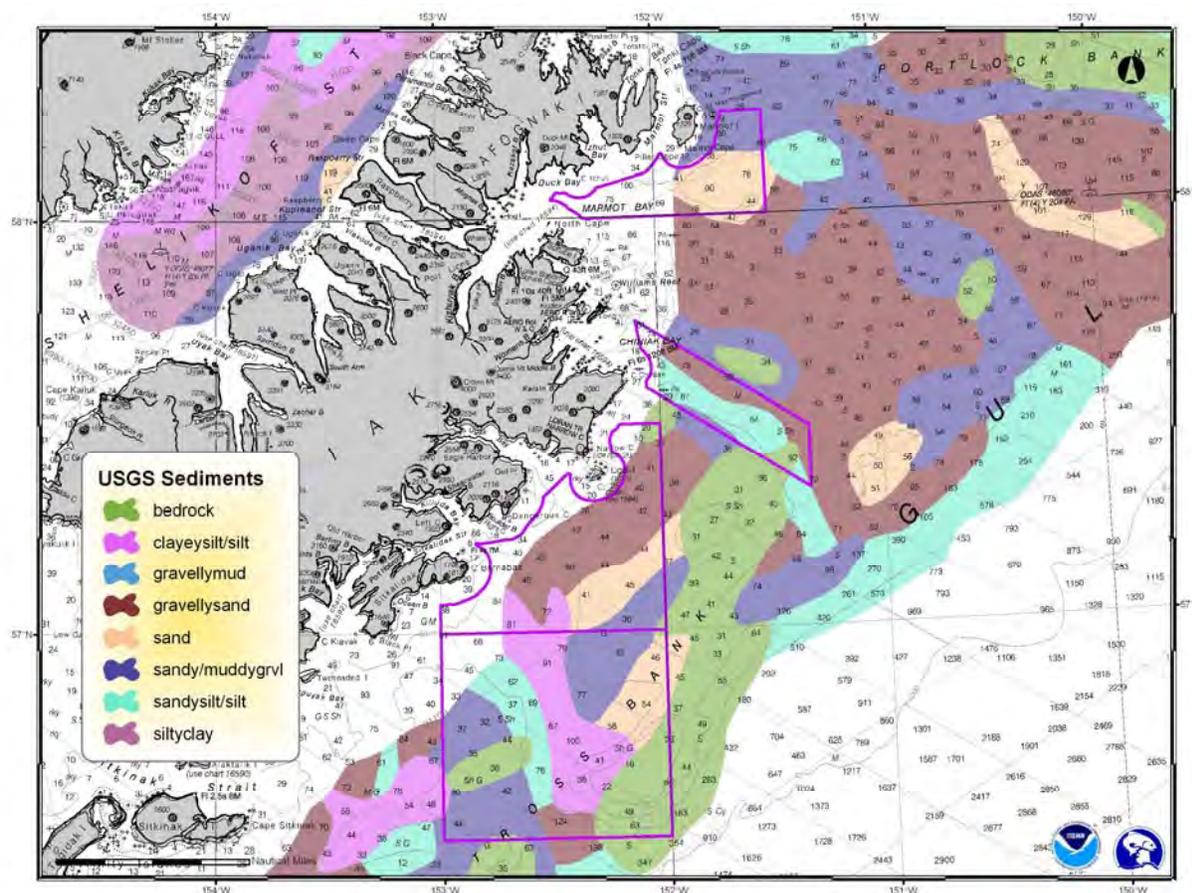


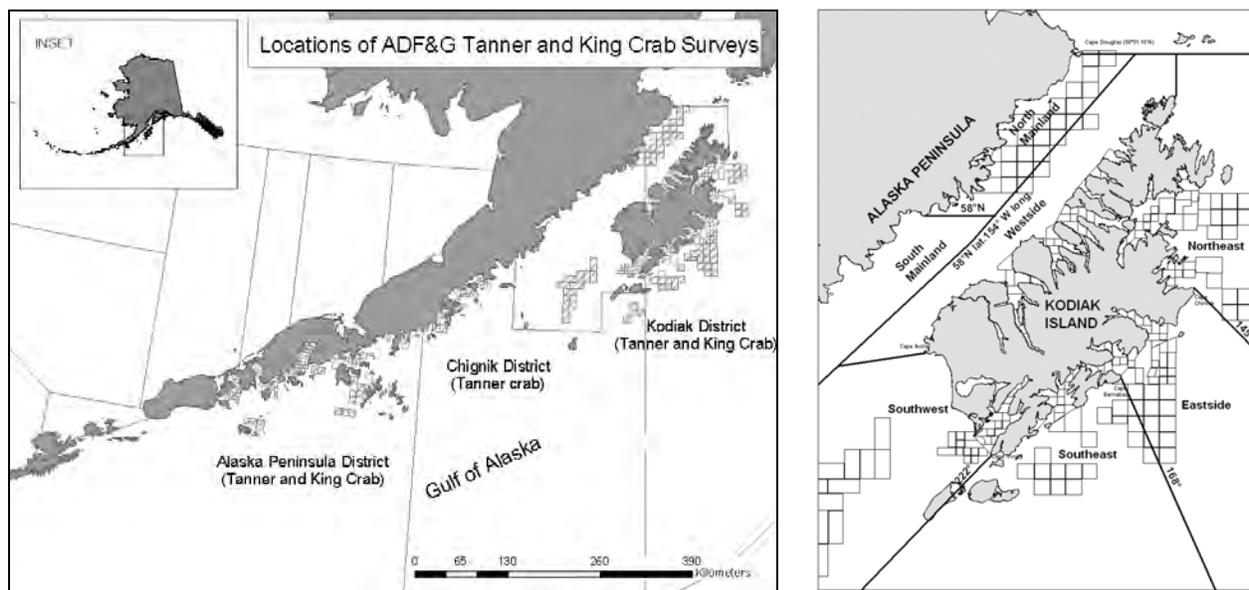
Figure 7 Sediment types within the proposed closed areas



3.1.4 Proposed area closures and Tanner crab management boundaries

Tanner crab fisheries in the GOA are managed by the State of Alaska. Crab populations are evaluated and managed in units called districts. Fisheries south of Cape Douglas (58° 1.10' N lat.), west of Cape Fairweather (148° 50.25' W. long.), and east of Cape Kumlik (157° 27' W. long.) are part of the Kodiak District (5 AAC 35.505). The Kodiak District is further divided into seven sections to distribute harvest and effort (Figure 8).

Figure 8 ADF&G trawl survey stations for Tanner and king crab abundance, and fishery management districts around Kodiak Islands

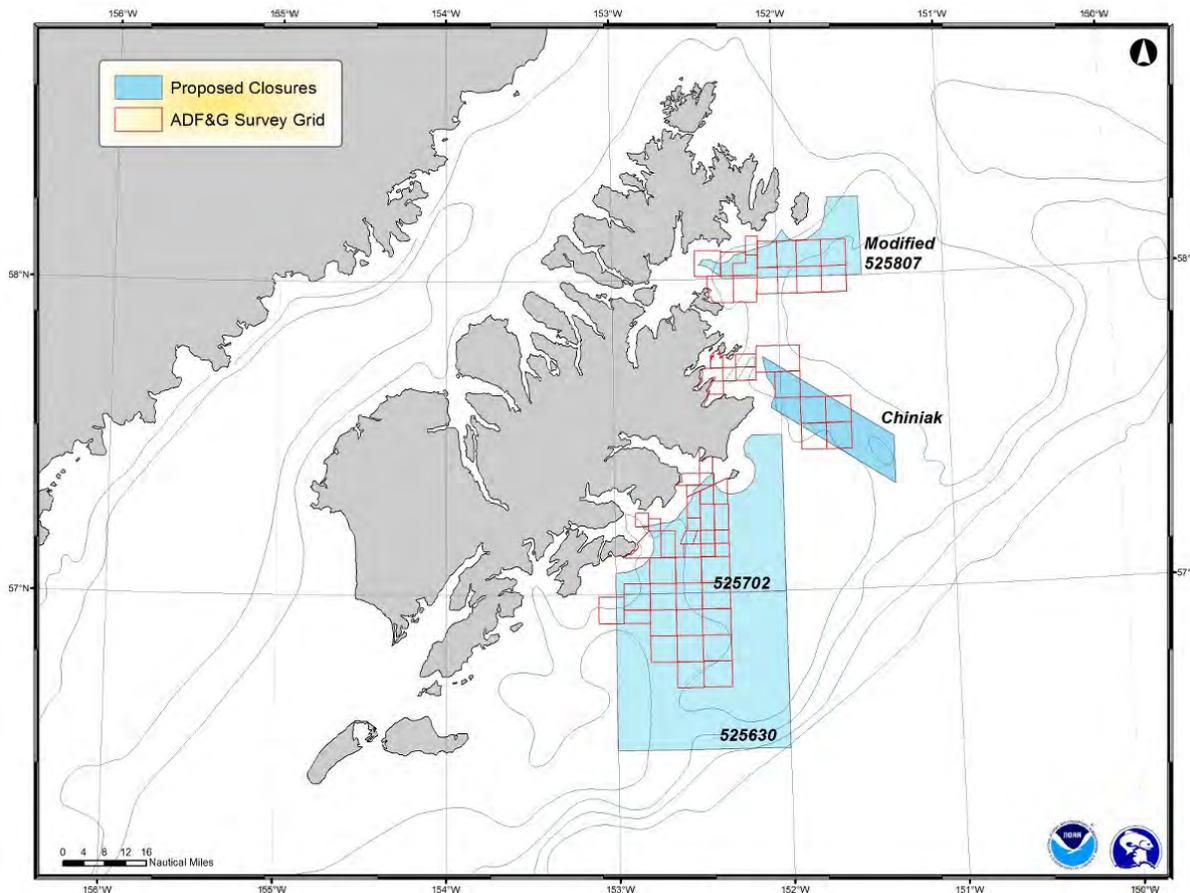


Source: K Spalinger, ADF&G

An annual trawl survey is conducted by ADF&G covering the Alaska Peninsula, Chignik, and Kodiak districts (Spalinger 2010). The survey methodology is designed to concentrate sampling in areas of historical king and Tanner crab abundance. While a large proportion of preferred fishing areas are surveyed, not all Tanner crab habitat is covered by the survey.

Not all of the proposed area closures are entirely surveyed by the ADF&G Tanner crab survey. Especially for closure areas 525702 and 525630, which have been identified as important for the GOA Tanner crab stock, the surveyed area is notably smaller than the statistical areas which are proposed for closure. Figure 9 shows a map overlaying the proposed area closures on the ADF&G crab survey grid. (Note, however, that crab bycatch is also observed in the areas outside of the survey area, but within the statistical areas identified as proposed closures, as described in Section 3.3.4 and illustrated in the color figures in Appendix A). While Tanner crab are found outside the station grid, the majority of the population is believed to be contained within the survey grid.

Figure 9 Proposed closed areas (shaded) and areas surveyed in the ADF&G crab trawl survey (grids)

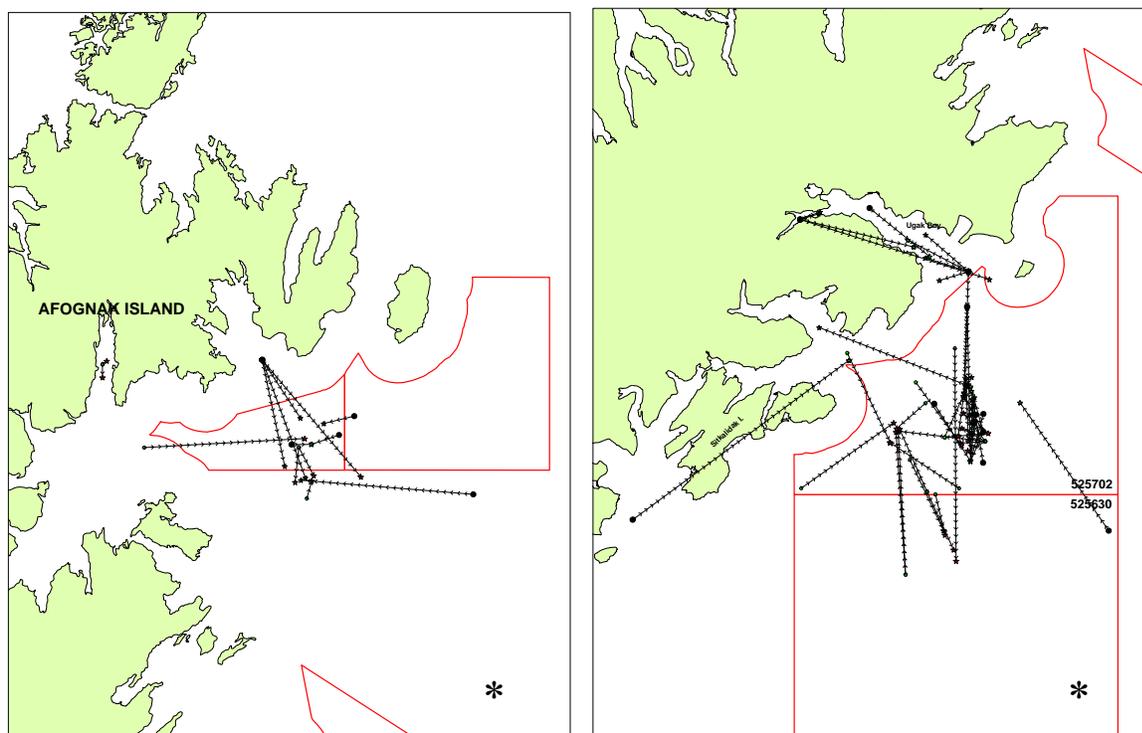


3.2 *C. bairdi* Tanner crab stocks

Tanner crab are a member of the genus *Chionoecetes*, and are found from subtidal areas to 437 m (Jadamec et al. 1999). Tanner crabs feed on a wide assortment of marine life including worms, clams, mussels, snails, crabs, other crustaceans, and fish parts. They are fed upon by bottomfish, pelagic fish, and humans. The top 5 predators of Tanner crab in the Gulf of Alaska are Pacific cod, Pacific halibut, sculpin spp., flathead sole, and walleye pollock.

Migration patterns are not well understood; however, it is known that the sexes are separated during much of the year and move into the same areas during the reproductive season. Donaldson (1983) found that mean movement of male Tanner crab in the Kodiak area was approximately 24.0 km. In addition, male Tanner crab in bays tended to move to deeper offshore waters while those in offshore areas tended to remain offshore (Donaldson 1983). Recent tagging research by ADF&G (ADF&G unpublished data) suggests that Tanner crab in the Eastside Section of Kodiak do not move into other sections; likewise, Tanner crab in Marmot Bay do not move south of Marmot Bay. Tanner crab that were tagged within the proposed closure areas were generally recovered within the proposed closure areas (Figure 10). It should be noted that tagging data has limitations and should be interpreted with caution. Recoveries are made during the commercial fishery so if fishing did not occur outside the closure areas, crab would not be recovered.

Figure 10 Tanner crab release and recovery locations from the Northeast (left panel) and Eastside Sections (right panel) 2008 and 2009. Circles denote release location, stars denote recovery location and arrows denote direct path between release and recovery.



Females mate with an adult male for the first time during her last molt (maturity molt). The male crab is attracted by a chemical attractant (pheromone) released by the female. Females molt to sexual maturity and mate in the softshell condition while grasped by the male. Older hardshelled females are also mated by adult males, but in the absence of a male they are capable of producing an egg clutch with sperm stored from a previous mating.

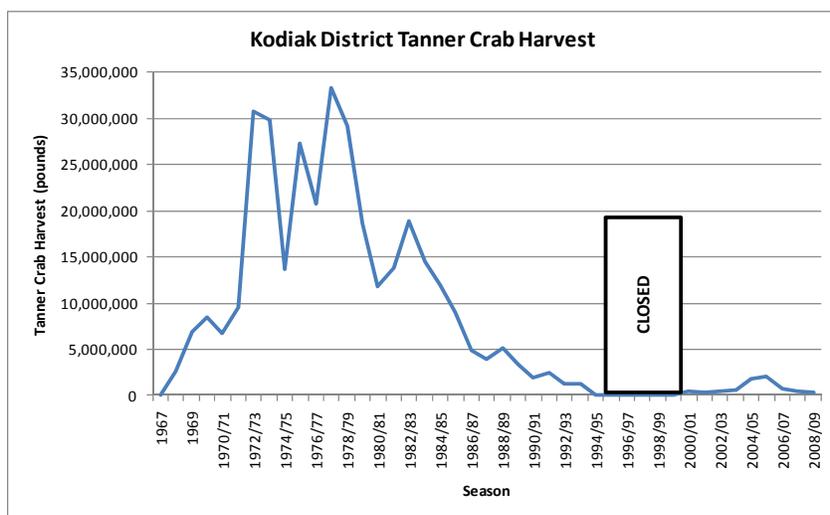
Fertilization is internal, and the eggs are usually extruded within 48 hours onto the female's abdominal flap where they incubate for a year. Hatching occurs late the following winter and spring with the peak hatching period usually during April to June.

The young, free-swimming larvae molt many times and grow through several distinct stages. Growth during this period is usually dependent on water temperature but lasts about 63 to 66 days, after which the larvae lose their swimming ability and settle to the ocean bottom. After numerous molts and several years of growth, females mature at approximately 5 years of age. Males will mature at about 6 years.

Tanner crab live to an estimated maximum age of 14 years. Males of commercial size range from 7 to 11 years of age.

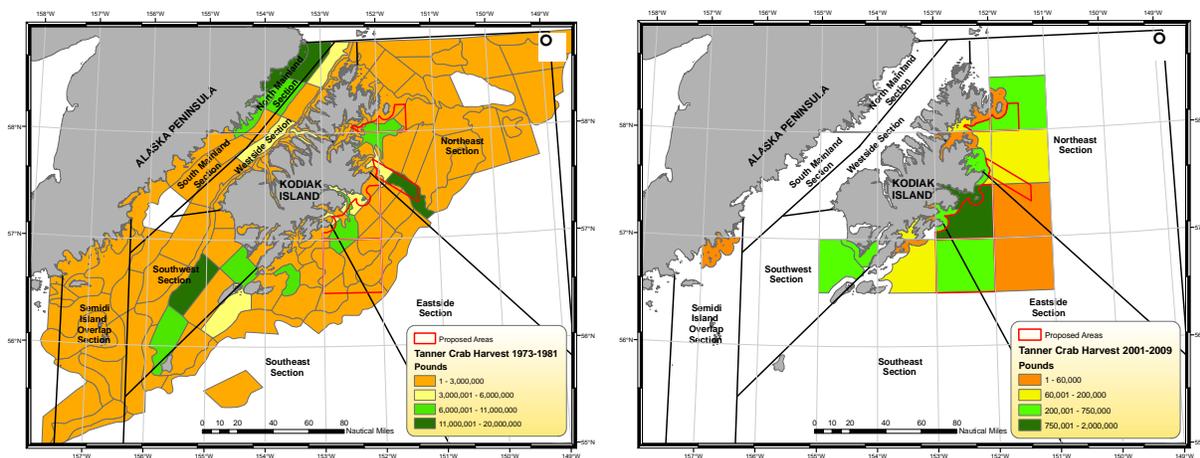
Commercial Tanner crab harvests in the Kodiak District date back to the late 1960s (Brown 1971; Figure 11). As Tanner crab fisheries grew in economic importance, Tanner crab populations were indexed using a pot survey starting in 1973 (Colgate and Hicks 1983). The annual trawl survey did not begin until the early 1980s (Colgate and Hicks 1983) after the Tanner crab population had declined. Since implementation of the trawl survey, the highest harvest of Tanner crab was just over 5 million pounds (1989), and has averaged less than 2 million pounds.

Figure 11 Kodiak District Commercial Tanner crab harvest, 1967 to 2008/2009.



Because of the differences in survey methods, it is difficult to make direct comparisons pre- and post-1988 survey data. Harvests prior to the start of the trawl survey often exceed 10 million pounds suggesting that populations in the 1970s were much larger (Stichert *in press*). In addition to higher harvests, historical effort was much broader throughout the management area than current fishing effort (Figure 12).

Figure 12 Historical harvest locations, summing harvests 1973-1981, compared to current harvest locations, summing harvests 2001-2009



Historically, harvests were strongest in Chiniak Gully, south of Kodiak Island, and along the North Mainland. Current harvest locations are strongest on the Eastside of Kodiak Island.

From 1997 through 2009 the total Tanner crab population in the Kodiak District ranged from just over 19 million crabs to over 186 million crabs (Spalinger 2010; Table 1). The average Tanner crab population estimate from 2003 – 2009 is approximately 109 million crabs. The management section that consistently has had the highest population of Tanner crab is the Eastside Section, which has averaged over 48 million crabs from 2003-2009. The section with the second highest abundance is the Northeast Section which has averaged over 17 million crabs from 2003-2009.

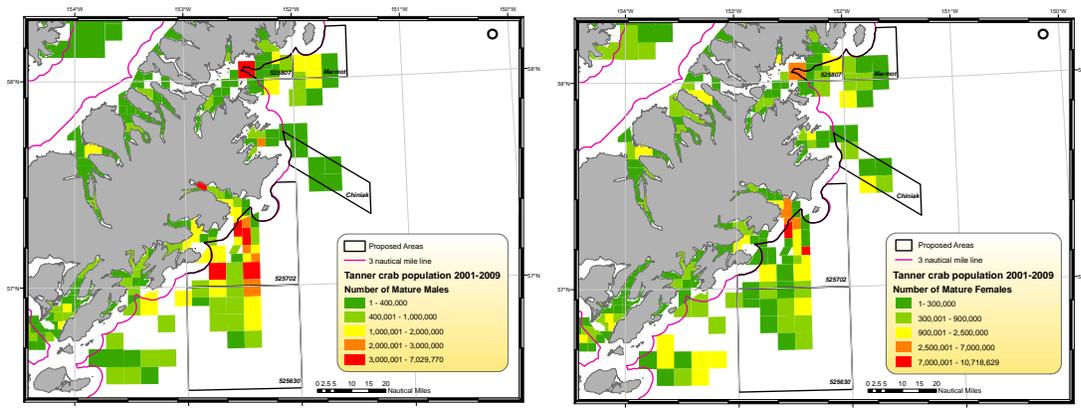
Table 1 Population estimates for total numbers of Tanner crab for Kodiak District, by section from the ADF&G bottom trawl survey

Year	Northeast	Eastside	Southeast	Southwest	Westside	North Mainland	Kodiak District
1997	3,550,650	4,578,002	1,379,455	1,172,719	2,113,986	6,754,956	19,549,768
1998	10,685,184	18,270,254	4,784,391	801,642	2,883,401	8,554,251	45,979,123
1999	6,075,563	17,913,837	8,859,587	2,126,585	2,591,322	9,741,951	47,308,845
2000	15,698,017	19,832,495	8,275,551	6,658,290	3,402,796	11,889,904	65,757,053
2001	42,326,627	61,399,533	25,240,766	21,281,118	5,824,141	13,655,815	169,728,000
2002	16,294,283	39,331,894	15,151,262	9,262,329	3,196,077	18,627,785	101,863,630
2003	13,443,591	36,166,904	6,058,690	3,141,350	4,593,172	7,013,798	70,417,505
2004	16,321,335	26,352,608	12,333,843	3,575,099	1,804,194	10,356,807	70,743,886
2005	17,403,505	19,113,246	10,974,042	3,011,422	3,947,639	13,226,334	67,676,188
2006	21,906,413	68,461,704	33,083,614	15,342,283	9,334,219	16,914,410	165,042,643
2007	18,653,830	98,433,348	35,342,446	25,861,206	4,582,398	3,382,721	186,255,949
2008	21,179,965	50,858,092	10,731,234	23,520,341	8,397,115	4,825,933	119,512,680
2009	16,992,570	39,006,970	7,768,620	9,716,347	5,623,343	5,283,555	84,391,405
97-09 average	16,963,964	38,439,914	13,844,885	9,651,595	4,484,139	10,017,555	93,402,052
03-09 average	17,985,887	48,341,839	16,613,213	12,024,007	5,468,869	8,714,794	109,148,608

Source: Spalinger *in press*

Similar to the trends of the total Tanner crab population, mature Tanner crab population estimates are highest in statistical area 525702 and inside state waters of Marmot Bay (statistical area 525805; Figure 13).

Figure 13 Numbers of mature male and mature female Tanner crab as surveyed by the ADF&G trawl survey, summed 2001-2009



3.2.1 Tanner crab abundance inside proposed area closures

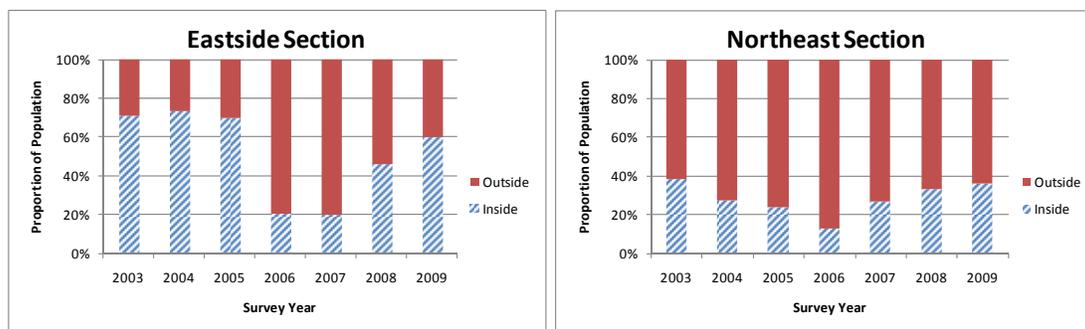
The proposed area closures are located in the Northeast and Eastside sections of the Kodiak District. The proposed closure in statistical area 525807, the “boot”, and the proposed Chiniak closures are in the Northeast Section. The proposed 525702 and 525630 closures are in the Eastside Section. Estimates of Tanner crab populations within the proposed area closures range from just over 16 million crabs (2006) to over 38 million crabs (2003 and 2008) and average 22.7% of the total Kodiak District population (Table 2). The proportion of crab inside the area closures in the Eastside Section ranged from 20% to 71% of the total Eastside Tanner crab population estimate. The proportion of crab inside the proposed closures in the Northeast Section was generally lower, ranging from 13% to 39% of the total Northeast Tanner crab population estimate (Table 2 and Figure 14).

Table 2 Population estimates for Tanner crab inside and outside proposed area closures (boxes) in the Eastside (525702 and 525630) and Northeast (Marmot and Chiniak) sections in relation to the total Kodiak District population estimate, 2003-2009.

Year	Kodiak District	Inside Proposed Boxes			% of Kodiak Total inside Box
	Total	Eastside	Northeast	Total	
2003	70,417,505	25,686,289	5,187,889	30,874,178	43.8%
2004	70,743,886	19,355,934	4,509,878	23,865,812	33.7%
2005	67,676,188	13,306,984	4,122,476	17,429,460	25.8%
2006	165,042,643	13,853,614	2,859,629	16,713,243	10.1%
2007	186,255,949	19,729,269	5,044,104	24,773,373	13.3%
2008	119,512,680	23,269,812	7,002,210	30,272,022	25.3%
2009	84,391,405	23,359,852	6,119,616	29,479,468	34.9%
03-09 avg.	109,148,608	19,794,536	4,977,972	24,772,508	22.7%

Source: N. Sagalkin, ADF&G

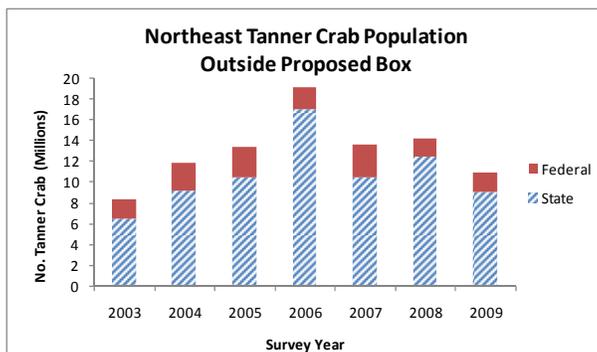
Figure 14 Estimated Tanner crab population outside the proposed area closures (boxes) in the Eastside (525702 and 525630) and Northeast (Marmot and Chiniak) Sections relative to state and federal waters, 2003-2009.



Source: N. Sagalkin, ADF&G.

Bottom trawl gear is prohibited inside most state waters of the Kodiak Area and from all state waters in the Tanner crab management sections with the proposed closures. Tanner crab populations are distributed inside and outside the 3-mile state-water boundary. In the Eastside Section of the Kodiak District, the entire surveyed Tanner crab habitat outside of state waters is contained within the proposed area closures. In the Northeast Section of the Kodiak District, portions of the Tanner crab population are outside state waters and outside of the proposed area closures (Figure 15).

Figure 15 Estimated Tanner crab population outside the proposed area closures (boxes) in the Northeast Section relative to state and federal waters, 2003-2009.

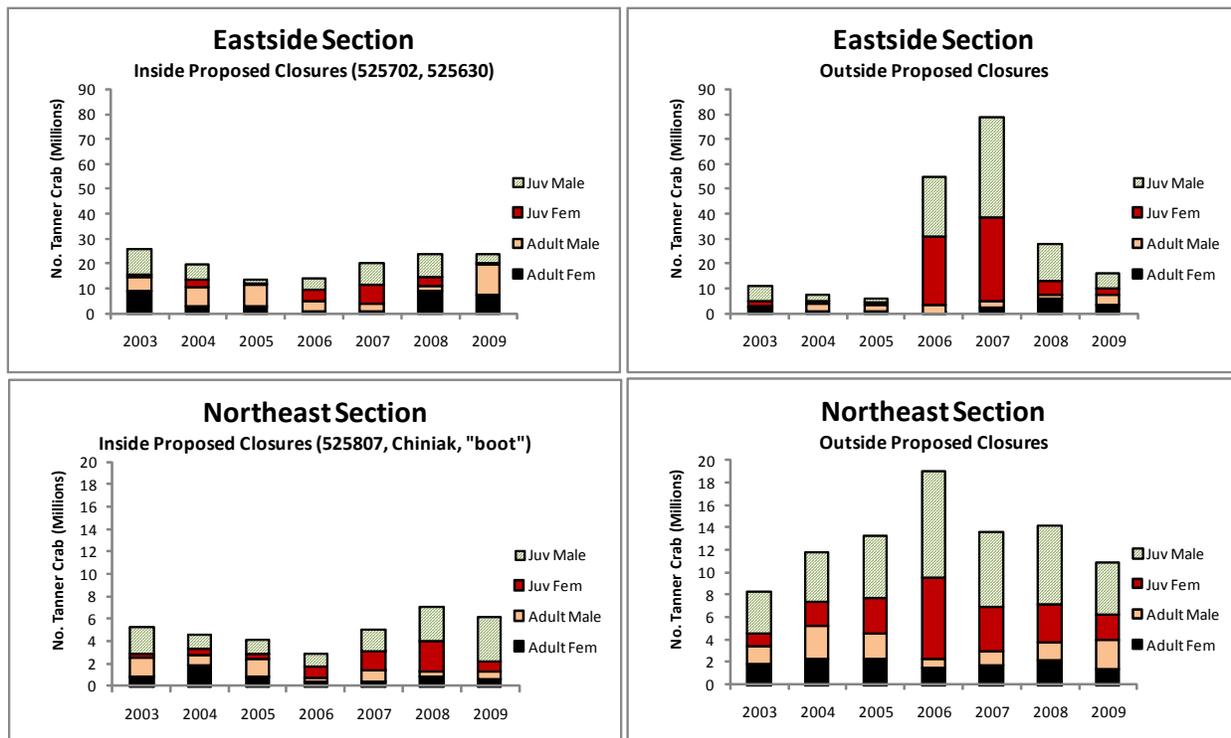


Source: N. Sagalkin, ADF&G

In general, the majority of the Tanner crab population in the Northeast Section outside of the proposed area closures is located within state waters (Figure 15).

Tanner crab population estimates are comprised of juvenile and mature, male and female Tanner crab. Figure 16 demonstrates the composition of Tanner crab inside the proposed area closures in the Eastside Section of the Kodiak District. Comparing the population composition (Figure 16) in relation to the proportion of the population inside and outside the proposed area closures (Figure 14), illustrates some spatial patterns that exist in the Eastside Section where mature crab tend to be offshore. This pattern is less evident in the Northeast Section (Figure 16).

Figure 16 Estimated population of juvenile male, juvenile female, adult male, and adult female Tanner crabs inside and outside of the proposed area closures (boxes) in the Eastside and Northeast sections of the Kodiak district, 2003-2009.



Source: N. Sagalkin, ADF&G.

3.2.2 *C. bairdi* Tanner crab life history and seasonal patterns

Tanner crab are found mainly on soft bottom and most abundant in depths of 40-50 fathoms (Urban and Hart 1999). Tanner crab may be more sensitive to disturbance during molting, mating, and egg hatching periods than during other portions of the year. While males appear to have synchronous molting in the spring (ADF&G unpublished data; Table 3), there is less data on the timing of female molting, except for the female molt to maturity.

The first time female Tanner crab mate is during their molt to maturity. Final molt for females may occur as early as December and as late as June (Donaldson and Adams 1989; Donaldson 1975; Table 3). Females molt to sexual maturity and mate in the softshell condition while grasped by mature male (primiparous females). Peak of egg deposition for primiparous female Tanner crab occurs in April and May (ADF&G unpublished data; Table 3). After the maturity molt, females do not continue to grow, but do continue to mate and produce eggs (multiparous females). Primiparous females tend to mate with males in shallow waters in isolated pairs, while multiparous females mate in large aggregations in deeper waters during April, May, and June (Stevens et al. 1994; Table 3); this differential mating behavior is termed bipartite breeding (Somerton 1982). Mating behavior is intricate and may last several days (Adams 1982; ADF&G unpublished data). Some authors have suggested that groundfish trawls could easily capture or disrupt an entire Tanner crab mating aggregation (Stevens 1990).

Table 3 Seasonal pattern of life history traits of Tanner crab

Event	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
Female final molt to maturity/mating	■	■	■	■	■	■	■						Donaldson and Adams 1989; Donaldson 1975
Primiparous peak of new egg clutch deposition				■	■	■							ADF&G unpublished data
Multiparous females mate in deepwater aggregations				■	■	■							Stevens, Haaga, and Donaldson 1994
Multiparous females mounding in pods, hatching				■	■	■	■						Stevens 2003
Male molt - observations of casts on beaches around Kodiak		■		■									ADF&G unpublished data
Male molt - Southeast Alaska				■									Stone 1999

3.3 C. bairdi Tanner crab bycatch in Federal groundfish fisheries

In this section, an overview of Tanner crab bycatch in the Federal groundfish fisheries is provided, both by reporting area and specifically in the proposed area closures. Although some information is given on crab bycatch as a proportion of overall groundfish effort, more detail on groundfish effort is provided in the RIR, in Section 6.5.

In order to understand the bycatch information presented, the first two subsections below provide some context to the bycatch overview. Section 3.3.1 describes the proportion of groundfish fishing effort, by gear type and target fishery, which is observed in the central GOA. The reported numbers of total bycatch are extrapolated based on the rates of bycatch on observed vessels, using a procedure described in Cahalan et al. (2010). Section 3.3.2 provides information about the various studies of crab bycatch mortality rates that have been conducted for various gear types. The numbers reported here of bycatch in the groundfish fisheries do not account for the differing levels of mortality that may affect bycaught crab caught by different groundfish gear types. Finally, in Section 3.1.2, the existing area closures that affect some or all gear types in the groundfish fisheries around Kodiak are described, which provides context for understanding the constraints that are already in place for certain gear types.

3.3.1 Observer coverage

Catch and bycatch data were obtained from the NMFS catch accounting database, and analyzed to represent the amount, species composition, timing, and location of salmon and crab caught incidentally in GOA groundfish fisheries. All NMFS data were screened to ensure confidentiality is maintained. The process that is used to estimate bycatch for groundfish fisheries is described in Cahalan et al (2010). In short, bycatch estimates are derived from observer information. If a trip is unobserved, then bycatch rates from observed vessels are applied to the industry report of retained catch. The resulting estimates are used in this analysis. Further discussion on the proportion of GOA groundfish fisheries that are observed is addressed below.

Spatial analysis of bycatch in this analysis uses only the data directly from observed vessels, as described below represents only a proportion of total catch in the groundfish fisheries.

The North Pacific Groundfish Observer Program collects catch and bycatch data used for management and inseason monitoring of groundfish fisheries. Since 1990, all vessels larger than 60 ft (length overall) participating in the groundfish fisheries have been required to have observers onboard at least part of the time. It is important to note that in a separate initiative, the Council has tasked staff with analyzing alternatives to address known problems with the existing system of observer procurement and deployment. While several issues are being addressed in that analysis, potential bias of catch and bycatch estimates is a key element, particularly in fleets with less than 100% observer coverage. That analysis is proceeding in tandem with, but not linked to, this discussion paper. Concerns about data quality are intended to be addressed through the Observer Program restructuring initiative. More information about the observer restructuring initiative is in Chapter 5 of this document.

Under the structure of the current Observer Program, the amount of observer coverage is based on vessel length. No vessels less than 60 ft are required to have observers onboard. Trawl and hook and line vessels that are between 60 ft and 125 ft must have an observer onboard for 30% of fishing days, by quarter. Vessels that are larger than 125 ft that are not fishing with pot gear must have an observer onboard 100% of the time. All vessels fishing with pot gear that are greater than 60 ft LOA must have observer coverage for 30% of their pot retrievals each quarter. Shore-based processing facilities that process 1,000 mt or more of groundfish in a month must have an observer present for 100% of the time. Facilities that process between 500 and 1,000 mt per month are required to have observer coverage on 30% of their processing days.

There is a greater prevalence of smaller vessels participating in the GOA groundfish fisheries than in the Bering Sea/Aleutian Islands, and over the past 10 years, participation by smaller vessels in the GOA groundfish fisheries has generally increased, particularly catcher vessels less than 60 ft length overall (NPFMC 2003). Because observer coverage requirements are generally based on vessel length, the proportion of total catch that is observed in GOA groundfish fisheries is much lower than, for example, in the Bering Sea fisheries. The majority of the GOA fleet is subject to 30% observer coverage. Table 4 illustrates the total groundfish catch in the GOA, the total amount of groundfish that is caught while an observer is onboard the vessel, and the resulting percentage. In the central GOA the range is from 32% to 37%. In comparison, the average percentage of observed catch in the Bering Sea is approximately 86%, and in the Aleutian Islands is approximately 95%. Please note that the percentage of observed catch provides only a gross overview as to the quality of information, and may mask data quality concerns. The goal is to have an unbiased estimate that is sufficiently precise to meet the management need for the information. The precision of bycatch estimates depends upon the number of vessels observed and the fraction of hauls sampled (Karp and McElderry 1999). Because of the relatively lower levels of observer coverage in the GOA, estimates of salmon and crab bycatch are less precise in the GOA than in Bering Sea groundfish fisheries. To what degree they are less precise, however, is not known, as current PSC estimates do not include a measure of uncertainty.

Detailed information on percent of harvest observed in the GOA groundfish fisheries has been presented to the Council meeting as part of their reports from the Observer Advisory Committee, most recently at the April 2008 Council meeting. NMFS compiled a series of tables that provides a breakout of the percentage of harvest observed for each year 2004–2007, inclusive, in order to show the effective rate of coverage in particular target fisheries. The data are broken out by observer coverage category (30%, 100%), gear type, area, and component of the catch by the <60' fleet that is unobserved.⁴ The information for the central GOA is presented in Table 5.

Information in the tables pertinent to the discussion of fisheries in the GOA is summarized below. For the GOA Pacific cod pot fisheries, more than half the catch from 2004–2007 came from the <60 ft fleet, which is unobserved. The remaining catch primarily came from the >60 ft to <125 ft fleet where percent coverage ranged from 17-28% over the four years. For the Pacific cod trawl fisheries delivering shoreside, coverage in the >60 ft to <125 ft category ranged from 24%–30% in this time frame. The State waters Pacific cod fishery is unobserved, however bycatch rates from comparable vessels/areas are applied to the State waters Pacific cod catch. Bycatch attributable to the State waters Pacific cod fishery is included in this discussion paper, but is presented in a separate section.

⁴ Note that the total catch data referenced is from the NMFS catch accounting system, and the observer data is from the NMFS observer database. The observer data includes all sampled and unsampled hauls that occurred while an observer was onboard. High variability in percent observed catch among years has been correlated to several factors, such as the varying season lengths, number of participating vessels, different catch rates per year, weather, and market prices.

Table 4 Total catch, observed catch, and percent observed catch by area and year

Area	Year	Total (mt)	Observed (mt)	Percent
Western GOA	2004	50,853	14,414	28%
	2005	53,142	13,195	25%
	2006	51,944	17,253	33%
	2007	46,968	16,882	36%
Central GOA	2004	108,707	37,744	35%
	2005	120,030	41,586	35%
	2006	131,271	42,349	32%
	2007	118,871	44,113	37%
Eastern GOA	2004	7,610	2,911	38%
	2005	8,709	3,072	35%
	2006	8,772	3,293	38%
	2007	4,274	3,225	75%
Bering Sea	2004	1,695,228	1,450,413	86%
	2005	1,702,671	1,467,153	86%
	2006	1,696,337	1,470,680	87%
	2007	1,569,110	1,352,914	86%
Aleutian Islands	2004	98,169	93,188	95%
	2005	94,209	89,516	95%
	2006	95,288	91,461	96%
	2007	107,090	101,060	94%

Note: This table does not include jig gear, but otherwise includes all targets.

Source: http://www.fakr.noaa.gov/sustainablefisheries/inseason/percent_observed.pdf

For the pollock pelagic trawl fishery, the data are mostly confidential for the unobserved <60 ft fleet each year. The remaining catch came from the >60 ft to <125 ft fleet where coverage ranged from 31%–37% over the four years. For nonpelagic trawl arrowtooth flounder and shallow water flatfish targets delivered shoreside, the majority of the catch was in the >60 ft to <125 ft category and percentage covered ranged from 13%–34% over the three-year period. Catch of flatfish in the catcher processor fleet was largely in the >60 ft to <125 ft category, with the exception of arrowtooth flounder in the central GOA, and percentage covered varied widely.

