AGENDA D-1(g)
DECEMBER 2007

ESTIMATED TIME
8 HOUR
(all D-1 items)

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver
Executive Director

DATE: November 30, 2007

SUBJECT: Gulf of Alaska Salmon and Crab Bycatch

ACTION REQUIRED:

Review discussion paper, and take action as necessary

BACKGROUND:

In October 2007, the Council tasked staff to update a previous discussion paper on options for salmon and crab bycatch reduction measures in the GOA. The previous paper was presented to the Council in October 2005, as part of the GOA groundfish rationalization initiative. In this revised draft, we provide updated information on salmon and crab bycatch, an overview of species abundance and discuss the alternatives that had been under consideration in 2005. The revised discussion paper is attached as Item D-1(g)(i).

Salmon and Crab Bycatch Measures for GOA Groundfish Fisheries

December 2007 Staff Discussion paper

INTRODUCTION

The North Pacific Fishery Management Council (Council) has adopted measures over the years to control the bycatch of some species taken incidentally in groundfish fisheries (Witherell and Pautzke, 1997). Bycatch control measures have been established in the Bering Sea and Aleutian Islands trawl fisheries for Chinook salmon (*Oncorhynchus tshawytscha*), 'other salmon' (consisting primarily of chum salmon, *O. keta*), Pacific herring (*Clupea pallasi*), Pacific halibut (Hippoglosses stenolepis), red king crab (*Paralithodes camtschaticus*), Tanner crab (*Chionoecetes bairdi*), and snow crab (*C. opilio*). Halibut bycatch limits and bottom trawl closure areas to protect red king crab have also been established for Gulf of Alaska (GOA) groundfish trawl fisheries (NMFS 2003). To date, no bycatch control measures have been implemented for salmon or other crab species taken incidentally in GOA groundfish fisheries.

In October 2007, the Council tasked staff to update a previous analysis on options for salmon and crab bycatch reduction measures in the GOA. The previous paper was presented to the Council in October 2005 under the GOA groundfish rationalization initiative. The Council is considering bycatch reduction measures for salmon and crab species in the groundfish fisheries. Species currently under consideration are Chinook salmon, Chum (or 'other') salmon, *C. bairdi* Tanner crab and red king crab. In this paper, we provide a general overview of the available information on salmon and crab bycatch, an overview of species abundance and discuss the alternatives under consideration.

METHODS

Catch and bycatch data were provided by the NMFS regional office and the North Pacific groundfish fishery observer program, and examined to gain insight into the amount, species composition, timing, and location of salmon and crab caught incidentally in GOA groundfish fisheries. NMFS catch statistics for years 1990-2006 for salmon and crab bycatch were summarized annually by each groundfish trawl fishery. Additionally, the amount of bycatch was reported by both a weekly and quarterly period to determine any temporal aspect to the bycatch rates for the fisheries with the highest bycatch. Average amounts of bycatch for multiple years and for percent contribution by individual fisheries were calculated with equal weighting given to each year utilized. No attempt was made to weight individual years higher than others. The observer data represented all trawl catch for a given year, and was queried to produce bycatch of observed hauls by target fishery. Specific locations of salmon and crab bycatch were input into a GIS to produce charts of catch locations. Information on crab survey abundance estimates were obtained by published ADF&G reports as well as data provided by the ADF&G staff.

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. The amount of observer coverage is based on vessel length, with 30% coverage required on vessels 60 ft to 125 ft, 100% coverage on vessels larger than 125 ft, and 100% coverage at shore-based processing facilities. There are no observer coverage requirements for vessels less than 60 ft. Since January 2003, observer requirements for pot vessels > 60 feet have been modified such that these vessels are only required to have coverage on 30% of their pots pulled for that calendar year as opposed to the 100% of the fishing days coverage required on other vessels > 125 feet. Observer data provide for accurate and relatively precise estimation of groundfish catch, particularly on fleets with high levels of observer coverage, such as the Bering Sea walleye pollock fishery (Volstad et al. 1997). However, the precision of salmon bycatch estimates depends upon the number of vessels observed and the fraction of hauls sampled within vessels (Karp and McElderry 1999). In the Bering Sea, fisheries such as walleye pollock have a high percentage of hauls that are sampled so fleet wide estimates of salmon bycatch are considered to be reasonably accurate for management purposes (NPFMC 1995a, 1995b, 1999).

For Gulf of Alaska fisheries, observer coverage is lower in some target fisheries due to the prevalence of smaller vessels in the GOA fishing fleet than in the Bering Sea fleet. Only 53% of bottom trawl vessels in the GOA had observed coverage between 1990-2000 (Coon, 2006). Over the past ten years, there has generally been an increasing level of participation by smaller vessels in the GOA groundfish fisheries, particularly trawl and fixed gear catcher vessels less than 60 ft (NPFMC 2003). Therefore, it should be noted that estimates of salmon and crab bycatch in GOA fisheries may be less precise than estimates of bycatch in Bering Sea fisheries.

Catch Accounting

Data from observed vessels is utilized to determine prohibited species catch (PSC) rates when sufficient data are available. The PSC rate is the weight or number of animals per metric tons of groundfish; salmon are calculated by number. All shoreside processing with the same gear, target, and area use an average PSC rate for all observed catcher vessels with the same gear, target, and area. An observed catcher/processor uses the rates from the observer on the vessel. An unobserved catcher/processor uses a PSC rate from observed vessels in the same area and target fishery using the same gear type. The smaller vessels (under 60 ft) with no observers and those that only require 30% observer coverage utilize rates calculated based on the best data available. The first choice is to use one of four different types of "three week average rates" for the same week, reporting area, gear and target. Three of the four types are sector rates that use either observer data from catcher vessels delivering to shoreplants, catcher vessels delivering to motherships or data from catcher processor observers. The sector rates are used and applied to unobserved catch from the corresponding sector if a sufficient number of observer reports are available. The fourth rate combines data from all catcher vessels and catcher processor observers. The combined rate is used only if an insufficient amount of observer data exists to be able to use one of the three sector rates. If one of the four different types of "three week average" sector rates do not have sufficient observations, a substitute rate based on data from prior years, in the same reporting area, gear and target may be used as the second choice. If that is not available, the third choice is for GOA and BSAI annual average year rates using the same gear and target.

Once the PSC rate has been determined, the PSC estimates are computed by multiplying the rate for each prohibited species times the total groundfish weight for the processor from the groundfish catch accounting system. Key information including week, reporting area, gear and target are used to match PSC rates with the groundfish catch.

Several improvements were made to the catch accounting system in 2003 which include computing PSC rates daily instead of weekly. Observed catcher vessels also now use the rates from the observer on the vessel rather than an average PSC rate for all observed catcher vessels applied to the shoreside processor data with the same gear, target, and area. Although this data methodology is not as accurate as having an observer onboard 100% of the hauls on all vessel sizes, it is repeatable and uses the best known information (NMFS, AKR, Mary Furuness personal communication).

MORTALITY RATES

Gear specific mortality rates for crab species have been calculated as 8% for pot gear, 80% for trawl gear, 37% for longline gear, and 40% for scallop dredge gear (NPFMC 1995). NRC (1990) estimates for trawl caught king crab range from 2-81%, while Tanner crab mortality estimates from trawl gear range similarly from 12-82%. Mortality studies for crab which did not distinguish between species estimate trawl mortality rates of 50-100%. Longline mortality rates for crab (no species distinguished) in the GOA range from 0-50% (FAO 1990).

Bycatch mortality rates in the directed snow crab fishery (pot rates) were estimated for discarded snow crabs during the 1998 fishery (Warrenchuck and Shirley 2002). An estimate of 22.2% mortality which included the estimated effects of wind and cold exposure as well as handling injuries was considered to be a conservative estimate because these factors were considered separately and not synergistically (Warrenchuck and Shirley 2002). These results were in agreement with NPFMC estimates for bycatch mortality in the directed crab pot fishery of 25% (NPFMC 1999). Available studies on Tanner crab mortality in the GOA were all laboratory studies of natural mortality in crabs and focused upon snow crab not *C. bairdi* Tanners (e.g. Shirley 2004). No additional studies on trawl or pot caught mortality rates for *C. bairdi* (or any other) crabs in the GOA were available at this time (T. Shirley, personal communication). A summary of mortality rate studies, information and estimated mortality rates is provided in the Stock Assessment and Fishery Evaluation (SAFE) report for the BSAI king and Tanner crabs (NPFMC 2005). Discard mortality rates for red king crab have been estimated at 37% for longline fisheries and 8% for pot fisheries (NPFMC 1999). Estimated bycatch mortality rates for Tanner crab were 45% in longline fisheries and 30% in pot fisheries. Observer data on condition factors collected for crab during the 1991 domestic fisheries, suggested lower mortality of red king crab taken in groundfish pot fisheries (NPFMC 1996).

Salmon mortality rates are also highly variable both by gear type and for different size salmon. Legal-size Chinook salmon caught in troll gear have an estimated mortality rate as low as 8%, while longline gear mortality rates have been estimated to be as high as 100% (FAO 1990). For the purpose of this discussion it is assumed that the full bycatch of salmon has a 100% mortality rate within the longline and trawl fisheries.

REVIEW OF EXISTING CLOSURES

In consideration of additional time and area closures in the GOA groundfish fisheries, it is important to review and consider the interaction of the existing closures in this region. Supplemental Figures 1-4 show the existing state and federal closures in the GOA management area. The timing and purpose of each closure are summarized below (dates in parentheses indicate the year of implementation of the closure).

Kodiak red king crab closures: Type 1 and Type II (1993)
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 non-pelagic gear from February 15 through June 15.

Steller Sea Lion (SSL) 3nm 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 pollock trawl zones- (2003) Groundfish fishing closures related to SSL conservation establish 10 nautical mile (nm) fishing closures surrounding rookeries to protect endangered Steller sea lions.

Scallop closures (1995) Year round closure to scallop dredging to reduce high bycatch of other species (i.e., crabs) and avoid and protect biologically critical areas such as nursery areas for groundfish and shellfish.

Prince William Sound rookeries no fishing zone (2003) Groundfish fishing closures related to SSL conservation include two rookeries in the PWS area, Seal Rocks (60° 09.78' N. lat., 146° 50.30' W. long.) and Wooded Island (Fish Island) (59° 52.90' N. lat., 147° 20.65' W. long.). Directed commercial fishing for groundfish is closed to all vessels within 3 nautical miles of each of these rookeries.

Cook Inlet bottom trawl closure- (2001) Prohibits non-pelagic 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) State managed area provides year round protection from all bottom trawl gear. Closes all state waters (0-3nm) to commercial bottom trawling to protect nearshore habitats and species.

Southeast Alaska no trawl closure-(1998) Year round trawl closure E. of 140° initiated as part the license limitation program.

SALMON BYCATCH

The following section provides updated bycatch information for salmon in the GOA. A more detailed report on salmon bycatch in Alaska groundfish fisheries is provided by Witherell et. al (2002).

Amount of Bycatch

Pacific salmon, including Chinook, chum, coho *(O. kisutch)*, sockeye (*O. nerka*), and pink (*O. gorbuscha*) are taken incidentally in the groundfish fisheries within the Gulf of Alaska. Salmon are not generally caught in longline and pot gear (Berger 2003). However, salmon are taken incidentally in most GOA trawl fisheries, thus this discussion focuses upon bycatch in the trawl sector. Salmon bycatch is currently grouped as Chinook salmon or 'other' salmon, which consists of the other 4 species combined. Over 95% of the 'other salmon' bycatch consists of chum salmon (Table 1). The bycatch of 'other' salmon in the last 3 years (average of 5,052 salmon, 2004-2007) is slightly lower than the time series average (average of 6,787, salmon, 1990-2007). Bycatch of Chinook salmon in the last 3 years (average of 27,274 salmon, 2004-2007) is higher than the time series average (average of 20,422 salmon, 1990-2007).

Other salmon bycatch has declined substantially from the 1993-1995 period. Bycatch of 'other' salmon in the GOA groundfish trawl fisheries from 1993-1995 are shown inTable 1. Bycatch is typically highest in the month of July, in more recent years a maximum of 4,224 in 2005 but has dropped to 605 in 2007 (Table 2). This peak in other salmon bycatch during this period was due to the timing of the pollock trawl fishery. During these years the season opened in July. In 2000, the pollock trawl fishery timing was changed due to changes in regulation for Steller sea lions to the current seasonal openings of January 20, March 10, August 25 and October 1. Since this time the other salmon bycatch has been far less than the peak in 1995. Since 1995, the highest annual amount of other salmon bycatch was 13,539 in 1998, with amounts decreasing to 3,524 in 2007. Other salmon bycatch increased in 2003 to 10,409 but declined again in 2004 to 5,715 and has remained lower than 10,000 in the last 4 years.

Bycatch of Chinook Salmon also fluctuates around the pollock fishery. In recent years (2004-2007) the numbers of Chinook has increased from 15,506 to over 40,000 in 2007. In February of 2005 Chinook bycatch was recorded at over 10,000 fish but has dropped to 1,304 in 2007 (Table 3). March however has seen a greater increase this last year 2007 with over 28,654 estimated. Additionally Chinook bycatch is higher in October with a range of 2,339-10,529 fish caught between 2004 and 2007 (Table 3)

In the 2003-2007 fisheries, an average of about 11,000 Chinook salmon per year were taken by the walleye pollock pelagic trawl fishery, followed by 7,600 in the non-pelagic trawl fishery 1,110 Chinook salmon in the Pacific cod fishery, 3,900 Chinook salmon in the flatfish fishery (all targets combined), and almost 1,000 Chinook salmon in rockfish target fisheries (Table 4). In an average year, the walleye pollock fishery accounted for 75% of the Chinook salmon bycatch, with the trawl fisheries targeting Pacific cod taking 4%, and flatfish fisheries taking 15%. About 1,900 'other' salmon were taken in the walleye pollock fishery, on average, during the 2003-2007 fisheries (Table 5). In 2004, bycatch of other salmon in this fishery was drastically reduced to 594 (in 2004), although the annual bycatch numbers showed an increase to 1,417 and 817 in 2006 and 2007 respectively (Table 5). Out of the average 5 years more of the 'other' salmon bycatch has been taken in the flatfish fishery (44%) followed by the walleye pollock trawl fishery (30%) with the rockfish (26%) also taking a substantial proportion. It is likely that relative amounts of bycatch taken in the walleye pollock fisheries have been lower in recent years due to reduced catch limits for walleye pollock catches.

Location and Timing of Bycatch

The timing of salmon bycatch in GOA fisheries followed a predictable pattern in 2007. Chinook salmon were taken regularly from the start of the trawl fisheries on January 20th through early April, and also in high quantities during June/July and September/October in the walleye pollock fishery (Figure 1). Chum salmon were not taken in any great numbers until mid-June, after which they were taken regularly through the end of the season (Figure 2). The timing of salmon bycatch in 2007 appears similar to what occurred in previous years. Recall that the 2000 fishery exhibited a different temporal pattern of bycatch, perhaps due to the U.S. District Court order that forced the walleye pollock fleet to fish outside of Steller sea lion critical habitat (Witherell et al. 2002).

Salmon bycatch occurs in the western and central GOA management areas, corresponding to locations of the trawl fisheries. Since 1998, the eastern GOA (east of 140°W longitude) has been closed to all trawling, with the implementation of amendment 58 to the GOA groundfish FMP. During the 2003-2006 period, Chinook salmon were taken in relatively higher numbers in some trawl hauls to the east of Kodiak Island (some over 200 salmon per haul from extrapolaitons), although they can be taken in relatively high numbers per haul in other areas (Supplemental Figure 5). During the 2003-2006 period, Other salmon were taken in relatively low numbers along the shelf (Supplemental Figure 6).

Comparison of salmon bycatch with regional and foreign run strength and hatchery release

Several countries in addition to the U.S. have hatchery releases of chum and chinook salmon. The North Pacific Anadromous Fish Commission tabulates summaries of these hatchery releases in millions of fish (Table 6). For Chinook salmon, Canada and the United States share the highest amount of hatchery releases, with the U.S. releases predominantly in the Alaska region and the Canadian releases predominantly located in the western and southern coasts of Vancouver Island. For chum salmon a far greater amount of hatchery releases are recorded in Japan than Canada, the United States or Russia. No correlation is available, however, with the bycatch of salmon in the GOA and the release from any of these hatchery sites.

Origin of Chinook and chum bycatch in the Gulf of Alaska

It is difficult to ascertain direct effects of hatchery salmon releases and bycatch of salmon without specific information on those taken salmon. While some bycatch sampling studies have been conducted for the Bering Sea salmon bycatch in the BSAI trawl fisheries, no studies have been done to specifically address the origin of the GOA trawl fishery bycatch. However some information is available from other studies on the origin of salmon species. The High Seas Salmon Research Program of the University of Washington routinely tags and monitors Pacific salmon species. The Coded Wire Tag (CWT) information may not accurately represent the true distribution of hatchery caught salmon however as much of the CWT tagging occurs within the British Columbia hatcheries and thus most of the CWT recovered come from those same hatcheries. CWT tagging does occur in some Alaskan hatcheries, specifically in Cook Inlet, Prince William Sound, other Kenai region hatcheries as well as in hatcheries in Southeast Alaska (Johnson, 2004). Some CWT studies have also tagged Washington and Oregon salmon and many of these tagged salmon have been recovered in the GOA (Myers et al. 2004). The 2003 program report for the High Seas Salmon Research Program details additional data on west coast salmon tag recoveries (Myers et al 2004). In 2006, 63 tags were recovered in the eastern Bering Sea and GOA (Celewycz et al, 2006). Of these 63 new CWT recoveries, 8 CWT Chinook salmon were recovered from the Gulf of Alaska trawl fishery in 2006 and 2007, 8 CWT Chinook salmon were recovered from the Bering Sea-Aleutian Islands trawl fishery in 2006 and 2007, 44 CWT Chinook salmon were recovered from the Pacific hake trawl fishery in the North Pacific Ocean off WA/OR/CA in 2006, and 3 CWT steelhead were also recovered from Japanese gillnet research in the central North Pacific Ocean. Overall tagging results in the GOA showed the presence of Columbia River Basin chinook and Oregon Chinook salmon tag recoveries (from 1982-2003). Some CWT recovered by research vessels in this time period also showed the recoveries of coho salmon from the Cook Inlet region and southeast Alaska coho salmon tag recoveries along the southeastern and central GOA. Scientists at the University of Washington are currently studying the stock origins of Chinook salmon incidental catch in the eastern Bering Sea (Myers et al. 2004), however no studies have specifically examined the stock composition of salmon bycatch from GOA trawl fisheries.

Future studies of Chinook salmon bycatch will likely utilize allozyme methodology, because the allozyme baseline is complete enough to discriminate Chinook stocks in Bering Sea stock mixtures (Teel et al. 1999). Allozymes have been successfully applied to Chinook mixtures from confiscated high seas Chinook salmon catches (R. Wilmot, National Marine Fisheries Service, Juneau, personal communication). Attempts are underway to obtain further tissue collections from Russian stocks that would improve the accuracy of allozyme methods for delineating stock origins. However, funds to collect and analyze Chinook samples from trawl bycatch are limited. The allozyme methodology, however, has been applied to chum salmon samples collected by research gillnets in the high seas (Urawa et al. 2000). Results indicate that North American chum stocks were common in the central GOA (15% western Alaska, 25% Alaska Peninsula/Kodiak, 28% Southeast Alaska/Prince William Sound, 18% from Canada), and Asian chum salmon were predominant in the western GOA (25% Japan, 53% Russia, 13% western Alaska, 10% elsewhere). Chum salmon research in the Bering Sea was also recently completed, which details additional information on the origin of those stocks (Urawa et al. 2004).

Additional research on stock discrimination for Chinook salmon is being conducted using microsatellite DNA, but the microsatellite DNA baseline is not complete enough at present to be used for analysis of Chinook salmon mixtures that potentially include Chinook salmon throughout the Pacific Rim (A. Gharrett, University of Alaska Fairbanks, personal communication). Current research is focusing upon establishing this baseline for future use in this regard (Gharrett et al. 2005). Preliminary results suggest that there are distinguishable characteristics between U.S., Canadian and Russian salmon stocks (Gharrett et al. 2005).

OVERVIEW OF CHUM AND CHINOOK STOCK STATUS AND COMMERCIAL CATCH

Salmon stocks in the Gulf of Alaska are managed by the State of Alaska. Forecasts of salmon runs (catch plus escapement) for major salmon fisheries and projections of statewide commercial harvest are published annually by ADF&G. For purposes of evaluating the relative amount of bycatch as compared to the commercial catch of salmon by area, Table 7and Table 8 show the commercial catch of Chinook and chum species by management area between 2004 and 2007. It should be noted that these catches are shown here only as a proxy for an indication of run strength for Chinook and chum stocks across the GOA. Available information on individual stocks and run strengths varies greatly by river and management area. Commercial catches are subject to market constraints and thus are not the best estimate of the relative stock size. However, understanding this limitation, some limited information regarding the health of the resource can be obtained by reviewing the commercial catch.

For Chinook stocks, the 2004 catch in the southeast area represented the highest Chinook harvest on record (since statehood) and almost twice the 10-year average (Eggers, 2005). In Prince William Sound, the 2007 harvest was below the projected harvest and the 7th largest since 1985. Cook Inlet harvests were low compared to long term averages as well. For Kodiak, the 2004 harvest was much higher than the previous 10-year average (Eggers, 2006) with lower catches in 2007 compared to the long term average. Estimated Chinook escapement was likewise higher than the escapement objective and greater than the previous 10-year average (Eggers, 2005). For Chignik, the 2004 escapement was the largest on record and greatly exceeded the escapement goal (Eggers, 2006). The harvest of Chinook was approximately equal to the previous 2 years' harvests (under the cooperative management plan) and roughly half of the 10 and 20-year averages. South Alaska Peninsula Chinook harvest in 2007 was less than the 10 year average.

For chum salmon, the Southeast Alaska harvest in 2007 was the ten highest in the last ten years. It was noted that the trend in reduced fishing effort is affecting the ability of the fleet to harvest the available fish in some areas thus the harvest of some species might have been higher had there been greater demand for the product (Eggers, 2006). Prince William Sound chum runs were below the expected enhanced run estimates. In the Upper Cook Inlet, the run was approximately 25% less than the recent 10 year average due primarily to reduced fishing time by the drift fleet (Eggers, 2006). While chum salmon production in south central Alaska has been poor since 1986, incremental improvements have been occurring each year since 1995-1996 and the 2004 runs to most of Cook Inlet were good (Eggers, 2005). Lower Cook Inlet chum harvest in 2004 was the highest catch since 1988 and over 7 times the 10 year average. For the Kodiak management area, the chum harvest was near the forecast and above the ten year average. Overall escapement for Kodiak met the escapement objective but was slightly below the ten year average. Limited aerial surveys led to incomplete escapement estimation for some systems (Eggers, 2006). Chum harvests in the Chignik area were below average but also likely attributable to a lack of commercial effort. Overall Chignik escapement estimates for chum exceeded the sustainable escapement goals. The South Peninsula indexed total chum escapement was above the escapement objective in 2004, while harvests were below the 10 year average (Eggers, 2005).

CRAB BYCATCH

Several species of crabs may be taken incidentally in GOA groundfish fisheries. For purposes of this discussion we are only characterizing the bycatch of red king crab and *Bairdi* Tanner crab species in the GOA groundfish fisheries. Additional information on the bycatch of other crab species in the GOA was provided in previous discussion papers. See the NPFMC website for additional background information: (http://www.fakr.noaa.gov/npfmc/current_issues/groundfish/goacoop.htm)

Amount of Bycatch in Trawl Fisheries

The number of crabs taken as bycatch in GOA groundfish trawl fisheries are shown in Table 9. Bycatch of red king crabs is relatively low. An average of 256 red king crabs were taken in 2004-2007 trawl fisheries.