Table 5 Central Gulf of Alaska total catch (mt), observed catch, and percent observed catch by area, harvest sector, gear type, trip target fishery, and vessel length

Gear	Trip target	Sector	Length	2004			2005			2006			2007		
				Total	Observed	Percent									
NPT	Arrowtooth	CP	>=60 and <125	0	0	0%	2,735	2,150	79%	3,878	1,500	39%	518	0	0%
			>=125	--	--	100%	--	--	100%	3,785	3,785	100%	4,498	4,498	100%
		S	<60	0	0	0%	0	0	0%	0	0	0%	--	--	0%
			>=60 and <125	7,517	1,476	20%	8,519	2,212	26%	12,543	2,993	24%	12,818	2,574	20%
	Flathead sole	CP	>=60 and <125	--	--	104%	--	--	77%	--	--	70%	--	--	104%
	Pacific cod	CP	>=60 and <125	--	--	0%	565	411	73%	--	--	0%	0	166	0%
			>=125	--	--	100%	0	0	0%	0	0	0%	0	0	0%
		S	<60	--	--	0%	--	--	0%	--	--	0%	--	--	0%
			>=60 and <125	12,443	3,716	30%	7,376	2,185	30%	4,861	1,152	24%	8,377	2,216	26%
	Rex sole	CP	>=60 and <125	2,674	0	0%	2,776	1,133	41%	6,883	1,691	25%	--	--	36%
			>=125	--	--	100%	--	--	100%	0	0	0%	0	0	0%
	Shallow water flatfish	S	<60	0	0	0%	11	0	0%	0	0	0%	547	0	0%
>=60 and <125			3,339	1,127	34%	6,835	1,300	19%	10,432	1,393	13%	13,382	3,441	26%	
PTR	Pollock, bottom and midwater	S	<60	--	--	0%	1,677	0	0%	--	--	0%	--	--	0%
			>=60 and <125	36,431	13,520	37%	47,273	14,845	31%	44,371	14,187	32%	33,530	11,150	33%
	Rockfish	S	>=60 and <125	66	217	327%	535	636	119%	1,999	1,211	61%	2,990	4,029	135%
POT	Pacific cod	CP	>=60 and <125	0	0	0%	0	0	0%	0	0	0%	--	--	0%
			S	<60	2,426	0	0%	3,233	0	0%	3,778	0	0%	4,296	0
		>=60 and <125		2,475	687	28%	4,920	1,298	26%	4,369	981	22%	4,090	969	24%
		>=125		0	0	0%	0	0	0%	--	--	0%	0	0	0%

Source: http://www.fakr.noaa.gov/sustainablefisheries/inseason/percent_observed.pdf

Notes for Table 5:

These tables do not include data from shoreside processors using paper weekly production reports because the data is at the processor level. The vessel length associated with the catcher vessels delivering to the shoreside processor is not available. This includes 5,717 mt of total groundfish catch in the GOA, consisting of 19 processors in 2004, 11 processors in 2005, and 8 processors in 2006 in the GOA.

1. Values where total and observed columns are blank (-) indicate confidential data. Confidential data have been defined as <3 vessels and processors for that given year, area, sector, gear type, target fishery, and vessel length.
2. Total catch data are from the catch accounting system, and the observer data are from the observer database in March 2008.
3. Harvest sector: S=shoreside; CP/M=catcher processor or mothership
4. Gear type: HAL=hook-and-line; JIG=jig (not included in this table); NPT=nonpelagic trawl, POT=pot; PTR=pelagic trawl
5. Vessel length: <60=vessels less than 60 ft length overall (LOA); >=60 and <125=vessels greater than or equal to 60 ft and less than 125 ft LOA; >=125=vessels greater than or equal to 125 ft LOA
6. Year= target fishery year
7. Weight is rounded to the nearest mt.
8. Percent= (mt of observed catch/mt of total groundfish catch in catch accounting system)*100
9. Not included in the GOA are trip target fisheries per gear type: HAL= pollock, deepwater flatfish, rockfish, other species, arrowtooth (2,406 mt shoreside, 404 mt CP/M); NPT= pollock, deepwater flatfish, shallow water flatfish, rockfish, flathead sole, other species, sablefish (21,367 mt shoreside, 1,633 mt CP/M); POT= pollock, other species (18 mt shoreside); PTR= Pacific cod, shallow water flatfish, flathead sole, other species, arrowtooth, sablefish (2,220 mt shoreside, 566 mt CP/M)
10. For CPs and motherships groundfish catch estimates, the catch accounting system uses weekly production reports for vessels >=60 and <125 and observer data for vessels >=125 except for pot gear uses weekly production reports for vessels >=60.
11. In some cases, the observed data are higher than the total catch for a given area, sector, gear type, target fishery, vessel length. There are several reasons that this occurs:
 - a. In 2004-2006, four CPs >=125 ft. had haul data considered to be invalid by the Observer Program. These data were replaced with weekly production reports in the catch accounting system, but are still used as the observed total.
 - b. For catcher/processors and motherships >=60 and <125, there can be a mismatch between the trip target that is assigned from the observed data and the trip target that is assigned based on weekly production report data. This occurs when a vessel targets more than one target species during a week.
 - c. For the shoreside sector, the total catch is based on fish tickets, which could be different from the observer data.
 - d. The two databases include separate sources of information. The catch accounting system partially uses weekly production reports, landing reports, and observer data. Production reports are focused on different goals from the observer data (production vs. total catch), uses a different method to determine catch and targets, and in the cases of 30% observer coverage include dis-coordinated time frames of estimates, especially at the target level (i.e. observer data may not cover the entire week that a production report is based on).
12. A high level of variability in the percent observed catch for a given target fishery may be explained by the level of coverage that vessels had prior to entering a different FMP area. Observer coverage is by quarter and by fishery category, not by FMP area. A 30% vessel may have enough observer coverage in one FMP area to meet the requirements for their fishing in another FMP area. A high level of variability in percent observed catch also may be attributed to a variable number of vessels that participate in certain GOA fisheries each year.
13. This is NMFS' approach to the OAC data request, as of March 26, 2008.

3.3.2 Mortality Rates

Bycatch mortality in trawl gear

The Council has consistently used an estimated mortality rate of 80% for crab bycatch in trawl fisheries in Council analyses, since the early 1990s (Table 6). This rate is an approximation based on a trawl research study conducted in 1987 in the BSAI joint venture fisheries (Stevens 1990). Species targeted were yellowfin sole, rock sole, and Pacific cod. The study found that 21% of the king crabs and 22% of the Tanner crabs captured incidentally in Bering Sea trawl fisheries survived at least two days following capture. A few earlier studies also looked at bycatch mortality in the trawl fisheries (Blackburn and Schmidt 1988, Owen 1988, Fukuhara and Worlund 1973, Hayes 1973), which generally indicated that soft shell crab are much more vulnerable to impacts from trawling than hard shell crab, and that mortality appears to be directly correlated with time out of water. This latter finding was also apparent from the Stevens study, which noted that captivity time (which includes both towing time and deck sorting time) may have been longer in the study than it would be in a normal fishery, especially for king crab. The Blackburn and Schmidt (1988) and Owen studies (1988) were both conducted around Kodiak.

Table 6 History of mortality rate calculations for crab bycatch in groundfish fisheries, in research studies and Council analyses

Study		King crab			Tanner/snow crab			Notes/rationale
		Trawl	Pot	Longline	Trawl	Pot	Longline	
Study on observed crab bycatch viability in domestic trawl fishery around Kodiak, 1978-1981	Blackburn and Schmidt 1988	1-21%			12-17%			Red king and Tanner crab study. King crab: found 1% mortality for hard shell, 2% injured for hard shell, and 21% mortality for soft shell. Tanner: found 17% mortality overall, but excluding one unusual tow averages to 12 % mortality overall; 36% of crab injured.
Research study on crab bycatch on west side of Kodiak, trawling for flatfish	Owen 1988	19%			12%			Red king and Tanner crab study (but low king crab sample size). No soft shell crab caught.
1987 trawl comparison research study on bycatch in BSAI joint venture fishery targeting yellowfin sole, rock sole, Pacific cod	Stevens 1990	78%			79%			Red king crab and Tanner crab study. Mortality rate directly proportional to captivity time (which in study may have been longer than is normal in fishery), especially for king crab (at 3 hours captivity, 0% mortality, at 17 hours, 100% mortality).
1990 Observer Program study of condition factor of crab bycatch	Guttormsen et al 1992	20.1% (+27.5 % poor)	0% (+0% poor)		37.5% (+32.0 % poor)	1.3% (+1.4 % poor)	7.5% (+21.7% poor)	Observers identified 3 condition factors: excellent, poor, dead. No estimate available for longline king crab bycatch.
BSAI groundfish FMP amendment 24 (Pacific cod gear allocations)	NMFS 1993	80%	37%	37%	80%	30%	45%	Trawl mortality rate based on Stevens 1990; pot and longline rates proportionally adjusted from Guttormsen et al 1992, so that trawl = 80% as per Stevens 1990.
BSAI groundfish FMP amendment 37 (Bristol Bay nearshore closure)	NPFMC 1996	80%	8%	37%	80%	30%	45%	Mortality rates supposedly based on NMFS 1993, no explanation for change in pot king crab rate.
BSAI crab FMP amendment 11 (Tanner crab rebuilding)	NPFMC 2000				80%	35%	35%	Mortality rate for combined fixed gear, based on NPFMC 1996; assumes average 2/3 of bycatch from pot gear (30% mortality rate) and 1/3 from longline gear (45% mortality rate)
BSAI crab FMP amendment 14 (Snow crab rebuilding)	NPFMC 2000				80%	20%	20%	Mortality for combined fixed gear, no rationale in analysis for change in mortality rate
BSAI crab FMP amendment 15 (St Matthew blue king crab rebuilding)	NPFMC 2000	80%	8%	37%				Mortality rates based on NPFMC 1996

Study		King crab			Tanner/snow crab			Notes/rationale
		Trawl	Pot	Longline	Trawl	Pot	Longline	
Chapter on BSAI bycatch in Council's BSAI Crab SAFE reports	NPFMC 2001-2007	80%	20%	20%	80%	20%	20%	No rationale in analysis for choice of mortality rates. May have averaged fixed gear rates for king crab from NPFMC 1996, and used fixed gear rate from NPFMC 2000 (snow crab rebuilding) for Tanner/snow crab.
BSAI bycatch considered as part of stock assessments in BSAI Crab SAFE reports	NPFMC 2008-2009	80%	80%	80%	80%	80%	80%	Crab Plan Team directive in 2008 SAFE report to use 80% for bycatch in groundfish fisheries (presumably because most bycatch was assumed to be from trawl)
BSAI bycatch considered as part of stock assessments in BSAI Crab SAFE report	NPFMC 2010	80%	50-80%	50-80%	80%	50-80%	50-80%	Pribilof Is red, blue, and golden king crab, AI golden king crab, and Adak red king crab assessments use 50% mortality for fixed gear; others use 80%
2010 AFSC study on crab bycatch mortality on GOA trawl vessels targeting arrowtooth (ATF) and shallow water flatfish (SWF)	preliminary results				32-68% overall average 46%			Assessments made on six GOA vessels, half of each target. Reflex action mortality predictor tests used to estimate bycatch mortality rates of Tanner crab. Average for arrowtooth flounder target: 37%; average for shallow water flatfish target: 52%.

At the request of the Council, this analysis evaluates an 80% mortality rate for trawl gear.

However, in 2010, scientists of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering Division worked with the Alaska Groundfish DataBank (AGDB) to improve the information available to assess the effects of bottom trawling on Tanner crab of the Gulf of Alaska. This has included collecting information on the condition of crabs released after capture by vessels targeting arrowtooth flounder and shallow-water flatfish (the two fisheries with highest Tanner crab bycatch), as well as collecting information on the characteristics of trawls used by GOA vessels to assess the applicability of research estimating unaccounted crab mortality from Bering Sea fisheries. These results are preliminary and will be supplemented with more detailed analyses and results from work later this summer.

Scientists accompanied six GOA vessels on trawl trips, three targeting arrowtooth flounder (ATF) and three targeting shallow water flatfishes (SWF). They made reflex assessments on Tanner crabs (*Chionoectes bairdi*) taken as bycatch, just before their return to the water. Assessments consisted of testing for the presence or absence of six specific reflexes and using the number of missing reflexes as a reflex action mortality predictor (RAMP). Stoner et al. (2008) established a relationship between RAMP scores and delayed mortality for Tanner crabs following trawl encounters in the Bering Sea. That relationship was used to estimate bycatch mortality rates for the Tanner crab captured by these vessels. Crabs taken as bycatch are subjected to longer periods out-of-water than those from the unobserved mortality studies (e.g., Stoner et al. 2009). Tests of whether such air exposure affects the RAMP relationship will be conducted during a research cruise in August 2010.

A total of 1265 crabs were assessed, 820 during ATF trips and 445 from SWF trips. Average estimated mortality varied significantly between vessels, from 32% to 54% for the ATF vessels and from 38% to 68% for SWF trawling. Overall, mortality averages were 37% for the ATF trips, 52% for SWF trip, and

46% overall. These are all substantially below the 80% bycatch mortality estimate currently used for trawl bycatch mortalities for Tanner crabs. That estimate was based on Stevens (1990), who studied catches of joint-venture trawls delivered to a Soviet mothership in the Bering Sea, with relatively long processing times. The 2010 data reported here are more likely reflective of current GOA bottom trawl fisheries. Preliminary observations during sampling and patterns in the estimated mortalities indicated several operational differences likely affecting mortality outcomes. Probability of mortality increased the longer a crab was out of the water. When a vessel moved after encountering large crab numbers to an area with few crab, the few crab in subsequent tows had very poor reflex assessments. This would be explained if those particular crabs had remained in the net from the previous tows and were thus subjected to additional time out of water and at least one additional tow. Handling differences that could affect mortality rates were also apparent. Increasing awareness of these factors could be used to improve crab mortality rates for these fisheries.

Bycatch mortality in fixed gear

Since the 1990s, various mortality rates have been used for crab bycatch in the fixed gear groundfish fisheries in the analysis of Council amendments (Table 6). No direct research studies have been conducted on mortality of crab caught as bycatch in the longline or pot groundfish fisheries. A study was conducted through the observer program in 1990 which evaluated the condition of crab caught as bycatch in the groundfish fisheries. Combining these results with the Stevens (1990) research that looked at trawl mortality, a calculation was made for a 1993 Council analysis to scale the mortality results from the observer study for pot and longline crab bycatch upwards proportional to the difference between the observer study and Stevens' findings for trawl crab bycatch. Consequently, the Council's 1993 analysis used 30% pot and 45% longline mortality rates for Tanner crab bycatch, and 37% mortality rates for both gears for king crab bycatch⁵. These rates were also used in subsequent Council analyses for several years, with the exception that NPFMC (1996) changed the pot bycatch mortality rate for red king crab to 8% (the rationale for this change is not clear, but is likely from research in the directed crab fishery about mortality rates of crab bycatch in crab pots). In 2000, the Council's snow crab rebuilding amendment assigned a 20% mortality rate to bycatch from the pot and longline groundfish fisheries, but it is not clear what the rationale was for this change. This rate did, however, get perpetuated for much of the 2000s in the Council's bycatch chapter in the BSAI Crab SAFE report, and the 20% rate was also applied to king crab bycatch (again, the rationale is not entirely clear, but may result from an averaging of the 8% pot mortality rate and 37% longline mortality rate that had previously been used).

With the implementation, in 2008, of overfishing limits in the BSAI Crab SAFE, and assessments that accounted for total catch, the Crab Plan Team issued a directive that all assessments should use an 80% mortality rate for all bycatch in the groundfish fisheries, under the assumption that most of the bycatch originated from trawl vessels. Following a presentation to the Crab Plan Team in 2009 about the occurrence of crab bycatch in the pot and longline groundfish fisheries, the assessment authors have now begun to distinguish among gear types in accounting for crab bycatch in the groundfish fisheries. A 50% mortality rate is currently applied to crab bycatch in the directed Tanner crab pot fisheries, consequently this rate is now also being applied to all crab bycatch in the fixed gear groundfish fisheries (where the assessment distinguishes bycatch among gear types).

Previous discussion papers on bycatch in the GOA groundfish fisheries, and the initial review draft of this analysis, did not calculate the mortality associated with crab bycatch, due to the variability associated with mortality rates. The Council discussed this issue at the April Council meetings, and requested that the data be presented with mortality rates. Consequently, to account for the variability in fixed gear rates, **this analysis evaluates both 20% and 50% mortality rates for fixed gear.**

⁵ There were no results for longline red king crab bycatch in the observer study, consequently it is assumed that the pot mortality rate was simply cross-applied to longline gear.

3.3.3 Overview of bycatch by area, gear type, and target fishery

In the GOA, *C. bairdi* bycatch primarily occurs in the western and central regulatory areas, and corresponds to the locations of the trawl and pot fisheries. Table 7 illustrates bycatch for 2003-2009, for reporting areas in the western and central GOA. Crab bycatch in the eastern regulatory area is negligible. Given that the proposed area closures in this analysis are all located in reporting area 630, from this point forward, the bycatch overview will focus on this particular reporting area.

Table 7 *C. bairdi* bycatch (number of crab) in the western and central GOA, 2003-2009, in Federal⁶ groundfish fisheries

Year	610	620	630
2003	7,388	24,033	116,814
2004	12,313	4,576	50,217
2005	45,865	7,037	111,129
2006	9,912	67,266	255,151
2007	34,219	57,336	220,545
2008	31,278	44,074	162,440
2009	8,922	50,717	182,542
Average 2003-2009	21,414	36,434	156,977

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to the State Pacific cod fishery.

Table 8 identifies *C. bairdi* Tanner crab bycatch for 2003-2009, by gear type, in reporting area 630. Nonpelagic trawling contributes the majority of *C. bairdi* bycatch in the Federal groundfish fisheries in 630, ranging from 56% to 99% from 2003-2009, and averaging 83% over the time period. In Table 9, a similar estimate of crab bycatch mortality by gear type is provided, using an estimated 80% mortality rate for trawl gear, and both 20% and 50% mortality rates for pot gear. Using the 20% pot gear mortality rate, nonpelagic trawl vessels are responsible for 95% of crab bycatch mortality, on average from 2003 to 2009; using the 50% mortality rate, nonpelagic trawl vessels are responsible for 88% of crab bycatch mortality. Table 10 provides some historical context for Tanner bycatch in the trawl fisheries, for the GOA as a whole, from 1993-2002. Pot gear catches the remainder of Tanner crab bycatch, with less than 1% of the total attributable to hook and line and pelagic trawl gear. Note, this section only reports on the number of crab caught as bycatch; the relative impact of bycatch on the mortality of crab likely differs by gear type, although studies differ as to the degree (see Section 3.3.2).

⁶ Prohibited species catch (PSC), including catch of *C. bairdi*, is extrapolated to all catch in the GOA groundfish fleet using specific catch estimation procedures based on observed bycatch rates (see further explanation in Section 3.3.1). The observed bycatch rate is also applied to Pacific cod catch in the State managed fisheries that base their guideline harvest level on the Federal Pacific cod acceptable biological catch level (ABC). In order to provide the Council with an estimation of only the PSC taken in Federal fisheries, crab bycatch in the State waters pot fisheries was identified based on the date and location of catch. A discussion of the State waters Pacific cod fishery bycatch is presented separately in Section 3.4.1.

Table 8 *C. bairdi* bycatch in reporting area 630, by gear type, in GOA Federal groundfish fisheries, 2003-2009

Year	Hook and Line		Nonpelagic Trawl		Pelagic Trawl		Pot		Grand total
	Number of crab	% of grand total	Number of crab	% of grand total	Number of crab	% of grand total	Number of crab	% of grand total	
2003	20	0%	112,133	96%	104	0%	4,557	4%	116,814
2004	1	0%	49,763	99%	18	0%	434	1%	50,217
2005	805	1%	87,653	79%	136	0%	22,535	20%	111,129
2006	175	0%	234,238	92%	382	0%	20,356	8%	255,151
2007	117	0%	158,636	72%	1,285	1%	60,507	27%	220,545
2008	531	0%	91,696	56%	31	0%	70,182	43%	162,440
2009	356	0%	172,895	95%	171	0%	9,118	5%	182,542
Average 2003-2009	287	0%	129,573	83%	304	0%	26,813	17%	156,977

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to the State Pacific cod fishery.

Table 9 Mortality of *C. bairdi* bycatch in reporting area 630, by gear type, in GOA Federal groundfish fisheries, 2003-2009

Year	Trawl mortality 80%, pot mortality 20%							Trawl mortality 80%, pot mortality 50%						
	Nonpelagic trawl		Pelagic trawl		Pot		Grand total	Nonpelagic trawl		Pelagic trawl		Pot		Grand total
	# of crab	% of total	# of crab	% of total	# of crab	% of total	# of crab	# of crab	% of total	# of crab	% of total	# of crab	% of total	# of crab
2003	89,706	99%	83	0%	911	1%	90,701	89,706	97%	83	0%	2,279	2%	92,068
2004	39,811	100%	15	0%	87	0%	39,912	39,811	99%	15	0%	217	1%	40,042
2005	70,122	94%	109	0%	4,507	6%	74,738	70,122	86%	109	0%	11,268	14%	81,498
2006	187,390	98%	306	0%	4,071	2%	191,767	187,390	95%	306	0%	10,178	5%	197,874
2007	126,909	91%	1,028	1%	12,101	9%	140,039	126,909	80%	1,028	1%	30,253	19%	158,190
2008	73,357	84%	24	0%	14,036	16%	87,418	73,357	68%	24	0%	35,091	32%	108,472
2009	138,316	99%	137	0%	1,824	1%	140,277	138,316	97%	137	0%	4,559	3%	143,013
Average 2003-2009	103,659	95%	243	0%	5,363	5%	109,264	103,659	88%	243	0%	13,406	11%	117,308

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to the State Pacific cod fishery.

Table 10 Bycatch of Tanner crabs in Gulf of Alaska groundfish trawl fisheries, 1993-2002 (number of crab)

Year	<i>C. bairdi</i> Tanner crab
1993	55,304
1994	34,056
1995	47,645
1996	120,796
1997	134,782
1998	105,817
1999	29,947
2000	48,716
2001	125,882
2002	89,433

Data have been screened for confidentiality. Source: M. Furuness, J. Keaton, NOAA Fisheries.

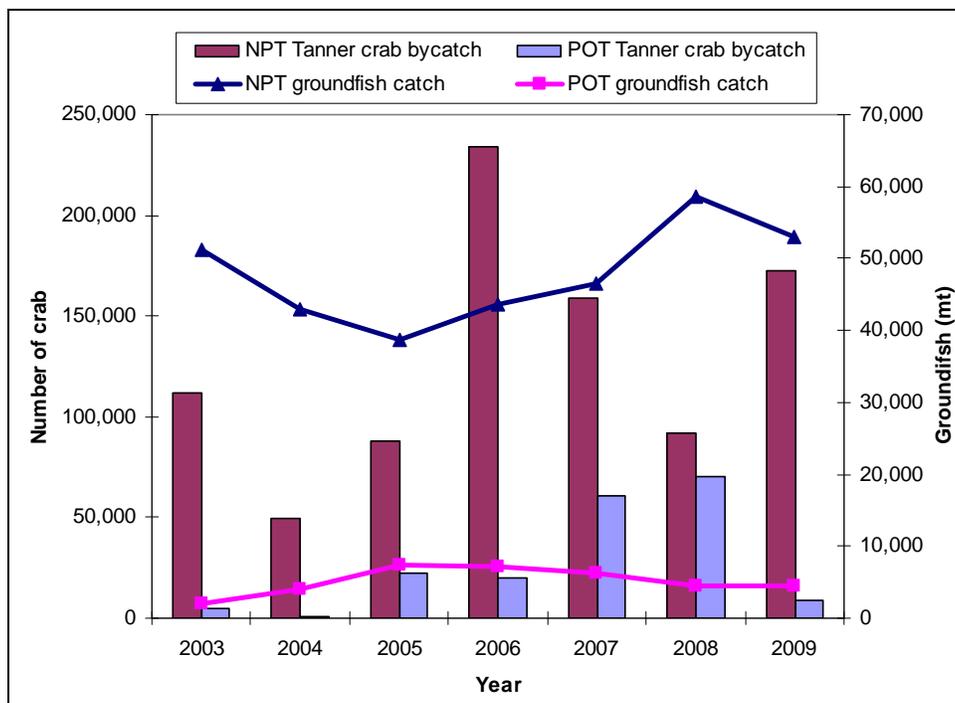
Table 11 and Figure 17 show the bycatch of Tanner crab in proportion with overall groundfish catch for each gear type. In Table 11, the average rate of Tanner crab bycatch per mt of groundfish catch for 2003-2009 was 2.71 crab per mt of groundfish for the nonpelagic trawl fisheries, and 5.2 crab per mt of groundfish for the pot fishery. When bycatch mortality by gear type is taken into account, the rate of mortality averages 2.17 crab per mt of groundfish for nonpelagic trawl fisheries, and either 1.04 or 2.60 crab per mt of groundfish for pot fisheries. Catch of groundfish by pot gear has remained relatively consistent throughout the last five years (Figure 17), while bycatch of crab increased in 2007 and 2008. The correlation of nonpelagic trawl bycatch and groundfish catch is less consistent over 2003-2009, with 2004 and 2008 having low bycatch rates, and 2006 having a high bycatch rate. It should be remembered when evaluating these bycatch numbers that they are extrapolated to the fleet as a whole from bycatch recorded on observed vessels, which account, on average, for about one third of groundfish catch in the central GOA.

Table 11 Rate of Tanner crab bycatch and bycatch mortality per mt of groundfish catch in reporting area 630, by gear type, 2003-2009, in Federal groundfish fisheries

Year	Nonpelagic Trawl		Pelagic Trawl		Pot		
	Bycatch	Bycatch mortality	Bycatch	Bycatch mortality	Bycatch	Bycatch mortality at 20%	Bycatch mortality at 50%
2003	2.19	1.75	0.01	0.01	2.20	0.44	1.10
2004	1.16	0.93	0.00	0.00	0.11	0.02	0.05
2005	2.26	1.81	0.01	0.01	3.04	0.61	1.52
2006	5.38	4.31	0.02	0.02	2.84	0.57	1.42
2007	3.41	2.73	0.07	0.06	9.59	1.92	4.79
2008	1.57	1.25	0.00	0.00	15.48	3.10	7.74
2009	3.26	2.61	0.02	0.01	2.02	0.40	1.01
Average 2003-2009	2.71	2.17	0.02	0.02	5.20	1.04	2.60

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to State Pacific cod fishery.

Figure 17 Annual bycatch of *C. bairdi* Tanner crab and groundfish catch in reporting area 630, by Federal trawl and pot fishery sectors, 2003-2009



Source: *C. bairdi* crab bycatch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010; excludes PSC attributed to the State Pacific cod fishery. Groundfish catch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Represents total GOA groundfish catch excluding State waters catch.

The highest numbers of Tanner crab taken as bycatch occur primarily in the nonpelagic trawl fisheries targeting flatfish, and in the pot fishery for Pacific cod (Table 12). In the nonpelagic trawl fisheries, the arrowtooth flounder target accounted for 33 to 66% of all *C. bairdi* bycatch in reporting area 630 (by any gear type) in 2004-2006, the shallow water flatfish target accounted for 30% in 2007 and 48% in 2003, and the rex sole target accounted for 58% of bycatch in 2009. Nonpelagic trawl vessels targeting pollock and Pacific cod also contribute to Tanner crab bycatch in some years, but always account for less than 10% of the gear type's total bycatch, and bycatch in the rockfish target fishery was less than 4% of the total in 2004 and 2005, and has been very low since the implementation of the rockfish pilot program in 2007. Bycatch in the Pacific cod pot fishery accounted for 20%, 27%, and 43% of all Tanner crab bycatch in reporting area 630 in 2005, 2007, and 2008, respectively, but only 1-8% in other years.

Table 12 Bycatch of *C. bairdi* Tanner crabs in Federal groundfish fisheries, in reporting area 630, by gear type and target fishery, 2003-2009.

Gear type	Target Fishery	2003	2004	2005	2006	2007	2008	2009	Average 2003-2009
Nonpelagic trawl	Arrowtooth Flounder	20,934	33,012	66,931	84,106	39,545	33,716	34,461	44,672
	Flathead Sole	16,500	2,249	12,540	23,470	24	6,397	7,647	9,832
	Pacific Cod	1,498	846	270	526	11,693	9,282	1,434	3,650
	Pollock (bottom)		517		7,690	16,484	229	3,055	3,996
	Rex Sole	17,241	4,115	1,187	37,410	24,979	21,373	105,058	30,195
	Rockfish	171	1,517	1,445	830	55	61	195	611
	Shallow Water Flatfish	55,780	7,506	5,091	31,098	65,687	20,456	20,957	29,511
Pelagic trawl	Pollock (bottom)	0	18	4	379	51	13	0	67
	Pollock (midwater)	2	0	1	1	17	15	1	5
	Rockfish			130	0	2	3	0	19
Pot	Pacific Cod	4,557	434	22,535	20,356	60,507	70,182	9,118	26,813

** = data are confidential.

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to State Pacific cod fishery.

Timing of bycatch in Federal groundfish fisheries

The majority of Tanner crab bycatch is taken in the nonpelagic trawl and pot groundfish fisheries between January 1 and July 31 (Table 13). From 2003-2006, between 80% and 100% of all Tanner crab bycatch in the trawl fishery occurred within this season. In 2007 and 2008, approximately two-thirds of trawl Tanner crab bycatch occurred in January-July, although in 2009, only one third of bycatch occurred during this period. For pot vessels, the proportion of bycatch taken in January-July has varied from 59% to 100%, with an average of 89% over 2004-2009.

Table 13 Proportion of annual *C. bairdi* Tanner crab bycatch taken in January-July in reporting area 630, 2003-2009, in GOA Federal groundfish fisheries, by gear type

Year	Hook and Line	Nonpelagic Trawl	Pelagic Trawl	Pot
2003	100%	80%	98%	**
2004	100%	98%	0%	90%
2005	87%	100%	97%	75%
2006	73%	81%	0%	59%
2007	2%	68%	98%	93%
2008	100%	64%	18%	100%
2009	90%	32%	0%	84%
Average 2003-2009	85%	70%	71%	89%

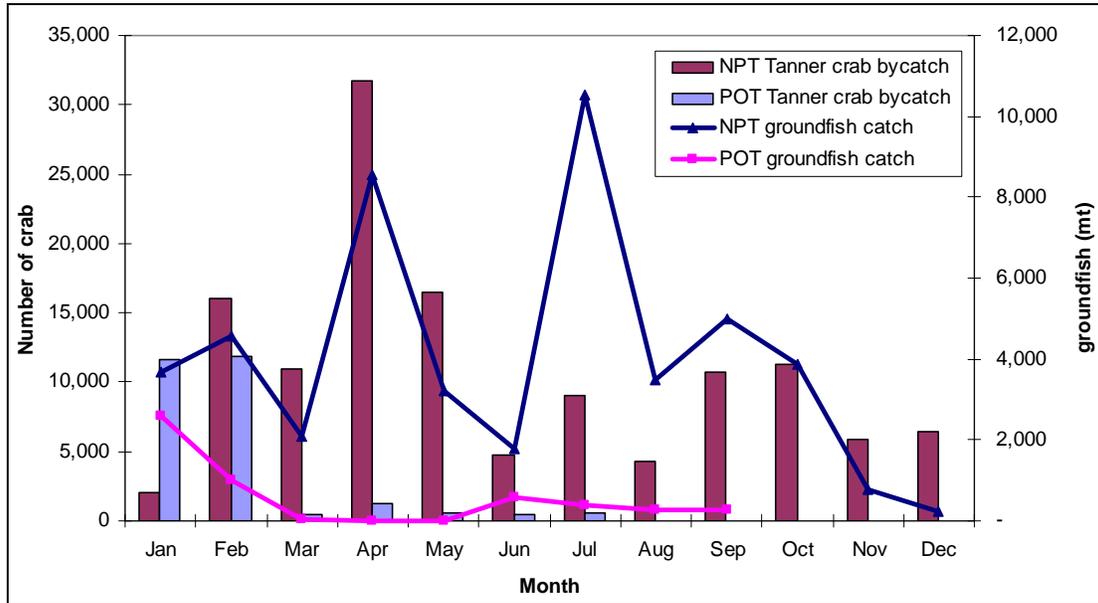
** = data are confidential.

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Excludes PSC attributed to State Pacific cod fishery.

Bycatch amounts of *C. bairdi* Tanner crab taken in nonpelagic trawl and pot fisheries generally fluctuate temporally in direct response to groundfish catches (Figure 18). Trawl Pacific cod and flatfish harvests are managed on a quarterly basis, and the trawl fishery begins on January 20th each year. The pot Pacific cod fishery has two seasons (note, the State-managed Pacific cod fishery occurs in the middle of these, beginning in March, as described further in Section 3.4.1). In the nonpelagic trawl fisheries, average bycatch of Tanner crabs from 2003 - 2009 (in numbers of crabs) increased notably in April due to bycatch

in the combined flatfish fisheries. High groundfish catch by trawl vessels in July is associated with the rockfish fishery, which has lower Tanner crab bycatch.

Figure 18 Average bycatch of *C. bairdi* Tanner crab and total groundfish catch by month in reporting area 630, for nonpelagic trawl and pot sectors, in Federal fisheries, 2003-2009



Source: *C. bairdi* crab bycatch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010; excludes PSC attributed to the State Pacific cod fishery. Groundfish catch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010; excludes State waters catch.

The implementation of the central GOA rockfish pilot program, in 2007, has allowed some GOA nonpelagic trawl fisheries to occur later into the year than has been the case in years immediately previous. The rockfish pilot program has allowed fishery participants to reduce their catch of halibut PSC, which in previous years has closed down flatfish trawl fisheries in the GOA. Figure 19 illustrates the weeks in the last quarter of the year during which participants have been active in central GOA trawl fisheries, primarily for flatfish, from 2000 to 2009. Table 13 identifies that bycatch of crab in the nonpelagic trawl fisheries in August-December was higher in 2007-9, the years of the program, than in the years immediately previous.

Figure 19 Season duration of the trawl Central Gulf of Alaska groundfish fisheries from October 1 to December 31, 2000 to 2009.

Year	October				November				December			
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
2000	Active				Active				Active			
2001	Active				Active				Active			
2002	Active				Active				Active			
2003	Active				Active				Active			
2004	Active				Active				Active			
2005	Active				Active				Active			
2006	Active				Active				Active			
2007	Active				Active				Active			
2008	Active				Active				Active			
2009	Active				Active				Active			

Source: NOAA Fisheries status reports and groundfish closure summaries

3.3.4 Bycatch in proposed area closures

The proposed area closures are within the 630 reporting area described in Section 3.3.3 above. In order to examine the spatial distribution of bycatch at a finer scale than that of the reporting area, it is only possible to use the bycatch data collected on observed trips, as only observed hauls are associated with geographical coordinates. Consequently it is not possible to use the NMFS catch accounting database, which takes bycatch reports from observed fishing trips and extrapolates them to apply to all vessels fishing within the reporting area, to investigate the catch and bycatch activity of vessels fishing within these specific areas. It is possible to get a sense for how much catch and bycatch is occurring in the closed areas, however, by looking at data from observed groundfish vessels, as long as the limitations of using only data from observed vessels are kept in mind. These limitations are discussed in detail in Section 3.3.1. Only vessels that are 60 ft or longer are observed. Vessels between 60 and 125 ft using hook and line or trawl gear are only required to carry an observer for 30% of their fishing days, by quarter, although if they are larger than 125 ft the must have an observer onboard 100% of the time. Pot vessels carry an observer while 30% of their pots are pulled for the calendar year. Table 14 shows the number of observed vessels fishing in the proposed area closures over the period 2001-2009, compared to the number of vessels fishing in reporting area 630 as a whole. In many of the proposed areas closures, the number of vessels of a particular gear type fishing in an area in a particular year may be very low. As a point of comparison, Table 15 shows the number of unique vessels fishing in the proposed area closures that appear in the observer data, and the number of unique vessels that reported on fish tickets that they fished in the statistical areas that approximate the proposed area closures. This comparison is intended to provide some information as to the number of unobserved vessels that may be using the proposed closed areas. However, it should be noted that in some cases (particularly for the Marmot and Chiniak closures), using the statistical areas to approximate the proposed closures may overestimate the number of vessels fishing in those areas. Also, the location information from the fish ticket data is self-reported, and may not always be entirely accurate. From the table, it is apparent that there appear to be many more pot vessels fishing in the proposed closures than is apparent in the observer data (15 vessels were observed, although 62 vessels reported fishing in the areas on fish tickets). For pelagic trawl vessels, approximately two-thirds of all vessels reportedly fishing in the areas have carried observers there at some time, and almost all (60 out of 64) nonpelagic trawl vessels have carried observers to the areas.

Table 14 Number of observed vessels fishing in the proposed area closures, by gear type, for the period 2001-2009, and total of all vessels fishing in reporting area 630

Gear type		Observed vessels							Total vessels fishing in 630
		Proposed area closures					Rest of 630	Total – all of 630	
		Marmot	Chiniak	525702	525630	Total			
Nonpelagic trawl	Number of vessels in any given year	2 - 10	9 - 32	14 - 38	10 - 26	20 - 49	37 - 52	38 - 55	
	Total unique vessels	20	52	47	48	60	62	64	74
Pelagic trawl	Number of vessels in any given year	2 - 8	0 - 11	5 - 19	1 - 3	13 - 23	9 - 28	22 - 30	
	Total unique vessels	24	23	39	12	41	39	43	53
Pot	Number of vessels in any given year	0 - 1	0 - 7	0 - 3	0 - 3	1 - 6	4 - 14	4 - 15	
	Total unique vessels	3	11	7	7	15	32	32	129

Source: AKFIN Comprehensive Observer database, March 2010; NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

Table 15 Number of unique vessels fishing in the proposed closed areas¹, based on observer data and fish ticket data²

Gear type	Data	2001	2002	2003	2004	2005	2006	2007	2008	2009	All years
Nonpelagic trawl	Observer data	49	37	36	32	20	29	31	36	37	60
	Fish ticket data	56	48	49	45	34	32	35	38	33	64
Pelagic trawl	Observer data	21	17	16	23	15	23	18	17	13	41
	Fish ticket data	48	29	37	43	32	31	26	28	34	61
Pot	Observer data	2	2	1	4	6	5	3	4	2	15
	Fish ticket data	14	11	8	18	21	28	25	25	23	62

¹For the fish ticket data, proposed closed areas are approximated using the seven statistical areas within which the closed areas occur. In some cases, this may overestimate the number of vessels.

²The location of fishing in a particular statistical area is self-reported on fish tickets.

Table 4 in Section 3.3.1 examines the actual percentages of observed catch by gear type and target fishery. Overall, the pot Pacific cod target had averaged between 12% and 26% of groundfish catch observed in the Central GOA between 2004 and 2006. Similarly, the nonpelagic trawl shallow water flatfish fishery averaged between 13% and 34% of catch observed between 2004 and 2007 in the same area. **Therefore it should be remembered, throughout this discussion, that the data does not represent all fishing effort within the closed areas.**

In this section, we report annual observed bycatch and groundfish catch in the proposed area closures as a proportion of the total observed effort in reporting area 630. In the figures which illustrate where observed vessels fished, bycatch and groundfish catch numbers are summed for all the years from 2001 to 2009.

Observed bycatch in area closures, by gear type and target fishery

Tanner crab bycatch in the proposed closures, on observed vessels, represents an average of 65% of total observed Tanner crab bycatch from reporting area 630, for the years 2001-2009 across all gear types (Table 16). The majority of bycatch comes from ADF&G statistical areas 525702 and 525630, representing approximately 55% of the total observed Tanner crab bycatch from reporting area 630. The proportion of bycatch coming from these areas is fairly consistent across the range of years included in this analysis, with the exception of 2002 and 2005, when the rate of bycatch in areas outside of the proposed closure areas represented the majority of Tanner crab bycatch in reporting area 630. Figure 20 compares the proportion of observed bycatch with the proportion of observed groundfish catch that is attributed to the proposed closure areas, as compared with reporting area 630. The proportion of groundfish catch from the proposed closure areas varies between 16 and 30% of the total groundfish catch for 630.

Table 16 Observed Tanner crab bycatch in the proposed area closures, as a proportion of total observed Tanner crab bycatch in reporting area 630, for all gear types

Year	Proposed area closures					Rest of 630
	Marmot	Chiniak	525702	525630	Total	
2001	0%	43%	26%	8%	78%	22%
2002	4%	1%	20%	7%	33%	67%
2003	14%	8%	18%	34%	74%	26%
2004	2%	12%	37%	20%	71%	29%
2005	1%	2%	19%	6%	29%	71%
2006	0%	1%	36%	36%	73%	27%
2007	0%	1%	40%	32%	73%	27%
2008	1%	1%	38%	36%	76%	24%
2009	13%	1%	51%	19%	84%	16%
Average 2001-2009	4%	6%	31%	24%	65%	35%

Source: AKFIN Comprehensive Observer data, March 2010.