Since 2003, the majority of red king crab have been taken in the combined flatfish fisheries, and in the rockfish trawl fisheries. The highest amounts of red king crab bycatch since 2003 occurred in 2006 fishery with 345 red king crabs caught, all were from the shallow water flatfish trawl fishery. Previous to that high bycatch was recorded in the rockfish fishery in 2004 with 275 crabs (Table 10).

The bycatch of *C. bairdi* Tanner crabs in GOA trawl fisheries has fluctuated through the time series, reaching a high of 306,767 crabs in 2006 to a low of 29,947 crabs in 1999. Bycatch of *C. bairdi* Tanner crabs in the last 4 years (175,670 crabs per year average, 2004-2007) is higher than the average for the time series from 1993-2004 (109,170 crabs). An examination of the seasonal and annual bycatch of *C. Bairdi* Tanner crabs since 1993, with a specific focus on the recent period (since 2000) was conducted to identify the appropriate limits and the fisheries for which these limits should apply. The bycatch of *C. bairdi* Tanner crabs in GOA groundfish fisheries has fluctuated through the time series, from a low of less than 35,000 crabs in 1994 to a high of over 300,000 crabs in 2007 (Figure 3).

During these years, the highest bycatch of Tanner crabs occurred in 2007, where elevated bycatch in both trawl and pot sectors was observed (Figure 4). The highest numbers of Tanner crab taken as bycatch occur primarily in the trawl fisheries (specifically the Pacific cod trawl and flatfish trawl) and in the pot fishery for Pacific cod. The relative numbers taken over this time period by the combined trawl fisheries (again primarily for Pacific cod and flatfish) as well as the bycatch taken in the Pacific cod pot fishery are shown in Figure 4. In recent years the trawl and pot bycatch has fluctuated as to the higher contribution of bycatch.

The average percent contribution by gear type for *C. bairdi* Tanner crab are: 65% for combined trawl fisheries, 35% for pot fisheries and <0.01% for all longline fisheries (Table 11). Bycatch of *C. bairdi* Tanner crabs in the Pacific cod pot fishery was notably higher from 2005-2007than the estimates from 2003 and 2004. Further examination of the location of the pot cod fishery (and flatfish trawl fishery) would possibly provide an explanation for the relative decrease in crab bycatch in the pot cod fishery and increase in the flatfish fishery. The relative observer coverage in these fleets is notably limited, particularly in the Pacific cod pot fishery. This will be an important aspect for examination in the forthcoming analysis.

Location and Timing of Bycatch in Trawl Fisheries

Bycatch amounts of *C. bairdi* Tanner crab taken in trawl fisheries appear to fluctuate temporally in direct response to groundfish catches, particularly catches of Pacific cod and flatfish, which are managed on a quarterly basis, with the trawl fishery beginning on January 20th each year. The seasons for trawl gear increased to 5 beginning in 2001. Average bycatch of Tanner crabs between 2003 and 2006 (in numbers of crabs) increased dramatically in mid-March due to bycatch in the combined flatfish fishery, and was high from late April through May and once again in mid-October (Figure 5), each time in the flatfish fisheries, notably in the flathead sole fishery (March), Shallow water flatfish (April-May) and Arrowtooth flounder fisheries (October). Bycatch of *C. bairdi* Tanner crabs in 2006 was highest (in numbers of crab) during late March and early April (shallow water flatfish), corresponding to seasonal release of the halibut PSC apportionment for use in the flatfish fishery with an additional spike in late July (Arrowtooth flounder) (**Error! Reference source not found.**).

Bycatch in longline and pot fisheries

Bycatch of red king crab and *C. bairdi* Tanner crab by gear and fishery for 2000-2004 are shown in Table 10 and Table 11. Longline gear catches very few crabs of any species, however in 2005 some crab was taken in the P. Cod and sablefish fisheries.

For red king crab, the average number of crabs taken in all fisheries for 2004-2007 is 256 crabs. Of this, 77% were in the trawl fishery, 3% in the pot fishery and 14% in the longline fishery.

Bycatch of *C. bairdi* Tanner crabs in the Pacific cod pot fishery was notably higher from 2004-2007. Further examination of the location of the pot cod fishery (and flatfish trawl fishery) would possibly provide an explanation for the relative decrease in crab bycatch in the pot cod fishery and increase in the flatfish fishery. Also, as was noted in the previous discussion, the relative observer coverage in these fleets is limited, particularly in the Pacific cod pot fishery (Table 11).

Contribution to bycatch by the state waters cod fishery

An examination was made of the state waters Pacific cod fishery contribution to the *C. bairdi* Tanner crab bycatch amounts (Table 12). Preliminary data were obtained by ADF&G for three locations in the Western GOA: Kodiak, South Peninsula and Chignik. Data were available for various years in each location. In the Kodiak region, data were obtained for 1997-1999, 2001-2002 2004-2006. Of these years, 2001 showed the highest number of Tanner crab, 171 crab. It was noted by ADF&G that this was obtained in only one observed trip. In the S. Peninsula region, the highest number of Tanner crab was obtained in 2001 where 52 crab were caught and 25 in 2006 as compared with 0 to 1 in all other years for which data were obtained for this region (1998-2006). For Chignik, 2003 was the only year for which preliminary data were available. Here 42 crabs were obtained as bycatch. The state waters bycatch numbers for *C. bairdi* Tanner crab are still low in comparison to total *C. bairdi* Tanner numbers in the GOA. Currently due to the absence of a full state onboard observer program less than 1% of the state waters fishery is observed. ADF&G staff had noted that due to rising concerns regarding the limited available observed pots increased effort would be made to observe more trips in future fisheries (Mike Ruccio, personal communication). Unfortunately, the short and intense season in 2007 made it very difficult for ADF&G staff to allocate a dockside sampler for an observer trip thus only one new observer trip was possible last year (Kally Spalinger, personal communication).

OVERVIEW OF CRAB MANAGEMENT AND STOCK STATUS

Crab fisheries in the GOA are solely managed by the State of Alaska. Abundance estimates are produced by region (where possible). For most regions actual abundance estimates are limited and commercial fishing has been closed. An annual trawl survey is conducted by ADF&G. The survey methodology is designed to concentrate sampling in areas of historical king and Tanner crab abundance (Figure 7).

Red King Crab:

Major red king crab fisheries have occurred historically in the Kodiak and Alaska Peninsula Areas. Stock size is estimated by an annual trawl survey, and fisheries are opened if biomass estimates meet or exceed threshold levels established by the state. The Kodiak area red king crab population remains at historically low levels (Mattes & Spalinger, 2007). Fishing seasons for Kodiak red king crabs have remained closed since the 1982/83 season.

Results from the 2006 Kodiak trawl survey estimated the red king crab population at 215,976 animals (up from 113,710 crabs in 2005 and down from 369,779 in 2004). The majority of the crabs were found in the Southwest and Shelikof districts (Spalinger, *In prep*). The mature red king crab female population was estimated to be 74,259 animals, well below the 5.1 million threshold required for a fishery opening (Mattes & Spalinger, 2007) Population estimates for Kodiak based on 1994-2004 ADF&G trawl surveys are shown in Figure 9.

Results from the 2006 Alaska Peninsula survey indicated that the red king crab population there remains at very low levels. The estimated population from the survey was 34,178 crabs, a decrease from the estimated 31,102 from the 2005 survey (Spalinger, *In prep*). The stock is notably patchy in distribution as well as at low levels, hence biomass estimates can be wildly varying from year to year. The fishery has been closed since the 1982/83 season. Population estimates for the Alaska Peninsula based on 1994-2004 ADF&G trawl surveys are shown in Figure 9.

For the Cook Inlet management region, no population abundances are estimated, but the survey is used to provide a relative abundance index (thus no extrapolation is done on survey data for an overall population abundance estimate). However, based on the abundance index, the red king crab stocks in the Cook Inlet management region are considered to be severely depressed and patchily distributed. It was noted in the assessment that all of the current populations of red king crabs in the region are vital to supporting the existing population (Bechtol et al. 2002).

In the Southeast management region, pot surveys are used to estimate trends in abundance in northern and southern bays of the region, however a regional estimate of total population is not available. Survey results are utilized to estimate relative abundances, estimated as catch per pot day for each sex and size class of crabs. Survey results indicated greater increases in abundance in the northern regions though both northern and southern regions have abundances comparable to the relatively high abundances seen in the early 1980s (Clark et al. 2003). A commercial fishery for combined red and blue king crab in the Southeast will open in 2005 with a combined GHL of 20,000 pounds.

Tanner Crab:

Commercial fishing for *C. Bairdi* in 2007 occurred in areas of the Eastside and Northeast Sections of the Kodiak District and the Western Section of South Peninsula District. GHLs by region were the following in 2007: Kodiak (Eastside and Northeast sections combined) 800,000 (pounds), and South Peninsula 200,000 pounds. For 2008 the GHLs (fishery begins January 15, 2008) will be Kodiak District 500,000 pounds and South Peninsula 250,000 pounds.

For *C. bairdi* Tanner crab, 2006 population estimates for the Kodiak District are at approximately 165 million crabs, for S. Peninsula 77.3 million crabs, and Chignik 42 million crabs (Spalinger, 2006). Population estimates for Kodiak based on 1994-2006 ADF&G trawl surveys are shown in Figure 10. For the S. Peninsula this estimate represents an increase from the previous survey. Recent survey results indicate an increase in females from 2006-2007 (Spalinger, 2007).

Population estimates for Cook Inlet management region list male *C. bairdi* Tanner crab abundances in the Southern region as 3.1 million males, however it was noted that the estimate of legal sized males is at a historic low. Female abundance in this region was estimated at 2.1 million crabs in 2001, primarily due to a very high number of estimated juveniles. The southern region has been closed to commercial fishing due to low crab abundances since 1995 (Bechtol et al 2002).

The Kamishak and Barren Islands District of the Cook Inlet management region has also been closed to commercial fishing (since 1991) due to concerns of low crab abundance. In these regions the male abundance is estimated at 6.1 million crabs, with a near historic low in mature males, while female abundance is estimated at 5.1 million crabs with a record low percentage of mature females. There is limited data to assess the Outer, Eastern, and Central Districts of the Cook Inlet management region and both regions have been closed to commercial fishing (since 1998 for Central and 1993 for Eastern/Outer).

For the Southeast region, a population survey was begun in 1997/1998 to evaluate regional distribution of *C. bairdi* Tanner crab stocks and the relative abundance estimates. However, at present, no estimates of overall *C. bairdi* Tanner crab abundance in the region are available.

COMPARISON OF SURVEY ABUNDANCE, EXISTING CLOSURES AND TRAWL FISHERY BYCATCH (through 2002)

Tanner crab bycatch in all fisheries from 2000-2002 is shown with the survey abundance estimates for 2002 and existing closures in the area near Kodiak Island (Supplemental Figure 7). The bycatch is highest in the areas of Marmot Bay, along Albatross Bank, the southern and eastern shore of Kodiak, and northeast of the Trinity Islands. Some bycatch is also concentrated in Shelikof Strait. The highest concentration of Tanner crabs from the ADF&G survey are found in Alitak Bay, Ugak Bay and to the north of Marmot Bay (Supplemental Figure 7). The ADF&G survey area is not uniform across the Kodiak Region, and is instead concentrated in areas of historical biomass of king and Tanner crabs (Figure 7). Additional information on the actual size and sex distributions of crabs by area and year are available in the assessment report (e.g., Worton, 2002).

Red king crab bycatch in all fisheries from 2000-2002 is shown with the survey abundance estimates for 2002 and the existing closures in the area near Kodiak Island (Supplemental Figure 8). Limited bycatch is observed in this area in these years, however some red king crab bycatch was observed on Portlock Bank to the east of Marmot Island. The highest concentration of red king crabs from the 2002 survey were observed in Alitak Bay and Uyak Bay. Smaller numbers of crabs were found near Cape Chiniak. Again, additional information on the actual size and sex distribution of red king crabs by area and year are available in the assessment report (Spalinger, 2006).

DISCUSSION

In February 2002, the Council initiated the analysis of alternatives to control salmon bycatch in the GOA groundfish trawl fisheries, and proposed alternatives, which included bycatch limits based on 1990-2001 average bycatch amounts (21,000 Chinook salmon and 20,500 'other' salmon). Attainment of these limits by trawl fisheries would result in closure of specified areas for the remainder of the fishing year. The Council further clarified that specified areas would be designated based on analysis of areas that have had historically high bycatch rates. Recent analysis suggests that these bycatch limit amounts may not reflect the current manner in which the groundfish trawl fisheries operate and the reduced bycatch of salmon in more recent years.

Draft Alternatives as modified by the Council in June 2005:

Draft bycatch reduction alternatives have been incrementally refined by the Council since first drafted in December 2003. The alternatives had been folded into the larger GOA groundfish rationalization EIS package for analysis, however based on Council discussion in October 2007 the analysis may occur on a separate tract. Providing the additional information as contained in this paper is intended to assist the Council in further refining the alternatives and focusing the measures appropriately.

The following are the draft alternatives:

<u>Chinook Salmon</u>

Alternative 1: Status Quo (no bycatch controls).
Alternative 2: Trigger bycatch limits for salmon. Specific areas with high bycatch (or high bycatch rates) are closed seasonally (could be for an extended period of time) if or when a trigger limit is reached by the pollock fishery.
Alternative 3: Seasonal closure to all trawl fishing in areas with high bycatch or high bycatch rates.
Alternative 4: Voluntary bycatch coop for hotspot management.

<u>Other Salmon</u>

Alternative 1: Status Quo (no bycatch controls).
Alternative 2: Trigger bycatch limits for other salmon. Specific areas with high bycatch (or high bycatch rates) are closed for the remainder of the year if or when a trigger limit is reached by the pollock trawl fishery (and potentially additional areas for flatfish trawling).
Alternative 3: Seasonal closure to all trawl fishing in areas with high bycatch or high bycatch rates.
Alternative 4: Voluntary bycatch coop for hotspot management.

<u>Tanner Crab</u>

Alternative 1: Status Quo (no bycatch controls).
Alternative 2: Trigger bycatch limits for Tanner crab. Specific areas with high bycatch (or high bycatch rates) are closed for the remainder of the year if or when a trigger limit is reached by:
Options: a) trawl flatfish fishery
b) all bottom trawling
c) groundfish pot
Alternative 3: Year-round closure in areas with high bycatch or high bycatch rates of Tanner crab by gear type.
Alternative 4: Voluntary bycatch coop for hotspot management.

<u>Red King Crab</u>

Alternative 1: Status Quo (no bycatch controls).
Alternative 2: Trigger bycatch limits for red king crab. Specific areas with high bycatch (or high bycatch rates) are closed to flatfish trawling for the remainder of the year if or when a trigger limit is reached by the flatfish fishery.
Alternative 3: Year-round bottom trawl closure in areas with high bycatch or high bycatch rates of red king crab.
Alternative 4: Voluntary bycatch coop for hotspot management.

Estimating Trigger Limits

Trigger limits as proposed under alternative 2 would close designated areas (as yet to be defined) to trawling in specified fisheries once a bycatch limit has been reached. For instance, for Chinook salmon, once a bycatch limit has been reached, the designated area closure would be closed to pollock fishing for the remainder of the year. Likewise for Tanner crab, once the bycatch limit has been reached, the area closure for the flatfish fishery would go into effect for the remainder of the year. For other salmon, trigger limits may also be considered for flatfish trawl fishery (in addition to pollock trawl fishery) given the relative contribution of bycatch by that fishery.

At their June 2005 meeting, the Council provided direction to staff in proceeding with this analysis (Appendix A). Staff were encouraged to look at abundance-based methodologies in considering potential trigger limits. These could be either based on an estimate of, or float as a percentage of, the overall biomass of PSC species. This approach has been utilized in the BSAI groundfish fisheries using a stair-step procedure for crab species such as red king crab, an abundance-based zonal approach for *C. bairdi* Tanner crab and as a percentage of annual biomass estimates for snow crab. Biomass-based limits require a good understanding of the relative stock status for that species. A full description of stock status and the relative understanding of the health and vulnerability of crab stocks in the GOA will be included in the forthcoming analysis of these measures and will be integral to determining the appropriate mechanism for establishing trigger limits.

The proposed alternatives using trigger closures would work similar to other existing PSC management measures. Currently in the GOA, PSC limits exist in the flatfish fishery for halibut only, whereby if a given apportionment is reached within a specified season, the flatfish fishery is then closed for the remainder of that season. Trigger bycatch limits as proposed here would be similar, but would not close the area-wide flatfish fishery. Instead, designated high bycatch or hotspot areas would be closed to the fishery if the given trigger bycatch limit was reached while the fishery was being prosecuted. Similar trigger closures have been implemented in the Bering Sea to control the bycatch of Tanner crab, snow crab (*C. Opilio*) and red king crab (Witherell and Pautzke 1997).

Determining Appropriate Area Closures

Year-round and seasonal trawl closures, such as those as proposed under alternative 3, have also been used in both the GOA and BSAI fisheries to control the bycatch of prohibited species. Currently in the GOA, trawl closure areas have been implemented around Kodiak Island to protect red king crab. Specific areas are designated as Type I, Type II and Type III areas depending upon the importance of the area to concentrations of red king crab at various life stages. Type I closures are closed year-round to all non-pelagic trawling. Type II areas are closed during the molting period for red king crab (February 15-June 15), while Type III areas are closed only during specified 'recruitment events" and are otherwise opened year-round. These closures are delineated in green (year-round) and red (seasonal) in figure 18.

For salmon, however, the highest bycatch is seasonal and is tied to the timing of the walleye pollock fishery. Here seasonal closures of hot spot locations could possibly be examined rather than year-round closures. Seasonal salmon closures have been utilized to control salmon bycatch in the BSAI groundfish fisheries, although in recent years these closures have been problematic and will potentially be revised by the Council at this meeting due to increased bycatch of salmon in the BSAI pollock fishery since 2003. The Council is currently evaluating alternatives means to reduce salmon bycatch in the BSAI, including potentially suspending the existing closure areas and allowing the fleet to work within their cooperative structure to control bycatch. The existing regulatory measures in the BSAI are closures areas which are triggered upon the attainment of a specified limit in the designated fishery. The Chum Salmon Savings

Area in the eastern Bering Sea is closed to trawl fishing for all of August, and can be extended from September 14th through October 14th if specified chum salmon bycatch limits are reached in the trawl fishery. For Chinook salmon, the Chinook Salmon Savings Areas are closed when annual Chinook salmon bycatch limits are reached by the trawl fishery (similar to a seasonal closure under the trigger bycatch limits as described for alternative 2). Given that the Council is currently looking to revise the closure areas in the BSAI, any measures evaluated for bycatch reduction in the GOA should consider and build upon lessons learned in the BSAI.

Voluntary Bycatch Cooperatives

Alternative 4 for both crab and salmon species proposes enacting a bycatch pool or cooperative for hotspot area management. This alternative is designed after the current BSAI bycatch cooperatives in use by industry to control bycatch in the pollock fishery. Currently in the BSAI, a program of voluntary area closures exists with selective access to those areas for fleets which demonstrate success in controlling bycatch (Haflinger 2003). Voluntary area closures can change on a weekly basis and depend upon the supply and monitoring of information by fishermen. The sharing of bycatch rates among vessels in the fleet has allowed these bycatch hotspots to be mapped and identified on a real-time basis, so that individual vessels can avoid these areas (Smoker 1996, Haflinger 2003).

A voluntary cooperative program could be modeled after the AFA catcher vessel Intercooperative Agreement between the nine catcher vessel cooperatives in the BSAI pollock fishery (Gruver 2003). Some aspects of this inter-cooperative agreement which would be useful to include in a GOA coop alternative include provisions for: allocation, monitoring and compliance of the PSC caps amongst the catcher vessel fleet; establishment of penalties for coops which exceed allocations; promoting compliance with PSC limits while allowing for maximum harvest of allocated groundfish; and the reduction of PSC bycatch in the groundfish fishery. For the BSAI cooperative, Sea State is retained to provide data gathering, analysis and reporting services to implement the bycatch management agreement, and in doing so provides timely hot spot reports to the fleet as well as summaries of bycatch characteristics, trends and/or fishing behaviors which may be having an effect on bycatch rates (Gruver 2003). Fleets are notified of avoidance areas for Chinook salmon and have previously agreed within the cooperative to avoid these areas as notified. Cooperative agreements in the BSAI vary between salmon species, with bycatch rates calculated for use in monitoring access to the Chum Salmon Savings Area while hot spot avoidance areas are utilized for Chinook salmon bycatch reduction. Specific cooperative measures would need to be created for the characteristics of the GOA groundfish fishery; however measures from the BSAI cooperatives may prove useful in designing appropriate programs for salmon and crab bycatch co-ops in the GOA.

ACTION BY THE COUNCIL AT THE DECEMBER 2007 MEETING:

At this meeting the Council may wish to refine the existing draft alternatives in order to better focus measures prior to the initiation of the analysis. At the June 2005 meeting, the Council provided guidance to staff on methodologies for the analysis as well as refined alternatives 2 and 3 for Tanner crab.

At this meeting the Council may wish to review the following and consider further analysis:

1) Current range of species covered for bycatch reduction:
    a. Are all of these salmon and crab species priorities for bycatch reduction measures under current fishing practices?
2) Current alternatives for species:
    a. Are there similar refinements (as per June 2005 Tanner crab action) to make for the other species under consideration?

3) Next steps for Council review:

a. Staff could prepare "strawman" trawl closure areas based on data as specified by the alternatives. Does the Council wish to review these closure area boundaries as the next step?
b. Does the Council wish initiate an analysis for GOA bycatch reduction measures?

Appendix A:

Council Motion on GOA Salmon and Crab Bycatch Measures June 2005
(as part of GOA Groundfish Rationalization)

The Council recommends the following to address staff questions and clarifications per directions for GOA bycatch reduction measures:

Trigger Limits:

1- Average numbers are not an appropriate approach to establishing trigger limits. The analysis should instead focus upon the use of biomass-based approaches for establishing appropriate trigger levels.
2- Trigger limits under consideration should be separated by gear type (i.e. separate limits for pot gear versus trawl gear)
3- Rather than considering an improperly defined duration of a triggered closure, the AP recommends moving in the direction of dynamic revolving closures (hot spots) which reflect the distribution and mobility of the crab population.

General recommendations for the analysis:

1- Differential discard mortality rates by gear type should be addressed in the analysis using the most up-to-date and applicable information.
2- Additional information must be included with respect to the overall precision of bycatch estimates given the low levels of observer coverage in many of the fisheries under consideration.
3- The addition of another alternative (from staff discussion paper) for an exemption from time and area closures if an observer is on board, seems pre-mature at this time.
4- Emphasis should be focused on alternatives 3 and 4 rather than focusing attention on trigger limits under alternative 2.
    a. With respect to alternative 3, additional information may be necessary (in addition to ADF&G survey information and bycatch information from the NOAA groundfish observer program) in order to appropriately identify sensitive regions for year-round or seasonal closures. Some of this additional information may include catch data from the directed Tanner crab fisheries in these areas.
    b. Alternative 4 should include the concept of required participation in a contractual agreement for a hot spot management system
5- A rate-based approach format should be added as much as possible in all graphs and figures for the analysis.
6- Consideration should be given to the overall significance of the total amount of Tanner bycatch numbers as compared with the best available information on the population abundance in order to evaluate the actual population-level impact of the bycatch from the directed groundfish fisheries.

GOA bycatch reduction measures will continue to be linked with the GOA groundfish rationalization initiative.

The Tanner crab alternatives are amended as follows (in bold and strike-out):

Tanner Crab

Alternative 1: Status Quo (no bycatch controls).

Alternative 2: Trigger bycatch limits for Tanner crab. Specific areas with high bycatch (or high bycatch rates) are closed for the remainder of the year if or when a trigger limit is reached ~~by the flatfish fishery~~.
Options: a) trawl flatfish fishery
b) all bottom trawling
c) groundfish pot

Alternative 3: Year-round ~~bottom trawl~~ closure in areas with high bycatch or high bycatch rates of Tanner crab **by gear type.**

Alternative 4: Voluntary bycatch coop for hotspot management.

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LIST OF TABLES

LIST OF FIGURES

Table 1. Bycatch of Pacific salmon in Gulf of Alaska groundfish trawl fisheries, by species, 1990-2007.

Year	Chinook	Chum	Coho	Sockeye	Pink
1990	16,913	2,541	1,482	85	64
1991	38,894	13,713	1,129	51	57
1992	20,462	17,727	86	33	0
1993	24,465	55,268	306	15	799
1994	13,973	40,033	46	103	331
1995	14,647	64,067	668	41	16
1996	15,761	3,969	194	2	11
1997	15,119	3,349	41	7	23
1998	16,941	13,539			
1999	30,600	7,529			
2000	26,705	10,996			
2001	14,946	5,995			
2002	12,921	3,218[a]			
2003	15,998	10,409[a]			
2004	18,075	5,715[a]			
2005	31,599	6,694[a]			
2006	19,158	4,273[a]			
2007	40,264[c]	3,524[a,c]			
1990-2007	20,422	6,787[b]			
2004-2007	27,274	5,052[b]			

[a] Coho, sockeye, and pink salmon are combined with chum salmon.
[b] Average chum salmon bycatch includes chum, coho, sockeye, and pink salmon.
[c] Data thru Nov 17, 2007

SOURCE: NMFS catch reports (website)

Table 2. "Other salmon" bycatch by month, 1996-2007, in GOA groundfish trawl fisheries. Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, 1996-2002 (from blend database) 2003-2007 (from catch accounting database).

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
January	132	-	105	291	145	43	1	0	5	-	-	-
February	167	60	201	3,990	502	298	67	255	18	-	117	0
March	422	65	220	72	387	888	56	159	7	-	13	38
April	557	40	149	338	632	213	4	229	774	163	239	-
May	5	4	-	22	780	388	123	261	23	25	-	152
June	2,075	672	8,652	429	44	433	1,489		2,942	-	-	244
July	439	543	603	553	797	1,326	548	2,715	848	4,224	2,362	605
August	17	20	742	1,033	3,671	141	193	5,931	578	1,411	130	1,305
September	232	1,288	2,354	595	2,116	967	697	42	377	547	350	493
October	112	73	518	206	1,851	1,362	41	770	244	236	1,047	463
November	17	249	-	-	53	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-	-	-

Table 3. Chinook salmon bycatch by month, 1996-2007, in GOA groundfish trawl fisheries. Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, 1996-2002 (from blend database) 2003-2007 (from catch accounting database).

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
January	1,454	1,528	1,120	3,776	3,181	829	1,093	1,187	300	961	1,955	167
February	3,537	3,501	1,022	7,427	2,813	4,875	3,226	2,316	3,791	10,674	1,855	1,304
March	1,842	1,732	944	634	3,052	3,287	2,275	1,069	3,820	7,348	4,693	28,654
April	1,853	852	676	1,649	2,472	1,161	1,482	3,057	629	451	1,450	210
May	15	5	1	68	1,375	1,381	326	2,608	33	60	10	1,468
June	383	292	2,330	332	1	22	1,278		33	-	-	1,227
July	392	2,372	251	361	1,293	536	224	938	1,033	461	291	713
August	68	42	337	352	6,117	149	372	1,242	1,519	121	13	198
September	6,038	4,450	6,176	5,649	4,048	625	2,412	470	1,644	961	4,966	2,120
October	120	235	4,126	10,352	2,177	2,156	233	2,619	5,119	10,529	3,787	2,339
November	62	221	-	-	173	-	-	-	-	-	138	-
December	-	-	-	-	-	-	-	-	-	-	-	-

Table 4. Bycatch of Chinook salmon in Gulf of Alaska groundfish trawl fisheries, by target fishery, 2003-2007. Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, from catch accounting database.

Fishery	2003	2004	2005	2006	2007	Average (2003-2007)
Arrowtooth flounder	3,378	359	1,802	414	1,444	1,480
Deep water species	-	-	-	-	-	-
Flathead sole	598	1,446	-	56	-	700
Non pelagic pollock	895	5,302	15,032	10,187	6,620	7,607
Pacific cod	3,167	893	41	892	617	1,122
Pelagic pollock	3,605	8,039	13,176	5,873	26,093	11,357
Rex sole	2,819	498	982	1,444	-	1,436
Rockfish	928	885	461	291	2,375	988
Shallow water species	116	498	63	-	537	303

Table 5. Bycatch of 'Other' salmon in Gulf of Alaska groundfish trawl fisheries, by target fishery, 2003-2007. Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, from catch accounting database.

Fishery	2003	2004	2005	2006	2007	Average (2003-2007)
Arrowtooth flounder	1,061	-	425	429	702	654
Deep water species	-	6	-	-	-	6
Flathead sole	-	91	-	-	-	91
Non pelagic pollock	44	152	104	592	129	204
Pacific cod	-	47	141	-	152	113
Pelagic pollock	6,156	442	689	825	688	1,760
Rex sole	479	1,053	109	-	-	547
Rockfish	2,603	499	3,453	1,870	830	1,851
Shallow water species	-	3,524	1,774	-	236	1,845

Table 6. Salmon hatchery releases by country from NPAFC for Chinook and Chum Salmon.
Chum Salmon

Year	Russia	Japan	Korea	Canada	US	Total
1999	278.7	1867.9	21.5	172	520.8	2860.9
2000	326.1	1817.4	19	124.1	546.5	2833.1
2001	316	1831.2	5.3	75.8	493.9	2722.2
2002*	306.8	1851.6	10.5	155.3	507.2	2831.4
2003*	363.2	1840.6	14.7	137.7	496.3	4091.5
2004	363.1	1817.2	12.93	105.2		
2005	387.3	1844.0	10.93	131.8		
2006	344.3	1858.25	13.75	107.1		

Chinook	millions of fish				
year	Russia	Japan	Canada	US	Total
1999	0.6	-	54.4	208.1	263.1
2000	0.5	-	53	209.5	263
2001	0.5	-	45.5	212.1	258.1
2002	0.3	-			
2003	0.74	-			

Table 7. Chinook salmon GOA Commercial Catch (1000's of fish)

Year	Area: Southeast	PWS	Cook Inlet	Kodiak	Chignik	South Peninsula	Total
2004	497	39	29	29	3	18	615
2005	462	36	29	14	3	14	558
2006	379	32	19	20	2	13	465
2007	352	40	18	17	2	13	442

Source: ADF&G (http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/blusheet/07exvesl.php)
*preliminary through Nov. 6, 2007.

Table 8. Chum salmon GOA Commercial Catch (1000's of fish)

Year	Area: Southeast	PWS	Cook Inlet	Kodiak	Chignik	South Peninsula	Total
2004	11,372	2,002	352	1,122	1	810	15,659
2005	6,428	2,099	169	477	9	785	9,967
2006	13,993	2,182	137	1,082	62	1,320	18,776
2007	9,412	3,579	78	745	79	861	14,754

Source: ADF&G (http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/catchval/blusheet/07exvesl.php)
*preliminary through Nov. 6, 2007.

Table 9. Bycatch of red king crab and Tanner crabs in Gulf of Alaska groundfish trawl fisheries, by species, 1993-2007. Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, 2003-2007 from catch accounting database.
2007 data through 9/20/07.

YEAR	Bairdi tanner	Golden king crab	Opilio tanner	Red king crab
1993	55,304	-	-	1,012
1994	34,056	-	-	45
1995	47,645	-	-	223
1996	120,796	-	-	192
1997	134,782	-	-	18
1998	105,817	-	-	275
1999	29,947	-	-	232
2000	48,716	698	-	35
2001	125,882	551	-	46
2002	89,433	914	-	20
2003	142,488	665	1,370	60
2004	62,277	326	-	331
2005	126,905	-	20	91
2006	306,767	71	76	345
2007	206,730	139	2,083	
Average 1993-2007	109,170	481	887	209
Average 2004-2007	175,670	179	726	256

Table 10. Bycatch of red king crab in Gulf of Alaska groundfish fisheries, by gear type and target fishery, 2003-2007.

Hook & Line	2003	2004	2005	2006	2007
Halibut	0	23	0	0	0
Pacific cod	0	0	0	0	0
Sablefish	29	0	88	0	0

Pot	2003	2004	2005	2006	2007
P. Cod	0	31	0	0	0

Non-Pelagic Trawl	2003	2004	2005	2006	2007
Arrowtooth	0	0	0	0	0
Arrowtooth flounder	0	0	0	0	0
Flathead sole	0	0	0	0	0
Non pelagic pollock	0	0	0	0	0
Other species	0	0	0	0	0
Pacific cod	0	0	0	0	0
Pelagic pollock	0	0	0	0	0
Rex sole	0	0	0	0	0
Rockfish	60	275	0	0	0
Sablefish	0	0	0	0	0
Shallow water species	0	0	91	345	0

Pelagic Trawl	2003	2004	2005	2006	2007
Non pelagic pollock	0	56	0	0	0
Pacific cod	0	0	0	0	0
Pelagic pollock	0	0	0	0	0

Total GOA:	89	385	179	345	0

Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, 2003-2007 from catch accounting database. 2007 data through 9/20/07.

Table 11. Bycatch of *C. bairdi* Tanner crabs in Gulf of Alaska groundfish fisheries, by gear type and target fishery, 2003 -2007.

Hook & Line	2003	2004	2005	2006	2007
Arrowtooth	0	0	0	8	0
Halibut	0	0	0	138	0
Pacific cod	0	0	1,491	403	118
Sablefish	21	29	290	8	157

Pot	2003	2004	2005	2006	2007
P. Cod	13,036	17,030	116,764	103,370	285,091

Non-Pelagic Trawl	2003	2004	2005	2006	2007
Arrowtooth	29,377	33,133	69,364	89,114	36,435
Flathead sole	17,484	7,514	43,957	25,885	254
Non pelagic pollock	0	474	0	7,743	25,674
Other species	20	0	189	0	0
Pacific cod	2,227	1,160	1,381	742	15,556
Pelagic pollock	1	0	0	75,855	1
Rex sole	33,932	9,030	4,461	73,528	45,274
Rockfish	183	1,510	1,475	957	161
Sablefish					171
Shallow water species	59,153	8,789	5,942	32,533	81,650

Pelagic Trawl	2003	2004	2005	2006	2007
Arrowtooth	0	0	0	2	1,155
Flathead sole	102	0	0	0	
Non pelagic pollock	1	533	4	407	63
Pacific cod	0	0	0	0	280
Pelagic pollock	8	134	1	1	51
Rockfish	0	0	130	0	8

Total GOA	155,546	79,336	245,450	410,694	492,096

Data has been screened for confidentiality. Source: M. Furuness, NOAA Fisheries, 2003-2007 from catch accounting database. 2007 data through 9/20/07.

Table 12. Pacific Cod observer data, crab bycatch numbers, observed vessels only. Source: ADF&G K. Spalinger

Area	Year	Observed trips	Pots lifted	Tanner Crab	King crab	Cod catch Whole pounds	Cod catch Metric tons	Tanner/mt	king/mt
Chignik	2003	1	268	42	0	28,297	12.84	3.27	0.00
Kodiak	1997	1	333	11	0	36,432	16.53	0.67	0.00
Kodiak	1998	1	261	4	9	20,418	9.26	0.43	0.97
Kodiak	1999	3	1006	48	0	69,257	31.42	1.53	0.00
Kodiak	2001	1	200	171	0	6,638	3.01	56.79	0.00
South Peninsula	1998	1	174	1	0	47,453	21.53	0.05	0.00
South Peninsula	1999	1	240	0	0	40,952	18.58	0.00	0.00
South Peninsula	2000	2	419	0	0	126,908	57.57	0.00	0.00
South Peninsula	2001	2	619	52	0	130,771	59.32	0.88	0.00
South Peninsula	2002	1	58	1	0	10,248	4.65	0.22	0.00
South Peninsula	2004	1	30	1	0	13,099	5.94	0.17	0.00
South Peninsula	2005	1	76	0	0	13,554	6.15	0.00	0.00
South Peninsula	2006	2	433	25	0	94,827	43.01	0.58	0.00

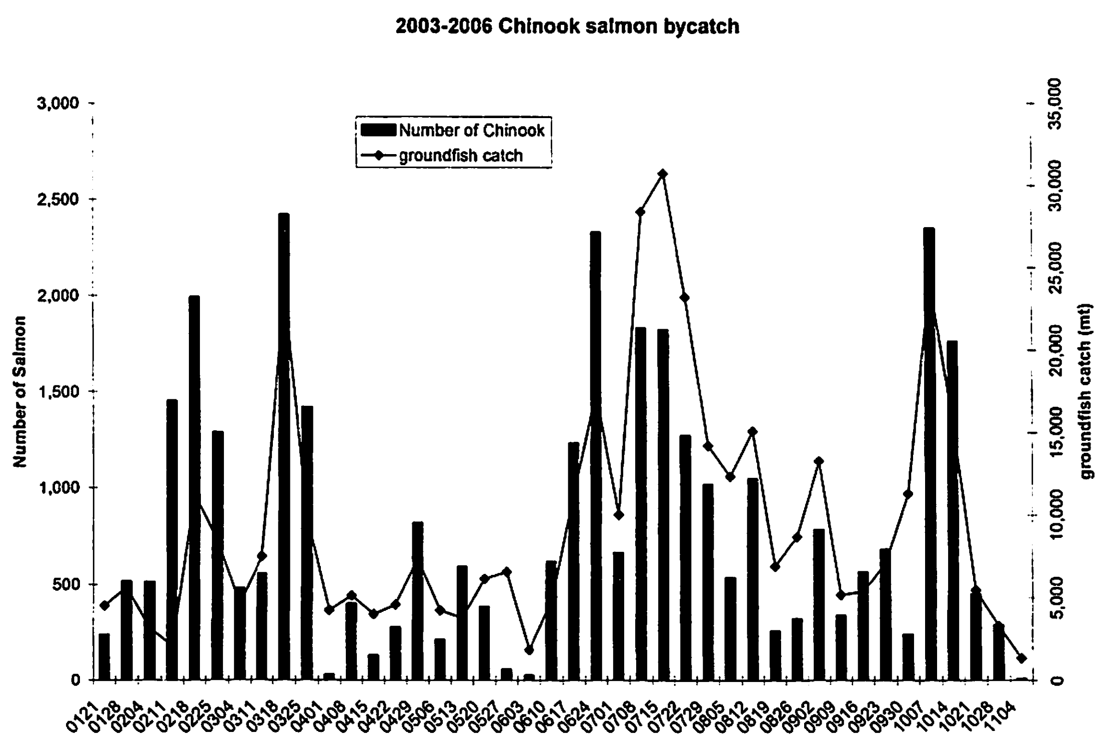


Figure 1. Chinook salmon bycatch rates within the groundfish fisheries by groundfish catch (mt) by week, 2003-2006.

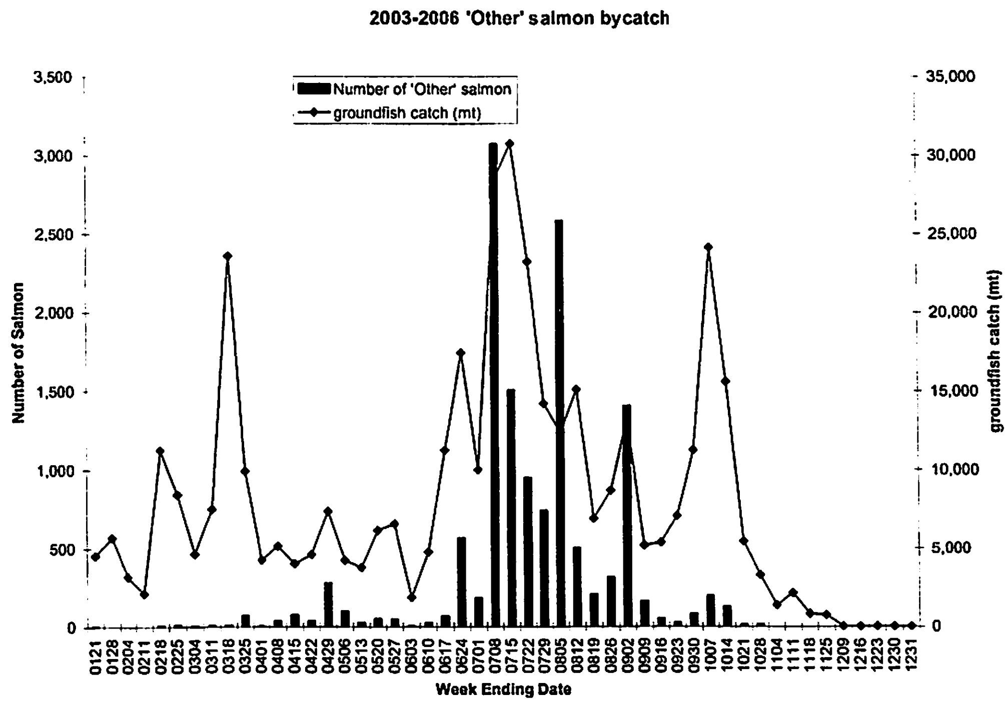


Figure 2 Other Salmon bycatch rates within the groundfish fisheries by groundfish catch (mt) by week, 2003-2006

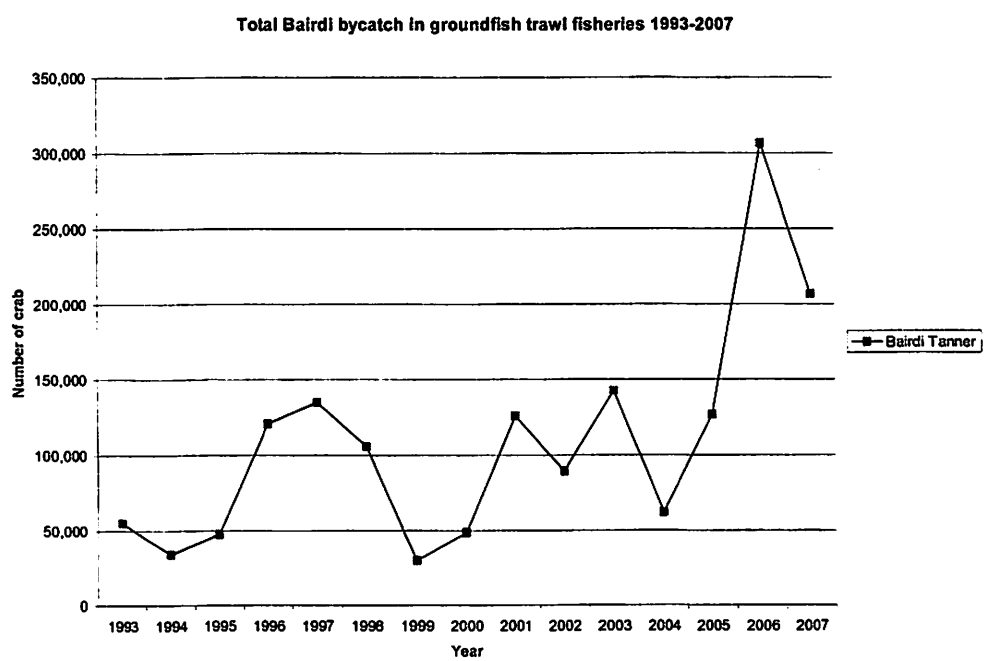


Figure 3. Total bycatch of *C. bairdi* Tanner crabs in all GOA groundfish trawl fisheries 1993-2007

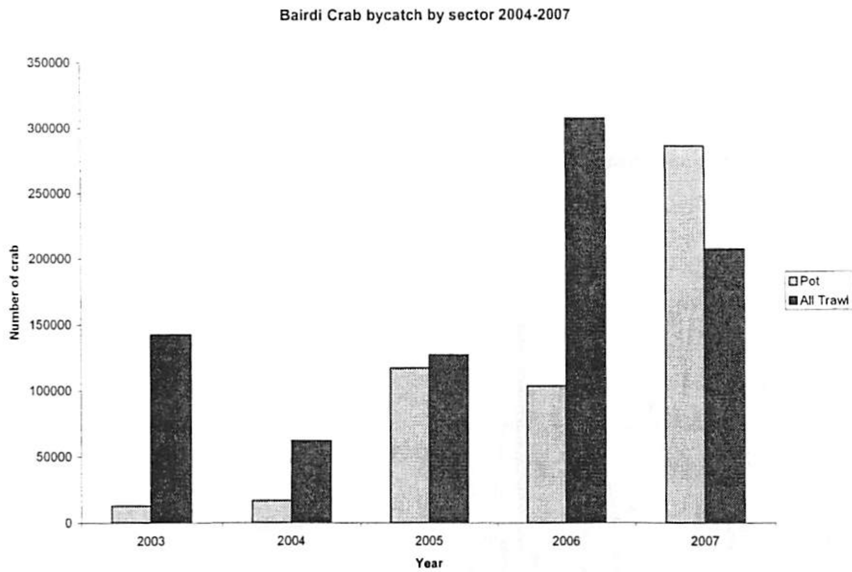


Figure 4. Overall annual bycatch of *C. bairdi* Tanner crab by trawl and pot fishery sectors (2004-2007)

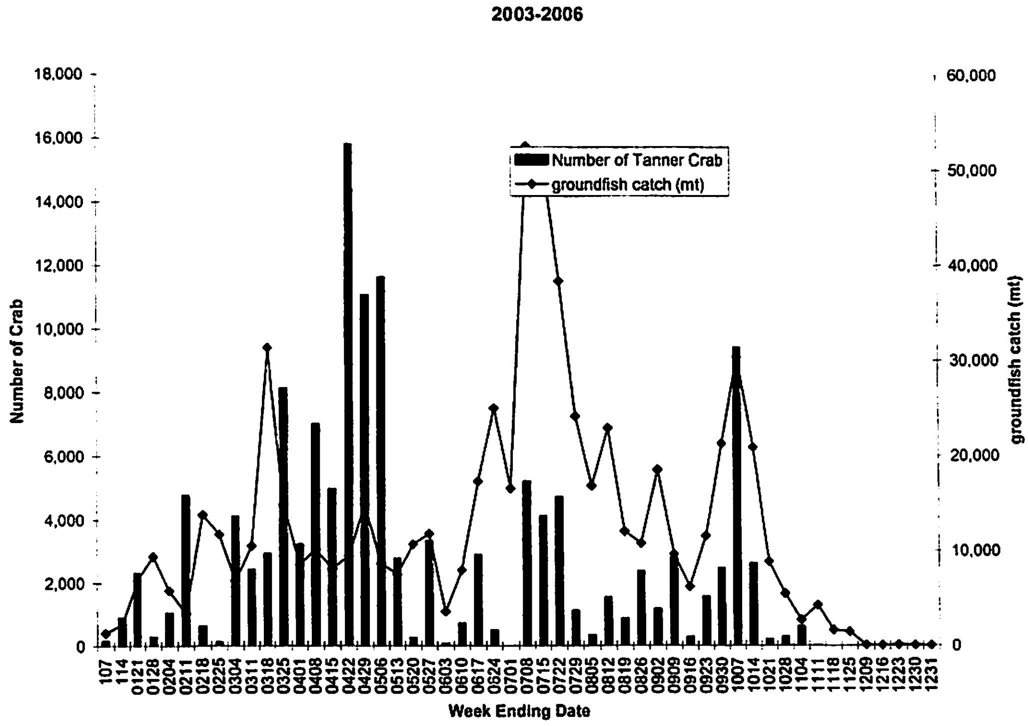


Figure 5 Bycatch of *C. bairdi* Tanner crab and associated groundfish catch in 2003-2006