Figure 20 Groundfish catch and Tanner crab bycatch in the proposed closed areas, as a proportion of total catch and bycatch in reporting area 630

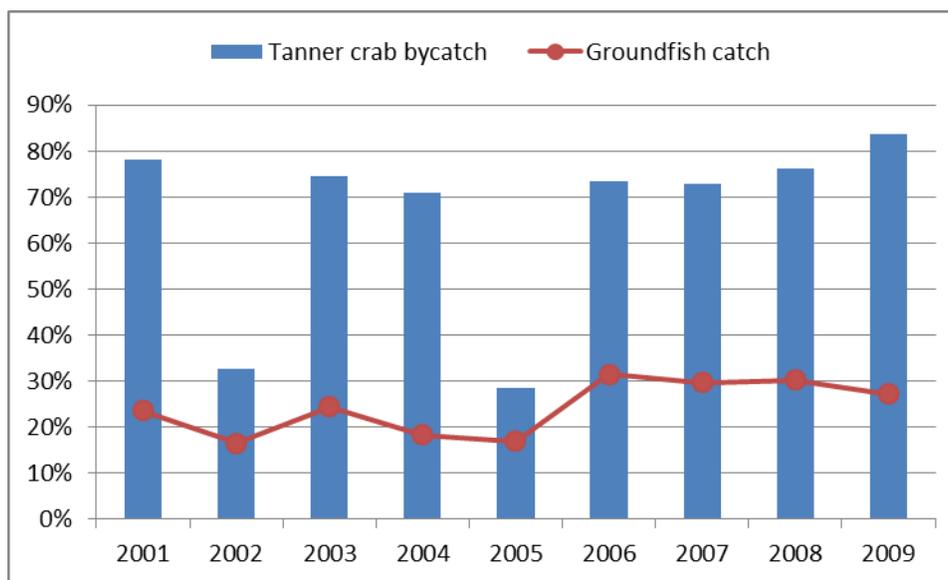


Table 17 combines observer data for the years 2001 to 2009, and identifies the proportion of observed bycatch for reporting area 630, for all years combined, that is attributable to each gear type in each of the proposed closure areas. Very few hook and line vessels were observed within the closed areas during the 2001-2009 period. Pelagic trawl vessels did fish in the closed areas, but contributed very little to the total observed Tanner crab bycatch in all of 630, including in the proposed closure areas. Based on observer data, nonpelagic trawl vessels fishing in the proposed closed areas account for 89% of the total Tanner crab bycatch observed in 630 across all years combined, with 70% of that bycatch caught in the proposed closure areas, the majority in statistical areas 525702 and 525630 (Figure 30). For pot vessels, the majority of observed Tanner crab bycatch attributable to the gear type was caught in areas outside of the proposed closures. Table 18 shows observed bycatch mortality rates for each gear type, number of dead bycaught crab per mt of groundfish, over the same period for inside and outside the proposed area closures and in reporting area 630 as a whole. For all gear types, bycatch mortality rates are higher inside the closed areas as a whole than outside, which is consistent with the fact that the closures represent areas with higher crab abundance. For nonpelagic trawl vessels, bycatch mortality rates are highest in the

Marmot closure, where there is least observed nonpelagic trawl effort. For pot vessels also, observed groundfish catch is low in all of the closed areas, but the bycatch mortality rate is highest in 525630. Only 14% of observed groundfish catch by pot vessels in reporting area 630 occurred in the closed areas, compared to 29% of catch for nonpelagic trawl vessels, 22% of catch for pelagic trawl vessels, and 2% of catch for hook and line vessels (see Table 34 in Section 6.5.2).

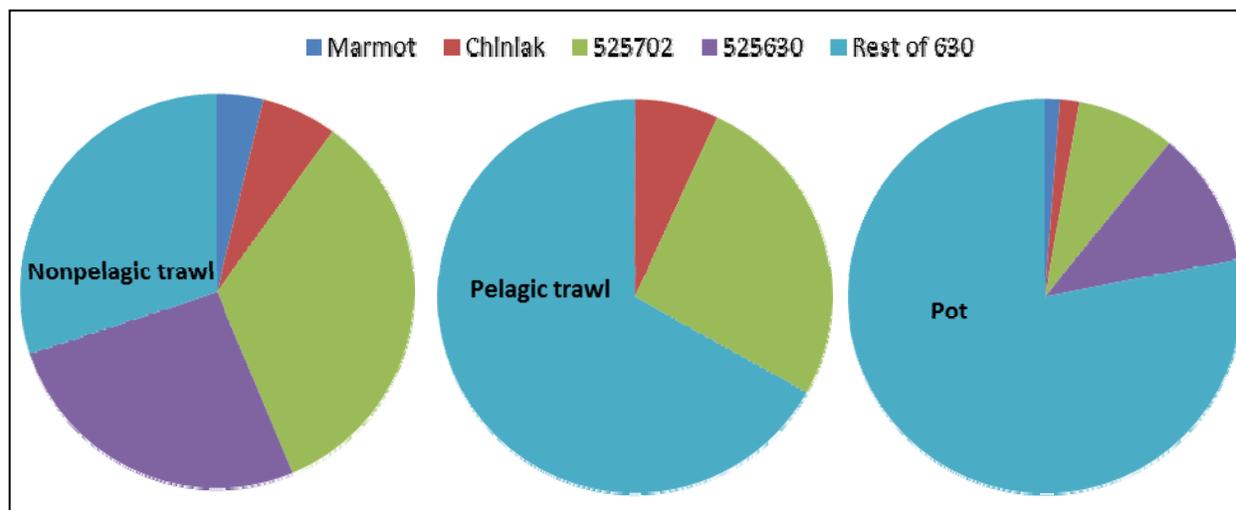
Table 17 Observed tanner crab bycatch in the proposed area closures, as a proportion of total observed Tanner crab bycatch in reporting area 630, by gear type, for the combined years 2001-2009

Gear type	Proposed area closures					Rest of 630	Gear type's proportion of bycatch in 630
	Marmot	Chiniak	525702	525630	Total		
Hook and line			**	**	10%	90%	0%
Nonpelagic trawl	4%	6%	34%	26%	70%	30%	89%
Pelagic trawl	0%	7%	26%	0%	33%	67%	1%
Pot	1%	2%	8%	11%	22%	78%	10%
Total (all gears)	4%	6%	31%	24%	65%	35%	

** = data are confidential

Source: AKFIN Comprehensive Observer data, March 2010.

Figure 21 Observed Tanner crab bycatch in proposed closed areas and reporting area 630, by gear, for the combined years 2001-2009



Source: AKFIN Comprehensive Observer data, March 2010.

Table 18 Observed bycatch mortality rate in the proposed area closures, observed tanner crab bycatch per mt of groundfish catch, by gear type, for the combined years 2001-2009

Gear type	Proposed area closures					Rest of 630	All of 630
	Marmot	Chiniak	525702	525630	Total		
Nonpelagic trawl	7.68	2.38	3.70	3.11	3.39	0.59	1.40
Pelagic trawl	0.00	0.08	0.09	0.00	0.07	0.04	0.05
Pot – 20% rate	1.44	0.50	1.85	2.54	1.73	0.99	1.09
Pot – 50% rate	3.60	1.26	4.63	6.35	4.31	2.48	2.74

Source: AKFIN Comprehensive Observer data, March 2010.

The targets that have been observed in the proposed area closures are similar to those described for reporting area 630 as a whole. Primary nonpelagic trawl targets are flatfish (mainly arrowtooth flounder

and shallow water flatfish, and some rex sole and flathead sole), with some Pacific cod and pollock targeting. Pelagic trawlers in the area are targeting pollock, and pot vessels Pacific cod.

Timing of observed bycatch in proposed closed areas

The majority of Tanner crab bycatch in the proposed areas closures, and in reporting area 630 as a whole, is caught during the first part of the year. Table 19 identifies the proportion of annual observed bycatch caught in each of the proposed area closures, by all gear types, between January 1 and July 31, for the years 2001 to 2009. On average, with the exception of the Chiniak area, between 73% and 82% of all Tanner crab bycatch in the proposed closures occurred in this time period. Table 20 shows the proportion of bycatch caught in January through July for each gear type, all years combined. In the Chiniak area, there is a higher occurrence of groundfish fishing in the second half of the year by nonpelagic trawl vessels than occurs in the other proposed closures. Table 21 illustrates how the bycatch is proportioned on a monthly basis.

Table 19 Proportion of annual observed Tanner crab bycatch caught in each proposed area closures between January 1 and July 31, 2001-2009

Year	Proposed area closures					Rest of 630
	Marmot	Chiniak	525702	525630	Total	
2001	100%	22%	44%	96%	37%	86%
2002	98%	100%	97%	100%	98%	96%
2003	100%	95%	88%	7%	54%	99%
2004	87%	100%	96%	95%	96%	98%
2005	34%	63%	100%	100%	94%	97%
2006	96%	3%	71%	98%	83%	89%
2007	32%	100%	84%	98%	90%	87%
2008	74%	95%	73%	99%	86%	95%
2009	10%	26%	98%	97%	83%	93%
Average 2001-2009	73%	49%	82%	82%	78%	94%

Source: AKFIN Comprehensive Observer data, March 2010.

Table 20 Proportion of annual observed Tanner crab bycatch, by gear type, caught in the proposed area closures between January 1 and July 31, for the combined years 2001-2009

	Proposed area closures					Rest of 630	All of 630
	Marmot	Chiniak	525702	525630	Total		
Nonpelagic trawl	76%	49%	83%	81%	79%	94%	83%
Pelagic trawl	100%	100%	91%		93%	98%	96%
Pot	**	11%	49%	95%	67%	93%	87%
Total	73%	49%	82%	82%	78%	94%	84%

** data are confidential

Source: AKFIN Comprehensive Observer data, March 2010.

Table 21 Proportion of annual observed nonpelagic trawl Tanner crab bycatch caught in the proposed area closures in each month, for the combined years 2001-2009

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marmot		3%	9%	13%	43%	0%	4%	1%	24%	0%	1%	
Chiniak	0%	3%	32%	0%	7%		6%		1%	49%	2%	0%
525702	1%	5%	15%	29%	14%	3%	15%	2%	6%	6%	4%	0%
525630	2%	6%	2%	29%	1%	0%	41%	0%	2%	16%		0%
Total – closed areas	1%	5%	12%	26%	10%	1%	23%	1%	5%	13%	2%	0%
Rest of 630	8%	17%	10%	29%	20%	3%	6%	0%	0%	3%	0%	2%
All of 630	3%	9%	11%	27%	14%	2%	17%	1%	3%	10%	2%	1%

** data are confidential

Source: AKFIN Comprehensive Observer data, March 2010.

Composition of bycatch

The bycatch composition of Tanner crab caught and sampled on observed vessels within reporting area 630 was evaluated for 2001 to 2009 (Table 22). Overall, the majority of bycatch is comprised of sublegal males (i.e., males less than 140cm in carapace width), averaging 69% of the observed, sampled bycatch for 2001 to 2009 (ranging from 54% to 85% in individual years). Approximately one fifth of bycatch is mature crab (10% legal males and 11% female crab with eggs), and an average of 8% of crab caught as bycatch are females without eggs. The distribution of bycatch by sex and size/maturity is fairly consistent by month, although the number of bycatch samples is considerably lower in June, August, November, and December.

Table 22 Estimate of bycatch composition of Tanner crab for 2001-2009, in reporting area 630

Sex		2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 2001-2009
Male	Legal	8%	1%	2%	6%	12%	12%	19%	8%	6%	10%
	Sublegal (<140cm)	60%	68%	68%	85%	80%	74%	54%	77%	66%	69%
Female	Adult (with eggs)	8%	13%	24%	5%	4%	10%	17%	6%	19%	11%
	Sublegal (no eggs)	21%	17%	5%	4%	4%	4%	8%	8%	6%	8%
Unknown		3%	1%	0%	1%	0%	1%	3%	0%	1%	1%
Total number of samples		868	1,176	1,098	524	1,916	1,701	2,336	1,370	470	1,273

Table 23 identifies the bycatch composition in the proposed closed areas, compared to the rest of reporting area 630. In general, the composition of bycatch in the proposed closures is very similar to the overall bycatch composition for 630. The Marmot closure shows a slightly higher proportion of females with eggs (19%), as does the inshore portion of the Chiniak closure (19% in statistical area 525732, compared to 9% and 7% in the offshore areas 515730 and 515700). Sublegal females are also a higher proportion of bycatch in the inshore portion of the Chiniak closure (19%).

Table 23 Estimate of average bycatch composition of Tanner crab in proposed closure areas, for 2001-2009 combined, compared to reporting area 630

Sex		Proposed area closures					Rest of 630	Total in 630
		Marmot ¹	Chiniak ²	525702	525630	Total for closure areas		
Male	Legal	6%	4%	12%	12%	9%	12%	10%
	Sublegal (<140cm)	71%	74%	57%	71%	68%	71%	69%
Female	Adult (with eggs)	19%	10%	12%	10%	12%	11%	11%
	Sublegal (no eggs)	4%	11%	14%	7%	10%	5%	8%
Unknown		0%	1%	4%	0%	2%	0%	1%
Total number of samples		1,007	2,250	2,137	1,384	6,778	4,681	11,459

¹Estimates for the Marmot closure here include samples of all observed bycatch in ADF&G statistical areas 525807 and 515802, although in fact the closure would only apply to approximately a quarter of 515802 (see Figure 2).

²Estimates for the Chiniak closure here include samples of all observed bycatch in ADF&G statistical areas 525732, 515730, and 515700, although in fact the closure would only apply to parts of those three areas (see Figure 2).

Location of bycatch in proposed closed areas

In order to map the location of *C. bairdi* Tanner crab bycatch in GOA fisheries, as described above, only data from observed vessels are used because they are associated with geographical coordinates. The observer program database contains detailed sample-level information on species composition and the results of extrapolations from the sample(s) to the haul level. This spatial analysis uses the haul-level extrapolated bycatch numbers of *C. bairdi*, as well as the official ton weight of the haul, to calculate and present bycatch numbers and rates. The distribution of bycatch for 2001-2009 (summed over those nine years) is mapped using data from the AKFIN Comprehensive Observer database, March 2010.

Color Figure 1 through Color Figure 3, found at the end of this document, map observed Tanner crab bycatch and groundfish catch in reporting area 630 for nonpelagic trawl vessels. Color Figure 1 shows the observed number of crab caught as bycatch, summed over 2001 through 2009, within 10km grids. The red squares indicate areas of high bycatch, and the green areas indicate areas of low bycatch. Note that the northwestern portion of the Chiniak proposed area closure is closed to nonpelagic trawling under the GOA red king crab Type 1 closure, and that part of the western portion of 525702 is closed seasonally as a Type 2 closure (see Section 0 for more information). The southeastern portion of the Chiniak closure has areas of higher bycatch, as does the central sections of the 525702 and 525630 closures. Bycatch in the 525807 closure is comparatively not as high, although directly to the east of the proposed closures are grids with higher bycatch.

By comparing Color Figure 1 with Color Figure 2, it is apparent that many of the areas that are subject to high Tanner crab bycatch are also areas that are heavily fished by nonpelagic trawl vessels. This is particularly true for the central sections of 525702 and 525630, and to some extent also for the Chiniak southeastern section. Color Figure 3 demonstrates this comparison by illustrating the amount of groundfish that is caught for each bycaught crab. In this figure, grids with a high rate of catch to bycatch are shown in orange and red. A relationship is apparent between high groundfish effort and higher bycatch levels in 525702, 525630, and Chiniak.

The same three types of figures are provided for pelagic trawl and pot vessels. Maps of hook and line effort in the proposed closure areas are not included, as there has been very little observed hook and line

effort in these areas in 2001-2009. Color Figure 8 shows the number of crab caught as bycatch by observed pelagic trawl vessels, and Color Figure 9 the groundfish catch for the same period. Note that the scales are the same for each gear type for crab bycatch and the bycatch rate per mt groundfish, however for groundfish effort, the pot gear map (Color Figure 12) has a different scale. Pelagic trawling for pollock, the primary target in these areas, is prohibited in the northeastern portion of the Chiniak proposed closure, due to Steller sea lion protection measures. Color Figure 10 shows the rate of groundfish catch per crab caught as bycatch, which identifies the northcentral portion of 525702 as having a low bycatch rate for pelagic trawlers.

The maps for pot effort show that the majority of observed pot fishing does not occur within the proposed closed areas. The highest areas for crab bycatch on observed vessels were to the southwest, just outside of 525630 (Color Figure 11), and Color Figure 12 shows that the majority of observed catch in reporting area 630 occurs to the northeast of Kodiak Island. There are pockets of higher bycatch in 525702 and 525630, and in the inshore part of the Chiniak proposed closure. Color Figure 13 illustrates bycatch rates for observed pot vessels, which are often high, however it should be remembered that studies show that the mortality rate of bycaught crab for this gear type are lower than that for trawl gear (Section 3.3.2).

3.4 C. *Bairdi* Tanner crab bycatch in other fisheries

3.4.1 Bycatch of *C. bairdi* in the State waters Pacific cod pot fishery

The State-managed Pacific cod fishery in western and central GOA began in 1997, and is only open to pot and jig gear. The fishery is managed in five districts: South Alaska Peninsula, Chignik, Kodiak, Cook Inlet, and Prince William Sound. The State bases its guideline harvest level on the Federal acceptable biological catch (ABC) for Pacific cod, and the Council and NMFS reduce the Federal total allowable catch (TAC) for Pacific cod to accommodate the State fishery. In most cases, the fisheries open one week after the close of the Federal Pacific cod A season, and occur in late February to April.

In the discussion of bycatch numbers in Sections 3.3.3 and 3.3.4, catch amounts attributable to the State Pacific cod fishery are not included in the data. However, NMFS inseason management tracks the catch of Pacific cod in the State water fishery, and also makes prohibited species catch extrapolations based on that groundfish catch, because the State Pacific cod fishery guideline harvest level is based on the Federal ABC for Pacific cod. Since there is no observer coverage in the State Pacific cod fishery, NMFS uses observer information from the federal fishery to estimate prohibited species in the State fishery. Crab bycatch from the State Pacific cod pot fishery was identified based on the date and location of catch, and these data are presented separately in this section.

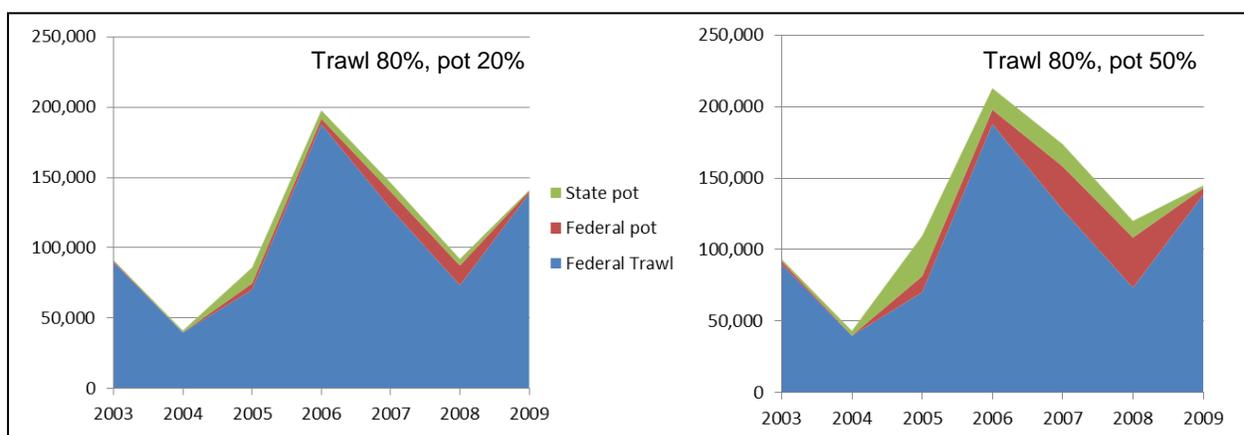
Table 24 identifies the *C. bairdi* bycatch attributable to the State managed Pacific cod pot fishery, which varied from a low of approximately 2,750 crab in 2003, to a high of 56,436 crab in 2005. The contribution of the State managed fishery to overall *C. bairdi* bycatch in the GOA ranged from a low of 2%, in 2003, to a high of 34%, in 2005. On average, the State Pacific cod fishery contributes approximately 12% to the overall *C. bairdi* bycatch in reporting area 630 (Figure 22). It is worth remembering that the bycatch estimates from the State managed fishery are based on extrapolations from similar size vessels fishing in the Federal Pacific cod pot fishery, as there is minimal observer coverage in the State fishery. Consequently, these estimates should be interpreted with caution.

Table 24 C. bairdi bycatch in Federal and State pot and trawl fisheries in reporting area 630, 2003-2009

	Federal trawl fisheries	Federal pot fishery	State Pacific cod fishery (pot gear)	Grand Total	State as % of total
2003	112,237	4,557	2,751	119,545	2%
2004	49,781	434	6,355	56,571	11%
2005	87,788	22,535	56,436	166,760	34%
2006	234,620	20,356	29,894	284,870	10%
2007	159,921	60,507	31,057	251,485	12%
2008	91,727	70,182	23,319	185,227	13%
2009	173,067	9,118	3,751	185,937	2%
Average 2003-2009	129,877	26,813	21,938	178,628	12%

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

Figure 22 Federal and State C. bairdi Tanner crab bycatch mortality in GOA groundfish fisheries



Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

3.4.2 Scallop fishery

Tanner crab are also caught as bycatch in the scallop dredge fishery. Bycatch is controlled through the use of crab bycatch limits (CBLs), which are based on the condition of individual crab stocks. CBLs were first instituted by the State of Alaska in July 1993. In the scallop fishery's Kodiak Northeast District⁷, in which the proposed area closures are located, CBLs for Tanner crab are set at 0.5% or 1.0% of the total crab stock abundance estimate, based on most recent survey data. When Tanner crab abundance is sufficient to support a commercial crab fishery, the cap is set at 1.0% of the most recent abundance estimate; when Tanner crab abundance is insufficient to support a commercial crab fishery, the CBL is set at 0.5%. Bycatch caps are expressed in number of crabs and include all sizes of crabs caught in the scallop fishery. Table 25 lists the CBLs in the scallop fishery from 2000/01 to 2008/09, as well as the estimated bycatch. State managers also have inseason authority to close the scallop fishery out of specific areas within the Kodiak Northeast District to address crab bycatch. This might occur if the overall crab survey abundance in an area is low, or if the proportion of juveniles to legal males observed as bycatch is high (N. Sagalkin, pers. comm., 2/1/10).

⁷ Note, the Kodiak Northeast District for scallop management has different boundaries than the northeast section of the Kodiak District for management of Tanner crab. The scallop Kodiak Northeast District includes all waters around Kodiak except in the Shelikof Straits.

Table 25 C. bairdi Tanner crab bycatch limits and estimated bycatch in the scallop fishery in Kodiak Northeast District, 2000/01-2008/09, in numbers of animals

Year	Crab bycatch limit	Estimated bycatch
2000/01	81,000	13,311
2001/02	425,000	20,362
2002/03	1,100,000	22,821
2003/04	606,991	18,230
2004/05	527,388	30,717
2005/06	449,403	29,264
2006/07	302,000	16,899
2007/08	220,000	77,348
2008/09	186,000	39,732
Average 2002/3-2008/9		33,573

Source: Rosenkranz and Burt, in prep.

3.5 C. bairdi Tanner crab directed fisheries

The Tanner crab fishery in the Kodiak District began in 1967 when 110,961 pounds were landed. The fishery quickly expanded and over 34 million pounds were harvested from 1968 through the 1971/72 season. In response to increased demand and larger harvests, ADF&G initiated a pot survey in 1973 to estimate relative abundance, predict recruitment trends, and develop annual harvest levels. The fishery continued to grow with annual harvests increasing to a peak of 33 million pounds in the late-1970s. ADF&G implemented an April 30 season closure date in 1975 to protect crab at the onset of the mating and molting season. A minimum carapace width (CW) of 5.5 inches was additionally established in 1976. In the early 1980s, Tanner crab stocks and commercial harvests began to decline, and by the early 1990s, annual harvests averaged less than two million pounds. The fishery was closed for the 1994/95 season, and remained closed until the 2000/01 season. During the six-year closure, a harvest strategy was developed by ADF&G and adopted by the Alaska Board of Fisheries (BOF) in 1999. This harvest strategy has a number of conservation measures to help sustain the Tanner crab population as well as a number of provisions to slow the pace of the fishery. The plan has minimum population levels (biological thresholds) and minimum guideline harvest levels (management thresholds) to open a commercial fishery. Each section must have a GHL of at least 100,000 pounds and the entire district GHL must be at least 400,000 pounds to open. In order to slow the pace of the fishery, fishing is restricted to daylight hours; gear may only be operated from 8:00 AM to 5:59 PM, although gear may be left to soak from 6:00 PM until 7:59 AM. The fishery also has pot limits. Vessels are restricted to 20 pots until harvest levels exceed 2 million pounds, and from 2 to 4 million pounds the pot limit is 30 per vessel. The Kodiak District is designated superexclusive, which means vessels may not participate in any other Tanner crab fishery in the same calendar year. The number of permits is limited through the limited entry program to approximately 180 permits; although in recent years actual participation has been much lower.

In addition to the mandatory escape mechanism (“bio-twine”), pots are also required to have either 4 escape rings or one third of on vertical surface composed of 7 ¼ inch stretch mesh webbing. Escape rings (or escape mesh) have been shown to reduce the amount of sub legal and female Tanner crab (Pengilly 2000). Vessels must register for individual sections so that ADF&G can track effort and harvest. Most of the fleet participates in a voluntary reporting program where vessels are contacted on a daily basis for information on harvest, effort, and CPUE. This voluntary reporting is the primary method ADF&G uses to manage the fishery. The distribution of the harvest generally matches stock distributions observed on the trawl survey, and ADF&G closes waters to fishing when inseason targets are achieved. At times, ADF&G will keep areas of a section closed for protection. For example, in 2010, Danger Bay in the Northeast Section was kept closed because the population of crab during the survey was very low. Ugak Bay in the Eastside Section was also kept closed. While there was a fishable population of legal crab in

Ugak Bay, the proportion of legal males to sublegal males was high, and ADF&G kept the bay closed to minimize sorting on sub-legal crab.

Since adoption of the Tanner crab management plan in 2001, only the Northeast, Eastside, Southeast, and Southwest sections have opened to commercial fishing. The majority of the harvest has occurred in the Eastside Section. Total Kodiak District harvests from 2003 to 2009 have averaged just under a million pounds, and harvests from the Eastside Section over the same time span have averaged approximately 500,000 pounds (232,602 crab).

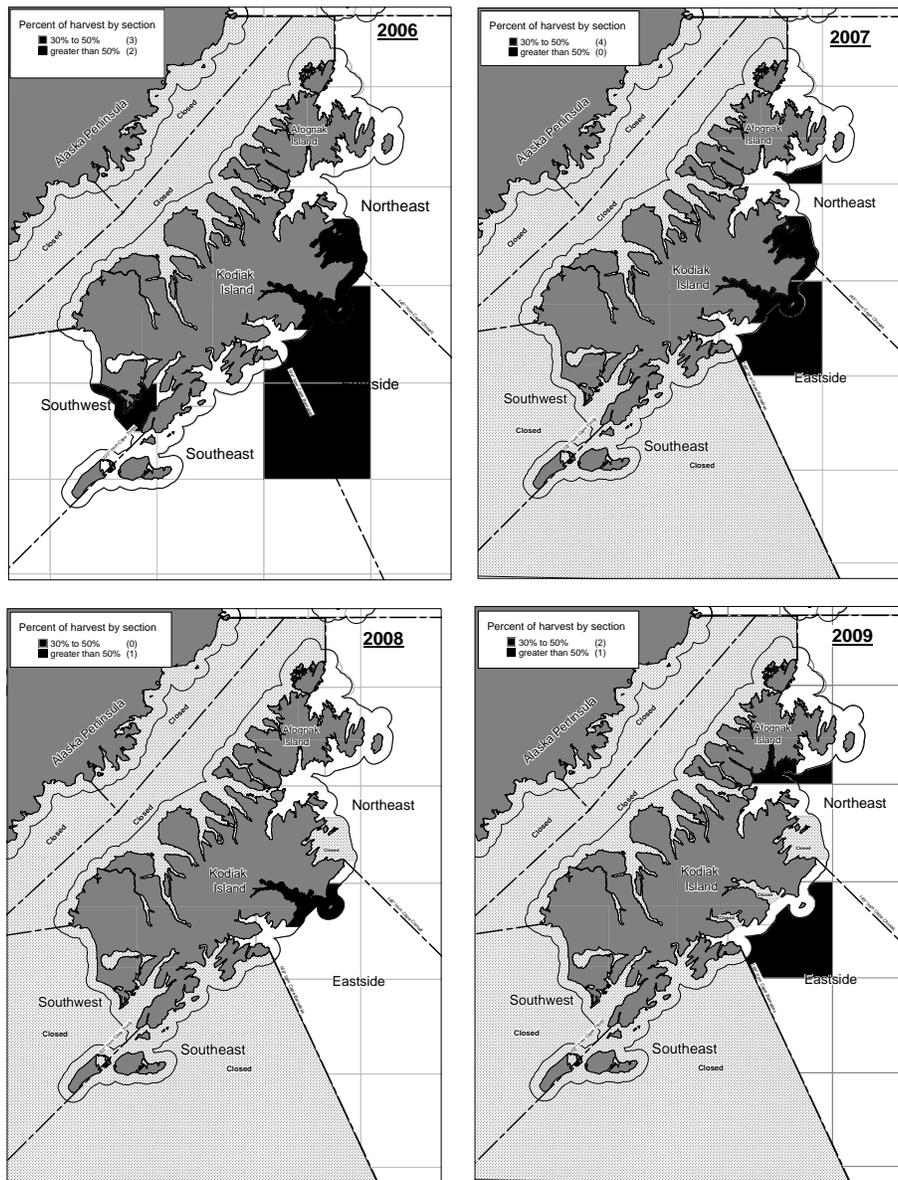
Figure 23 depicts sections that opened to commercial fishing from 2006 to 2009 and ADF&G statistical areas within those sections where the majority of the harvest has occurred.

Table 26 Commercial fishery harvest for Kodiak district, 2003-2009

Kodiak District Tanner crab commecial fishery														
Sections	Northeast		Eastside		Southeast		Southwest		Westside		N. and S. Mainland		TOTAL	
	pounds	no. of crab	pounds	no. of crab	pounds	no. of crab	pounds	no. of crab	pounds	no. of crab	pounds	no. of crab	pounds	no. of crab
2003	162,494	67,706	348,830	145,346	no fishery		no fishery		no fishery		no fishery		511,324	213,052
2004	259,572	117,987	219,980	99,991	86,666	39393.64	no fishery		no fishery		no fishery		566,218	257,372
2005	467,516	203,268	665,339	289,278	92,398	40,173	574,944	249,976	no fishery		no fishery		1,800,197	782,694
2006	519,730	216,554	1,302,378	542,658	130,292	54,288	168,984	70,410	no fishery		no fishery		2,121,384	883,910
2007	88,584	36,910	676,508	281,878	no fishery		no fishery		no fishery		no fishery		765,092	318,788
2008	87,774	35,110	335,815	134,326	no fishery		no fishery		no fishery		no fishery		423,589	169,436
2009	88,598	35,439	336,839	134,736	no fishery		no fishery		no fishery		no fishery		425,437	170,175
Average	239,181	101,853	555,098	232,602	103,119	44,618	371,964	160,193					944,749	399,347

Source: http://www.cf.adfg.state.ak.us/geninfo/shellfish/shellfish_harvest.php for commercial harvest.

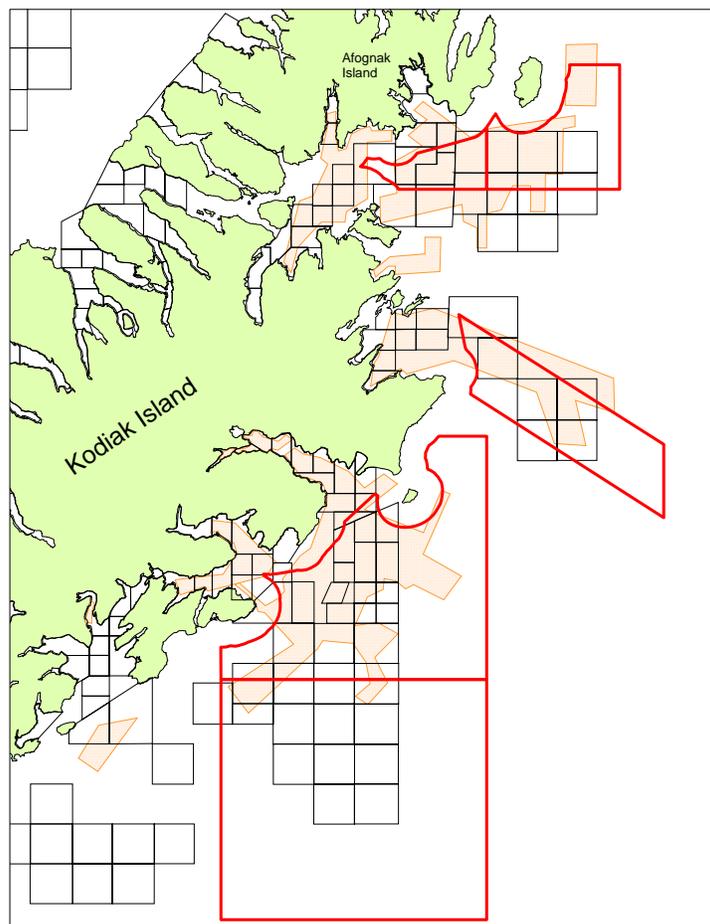
Figure 23 Statistical areas where 30-50% of the harvest occurred and locations where greater than 50% of the harvest occurred, 2006-2009.



Source: K. Spalinger and N. Sagalkin, ADF&G

Because harvest is documented at the statistical area level, it is difficult to apportion harvest on a smaller scale. In order to analyze fishing locations on a smaller scale, confidential interview data from 2006 through 2009 was aggregated (to maintain confidentiality) and plotted in relation to the proposed closure areas (Figure 24).

Figure 24 Directed Tanner crab fishing locations (2006-2009; orange shapes), in relation to the trawl survey stations (black boxes) and the proposed areas (red boxes).



3.6 Modified gear to reduce impacts on crab

3.6.1 Sweep modification for bottom trawl vessels

The predominant direct effects caused by nonpelagic trawling include smoothing of sediments, moving and turning of rocks and boulders, resuspension and mixing of sediments, removal of seagrasses, damage to corals, and damage or removal of epibenthic organisms. Trawls affect the seafloor through contact of the doors and sweeps, footropes and footrope gear, and the net sweeping along the seafloor. A considerable proportion of the area impacted by trawling is due to contact between the seafloor and the sweeps.

The Council has approved a gear modification requirement that trawl sweeps used for all flatfish fishing in the Bering Sea must be modified. Vessels must install elevating devices (Figure 25) on the sweeps and regular intervals, in order to raise the sweeps off the seafloor and reduce adverse impacts on benthic animals. For most Bering Sea flatfish trawls, sweeps are so long (up to 1500 ft) that they sweep 90 percent of the area covered between the trawl doors. The proposed modifications elevate most of the sweep area 2 to 3 inches above the substrate, allowing space for animals to pass beneath. If the Secretary of Commerce approves the Council's gear modification requirement, the regulations will likely be implemented for the beginning of the 2011 fishing year.

Figure 25 Examples of elevating devices.



10 inch elevating bobbin connected to 2-inch (52-mm) combination wire with hammerlocks (coupling links).



8 inch elevating discs mounted on body of 2-inch (52-mm) combination wire with stopper swages each side.

The process for implementing the sweep modification in the Bering Sea required extensive testing and discussion between the industry and NMFS, in order to identify in regulation a configuration of the gear that was both practicable and enforceable. It is anticipated that a similar discussion would be needed to implement such a gear modification on GOA trawl vessels, in order to determine the optimum configuration, as the class of vessels participating in the two management areas differs (in the Bering Sea flatfish fishery, trawl vessels are primarily catcher processors; there are more smaller trawl vessels operating in the GOA).

Effects on Crab Mortality

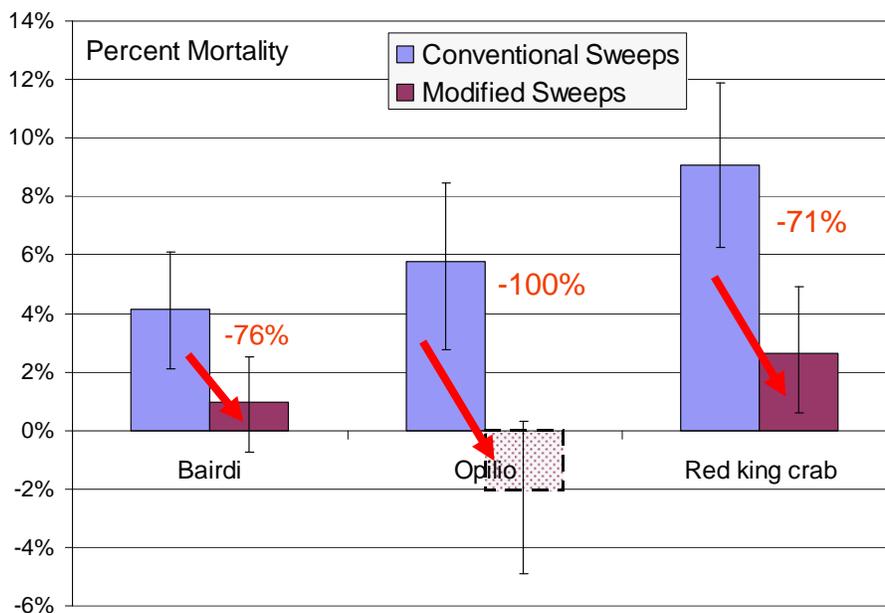
In the summer of 2008, researchers conducted a study in the Bering Sea, funded by the North Pacific Research Board, to estimate the mortality rates for snow and Tanner crabs that encounter bottom trawls, but remain on the seafloor. That study estimated mortalities for both species for conventional and modified sweeps. Briefly, crabs were captured by auxiliary nets fished behind different parts of a commercial bottom trawl. They were carefully brought aboard and assessed using a six part reflex test. A subsample of those crabs was held for 5 to 12 days to establish the relation between reflex state and delayed mortalities. The proportions of crabs in different reflex states and the reflex-mortality relationship were used to estimate raw mortality rates for crabs encountering each part of the trawl. Results for crabs captured with a control net, fished in front of the trawl to serve as a scientific control for the effects of the recapture net itself, were used to assess and adjust for mortalities due to capture and handling. Sample sizes were 21 tows for conventional and modified sweeps and 19 tows of the control net.

Estimates of mortality for crabs encountering conventional sweeps were approximately 5 percent for both species (Figure 26). Mortality rates dropped to nearly zero for crab encountering the modified sweeps. Significance levels for these decreases (conventional versus modified) were 0.002 for *Chionoecetes bairdi* and <0.001 for *C. opilio*. While overall crab mortality varied significantly by sex and size after gear effects had been accounted for, there were no significant interactions between these factors and gear effects. Thus, the mortality reduction due to the sweep modification persisted across sizes and sexes.

A similar study, also funded by the North Pacific Research Board, was conducted in summer of 2009 in Bristol Bay to estimate mortality rates for red king crab encountering bottom trawls. Results indicate a similar trend in reduced mortality rates for king crab encountering the modified sweeps. The demonstrated reductions in mortality to crabs likely indicate that any mortality of other, smaller epibenthos (such as other crab, sea stars, or shrimp) would also be reduced.

Figure 26 Estimated mortalities of *Chionoecetes opilio*, *C. bairdi*, and red king crab after contact with conventional and modified sweeps.

Rates have been adjusted for handling mortality based on mortality estimates from a control net. (Apparent negative mortality is a non-significant artifact of the control adjustment).



Overall, the trawl sweep modification has been tested to be effective in the Bering Sea flatfish trawl fishery in reducing trawl sweep impact effects on *C. bairdi*, *C. opilio*, and red king crabs by reducing the unobserved mortality of these species. Additionally, the trawl sweep modification has proven effective on the Bering Sea shelf at reducing effects on sea whips (a long-lived species of primary concern), and did not substantially reduce catches of target flatfish. Tests for reduced impacts on basketstars, sponges, and polychaete siphons were positive in direction, but non-significant.

The relevance of that study to crabs in the GOA depends largely on the similarities in sediment type in the Bering Sea and GOA, and between the bottom trawl gear tested in the Bering Sea and those used in the GOA. The sediment in the Bering Sea where the flatfish fishery occurs consists mainly of sand, muddy sand, or gravelly muddy sand (NMFS 2009), and such was the sediment in the areas of the research study. As can be seen in Figure 7, sediment in the proposed closure areas is variable, with similar sand and gravelly sand substrates, but also gravelly mud and silty clay areas.

With respect to gear type, AGDB distributed a survey form to their members describing the most relevant characteristics of the trawl gear used in GOA bottom trawl fisheries. RACE Division scientists compiled and summarized the data from the returned survey forms. Fourteen vessels responded to the survey, describing 22 nets used to target flatfish. The survey indicated that GOA bottom trawl gear used to target flatfish in the GOA is similar to that used in the Bering Sea, including the gear used in the research project. It consists of bottom trawls with footropes equipped with large diameter bobbins or disks. Most of the area affected by these trawls is covered by sweeps, long cables between the trawl doors and the net, that herd flatfish into the path of the capture net. The differences in the gear used in the GOA included:

- 1) Most of the GOA trawlers reported diameters of footrope bobbins from 16 to 18 inches diameter in the center and 14 – 16 inches in the wings (sides of the trawl footrope) while Bering Sea trawlers use footrope bobbins and disks from 18 – 23 inches in diameter .

- 2) Most GOA sweeps used 3 inch diameter rubber disks strung over a steel cable instead of the 2 inch diameter combination rope (polyethylene-wrapped steel) used in the Bering Sea fisheries and tests. The rubber disk gear has a rougher surface than the combination rope, but more surface area over which to spread the cable weight. Some GOA vessels reported using combination rope. Some also reported using widely spaced (90 – 120 ft) devices that raised the sweeps above the seafloor, similar to the modified sweeps identified in the research.
- 3) Finally, GOA vessels used shorter sweeps than those used by the larger Bering Sea trawlers. While Bering Sea sweeps cover approximately 90% of the area affected by their trawls, similar calculations for GOA gear yield 75%.

The general similarity of GOA trawl gear to that used in the Bering Sea tests indicates that the results of those tests should approximate mortality rates in GOA fisheries. The smaller area swept by the sweeps in the GOA indicates that the benefits of sweep modifications would be somewhat smaller than those for Bering Sea fisheries, but still substantial. Additional research would be useful to document the effects of the somewhat smaller diameters of footrope components and the differences in sweep materials and diameter.

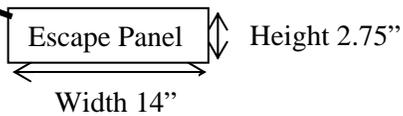
3.6.2 Pot escape mechanisms

The typical Pacific cod pot has tunnels on three sides with cod triggers that allow the passage and retention of Pacific cod. These tunnels with triggers are normally fixed via webbing to a set of web bars that are inset from the outside frame bars by approximately 2 inches. Crab below a threshold size are also able to enter the pot through the triggers, resulting in Tanner crab bycatch when fishing in areas having concentrations of both Pacific cod and Tanner crab. To reduce the bycatch of crab, a pot would need an opening that would permit crab to exit while retaining Pacific cod. The prototype pots are identical to the normal pots (overall dimensions: 6 ½ ft x 7 ft x 3 ft) with tunnels on three sides and an access door on the fourth side (Pikus personal communication). On the rear side of the pot (opposite the door), two web bars are placed horizontally across the bottom instead of the usual one, with the tunnel web laced to only the top bar (Figure 27). Vertical bars are then placed in between the two web bars resulting in four escape openings that are 15 inches wide and 3 inches high. These openings are large enough to permit a Tanner crab to escape, but are not high enough to allow Pacific cod to escape.