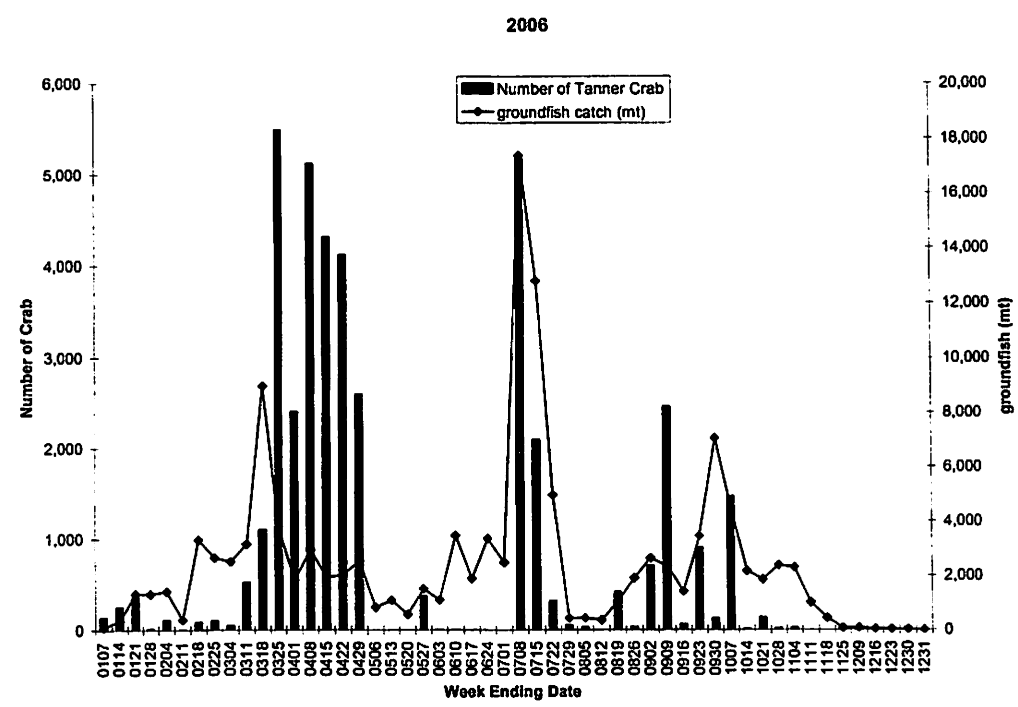


Figure 6. Bycatch of *C. bairdi* Tanner crab and associated groundfish catch in 2006

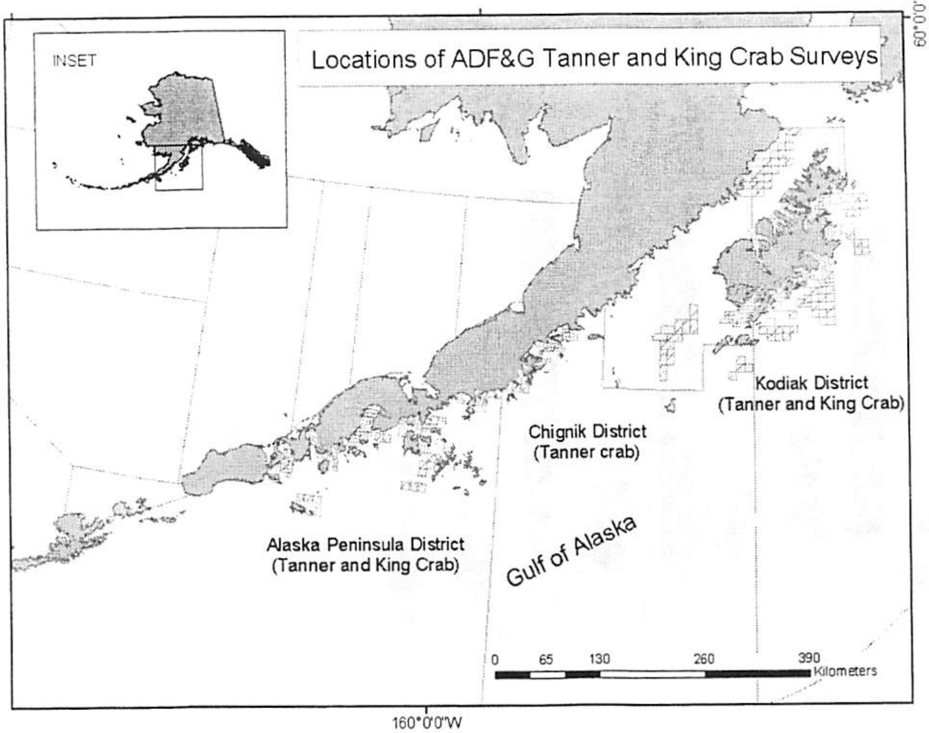


Figure 7. Locations of ADF&G trawl surveys for Tanner and king crab abundance.

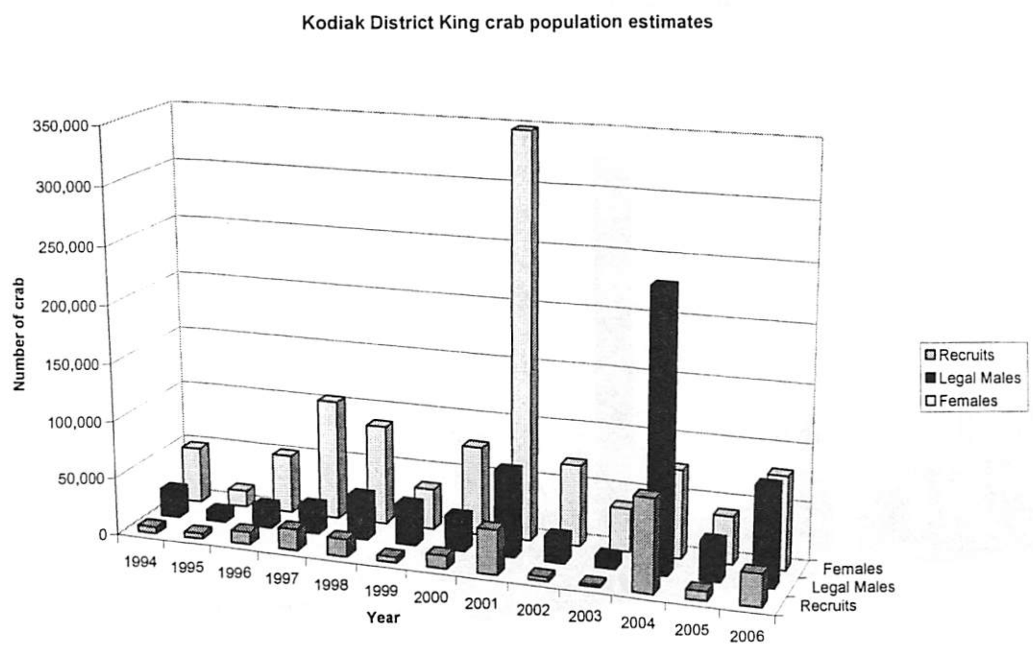


Figure 8. Red king crab population estimates Kodiak District based on ADF&G trawl surveys 1994-2006. Source: ADF&G K. Spalinger.

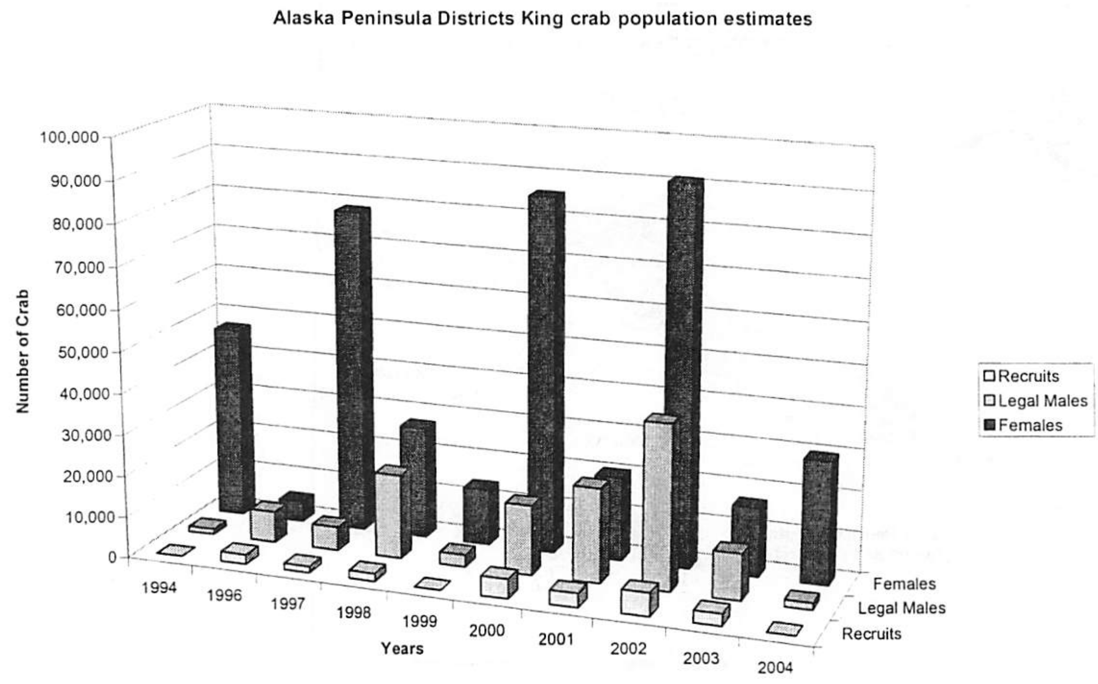


Figure 9 Red king crab population estimates for Alaska Peninsula based on ADF&G trawl surveys 1994-2004.

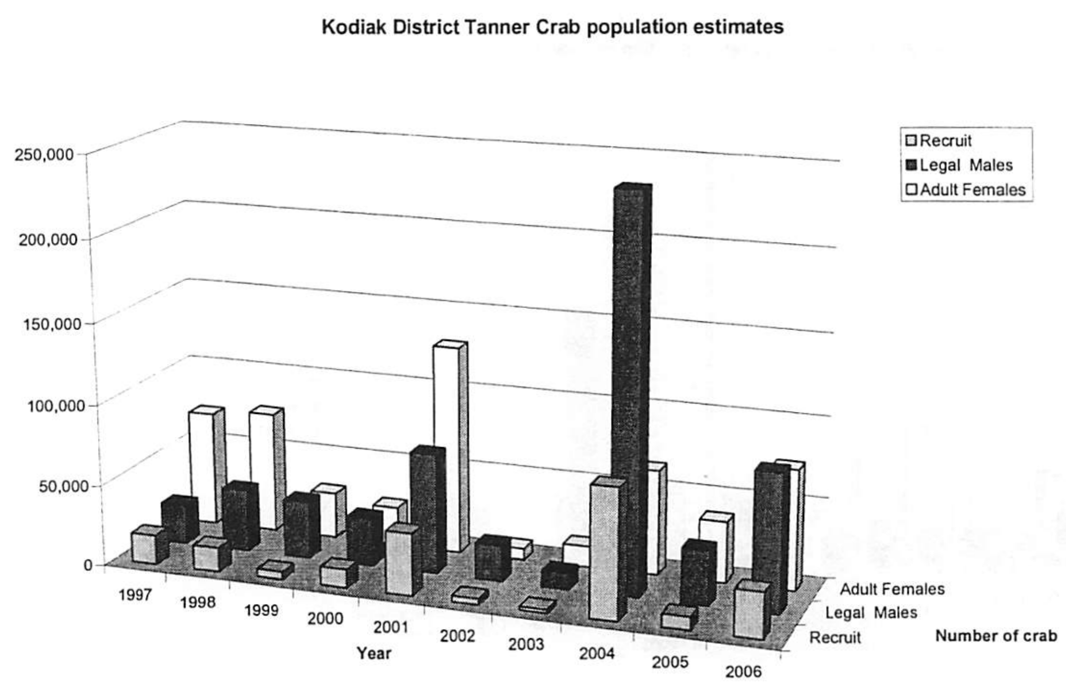


Figure 10 *C. bairdi* Tanner crab population estimates for Kodiak District based on ADF&G trawl surveys 1997-2006.

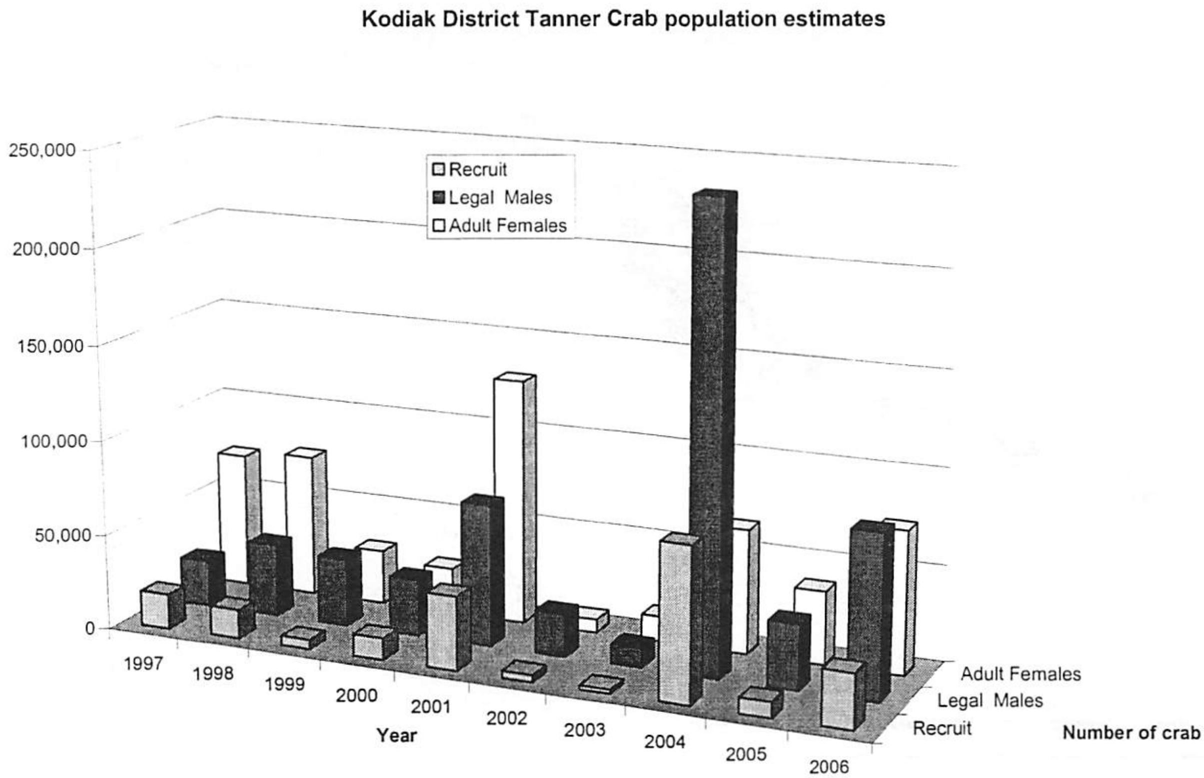


Figure 11. ***C. bairdi*** **Tanner crab population estimates for Kodiak District based on ADF&G trawl surveys 1997-2006.**

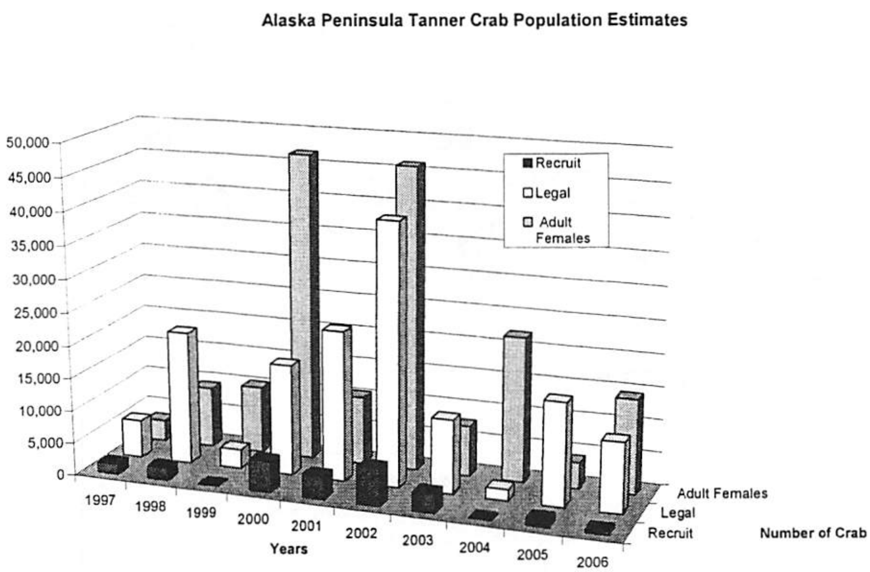
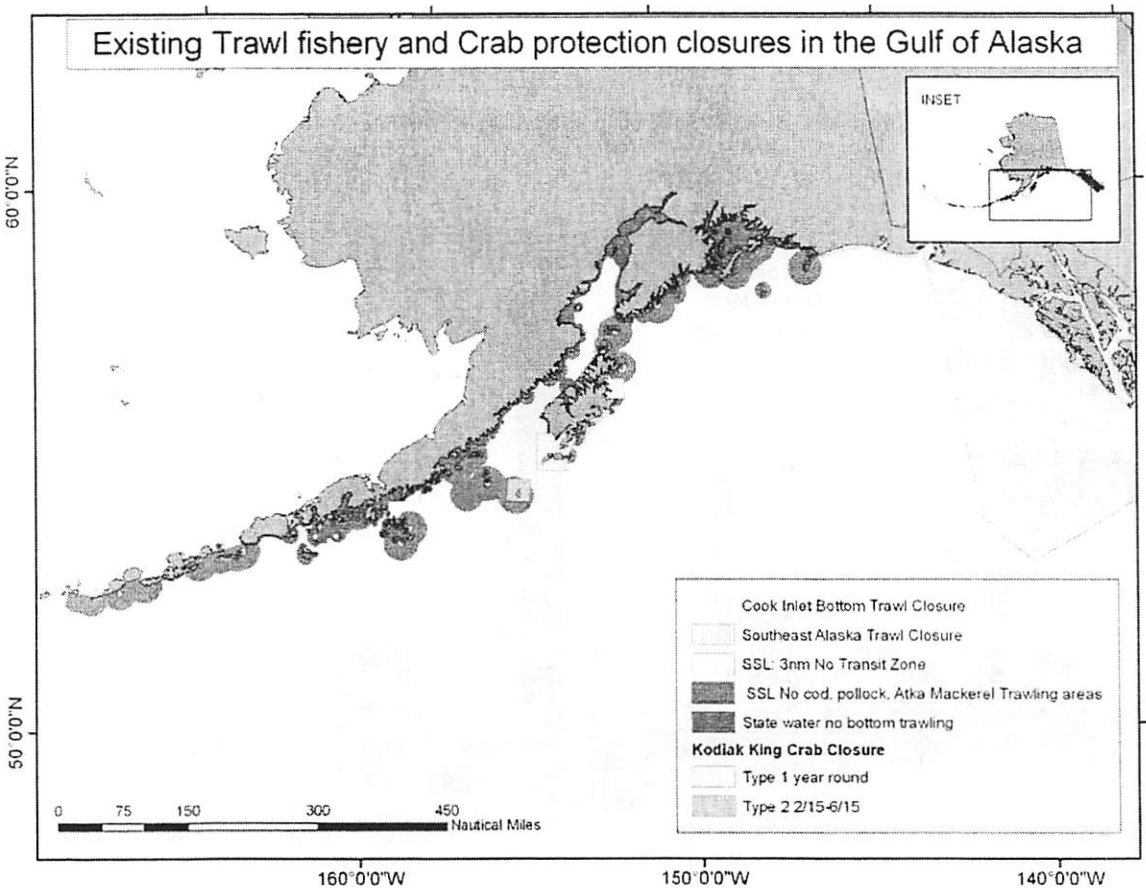
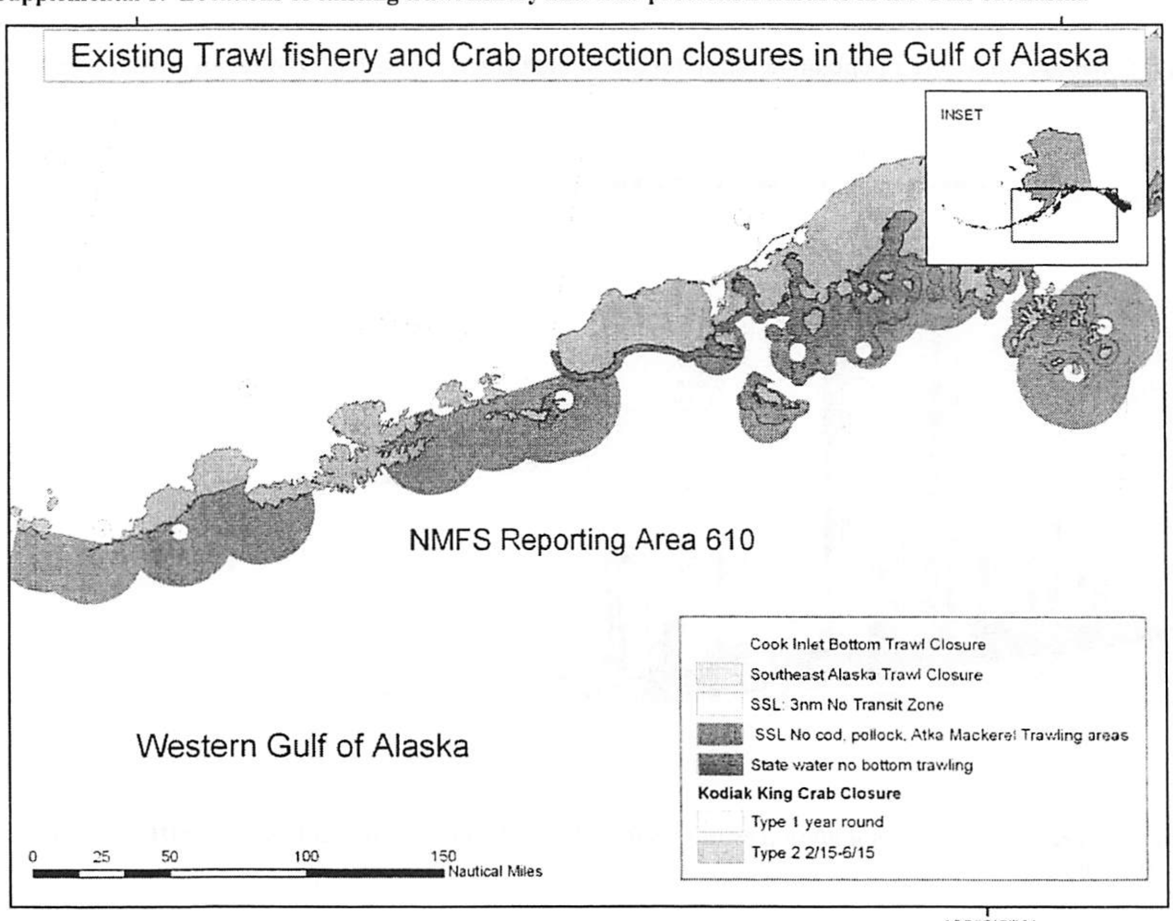


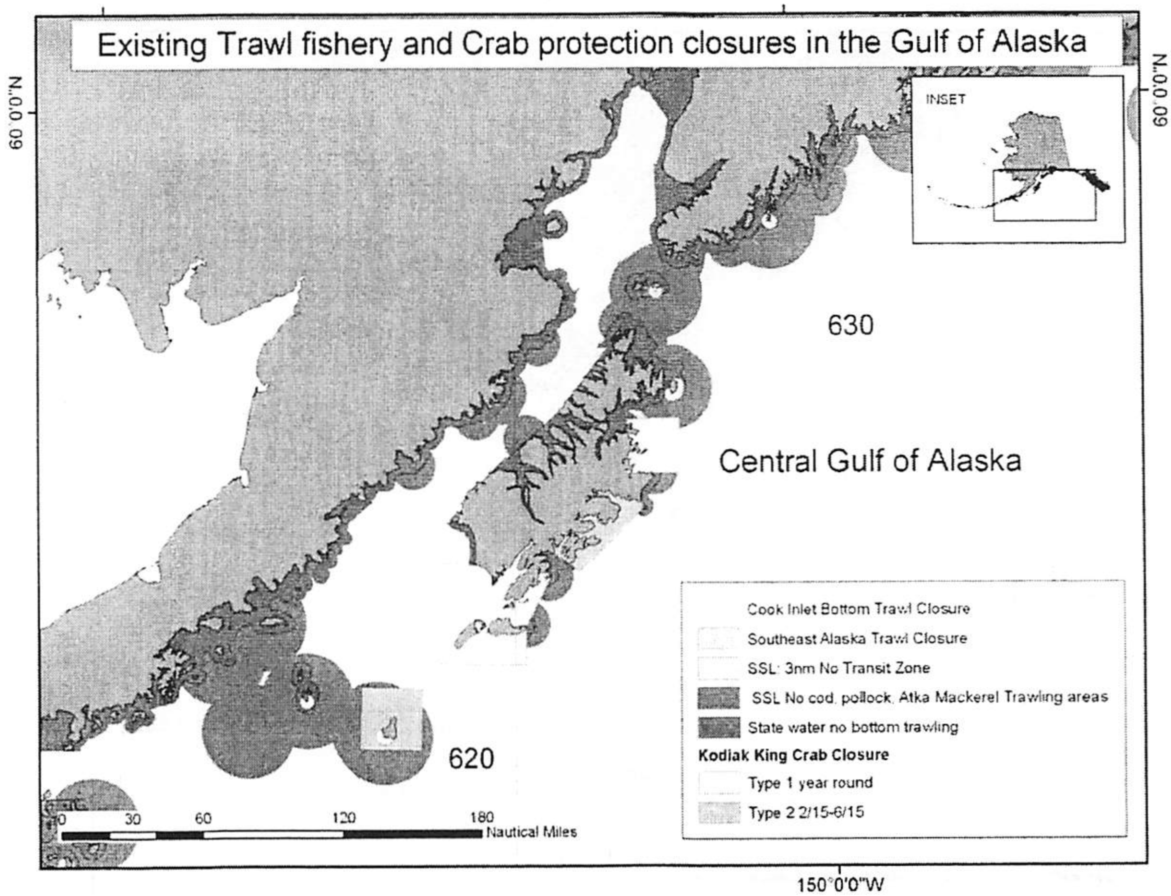
Figure 12. ***C. bairdi*** **Tanner crab population estimates for Alaska Peninsula District based on ADF&G trawl surveys 1997-2006.**



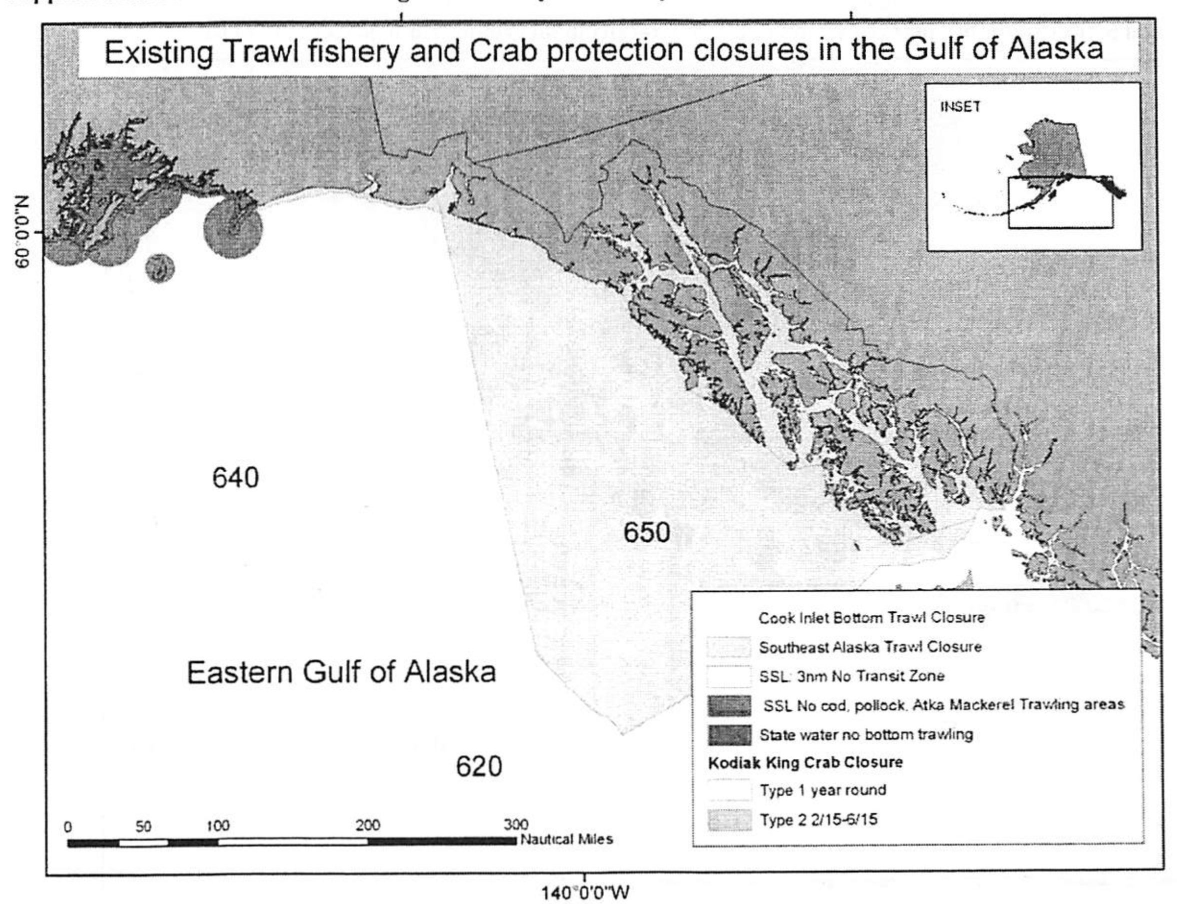
Supplemental 1. Locations of existing trawl fishery and crab protection closures in the Gulf of Alaska.



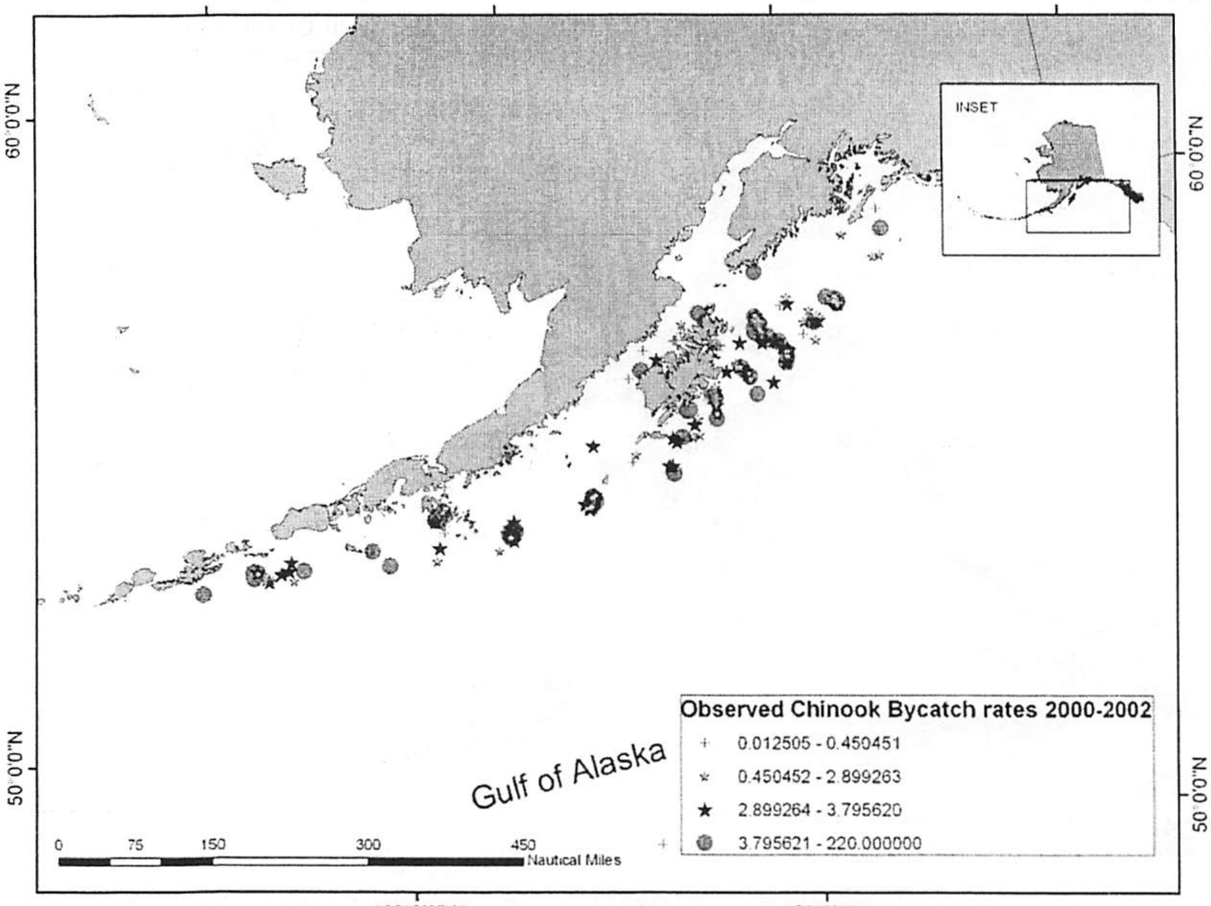
Supplemental 2. Locations of existing trawl fishery and crab protection closures in the Western Gulf of Alaska.



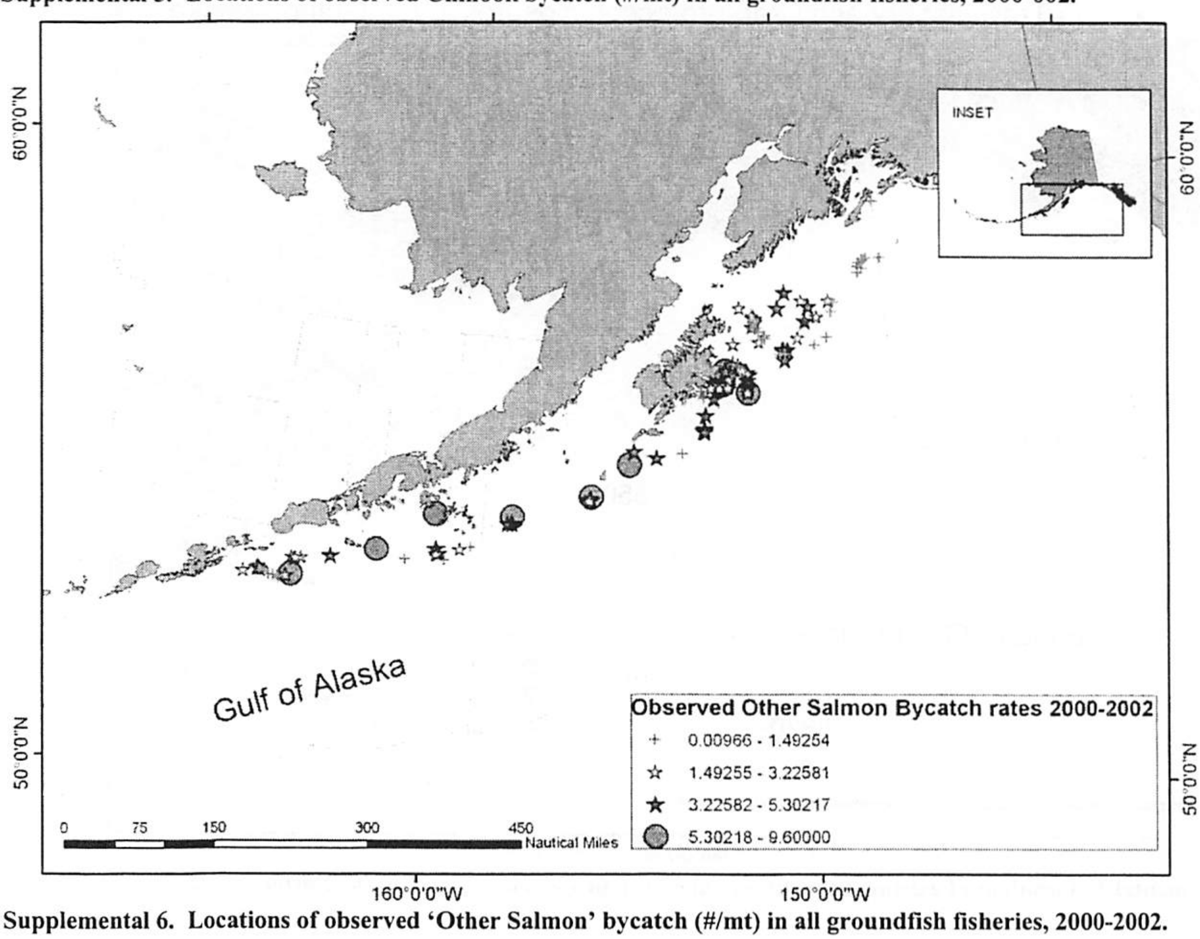
Supplemental 3. Locations of existing trawl fishery and crab protection closures in the Central Gulf of Alaska.



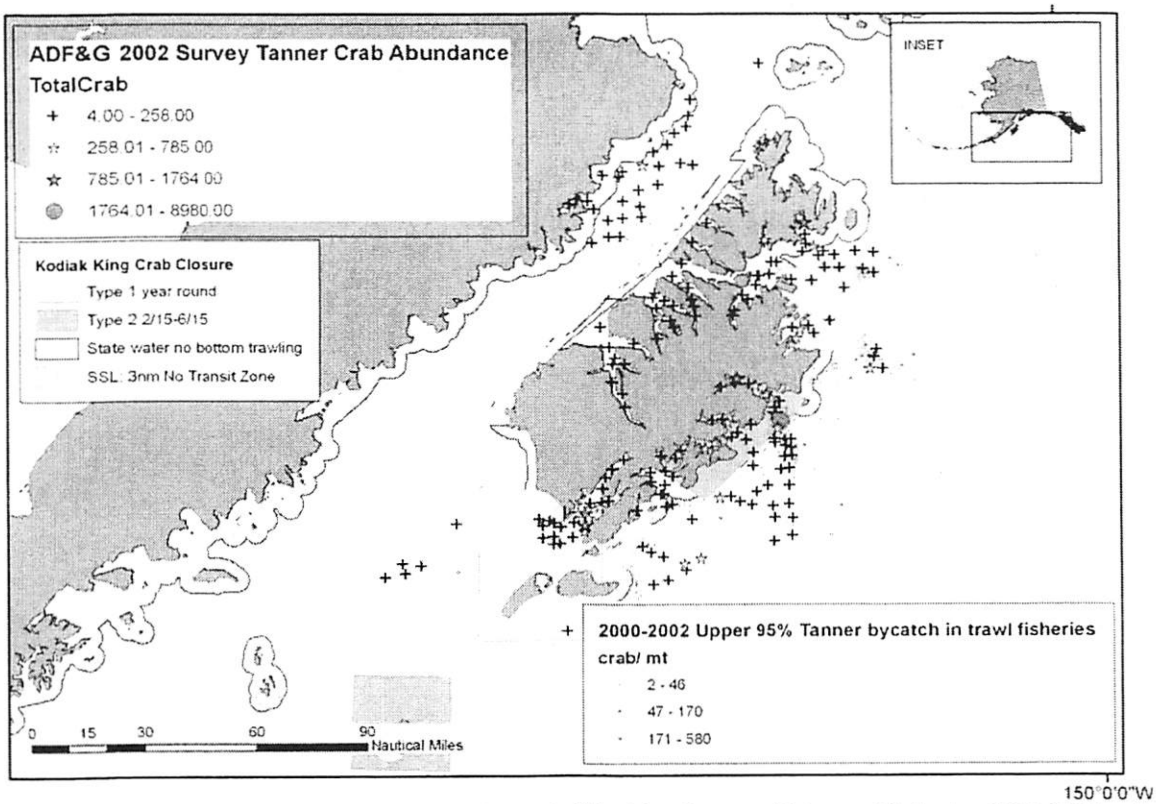
Supplemental 4. Locations of existing trawl fishery and crab protection closures in the Eastern Gulf of Alaska.



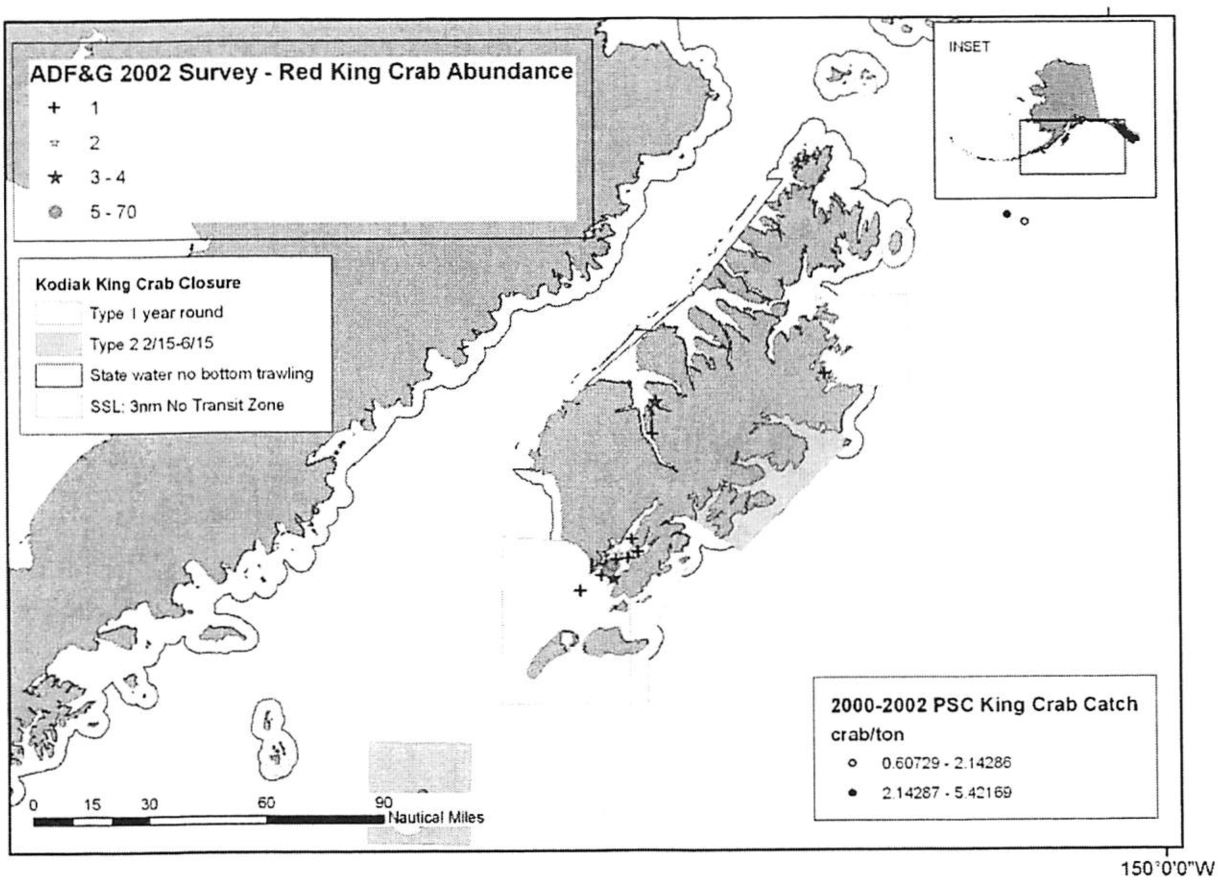
Supplemental 5. Locations of observed Chinook bycatch (#/mt) in all groundfish fisheries, 2000-002.



Supplemental 6. Locations of observed 'Other Salmon' bycatch (#/mt) in all groundfish fisheries, 2000-2002.



Supplemental 7. Locations of observed Tanner crab bycatch (#/mt) in all groundfish trawl fisheries, 2000-2002 and ADF&G Tanner Crab Abundance estimates from 2002 survey.



Supplemental 8. Locations of observed Red King crab bycatch (#/mt) in all groundfish trawl fisheries, 2000-2002 and ADF&G Red King crab Abundance estimates from 2002 survey.

Vessel Monitoring System Requirements in the GOA Dinglebar Fishery for Lingcod

Discussion paper prepared for the North Pacific Fishery Management Council

December 2007

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Executive Summary

Introduction

In April 2007 the North Pacific Fishery Management Council (Council) requested a discussion paper reviewing the impact of the vessel monitoring system (VMS) requirement on the dinglebar fishery for lingcod in the Gulf of Alaska (GOA). Dinglebar gear is a variant of troll gear, and has a long, heavy, iron bar attached to the line to keep the hooks close to the bottom.

A VMS requirement had been imposed on vessels with Federal Fishing Permits using dinglebar gear as part of a suite of measures meant to protect vulnerable bottom habitat features. The requirement has been controversial because of the small numbers of operators, the small size of the vessels, the short period of the fishery, and the relatively small revenues generated. This paper reviews the history of the VMS requirement in the dinglebar fishery, describes the fishery, describes the usefulness of the VMS requirement, and provides estimates of the costs of the requirement.

History of, and reason for, the requirement

VMS requirements were imposed on vessels with Federal fishing permits (FFPs) in the dinglebar fishery for lingcod in the GOA beginning July 28, 2006, to help enforce measures being adopted to protect certain categories of bottom habitat from gear damage under the Essential Fish Habitat (EFH) provisions of the Magnuson Stevens Fishery Conservation and Management Act. Dinglebar gear was believed to be capable of damaging bottom habitat because it is mobile and the heavy iron bar makes the gear contact the bottom.

Under EFH provisions, Habitat Areas of Particular Concern (HAPC) were identified in Southeast Alaska. Four of these areas are located in Southeast Alaska near the area where the dinglebar lingcod fishery takes place. These HAPCs are now considered the GOA Coral Habitat Protection Areas where all federally permitted vessels are prohibited from anchoring or fishing with bottom contact gear. The areas near the Fairweather Grounds and off Cape Ommaney cover a total area of 13.5 square nautical miles. Dense thickets of *Primnoa* sp. coral have been identified in these areas by NMFS and the Alaska Department of Fish and Game (ADF&G) during survey work using submersible dives. These living habitat structures grow very slowly, are sensitive to disturbance by any bottom contact gear and anchoring, and have long recovery times.

These fishing restrictions involve relatively small areas dispersed over a large section of the exclusive economic zone (EEZ), making surveillance by enforcement vessels or aviation patrols difficult with existing resources. Because of this, VMS is very helpful in enforcing management regulations designed to limit transit or fishing in defined areas. Tracking the location of fishing vessels by VMS facilitates enforcement of the EFH and HAPC management measures.

Lingcod is not a species covered in the Fishery Management Plan for Groundfish of the Gulf of Alaska (FMP). This fishery is managed by the State of Alaska. An FFP is not required to fish for lingcod. However, rockfish are caught and retained as bycatch in lingcod fisheries, and rockfish are covered under the GOA groundfish FMP. Rockfish are the primary source of bycatch in this fishery. An FFP is required to harvest and retain rockfish. Moreover, State and Federal regulations require the retention of certain types of rockfish, including demersal shelf rockfish.