Figure 27 Diagram of a modified groundfish pot that has a bottom escape panel.



Photo credit: Jeremy Pikus



4 Probable Environmental Impacts

This document analyzes three alternatives that evaluate proposed area closures to protect *C. bairdi* crab around Kodiak Island. Included in the alternatives are options to apply the closures year round or seasonally, and to pot and/or trawl gear types. Additionally, some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement.

The proposed action affects vessels fishing in the Federal groundfish fishery in the Central Gulf of Alaska. Only those environmental components that occur in the proposed area closures around Kodiak Island, or in adjacent areas in which displaced vessels may choose to fish, are likely to be affected by this action. These components include crab species, especially *C. bairdi* crab, target and nontarget fish species, marine mammals and seabirds, bottom habitat, and ecosystem components. This environmental assessment focuses on these potentially affected components, and no effects are expected on the other components of the marine environment in the Gulf of Alaska.

In this section, the impacts of the alternatives and option on the various environmental components are evaluated. Section 4.1 addresses the impacts of the alternatives on *C. bairdi* crab. Section 4.2 looks at impacts on other crab and fish species, and Section 4.3, seabirds and marine mammals. Sections 5.4 and 5.5 address impacts on habitat and the ecosystem, respectively. The socio-economic impacts of this action are described in detail in the RIR and IRFA portions of this analysis (Sections 6.5.4 and 7.8).

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

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

For the most part, the discussion of past and present cumulative effects is addressed with the analysis of direct and indirect impacts for each resource component below. The cumulative impact of reasonable foreseeable future actions is addressed in Section 4.6.

Section 5 addresses the management and enforcement considerations of the proposed alternatives and options.

The criteria listed in Table 27 are used to evaluate the significance of impacts. If significant impacts are likely to occur, preparation of an Environmental Impact Statement (EIS) is required. Although economic and socioeconomic impacts must be evaluated, such impacts by themselves are not sufficient to require the preparation of an EIS (see 40 CFR 1508.14).

Table 27 Criteria used to evaluate the alternatives

Component	Criteria
Fish species	An effect is considered to be significant if it can be reasonably expected to jeopardize the sustainability of the species or species group.
Habitat	An effect is considered to be significant if it exceeds a threshold of more than minimal and not temporary disturbance to habitat.
Seabirds and marine mammals	An effect is considered to be significant if it can be reasonably expected to alter the population trend outside the range of natural variation.
Ecosystem	An effect is considered to be significant if it produces population-level impacts for marine species, or changes community- or ecosystem-level attributes beyond the range of natural variability for the ecosystem.

4.1 *C. bairdi* Tanner crab

A discussion of crab stock abundance and bycatch in the groundfish fisheries, both inside and outside of the proposed closed areas, is addressed in Chapter 3. This section draws on this information to evaluate the effects of the alternatives and options.

Alternative 1 – status quo

The impact of Tanner crab bycatch in the groundfish fisheries on Tanner crab stocks was analyzed in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007), and the Alaska Groundfish Fisheries Programmatic SEIS (NMFS 2004). As described in Section 3.2, ADF&G conducts annual surveys of the crab stocks in the GOA (Spalinger 2010). The surveys are partial, and concentrate on the historically most important areas of crab abundance; however, the estimates of abundance are on the low side of total abundance in the area since the total crab habitat is only partially surveyed. In 2009, the estimate of Tanner crab in the Kodiak District was approximately 84 million animals (Table 1). The estimated bycatch in 2009 in the groundfish fisheries for reporting area 630 was approximately 183,000 animals (Table 7 in Section 3.3.3); combined for areas 620 and 630, estimated bycatch was 223,000 animals (although area 620 also includes the Tanner crab Chignik district population). In either case, this represents approximately 0.2 percent of the surveyed abundance of the Kodiak District. The proportion is also comparable for the 2003-2009 averages for groundfish Tanner crab bycatch and Kodiak District Tanner crab surveyed abundance. Approximately two-thirds of the bycatch is composed of sublegal males (Table 22). The Harvest Specifications EIS concludes that bycatch of this magnitude is not considered to have an impact on stocks of Tanner crab in the GOA (NMFS 2007).

State crab fishery managers have identified the Eastside Section of the Kodiak District as the most important area for the Tanner crab population (N. Sagalkin, pers. comm., 2/1/10). This area contains most of the biomass for the District (an average of 44% of abundance for the period 2003-2009; Table 1). Bycatch information for the groundfish fishery as a whole is available for reporting area 630, which is larger than the Eastside Section, including most of the Kodiak District Sections excepting Southwest and South Mainland. However, observer data shows that Tanner crab bycatch in the Eastside Section (represented by bycatch in proposed area closures 525702 and 525630) was approximately 70% of total observed bycatch in 630 in 2009, and 55% on average from 2001-2009. The total Tanner crab bycatch by the groundfish fisheries in reporting area 630 represents 0.5% of the surveyed crab abundance in the Eastside Section for 2009, or 0.3% of the average abundance for 2003-2009. To provide some context for this percentage, the State of Alaska has set crab bycatch limits for the scallop fishery at 0.5-1% of the total crab stock abundance for the Kodiak area (however, the scallop fishery is also 100% observed, and bycatch numbers for that fishery are more reliable than is the case for the groundfish fishery).

Additionally, Sections 3.1 and 3.5 describe that the Tanner crab population around Kodiak has been rebounding from lows in the mid-1990s, despite continued bycatch in the groundfish fisheries throughout this period (Table 12). Since 2000/01, crab abundance has met the minimum population levels to support a commercial fishery. Overall abundance since that time has been variable, with peaks in 2001 and 2006-

07 (Table 1). Consequently, based on the criteria identified in Table 27, groundfish bycatch impacts on the sustainability of Tanner crab in the Kodiak District are considered as adverse, but are not likely to be significant.

Alternative 2 – close areas to groundfish fishing

Closing specific areas to groundfish fishing in order to reduce bycatch of Tanner crab is likely to benefit the stock by reducing a source of both observed and unobserved mortality. The proposed area closures account for an average of 65% of the total observed Tanner crab bycatch in the groundfish fisheries for 2001-2009, while only representing an average of 25% of groundfish catch (Table 16 and Figure 20). Consequently, groundfish effort that is displaced into neighboring areas is not likely to have as high a bycatch of Tanner crab as is currently occurring in the proposed closed areas.

Ecosystem effects of area closures to groundfish fishing

Ecosystem model simulations were conducted to evaluate the potential effects of reduced groundfish catch due to area closures for Tanner crab in the Central Gulf of Alaska (CGOA). Six scenarios of reduced groundfish fishing effort in the flatfish trawl, cod trawl, and pollock trawl fisheries were conducted to reflect potential outcomes of proposed crab closures; these simulations ignore that groundfish would be harvested outside of the proposed closure areas. These scenarios were compared with a base scenario of status quo (2009) effort. The results suggest that changes in flatfish trawl fishing effort would have the largest side effects in terms of changes in the biomass of both target and nontarget species. Isolated changes to the pollock trawl or cod trawl fisheries had little to no discernable ecosystem effects or impacts to Tanner crabs. The largest change in Tanner crab biomass due to the most extreme scenario (where effort in flatfish, pollock, and cod trawl fisheries were all reduced by the maximum expected amount simultaneously) was most likely to range from no change to a 9% reduction from the base scenario.

The ecosystem model used was derived from the full Gulf of Alaska food web model described in Aydin et al. (2007) by retaining biomass, diet, and fisheries catch data for regions only in the Central GOA (NMFS areas 620 and 630) and rebalancing. Changes to fisheries were modeled by converting the expected range of harvest declines for target species in target fisheries into reduced relative effort in those target fisheries. Changes in fishing gear effort better simulate the indirect effects of changes to fisheries (e.g. bycatch reductions) as well as the indirect effects of leaving more predators and prey in the ecosystem. Seven fishing effort scenarios were implemented to simulate a range of outcomes from crab closures (reductions are relative to 2009 effort, all other fisheries held constant at 2009 level):

Scenario	Flatfish trawl effort	Cod trawl effort	Pollock trawl effort
Base	Constant 2009	Constant 2009	Constant 2009
ATF med	16.61% reduction	Constant 2009	Constant 2009
Cod med	Constant 2009	34.57% reduction	Constant 2009
Poll med	Constant 2009	Constant 2009	14.02% reduction
All med	16.61% reduction	34.57% reduction	14.02% reduction
All low	3.12% reduction	8.30% reduction	4.00% reduction
All high	33.23% reduction	69.15% reduction	28.03% reduction

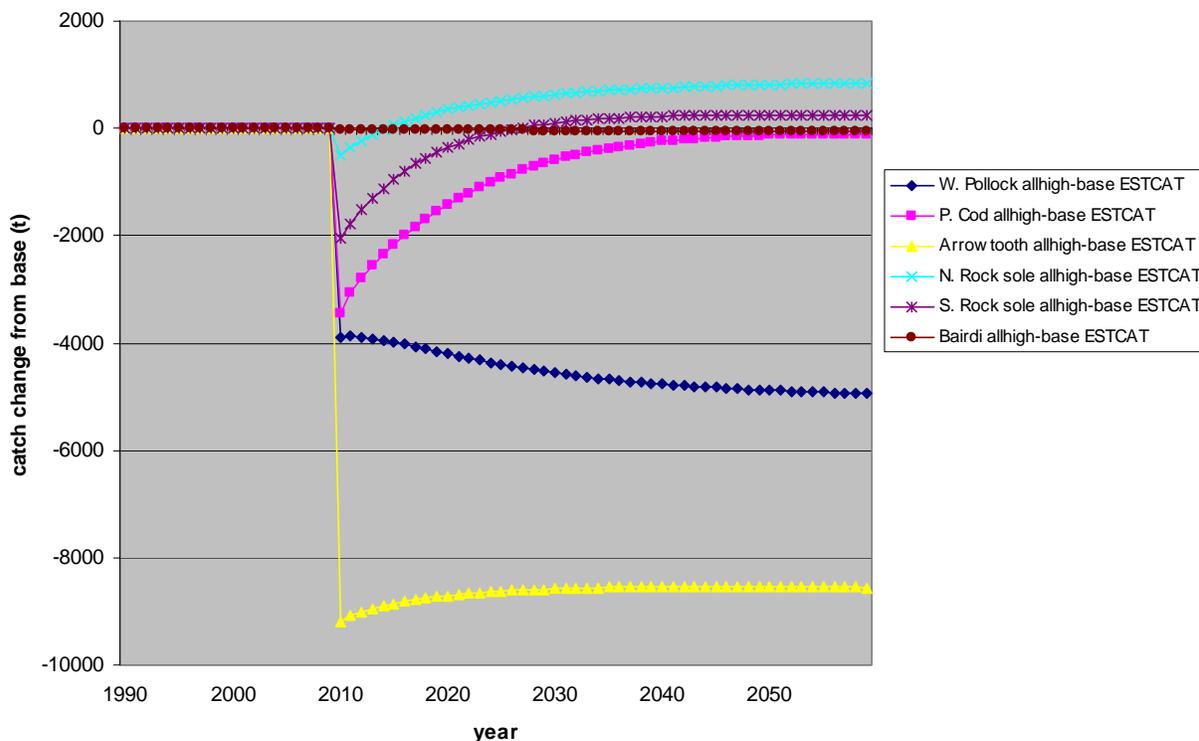
Without incorporating uncertainty, these effort change scenarios resulted in the following 2010 catch changes (t) relative to the base scenario:

Scenario	Arrowtooth	Rock soles	Cod	Pollock	Tanner crabs
ATF med	-4,465	-1,225	-893	-251	-7
Cod med	-71	-6	-746	-27	-1
Poll med	-55	-22	-77	-1,667	0
All med	-4,591	-1,254	-1,719	-1,946	-8
All low	-869	-234	-368	-529	-1
All high	-9,195	-2,552	-3,450	-3,896	-15

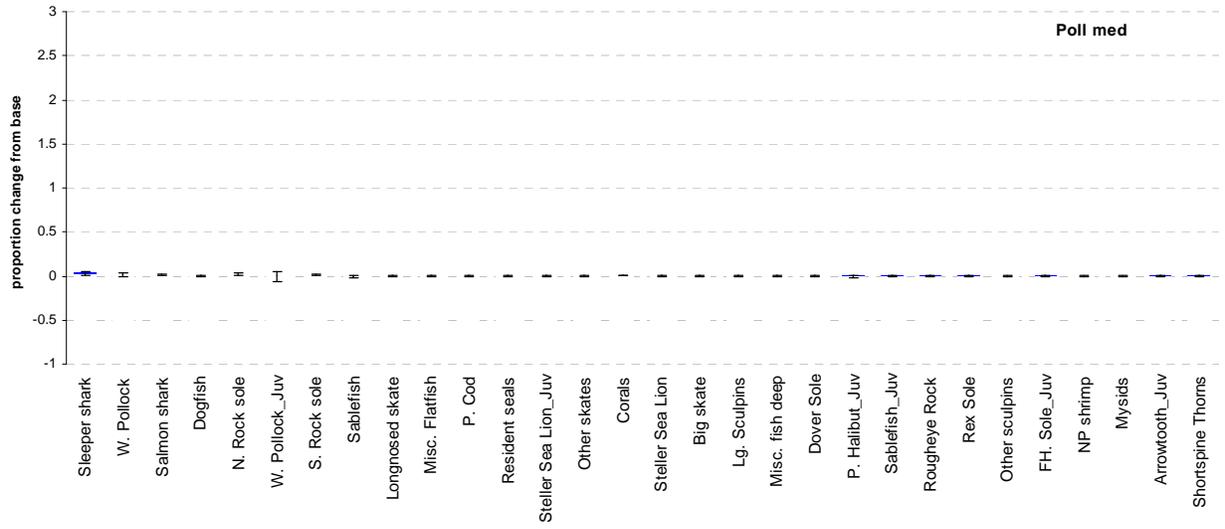
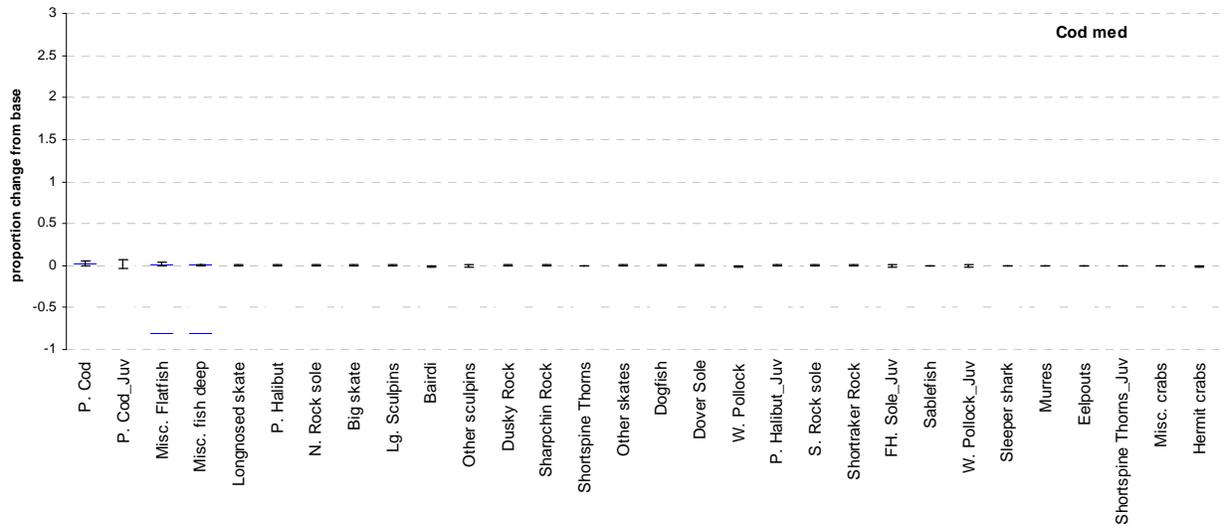
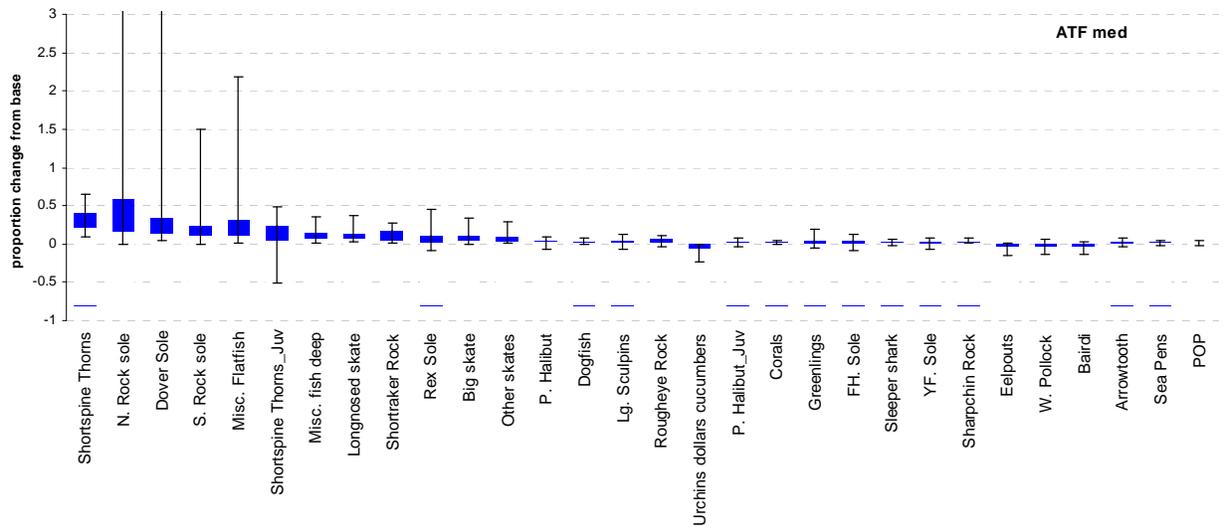
After a 50 year simulation (allowing populations to adjust to changes) relative catch (t) was:

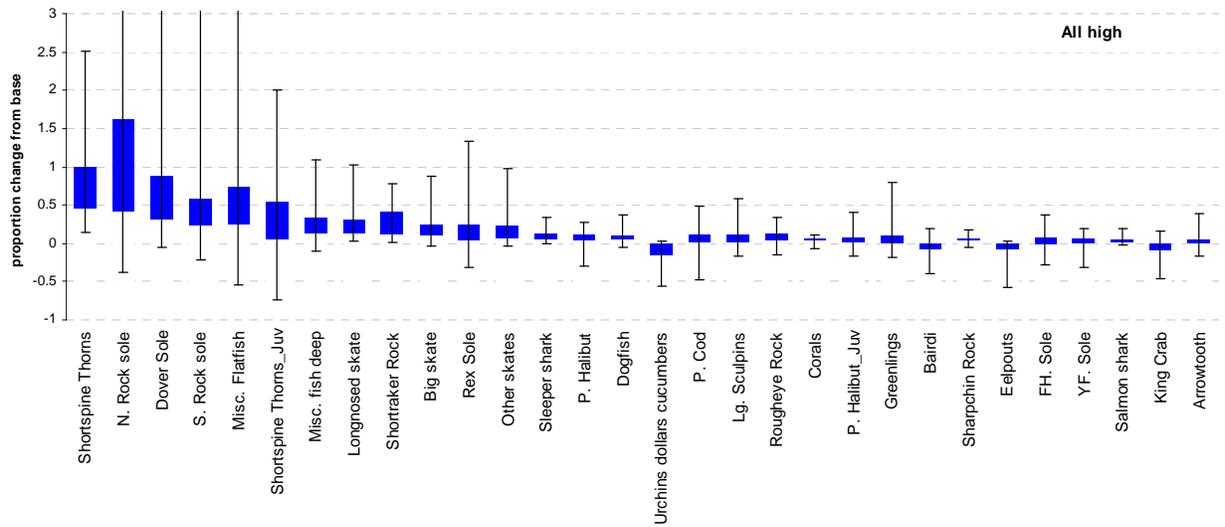
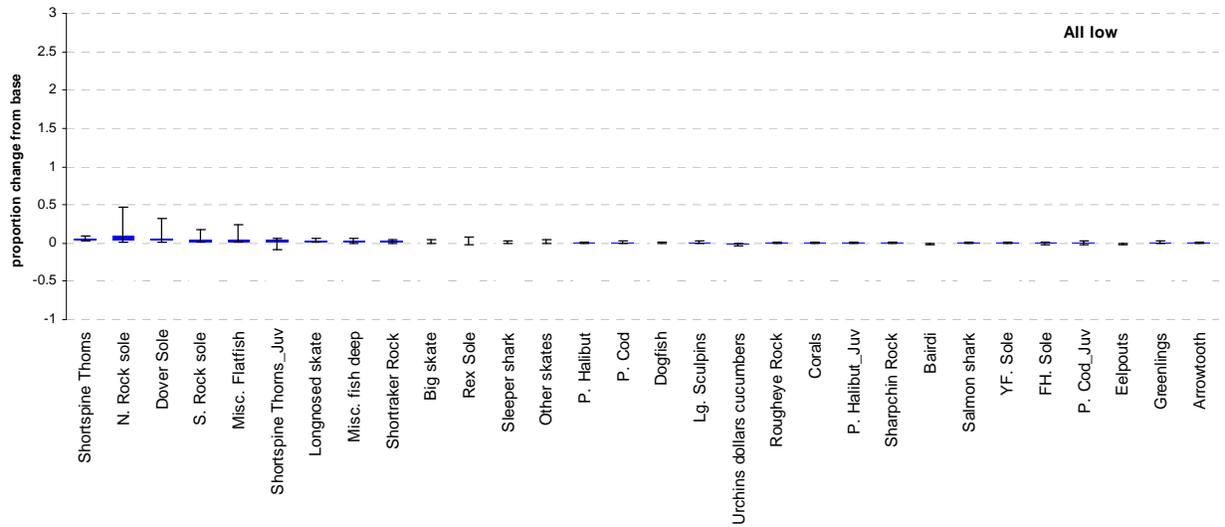
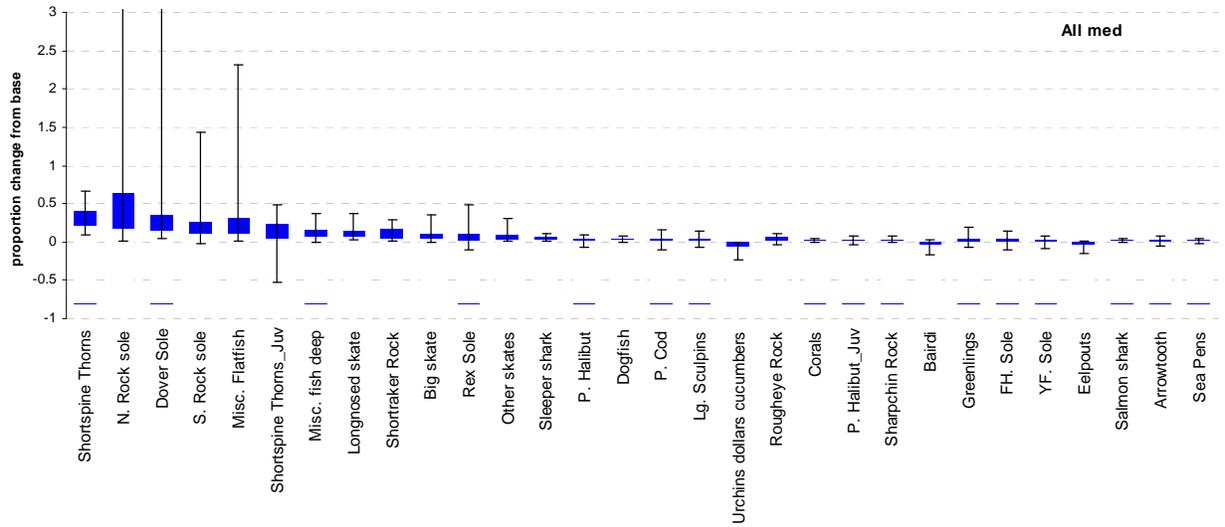
Scenario	Arrowtooth	Rock soles	Cod	Pollock	Tanner crabs
ATF med	-3,970	649	-626	-890	-19
Cod med	-88	6	542	-116	-6
Poll med	-131	20	119	-1,621	-1
All med	-4,181	672	0	-2,545	-25
All low	-787	140	49	-651	-5
All high	-8,558	1,103	-112	-4,942	-49

Note that with constant reduced effort, catches of rock sole and cod increase over the 50 year simulation in many or all scenarios because reduced effort allows the population to grow, so the model estimates more catch to be taken from this higher biomass even with reduced effort. Conversely, pollock catch declines further in some scenarios because predation mortality from their predators (cod and arrowtooth) increases more than their fishing effort decreases. The following plot shows the change in catch relative to the base scenario for these species in the All high scenario (prior to incorporating uncertainty):



Uncertainty was incorporated to assess changes in biomass due to reductions in fishing effort and the resulting ecosystem adjustments. The time series of relative effort for each scenario were used to force each of the 700 feasible ecosystems for 1990-2059, with experimental fishing in 2010-2059. The following plots show the ranges of relative biomass changes at the end of each run, averaged over the final 10 years (2050-2059). Species are arranged from those having the largest median change at left to those with the smallest median change at right for the top 30 species in each scenario. Note that different species are affected by each scenario. Blue bars show the 25-75% interquartile range of reduction or increase in a particular species relative to its original biomass. Error bars show the 5-95% interquartile range. The scenario name is in the upper right hand corner of each plot.





The three scenarios manipulating individual trawl fisheries show considerable contrast. The species most affected in each of these scenarios are bycatch in each target fishery. Reduced catch in the cod trawl and pollock trawl fisheries alone had very small impacts to any species in the ecosystem, even in the 5-95% interquartile range for the target species. In these scenarios, Tanner crabs (labeled “Bairdi” in plots) were not included in the top 30 species for Poll med and were predicted to remain close to base biomass for Cod med (extreme low predicted biomass at the 5% interquartile was 2% below base).

Reduced catch in only the flatfish trawl fishery was predicted to have larger impacts, increasing biomass for thornyhead rockfish, dover sole, longnose skate, shortraker rockfish even at the 5% quantile. Rock soles were also predicted to increase although there is more uncertainty in how much (in some models they increased more than threefold). Tanner crab rank 27th in the top 30 biggest median biomass changes in this scenario. The 25-75% prediction for Tanner crab biomass was to decline between 3.5 and <1% relative to base; models at the 5-95% extreme ranges predicted between a 13.7% decline and a 3.4% increase in biomass.

When fishery changes were implemented across all three trawl fisheries simultaneously, the largest predicted changes were to species that also changed when only the flatfish trawl fishery effort decreased. The All med scenario combines the same changes implemented separately in ATF med, Cod med, and Poll med. The top 9 species changed in All med were identical to those in ATF med, as were the top 9 species in All high. However, the combined effects of changes to all fisheries were also apparent in these scenarios, with species such as sleeper sharks (bycatch in pollock trawl) and cod (target of cod and bycatch in other trawl fisheries) showing larger changes than in the ATF med scenario. The difference between catch levels between the All low, All med, and All high scenarios appeared to simply scale up (or down) the effects to particular species, with the All high scenario having the largest overall effects.

Tanner crab ranked 23rd in the top 30 biggest median biomass changes in the All low, All med, and All high scenarios. The predicted interquartile ranges of Tanner crab biomass change in each model were:

Scenario	Rank	5%	25%	Median	75%	95%
ATF med	27 th	-13.7%	-3.5%	-1.4%	-0.2%	3.4%
Cod med	10 th	-2.1%	-0.5%	-0.1%	0.0%	0.3%
Poll med	55 th	-0.5%	-0.1%	0.0%	0.1%	0.4%
All med	23 rd	-16.0%	-4.2%	-1.7%	-0.3%	3.4%
All low	23 rd	-2.6%	-0.8%	-0.3%	-0.1%	0.4%
All high	23 rd	-38.8%	-9.0%	-3.5%	-0.6%	18.5%

Modeling fishery changes separately suggested that major changes due to the combined fishery effort reductions were primarily due to changes in the flatfish trawl fishery. In this model the flatfish trawl fishery is generalized and does not distinguish between deep and shallow water flatfish targets; its primary catch is arrowtooth flounder. In all scenarios, the expected change to Tanner crab biomass ranked fairly low among species and was expected to be small (< 10% reductions in the more likely 25-75% interquartile ranges) relative to the base scenario with constant effort in all fisheries. All high, the most extreme scenario with the largest simultaneous changes to trawl fisheries had the largest potential negative effect on Tanner crabs. However, the 5-95% interquartile range for the All high scenario shows considerable uncertainty, with outcomes ranging from a 39% decline in crab biomass to a 19% increase. If the changes to fisheries resulting from the proposed trawl closure areas are of the magnitude implemented in the All high scenario, then indirect impacts to Tanner crabs should be weighed against the potential benefits of protecting them in critical habitat. However, if changes to fisheries are expected to be lower than that extreme scenario, changes to Tanner crab biomass resulting from indirect impacts may be small and difficult to distinguish from observation error in abundance estimates.

Suboptions 1, 2, 4, 5 – close areas to a particular gear type

Nonpelagic trawl gear catches the vast majority of Tanner crab bycatch in reporting area 630 (Table 8), in part because this gear type also accounts for approximately 60% of total groundfish catch in the area. Bycatch mortality rates are higher in the proposed area closures, based on observer data, 3.39 crab/mt groundfish compared to 0.59 crab/mt groundfish in the rest of 630 (Table 18). Based on observer data, bycatch is highest in 525702 and 525630 (the areas with the highest Tanner crab population), and lower in the Chiniak and Marmot areas (which have lower abundance of Tanner crab) (Color Figure 1). Fishing effort is also highest in the Eastside Section closures (525702 and 525630; Color Figure 2). Displaced vessels may have a lower catch per unit effort from harvesting groundfish in neighboring, less productive areas; this may increase the bycatch of Tanner crab in these neighboring areas. However, overall the implementation of the area closures for nonpelagic trawl vessels is likely to reduce Tanner crab bycatch overall, and as such would benefit the stock.

Pot vessels account for an average of 17% of Tanner crab bycatch in reporting area 630 (Table 8), although in terms of bycatch mortality, pot vessels account for either 5% or 11% of the total, depending on the rate used (Table 9). According to the observer data, the proposed area closures are not used extensively by pot vessels; most of the observed pot effort occurs elsewhere, and bycatch of Tanner crab is highest for pot vessels in areas outside of the proposed area closures (Color Figure 11 and Color Figure 12). The limitations of observer coverage should be remembered for this sector, as observed trips are fewer both due to the size of vessels in the fleet and the overall amount of groundfish catch by this sector. Observer data would indicate that the area closures that are proposed in this analysis are not optimally designed for reducing crab bycatch in the pot sector, however to the extent that pot vessels are currently fishing in the proposed area closures, the crab stocks will benefit from the reduced bycatch.

Pelagic trawl vessels use the proposed closed areas for pollock fishing, according to data from observed vessels, but also have very low Tanner crab bycatch, both in the proposed closed areas and in reporting area 630 as a whole. The benefit to Tanner crab stocks of closing the proposed areas to pelagic trawling would be slight.

Suboption 3 – exempt vessels using approved, modified gear from area closures

Section 3.6 discussed two types of modified gear that might be used in the groundfish fisheries to reduce crab bycatch, however neither has been tested for use in the GOA. The trawl sweep modification has proven to be effective in the Bering Sea flatfish fisheries, and in that instance is successful at reducing unobserved mortality of crab from the trawl sweeps. While requiring this modification for vessels fishing in the area closure could certainly provide benefit to crab stocks, by reducing unobserved mortality, it would not be likely to change reported bycatch totals from trawl fishing, which account only for bycatch that comes up in the trawl net. It is not possible to quantify any benefit to crab stocks in the GOA without further testing to understand how sediment conditions in the area closures compare to the areas in which Bering Sea experiments occurred. However, the general similarity of GOA trawl gear to that used in the Bering Sea indicates that while the benefits may be smaller, they would still be substantial.

The pot modification has not yet been tested at all. Should it prove effective, it would successfully reduce bycatch for the Pacific cod pot fishery. As there are currently no test results available, it is, however, unknown what the impact will be on crab stocks.

Before either of these modifications could be regulated, it would be necessary to conduct further discussions to ensure that the modifications are both practicable in the fleet.

Option 1 or 2 – close areas either year round or seasonally

As described in Section 3.2.2, crab are most vulnerable during mating, molting, and hatching. Table 3 shows the annual timing for these activities for Tanner crab. April and May appear to be key months during which crab are sensitive, although the timing of the female molt to maturity spans a longer timeframe. The directed crab fishery is closed from April 30, in order to protect crab at the onset of the mating and molting season.

Option 1, the year round closure, would provide the most protection to Tanner crab. However, Table 13 illustrates that on average, 70-90% of Tanner crab bycatch in the groundfish fisheries (for reporting area 630) is taken with the January-July period, so that under Option 2, crab stocks would still receive considerable benefit from the seasonal closure. The January to July period would encompass the most sensitive months of the crab mating and molting cycle. Using observer data to look specifically at the proposed area closures, the pattern is similar for most of the areas except for Chiniak. In that case, only half of the bycatch on average is caught during the January-July period, as more groundfish fishing occurs in this area in the latter part of the year.

Alternative 3 – close areas to groundfish fishing unless vessels using trawl gear have 100% observer coverage and vessels using pot gear have 30% coverage

Alternative 3 would not provide additional protection to crab for those vessels who take advantage of the exemption and fish in the area with 100% observer coverage for vessels using trawl gear and 30% observer coverage for vessels using pot gear. For vessels electing not to take the additional observer coverage to fish in the areas, the impact would be similar to Alternative 2. The primary benefit of Alternative 3 would be to reduce the uncertainty associated with the reported bycatch numbers for vessels using trawl gear fishing in the proposed area closures, as all fishing in the areas would be fully monitored. This would allow the Council, at some time in the future, to have a more precise understanding of the exact extent of bycatch by vessels using trawl gear in the proposed area closures, and to take appropriate action as necessary. Alternative 3 also would increase observer coverage for any vessel less than 60' length overall using pot gear, as these vessels currently are not required to carry observers. Some additional information also may be gathered from vessels 60' and greater LOA using pot gear. Although these vessels currently are required to have 30% observer coverage, the additional requirement that observer coverage obtained inside the closure areas may not be used to count towards the vessels' 30% observer coverage outside of the closure areas could increase the amount of observer data for pot fishing within the closure areas.

4.2 Groundfish and incidental catch species

Groundfish fishing occurs in the proposed closure areas primarily with trawl gear. Based on observer data, the majority of observed pot effort occurs to the northeast rather than in the proposed closure areas.

Pelagic trawl vessels in the area target pollock. Color Figure 9, at the end of this document, illustrates observed pelagic trawl effort in reporting area 630. Nonpelagic trawl vessels target primarily flatfish, with some Pacific cod and pollock targeting as well. The distribution of observed catch is shown in Color Figure 2. Further information describing the groundfish fisheries affected by the proposed action can be found in Section 6.5, in the Regulatory Impact Review.

Effects of the Alternatives

All groundfish harvest during the GOA groundfish fisheries is counted toward the TAC for that species or species group. Groundfish stocks are assessed annually and are managed using conservative catch quotas. Incidental catch in the groundfish fisheries, including of prohibited species (crab, halibut, herring, and salmon), is also monitored. The Groundfish PSEIS (NMFS 2004) and the Harvest Specifications

Environmental Impact Statement (NMFS 2007) both conclude that the groundfish species targeted and caught incidentally during the GOA groundfish fisheries are currently at sustainable population levels and are unlikely to be overfished under the current management program. Bycatch levels of prohibited species are not at levels that are likely to jeopardize the sustainability of the species. As a result, impacts on these species under the status quo alternative are not likely to be significant.

The proposed action is not expected to result in significant changes in groundfish or incidental catch levels. The proposed area closures may displace some vessels, and there may be some difficulty for vessels targeting shallow water flatfish to fully harvest the TAC (see further discussion in Section 6.5.2). In general, the timing and general location of effort in the groundfish fisheries is unlikely to change as a result of the closures, although there may be an increased level of effort in localized areas outside of the closures as displaced vessels attempt to harvest their target fish elsewhere. However, effects on populations of the species caught directly or incidentally in the GOA groundfish fisheries are not expected to be significant.

4.3 Marine mammals and seabirds

Marine mammals

Marine mammals occur in diverse habitats in the GOA, and include both resident and migratory species. Marine mammal species that occur in the GOA are in Table 28 (Allen and Angliss 2010 and NMFS 2007). The Groundfish PSEIS (NMFS 2004) provides descriptions of the range, habitat, and diet for these marine mammals. Annual stock assessment reports prepared by the National Marine Mammal Laboratory provide population estimates, population trends, and estimates of potential biological removals (Allen and Angliss 2010).

Direct and indirect interactions between marine mammals and the groundfish fisheries result from temporal and spatial overlap between commercial fishing activities and marine mammal occurrence. Direct interactions include injury or mortality due to entanglement in fishing gear and disturbance. Indirect interactions include overlap in the size and species of groundfish important both to the fisheries and to marine mammals as prey. The GOA groundfish fisheries (pot, trawl and hook and line) are classified as Category III fisheries under the Marine Mammal Protection Act (2009 draft List of Fisheries (74 FR 27739, June 11, 2009)). Category III fisheries are unlikely to cause mortality or serious injury to more than 1% of the marine mammal's potential biological removal level, calculated on an annual basis (50 CFR 229.2). Taking of marine mammals is monitored by the North Pacific observer program.

Marine mammals listed under the Endangered Species Act (ESA) that may be present in the GOA are listed in Table 28. All of these species are managed by NMFS, with the exception of Northern Sea Otter, which is managed by U.S. Fish and Wildlife Service. A Biological Opinion evaluating impacts of the groundfish fisheries on the endangered species managed by NMFS was completed in November 2000 (NMFS 2000). The western population segment of Steller sea lions was the only ESA-listed species identified as likely to be jeopardized or to have adverse modification of designated critical habitat from the Alaska groundfish fisheries. A 2001 biological opinion on the Steller sea lion protection measures for the groundfish fisheries determined that the fisheries were not likely to result in jeopardy of extinction or adverse modification or destruction of critical habitat for Steller sea lions (NMFS 2001). Because of new information on Steller sea lions and potential fishery interactions, and new information on humpback and sperm whales, a new Section 7 consultation was initiated in 2006. This draft biological opinion for these species is expected to be released in April 2010. NMFS completed informal consultation on northern sea otters in 2006 and found that the Alaska fisheries were not likely to adversely affect northern sea otters (Mecum 2006). Critical habitat for sea otters has been designated and is located primarily in nearshore waters (74 FR 51988, October 8, 2009) and is not likely affected by Federal fisheries.

Table 28 Marine Mammal Stocks Occurring in Gulf of Alaska

NMFS Managed Species		
	Species	Stocks
Pinnipedia	Steller sea lion*	Western U.S (west of 144° W long.) and Eastern U.S. (east of 144° W long.)
	Northern fur seal**	Eastern Pacific
	Harbor seal	Southeast Alaska, Gulf of Alaska, Bering Sea
	Ribbon seal	Alaska
	Northern elephant seal	California
Cetacea	Species	Stocks
	Beluga Whale*	Cook Inlet
	Killer whale	Eastern North Pacific Northern Resident, Eastern North Pacific Alaska Resident, Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient, AT1 transient**, West Coast Transient
	Pacific White-sided dolphin	North Pacific
	Harbor porpoise	Southeast Alaska, Gulf of Alaska, and Bering Sea
	Dall's porpoise	Alaska
	Sperm whale*	North Pacific
	Baird's beaked whale	Alaska
	Cuvier's beaked whale	Alaska
	Stejneger's beaked whale	Alaska
	Gray whale	Eastern North Pacific
	Humpback whale*	Western North Pacific, Central North Pacific
	Fin whale*	Northeast Pacific
	Minke whale	Alaska
	North Pacific right whale*	North Pacific
Blue whale*	North Pacific	
Sei whale*	North Pacific	
USFWS Managed Species		
	Species	Stock
Mustelidae	Northern sea otter*	Southeast Alaska, Southcentral Alaska, Southwest Alaska

Source: Allen and Angliss 2010.

* ESA-listed species.

** Listed as depleted under the MMPA.

The Steller sea lion protection measures include area-specific closures around rookeries and haulouts and seasonal divisions of TACs to disperse fishing effort throughout the year. The Pacific cod fishing season was divided into two periods: 60% of the TAC was allocated among the A season (Jan. 1 – June 10) and 40% to the B season (June 10 – Dec. 31). The objective was to limit the total amount of cod harvested in the first half of the year. Pacific cod is an important prey item of Steller sea lions (NMFS 2000).

Since 2000, the U.S. portion of the western population of Steller sea lions has been increasing. However, the 2004 count (38,988 animals) was still 7.4% lower than the 1996 count and 32.6% lower than the 1990 count. In the GOA, the 2004 count (9,005 animals) was 12.6% higher than the 2000 count (7,995 animals), but was 45.1% lower than the 1990 count. Although counts at some trend sites are missing for both 2006 and 2007, available data indicate that the size of the adult and juvenile portion of the western Steller sea lion population throughout much of its range (Cape St. Elias to Tanaga Island, 145°-178° W) in Alaska has remained largely unchanged between 2004 (23,107 animals) and 2007 (23,118 animals) (Fritz et al. 2007). However, there are significant regional differences in recent trends: increases between 2004 and 2007 in the eastern Aleutians and western/central Gulf of Alaska have largely been offset by decreases in parts of the central Aleutians and eastern Gulf of Alaska. The relative stability in the Cape St. Elias-Tanaga Island area coupled with the declining trends observed through 2006 west of Amchitka Pass suggest that the overall trend for the western stock in Alaska (through 2007) is either stable or declining slightly.

Incidental mortality of Steller sea lions during the GOA groundfish fisheries is summarized in Table 29. No incidental mortalities were observed in the fixed gear sectors. In the 2007 stock assessment, the GOA pollock trawl fishery contributes an estimated 0.5% of the total annual mortality to the western population of Steller sea lions attributed to commercial fisheries. The minimum estimate of incidental mortality due to commercial fishing activities in all waters off Alaska is 26.2 sea lions per year, which exceeds 10% of the potential biological removal (PBR), however the total estimated annual level of human-caused mortality and serious injury for all sources is below the PBR level (247) for this stock (Allen and Angliss 2010).