State regulations (5AAC 28.010 and 5AAC 28.171) require the full retention of demersal shelf rockfish and black rockfish for Alaska's Commercial Fishery Entry Commission (CFEC) permit holders fishing for groundfish in the Southeast District. The demersal shelf rockfish assemblage includes yelloweye, quillback, canary, tiger, copper, china, and rosethorn rockfish. A permit holder fishing for groundfish must retain, weigh, and report all demersal shelf rockfish and black rockfish taken. The Southeast District includes waters in the EEZ as well as state waters (ADF&G, news release)[1].

The fishery

The lingcod fishery takes place primarily in May and June each year. Fishermen typically fish for only one or two weeks. There is relatively little bycatch in this fishery; most bycatch is rockfish. Most vessels have Southeast Alaska home ports, although a few originate in Washington. Sitka appears to be the most important home port. Lingcod fishing is a relatively minor, but not trivial, source of annual revenue for these operations. In recent years participation in the fishery has ranged between six and twelve vessels. Vessels appear to be in the range of 40 to 50 ft length overall. There is high turnover among the vessels in the fishery. From 2001 to 2007, most vessels appear to have been active in only one or two years. Only two vessels operated in all seven years. Average revenues in 2007 were about $15,900 for participating vessels; median revenues were about $12,400.

An examination of landings records and VMS tracks indicates that eight vessels fished for lingcod with dinglebar gear in Federal waters off of Southeast Alaska in 2007. All of these carried transmitting VMS units. None of these appear to have been required to carry VMS units to comply with other regulations, thus the presence of VMS on these vessels can be attributed to their participation in this fishery. All of these vessels have applied for and received, or indicated an intention to apply for, reimbursements for the unit purchase costs.

Costs of the VMS requirement in 2007

The average cost of acquiring a VMS unit is estimated to be $2,068 per vessel. This includes the costs of purchase and freight, installation, brackets, sales tax, initiation fees with satellite providers, and initialization costs with NMFS. Annual operating costs are estimated to be $188 for vessels in this fleet. This covers a month of transmissions, plus repairs and maintenance. Vessels buying VMS to comply with this regulation are eligible for a reimbursement of the purchase costs from the Pacific States Marine Fisheries Commission (PSMFC). The PSMFC was ready to reimburse Alaska fishermen for purchase costs up to $1,750. Based on a preliminary and partial review of reimbursement records, actual reimbursements are estimated to be about $1,500.

The total costs of the VMS requirement in 2007 to the fishing operations subject to the regulation, after accounting for reimbursements, are estimated to be between $6,800 and $9,000. This includes the costs to persons buying and using the VMS, and the cost to persons who may have shifted out of the fishery due to the costs of the VMS requirement. Average costs for operations acquiring VMS and participating in the fishery were about $756 and the average costs for vessels shifting to another fishery to avoid the requirement were a maximum of about $756 per vessel. A

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[1] Under Federal regulations (50 CFR 679.20(j)), the operator of a catcher vessel that is required to have a Federal fisheries permit, or that harvests individual fishing quota (IFQ) halibut with hook and line or jig gear, must retain and land all demersal shelf rockfish that is caught while fishing for groundfish or IFQ halibut in the Southeast Outside District. However, this does not appear to apply to a vessel that only retains lingcod, since this is not a groundfish covered under the FMP, and an FFP is not required to fish for it.

significant part of the costs for vessels with VMS was composed of acquisition costs, which would not recur every year. Thus average costs in future years are expected to be lower. Average revenues from the dinglebar ling cod fishery were about $15,900 in 2007; median revenues were about $12,400.

The total social costs of the regulation in 2007 were estimated to be between $17,900 and $20,200. The total social costs differ from the costs to the fishing operations themselves, because the units reimbursed by the PSMFC are a real social cost, and the sales tax paid by the fishermen is a transfer payment and not a real social cost.

Longer term costs for dinglebar operations

VMS is a permanent requirement in this fishery. Fishermen subject to the requirement would incur transmission and maintenance costs every year, and new acquisition costs as existing units wore out or became obsolete. The estimated present value of the requirement to a single vessel owner over a 20 year horizon was estimated to be about $9,000 (this assumes the first purchase of a unit would be reimbursed, but that there would be no reimbursement for later unit purchases).

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Introduction

Vessel monitoring system (VMS) requirements were imposed on vessels with Federal fishing permits (FFPs) in the dinglebar fishery for lingcod in the Gulf of Alaska, effective July 28, 2006, to help enforce measures being adopted to protect certain categories of bottom habitat from gear damage. VMS requirements make it possible to track vessel positions in real time with a high degree of accuracy. Because of this, they are very helpful in enforcing management regulations designed to limit transit or fishing in defined areas. However, this VMS requirement is controversial because of the small scale of this fishery. In April 2007 the North Pacific Fishery Management Council (Council) requested a discussion paper reviewing the impact of the VMS requirement on this fishery. This report responds to that request.

History of this action

In February 2005 the Council adopted amendments revising five FMPs by identifying essential fish habitat (EFH) and habitat areas of particular concern (HAPCs) and authorizing protection measures. These amendments to the groundfish, scallop, crab, and salmon FMPs were implemented July 28, 2006[2] (71 FR 36694; June 28, 2006).

The Council's action incorporated three elements that protected different classes of areas in the Gulf of Alaska (GOA). First, EFH amendments established ten GOA Slope Habitat Conservation Areas where fishing for groundfish by federally permitted vessels with nonpelagic trawl gear would be prohibited. These areas were identified based on the likely occurrence of high relief corals and rockfish in these lightly fished areas. As noted in the proposed rule for this action, the EFH environmental impact statement indicated that nonpelagic trawl gear has the largest impact on this habitat (71 FR 14473; March 22, 2006).

The second element identifies and manages HAPCs within EFH. Anchoring and fishing with bottom contact gear is prohibited in fifteen Alaska Seamount Habitat Protection Areas. Fourteen of these areas are located in the GOA. These areas were identified for this level of protection by NMFS, industry representatives, and environmental organizations during the HAPC identification process. Bottom contact gear and anchoring restrictions for these areas are needed because the areas contain especially diverse and fragile living habitat structures that are particularly sensitive to the impacts of bottom contact gear and anchoring, and have long recovery times once damaged. Seamounts contain unique oceanographic and living habitat features that are important habitat for fish (71 FR 14473; March 22, 2006).

Neither of these first two elements requires restrictions on dinglebar fishing. They either deal with non-pelagic trawling, or they restrict operations on the seamounts, where dinglebar fishing does not take place. However, the third element established the GOA Coral Habitat Protection Areas where all federally permitted vessels are prohibited from anchoring or fishing with bottom contact gear. Four of these areas are located on the Fairweather Grounds and one is located off Cape Ommaney (see Figures 9 and 10 for maps of these areas). They cover a total area of 13.5 square nautical miles. Dense thickets of *Primnoa* sp. coral have been identified in these areas by

[2] The specific amendments and FMPs were Amendments 78 and 65 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Areas, Amendments 73 and 65 to the FMP for Groundfish of the Gulf of Alaska, Amendments 16 and 12 to the FMP for Bering Sea/Aleutian Islands King and Tanner Crabs, Amendments 7 and 9 to the FMP for the Scallop Fishery off Alaska, and Amendments 7 and 8 to the FMP for Salmon Fisheries in the Exclusive Economic Zone off the Coast of Alaska.

NMFS and the Alaska Department of Fish and Game during survey work using submersible dives. These living habitat structures grow very slowly, are sensitive to disturbance by any bottom contact gear and anchoring, and have long recovery times. Restricting bottom contact gear and anchoring ensures that the living structures are protected from fishing activities that may adversely impact the habitat. (71 FR 14473; March 22, 2006) It was this action that necessitated the vessel monitoring system (VMS) requirement for vessels targeting lingcod with dinglebar gear. These vessels use bottom contact gear in the vicinity of these protected areas.

Many of the proposed fishing restrictions involve relatively small areas dispersed over a large section of the exclusive economic zone off Alaska (EEZ), making surveillance by enforcement vessels or aviation patrols difficult with existing resources. Tracking the location of fishing vessels by VMS facilitates enforcement of the EFH and HAPC management measures. In February 2005, the Council recommended the adoption of VMS requirement for all federally permitted vessels operating in the Aleutian Islands to facilitate enforcement of the EFH protection measures (71 FR 14473; March 22, 2006).

The Council did not originally recommend a VMS requirement for vessels operating in the GOA. In April 2005, during staff tasking, the Council scheduled a review and comment on the proposed rule for EFH for its June 2005 meeting. The Council expressed an interest in potential VMS requirements for GOA vessels relative to the EFH/HAPC closure areas, including review of the supplemental analyses for such VMS requirements by the Science and Statistical Committee, Advisory Panel, and Enforcement Committee (Council, April 2005 Newsletter).

In June 2005, the Council discussed potential VMS requirements for GOA vessels relative to the proposed EFH/HAPC closure areas. The Council recommended VMS requirements for vessels operating in the GOA with mobile bottom contact gear; however, the Council requested that NMFS not require VMS for fixed gear vessels, with the clarification that this recommendation not affect existing requirements promulgated as part of the Steller sea lion protection measures. Mobile bottom contact fishing gears were believed to have the greatest potential for adverse effects on sensitive sea floor habitat features (71 FR 14473; Council, June 2005 Newsletter).

The rules implementing the EFH/HAPC protection measures became effective on July 28, 2006 (71 FR 36694; June 28, 2006). The effective date for these measures was after the 2006 May-June dinglebar fishery for lingcod had ended, so dinglebar fishermen were not required to carry VMS units until the May-June 2007 fishery. The requirements in the *Code of Federal Regulations* read as follows[3]:

> 50 CFR 679.7(c)(22):
>
> ...it is unlawful for any person to do any of the following:
>
> Operate a federally permitted vessel in the GOA with mobile bottom contact gear on board without an operable VMS and without complying with the requirements at § 679.28.
>
> 50 CFR 679.28(f)(6):
>
> Your vessel's transmitter must be transmitting if...

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[3] This has been modified by a subsequent regulatory amendment to correct and clarify certain parts of the original final rule effective December 10, 2007 (72 FR 63500; November 9, 2007).

(iii) You operate a federally permitted vessel in the GOA and have mobile bottom contact gear on board;

Definitions pertaining to Federal fishing regulations are at § 679.2. The definition for "operate" means "...for purposes of VMS that the fishing vessel is: (1) Offloading or processing fish; (2) in transit to, from, or between the fishing areas; or (3) Fishing or conducting operations in support of fishing." "Mobile bottom contact gear" is defined as nonpelagic trawl, dredge, and dinglebar gear.

Under 50 CFR part 679.4(b), if a vessel is used to fish in the EEZ of the GOA or Bering Sea and Aleutian Islands (BSAI) management areas, and is required to retain any groundfish caught in the EEZ, the vessel must have an FFP. If the vessel catches and retains any groundfish in the EEZ, it is also considered to be fishing for groundfish, and even if it wasn't required to retain the groundfish, it also must carry an FFP (NMFS 2007b).

Lingcod is not a species covered in the GOA groundfish FMP. This fishery is managed by the State of Alaska. An FFP is not required to fish for lingcod. However, rockfish are caught and retained as bycatch in lingcod fisheries, and rockfish are covered under the GOA groundfish FMP. Rockfish are the primary source of bycatch in this fishery. An FFP is required to harvest and retain rockfish. Moreover, State and Federal regulations require the retention of certain types of rockfish, including demersal shelf rockfish (DSR).

State regulations (5AAC 28.010 and 5AAC 28.171) require the full retention of DSR and black rockfish for Alaska's Commercial Fishery Entry Commission (CFEC) permit holders fishing for groundfish in the Southeast District. The DSR assemblage includes yelloweye, quillback, canary, tiger, copper, china, and rosethorn rockfish. A permit holder fishing for groundfish must retain, weigh, and report all DSR and black rockfish taken. This district includes waters in the EEZ as well as state waters (ADF&G, news release)[4].

The extension of the VMS requirement to dinglebar gear used to fish for lingcod is controversial because of the small numbers of operators, the small size of the vessels, the short period during which the fishery takes place, and the relatively small revenues generated. In June 2005, at the time it recommended the use of VMS on vessels with mobile bottom contact gear, but not on vessels with fixed gear, the Council requested an examination of a comprehensive approach to implementing VMS requirements in federally managed fisheries in the GOA and BSAI to address enforcement, monitoring, and safety concerns. The Council initially adopted a set of alternatives in December 2005 and modified them in April 2006 (NMFS 2007a).

In October 2006, the Council received an initial review draft of an environmental assessment/ regulatory impact review/ initial regulatory flexibility analysis (EA/RIR/IRFA) on this issue. The Council did not release the draft for public review, but instead requested the analysis of additional options, and scheduled a second review of the analysis for February 2007. One of the new options would have provided an exemption for vessels deploying dinglebar gear (NMFS 2007a).

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[4] Under Federal regulations (50 CFR 679.20(j)), the operator of a catcher vessel that is required to have a Federal fisheries permit, or that harvests individual fishing quota (IFQ) halibut with hook and line or jig gear, must retain and land all DSR that is caught while fishing for groundfish or IFQ halibut in the Southeast Outside District. However, this does not appear to apply to a vessel that only retains lingcod, since this is not a groundfish within the meaning of the FMP, and an FFP is not required to fish for it.

In February, 2007, the Council received a preliminary initial review draft for the action. This document was not a complete EA/RIR/IRFA, but provided a status report on the work which had been completed on the analysis since the October meeting. This document included a section examining the impact of the dinglebar VMS requirement. This analysis examined the lingcod fishery in 2004, made estimates of the cost of the VMS requirement to the fishery under the conditions prevailing that year, and compared the costs to various measures of individual vessel production (NMFS 2007a).

At the February 2007 meeting, the Council decided to postpone indefinitely any further work on a comprehensive VMS program. The Council noted that other tools may be available to address specific problems or enforcement needs for different circumstances, and a comprehensive solution may not be optimal (Council, February 2007 newsletter). When this occurred, further analytical work was suspended on all the alternatives and options, including the proposal to exempt dinglebar vessels from the VMS requirement.

At its April 2007 meeting, the Council requested a discussion paper on VMS requirements in the dinglebar fishery for its October 2007 meeting. Council staff subsequently rescheduled delivery of the discussion paper for the Council's December 2007 meeting. Staff did so because of an existing heavy workload for the October meeting, and because it recognized that, should the Council decide to adopt a problem statement and alternatives and request a preliminary analysis in October, NMFS could not realistically have regulations in place to modify the VMS requirement prior to the May and June fishery in 2008. Thus, a delay in delivery of the discussion paper until December would not delay potential implementation of a repeal of the VMS requirement.

At its December meeting, the Council may decide to request an analysis of an action to repeal the VMS requirement on dinglebar vessels. On the most optimistic assumptions about the Council time line for taking final action, and the time required for a regulatory change, it would not be possible to repeal the requirement prior to the 2008 fishery in May and June.

What is a VMS unit?

VMS in Alaska is a relatively simple system involving a tamperproof VMS unit, set to report a vessel identification and location at fixed 30 minute intervals to the NOAA Fisheries Office of Law Enforcement (OLE). Some of these units allow OLE to communicate with the unit and modify the reporting frequency. The Alaska system is relatively simple, because it doesn't require the range of functions that are required for VMS in other regions of the United States. Moreover, the Alaska system doesn't require the VMS unit to report on the status of other vessel sensors (in addition to the GPS units).

VMS units on a vessel have the following components:

- A power source and power cabling
- A GPS antenna to pick up satellite signals
- The VMS itself – a box about the size of a car radio containing a GPS and VHF radio
- A VHF antenna to transmit the report to a satellite
- A battery
- Cabling between the VMS and both antennas

Some people with VMS units add optional equipment by connecting an onboard computer to the VMS unit. This can significantly enhance communications, and the potential for onboard use of information collected by the VMS. It is, however, not needed to comply with Alaska's VMS standard.

Fishing firms must use VMS units supplied by vendors approved by OLE. Approval is required to ensure integration of privately supplied VMS units and OLE data processing capabilities. VMS transceiver units approved by NMFS are referred to as type-approved models. A list of approved VMS units is available from the OLE (website at http://www.nmfs.noaa.gov/ole/ak_faqs.html).

VMS units transmit position information to a communications satellite. From the communications satellite, the vessel's position is transmitted to a land-earth station operated by a communications service company. From the land-earth station, the position is transmitted to the OLE processing center. At the center, the information is validated and analyzed before being disseminated for surveillance, enforcement purposes, and fisheries management. Figure 1 provides a schematic of the generic VMS data path.

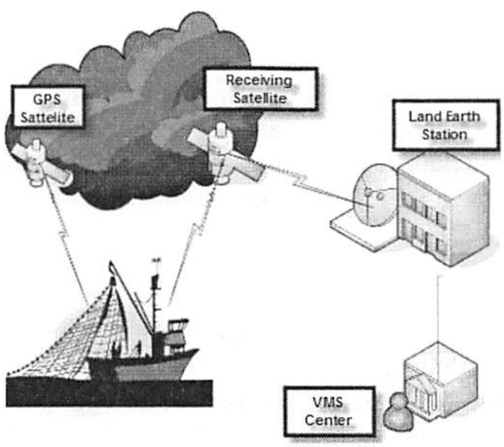


Figure 1. Generic VMS data path. Details vary among service providers.

From the VMS data server, the rate at which VMS units send signals can be remotely programmed or altered. Some units in Alaska are programmed to report every half hour but can be reprogrammed in response to pre-defined criteria. For example, a vessel can be monitored more frequently. Obviously, more frequent reports mean more data and therefore a more accurate picture of the vessel's activity. OLE may sometimes program a VMS to report a vessel's position more frequently, for example, if it appears to be operating near a no transit or fishing zone.

Position data is received and stored by NMFS. This data is also sent out to field offices for analysis of vessel activity. VMS data is reviewed and analysed daily, using a range of manual and automated checks. These checks identify such anomalies as vessels failing to send VMS signals or entering closed waters. Manual checks are completed by an operator monitoring the vessel movements on a computer screen. The operator examines vessel tracks, which are overlaid on digitized maps. Automated checks are run at various times over a 24-hour period. They detect instances of possible non-compliance and highlight them for later follow-up by VMS personnel.

When an instance of non-compliance is detected, it is referred to field agents or officers for follow-up after assuring all components are functioning properly.

Access to VMS data is gained through a secure, web-based system and viewable on a color chart on a computer monitor. OLE Special Agents and Enforcement Officers can monitor vessel activity from their computers. In Alaska, there are also two Enforcement Technicians who are tasked with monitoring vessel activity using VMS. In-season managers in the NMFS Alaska Region Sustainable Fisheries Division and the USCG also have access to the VMS data. Information collected under a VMS program is considered confidential and is subject to the confidentiality protection of Section 402 of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act.

Confidential data are only disclosed to Federal employees and Council employees who are responsible for management plan development and resource monitoring, and State fisheries enforcement and fishery management employees when there is a confidentiality agreement that prevents public disclosure of the identity or business of any person. Confidential data can only be disclosed to the general public when required by the Freedom of Information Act (FOIA), 5 U.S.C. 552, the Privacy Act, 5 U.S.C. 552a, or by court order. (NMFS n.d.; Magnuson-Stevens Act, Sections 311 and 402).

Lingcod

Lingcod (*Ophiodon elongatus*) are the largest member of the greenling family (Family Hexagrammidae), and are related to sculpins and scorpion fish. They are not true cod. They range from Baja California to the Alaska Peninsula and are most commonly found in waters from 10 to 100 meters deep (although they can be found as deep as 300 meters) (Gordon 1994; Vincent-Lang 1994).

The lingcod life cycle can last 25 years (the maximum reported age). Spawning starts in December, and peaks between mid-January and mid-March. Eggs are deposited and fertilized in nests, which are guarded by adult males for the 5 to 11 weeks it takes for them to hatch. Most of the eggs have hatched by mid-May. During this period, the eggs are very vulnerable to predation. Larval lingcod are initially pelagic, but begin using bottom habitats by mid-summer of their first year. Males begin to become sexually mature at two years (at about 20 inches), and females mature at three to five years (at 24 to 30 inches). Adults can weigh up to 80 pounds (35 kg) and grow up to 60 inches (150 cm) in length. (Vincent-Lang 1994)

The dinglebar fishery operates in a West Coast and International marketplace. Lingcod are harvested as bycatch and in directed fisheries off of the U.S. West Coast, British Columbia, and Alaska. Primary markets are in the United States, Japan, and Canada. Lingcod have a white flaky flesh when cooked, and a review of market websites suggests that lingcod, halibut, and other white fleshed species are substitutes for one another. Lingcod may be taken as bycatch in trawl and longline fisheries, and as directed catch in jig or dinglebar fisheries. The highest quality lingcod is taken in hook-and-line fisheries that bleed and ice the fish immediately and deliver a fresh product. Fresh fish may last a week, frozen up to a year. They are also the subject of small live fish fisheries (Pacific Seafood Group 2002).

There is a directed dinglebar fishery in southeast Alaska. Directed fishing is also allowed with mechanical jigging gear and with hand troll gear in Southeast Alaska as well as elsewhere in the state. Lingcod are also taken as bycatch in longline fisheries for groundfish and halibut (Vincent-Lang, 1994).

Lingcod are aggressive and good eating; therefore they've become a popular sport fish target (Vincent-Lang 1994).

Management authority and the VMS requirement

A fishery not explicitly covered by the Council's FMPs or their implementing regulations may be regulated by the State of Alaska as authorized by the Magnuson-Stevens Act under Section 306(a) in the following circumstances. First, Magnuson-Stevens Act Section 306(a)(3)(A) provides for State regulation of a fishing vessel outside State boundaries if the vessel is registered with the State and there is no FMP or other applicable Federal regulations for the fishery in which the vessel is operating. If there is an FMP, this section also provides for State regulation of fishing outside State boundaries if the State's laws and regulations are consistent with the FMP and applicable Federal regulations for the fishery in which the vessel is operating. Second, Magnuson-Stevens Act Section 306(a)(3)(B) provides for State management when an FMP specifically delegates that management authority and the State's laws and regulations are consistent with that FMP. The third circumstance is applicable to fishing vessels that are not registered under the law of the State of Alaska and operate in a fishery in the EEZ for which there was no FMP in place on August 1, 1996. In this case, if the Council and the Secretary of Commerce find a legitimate interest of the State in the conservation and management of such a fishery, then the State may regulate fishing until an FMP is approved and implemented (Wilson 2007).

There is no FMP which covers lingcod fishing in Federal waters of the GOA. Under these circumstances, the State of Alaska has exercised its regulatory authority over commercial fishing for lingcod in Federal waters.

The regulations governing the VMS requirement specifically apply to a "federally permitted vessel." Thus, if a vessel was not required to carry, or did not voluntarily carry, an FFP, the VMS requirement would not apply. Because there is no FMP governing lingcod fishing in Federal waters of the GOA, a Federal fishing permit (FFP) is not required to fish for lingcod in these waters.

However, according to Federal requirements for groundfish federal fishing permits at 50 CFR part 679.4(b), if a vessel is used to fish in the EEZ of the GOA or the BSAI management areas and is required to retain any groundfish caught in the EEZ, the vessel must have an FFP. For purposes of this regulation, groundfish means Atka mackerel, flatfish except for Pacific halibut, octopus, Pacific cod, pollock, rockfish, sablefish, sculpins, sharks, skates, or squid (See Table 2a to CFR part 679).

State regulations require permits issued by the Commercial Fisheries Entry Commission (CFEC) for participation in the dinglebar fishery for lingcod. State regulations further require CFEC permit holders to retain all demersal shelf rockfish (DSR) and black rockfish taken as bycatch in the lingcod fishery. An FFP and associated VMS have been requirements for participation in the lingcod fishery because these rockfish are groundfish covered by the FMP, they are taken as bycatch in the fishery, and no fisherman can be confident of avoiding the bycatch.

State management

There are currently no accurate estimates for the abundance of lingcod in Alaska. Moreover, lingcod are believed to be vulnerable to overfishing and stocks take a long time to recover. Some stocks on the West Coast are believed to have been over harvested. For these reasons, the State of Alaska pursues what it believes to be a very conservative management regime (ADF&G n.d.).

The State has adopted a management approach that uses the following measures to assure there are enough lingcod in the spawning population to ensure future recruitment (Vincent-Lang 1994):

1) It protects spawning and nest-guarding fish. In many areas, sport and commercial fisheries are closed during the spawning and nest-guarding periods.

2) It allows fish to spawn at least once before being subject to harvest. Minimum size limits are established for both sport and commercial fisheries.

3) It restricts catch. In many areas, the sport fishery is restricted by daily bag and possession limits. Commercial fisheries are restricted by catch and bycatch quotas.

Specifically, the State of Alaska's management regime in Southeast Alaska currently includes the following components:

- Spatial protection for the stocks off of Southeast Alaska, by dividing the Southeast into seven lingcod management areas. The seven areas are (1) Northern Southeast Inside (NSEI), (2) Southern Southeast Internal Waters (SSEIW), (3) Northern Southeast Outside (NSEO), (4) Central Southeast Outside (CSEO), (5) Southern Southeast Outer Coast (SSEOC), (6) Icy Bay Sector (IBS), and (7) East Yakutat (EYKT). Figure 2 shows the state management areas for lingcod off of Southeast Alaska. Detailed descriptions of Management Area boundaries may be found at 5AAC 28.105.
- Prohibition of directed fishing in the inside districts, NSEI and SSEIW, and in the waters of the CSEO between latitudes 56 55.5' N. and 56 57.0' N. and longitudes 135 54' W. and 135 57' W. (the Pinnacle area) and waters of Sitka Sound.
- *Annual harvest quotas for the different areas.* In 2007, the directed lingcod quota was allocated as follows: (1) Icy Bay Sector 66,660 round pounds, (2) East Yakutat 111,000 pounds, (3) Central Southeast Outside 86,400 pounds, (4) Northern Southeast Outside 17,200 pounds, and (5) Southern Southeast Outer Coast 50,100 pounds.
- *Temporal protection*, especially during the spawning and nesting season. The directed fishery normally opens in mid-May.
- *Gear limitations.* Lingcod may be taken in a directed lingcod fishery only by mechanical jigging machines, dinglebar troll gear, and hand troll gear.
- *Vessel identification requirements.* Vessels fishing for groundfish with dinglebar troll gear must display the letter "D" and vessels fishing for groundfish with mechanical jigging machines must display the letter "M" (5AAC 28.135).
- *Prior registration with ADF&G.* The vessel owner or the owner's agent must register the vessel with the department prior to directed fishing for lingcod.
- *Super exclusive registration.* The IBS directed fishery is a super exclusive registration area and has its own registration form. A CFEC permit holder who participates in the directed commercial taking of lingcod in the Icy Bay Subdistrict may not participate or have participated in the directed commercial taking of lingcod as a CFEC permit holder in any other registration area or portion of a registration area during that calendar year.

- *Bycatch.* Full retention of DSR or black rockfish first sentence needs clarification that if the DSR overage is taken in federal waters, it may be retained for personal use or donated but may not be sold or enter commerce. This is different from DSR overage in state waters in which proceeds from the sale would go to the state.
- Bycatch retention limits expressed as percentages of the round weight of lingcod aboard: (1) 10% demersal shelf rockfish, (2) 5% all other rockfish and thornyheads in aggregate, (3) 20% Pacific cod, (4) 20% Spiny dogfish, (5) 20% other groundfish in aggregate.
- Lingcod logbooks are required and a copy of the logbook pages detailing a landing must be attached to the fish ticket documenting the landing.
- All lingcod harvested must be a minimum of 27 inches in length. Undersized lingcod that are tagged may be retained as long as the tag is not removed from the fish.

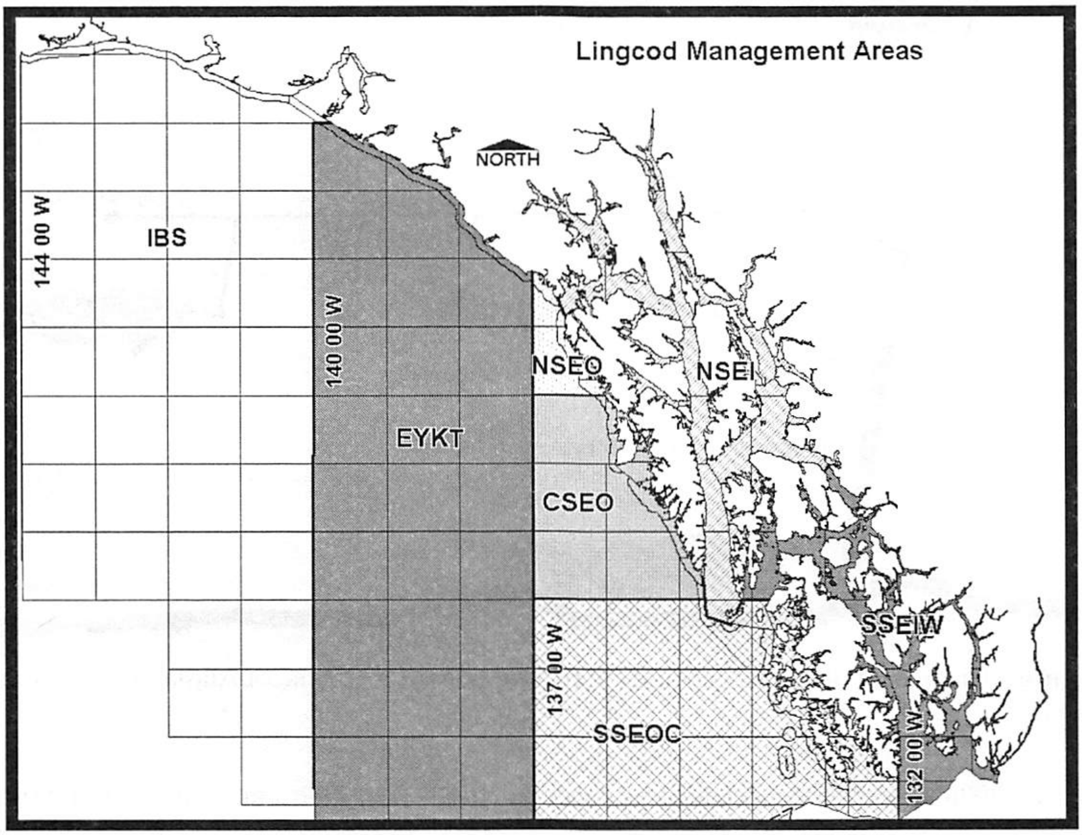


Figure 2. State of Alaska lingcod management areas

Dinglebar fishing

Dinglebar gear

Dinglebar gear is salmon troll gear with the addition of a heavy metal bar. The weight of the bar keeps the hooks close to the bottom. Gordon (1994) describes the fishing method as follows:

Most vessels participating in the directed fishery for lingcod are salmon trollers < 13 m in length that use dinglebar gear trolled at slow speeds. Salmon trollers are easily adapted to this fishery. Dinglebar gear is configured as a single horizontal spread of up to 13 lead-headed jigs extending from an attachment about 1 m above a 1- to 3-m steel bar weighing 13.6-34 kg... The troll wire is run directly into the water off a block and, unlike troll gear, is not tagged to a trolling pole. This allows the fisher to keep a hand on the wire and feel if the gear is hitting bottom or if fish are biting. For this reason a person can effectively fish only 1 line....

Figure 3 taken from Gordon, shows the dinglebar configuration.

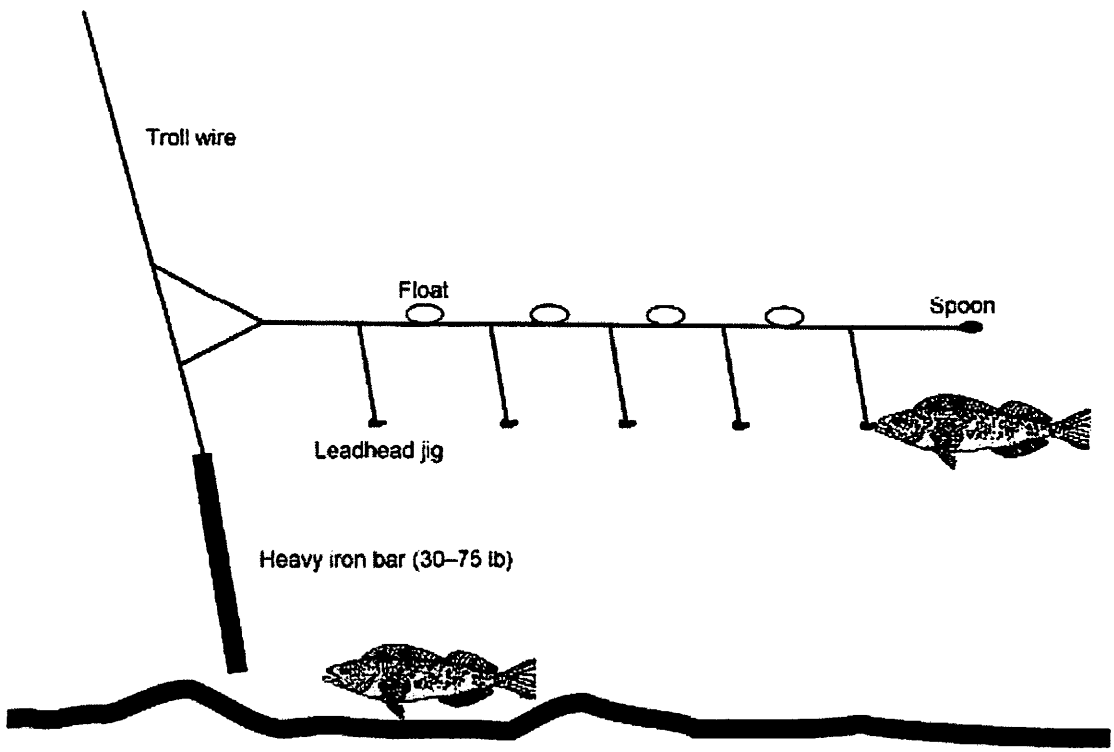


Figure 3 Diagram of dinglebar gear used to fish for lingcod in Southeast Alaska (from Gordon 1994)

Seltzer (2006) describes the technique as it was practiced off of California in the early 1990s:

I fished commercially for lingcod aboard the vessels Anna B., Duwam, Margie Mae, and Serenade II. Under one of the original masters, I learned an obscure and secretive, but highly effective, method called "dinglebar" trolling. This guy was so good he was practically worshipped any time we arrived in a new port. They often called him "Bruce the Ling-slayer." Those days, we actually hid our gear from sight so that it wouldn't get copied. The basic formula involved a lot of 8-oz. leadhead jigs, tuna cord, a few empty 12-oz. glass soda bottles, and the dinglebar, which is a 50 to 60-pound bar, typically made out of discarded sash weights originally used to counter-weight large hung windows. We would troll the dinglebar on the end of a steel cable very close to the bottom, sometimes along the bottom, which is tricky, since the bottom tends to grab your gear... and keep it! Up the cable a couple of feet there's a long cord tied on that trails way out behind the boat, with several leadered jigs tied on at intervals along the cord.

After every third jig, one of the empty sealed soda bottles is fastened to the cord to provide buoyancy. You roam around until you start to catch fish, then you set the boat on a tack and start pulling them up....

Elsewhere Seltzer indicates that, on this vessel, the crew – apparently of two – operated two sets of dinglebar gear from hydraulic salmon gurdies at the same time, one person setting as the other was hauling back. This operation fished for a live market, returning after two day trips with the live lingcod in a holding tank. The lingcod were marketed to customers at dockside; customers stood on the dock above the boat and pointed to the fish they wanted. This was retrieved from the holding tank, bludgeoned to death on the deck, and hoisted up to the customer in a paper sack (Seltzer 2006) Alaska's dinglebar fishermen, in contrast, are supplying a fresh market. Vessels make short trips, and ship a partly processed product by air to the lower 48 United States (Gordon 1994).

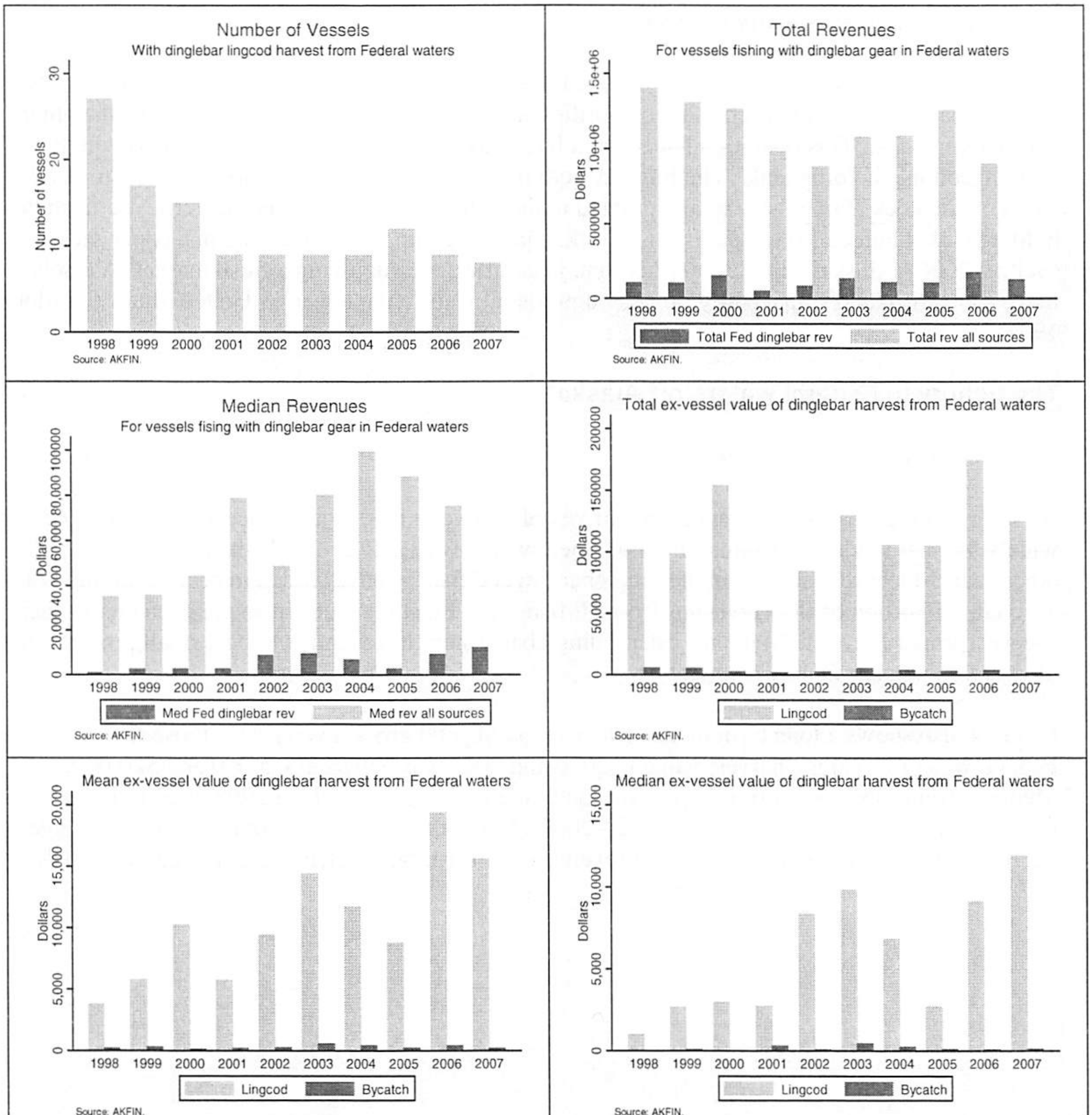
The fishery in Federal waters off Alaska[5]

Activity in Federal waters

As shown in Figure 4 below, the number of vessels active in this fishery since 1998 has ranged widely, but has tended to decline. In 2007, there were fewer active vessels than in any of the other years. Fleet revenues from the dinglebar lingcod fishery have tended to be a small, but not a trivial, proportion of fleet revenues from all fisheries. Fleet revenues from the bycatch of other species (primarily rockfish) in the Federal dinglebar fishery have tended to be a small proportion of overall dinglebar fishing revenues.

Figure 4 also shows a long term increase in average lingcod gross revenues for those fishing in Federal waters. Average harvest value in 2006 and 2007 was between $15,000 and $20,000. Median revenues show a different pattern, jumping up from low levels in 1998-2001 to higher levels (except for 2005) in the period 2002-2007. Neither the mean or median summaries suggest that bycatch was an important source of revenues from fishing dinglebar gear in Federal waters.

[5] The vessel count, vessel description, and harvest and revenue estimates described in this section are based on fish ticket reporting records as summarized by the Alaska Fisheries Information Network (AKFIN). The vessel count and other information for 2007 is based on AKFIN records showing six vessels made landings in Federal waters in 2007. VMS information was only received from four of these vessels. It is not clear whether or not the other two vessels should have carried VMS units. For example, they may have made all their landings in State waters and there may have been a statistical area reporting or transcription error at some point. In addition, one vessel that did not report landings from Federal waters, only from State waters, did carry and transmit with a VMS unit.

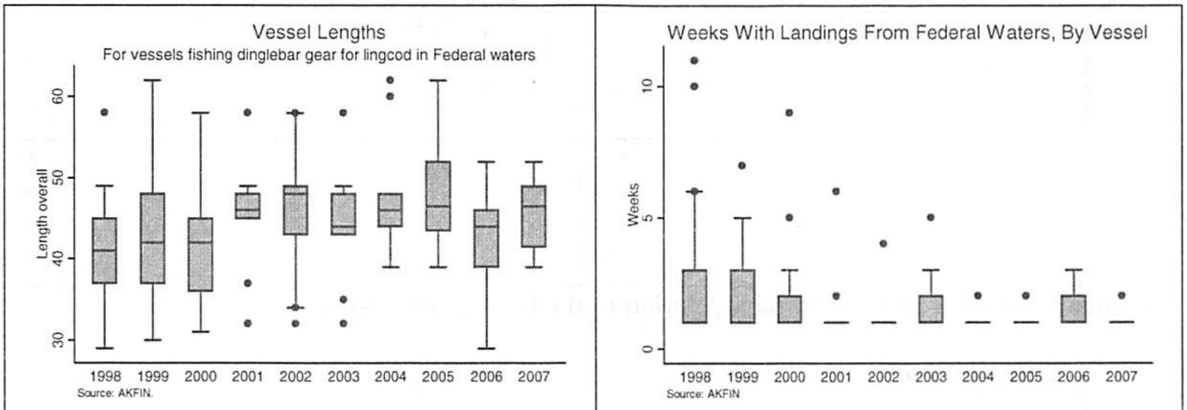


Note: 2007 revenue estimates are based on partial and preliminary information. The 2007 revenue estimates for the dinglebar fishery are probably reasonably accurate, but estimates of 2007 revenues from all sources may be misleading and have not bee reported. In one instance ex-vessel prices from other vessels were used to impute ex-vessel prices for an operation.

Figure 4. Number of vessels with Federal lingcod harvests, with median and total revenues, and value 1998-2007.

Vessels and their characteristics

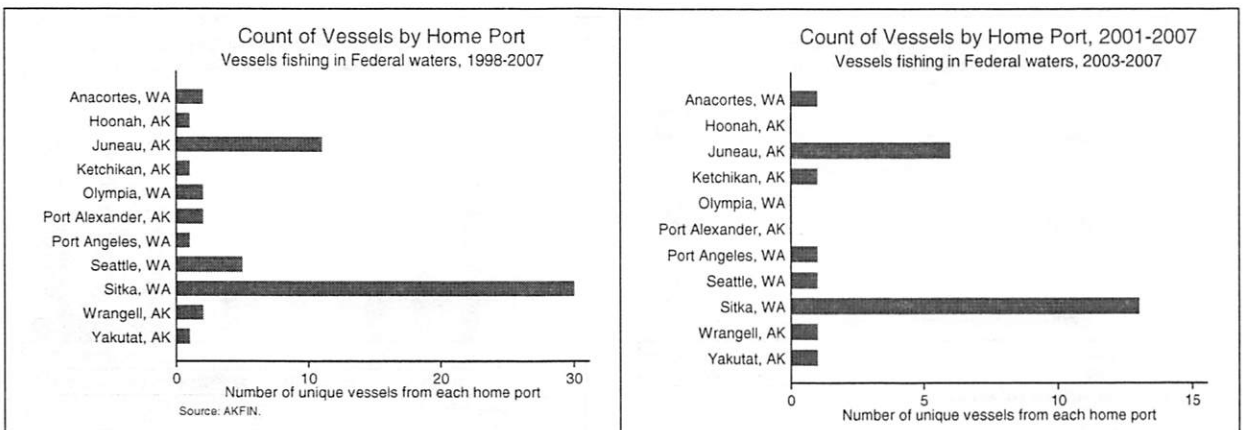
Figure 5 shows the distribution of vessels by vessel length overall (LOA) and the distribution of vessels by the number of separate weeks during which landings were made in a season. In recent years, the median vessel length appears to have been between 45 and 50 ft LOA. Vessels appear to have been somewhat shorter in the earlier years in this time series (note that the targeted commercial fishery goes back to the 1980s), but increased in length abruptly between the 2000 and 2001 seasons. During this time, the median vessel appears to have made landings from Federal waters in only one week per year. The most active vessels tended to make landings in fewer weeks as time passed.



Note on interpretation: The lower end of a box marks the 25th percentile, the upper end marks the 75th percentile. A bar in the center marks the median, or 50th percentile. The range between the 25th and 50th percentiles is called the interquartile range. The ends of the whiskers mark the last observation, if any, that falls within 1.5*IQR of the ends of the box. Circles mark extreme values.

Figure 5. Vessel lengths and numbers of weeks of fishing.

Figure 6 shows that most vessels fishing with dinglebar gear in Federal waters are from Southeast Alaska, especially from Sitka, and to a lesser extent Juneau. This pattern holds up over the longer 1998-2007 time period, and the last five years.



Source: vessel registration files

Figure 6. Vessel counts by home port.

Figure 7 shows the number of years that individual vessels were active in the fishery in Federal waters. The left hand side shows the numbers over the whole period from 1998-2007. The right hand side focuses on the numbers active since the overall annual vessel count stabilized in 2001. Even for the more recent period, a large number of operations were active for only one year. On the other hand, two vessels operated in each of the seven years of the period.

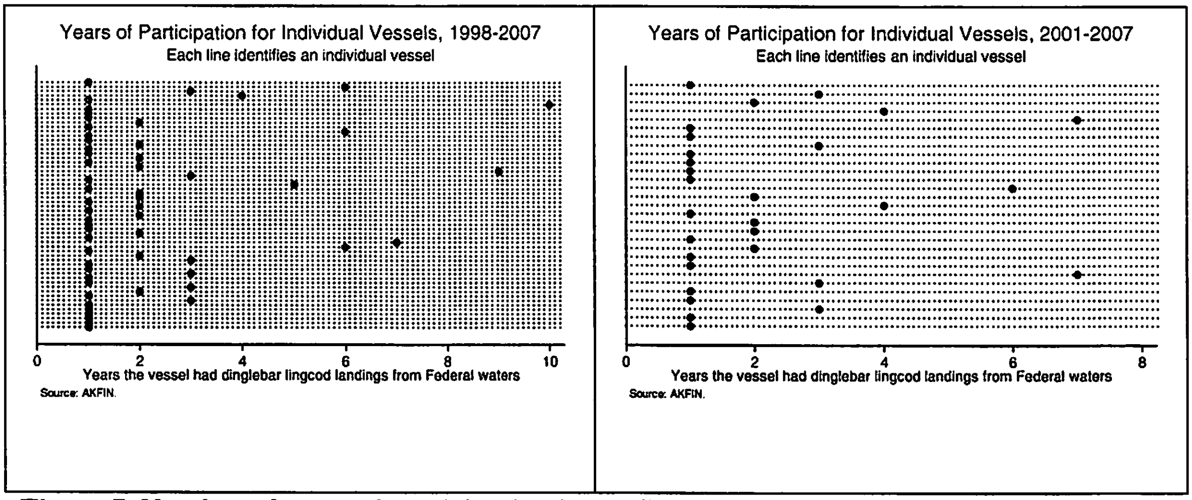


Figure 7. Number of years of participation in the fishery, by vessel.