Table 29 Incidental mortality of Steller sea lions in the GOA groundfish fisheries (2002-2006) and estimate of the mean annual mortality rate, based on observer data

Fishery	Years	Observer coverage	Observed mortality	Estimated mortality	Mean annual mortality
GOA Pacific cod trawl	2002	23.2%	0	0	0
	2003	27.3%	0	0	
	2004	27.0%	0	0	
	2005	21.4%	0	0	
	2006	22.8%	0	0	
GOA pollock trawl	2002	26.0%	0	0	1.33 (CV = 0.66)
	2003	31.2%	1	2.1	
	2004	27.4%	0	0	
	2005	24.2%	1	4.2	
	2006	26.5%	0	0	

Source: Allen and Angliss 2010.

Effects of the Alternatives on Marine Mammals

Impacts of the GOA groundfish fisheries on Steller sea lions were analyzed in the Programmatic SEIS (NMFS 2004) and in the 2001 Biological Opinion (NMFS 2001). Current management practices were found to have no adverse impacts on marine mammals, including Steller sea lions. As a result, the status quo alternative is not expected to have a significant impact on Steller sea lions or other marine mammals. NMFS has reinitiated consultation on the groundfish fisheries and their impact on listed species, including Steller sea lions. NMFS expects to provide a draft biological opinion to the Council in early April 2009 for review. Given the ongoing consultation, NMFS does not intend to initiate rulemaking or other Federal action that would require a separate formal Section 7 consultation outside the process already initiated.

The proposed action would institute proposed area closures to protect *C. bairdi* crab around Kodiak Island, year round or seasonally, for some or all gear types. Some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement. The proposed area closures may displace some vessels, and there may be some difficulty for vessels targeting shallow water flatfish to fully harvest the TAC (see further discussion in Section 6.5.2). In general, the timing and general location of effort in the groundfish fisheries is unlikely to change as a result of the closures, although there may be an increased level of effort in localized areas outside of the closures as displaced vessels attempt to harvest their target fish elsewhere. There would be no changes to the harvest specifications process or management of the fisheries relevant to Steller sea lion protection measures. Annual mortality of Steller sea lions is not expected to change under the proposed action, because fishing effort will remain similar to status quo. The alternatives are not likely to change fisheries activities in a way that would affect the potential for competition for prey, disturbance, or incidental takes of marine mammals. Thus, this action would not likely have any effects on marine mammals beyond those already analyzed for the GOA groundfish fisheries in previous biological opinions and environmental impact statements (NMFS 2001, NMFS 2007).

Seabirds

Various species of seabirds occur in the GOA, including resident species, migratory species that nest in Alaska, and migratory species that occur in Alaska only outside of the breeding season. A list of species is provided below⁸. The Groundfish PSEIS (NMFS 2004) provides descriptions of the range, habitat, diet, abundance, and population status for these seabirds.

Species nesting in Alaska

Tube-noses-Albatrosses and relatives: Northern Fulmar, Fork-tailed Storm-petrel, Leach's Storm-petrel

Kittiwakes and terns: Black-legged Kittiwake, Red-legged Kittiwake, Arctic Tern, Aleutian Tern

Pelicans and cormorants: Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Red-faced Cormorant

Jaegers and gulls: Pomarine Jaeger, Parasitic Jaeger, Bonaparte's Gull, Mew Gull, Herring Gull, Glaucous-winged Gull, Glaucous Gull, Sabine's Gull

Auks: Common Murre, Thick-billed Murre, Black Guillemot, Pigeon Guillemot, Marbled Murrelet, Kittlitz's Murrelet, Ancient Murrelet, Cassin's Auklet, Parakeet Auklet, Least Auklet, Wiskered Auklet, Crested Auklet, Rhinoceros Auklet, Tufted Puffin, Horned Puffin

Species that visit Alaska waters

Tube-noses: Short-tailed Albatross, Black-footed Albatross, Laysan Albatross, Sooty Shearwater, Short-tailed Shearwater

Gulls: Ross's Gull, Ivory Gull

Several species of conservation concern occur in the GOA as well (Table 30). Short-tailed albatrosses are listed as endangered under the ESA, while Kittlitz's Murrelet is a candidate species for listing under the ESA, and the U.S. Fish and Wildlife Service (FWS) is currently working on a 12-month finding for black-footed albatrosses.

Table 30 ESA-listed and candidate seabird species that occur in the GOA

Common Name	Scientific Name	ESA Status
Short-tailed Albatross	<i>Phoebastria albatrus</i>	Endangered
Steller's Eider	<i>Polysticta stelleri</i>	Threatened
Kittlitz's Murrelet	<i>Brachyramphus brevirostris</i>	Candidate
Black-footed Albatross	<i>Phoebastria nigripes</i>	FWS working on 12 month finding

FWS has primary responsibility for managing seabirds, and has evaluated effects of the BSAI and GOA FMPs and the harvest specifications process on currently listed species in two Biological Opinions (USFWS 2003a and 2003b). Both Biological Opinions concluded that the groundfish fisheries, including the GOA Pacific cod fishery, are unlikely to jeopardize populations of listed species or adversely modify or destroy critical habitat for listed species.

The groundfish fisheries have direct and indirect impacts on seabirds. Seabird take is the primary direct effect of fishing operations. Seabirds are taken in the hook-and-line fisheries in two ways. While hooks are being set, seabirds attracted to bait may become entangled in fishing lines. Seabirds are also caught directly on baited hooks. Seabirds are taken in the trawl fisheries when they are attracted by offal or discarded fish and become entangled in fishing gear. Indirect effects include impacts to food sources. The groundfish fisheries may reduce the biomass of prey species available to seabird populations. Fishing gear may disturb benthic habitat used by seabirds that forage on the seafloor and reduce available prey. Bottom trawl gear is the primary source of benthic habitat disturbance in the groundfish fisheries.

⁸ Source: (USFWS web site "Seabirds. Species in Alaska. Accessed at <http://alaska.fws.gov/mbsp/mbm/seabirds/species.htm> on August 31, 2007).

Fishing activities may also create feeding opportunities for seabirds, for example when catcher processors discard offal.

Hook-and-line gear accounts for up to 94% of seabird bycatch in the BSAI and GOA groundfish fisheries combined (Fitzgerald et al. 2006). In the GOA, this bycatch consists of 46% fulmars, 34% albatrosses, 12% gull species, 5% unidentified seabirds, 2% shearwater species, and less than 1% of 'all other' species (Fitzgerald et al. 2006). Most bycatch of Black-footed Albatross in waters off Alaska occurs in the GOA hook-and-line fisheries. From 2000 to 2004, an estimated 88 Black-footed Albatross were taken annually in the GOA hook-and-line fisheries. Total seabird bycatch in the GOA hook-and-line fisheries peaked in 1996 at 1,649 birds, and decreased to 156 birds in 2004, despite an increase in fishing effort. The incidental catch rate in the GOA decreased from an annual average of 0.021 birds per 1,000 hooks from 1993 to 1999 to 0.01 birds per 1,000 hooks from 2000-2004.

Due to different sampling procedures on trawl vessels, two sets of estimates are calculated for seabird bycatch. Average annual take by trawl vessels in the GOA from 1993 to 2004 was either 63 birds or 97 birds (Fitzgerald et al. 2006). Northern Fulmars comprised the majority of bycatch by trawl vessels during this period. Seabird bycatch by the groundfish pot sector has historically been very low. Average annual bycatch in the GOA pot sector from 1993–2004 was 55 seabirds, less than 1% of the average annual seabird bycatch in the groundfish fisheries.

Effects of the Alternatives on seabirds

The Groundfish PSEIS (NMFS 2004) concluded that the current groundfish fisheries are not adversely impacting ESA-listed seabird species. Biological Opinions by the USFWS (2003a and 2003b) concluded that the groundfish fisheries, including the GOA Pacific cod fishery, are unlikely to jeopardize populations of listed species or adversely modify or destroy critical habitat for listed species. Based on current estimates of seabird bycatch, the status quo alternative is not likely to have a significant impact on seabird populations.

The proposed action would institute proposed area closures to protect *C. bairdi* crab around Kodiak Island, year round or seasonally, for some or all gear types. Some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement. The proposed area closures may displace some vessels, and there may be some difficulty for vessels targeting shallow water flatfish to fully harvest the TAC (see further discussion in Section 6.5.2). In general, the timing and general location of effort in the groundfish fisheries is unlikely to change as a result of the closures, although there may be an increased level of effort in localized areas outside of the closures as displaced vessels attempt to harvest their target fish elsewhere. However, effects The hook and line sector is responsible for the majority of seabird take in the GOA, and this sector is not impacted by the proposed area closures. Thus, this action would not likely have any effects on seabird bycatch beyond those already analyzed for the GOA groundfish fisheries in previous biological opinions and environmental impact statements (USFWS 2003a,b; NMFS 2007).

4.4 Habitat

Benthic habitat is potentially impacted by fishing practices that contact the seafloor. The impacts of fishing gear on benthic habitat are discussed in the Groundfish PSEIS (NMFS 2004). Essential fish habitat (EFH) is defined as those areas necessary to fish for spawning, breeding, feeding, or growth to maturity. Maps and descriptions of EFH for the GOA groundfish species are available in the EFH EIS (NMFS 2005). This document also describes the importance of benthic habitat to different groundfish species and the impacts of different types of fishing gear on benthic habitat. In the hook-and-line fishery, anchors, groundline, ganglions, and hooks potentially contact the seafloor. The Pacific cod pot fishery

has a very small footprint (an estimated 0.17 square mile footprint for the GOA and BSAI combined; NMFS 2005). In the trawl fishery, doors, sweeps, and bobbins on the net may contact the seafloor.

Effects of the Alternatives

The effects of the GOA groundfish fisheries on benthic habitat and EFH were analyzed in the EFH EIS (NMFS 2005). Year-round area closures protect sensitive benthic habitat. Current fishing practices have minimal or temporary effects on benthic habitat and essential fish habitat. These effects are likely to continue under Alternative 1, and are not considered to be significant. The proposed area closures may displace some vessels, and there may be some difficulty for vessels targeting shallow water flatfish to fully harvest the TAC (see further discussion in Section 6.5.2). In general, the timing and general location of effort in the groundfish fisheries is unlikely to change as a result of the closures, although there may be an increased level of effort in localized areas outside of the closures as displaced vessels attempt to harvest their target fish elsewhere. However, impacts on benthic and essential fish habitat under this alternative are expected to be not significant.

4.5 Ecosystem

Ecosystems consist of communities of organisms interacting with their physical environment. Within marine ecosystems, competition, predation, and environmental disturbance cause natural variation in recruitment, survivorship, and growth of fish stocks. Human activities, including commercial fishing, also influence the structure and function of marine ecosystems. Fishing may change predator-prey relationships and community structure, introduce foreign species, affect trophic diversity, alter genetic diversity and habitat, and damage benthic habitats.

The GOA groundfish fisheries potentially impact the GOA ecosystem by relieving predation pressure on shared prey species (i.e., species which are prey for both groundfish and other species), reducing prey availability for groundfish predators, altering habitat, imposing bycatch mortality, or by “ghost fishing” caused by lost fishing gear. Further information may be found in the Ecosystems Considerations Appendix to the Stock Assessment and Fisheries Evaluation report (NPFMC 2009a) and the Groundfish PSEIS (NMFS 2004).

Effects of the Alternatives

An evaluation of the effects of the GOA groundfish fisheries on the ecosystem is conducted annually in the Ecosystem Assessment section of the Stock Assessment and Fishery Evaluation report (NPFMC 2009a) and in the Harvest Specifications SAFE report (NPFMC 2009b). These analyses conclude that the current GOA groundfish fisheries do not produce population-level impacts to marine species or change ecosystem-level attributes beyond the range of natural variation. Consequently, Alternative 1 is not expected to have a significant impact on the ecosystem.

Alternatives 2 and 3 will result in the same overall level of groundfish harvest as Alternative 1. As a result, Alternatives 2 and 3 is not likely to have a significant impact on the ecosystem.

4.6 Cumulative effects

Analysis of the potential cumulative effects of a proposed action and its alternatives is a requirement of NEPA. Cumulative effects result from the incremental impact of the proposed action in addition to past, present, and reasonably foreseeable future actions. The Alaska Groundfish Fisheries PSEIS (NMFS 2004) assesses the potential direct and indirect effects of groundfish FMP policy alternatives in combination with other factors that affect physical, biological, and socioeconomic components of the BSAI and GOA environment.

Beyond the cumulative impacts analysis documented in the Groundfish PSEIS, no additional past, present, or reasonably foreseeable future negative impacts on the natural and physical environment (including fish stocks, essential fish habitat, ESA-listed species, marine mammals, seabirds, or marine ecosystems), fishing communities, fishing safety, or consumers have been identified that would occur as a result of the proposed action. The proposed action, in combination with other actions, may have additional economic effects on sectors participating in the GOA groundfish fisheries. In recent years, several regulatory changes implemented to protect Steller sea lions have had economic effects on participants in the GOA groundfish fisheries. Several recent or reasonably foreseeable future actions, are expected to have additional social and economic effects on these sectors, including GOA fixed gear LLP recency, GOA and BSAI trawl LLP recency, and GOA Pacific cod sector allocations. Economic impacts of this action are discussed further in Section 6.

5 Management and enforcement considerations

Alternative 2 provides a series of options to close certain areas around Kodiak to directed fishing for groundfish by vessels using specific gear types. Some options would allow directed fishing for groundfish in these areas by vessels using specific gear types or specified types of modified gear. Alternative 3 would allow fishing in these areas, but increase observer coverage requirements for selected vessels using trawl or pot gear.

Closures by NMFS for vessels directed fishing for groundfish in these areas would apply only to federal waters. These closures would not apply in State of Alaska waters, so would not affect the adjacent parallel or State waters fisheries. Directed fishing for groundfish is defined as fishing by a vessel with a Federal Fisheries Permit (FFP) that results in retaining more than the maximum retainable amounts (MRA) of any groundfish managed by NMFS under the GOA groundfish FMP. MRAs for groundfish in the GOA fisheries are in Table 10 to part 679. All operators of vessels named on an FFP must comply with NMFS recordkeeping and reporting requirements and observer coverage requirements in the federal fisheries. In addition, vessel operators who hold an FFP must comply with vessel monitoring system (VMS) requirements if they use nonpelagic trawl gear or dredge gear in the GOA, or if they participate in a directed fishery for Atka mackerel, Pacific cod, or pollock, or in the CGOA Rockfish Program.

5.1 Alternatives 2 and 3: Area closures

The four closure areas being considered under Alternatives 2 and 3 have high Tanner crab abundance based on crab surveys conducted annually by the Alaska Department of Fish and Game (ADF&G). In these areas, vessels using nonpelagic (bottom) trawl gear predominantly target Pacific cod, arrowtooth flounder, and shallow-water flatfish. Vessels using pot gear predominantly target Pacific cod. Vessels using pelagic trawl gear target both pollock and rockfish in these areas.

The boundaries of the proposed closure areas are defined by existing ADF&G statistical areas and by polygons defined by latitude and longitude coordinates. Closure areas defined in this manner are easier for both the regulated industry to understand and comply with, as well as enforcement entities to patrol and enforce. The proposed closure areas present no noteworthy enforcement challenges. The proposed closure areas would be principally enforced by using information from VMS units aboard vessels required to carry VMS. Most of the vessels subject to the proposed closure areas are already required to carry VMS units due to their participation in existing fisheries subject to VMS requirements.

The proposed areas are located relatively close to the Port of Kodiak, and would be expected to receive a relatively high amount of aerial and surface patrol by USCG platforms, as these patrols depart and arrive into the Kodiak USCG base. These proposed closure areas are also located in areas of high transit activity by the Kodiak and GOA-based fishing fleets and other maritime vessels. For this reason, one could expect a higher likelihood of reporting potential violations by the fishing and maritime community.

5.2 Alternative 2, Component 2, Options 1 and 2

Both year round and seasonal closures are being considered. Aside from personnel to perform the monitoring activities, enforcement of year round versus seasonal closures presents no additional monitoring challenges.

5.3 Alternative 2, Suboption 3: Gear modification exemption

Proposed modified gear requirements under Suboption 3, such as trawl sweep modifications or pot escapement mechanisms, require a detailed description in regulations of the specific gear modification that would be required to qualify for exemption of the area closures. Such specifications have been discussed in general in this analysis, but no specific gear modifications have been described or widely tested for efficacy in protection of Tanner crab in the GOA fisheries. Therefore, Alternative 2, Suboption 3 should not be included in the preferred alternative as a specific recommended regulatory amendment at this time.

If specific gear modifications are identified in the future, they likely would be enforced in the same manner as the existing requirements for tunnel eyes on pot gear and trawl sweeps in the flatfish fisheries of the Bering Sea. During boardings at sea, both the USCG and OLE check vessels to ensure proper use and functionality of any gear modifications. Most vessels subject to the proposed alternatives are currently required to operate VMS. Thus, if OLE or USCG desired to check gear compliance of vessels fishing in the closure areas, these vessels could be identified.

5.4 Alternative 2, Suboptions 4 and 5: Pelagic trawl gear exemption

Suboptions 4 or 5 would exempt vessels using pelagic trawl gear from the proposed area closures. The principle fisheries prosecuted by vessels using pelagic trawl gear in these areas are pollock and rockfish. Vessels used to conduct these fisheries are required to operate VMS.

As described in Section 3.1.2 and Figure 3, there are several areas around Kodiak Island that already are closed to nonpelagic (bottom) trawling. These closure areas overlap with some of the closure areas proposed under Alternative 2. Regulations governing these closures are in 50 CFR part 679 (§ 679.22(b)). These regulations state that “no person may trawl” in these areas “from a vessel having any trawl other than a pelagic trawl either attached or on board”. Compliance with this requirement is based on examining the gear on board the vessel and determining if it meets the requirements of pelagic trawl gear defined in § 679.2. These regulations contain a list of ten items that define pelagic trawl gear (see definition of “authorized gear”). However, a net meeting the physical description of a pelagic trawl could be fished in contact with the sea floor.

If directed fishing for pollock using bottom trawl gear is closed, NMFS also applies a “trawl gear performance standard” (50 CFR 679.7(a)(14)). Under this standard, it is unlawful to possess aboard a vessel, at any point in time, 20 or more crab of any species, with a carapace width of more than 1.5 inches. Enforcement of this standard on any vessel (observed or unobserved) is difficult, and it is virtually impossible to monitor and enforce on unobserved vessels. Anecdotal reports from operators and observers indicate this trawl gear performance standard is not difficult to overcome by slowly dumping the catch, sorting, and discarding crab from the catch. The existing tools are not considered adequate to provide effective enforcement of a prohibition for directed fishing using nonpelagic trawl gear in the proposed closure areas. However, if the vessels are simply prohibited from having nonpelagic trawl gear aboard while in the proposed closure areas, OLE could board vessels to check for the presence of nonpelagic trawl gear. If the concern is pelagic gear contacting the sea floor, the only tool OLE currently has is the use of the “trawl gear performance standard” described above.

NMFS recommends that the regulations described above would be used as a basis for any additional closures to nonpelagic trawling under this action. The prohibition against having nonpelagic trawl gear onboard the vessel when trawl fishing is occurring would apply in general, and the “trawl gear performance standard” also would apply for vessels directed fishing for pollock. Transiting closed areas with nonpelagic trawl gear aboard would be allowed.

5.5 Alternative 3: Exemption to area closures with increased observer coverage

Alternative 3 would allow fishing in the proposed closure areas by vessels using trawl gear only if they carry an observer 100% of the days they conducted directed fishing for groundfish in these areas. All vessels using pot gear to directed fish for groundfish in these areas would be required to have 30% observer coverage. In addition, observer coverage inside these closure areas would be separate from and not count towards meeting a vessel's 30% observer coverage requirements for fishing outside of these closure areas.

The following observer coverage requirements apply to vessels that may be fishing in these proposed closure areas:

- Amendment 80 vessels, except for the F/V *Golden Fleece*, are required to have at least one observer (100% coverage) while harvesting or processing groundfish in the GOA.
- Catcher/processors in a CGOA rockfish cooperative or fishing in the rockfish limited access fishery are required to have at least two observers (200% coverage) while fishing under the Rockfish Program. Catcher/processors subject to sideboard limits under the Rockfish Program (except those in the opt-out fishery) also are required to have at least two observers while fishing under the Rockfish Program. Catcher/processors assigned to the opt-out fishery and subject to a sideboard limit under the Rockfish Program area required to have at least one observer (100% coverage) during certain times of the year in certain areas of the GOA.
- Catcher vessels in the Rockfish Program limited access fishery are required to have one observer while fishing under the Rockfish Program. Catcher vessels subject to sideboard limits under the Rockfish Program are required to have one observer during certain times of the year and in certain areas of the GOA.

For all other vessels and fisheries, the standard observer coverage at §679.50(c)(1) applies.

- For vessels using gear other than pot gear:
 - Vessels 125 feet length overall (LOA) or greater are required to carry an observer 100% of all fishing days while fishing for groundfish.
 - Vessels between 60 feet and 124 feet that participate for more than 3 fishing days in any directed fishery for groundfish in a calendar quarter are required to carry an observer 30% of fishing days by quarter, and at least one fishing trip per quarter and fishery category.
- Vessels equal to or greater than 60 feet LOA using pot gear that participate for more than 3 fishing days in any directed fishery for groundfish in a quarter are required to carry an observer for at least 30% of the total number of pot retrievals for that quarter, and for at least one entire fishing trip using pot gear in a quarter in each fishery category in which the vessel participates.
- Vessels less than 60 feet LOA are not required to carry observers.

100% observer coverage requirements for vessels using trawl gear: Enforcing 100% observer coverage on vessels using trawl gear fishing in the closure areas does not present any unreasonable monitoring and enforcement challenges, as long as enforcement entities can identify which vessels are directed fishing for groundfish in the closure areas. Once a vessel is identified as directed fishing for groundfish in the area,

the OLE can monitor compliance with the observer coverage requirement by comparing vessel activity with information about where and when observers were deployed on vessels.

Under Alternative 3, any vessel using trawl gear currently in the 30% observer coverage category that would be required to carry 100% observer coverage inside the closure areas would not be allowed to count the fishing days inside these areas towards meeting the 30% observer coverage requirements for fisheries outside these areas. This provision was added to the alternative to address the concern NMFS identified in the initial review draft that increased observer coverage requirements inside the proposed closure areas could decrease the observer data available from fishing outside of the closure areas. While this provision addresses that concern, the other concern identified in the initial review draft persists because it is a feature of the current process for obtaining observer coverage for vessels subject to 30% coverage requirements.

NMFS uses observer data and extrapolates prohibited species catch (PSC) sampled on observed trips to similar unobserved trips in the larger federal reporting area (by processing sector, week ending date, target fishery, gear, and federal reporting area). NMFS does not create separate PSC estimates for each ADF&G state statistical area or for catcher vessels fishing inside and outside of closure areas, such as those proposed in this action. It is not known whether data collected from the proposed closure areas would be representative of fishing over the entire reporting area. However, through ongoing work NMFS is working to improve the estimation process in concert with the observer restructuring efforts. The restructured program would enable NMFS to define estimation strata and randomly select trips at a consistent rate within them. Action to increase observer coverage in this one GOA area without modifications to the NMFS catch estimation process could result in estimates which are biased by data from this specific area. Thus NMFS would need to make changes to the current estimation process to accommodate this change in coverage. Likely NMFS would need to handle estimation for this specific area discrete from other areas in the GOA. Modifications to the catch estimation process would be complex and expensive, and would compete with other priorities for additions and improvements to NMFS's catch accounting system.

30% coverage for vessels using pot gear: Alternative 3 would require a vessel *of any size* using pot gear that participated for more than 3 fishing days in any directed fishery for groundfish in a quarter to carry an observer for at least 30% of the total number of pot retrievals that occurred inside the closure areas each quarter. In addition, vessels equal to or greater than 60 feet would not be allowed to use the observed pot retrievals that occurred inside the closure area to comply with their 30% observer coverage requirements for fishing that occurred outside the closure areas. Vessels using pot gear to fish for groundfish currently are participating primarily in directed fisheries for Pacific cod.

30% coverage requirement related to at least one fishing trip per quarter per fishery category: NMFS recommends that, if Alternative 3 is selected as the preferred alternative, the current 30% observer coverage requirement for coverage of at least one fishing trip in a quarter for each fishery category would continue to apply to all fishing during a quarter and would not be applied separately inside and outside the closure areas. For using pot gear, this distinction is not as relevant because they are participating primarily in directed fisheries for Pacific cod. Therefore, the requirement for separate accounting of pot retrievals inside and outside the closure areas will effectively require observer coverage on at least one Pacific cod fishing trip each quarter inside the closure areas and at least one Pacific cod fishing trip outside the closure areas.

Vessels less than 60 feet LOA: Some vessels less than 60 feet LOA may have fished in the proposed closure areas in the past. Under Alternative 3, any vessels of this size class would be required to carry observers for at least some of the fishing inside the proposed closure areas (unless they didn't meet the minimum threshold for observer coverage of 3 days per quarter). Although some vessel operators may choose to fish outside the closure areas rather than incur the cost of the required observer coverage, some

of these vessels may seek observer coverage. They would be required to comply with existing safety and all other vessel requirements in 50 CFR part 679.50.

Interaction with the Observer Restructuring Action

Proposed Alternative 3 would interact with the Observer Restructuring action currently in review by the Council. In two out of four action alternatives under consideration for restructuring the groundfish Observer Program, the designation of 100% observer coverage determines the fee structure and service delivery model to which an operation is subject. Under these alternatives, vessels and processors will be classified in regulation into two observer coverage categories: <100% or \geq 100%. Generally, all catcher/processors, motherships, catcher vessels fishing under cooperatives with transferable quotas, and shoreside processors taking deliveries of AFA and CDQ pollock would be in the \geq 100% category. An exception to this category is the halibut and sablefish IFQ fisheries, which would be less than fully observed (<100% coverage category) under the observer restructuring proposed action. All other catcher vessels and most shoreside processors would also be in the <100% coverage category.

Current regulations include increased observer coverage requirements for two “special areas” similar to those proposed under Alternative 3:

- Nearshore Bristol Bay Trawl Closure area: Under § 679.50(c)(1)(ix), any catcher/processor or catcher vessel using trawl gear to fish for groundfish in the Nearshore Bristol Bay Trawl Closure area must carry an observer during 100% of its fishing days in this area.
- Red King Crab Savings Area: Under § 679.50(c)(1)(viii), any catcher/processor or catcher vessel using pelagic trawl gear, pot, jig, or longline gear to fish for groundfish in the Red King Crab Savings Area (RKCSA) of the Bering Sea must carry an observer during 100% of its fishing days in this area. In addition, any catcher/processor or catcher vessel used to fish for groundfish in the Red King Crab Savings Subarea when this subarea is open to fishing for groundfish with nonpelagic trawl gear must carry an observer during 100 percent of its fishing days in which the vessel uses nonpelagic trawl gear in the subarea.

If the Council recommended increased observer coverage for vessels fishing with the GOA Tanner crab protection areas under Alternative 3, this would add a third special area with 100% observer coverage requirements to NMFS’s current regulations. These specific requirements for 100% observer coverage within special areas currently are not included in the categories that would require \geq 100% observer coverage under the observer restructuring alternatives. Therefore, unless otherwise specified by the Council, increased observer coverage requirements under Alternative 3, and the 100% coverage requirements for the two special areas in the BSAI, would be removed from NMFS regulations if the vessels in the <100% observer coverage category in the relevant management area were subject to assignment of observer coverage under a sampling plan as described in the observer restructuring analysis.

Many vessels operating in the Bering Sea and Aleutian Islands management area are already included in a sector that requires \geq 100% observer coverage in the observer restructuring analysis, and this coverage requirement would continue to apply when they fished inside the Nearshore Bristol Bay Trawl Closure area or the RKCSA. Therefore, the impact of removing the 100% coverage requirements for the BSAI special areas under observer restructuring may not have a big impact on the actual level of observer coverage that occurs in these areas. However, many of the vessels currently operating in the GOA are not included in the \geq 100% observer coverage category under the restructuring alternatives. If increased observer coverage implemented under Alternative 3 was removed under observer restructuring, any vessel that did not fall into the \geq 100% observer coverage category may or may not end up carrying an observer when fishing in the areas considered under the GOA tanner crab area closures action.

However, the Council's current alternatives for restructuring the observer program could accommodate continuation of 100% observer coverage requirements for all vessels within these special areas. Vessels that are in the <100% coverage category would pay an exvessel value based fee for observers, and these vessels would be subject to an annual sampling plan developed by NMFS. Should vessels choose to fish in the special areas, the sample design could require that they carry observers 100% of the time they are directed fishing for groundfish in these areas. Thus, even though many of the affected vessels would not have 100% coverage any other time or in any other area, the observer restructuring action allows for flexibility in determining coverage on vessels in the <100% coverage category. If a group of vessels is determined to need 100% coverage at specific times of the year, seasons, or areas, NMFS could direct observer deployment to accommodate those needs. The fee paid by those vessels would not change, but the coverage amount could be modified to account for those circumstances; this flexibility is part of the impetus of restructuring. This accommodation in the sampling plan is not currently described in the observer restructuring analysis, as that level of detail by sector was not deemed necessary. Establishing special areas of 100% observer coverage would significantly complicate the current sampling plan and necessarily reduce the amount of coverage days available for other fisheries and management priorities in the GOA. The vessel selection plan currently included in the observer restructuring analysis does not assign observer coverage based on what a vessels intends to do. Instead, it takes parameters such as vessel length and gear type, which are known in advance, and assigns random coverage of trips based on a pre-determined coverage rate. Vessels would call in prior to trips and be selected for coverage or not regardless of where they planned to fish.

6 Regulatory Impact Review and Probable Economic and Socioeconomic Impacts

6.1 Introduction

This Regulatory Impact Review (RIR) evaluates the costs and benefits of three alternatives that evaluate proposed area closures to protect *C. bairdi* Tanner crab around Kodiak Island. Included in the alternatives are options to apply the closures year round or seasonally, and to pot and/or trawl gear types.

Additionally, some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement.

6.2 What is a Regulatory Impact Review

This RIR is required under Presidential Executive Order 12866 (58 FR 51735, September 30, 1993). The requirements for all regulatory actions specified in EO 12866 are summarized in the following statement from the order:

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

EO 12866 further requires that the Office of Management and Budget review proposed regulatory programs that are considered to be “significant.” A significant regulatory action is one that is likely to—

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

6.3 Problem Statement

The Council formulated a problem statement in October 2009, to initiate this analysis, and revised it slightly in April 2010:

Tanner crab are a prohibited species bycatch in the Gulf of Alaska (GOA) groundfish fisheries. Directed fisheries for Tanner crab in the GOA are fully allocated under the current limited entry system. No specific conservation measures exist in the GOA to address adverse interactions with Tanner crab by trawl and fixed gear sectors targeting

groundfish and low observer coverage in GOA groundfish fisheries limits confidence in the assessment of Tanner crab bycatch in those fisheries, and a greater level of observer coverage in the appropriate areas may provide the Council with a higher level of confidence in the assessment of any bycatch occurring in the designated areas as a basis for future management actions as necessary. Tanner crab stocks have been rebuilding since peak fisheries occurred in the late 1970s. Specific protection measures should be advanced to facilitate stock rebuilding.

6.4 Description of the Alternatives

The alternatives evaluated in this analysis were adopted by the Council in October 2009, and modified during initial review in April 2010.

Alternative 1: Status Quo – No action

Alternative 2: Close the areas specified below to pot and trawl groundfish fisheries.

Component 1: Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Component 2: Closure timing

Option 1: Year round

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Option 2: Seasonally (January 1 – July 31)

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Alternative 3: In order to fish in the areas specified below, require 100% observer coverage on all trawl groundfish vessels and 30% observer coverage on all pot groundfish vessels less than 125

feet. Note, fishing days and observer coverage in these areas would be separate from and not count towards meeting a vessel's overall 30% groundfish observer coverage requirement.

Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20" W), excluding State waters

ADF&G Eastside Section

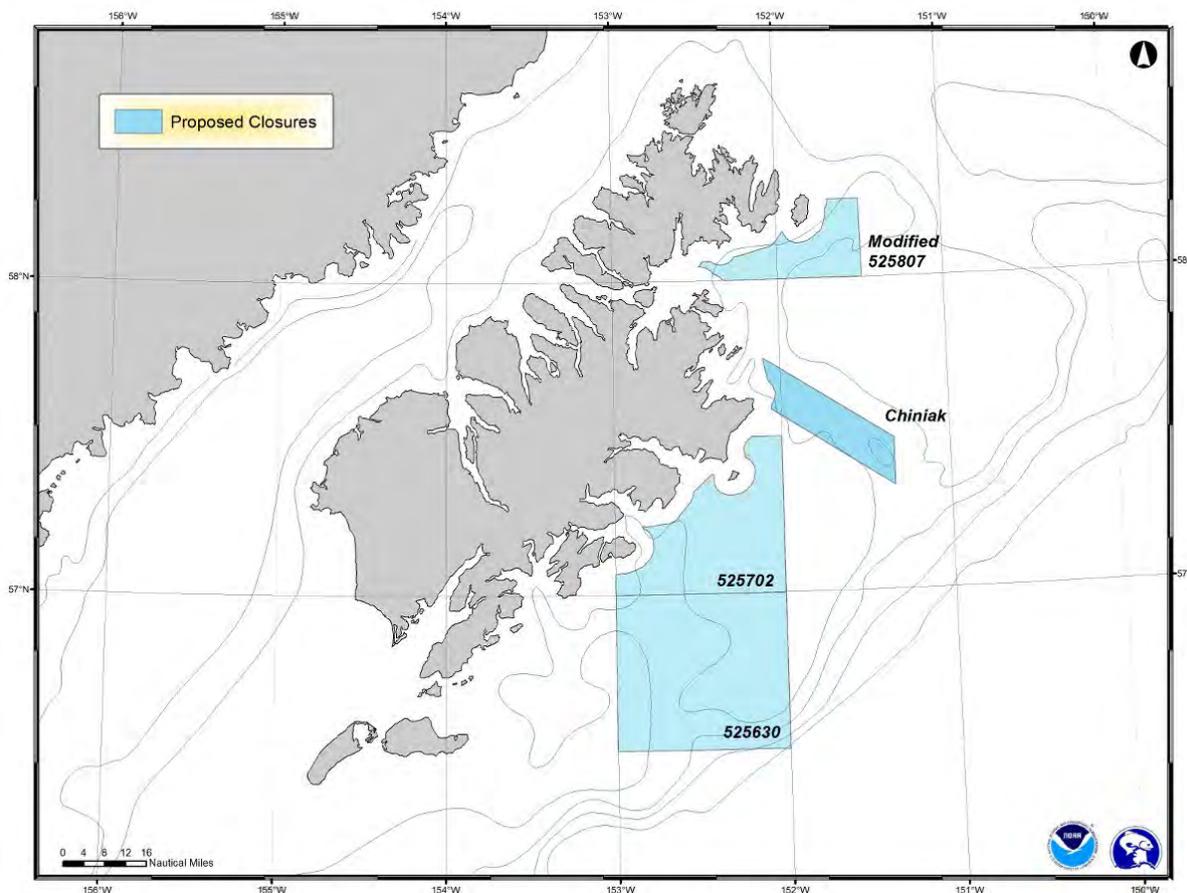
Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Note, the options and suboptions under Alternatives 2 and 3 are not intended to be mutually exclusive, and may be applied in combination.

Figure 28 Area closures around Kodiak Island considered in Alternatives 2 and 3



6.5 Description of the fisheries

6.5.1 Groundfish fisheries in reporting area 630

The proposed action would potentially regulate vessels participating in the trawl and pot groundfish fisheries in reporting area 630 (Kodiak district) of the Central GOA regulatory area. Table 31 provides the official total catch (retained and discarded) in the groundfish fisheries, by gear type, in area 630 from 2003 to 2009. Catch by vessels using nonpelagic trawl gear represents the largest proportion of groundfish catch by gear type, approximately 60% on average during the time period. The primary species targeted by gear type are as follows: for nonpelagic trawl gear, flatfish (shallow water flatfish, flathead sole, rex sole, arrowtooth flounder), Pacific cod, pollock, and rockfish; for pelagic trawl, pollock and rockfish; and for pot gear, Pacific cod.

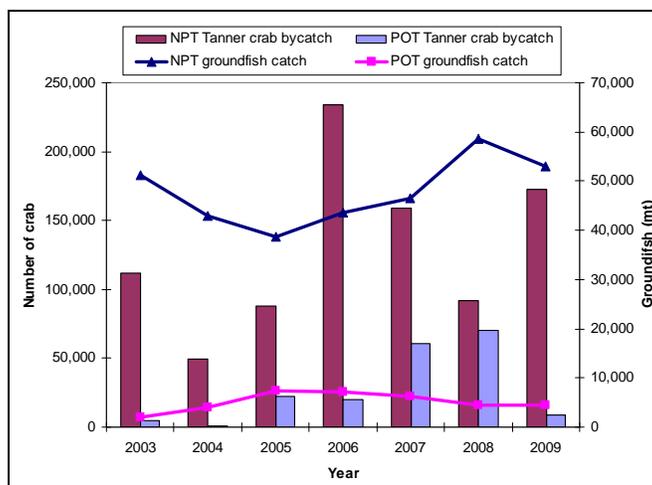
Table 31 Official total catch (mt) in groundfish fisheries in reporting area 630, by gear type, 2003-2009

Year	Nonpelagic trawl	Pelagic trawl	Pot	Hook and line	Total
2003	51,194	11,556	2,069	10,406	75,225
2004	42,916	13,539	4,114	12,419	72,987
2005	38,719	20,622	7,408	10,308	77,056
2006	43,505	18,205	7,177	11,435	80,321
2007	46,539	17,169	6,311	10,774	80,794
2008	58,538	14,180	4,533	11,735	88,986
2009	53,078	11,327	4,507	8,952	77,864
Average 2003-2009	47,784	15,228	5,160	10,861	79,033

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

A comprehensive discussion of Tanner crab bycatch in the GOA groundfish fisheries in reporting area 630 is included in Section 3.3.3. Pelagic trawl gear contributes very little to the overall bycatch levels (Table 8), while nonpelagic trawl vessels are responsible for an average (over 2003-2009) of 83% of crab bycatch, and pot gear for 17%. When bycatch mortality is considered, pot gear contributes either 5% or 11% of total bycatch mortality, depending on the mortality rate calculation used. The relationship of annual crab bycatch and groundfish catch in these two sectors is depicted in Figure 29.

Figure 29 Annual bycatch of *C. bairdi* Tanner crab and groundfish catch in reporting area 630, by Federal trawl and pot fishery sectors, 2003-2009



Source: *C. bairdi* crab bycatch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010; groundfish catch from NMFS Catch Accounting System. Data compiled by AKFIN, February 2010. Represents total GOA catch and bycatch, excluding State waters Pacific cod fishery catch.

Value of groundfish fisheries

Table 32 provides average exvessel values (2004-2008) for groundfish catch in the Gulf of Alaska, by gear, vessel category, and species, in millions of dollars.

Table 32 Exvessel value of groundfish catch in the Gulf of Alaska, by gear, vessel category, and species, average for 2004-2008 (\$ millions)

Gear type	Species	Catcher vessels	Catcher processors	Total
Trawl	Flatfish	4.5	1.68	6.2
	Pacific cod	10.74	.86	11.6
	Pollock	17.02	.08	17.1
	Rockfish	3.52	5.0	8.56
Pot	Pacific cod	20.28	.28	20.48

Source: Hiatt et al. 2009

Patterns in trawl and pot groundfish fisheries

Seasonal openings for area 630 differ between fisheries, as noted in Table 33. The pollock TAC is made available seasonally, as a protection measure for Steller sea lion regulations, and the openings are limited to only one or two days in length due to the limited pollock TAC and the number of participating vessels. Pacific cod is also allocated into two seasons. Trawl harvesters tend to focus on higher value Pacific cod and pollock fisheries when they are open, and fish for flatfish at other times in the year. Halibut PSC is also allocated seasonally, and the availability of halibut PSC often determines the season length for flatfish fisheries. Halibut PSC allocated to the flatfish fisheries is shared among the deep water (arrowtooth flounder and rex sole) and shallow water (shallow water flatfish and flathead sole) flatfish complexes.

Table 33 Opening dates of GOA trawl and pot target fisheries in 2008 and 2009

Target	Year	Open	Closed /Reason	Length of fishery
Arrowtooth flounder and rex sole	2009	20-Jan 1-Apr 1-Jul	3-Mar/halibut 23-Apr/halibut 31-Dec/regulations	42 days 22 days 6 months
	2008	20-Jan 1-Jul 1-Oct 16-Nov	21 Apr/halibut 11-Sep/halibut 6-Nov/halibut 31-Dec/regulations	3 months 2.5 months 36 days 46 days
Shallow water flatfish and flathead sole	2009	20-Jan 1-Oct	2-Sep/halibut 31-Dec/regulations	7.5 months 3 months
	2008	20-Jan 21-Mar 1-Jul 1-Sep 10-Sep 1-Oct 16-Nov	10 Mar/halibut 21-May/halibut 7-Aug/halibut 3-Sep/halibut 11-Sep/halibut 6-Nov/halibut 31-Dec/regulations	49 days 2 months 37 days 2 days 1 day 36 days 46 days
Pollock	2009	20-Jan 11-Feb 9-Mar 25-Aug 29-Sep	22-Jan/TAC 11-Feb/TAC 11-Mar/TAC 26-Aug/TAC 1-Oct/TAC	2 days 1 day 2 days 1 day 2 days
	2008	20-Jan 25-Jan 23-Feb 10-Mar 25-Aug 1-Sep 1-Oct	22-Jan/TAC 27-Jan/TAC 25-Feb/TAC 10-Mar/TAC 26-Aug/TAC 19-Sep/TAC 10-Oct/TAC	2 days 2 days 2 days 1 day 1 day 18 days 9 days
Pacific cod (inshore)	2009	20-Jan 1-Sep	27-Jan/TAC 2-Sep/halibut	7 days 1 day
	2008	20-Jan 1-Sep	1-Mar/TAC 3-Oct/TAC	40 days 32 days
Pacific cod (offshore)	2009	20-Jan 1-Sep	19-Feb/TAC 1-Nov/regulations	30 days 2 months
	2008	20-Jan 1-Sep	9-Mar/TAC 1-Nov/regulations	48 days 2 months

Source: NMFS

6.5.2 Groundfish fisheries in proposed area closures

The proposed area closures under Alternatives 2 and 3 are within the 630 reporting area. In order to examine the spatial distribution of fishing at a finer scale than that of the reporting area, it is only possible to use the data collected on observed trips, as only observed hauls are associated with geographical coordinates. Consequently it is not possible to use the NMFS catch accounting database, which takes reports from observed fishing trips and extrapolates them to apply to all vessels fishing within the reporting area, to investigate the catch and bycatch activity of vessels fishing within these specific areas. It is possible to get a sense for how much catch and bycatch is occurring in the closed areas, however, by looking at data from observed groundfish vessels, as long as the limitations of using only data from observed vessels are kept in mind. These limitations are discussed in detail in Section 3.3.1. Only vessels that are 60 ft or longer are observed. Vessels between 60 and 125 ft using hook and line or trawl gear are only required to carry an observer for 30% of their fishing days, by quarter, although if they are larger than 125 ft the must have an observer onboard 100% of the time. Pot vessels carry an observer while 30% of their pots are pulled for the calendar year. Table 4 in Section 3.3.1 examines the actual percentages of observed catch by gear type and target fishery. Overall, the pot Pacific cod target had averaged between

12% and 26% of groundfish catch observed in the Central GOA between 2004 and 2006. Many entries for the nonpelagic trawl fisheries are confidential, however a comparison may be made to the nonpelagic trawl shallow water flatfish fishery, which averaged between 13% and 34% of catch observed between 2004 and 2007 in the same area. **Therefore it should be remembered, throughout this discussion, that the data may only represent a small proportion of fishing effort within the closed areas.**

Table 34 identifies the proportion of observed catch from reporting area 630 that was observed in each of the proposed area closures. On average, from 2001-2009, approximately 25% of observed catch occurred in the proposed closures as a whole; most of this catch occurred in 525702, followed by 525630. Only 5% of the total observed GOA groundfish catch occurred in Marmot and Chiniak.

Table 34 Observed groundfish catch in the proposed area closures, as a proportion of total observed groundfish catch in reporting area 630, by gear type, for 2001-2009

Year	Proposed area closures					Rest of 630
	Marmot	Chiniak	525702	525630	Total	
2001	0%	4%	16%	4%	24%	76%
2002	0%	1%	5%	10%	17%	83%
2003	2%	4%	10%	8%	24%	76%
2004	1%	2%	13%	3%	18%	82%
2005	1%	1%	13%	2%	17%	83%
2006	1%	6%	14%	11%	32%	68%
2007	2%	3%	13%	12%	30%	70%
2008	1%	8%	10%	11%	30%	70%
2009	3%	2%	13%	9%	27%	73%
Average 2001-2009	1%	4%	12%	8%	25%	75%

Source: AKFIN Comprehensive Observer data, March 2010.

Groundfish catch in the proposed closure areas is examined by gear type in Table 35. For the most part, hook and line vessels are not observed to fish in the proposed area closures. The table provides the groundfish catch in each area, and by each gear type, as a percentage of total observed catch in 630 by each gear type over the combined years 2001-2009. As context, the final column indicates that fishing with trawl vessels constitutes the majority of groundfish catch in reporting area 630. Figure 30 illustrates the total observed catch for each gear type in reporting area 630, and how that catch is distributed inside and outside of the closed areas. For nonpelagic trawl, catch in the closed areas is approximately 29% of the total observed nonpelagic trawl groundfish catch in 630; for pelagic trawl, it is approximately 22%, and for pot vessels approximately 13%. In comparison, bycatch in the closed areas (described in detail in Section 3.3.4, and specifically in Figure 21) was approximately 70% of the 630 total for nonpelagic trawl vessels, 33% for pelagic trawl, and 22% for pot vessels.

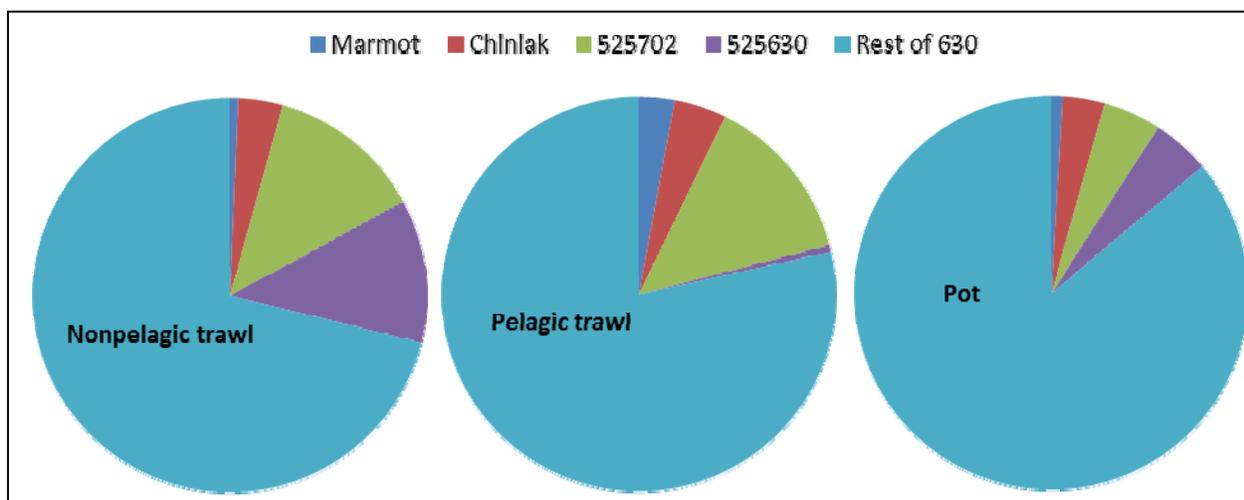
Table 35 Observed groundfish catch in the proposed area closures by gear type, as a proportion of total observed groundfish catch in reporting area 630 by gear type, for the combined years 2001-2009

Year	Proposed area closures					Rest of 630	Gear type's proportion of total groundfish catch in 630
	Marmot	Chiniak	525702	525630	Total		
Hook and line	**	0%	**	2%	2%	98%	7%
Nonpelagic trawl	1%	4%	13%	12%	29%	71%	64%
Pelagic trawl	3%	4%	14%	1%	22%	78%	27%
Pot	1%	3%	5%	5%	14%	86%	2%

** data are confidential

Source: AKFIN Comprehensive Observer data, March 2010.

Figure 30 Observed groundfish catch in proposed closed areas and reporting area 630, by gear, for the combined years 2001-2009



Source: AKFIN Comprehensive Observer data, March 2010.

Table 36 identifies the observed target fisheries for trawl and pot gear, listing catch in the proposed area closures (as a group) as a proportion of total observed catch by that gear type in reporting area 630. Table 37 breaks down the observed catch into each of the individual proposed closure areas, comparing the whole time series (2001-2009) with the most recent three years (2007-2009). For nonpelagic trawl vessels, over 50% of the flatfish and pollock target fishing is observed to occur in the proposed closure areas, while only 20% of Pacific cod target fishing and very little rockfish is targeted in these areas. The 525702 and 525630 areas are particularly important for flatfish fishing. In terms of weight, most flatfish catch is attributed to the arrowtooth flounder target, although in recent years the shallow water flatfish target has also been important. Approximately a third of the observed catch of nonpelagic trawl pollock target also came out of the Chiniak area closure. The Marmot closure is less important for nonpelagic trawl fishing. Pelagic trawl vessels in the areas are targeting pollock, with approximately a quarter of the observed catch coming from the proposed closures, primarily from 525702, although in recent years the Chiniak closure was also important for pollock fishing.

Table 36 Observed groundfish catch by gear type and target in the proposed closed areas, as a proportion of the total observed catch in that target, by gear type, in reporting area 630

Gear type	Target Fishery	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average 2001-2009
Non-pelagic trawl	Arrowtooth Flounder	30%	18%	45%	51%	26%	65%	82%	58%	74%	50%
	Flathead Sole	93%	71%	26%	67%	6%	9%	89%	79%	78%	60%
	Pacific Cod	28%	42%	9%	12%	1%	17%	28%	26%	18%	20%
	Pollock (bottom)	63%	36%	100%	35%	23%	76%	68%	75%	88%	70%
	Rex Sole						100%		98%	84%	74%
	Rockfish	0%	10%	7%	3%	0%	1%	6%	3%	4%	4%
	Shallow Water Flatfish	55%	28%	41%	43%	63%	80%	61%	57%	69%	58%
Pelagic trawl	Pollock	35%	7%	46%	27%	30%	24%	25%	23%	24%	27%
Pot	Pacific Cod	11%	2%	3%	4%	20%	17%	5%	21%	21%	14%

Table 37 Average observed groundfish catch by gear type and target in each of the proposed closed areas, as a proportion of the total observed catch in that target, by gear type, in reporting area 630, for 2001-2009 and 2007-2009

Gear type	Target Fishery	Marmot		Chiniak		525702		525630	
		2001-2009	2007-2009	2001-2009	2007-2009	2001-2009	2007-2009	2001-2009	2007-2009
Non-pelagic trawl	Arrowtooth Flounder	1%	2%	3%	1%	13%	14%	33%	54%
	Flathead Sole	2%	2%	9%	10%	36%	45%	14%	21%
	Pacific Cod	0%	0%	5%	6%	9%	13%	6%	4%
	Pollock (bottom)	1%	2%	29%	28%	36%	39%	5%	10%
	Rex Sole	0%	0%	1%	1%	12%	14%	61%	68%
	Rockfish	0%	0%	0%	0%	1%	0%	3%	4%
	Shallow Water Flatfish	2%	3%	7%	8%	49%	50%	0%	0%
Pelagic trawl	Pollock (bottom)	4%	6%	5%	11%	17%	7%	0%	0%
Pot	Pacific Cod	1%	2%	3%	1%	5%	2%	5%	9%

Location of observed groundfish catch in proposed closed areas

Observed groundfish catch and Tanner crab bycatch is mapped by gear type (for trawl and pot gears) in the color figures included at the end of this document, in Appendix A. As depicted in Color Figure 2, the primary density of groundfish catch for nonpelagic trawl vessels occurs in the central portions of the proposed closed areas 525702 and 525630. In comparison with Color Figure 1, it is apparent that this same area is also one where a high amount of crab bycatch is observed. Color Figure 3 maps the bycatch rate for nonpelagic trawl vessels (number of crab per mt groundfish catch), and while this area still has a higher bycatch rate than some other parts of reporting area 630, it is nonetheless apparent that the high bycatch in this area is due at least in part to the intensity of groundfish fishing that occurs in this area.

For nonpelagic trawl fisheries, a large proportion of groundfish in the various flatfish and pollock target fisheries is harvested within the proposed area closures. 65-70% of groundfish caught in the pollock target occurs in the Chiniak and 525702 closures; 50-60% of groundfish in the arrowtooth flounder and flathead sole target occurs in 525702 and 525630; 50% of shallow water flatfish occurs in 525702; and 60-70% of the rex sole target fishing occurs in 525630. Color Figure 4, Color Figure 5, Color Figure 6, and Color Figure 7 show the distribution of groundfish catch in the arrowtooth flounder, shallow water flatfish, flathead sole, and pollock target fisheries from 2003-2009. These maps are not based solely on observer

data, but rather use the NMFS catch in areas database, which utilizes specific procedures to allocate a spatial reference to unobserved catch data. For arrowtooth flounder and flathead sole targets, there are areas outside of the proposed closures where a concentration of catch in those targets occurs, however for shallow water flatfish target fisheries, there are few areas outside of the proposed area closures where significant catch occurs. For pollock, catch appears to be fairly widely distributed around Kodiak, although 525702 contains areas with high concentration of catch.

For pelagic trawl vessels, Color Figure 9 illustrates observed groundfish catch. Of fishing occurring in the proposed area closures, fishing is heaviest in area 525702, also in the central portion of that area. As is apparent in Color Figure 8, overall the bycatch of Tanner crab in the pelagic trawl fishery is substantially lower than for the nonpelagic trawl fleet. Color Figure 10 shows the bycatch rate for pelagic trawl vessels, and bycatch rates in the proposed closed area that is predominantly fished (525702) are very low.

The observed groundfish catch for pot vessels is mapped in Color Figure 11, and shows that the majority of observed pot effort occurs outside of the proposed closures. Within 525702 and 525630, the areas that are important to the pot fishery differ from those that are used by trawl vessels, based on observer data, without the concentration on the central portions of those statistical areas that is evident in trawl fishing patterns. Color Figure 12 shows that bycatch in the pot fishery is highest just outside the southeastern boundary of area 525630. Bycatch rates for the pot fishery are mapped in Color Figure 13, and bycatch rates for pot gear are generally higher than those for trawl.

Timing of observed groundfish catch in proposed closed areas

The majority of groundfish catch in the proposed area closures as a whole, and generally in reporting area 630, occurs in the period January 1 to July 31, representing between 62% and 75% of total observed catch between 2001 and 2009 (Table 38). In the Marmot closure, catch in the first half of the year encompasses almost all of the annual catch in 2001 to 2007, although in the last two years there has been a slight increase in observed catch in August to December. For Chiniak, the interannual variability of observed catch between the two periods is high, but on average, the area had a much lower proportion of catch in the first half of the year. From Table 39, one can see that this is true across all gear sectors, although the vast majority of the observed catch in the area is from nonpelagic and pelagic trawl vessels. 525702 also has a balanced proportion of catch from the January to July and August to December periods, where nonpelagic trawl catch is high in the beginning of the year, and pelagic trawl catch is high in the latter portion. Overall, area 525630, which is primarily fished by nonpelagic trawl vessels, has low usage by observed vessels in the latter half of the year.

Table 38 Proportion of annual observed groundfish catch caught in the proposed area closures between January 1 and July 31, 2001-2009

Year	Proposed area closures					Rest of 630	All of 630
	Marmot	Chiniak	525702	525630	Total		
2001	100%	38%	42%	62%	45%	87%	77%
2002	100%	81%	54%	82%	74%	78%	77%
2003	100%	30%	34%	36%	40%	74%	66%
2004	100%	78%	34%	75%	46%	76%	70%
2005	94%	56%	43%	85%	51%	79%	75%
2006	100%	8%	65%	96%	66%	72%	70%
2007	98%	15%	81%	89%	79%	75%	76%
2008	33%	18%	69%	95%	65%	69%	68%
2009	60%	46%	61%	99%	71%	64%	66%
Average 2001-2009	79%	29%	55%	84%	62%	75%	71%

Source: AKFIN Comprehensive Observer data, March 2010.

Table 39 Proportion of annual observed groundfish catch, by gear type, caught in the proposed area closures between January 1 and July 31, for the combined years 2001-2009

Year	Proposed area closures					Rest of 630	All of 630
	Marmot	Chiniak	525702	525630	Total		
Nonpelagic trawl	46%	42%	75%	85%	74%	81%	79%
Pelagic trawl	100%	2%	10%	21%	21%	58%	50%
Pot		33%	52%	81%	54%	66%	64%
Total	79%	29%	55%	84%	62%	75%	71%

Source: AKFIN Comprehensive Observer data, March 2010.

To provide additional perspective on the timing of fisheries within the two periods described above, Table 40 breaks out the observed groundfish catch for nonpelagic trawl vessels by month. The majority of nonpelagic trawl catch in the closed areas occurs in April and July, followed by October, February, and March as important time periods. For pelagic trawl vessels, the most important month for fishing in the closed areas is October, followed by September and August, and then March and February.

Table 40 Proportion of annual observed nonpelagic trawl groundfish catch caught in the proposed area closures in each month, for the combined years 2001-2009

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marmot	0%	24%	41%	10%	2%	0%	1%	0%	9%	10%	1%	0%
Chiniak	2%	6%	8%	2%	2%	1%	8%	3%	8%	56%	4%	0%
525702	3%	8%	9%	13%	5%	3%	14%	9%	12%	22%	2%	0%
525630	2%	10%	9%	35%	5%	1%	22%	1%	5%	9%	1%	0%
Total – closed areas	2%	9%	10%	18%	4%	2%	15%	5%	9%	22%	2%	0%
Rest of 630	4%	9%	7%	8%	9%	7%	31%	4%	11%	9%	1%	0%
All of 630	4%	9%	8%	11%	8%	6%	27%	4%	10%	12%	1%	0%

Source: AKFIN Comprehensive Observer data, March 2010.

6.5.3 Participants

Table 41 identifies the number of vessels fishing for groundfish in reporting area 630, by gear type, between 2003 and 2009, as well as the number of those vessels which are attributed with having caught Tanner crab as bycatch. Table 42 shows the number of observed vessels fishing in the proposed area closures over the period 2001-2009. In many of the proposed areas closures, the number of vessels of a particular gear type fishing in an area in a particular year may be very low. The most observed vessels fishing in the closed areas occur in the nonpelagic trawl sector.

Table 41 Number of vessels fishing for groundfish in reporting area 630, by gear type, over the period 2003-2009

Gear type	Total number of vessels	Total number of vessels to which Tanner crab bycatch was attributed	Vessels with bycatch as percentage of total
Hook and line	606	317	52%
Nonpelagic trawl	74	68	94%
Pelagic trawl	53	47	89%
Pot	129	100	76%

Source: NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

Table 42 Number of observed vessels fishing in the proposed area closures, by gear type, for the period 2001-2009, and total of all vessels fishing in reporting area 630

Gear type		Observed vessels						
		Proposed area closures					Rest of 630	Total – all of 630
		Marmot	Chiniak	525702	525630	Total		
Nonpelagic trawl	Number of vessels in any given year	2 - 10	9 - 32	14 - 38	10 - 26	20 - 49	37 - 52	38 - 55
	Total unique vessels	20	52	47	48	60	62	64
Pelagic trawl	Number of vessels in any given year	2 - 8	0 - 11	5 - 19	1 - 3	13 - 23	9 - 28	22 - 30
	Total unique vessels	24	23	39	12	41	39	43
Pot	Number of vessels in any given year	0 - 1	0 - 7	0 - 3	0 - 3	1 - 6	4 - 14	4 - 15
	Total unique vessels	3	11	7	7	15	32	32

Source: AKFIN Comprehensive Observer database, March 2010; NMFS Catch Accounting System. Data compiled by AKFIN, February 2010.

Of observed vessels fishing in the proposed closure areas, in all years except 2002 and 2003, most vessels are between 60 and 124 ft LOA. Table 43 shows the proportion of groundfish catch attributable to vessels greater than 125 ft in the proposed closed areas, compared to vessels fishing in reporting area 630 as a whole. Note, observer coverage is not required on vessels less than 60 ft overall, so information about how the proposed area closures are used by these vessels is not available.

Table 43 Proportion of total observed nonpelagic trawl groundfish catch from vessels greater than 125 ft LOA, with 100% observer coverage, 2001-2009

Gear type	Total – closed areas	630
2001	2%	35%
2002	37%	51%
2003	55%	33%
2004	8%	17%
2005	1%	13%
2006	0%	16%
2007	6%	16%
2008	9%	16%
2009	5%	14%
Average 2001-2009	12%	24%

Source: AKFIN Comprehensive Observer databases, March 2010.

6.5.4 Dependency

This section provides estimates of economic dependency for the proposed action. The data used to estimate dependency was Alaska Department of Fish and Game fish tickets. Unlike the observer data, fish tickets have revenue data at the statistical area level. Unfortunately, fish ticket data have some limitations. First, given that the Chiniak and Marmot areas are composed of several statistical areas, the fish ticket data used to estimate the economic dependency of these two areas would, in all likelihood, overstate that dependency, so dependency estimates for these two areas are not included in this analysis. Second, fish ticket data used to estimate dependency relies on fishermen reported harvest locations, which at times is an approximate location only. Finally, due to the lack of catcher processor revenue data at the statistical area, economic dependency for the catcher processor sector was not included in this section.

As indicated in the tables below, many of the catcher vessels targeting flatfish operating around Kodiak appear heavily dependent upon groundfish catch from the proposed closure areas. For example, several catcher vessels harvest more than 30 percent of their entire flatfish catch from these areas. Also, many of

the owners of these vessels are residents of Kodiak, therefore it is likely that the community of Kodiak is also dependent upon the groundfish catch in the proposed closure areas. As shown in Table 44, four catcher vessels generated, on average, greater than 20 percent of their total exvessel revenue from area 525702 alone. Looking at the rest of the catcher vessels that operated in area 525702 during the 2007 to 2009 period, 11 vessels on average had exvessel revenue greater than 15 percent but less than 20 percent from this area, 12 vessels on average had exvessel revenue greater than 10 percent but less 15 percent from this area, 31 vessels on average had exvessel revenue greater than 5 percent but less than 10 percent from this area, and the remaining 72 vessels on average had less than 5 percent of their exvessel revenue from this area. Looking at statistical area 525602, fewer than three vessels on average had exvessel revenue greater than 20 percent from this area, fewer than three vessels on average had exvessel revenue greater than 10 percent but less than 15 percent from this area, 13 vessels on average had exvessel revenue greater than 5 percent but less than 10 percent from this area, and 33 vessels on average had less than 5 percent of their exvessel revenue from this area.

Looking specifically at flatfish exvessel revenue in these two areas (Table 45), seven vessels on average generated greater than 30 percent of their total flatfish exvessel revenue from statistical area 525702, while five vessels on average generated greater than 30 percent of their total flatfish exvessel revenue from statistical area 525630. Another five vessels had greater than 20 percent but less 30 percent of their total flatfish exvessel revenue from statistical area 525702, while three vessels garnered a similar amount from statistical area 525630. In addition, all but three catcher vessels operating in the statistical area 525630 during the 2007 through the 2009 period also operated in statistical area 525702. However, 23 out of the total 70 catcher vessels that operated in statistical area 525702 during the period 2007 through 2009 did not operate in statistical area 525630 during this period. This could indicate the relative importance of statistical area 525702 when compared to statistical area 525630 for the numerous catcher vessels targeting groundfish in these areas.

Table 44 Number of vessels by average percent of exvessel revenue for groundfish from statistical areas 525702 and 525630, 2007 through 2009

Average percent of ex vessel revenue from the proposed closure area during the 2007 through 2009 period*	Number of vessels	
	525702	525630
Greater than 20%	4	*
greater than 15% but less than 20%	6	0
greater than 10% but less than 15%	7	*
greater than 5% but less than 10%	21	13
less than 5%	32	33
Total vessels	70	*
Source: Alaska Department of Fish and Game Fish Tickets		
* 2009 revenue data was not yet available for halibut IFQ		

Table 45 Number of vessels by average percent of exvessel revenue for flatfish from statistical areas 525702 and 525630, 2007 through 2009

Average percent of ex vessel revenue from the proposed closure area during the 2007 through 2009 period*	Number of vessels	
	525702	525630
Greater than 30%	7	5
greater than 20% but less than 30%	5	3
greater than 10% but less than 20%	13	7
greater than 0% but less than 10%	8	18
Source: Alaska Department of Fish and Game Fish Tickets		
* 2009 revenue data was not yet available for halibut IFQ		

Looking at dependency from the perspective of gear, both bottom trawl and pot gear appear to rely heavily on the groundfish fisheries in the proposed closure areas. For example, vessels that targeted groundfish in statistical area 525702 during the 2007 through the 2009 period using bottom trawl gear on average received 12.2 percent of their total exvessel revenue from the statistical area (Table 46). For pot gear, dependency appears even higher at 17.6 percent of all exvessel revenue from statistical area 525702. For statistical area 525602, dependency appears slightly lower for bottom trawl gear at 5.5 percent, but significantly higher for pot gear at 25 percent (Table 47).

Table 46 Exvessel revenue from statistical area 525702 by gear, 2007 through 2009

Year	Vessels	Pelagic trawl			Bottom trawl			Pot		
		Ex vessel revenue from 525702 (\$)	Ex vessel revenue in all pelagic trawl fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Ex vessel revenue from 525702 (\$)	Ex vessel revenue in all bottom trawl fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Ex vessel revenue from 525702 (\$)	Ex vessel revenue in all pot fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702
2007	50	304,395	16,146,276	1.89%	2,465,105	19,905,998	12.38%	615,340	4,972,780	12.37%
2008	47	200,092	22,639,298	0.88%	3,596,902	29,867,566	12.04%	433,806	2,729,676	15.89%
2009	48	362,169	18,587,535	1.95%	1,929,382	15,717,435	12.28%	602,636	1,699,601	35.46%
Total	145	866,656	57,373,109	1.51%	7,991,389	65,490,999	12.20%	1,651,782	9,402,058	17.57%
Source: Alaska Department of Fish & Game Fish Tickets										
* 2009 revenue data was not yet available for halibut IFQ										

Table 47 Exvessel revenue from statistical area 525630 by gear, 2007 through 2009

Year	Vessels	Pelagic Trawl			Bottom Trawl			Pot		
		Ex vessel revenue from 525630 (\$)	Ex vessel revenue in all pelagic trawl fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630	Ex vessel revenue from 525630 (\$)	Ex vessel revenue in all bottom trawl fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630	Ex vessel revenue from 525630 (\$)	Ex vessel revenue in all pot fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630
2007	28	19,920	11,713,692	0.17%	766,280	13,844,547	5.53%	841,239	2,454,824	34.27%
2008	40	1,615	22,132,606	0.01%	1,260,954	27,799,165	4.54%	367,915	2,346,748	15.68%
2009	27	1,019	6,919,886	0.01%	880,469	11,001,622	8.00%	324,198	1,381,778	23.46%
Total	95	22,554	40,766,184	0.06%	2,907,703	52,645,334	5.52%	1,533,352	6,183,349	24.80%
Source: Alaska Department of Fish & Game Fish Tickets										
* 2009 revenue data was not yet available for halibut IFQ										

Looking at exvessel revenue by target for the proposed closure areas, those harvesting flatfish and Pacific cod appear to rely heavily on these fisheries. For example, vessels that targeted flatfish in statistical area 525702 during the 2007 through the 2009 period on average received 20 percent of their total exvessel revenue from flatfish in this statistical area (Table 48). Those targeting Pacific cod in this area, received approximately 10 percent of their total exvessel revenue from this statistical area. For statistical area

525630, vessels targeting flatfish received 8 percent of their total exvessel revenue from this area, while those targeting Pacific cod received 8.5 percent of their total exvessel revenue from this area (Table 49).

Table 48 Exvessel revenue from statistical area 525702 by target, 2007 through 2009

Year	Vessels	Flatfish			Pelagic pollock			Bottom pollock			Pacific cod		
		Exvessel revenue from 525702 (\$)	Exvessel revenue in all flatfish fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Exvessel revenue from 525702 (\$)	Exvessel revenue in all pelagic pollock fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Exvessel revenue from 525702 (\$)	Exvessel revenue in all bottom pollock fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Exvessel revenue from 525702 (\$)	Exvessel revenue in all Pacific cod fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702
2007	50	1,667,677	8,846,580	18.85%	18,800	11,998,312	0.16%	308,988	3,162,209	9.77%	1,096,566	11,703,996	9.37%
2008	47	1,963,803	9,662,424	20.32%	5,203	15,279,871	0.03%	352,096	7,290,772	4.83%	1,765,374	18,320,594	9.64%
2009	48	1,481,127	7,341,701	20.17%	311,964	13,494,968	2.31%	166,541	5,345,805	3.12%	678,602	5,794,329	11.71%
Total	145	5,112,607	25,850,705	19.78%	335,967	40,773,151	0.82%	827,625	15,798,787	5.24%	3,540,542	35,818,919	9.88%

Source: Alaska Department of Fish & Game Fish Tickets
* 2009 revenue data was not yet available for halibut IFQ

Table 49 Exvessel revenue from statistical area 525630 by target, 2007 through 2009

Year	Vessels	Flatfish			Pelagic Pollock			Bottom Pollock			Pacific cod		
		Exvessel revenue from 525630 (\$)	Exvessel revenue in all flatfish fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630	Exvessel revenue from 525630 (\$)	Exvessel revenue in all pelagic pollock fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630	Exvessel revenue from 525630 (\$)	Exvessel revenue in all bottom pollock fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630	Exvessel revenue from 525630 (\$)	Exvessel revenue in all Pacific cod fisheries in all areas for historical 525630 vessels (\$)	Percent of ex vessel revenue from 525630
2007	28	426,294	6,429,646	6.63%	0	8,468,171	0.00%	29,935	2,513,721	1.19%	1,139,152	7,732,732	14.73%
2008	40	586,055	9,043,133	6.48%	967	15,157,983	0.01%	67,387	7,094,768	0.95%	882,614	16,559,814	5.33%
2009	27	736,625	6,073,092	12.13%	1,019	5,222,160	0.02%	29,657	2,062,939	1.44%	320,091	3,214,608	9.96%
Total	95	1,748,975	21,545,871	8.12%	1,986	28,848,314	0.01%	126,979	11,671,428	1.09%	2,341,858	27,507,154	8.51%

Source: Alaska Department of Fish & Game Fish Tickets
* 2009 revenue data was not yet available for halibut IFQ

From a community perspective, 23 catcher vessel owners that harvested groundfish from statistical area 525702 reported their residence in Kodiak during the 2007 through 2009 period. The total exvessel revenue for these vessels during the 2007 to 2009 period was \$72.3 million, of which \$5.4 million or 7.8% was generated from statistical area 525702 (Table 50). For statistical area 525630 (Table 51), 46 catcher vessels with owners residing in Kodiak had a total generated exvessel revenue during the 2007 to 2009 period of \$51.5 million, of which \$2.5 million or 4.9 percent was from groundfish harvested in the statistical area. Although an accurate estimate of total annual exvessel revenue generated from the proposed closure that is spent in the Kodiak economy is not known, it is likely that some portion of that revenue is spent in the community and therefore generates additional economic activity in the community.

Table 50 Exvessel revenue from statistical area 525702 by reported residence, 2007 through 2009

Vessel owners reported residency	Vessels	2007			2008			2009*			Total (2007 through 2009)					
		Exvessel revenue from 525702 (\$)	Exvessel revenue in all fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Exvessel revenue from 525702 (\$)	Exvessel revenue in all fisheries in all areas for historical 525702 vessels (\$)	Percent of ex vessel revenue from 525702	Exvessel revenue from 525702 (\$)	Exvessel revenue in all fisheries in all areas for historical 525702 vessels (\$)	Percent of Ex vessel revenue from 525702 in 2009	Exvessel revenue from 525702 (\$)	Exvessel revenue in all fisheries in all areas for historical 525702 vessels (\$)	Percent of Exvessel revenue from 525702			
Kodiak	25	1,536,418	25,467,462	6.03%	25	2,247,692	26,931,257	8.35%	22	1,571,663	19,949,807	7.88%	23	5,355,773	72,348,526	7.40%
Oregon	15	760,848	15,672,659	4.85%	15	1,089,052	19,864,696	5.48%	12	730,280	12,558,025	5.82%	13	2,580,181	48,095,380	5.36%
Washington	7	765,481	7,506,987	10.20%	7	659,731	11,977,084	5.51%	9	476,120	9,712,832	4.90%	10	1,901,332	29,196,903	6.51%
Other	3	322,091	2,902,122	11.10%	3	293,486	4,709,333	6.23%	4	116,123	1,608,350	7.22%	2	731,701	9,219,805	7.94%
Total	50	3,384,839	51,549,230	6.57%	50	4,289,961	63,482,370	6.76%	47	2,894,188	43,829,014	6.60%	16	3,522,996	52,953,538	6.65%

Source: Alaska Department of Fish & Game Fish Tickets
* 2009 revenue data was not yet available for halibut IFQ

Table 51 Exvessel revenue from statistical area 525630 by reported residence, 2007 through 2009

Vessel owners reported residency	2007				2008				2009*				Total (2007 through 2009)			
	Vessels	Exvessel revenue from 525630 (\$)	Exvessel revenue in all fisheries in all areas for historical 525630 vessels (\$)	Percent of exvessel revenue from 525630	Vessels	Exvessel revenue from 525630 (\$)	Exvessel revenue in all fisheries in all areas for historical 525630 vessels (\$)	Percent of Exvessel revenue from 525630	Vessels	Exvessel revenue from 525630 (\$)	Exvessel revenue in all fisheries in all areas for historical 525630 vessels (\$)	Percent of exvessel revenue from 525630 in 2009	Vessels	Exvessel revenue from 5257630 (\$)	Exvessel revenue in all fisheries in all areas for historical 525630 vessels (\$)	Percent of Ex vessel revenue from 525630
Kodiak	14	993,760	13,812,711	7.19%	19	865,501	26,440,246	3.27%	13	667,240	11,263,385	5.92%	46	2,526,500	51,516,342	4.90%
Oregon	15	405,068	14,639,547	2.77%	12	462,930	20,096,440	2.30%	9	312,910	8,765,059	3.57%	32	1,180,908	43,501,046	2.71%
Washington/other	3	236,108	4,178,587	5.65%	9	302,053	11,673,616	2.59%	5	225,536	4,739,267	4.76%	17	763,697	20,591,470	3.71%
Total	28	1,634,935	32,630,845	5.01%	40	1,630,484	58,210,302	2.80%	27	1,205,686	24,767,711	4.87%	95	4,471,105	115,608,858	3.87%

Source: Alaska Department of Fish & Game Fish Tickets

* 2009 revenue data was not yet available for halibut IFQ

In addition to the economic activity generated from the spending of exvessel revenue in communities such as Kodiak, economic activity also occurs from the processing of groundfish harvested from the proposed closure areas. Although processing data at the statistical area level is not available, it is not unreasonable to assume that a large share of the groundfish harvested in the proposed closure areas is processed at Kodiak shore processing facilities given the numerous and diverse processing operations available in Kodiak and the location of the proposed closure areas in relation to the community of Kodiak. Table 52 lists detailed information on total volume and value of fish landings for Kodiak for 2006, by species or species group. Clearly, the value of landings in Kodiak are dominated by salmon (30 percent), and Pacific cod (19 percent), pollock (13 percent), halibut (12 percent), which together accounted for 75 percent of the total value of all species landed. Sablefish accounted for about 8 percent of the total, while all species of crab combined accounted for a little over 6 percent of the total, and flatfish accounted for about 6 percent of the total (arrowtooth flounder and flatfish categories combined). The remaining species or species complex, including rockfish, accounted for more than 2 percent of the total but, as shown, several groundfish species were relatively high-volume species locally, but accounted for a relatively small proportion of the total value landed, due to relatively low values per pound.

Table 52 Volume and value of fish landed at Port of Kodiak, by species, 2006

Species	Volume Landed (pounds) ¹	% of Total Volume	Exvessel Value (dollars)	% of Total Value
salmon, Chinook	210,592	0.06%	\$197,956	0.19%
salmon, sockeye	8,146,700	2.14%	\$6,843,228	6.44%
salmon, coho	4,338,634	1.14%	\$2,863,498	2.70%
salmon, pink	117,392,708	30.82%	\$18,782,833	17.69%
salmon, chum	9,102,850	2.39%	\$3,003,941	2.83%
halibut, Pacific ²	3,454,834	0.91%	\$13,085,725	12.32%
herring, Pacific	5,624,729	1.48%	\$618,720	0.58%
cod, Pacific (gray)	50,039,197	13.14%	\$20,516,071	19.32%
pollock, walleye	101,523,425	26.65%	\$14,213,280	13.39%
arrowtooth flounder	30,710,932	8.06%	\$2,149,765	2.02%
black rockfish	214,151	0.06%	\$85,660	0.08%
octopus	209,709	0.06%	\$132,117	0.12%
perch, Pacific ocean	10,496,787	2.76%	\$1,679,486	1.58%
squid	3,375,890	0.89%	\$236,312	0.22%
sablefish (black cod)	2,467,618	0.65%	\$8,834,073	8.32%
skates	3,099,190	0.81%	\$688,156	0.65%
Rockfish ³	6,878,056	1.81%	\$1,124,548	1.06%
flatfish ⁴	20,421,644	5.36%	\$4,281,385	4.03%
crab ⁵	3,215,170	0.84%	\$6,851,290	6.45%
Total	380,922,816	100.00%	\$106,188,044	100.00%

¹ Represents pounds of product landed at the Port of Kodiak, including harvests from outside of the Kodiak management area (from Fish Ticket data).

² Halibut pounds from NMFS website: <http://www.fakr.noaa.gov/ram/ifqreports.htm> and includes all landings in Kodiak regardless of where fish were harvested.

³ Includes greenstripe, northern, thornyhead, yelloweye, quillback, tiger, rosethorn, rougheye, shortraker, redbanded, dusky, yellowtail, sharpchin, harlequin, and blackgill rockfish.

⁴ Includes dover sole, rex sole, butter sole, English sole, starry flounder, petrale sole, sand sole, Alaska plaice, and Greenland turbot.

⁵ Includes Dungeness, red king, bairdi, and opilio crab.

Source: Adapted from Kodiak Chamber of Commerce, 2004 (from Alaska Department of Fish and Game).

Community and Social Conditions for Kodiak

Historically, Kodiak has been the base for operations in the shore-based sector of the Central GOA rockfish fisheries. Kodiak is a large community by Alaska standards and is the seventh largest community in the state in terms of population.⁹ Accompanying this size is a relatively diversified economy compared to other fishing communities in the southwestern part of the state. In terms of direct employment in the fishery being the overriding factor in residency decisions, the population of Kodiak could be viewed as less directly tied to the fishing economy than, for example, is the case for Unalaska, Akutan, or King Cove. Much of the economic diversity seen in Kodiak, however, links back to commercial fisheries in one way or another, with commercial fishing underpinning much of the apparent diversity, generating secondary and indirect employment, and otherwise driving a wide range of related activities. For example, there is a considerable U.S. Coast Guard presence in the community. While not a direct fisheries activity, the base would not exist in Kodiak if it were not driven by commercial fishing-related demands.

The Kodiak fleet is primarily composed of multigear and multispecies boats. Vessels in this fleet usually have a handshake agreement with a shore processor for the delivery of fish. The vessel is said to “work for” the shoreplant and sometimes the plant operators refer to “their boats” meaning those with which working relationships exist. These vessels deliver to that plant on a regular basis. The size and

⁹ The six largest communities in Alaska, in order, are Anchorage, Juneau, Fairbanks, Sitka, Ketchikan, and Kenai. There are two different basic types of local governance in these communities: Anchorage, Juneau, and Sitka are unified Home Rule Municipalities (i.e., unified city/boroughs), while Fairbanks, Ketchikan, and Kenai, like Kodiak, are Home Rule Cities (Kodiak Chamber of Commerce 2004).

composition of processor fleets vary, depending on the plant's capacity and product mix, as noted in the processor discussion below. Most of the boats that deliver to Kodiak processors are multipurpose vessels that can change fisheries to meet the current market and fishing circumstances. For example, some vessels will switch between crab, halibut, and Pacific cod, or crab, halibut, and pollock. The size of a processor's fleet depends on what season it is and what they are targeting at the time. It is not uncommon, however, for a plant to have a fleet of 8 to 16 boats fishing groundfish and crab. Among plants that run pollock, there is a bimodal distribution of trawl fishing power. The larger plants typically have 8 to 10 trawlers working with them, whereas the smaller plants typically have 4 or fewer trawlers in their pollock fleet. Most plants also have 6 to 10 fixed gear vessels in their fleet. Most of the fixed gear boats are pot boats fishing for Pacific cod and/or Tanner crab (when openings occur). There is a small fleet that fishes for Dungeness crab as well.

Some information concerning the impacts of fisheries on the community can be gleaned from examining the residence of participants in the fisheries. Participation by residence estimates can be generated for each of the primary participating sectors, catcher vessels, catcher processors, and processors. In each case, care should be taken in evaluating the importance of the estimates, as the information available to estimate participation by residence will not fully reflect the distribution of regional and local impacts. For example, a vessel owner may not reside in the community that is used as a registered mailing address. In addition, participants in all sectors likely purchase inputs and hire crew from outside of their communities of residence. In addition, impacts of similar magnitudes will have differing importance with the size of the local and regional economy. Small communities could be greatly affected by impacts that are likely to go unnoticed in large communities.

As one of the largest ports of Alaska, vessels home ported in Kodiak participate in many of the State's largest fisheries. Nearly 550 fishing permit holders and over 190 owners of federally permitted vessels resided in Kodiak as of 2008. In excess of 98,000 metric tons of groundfish were delivered into Kodiak in 2008. Table 53 shows total landings by Kodiak-based vessels from 1995 through 2008. Table 54 shows total exvessel gross revenues of Kodiak-based vessels from 1995 through 2008. Comparing the total catch and exvessel revenues with catch and revenue from the rockfish fisheries, it is apparent that rockfish harvests are a relatively small portion of the total fishing activity in Kodiak. Notwithstanding this apparently small contribution to overall catch of Kodiak catcher vessels, some participants report that the fishery is important to their operations. These participants suggest that the supplemental income from the fishery is important to their overall returns. As such, the fishery could also be of some importance to the trawl catcher vessel contribution to the Kodiak economy, to the extent that it is important to the operations of these Kodiak groundfish vessels.

Table 53 Landings by Kodiak vessel owners (in metric tons) (1995-2008)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Groundfish (fixed gear)	14,907	15,348	16,521	15,033	17,785	14,173	10,293	12,045	12,273	15,307	14,648	16,007	14,571	
Groundfish (Trawl)	58,778	59,685	55,673	53,626	49,592	46,912	45,056	44,130	44,886	47,407	45,847	45,082	43,717	
Halibut and Sablefish	4,070	4,667	5,984	5,906	6,164	6,036	6,038	5,711	5,587	5,571	5,260	4,972	4,844	1,027
Herring	4,626	5,519	6,521	5,919	4,337	3,628	3,820	4,121	3,619	4,285	5,409	5,330	4,524	8,640
Crab and Other Shellfish	5,353	5,625	9,228	17,160	13,770	3,410	3,059	3,111	3,029	2,717	3,097	2,920	3,177	5,984
Salmon	37,395	10,259	11,626	23,087	17,666	14,285	22,232	19,180	16,192	20,568	25,464	26,458	22,513	10,771
Total	125,129	101,104	105,552	120,731	109,314	88,445	90,497	88,298	85,586	95,854	99,726	100,770	93,346	26,422

Source: Fish ticket data

Table 54 Exvessel gross revenue of Kodiak vessels (in \$1,000) (1995-2008)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Groundfish (fixed gear)	7,475	6,751	7,872	6,739	11,774	11,101	6,282	6,465	8,078	9,339	10,108	14,410	15,988	
Groundfish (Trawl)	14,519	13,790	14,992	10,208	13,929	13,182	11,189	10,421	11,100	11,202	13,449	14,024	14,142	
Halibut and Sablefish	17,794	21,912	27,861	16,859	27,443	32,264	26,113	27,369	33,766	33,470	31,974	38,196	41,268	6,403
Herring	5,139	6,599	2,127	2,129	2,144	1,192	1,503	1,329	1,152	1,563	2,166	1,056	1,526	3,566
Crab and Other Shellfish	29,137	23,736	24,953	29,868	41,366	19,400	17,239	19,866	20,075	18,333	16,552	12,240	18,279	31,651
Salmon	24,281	12,873	9,385	14,953	16,848	11,560	10,528	6,350	7,790	9,458	11,817	15,009	15,041	12,022
Total	98,346	85,661	87,191	80,756	113,504	88,699	72,854	71,801	81,960	83,365	88,066	94,936	106,244	53,641

Source: Fish ticket data

Table 55 shows first wholesale gross revenues of Kodiak processors by species from 1995 to 2008.

Table 55 First wholesale revenues of Kodiak processors by species (in dollars) (1995-2008)

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Halibut and Sablefish	22,534,581	28,599,072	38,441,173	23,860,232	28,866,143	27,739,523	28,616,318	27,446,192	36,668,853	38,866,827	40,032,729	36,359,124	53,206,713	50,856,898
Herring	*	*	*	*	*	*	1,853,842	1,404,470	1,949,958	4,280,851	3,896,177	1,824,505	2,011,010	3,189,873
King and Tanner Crab	4,319,361	3,247,326	1,821,944	1,547,476	4,561,219	7,494,551	6,807,231	8,127,264	7,017,851	7,933,187	8,903,039	9,517,672	8,106,729	12,162,422
Other	15,445,273	23,507,376	17,990,934	10,497,012	7,559,822	11,861,139	6,203,485	9,040,910	8,689,755	7,695,883	12,379,790	17,369,994	24,967,802	31,162,869
Pollock and Pacific Cod	57,676,104	74,447,330	52,606,288	62,626,309	73,412,002	65,668,095	61,323,482	48,575,665	45,590,668	62,930,625	73,463,569	72,674,768	75,212,858	87,415,130
Salmon	96,396,201	56,820,206	49,208,829	70,522,442	61,990,607	60,272,913	60,539,810	34,569,861	43,148,424	43,771,152	57,308,997	60,445,594	70,109,452	58,239,415
Targeted Rockfish	28,963	962,729	2,008,478	4,053,122	2,215,397	3,100,475	3,245,692	4,445,649	5,241,932	4,460,907	5,407,450	9,720,564	6,708,945	4,233,388
Total	197,274,975	188,163,413	162,745,675	173,292,574	178,699,585	176,217,861	168,589,860	133,610,011	148,307,441	169,939,432	201,391,752	207,912,221	240,323,507	247,259,995

Source: COAR data

* Withheld for confidentiality

Kodiak’s shoreplants have played a significant role in the history of community, influencing its economic and demographic patterns over the years. Even among the eight major contemporary processing plants there is a considerable amount of diversity in the size, volume, and species processed. It is this diversification that best characterizes Kodiak’s ability to weather the ebbs and flows of an industry dependent upon changes in the viability of the resource being harvested, the market itself, and past/future regulatory shifts. Locally based processors vary in product output and specialization, ranging from large quantity canning of salmon, processed at several different locations within Kodiak, to fresh and fresh-frozen products, as well as niche markets servicing the sports-fishing industry.

While the presence of local processing has been a constant in the community, individual operations have substantially different histories and have undergone a variety of changes in recent years. For example, among the large plants processing groundfish and salmon in the community, the facility now operated by Trident Seafoods centers around a converted World War II “Liberty Ship” that was reportedly brought to the community by previous owners (Alaska Packers) in the wake of the devastating 1964 earthquake to become the first plant up and running after that disaster. (This facility apparently later operated under the names All Alaskan and Tyson Seafoods, before being acquired by its present owner.) Ocean Beauty, on the other hand, operates in a facility originally built in 1911, which was the oldest and largest seafood production facility in Kodiak when it was purchased in the 1960s. In 1967, B&B Fisheries opened its doors, which became Western Alaska Fisheries in the early 1970s, and is still in existence today. Ownership type also varies widely. For example, International Seafoods of Alaska (ISA) is a wholly owned subsidiary of True World Group, Inc., which is in turn owned by the Unification Church. In contrast, Alaska Fresh Seafoods (AFS), a smaller plant, has been in operation since 1978 and is owned, in part, by Kodiak and other Alaska fishermen.

All plants experience busy and slow periods during the year, but these peaks and valleys differ at least slightly for each processor, based upon the dependence of processor to fishery or the relationship between fleet and processor. This seasonal pattern has also changed with changes in the fisheries. For example, earlier (2004) interviews with processing plant personnel pointed out how the role of halibut has changed in terms of local processing since the implementation of the halibut IFQ management program, with three-quarters or more of all halibut going to market as a fresh product, as opposed to perhaps one-quarter before IFQs. This has not only changed the role of halibut in individual operations, it has also resulted in a different pattern of landings, with the economics of the fresh market favoring road-connected ports over Kodiak for at least some harvest areas. More recently, BSAI crab rationalization has shifted the periods when BSAI crab is run at the local processors.

With regard to the workforce among Kodiak processors, the large majority of plant workers in Kodiak are drawn from the local labor pool. While some workers still come to the community specifically for processing work opportunities, in the past 20 years, the importation of short-term workers by the processing companies themselves has become less and less common. As of 2008, among all major Kodiak plants, only Trident reports bringing workers into the community on a 6-month contract basis and providing them bunkhouse quarters, similar to the pattern seen in the years before the development of a large local workforce. In the not-too-distant past, Ocean Beauty and Western Alaska Fisheries both utilized bunkhouse facilities during peak seasons, but neither continues to do so. (Alaska Pacific Seafoods

[APS] has retained a small bunkhouse, but this is used only as transitional housing for workers new to the community; ISA has a bunkhouse, but rents out spaces to workers as a more-or-less traditional landlord rather than providing living quarters as part of a room-and-board living arrangement; Western Alaska Fisheries will rent housing on a temporary basis for transient student workers during peak seasons but otherwise does not provide housing for its workers.) This high reliance on the processing workers from a local labor pool differentiates Kodiak from other major processing communities in the southwestern part of the state, such as Unalaska, Akutan, King Cove, and Sand Point. Major processors in each of these communities still retain a relatively transient labor force approach to staffing processing plants. In January 2005, however, in a departure from the local pattern, Western did hire seasonal workers from outside the community for the early peak Pacific cod season, but did not offer housing as part of the employment agreement. This ended up causing considerable concern in the community as, according to local newspaper accounts, about 80 people hired through Alaska Job Service in Anchorage arrived in the community prior to the start of the season, without having made housing arrangements (despite knowing that they needed to do so) and without sufficient resources to care for themselves prior to earning their first processing paycheck. This, in turn, proved to be a challenge for local service providers, as the unprepared workers utilized local shelters for immediate food and housing needs. While this may have been an isolated incident, it illustrates the continually changing nature of attempting to meet peak processing demands over time.

Since the program establishes a cooperative system, with strong cooperative associations with historical processors and a limited access fishery that requires deliveries to processors meeting historical processing qualifications, deliveries in the main program have continued to be made to Kodiak processors. In addition, only Kodiak processors have participated in the entry level fishery, by providing markets for entry level catcher vessels. As a result, all deliveries in the fishery have continued to be made to Kodiak under the pilot program. So, the community effects arising from implementation of the program have arisen from the changes in the Kodiak based activity. A more detailed description of the Kodiak community is available in Appendix A of the Public Review version of the Central Gulf of Alaska Rockfish Program (NPFMC, 2010)

6.6 Analysis of Alternatives

Alternative 1 – status quo

Under Alternative 1, no area closures for protecting GOA Tanner crab would be implemented.

Alternative 2 – close areas to groundfish fishing; Suboptions 1, 2, 3, 5 – close areas to a particular gear type

Alternative 2 proposes four specific area closures to all groundfish fishing by trawl and pot gear. Component 2, Suboptions 1, 2, 4, and 5 could limit the closures to only apply to a specific gear type: trawl, pot, or nonpelagic trawl (Suboptions 4 and 5 exempt pelagic trawlers from the area closures).

Groundfish vessels that are subject to the closures will be required to forego fishing in the proposed areas. The impact on these vessels will be proportional to the extent that they rely on the area for target fishing. Based on observer data, the nonpelagic trawl fisheries will be most impacted by the area closures. Specifically, a large proportion of groundfish in the various flatfish and pollock target fisheries is harvested within the proposed area closures. 65-70% of groundfish caught in the pollock target occurs in the Chiniak and 525702 closures; 50-60% of groundfish in the arrowtooth flounder and flathead sole target occurs in 525702 and 525630; 50% of shallow water flatfish occurs in 525702; and 60-70% of the rex sole target fishing occurs in 525630 (Table 37). For arrowtooth flounder (Color Figure 4) and flathead sole (Color Figure 6) targets, there are areas outside of the proposed closures where a concentration of catch in those targets occurs, however for the shallow water flatfish target fishery (Color Figure 5), there

are few areas outside of the proposed area closures where significant catch occurs. Therefore particularly for shallow water flatfish, it may be difficult to fully harvest the TAC outside the proposed area closures. While for arrowtooth flounder, the alternate area of high arrowtooth catch is not one in which there is high reported crab bycatch (Color Figure 1), this is not the case for flathead sole, so overall savings in crab bycatch may not be as high for this fishery.

Table 45 shows that there are 12 catcher vessels participating in the flatfish fishery who derive over 20% of their exvessel revenue for flatfish from 525702 and 8 vessels who derive the same proportion of their flatfish revenue from 525630. These vessels would be more impacted than others by the proposed closure of areas 525702 and 525630. To the extent that flatfish TACs cannot be fully harvested as a result of this alternative, there may also be impacts on the community of Kodiak and processing facilities. Table 52 identifies that flatfish represents 15% of total processing volume, and 6% of total value.

For pelagic trawl, the biggest impact would result from closing 525702, where the western and central portions of the statistical area are important for pollock trawling. Approximately 25% of the groundfish catch in the pollock pelagic trawl target fishery occurred within the Marmot, Chiniak, and 525702 closures, on average between 2007 and 2009. The pelagic trawl pollock fishery is prosecuted in other areas within reporting area 630, which would remain open to fishing (Color Figure 9). Table 46 shows that area 525702 accounted for an average of 1.51% of total exvessel revenue for catcher vessels. It is therefore assumed for this analysis that vessels would be able to fully harvest groundfish TACs despite the proposed area closures, albeit with potential costs. In some areas, there may be lower catch per unit effort, which would increase costs for fishers and could result in increased bycatch of crab or other incidental species. Depending where the vessels choose to fish, there are likely to be lower crab bycatch rates in these alternate areas (Color Figure 10; Table 18). However, crab bycatch in the pelagic trawl fisheries in all years is one percent or less of the overall bycatch total for reporting area 630.

For pot vessels, the proposed area closures at first appear to have a smaller impact on groundfish fishing because, according to observer data, the area is not as much fished as other parts of reporting area 630 (Color Figure 12). However, there appear to be a higher proportion of pot vessels using the proposed area closures that are unobserved (Table 15), so observer data may be less reliable for this gear type. Table 46 and Table 47 identify that an average of 42% of exvessel revenue from pot vessels came from the combined 525702 and 525630 statistical areas. Crab bycatch within the closed areas represents a quarter of all observed crab bycatch by vessels fishing with pot gear in reporting area 630 (Figure 21).

To the extent that the reduction in bycatch from the area closures increases crab recruitment to the fishery, crab fishers may also benefit from Alternative 2. However, current levels of crab bycatch in the groundfish fisheries represent 0.3% or less of surveyed crab abundance (see Section 4.1). Bycatch numbers of crab in the groundfish fisheries, and catch numbers in the directed crab fisheries are not comparable, as the groundfish bycatch numbers include all crab (including juvenile, female, and sublegal males), which crab fishery catch numbers include only legal males. It is not possible to assess the value to the directed crab fishery of crab caught as bycatch in the groundfish fisheries. Catch composition of bycatch is unknown, and studies differ with respect to the appropriate handling mortality rate to apply to bycatch in the groundfish fisheries by gear type.

The management and enforcement considerations section (Section 5.1) recommends that VMS be used to monitor the proposed area closures. Most of the vessels that would be subject to the closures are already required to have VMS, either because they operate nonpelagic trawl gear, they participate in the Rockfish Pilot Program, or they engage in directed fishing for Pacific cod or pollock. If the proposed closures are required for sablefish hook and line vessels, however, these vessels would need to install and operate VMS units. Purchase and installation costs for a VMS unit are approximately \$2,058, and monthly transmission fees are approximately \$63 (NMFS 2008). There is also an annual maintenance cost that is estimated at \$77.

Suboption 3 – exempt vessels using approved, modified gear

As described in Section 3.6, modified gear to reduce crab mortality and bycatch in the GOA has not been tested for any gear type. A sweep modification has been approved by the Council for implementation in the Bering Sea flatfish fisheries; this modification has been shown to reduce unobserved mortality of crab from trawl sweeps (although use of the modification would not result in lower bycatch in trawl nets). The average cost of the modification to fishermen, for the gear configuration used in the Bering Sea, is \$3,000-5,000 annually (NMFS 2009). This cost may be offset if, as suggested, the modification extends the useful life of the sweeps, and reduce the frequency with which new gear must be purchased. There may also be one-time costs for modifying the vessel to accommodate the sweep modification, depending on current vessel configuration.

A different modification has been proposed for pot gear, to build an escape mechanism into the bottom of the pot to allow crab to exit. No cost specifications are available for this proposed modification, nor has it yet been tested by agency personnel.

Assuming the logistics of approving modified gear for regulatory implementation can be addressed, vessels that habitually use the proposed area closures would have the option of paying for the installation and annual costs of using modified gear as an alternative to being displaced from their fishing grounds. Those vessels with historic exvessel revenue that is perceived to be less than the cost of the modified gear (for example, see Table 44 and Table 45 for number of vessels with a low percentage of exvessel revenue from the proposed area closures) may choose not to modify their gear in order to participate in the proposed area closures.

Option 1 or 2 – year round or seasonal closure

The majority of catch for all gear types occurs in January to July, which is the seasonal period identified in Option 2 (Table 39). For gears that account for almost all of the Tanner crab bycatch (nonpelagic trawl and pot gears), 75% and 58% of groundfish catch is caught in the January to July period, respectively, compared to 79% and 74% of Tanner crab bycatch. Under Option 2, the seasonal closure, adverse impacts from the area closures on groundfish fishers would be reduced, as vessels could fish in the areas for the remainder of the year. This would especially be beneficial for the nonpelagic trawl fleet fishing in the Chiniak area, where 58% of observed catch is caught in August to December.

Alternative 3 – close areas to groundfish fishing unless vessels have increased observer coverage

Alternative 3 would allow fishing in the proposed closure areas by vessels using trawl gear only if they carry an observer 100% of the days they conduct directed fishing for groundfish in these areas. All vessels using pot gear to directed fish for groundfish would be required to have 30% observer coverage for any fishing trip where catch occurred inside these areas. In addition, observer coverage for any trip where fishing occurred inside these areas could not be used to comply with 30% observer coverage for trips that occurred outside of these areas.

Alternative 3 would increase costs to the owners of any vessel that continued to fish in the closure areas that are not already required to have 100% or greater observer coverage. The category of vessels that could incur increased costs are (1) vessels less than 60' LOA currently required to have no observer coverage, and (2) vessels currently required to have 30% observer coverage. This section provides an estimate of those increased observer coverage costs.

Catcher/processors: From 2001 through 2009, thirteen catcher/processors reported harvest from the three ADF&G statistical areas fully within the proposed closure areas. All of these catcher/processors reported

using nonpelagic trawl gear in these areas and two reported also using pelagic trawl gear in the areas. Nine of these catcher/processors are 125' LOA or greater. In addition, three of the four catcher/processors between 60' and 125' LOA are Amendment 80 vessels, so are required to carry at least one observer while harvesting or processing groundfish in the GOA. These twelve catcher/processors would not incur increased costs for observer coverage under Alternative 3 because they already are required to have at least 100% observer coverage in all of their groundfish fisheries.

One catcher/processor between 60' and 125' LOA reported catch from the proposed closure areas. This vessel would be in the 30% observer coverage category unless it was fishing under the Rockfish Program. If it conducts fishing inside these areas in the future under any fishery that doesn't require 100% observer coverage, this catcher/processor would incur additional costs for observer coverage as a result of Alternative 3. However, the days this catcher/processor fished in these areas in the past is confidential, so no specific estimates of the increase in observer coverage costs by the vessel can be provided in this RIR.

No catcher/processors using pot gear reported fishing in the three ADF&G statistical areas fully within the proposed closure areas between 2001 and 2009.

Catcher vessels: ADF&G fish tickets from 2001 through 2009 were examined to identify deliveries from catcher vessels for which vessel operators reported fishing in any of the ADF&G statistical areas within or overlapping with the proposed closure areas. The three statistical areas that are fully within the proposed closure areas are 525702, 525630, and 525807. The statistical areas that overlap with the proposed closure areas are 515802, 515730, 525732, and 515700 (see Figure 2). Using fish tickets provides information for areas larger than the proposed closure areas, so may overestimate the number of catcher vessels that have historically fished in the proposed closure areas and the days fished in those areas. However, the smallest and most defined areas available on fish tickets are the ADF&G statistical areas, so this is the best available data for estimating the potential cost of increased observer coverage requirements for catcher vessels under Alternative 3.

Table 56 summarizes the number of catcher vessels and days fished, by vessel length and observer coverage category for trips where fishing occurred in at least one of the seven statistical areas listed above in 2001 through 2009. The days fished reported on the fish tickets starts from the time gear is deployed to when catch is offloaded from the vessel. Data on number of days fished in categories with less than 4 vessels is confidential, so is not presented in the table.

Many vessels used both pelagic and non-pelagic trawl gear, so are represented in both sections of Table 56. For example, in 2009, a total of 37 vessels reported using trawl gear in at least one of these seven ADF&G statistical areas. Thirty-two of these vessels reported using nonpelagic trawl gear and 34 reported using pelagic trawl gear.

Table 57 provides an estimate of the increased costs that could occur as a result of the observer coverage requirements under Alternative 3. The information in Table 57 is based on the number of vessels in each category and number of days fished in 2009. If observer coverage is required, the observer ends up being onboard the vessel during both transit and fishing times. Therefore, additional days are added to the number of days fished from the fish tickets to represent days transiting to the fishing grounds. The average number of days fished per trip from the fish ticket data is 1.99 for vessels using trawl gear and 2.31 for vessels using pot gear. For purposes of this analysis an average of 2 days fished per trip is used for both gear types. Transit time from Kodiak to the proposed closure areas could range from several hours to a day. An additional day is added to each trip represented by the fish ticket data to account for transit time. For example, the 1,018 fishing days for vessels between 60' and 125' LOA is divided by 2 (average fishing days per trip from fish tickets) to obtain an estimate of the total trips (509). Then, an additional day per trip is added to estimate the number of days that an observer would be required to be onboard these vessels ($1,018 + 509 = 1,527$). The total days from departure from Kodiak to offloading of

the vessel is used to calculate observer coverage costs in Table 57. Estimated average costs per vessel are determined by dividing the cost for all vessels by the number of vessels in each category.

Total costs in Table 57: There are two components to the estimated increased cost of the observer coverage requirements in Alternative 3. Column B in Table 57 estimates the cost of the increased days of observer coverage that would be required under Alternative 3. That is, the increase in costs from 0% or 30% to 100% for vessels using trawl gear and the increase from 0% to 30% for vessels using pot gear. Column C provides the estimated total increase in cost under Alternative 3 which, for vessels currently in the 30% coverage category, also includes the current observer coverage costs in Column A because they would no longer be able to use current observer coverage for fishing inside the proposed closure areas to comply with their 30% coverage requirements outside of the closure areas.

Less than 60' trawl catcher vessels: The one vessel less than 60' LOA fishing with nonpelagic trawl gear would incur the full cost of carrying an observer for all of the days fished in these areas. However, the number of days fished in these areas is confidential, so no estimate of increased cost can be displayed in Table 57.

60' - 125' trawl catcher vessels: Estimated costs of current observer coverage requirements for the 37 vessels using trawl gear in these seven ADF&G statistical areas in 2009 are broken out separately for the 32 vessels that reported 1,018 days fishing in the areas using nonpelagic gear and the 34 vessels that reported 56 days fishing using pelagic trawl gear. Current observer coverage costs in Column A were determined by (1) adding transit days to estimate the total number of fishing days, and (2) multiplying the total fishing days by .3 (30% of the days) and by \$366 (the estimated cost per day of providing a NMFS-certified observer onboard a vessel). For example, for the vessels reporting nonpelagic gear, the estimated costs of observer coverage from the 1,527 days fished \$167,665 ($1,527 * .3 * 366$). This estimate is divided by 32 to estimate the average cost per vessel of current observer coverage requirements for fishing inside these areas (\$5,240).

The additional cost of increasing observer coverage for the 32 catcher vessels that used nonpelagic gear to 100% while fishing inside the proposed closure areas is determined by estimating the cost of providing an observer for the remaining 70% of the total fishing days in the seven ADF&G areas. ($\$391,217 = 1,527 * .7 * \366).

The estimated total increase in costs for these vessels under Alternative 3 is the full cost of 100% observer coverage inside these areas (\$558,882 or an average of \$17,465 per vessel).

The estimated increase in cost under Alternative 3 for vessels using pelagic trawl gear is a total of \$30,744 or about \$900 per vessel. Because most of the 37 vessels using trawl gear in these areas in 2009 used both nonpelagic and pelagic trawl gear, the total cost of the increased observer coverage requirements for many trawl vessels between 60' and 125' LOA would be the sum of the cost estimates for nonpelagic and pelagic trawl gear (\$589,626 or an average of \$15,936 for the 37 vessels between 60' and 125' LOA using trawl gear).

Vessels using pot gear: Although observer coverage for vessels using pot gear is based on the number of pot retrievals, information about pot retrievals inside the seven ADF&G statistical areas is not available from the fish tickets. Therefore, the estimates in Table 57 of the cost of observer coverage for vessels using pot gear is based on the number of days vessel operators reported fishing in any one of the seven ADF&G statistical areas.

Less than 60' pot catcher vessels: The 12 vessels less than 60' LOA fishing with pot gear would incur the full cost of carrying an observer for 30% of the estimated 308 fishing days in these areas. The total cost for that observer coverage would be \$33,764 (average per vessel of \$2,814).

60' - 125' pot catcher vessels: The 11 vessels using pot gear currently required to have 30% observer coverage would continue to be required to carry 30% observer coverage. Current observer coverage costs for fishing inside these seven ADF&G statistical areas, based on 2009 fishing activity, is estimated to be \$22,948 for the 11 vessels (209 days *.3 * 366). That is an average of \$2,086 per vessel. These vessels would not be required to obtain additional observer coverage days to continue to fish inside these areas, so the estimate for additional coverage days in Colum B is zero. However, because these vessels could no longer use the 30% observer coverage inside the proposed closure areas to apply towards the 30% observer coverage requirements outside the closure area, Alternative 3 could increase their total cost of observer coverage in all of their fisheries the full amount of their current observer coverage costs.

Additional observer coverage costs: In addition to daily costs of carrying an observer while transiting or fishing, starting in 2010, vessel owners carrying observers out of Kodiak have been required to pay for observer coverage costs for the days observers must be on standby in Kodiak waiting for weather or fishery openings. Vessel owners are cooperating to use observer coverage as efficiently as possible. However, any increase in the number of observer days required likely will increase the number of days observers are on standby, thereby increasing the total cost of the observer coverage requirements under Alternative 3.

Importance of these seven ADF&G statistical areas: All fish tickets for the vessels that fished within these seven ADF&G statistical areas in 2009 also were examined to estimate the percentage of total reported fishing days that occurred within these areas. These seven ADF&G statistical areas represented from 2% to 68% of all of the fishing days for the catcher vessels from 60' to 125' using trawl gear, from 1% to 54% for vessels <60' LOA using pot gear, and from 8% - 77% for vessels 60' to 125' LOA using pot gear.

Cost of Alternative 3 to NMFS: NMFS estimates that each day of additional observer coverage costs the agency \$130. Based on 2009 data, we may expect an increase of 2,128 observer days as a result of Alternative 3 (the sum of total fishing days in Table 57). These additional observer coverage days would cost NMFS approximately \$277,000, a cost that is not currently identified in NMFS's budget.

Table 56 Number of catcher vessels, by vessel length and observer coverage category, and number of days fished in seven ADF&G statistical areas associated with proposed closure areas around Kodiak Island, 2001 - 2009

Year	< 60' LOA no observer coverage		60' - 125' LOA 30% observer coverage		≥ 125' LOA 100% observer coverage	
	# vessels	# days	# vessels	# days	# vessels	# days
Nonpelagic (bottom) trawl gear						
2001	8	212	48	1,356	0	0
2002	7	102	41	970	0	0
2003	8	90	43	1,025	0	0
2004	3	confidential	42	714	0	0
2005	1	confidential	33	518	0	0
2006	0	0	32	835	0	0
2007	1	confidential	34	857	0	0
2008	2	confidential	35	1,003	1	confidential
2009	1	confidential	32	1,018	0	0
Pelagic trawl gear						
2001	4	13	44	386	0	0
2002	1	confidential	28	66	0	0
2003	2	confidential	37	104	0	0
2004	2	confidential	41	212	0	0
2005	2	confidential	34	149	0	0
2006	1	confidential	30	239	0	0
2007	0	0	26	140	0	0
2008	0	0	28	99	0	0
2009	0	0	34	56	0	0
Pot gear						
2001	8	180	5	27	1	confidential
2002	5	36	6	33	0	0
2003	7	53	3	confidential	0	0
2004	9	156	9	137	0	0
2005	9	187	12	336	0	0
2006	15	294	13	310	0	0
2007	14	297	11	191	0	0
2008	14	241	11	140	0	0
2009	12	205	11	139	0	0

Source: ADF&G fish tickets.

Table 57 Estimated Current Observer Coverage Costs for Vessels Fishing in the Proposed Closure Areas and Potential Increased Costs under Alternative 3 (based on information in Table 56 for 2009)

	From Table 56		(A) Estimated Costs of Current Observer Coverage in Proposed Areas		(B) Estimated Cost of Additional Coverage Days under Alternative 3		(C) Estimated Increase in Total Costs under Alt. 3	
	# vessels	# days ¹	All vessels	Avg per vessel	All vessels	Avg per vessel	All vessels	Avg per vessel
Nonpelagic Trawl								
<60'	1	confidential	\$0	\$0	confidential	confidential	confidential	confidential
60' - 125'	32 ²	1,018 + 509 = 1,527	\$167,665	\$5,240	\$391,217	\$12,226	\$558,882	\$17,465
≥ 125'	0	0	na	na	na	na	na	na
Pelagic Trawl								
<60'	0	0	na	na	na	na	na	na
60' - 125'	34 ²	56 + 28 = 84	\$9,223	\$271	\$21,521	\$633	\$30,744	\$904
≥ 125'	0	0	na	na	na	na	na	na
Pot								
<60'	12	205 + 103 = 308	\$0	\$0	\$33,764	\$2,814	\$33,764	\$2,814
60' - 125'	11	139 + 70 = 209	\$22,948	\$2,086	\$0	\$0	\$22,948	\$2,086
≥ 125'	0	0	na	na	na	na	na	na

¹ # days for observer coverage = days fished from ADF&G fish tickets plus additional amount for transit days.

² A total of 37 vessels reported using trawl gear in the seven ADF&G statistical areas in 2009. Thirty-two of these vessels reported using nonpelagic trawl gear and 34 reported using pelagic trawl gear.

na = not applicable

Net benefit to the Nation

The net benefit to the Nation of the proposed alternatives is not quantifiable. The alternatives are not likely to result in forsaken groundfish harvest, as the groundfish TACs will likely be harvested in neighboring areas. There may be an increased cost associated with the displaced groundfish harvest, particularly for flatfish and potentially pollock, due to lower catch per unit effort rates elsewhere. Some benefits may accrue to the Nation through the continued rebuilding of Tanner crab stocks, as a source of mortality from the groundfish fisheries is reduced.

7 Initial Regulatory Flexibility Analysis

7.1 Introduction

This IRFA evaluates the impacts on directly regulated small entities of the proposed action, proposed area closures to protect *C. bairdi* crab around Kodiak Island. Included in the alternatives under consideration are options to apply the closures year round or seasonally, and to pot and/or trawl gear types. Additionally, some vessels may be exempted from the area closures if they meet specific conditions such as using approved gear modifications, or an observer coverage requirement.

7.2 The Purpose of an IRFA

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

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

In determining the scope or "universe" of the entities to be considered in an IRFA, NMFS generally includes only those entities that can reasonably be expected to be directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, and thus such a focus exists in analyses that are designed to address RFA compliance.

Data on cost structure, affiliation, and operational procedures and strategies in the fishing sectors subject to the proposed regulatory action are insufficient, at present, to permit preparation of a "factual basis" upon which to certify that the preferred alternative does not have the potential to result in "significant economic impacts on a substantial number of small entities" (as those terms are defined under RFA). Because based on all available information it is not possible to "certify" this outcome, should the proposed action be adopted, a formal IRFA has been prepared and is included in this package for Secretarial review.

7.3 What is Required in an IRFA?

Under 5 U.S.C., Section 603(b) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant adverse economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as—
 1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
 2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
 3. The use of performance rather than design standards; and
 4. An exemption from coverage of the rule, or any part thereof, for such small entities.

7.4 What is a Small Entity?

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

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

The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses. A business involved in fish harvesting is a small business if it is independently owned and operated and not dominant in its field of operation (including its affiliates)

and if it has combined annual receipts not in excess of \$4.0 million for all its affiliated operations worldwide. A seafood processor is a small business if it is independently owned and operated, not dominant in its field of operation, and employs 500 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide. A business involved in both the harvesting and processing of seafood products is a small business if it meets the \$4.0 million criterion for fish harvesting operations. Finally a wholesale business servicing the fishing industry is a small business if it employs 100 or fewer persons on a full-time, part-time, temporary, or other basis, at all its affiliated operations worldwide.

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

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

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

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

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

7.5 What is this Action?

The alternatives evaluated in this analysis were adopted by the Council in October 2009, and modified during initial review in April 2010.

Alternative 1: Status Quo – No action

Alternative 2: Close the areas specified below to pot and trawl groundfish fisheries.

Component 1: Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20' W), excluding State waters

ADF&G Eastside Section

Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Component 2: Closure timing

Option 1: Year round

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Option 2: Seasonally (January 1 – July 31)

Suboption 1: trawl gear

Suboption 2: pot gear

Suboption 3: Vessels using approved, modified gear would be exempt from closures (e.g., trawl sweep modifications or pot escape mechanisms).

Suboption 4: Vessels using pelagic trawl gear would be exempt from closures

Suboption 5: Vessels using pelagic trawl gear to directed fish for pollock would be exempt from the closures

Alternative 3: In order to fish in the areas specified below, require 100% observer coverage on all trawl groundfish vessels and 30% observer coverage on all pot groundfish vessels less than 125 feet. Note, fishing days and observer coverage in these areas would be separate from and not count towards meeting a vessel's overall 30% groundfish observer coverage requirement.

Area definition

ADF&G Northeast Section

Option 1: Statistical Area 525807 and the area east of Statistical Area 525807 north of 58 degrees latitude, south of 58 degrees 15 min. latitude and west of 151 degrees 30 min. longitude.

Option 2: Chiniak Gully (Four corners at 152°19'34" W x 57°49'24" N by 57°29' N x 151°20' W by 57°20' N x 151°20' W by 57° x 152°9'20" W), excluding State waters

ADF&G Eastside Section

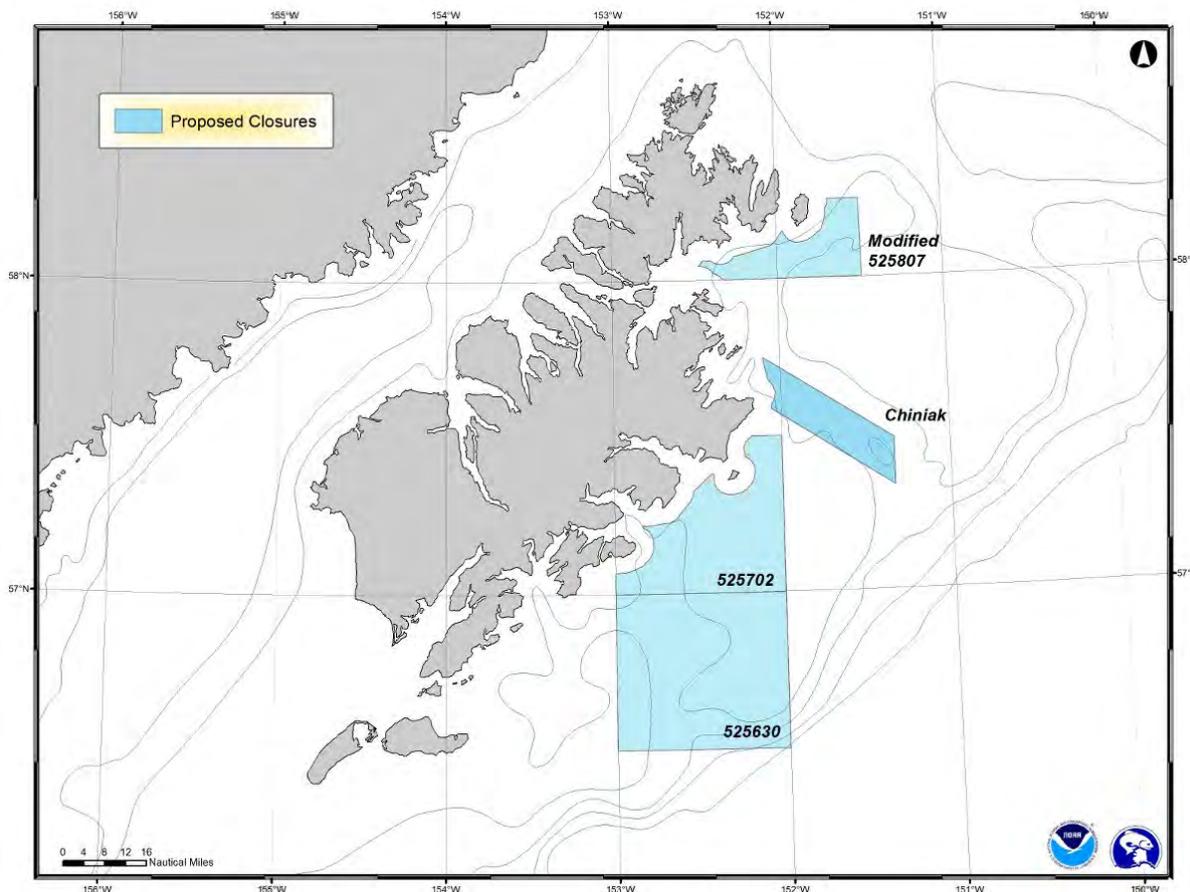
Option 3: Statistical Area 525702

ADF&G Southeast Section

Option 4: Statistical Area 525630

Note, the options and suboptions under Alternatives 2 and 3 are not intended to be mutually exclusive, and may be applied in combination.

Figure 31 Area closures around Kodiak Island considered in Alternatives 2 and 3



7.6 Objectives and Reasons for Considering the Proposed Action

The Council formulated a problem statement in October 2009, to initiate this analysis, and revised it slightly in April 2010:

Tanner crab are a prohibited species bycatch in the Gulf of Alaska (GOA) groundfish fisheries. Directed fisheries for Tanner crab in the GOA are fully allocated under the current limited entry system. No specific conservation measures exist in the GOA to address adverse interactions with Tanner crab by trawl and fixed gear sectors targeting groundfish and low observer coverage in GOA groundfish fisheries limits confidence in the assessment of Tanner crab bycatch in those fisheries, and a greater level of observer coverage in the appropriate areas may provide the Council with a higher level of confidence in the assessment of any bycatch occurring in the designated areas as a basis for future management actions as necessary. Tanner crab stocks have been rebuilding since peak fisheries occurred in the late 1970s. Specific protection measures should be advanced to facilitate stock rebuilding.

7.7 Legal Basis for the Proposed Action

NMFS manages the U.S. groundfish fisheries of the BSAI under the Fishery Management Plan (FMP) for this area. The Council prepared the FMP under the authority of the Magnuson-Stevens Act, and regulations implement the FMPs at 50 CFR part 679. General regulations that also pertain to U.S. fisheries appear at subpart H of 50 CFR part 600.

7.8 Number and Description of Small Entities Directly Regulated by the Proposed Action

This action could directly regulate all vessels, except those using jig gear, participating in Federal groundfish fisheries around Kodiak Island in the Central Gulf of Alaska. From 2003 to 2009, there were 68 nonpelagic trawl vessels, 47 pelagic trawl vessels, and 100 pot vessels with reported Tanner crab bycatch, participating in one or multiple years in the groundfish fisheries in reporting area 630.

Fishing vessels, both catcher vessels and catcher/processors, are considered small, for RFA purposes, if their gross receipts, from all their economic activities combined, as well as those of any and all their affiliates anywhere in the world, (including fishing in federally managed non-groundfish fisheries, and in Alaska-managed fisheries), are less than or equal to \$4.0 million annually. Further, fishing vessels were considered to be large if they were affiliated with an AFA or Amendment 80 fishing cooperative, as the members of these cooperatives had combined revenues that exceeded the \$4.0 million threshold. Of the vessels with reported Tanner crab bycatch, fishing in reporting area 630 from 2003-2009, 26 nonpelagic trawl vessels, 12 pelagic trawl vessels, and 97 pot vessels are considered small for RFA purposes.

7.9 Recordkeeping and Reporting Requirements

The IRFA should include “a description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record...”

Implementation of the proposed action would not change the overall reporting structure and record keeping requirements of the vessels participating in the Bering Sea flatfish fisheries.

7.10 Federal Rules that may Duplicate, Overlap, or Conflict with Proposed Action

An IRFA should include “An identification, to the extent practicable, of all relevant federal rules that may duplicate, overlap or conflict with the proposed rule...”

There do not appear to be any federal rules that duplicate, overlap, or conflict with the proposed action. Some current federal regulations will need modification to implement the proposed action.

7.11 Description of Significant Alternatives

An IRFA should include “A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the Magnuson-Stevens Act and any other applicable statutes and that would minimize any significant (implicitly adverse) economic impact of the proposed rule on small entities.”

The alternatives accepted by the Council for consideration in this EA/RIR/IRFA are described in detail in Section 2 of the EA and are briefly described in Section 6.4 of the RIR. The RIR for this action analyzes potential economic impacts of the suite of available alternatives and options. A complete discussion of significant alternatives will be included in this section once the Council has finalized their recommendation to the Secretary of Commerce.

8 FMP and Magnuson-Stevens Act considerations

8.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Act, and a brief discussion of the consistency of the proposed alternatives with those National Standards, where applicable.

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

The proposed action would impose area closures on some or all gear types participating in the Federal groundfish fisheries off Kodiak Island in the Central Gulf of Alaska. Target groundfish species that are currently caught in these areas include flatfish, Pacific cod, pollock, rockfish, and sablefish. It is not anticipated that the imposition of area closures will prevent the fishery from achieving annual total allowable catch for these species. These species are not currently in danger of overfishing and are considered stable. Additionally, the proposed action may reduce the mortality of *C. bairdi* crab species. While these are not subject to a Federal fishery managed under the Magnuson-Stevens Act, a reduction in bycatch mortality of crab species may result in an increase in yield from the directed fishery. In terms of achieving “optimum yield” from a fishery, the Act defines “optimum”, with respect to yield from the fishery, as the amount of fish which—

- (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
- (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and
- (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overall benefits to the Nation may be affected by the proposed action, though our ability to quantify those effects is quite limited. Overall net benefits to the Nation would not be expected to change to an identifiable degree between the alternatives under consideration.

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

Information in this analysis represents the most current, comprehensive set of information available to the Council, recognizing that some information (such as operational costs) is unavailable. Information previously developed on the GOA groundfish fisheries, as well as the most recent information available, has been incorporated into this analysis. It represents the best scientific information available.

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

The annual TACs are set for GOA groundfish according to the Council and NMFS’s harvest specification process. NMFS conducts the stock assessments for these species and makes allowable biological catch recommendations to the Council. The Council sets the TAC for these species based on the most recent stock assessment and survey information. These GOA stocks will continue to be managed as a single stock under the alternatives in this analysis.

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

Nothing in the alternatives considers residency as a criterion for the Council's decision. Residents of various states, including Alaska and states of the Pacific Northwest, participate in the major sectors affected by these allocations. No discriminations are made among fishermen based on residency or any other criteria.

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

The wording of this standard was changed in the recent Magnuson-Stevens Act authorization, to consider rather than promote efficiency. Efficiency in the context of this change refers to economic efficiency, and the reason for the change, essentially, is to de-emphasize to some degree the importance of economics relative to other considerations (Senate Report of the Committee on Commerce, Science, and Transportation on S. 39, the Sustainable Fisheries Act, 1996). The analysis presents information relative to these perspectives and provides information on the economic risks associated with the proposed area closures.

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

All of the alternatives under consideration in the proposed action appear to be consistent with this standard.

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

All of the alternatives under consideration appear to be consistent with this standard.

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

Many of the coastal communities in Alaska and the Pacific Northwest participate in the GOA groundfish fisheries in one way or another such as homeport to participating vessels, the location of processing activities, the location of support businesses, the home of employees in the various sectors, or as the base of ownership or operations of various participating entities. A summary of the level of fishery engagement and dependence in the communities of vessels affected by the proposed action is provided in the RIR.

An analysis of the alternatives suggests that while impacts may be noticeable at the individual operation level for at least a few vessels, the impacts at the community level for any of the involved fishing communities would be well under the level of significance. The sustained participation of these fishing communities is not put at risk by any of the alternatives being considered. Economic impacts to participating communities would not likely be noticeable at the community level, so consideration of

efforts directed at a further minimization of adverse economic impacts to any given community is not relevant.

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

The proposed action is specifically intended to reduce bycatch and bycatch mortality of *C. bairdi* crab in the groundfish fisheries. The practicability of bycatch reduction is discussed in the analysis of the impacts of the various alternatives and options, in Section 6.5.4 of the RIR.

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

The alternatives under consideration appear to be consistent with this standard. None of the alternatives or options proposed to modify the fishing grounds or gear of the flatfish fleet would change safety requirements for fishing vessels.

8.2 Section 303(a)(9) – Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that any plan or amendment include a fishery impact statement which shall assess and describe the likely effects, if any, of the conservation and management measures on (a) participants in the fisheries and fishing communities affected by the plan or amendment; and (b) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants taking into account potential impacts on the participants in the fisheries, as well as participants in adjacent fisheries.

The alternative actions considered in this analysis are described in Section 2. The impacts of these actions on participants in the fisheries and fishing communities are the topic of Sections 6 and 7, in the RIR and IRFA.

Fishery Participants

The proposed actions directly impact participants in the GOA groundfish fisheries occurring around Kodiak Island in the Central GOA. The primary target fisheries that are prosecuted around Kodiak Island in the areas proposed for closure are flatfish (arrowtooth flounder, flathead sole, shallow water flatfish, and rex sole), Pacific cod, pollock, rockfish, and sablefish. From 2001 to 2009, there have been a total of 536 different vessels participating in these directed fisheries.

Fishing Communities

The fishing communities that are expected to be potentially directly impacted by the proposed action are those communities which serve as homeports to the vessels potentially affected by the area closures, where they offload product, take on supplies, provide vessel maintenance and repair services, and provide homes to vessel owners and crew. Information on the residence of the vessel crew and processing crew that work aboard the potentially affected vessels is not readily available; however, generally companies operating vessels in the Central GOA groundfish sector tend to recruit crew from many locations.

Detailed information on the range of fishing communities relevant to the proposed action may be found in a number of other documents, including the *Alaska Groundfish Fisheries Final Programmatic Supplemental EIS* (NMFS 2004), *Sector and Regional Profiles of the North Pacific Groundfish Fishery* (Northern Economics and EDAW 2001), and in a technical paper (Downs 2003) supporting the *Final EIS*

for *Essential Fish Habitat Identification and Conservation in Alaska* (NMFS 2005) as well as that EIS itself. These sources also include specific characterizations of the degree of individual community and regional engagement in, and dependency upon, the North Pacific groundfish fishery.

Participants in Fisheries in Adjacent Areas

Neither the proposed action nor alternatives considered would significantly affect participants in the fisheries conducted in adjacent areas under the authority of another Council.

8.3 GOA FMP — Groundfish Management Policy Priorities

The alternatives discussed in this action accord with the management policy of the GOA Groundfish FMP. The Council's management policy (NPFMC 2009) includes the following objectives:

- Control the bycatch of prohibited species through prohibited species catch limits or other appropriate measures.
- Continue and improve current incidental catch and bycatch management program.
- Continue to manage incidental catch and bycatch through seasonal distribution of total allowable catch and geographical gear restrictions.
- Continue program to reduce discards by developing management measures that encourage the use of gear and fishing techniques that reduce bycatch which includes economic discards.

By proposing area closures or gear modifications to reduce bycatch of *C. bairdi* crab, the Council is consistent with its management policy.

9 NEPA Summary

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

Context: For this action, the setting is the Central GOA groundfish fisheries that participate in specific areas around Kodiak Island that are proposed for closure. Any effects of this action are limited to this area, or adjacent areas in the Central GOA where vessels may choose to catch their target fish once they have been closed out of specific fishing grounds. The effects of this action on society within this area are on individuals directly and indirectly participating in these fisheries and on those who use the ocean resources. Because this action concerns the use of a present and future resource, this action may have impacts on society as a whole or regionally.

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

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

(EA Section 4.2). No. No significant adverse impacts on target species were identified for Alternatives 2 or 3. No changes in overall amount or timing of harvest of target species are expected with any of the alternatives or option in the proposed action, and the general location of harvest is also likely to be similar to the status quo, although there may be localized shifts. Therefore, no impacts on the sustainability of any target species are expected.

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

(EA Section 4.2 and 4.1). No. Potential effects of Alternatives 2 and 3 on non-target and prohibited species are expected to be insignificant and similar to status quo because no overall harvest changes to target species were expected. Some benefit to *C. bairdi* crab, a prohibited species caught as bycatch in the groundfish fisheries, may accrue due to the area closures. Because no overall changes in target species harvests under the alternatives is expected, the alternatives and option are not likely to jeopardize the sustainability of any nontarget/prohibited species.

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

(EA Section 4.4). No. No significant adverse impacts were identified for Alternatives 2 or 3 on ocean or coastal habitats or EFH. The alternatives provide additional protection to areas around Kodiak Island where area closures are proposed. Alternative 3 is less protective of habitat than Alternative 2 because it allows an exemption to the area closures for vessels that meet a 100% observer coverage requirement. Substantial damage to ocean or coastal habitat or EFH by Alternatives 2 or 3 is not expected.

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

(EA Section 0). No. Public health and safety will not be affected in any way not evaluated under previous actions or disproportionately as a result of the proposed action. The proposed action for Alternatives 2 and 3 will not change fishing methods (including gear types), timing of fishing, or quota assignments to gear groups, which are based on previously established seasons and allocation formulas in regulations.

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

(EA Section 4.3). No. Alternatives 2 and 3 would create area closures around Kodiak Island in the Central GOA. The proposed action would not change the Steller sea lion protection measures, ensuring the action is not likely to result in adverse effects not already considered under previous ESA consultations for Steller sea lions and their critical habitat. The area adjacent to these closures, into which the groundfish vessels may be displaced, is not identified as critical habitat for any ESA-listed species and population level effects are not expected. Because there will be no change in overall harvest, the alternatives are not likely to adversely affect ESA-listed species or their designated critical habitat.

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

(EA Section 4.5). No significant adverse impacts on biodiversity or ecosystem function were identified for Alternatives 2 or 3. The alternatives would provide protection to biodiversity and ecosystem function by creating area closures around Kodiak Island, and likely benefit marine features that provide an ecosystem function. No significant effects are expected on biodiversity, the ecosystem, marine mammals, or seabirds.

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

(EA/RIR/IRFA Chapters 4, 6, and 7). Socioeconomic impacts of this action result from displacement of vessels that fish in the proposed area closures, or additional costs associated with the options that would allow them to be exempted from the closures. The social or economic impacts of the alternatives are not expected to be significant as target fish are harvested in areas adjacent to the proposed closure areas, and meeting the requirements for the exemptions do not appear to be excessively expensive to the groundfish fleet. Beneficial social impacts are likely for those who depend on directed fisheries for *C. bairdi* crab, a resource that may be protected by this action. No significant adverse impacts were identified for Alternatives 2 or 3 for social or economic impacts interrelated with natural or physical environmental effects.

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

No. This action is limited to specific areas around Kodiak Island in the Central GOA, areas that are historically of value to the groundfish fleet. Development of the proposed action has involved participants

from the scientific and fishing communities and the potential impacts on the human environment are well understood. No issues of controversy were identified in the process (EA Sections 4 and 6).

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

(EA Section 4). No. This action would not affect any categories of areas on shore. This action takes place in the geographic area of the Central GOA. The land adjacent to this marine area may contain archeological sites of native villages. This action would occur in adjacent marine waters so no impacts on these cultural sites are expected. The marine waters where the fisheries occur contain ecologically critical areas. Effects on the unique characteristics of these areas are not anticipated to occur with this action because of the amount of fish removed by vessels are within the total allowable catch (TAC) specified harvest levels and the alternatives provide protection to EFH and ecologically critical nearshore areas.

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

No. The potential effects of the action are well understood because of the fish species, harvest methods involved, and area of the activity. For marine mammals and seabirds, enough research has been conducted to know about the animals' abundance, distribution, and feeding behavior to determine that this action is not likely to result in population effects (EA Sections 4.3). The potential impacts of different gear types on habitat also are well understood, as described in the EFH EIS (NMFS 2005) (EA Section 4.4).

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

(EA Chapter 4.6). No. Beyond the cumulative impact analyses in the 2006 and 2007 harvest specifications EA and the Groundfish Harvest Specifications EIS, no other additional past or present cumulative impact issues were identified. Reasonably foreseeable future impacts in this analysis include potential effects of global warming. The combination of effects from the cumulative effects and this proposed action are not likely to result in significant effects for any of the environmental component analyzed and are therefore not significant.

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

(EA Section 4). No. This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources. Because this action occurs in marine waters, this consideration is not applicable to this action

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

(EA Section 4). No. This action poses no effect on the introduction or spread of nonindigenous species into the Gulf of Alaska beyond those previously identified because it does not change fishing, processing, or shipping practices that may lead to the introduction of nonindigenous species.

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

No. This action would provide for additional protection to GOA *C. bairdi* crab by imposing area closures. This action does not establish a precedent for future action because area closures have been frequently used as a management tool for the protection of marine resources in the Alaska groundfish fisheries. Pursuant to NEPA, for all future actions, appropriate environmental analysis documents (EA or EIS) will be prepared to inform the decision makers of potential impacts to the human environment and to implement mitigation measures to avoid significant adverse impacts.

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

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

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

(EA Section 4.2 and 4.6). No. The effects on target and non-target species from the alternatives are not significantly adverse as the overall harvest of these species will not be affected. No cumulative effects were identified that added to the direct and indirect effects on target and nontarget species would result in significant effects.

10 Preparers and agencies and persons consulted

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Appendix A Color Figures

Nonpelagic trawl

Observed <i>C. bairdi</i> Tanner crab bycatch in the nonpelagic trawl groundfish fishery, summed over 2001-2009.....	B
Observed groundfish catch in the nonpelagic trawl groundfish fishery, summed over 2001-2009.....	B
Observed rate of bycaught crab per metric ton of groundfish catch in the nonpelagic trawl groundfish fishery, for the period 2001 to 2009.....	C
Groundfish catch by vessels targeting arrowtooth flounder, for the period 2003-2009.....	D
Groundfish catch by vessels targeting shallow water flatfish, for the period 2003-2009.....	D
Groundfish catch by vessels targeting flathead sole, for the period 2003-2009.....	E
Groundfish catch by nonpelagic trawl vessels targeting pollock, for the period 2003-2009.....	E

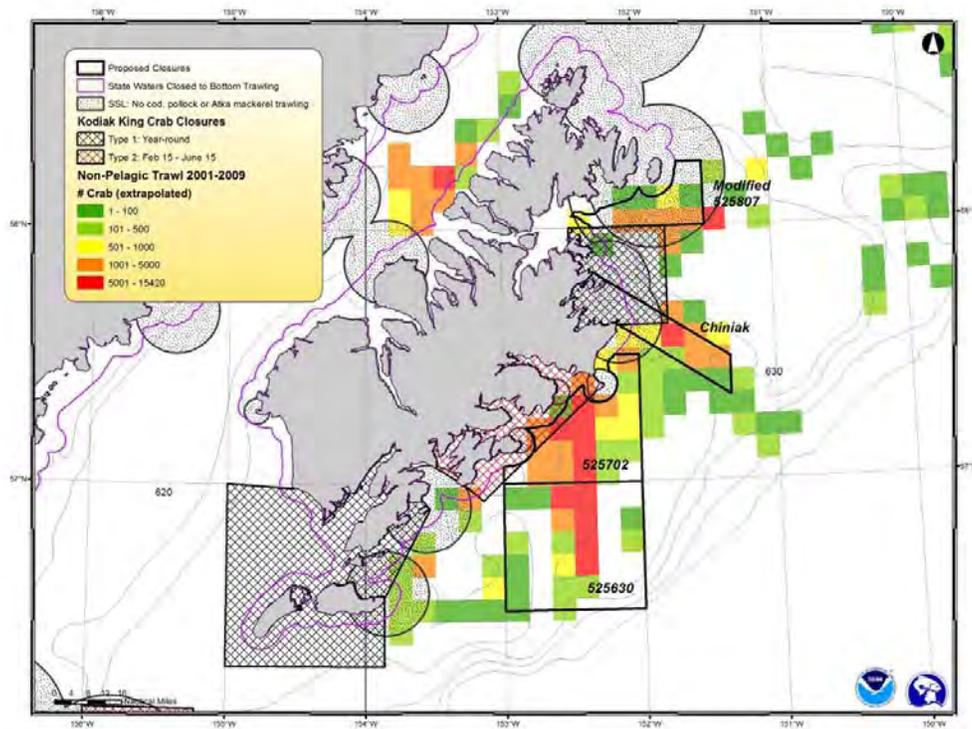
Pelagic trawl

Observed <i>C. bairdi</i> Tanner crab bycatch in the pelagic trawl groundfish fishery, summed over 2001-2009.....	D
Observed groundfish catch in the pelagic trawl groundfish fishery, summed over 2001-2009.....	G
Observed rate of bycaught crab per metric ton of groundfish catch in the pelagic trawl groundfish fishery, for the period 2001 to 2009.....	G

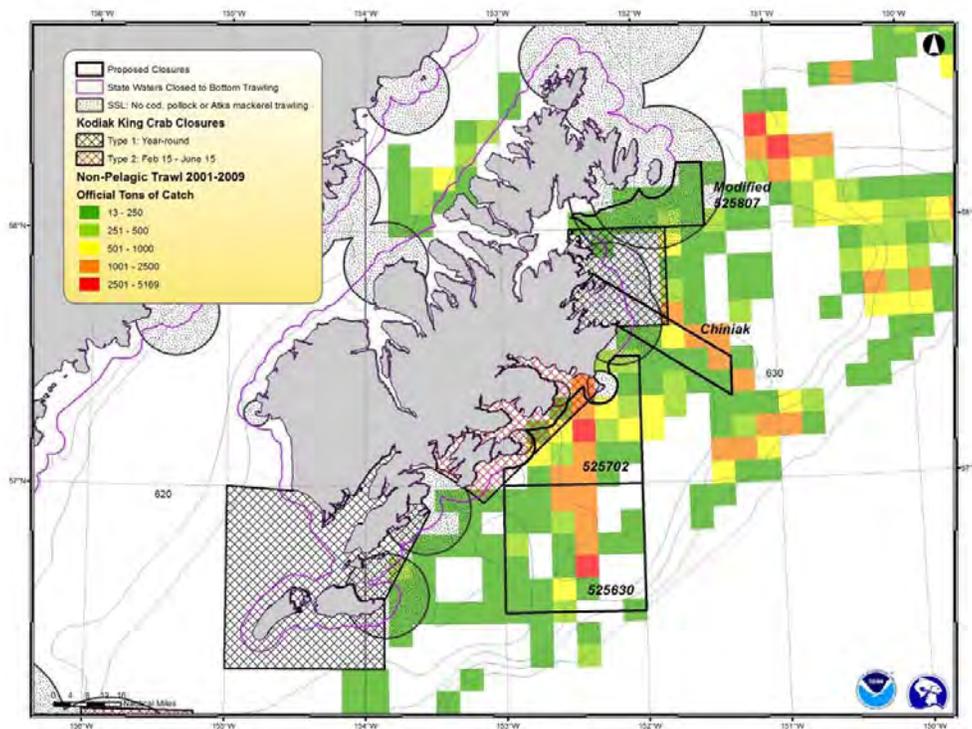
Pot

Observed <i>C. bairdi</i> Tanner crab bycatch in the pot groundfish fishery, summed over 2001-2009.....	H
Observed groundfish catch in the pot groundfish fishery, summed over 2001-2009.....	H
Observed rate of bycaught crab per metric ton of groundfish catch in the pot groundfish fishery, for the period 2001 to 2009.....	I

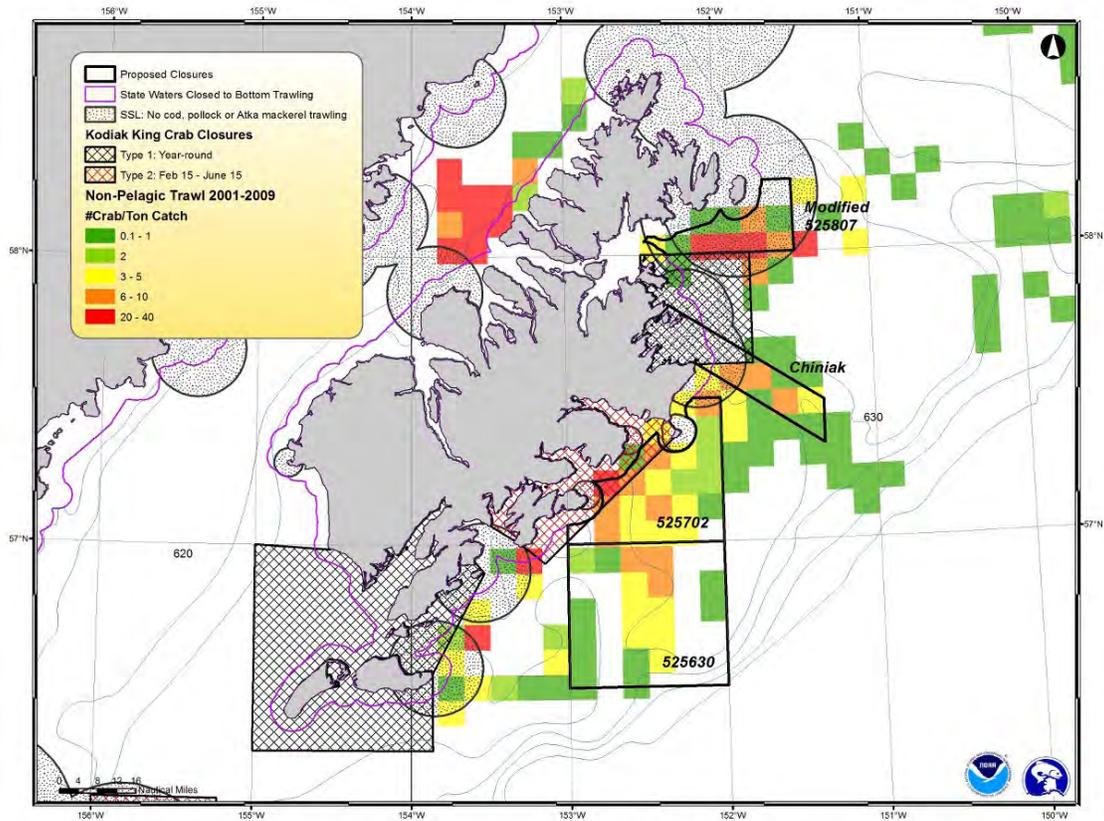
Color Figure 1 Observed *C. bairdi* Tanner crab bycatch in the nonpelagic trawl groundfish fishery, summed over 2001-2009



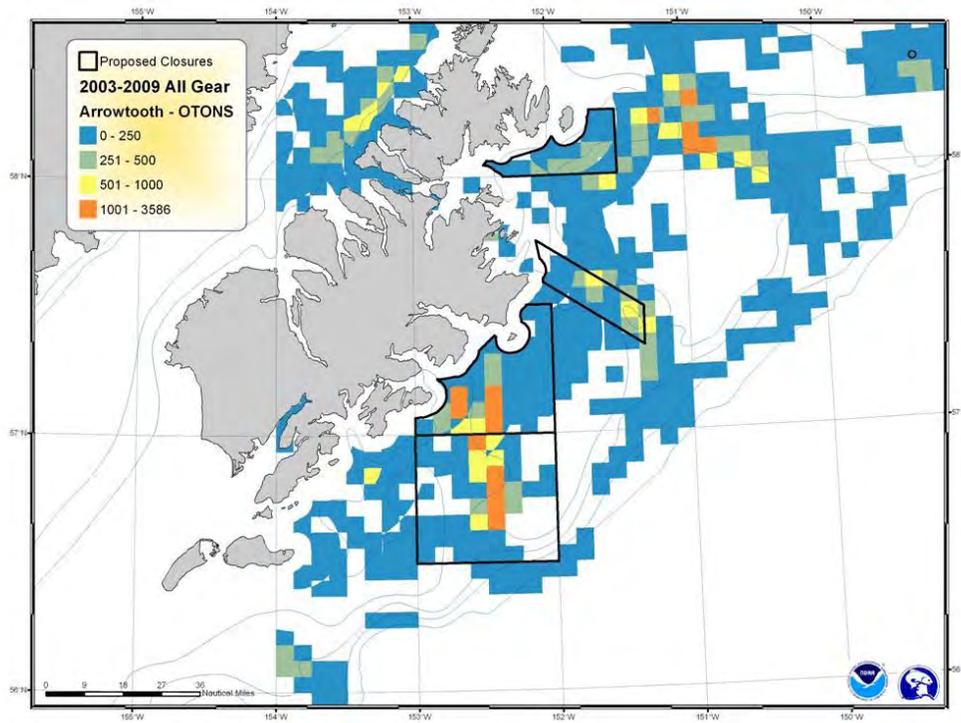
Color Figure 2 Observed groundfish catch in the nonpelagic trawl groundfish fishery, summed over 2001-2009



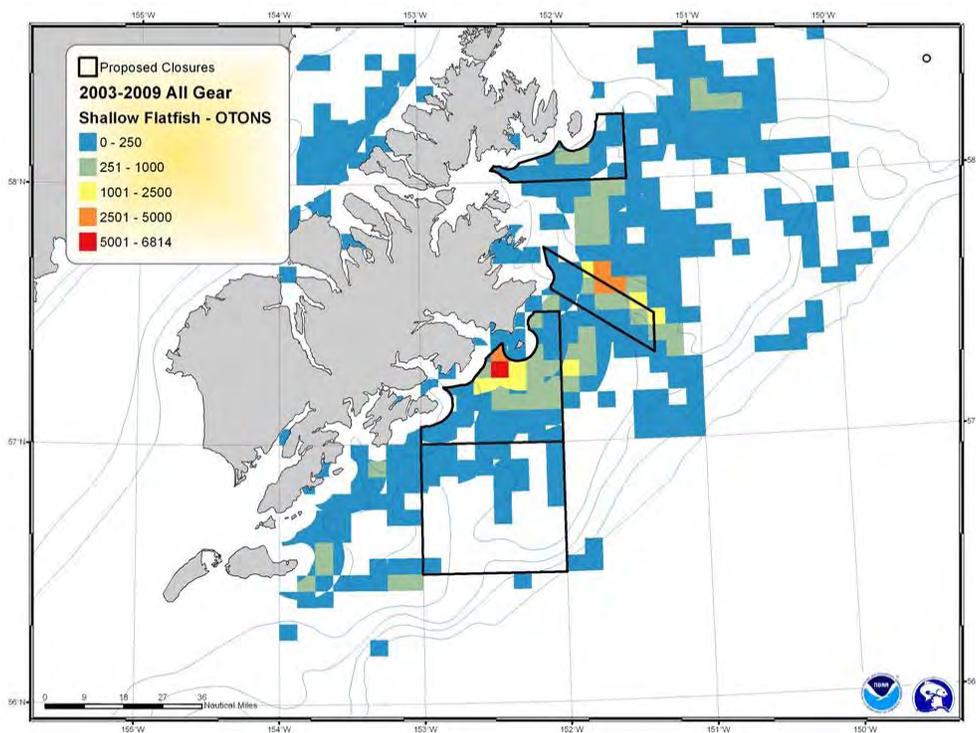
Color Figure 3 Observed rate of bycaught crab per metric ton of groundfish catch in the nonpelagic trawl groundfish fishery, for the period 2001 to 2009



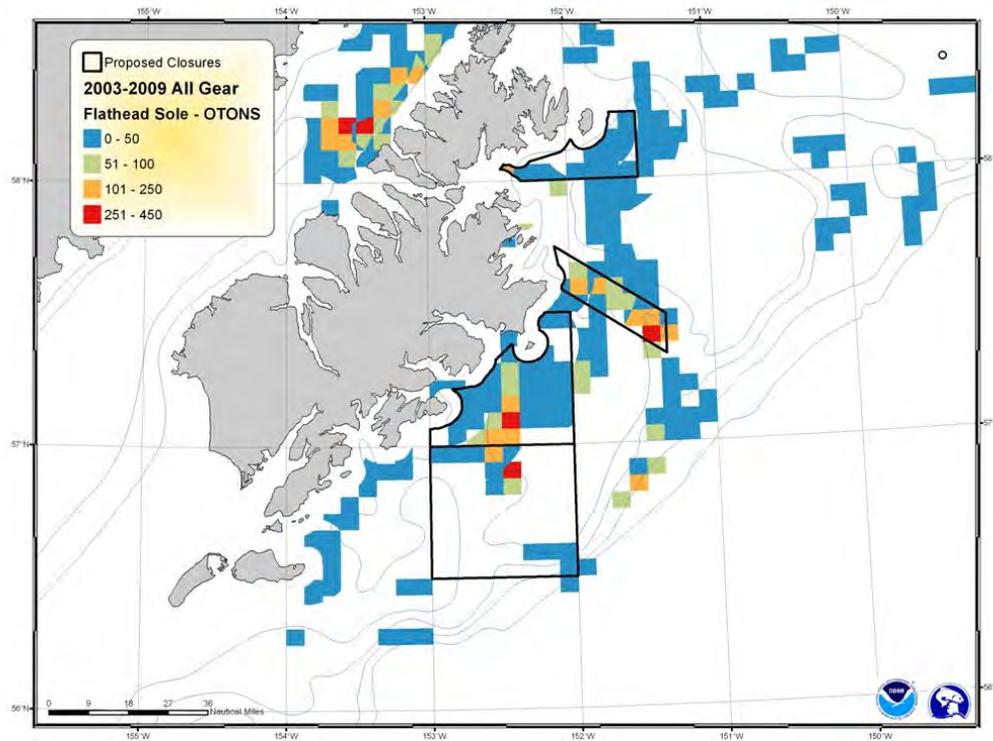
Color Figure 4 Groundfish catch by vessels targeting arrowtooth flounder, for the period 2003-2009 (from NMFS catch-in-areas database)



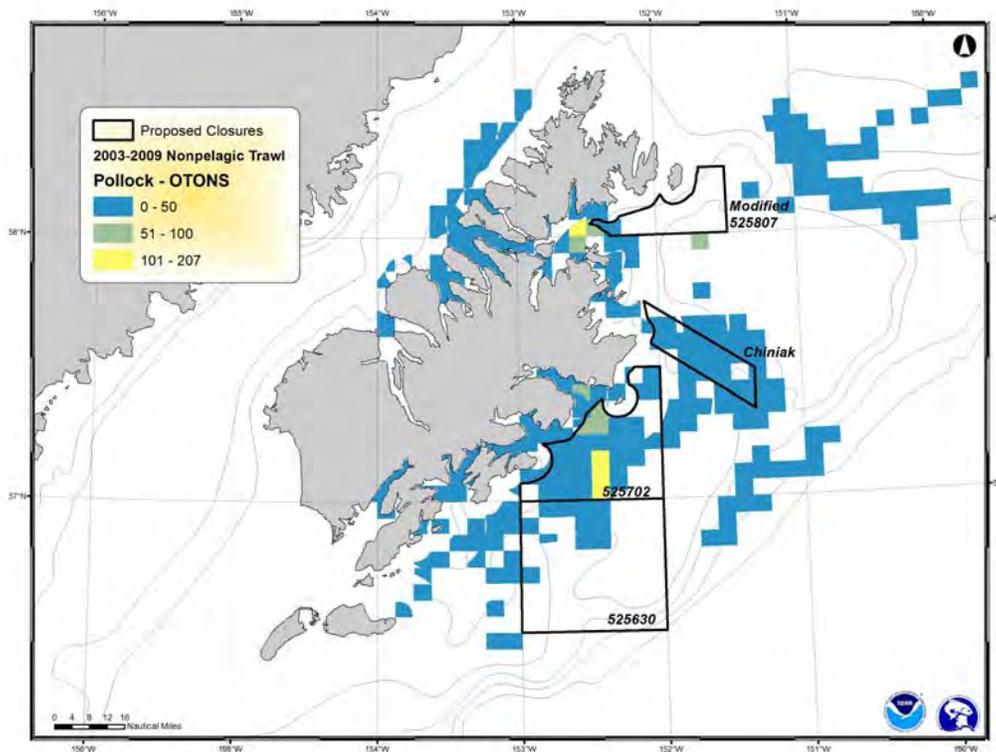
Color Figure 5 Groundfish catch by vessels targeting shallow water flatfish, for the period 2003-2009 (from NMFS catch-in-areas database)



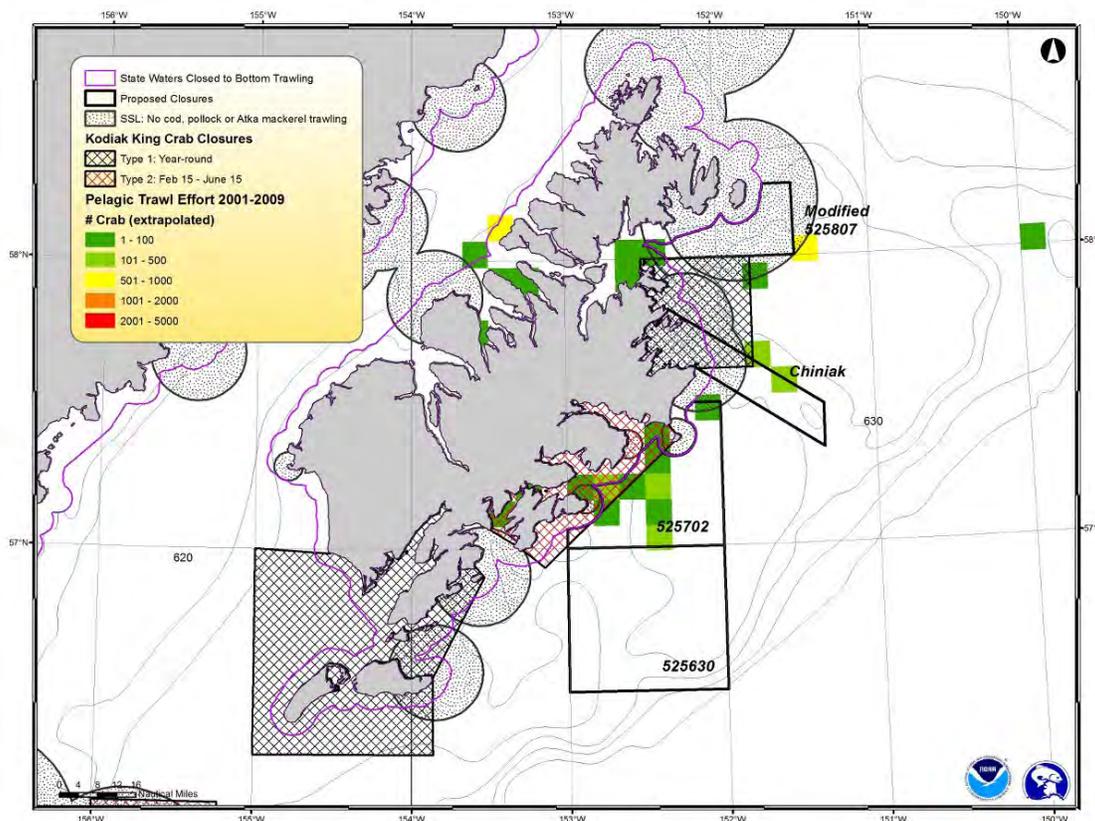
Color Figure 6 Groundfish catch by vessels targeting flathead sole, for the period 2003-2009 (from NMFS catch-in-areas database)



Color Figure 7 Groundfish catch by nonpelagic trawl vessels targeting pollock, for the period 2003-2009 (from NMFS catch-in-areas database)

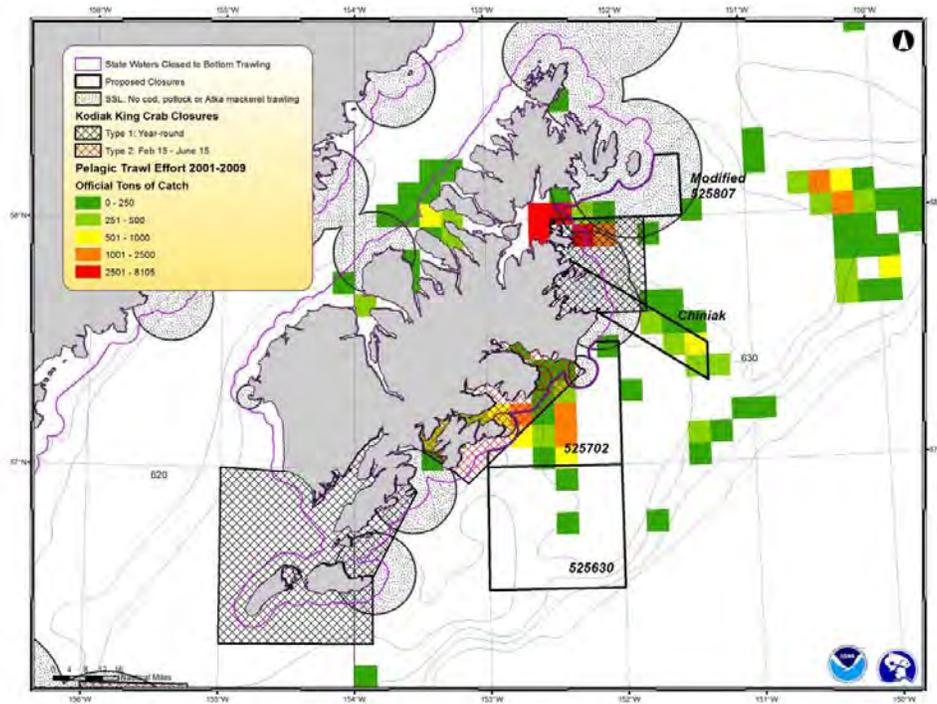


Color Figure 8 Observed *C. bairdi* Tanner crab bycatch in the pelagic trawl groundfish fishery, summed over 2001-2009¹⁰

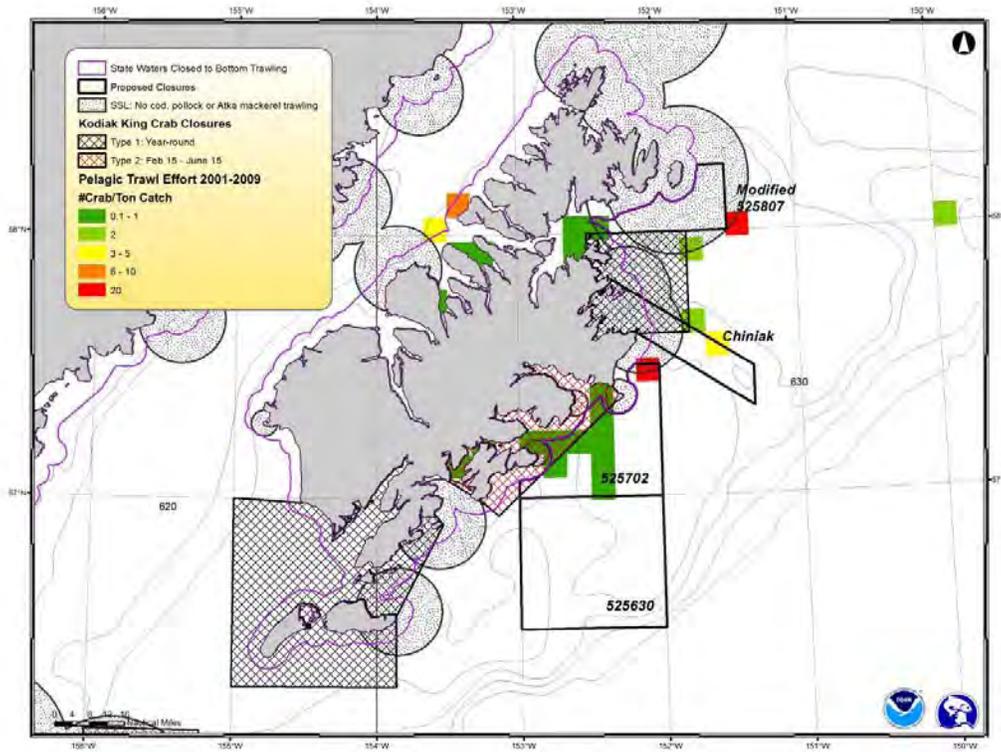


¹⁰ There is an important limitation in the observer program data for PSC from the shoreside pollock fishery when it is used for spatial analysis. The limitation is due to a technical database problem, which was corrected by NMFS re-design of the observer database implemented in 2008. The issue is that PSC in the shoreside pollock fishery are sampled at the plant, rather than onboard the vessel. This is because of the particular handling of large volumes of catch in the pollock fishery. Typically, catch is rapidly placed in below deck refrigerated seawater tanks and there is limited opportunity to take large samples. As all hauls are mixed together in the vessel's hold, the entire delivery is monitored for PSC at the shoreside plant upon delivery. Prior to 2008 the Observer Program database did not provide for capturing the delivery level information. Instead, the delivery level were proportioned back to individual tows made during the trip. This was done to fit the data into the existing system. We caution that care must be exercised when attempting to interpret PSC rates at the haul level. The spatial distribution currently displayed in the document maps the bycatch data by individual tows. In effect, this averages the bycatch among several hauls at several locations, when in fact it could possibly be the case that all the bycatch was caught during one haul in one location, and other locations had little or no associated bycatch.

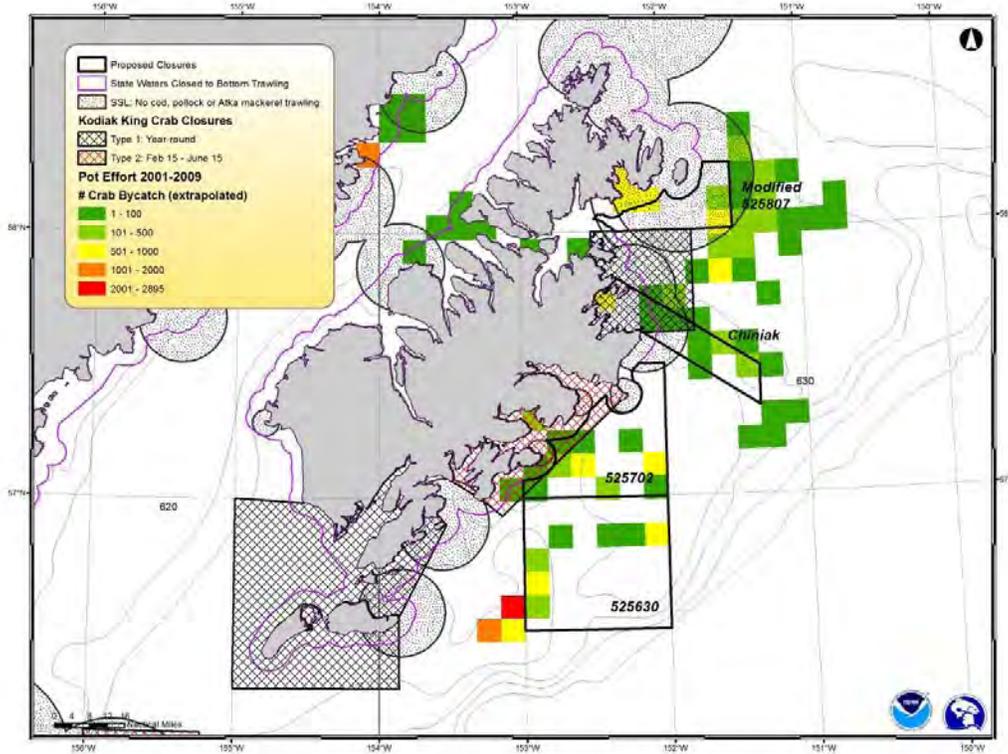
Color Figure 9 Observed groundfish catch in the pelagic trawl groundfish fishery, summed over 2001-2009



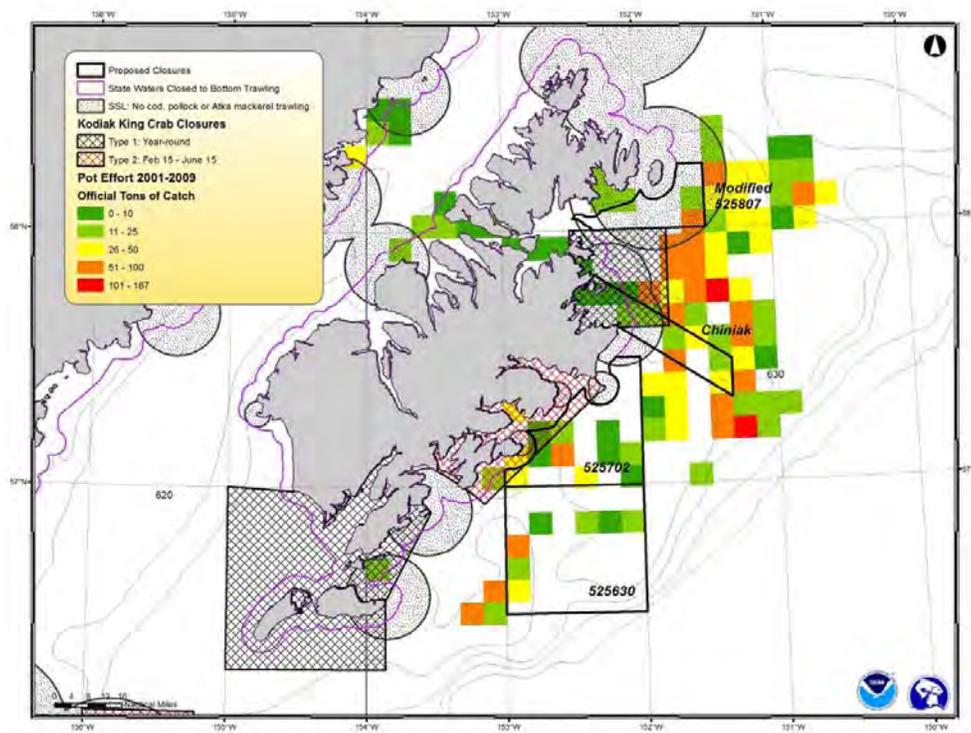
Color Figure 10 Observed rate of bycaught crab per metric ton of groundfish catch in the pelagic trawl groundfish fishery, for the period 2001 to 2009



Color Figure 11 Observed *C. bairdi* Tanner crab bycatch in the pot groundfish fishery, summed over 2001-2009



Color Figure 12 Observed groundfish catch in the pot groundfish fishery, summed over 2001-2009



Color Figure 13 Observed rate of bycaught crab per metric ton of groundfish catch in the pot groundfish fishery, for the period 2001 to 2009