Diversification

Participants in the dinglebar fishery in Federal waters were active in other fisheries during the year. As shown in Figure 8, dinglebar revenues were a relatively small, but not trivial proportion of their revenues from all sources.

In recent years, vessels taking lingcod with dinglebar gear in Federal waters during a year do not appear to take lingcod with dinglebar gear in State waters, and vice versa. In the early years of the data, from 1998 to 2000, vessels appear to have been more prone to be active in both State and Federal waters, but this pattern disappears from 2000 forward.

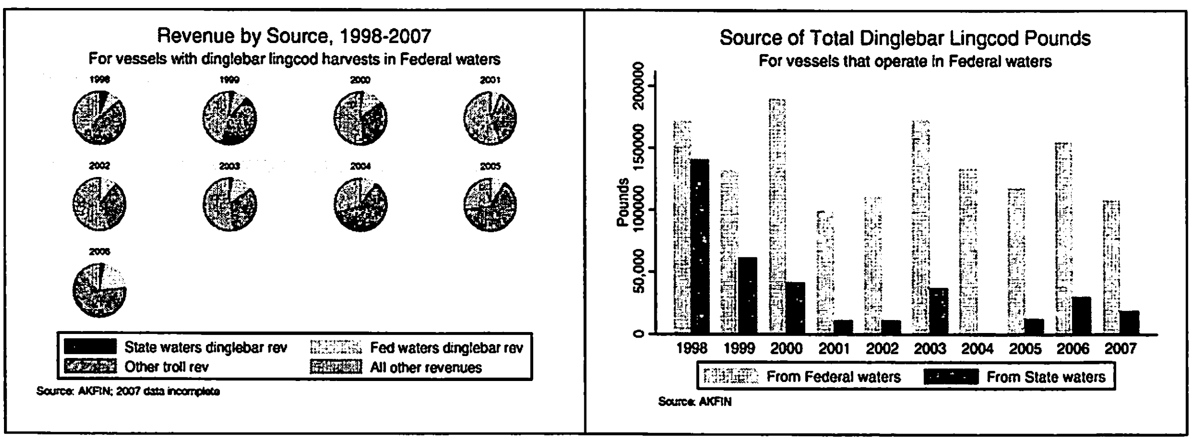


Figure 8 Revenues and pounds by source for vessels fishing for Lingcod with dinglebar gear in Federal waters, 1998-2007.

Reasons for the vessel monitoring system requirement

This section provides a description of the HAPC identified as the Primnoa Coral Marine Reserve. A full description of the HAPC process and methods to evaluate the areas can be reviewed in the

EA/RIR/IRFA (NMFS 2006b). The issues of primary concern with respect to the effects of fishing on the HAPCs are the potential for damage or removal of fragile biota, within each area that are used by fish as habitat and the potential reduction of habitat complexity, benthic biodiversity, and habitat suitability. The vulnerable habitats in the areas are those containing *Primnoa* species of coral.

A habitat profile for *Primnoa* species reported by Cimberg et al. (1981) associates *Primnoa* species with large boulders and exposed bedrock in areas with moderate to high currents and yearly temperatures above 3.7°C. Red tree coral (*Primnoa* sp.) may be the most common gorgonian coral[6] observed in fished areas of the eastern GOA. Concentrations of *Primnoa* sp. are unique and are considered rare in the vast areas of the slope and shelf, and the current efforts that have been taken to located these concentrations. Where *Primnoa* species are found, the high relief structure appears to offer refugia for commercially important demersal fishes (Bizarro 2002).

The overall abundance of high relief hard coral structures in Alaska is unknown. The analysis used the data from documented locations of high relief hard corals sites that have primarily been observed *in situ* by NMFS and ADF&G submersible research. Additional information from bycatch within the commercial fisheries as well as bycatch within NMFS research surveys was used as a supplement where appropriate.

Cape Ommaney Area

The Cape Ommaney HAPC is located in the eastern GOA about 28 km west of Cape Ommaney, Baranof Island, Alaska (Figure 9, Table 1). Common bottom types for Cape Ommaney area include rock, gravel, and cobble (NOAA Chart 17400). However, newer multi-beam survey technology shows that there is almost three times more rock habitat in this area than originally thought (O'Connell et al. 2002). Designation of the Cape Ommaney site as HAPC was based on directed NMFS research that documented boulder and bedrock substrates supporting concentrations of *Primnoa* species coral (red tree coral). Bedrock and large boulders at depths between 201 and 256 m support the concentrations of *Primnoa* species. Several hundred colonies were observed at this site and many were greater than 1 m in height. High *Primnoa* sp. concentrations and associated sedentary invertebrates were also associated with the small pinnacles. A series of small pinnacles also make this area unique.

[6] Gorgonian corals are colonial marine corals with rigid skeletons. There are 18 recognized Gorgonian families, including the *Primnoa* species. University of Alaska Alaska Natural Heritage program Website on Gorgonian corals provides more information: http://aknhp.uaa.alaska.edu/zoology/species_ADFG/ADFG_PDFs/Invertebrates/GorgonianCorals_ADFG_web_060105.pdf

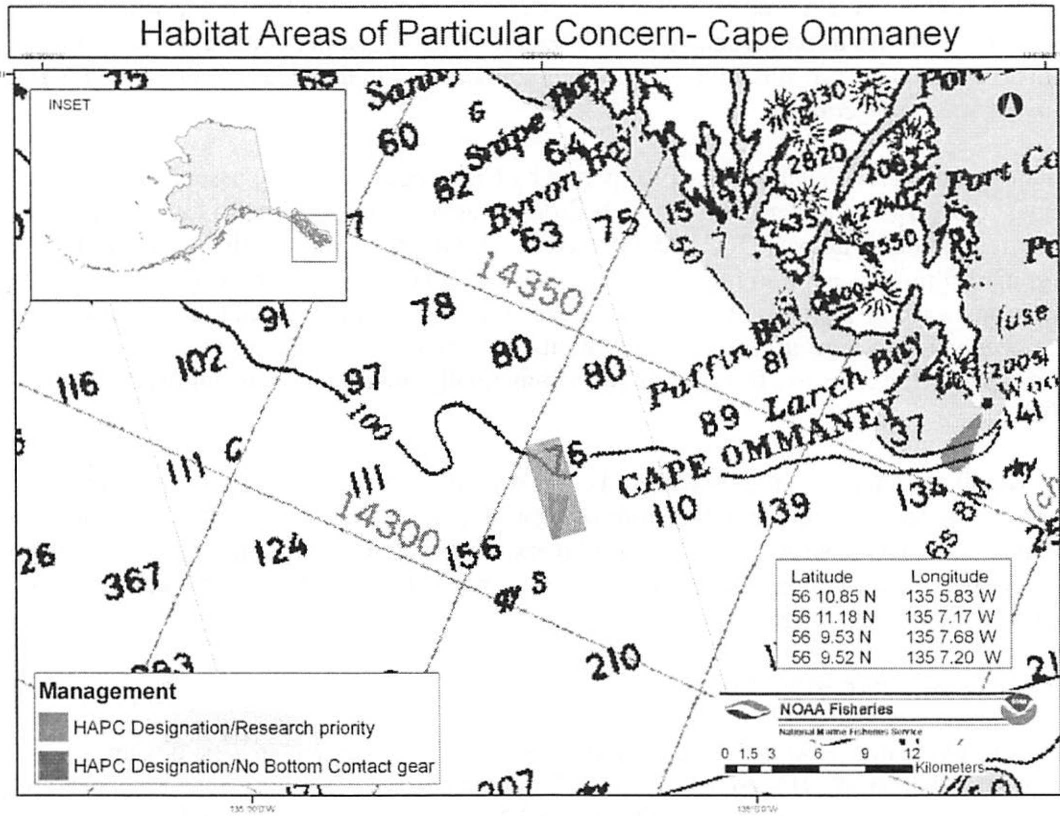


Figure 9 Primnoa Coral Marine Reserve identified as a HAPC near Cape Ommaney.

Fairweather Ground NW/SW Area

Two nearly adjacent HAPCs are located on the Fairweather Ground in the eastern GOA (Figure 10, Table 1). Common bottom types of the Fairweather Ground include bedrock, boulders, cobble, pebble, and gravel (NOAA Chart 16760; Bizzarro 2002), with a considerable amount of rock habitat on the bottom (O'Connell et al. 2002). In 2001, NMFS's Alaska Fisheries Science Center scientists conducted dives with the submersible vehicle *Delta* in areas of the Fairweather Grounds where large catches of *Primnoa* sp. coral were collected as bycatch during triennial groundfish surveys. Submersible observations confirmed the presence of a series of dense *Primnoa* sp. concentrations located along the western flank. Additional submersible research has also noted areas of *Primnoa* species in rocky and boulder substrates. However, these two areas had greater concentrations of *Primnoa* species than other surveyed areas (NPFMC 2004). Bedrock and large boulders at depths between 150 and 200 m support the concentrations of *Primnoa* species. Colonies were observed and distributed throughout the dive transects. Many colonies were greater than 1 m in height.

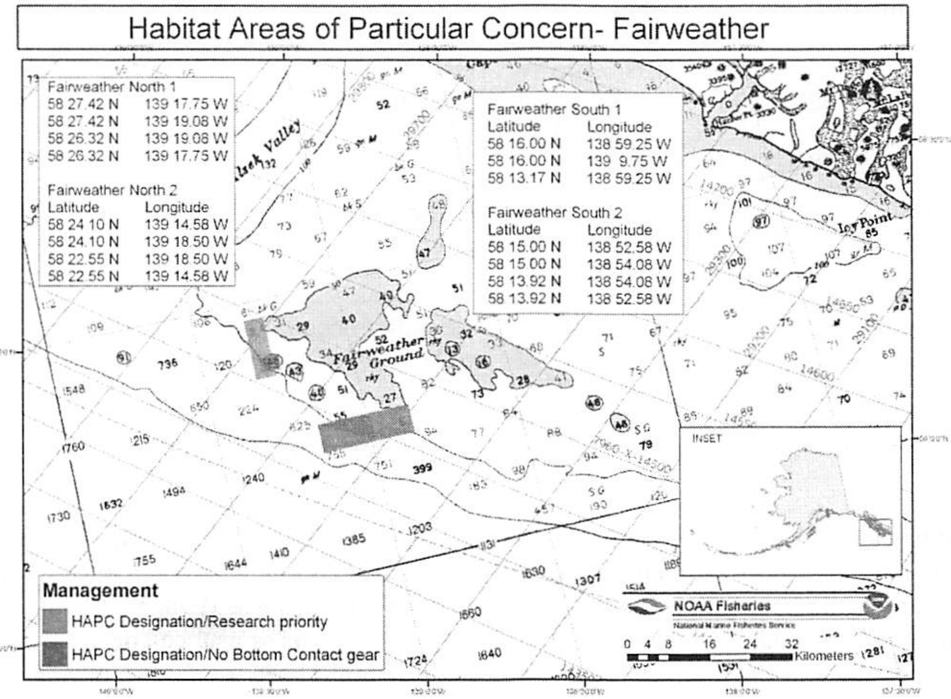


Figure 10. Primnoa Coral Marine Reserve identified as a HAPC near Fairweather ground.

Table 1. Name, location, and area of HAPC sites along the continental slope in the Eastern GOA

Proposed HAPC Area	Latitude	Longitude	Management	NOAA Chart No.	Area
Cape Ommaney	56 12 51 N 56 12 51 N 56 09 32 N 56 09 32 N	135 07 41 W 135 05 30 W 135 05 30 W 135 07 41 W	HAPC Designation	17320	4.0 nm^2
Cape Ommaney	56 11 11 N 56 10 51 N 56 09 31 N 56 09 32 N	135 07 10 W 135 05 50 W 135 07 12 W 135 07 41 W	No bottom contact gear	17320	0.9 nm^2
Fairweather Ground NW Area	58 28 10 N 58 28 10 N 58 22 00N 58 22 00 N	139 19 44 W 139 15 42 W 139 15 42 W 139 19 44 W	HAPC Designation	16760	13.11 nm^2
Fairweather Ground NW Area 1	58 27 25 N 58 27 25 N 58 26 19 N 58 26 19 N	139 19 05 W 139 17 45 W 139 17 45 W 139 17 45 W	No bottom contact gear	16760	0.77 nm^2
Fairweather Ground NW Area 2	58 24 06 N 58 24 06 N 58 22 33 N	139 18 30 W 139 14 35 W 139 14 35 W	No bottom contact gear	16760	13.11 nm^2

	58 22 33 N	139 18 30 W			
Fairweather Ground Southern Area	58 16 00 N 58 16 00 N 58 13 10 N 58 13 10 N	139 09 45 W 138 51 34 W 138 51 34 W 139 09 45 W	HAPC Designation	16760	27.3 nm^2
Fairweather Ground Southern Area 1	58 16 00 N 58 16 00 N 58 13 10 N	139 09 45 W 138 59 15 W 138 59 15 W	No bottom contact gear	16760	7.87 nm^2
Fairweather Ground Southern Area 2	58 15 00 N 58 15 00 N 58 13 55 N 58 13 55 N	138 54 05 W 138 52 35 W 138 52 35 W 138 54 05 W	No bottom contact gear	16760	0.86 nm^2

Only a few studies have been completed in Alaska on the effects of fishing gear on habitat, and none have been done for troll or dinglebar gear, so this discussion is qualitative in nature. Non-pelagic trawl gear has not been utilized in the Eastern Gulf of Alaska since 1998. Consequently the only restricted gear would be dinglebar gear. Trolling with dinglebar gear can occur over many bottom types and anecdotal information suggests the gear has been used in the GOA as deep as about 110 fathoms. Some of the dinglebar fishery occurs near the Fairweather Grounds. In most situations, the gear rarely contacts the ocean bottom; however, the gear is fished in lingcod habitat adjacent to the closure areas.

VMS requirements have clear enforcement benefits.[7] The number of management boundaries, no transit, and no fishing zones used to regulate fishing activity has grown enormously over the years. Many of these boundaries are located in remote places and are difficult to monitor. Moreover, neither the USCG, which has primary responsibility for monitoring boundaries at sea, nor the OLE have received budget increases to enforce these and other additional responsibilities.

Without VMS, closure violations can only be effectively deterred or identified when enforcement agents are physically present, or known to have a realistic capability of being physically present, and can observe the violation in progress. Individually, some of these areas are not unmanageable. However, because of the sheer number and complexity of these areas, the large expanses that must be monitored, and relatively limited resources, many USCG and OLE officials believe they may have been stretched beyond their ability to provide adequate monitoring without the aid of VMS.

If a vessel is carrying VMS, OLE and the USCG have the capability to determine its location at all times. If an area is closed to all transiting, VMS can determine compliance based upon VMS

[7] They may have other benefits. For example, if the data were shared with ADF&G lingcod managers, they may prove useful in monitoring the amount of effort active in the fishery, and in fine-tuning closures so as to neither over or under shoot harvest targets. The units may reduce USCG response times to accidents by allowing it to screen false alarms more rapidly, and to locate the position of vessels in distress more rapidly and accurately. The units may have scientific value and policy value. That has been the case in this analysis, because the VMS requirement has made it possible for analysts to identify 2007 fishing locations with considerable accuracy. Confidentiality rules preclude distribution of this information. Finally, they may have value to fishermen who would not otherwise have installed them, but who find private uses for the units given that the installation and transmission costs are already incurred.

transmissions, eliminating the need for random surface or aerial patrols. Vessels would not have legitimate reasons to be in a no-transit area. VMS reports would provide the key evidence needed for prosecution of a violation.

If an area, otherwise open to vessel transit, is closed to fishing, or to specific types of fishing, or to particular classes of vessels, the situation is more complex. Vessels may have legitimate reasons to transit the area. Some vessels may be allowed to fish in the area, and others may not be. Determining the activity of a vessel (e.g. fishing), based solely on its VMS track, is extremely difficult. These cases require follow-up investigation when the vessel returns to port. VMS does not track the type of fish being brought on board a vessel, so it can not be used to detect a directed fishing violation. Enforcement personnel can use it to monitor a vessel's behavior, its path with respect to closed or restricted areas, or areas known to have stocks of fish species at particular times of year. This information, combined with knowledge about the vessel itself, its size, its processing capacity, the gears it uses, may allow NOAAOLE to identify vessels that are behaving suspiciously. It is then possible to work with the USCG to target a vessel or area for more careful vessel, plane, or helicopter inspection. NOAA OLE can also arrange to follow-up with an inspection of the vessel when it returns to port, and/or to carry out further investigation at a later time.

VMS may provide other enforcement advantages as well. VMS will deter violations because the vessel operators will know NOAA OLE and the USCG have the ability to monitor their activities and to deploy aircraft or enforcement vessels directly on scene if illegal activity is suspected. Moreover, enforcement agencies monitoring VMS reports may be able to prevent illegal setting of gear, which may, for example, destroy sensitive corals and sponges, by calling vessels using radio or telephone if they look like they are working too near closed areas.

Some have suggested that enforcement of the prohibition of dinglebar fishing in the coral habitat protection areas may have little value because dinglebar fishermen are unlikely to fish in depths that support these species. This may be the case if there is little overlap in the depth at which dinglebar gear is fished and the depths included in the areas closed to mobile bottom contact gear. An examination of the bathymetry of the closed areas indicates that these areas are generally at depths greater than 100 fathoms (200-500m). A preliminary examination of dinglebar fishing logs for 2007 indicates that most vessels reported fishing at depths less than about 45 fathoms. One vessel did report using the gear in significantly deeper waters, but still less than 100 fathoms. Anecdotal information suggests, however, that dinglebar gear has been fished as deeply as 110 fathoms.

Estimated costs of the requirement[8]

VMS costs for operations are expected to fall into the following categories:

- Purchase and freight
- Installation charges

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[8] These cost estimates were originally prepared in the spring of 2006 for another VMS analysis (NMFS, 2006a). They were spot checked in February 2007 and again in the fall of 2007. Unless otherwise noted, the analysis in this section is based on the earlier document. Refer to that document for detailed background information. The only significant changes introduced for this analysis are (a) an adjustment in the estimated purchase costs which takes account of information on actual reimbursements for unit purchase provided by the Pacific States Marine Fisheries Commission under the program described in this section, and (b) a discussion of the potential impact of costs or residence in a remote community.

- Initiation fee, if any
- Sales taxes
- OLE notification
- Transmission costs
- Maintenance and repairs
- Lost fishing time due to unforeseen breakdowns
- Replacement cost

There is no statistical information about the extent to which fishermen are paying list price or a negotiated or sales price, the time requirements for installation, the nature of the transmission packages they are buying, or the average number of days or months they are transmitting. Under these circumstances, the individual vessel costs estimated here are rough approximations to plausible average values. The cost estimates used in this analysis are summarized in Table 2 and documented in the remainder of this section. The sections that follow provide estimates of the present value of the cost of the VMS requirement to a typical operation, and estimates of the costs of the requirement in 2007 (the first year in which it was effective).

Table 2. Summary of cost estimates used in this analysis

Purchase and freight	$1,500
Installation	$239
Brackets	$60
Initiation fee (with satellite service provider)	$150
Notify NOAA OLE	$108
Sales taxes	$18
Reimbursement for purchase	$1,500
Total acquisition and installation w/out reimbursement	$2,068
Total acquisition and installation with reimbursement	$568
Transmission costs for one year	$111
Maintenance and repairs for one year	$77
Note: these are estimates of the costs for a "typical" operation that bought and operated a VMS unit to comply with the regulations requiring its use on a vessel with an FFP using dinglebar gear. The reasoning behind the estimates is summarized in the text in this section.	

Purchase and freight[9]

Five VMS units are NMFS type-approved for Alaska. List price estimates are summarized in Table 3. Marine electronics firms in Alaska have been found selling units for more and less than the list price. Prices include freight, but not installation.

Vessel owners purchasing a VMS unit in order to comply with Federal regulations governing dinglebar fishing for lingcod in the GOA are eligible for a reimbursement of the initial purchase cost of the unit. The reimbursement covers the costs of purchase and freight, but not the costs of sales taxes, installation, annual operating expenses, or replacement. The program is operated through the Pacific States Marine Fisheries Commission (PSMFC), which reimburses up to $1,750 for the purchase of a VMS to meet regulatory requirements in the Alaska Region. A

[9] This section assumes that vessel operators will purchase a single unit. Anecdotal evidence suggests that at least some larger vessels have purchased additional backup units.

review of PSMFC reimbursement payments from the summer of 2007 to five vessel owners using their vessels in the dinglebar lingcod fishery suggests that actual unit costs averaged about $1,500. In this analysis, this cost has been used as an estimate of the average cost of purchase and freight to the vessel owners, and of the size of the reimbursement payments.

Table 3 Costs of different VMS units

UNIT	Manufacturer	List Price	Transmission Costs (1)	Activation Fee	Accuracy	Email Capable (2)	Satellite System
T&T 3026-S	Thrane & Thrane	$1,650	$2.88 / Day($86.40 / Month)	None	10 Meters	Yes	Inmarsat
T&T 3026-D	Thrane & Thrane	$1,750	$2.88 / Day($86.40 / Month)	None	10 Meters	Yes	Inmarsat
Stellar ST-2500G	Skymate	$1,599	$55.58 / Month($1.85 / Day)	$149.00	10 Meters	Yes	Orbcomm
Stellar St-2500G	Metocean	$1,599	$69.99/month ($2.25/day)	$99	10 meters	Yes	Orbcomm
Watchdog	Faria	$1,620	$59.95/month	None	10 meters	Yes	Iridium

(1) Transmission costs assuming 1/2 hour reports (30-day month); (2) Requires computer or message terminal; Installation fees have been quoted from $200 - $600 depending on the vessel; Warranty is two years for T&T units. Warranty is one year for Skymate Units. These cost estimates were prepared in early 2006 and modified in late 2007 by the addition of the Faria unit.

VMS units are a business expense. Tax deductibility would reduce the costs of these units to fishermen. However in a cost and benefit analysis from a national accounting stance, the tax savings would be a transfer payment and would not affect the costs or the benefits.

Installation

Installation requires placement of the VMS unit itself, placement of GPS and VHF satellite antennae, running of cables between the system components and the power source, and power hookup. Installers may need to add brackets and poles to the cost of the VMS packages during installation.

Buyers can install their own units. Installation services are also available from vendors or electricians. Vendors have indicated that one to two hours of installation time are typical, and that they charged on the order of $90/hour for the service.

Installation time can take more than two hours. Other NMFS estimates have ranged up to four to six hours. Installation may take longer, for example, when a 12 volt DC hookup is not convenient to a location where the VMS unit can be installed.

A "most-likely" cost for installation has been estimated assuming that a normal installation would take about three hours for a self-install[10], or two hours for a professional installation, and that each is equally likely. The cost for a typical installation was estimated to be $239.[11]

VMS units require brackets for installation. The units may be purchased with brackets, or fishermen may be able to obtain brackets elsewhere for installation. Purchase of brackets may be an additional expense, running from about $30 for two brackets and up to $100 or $150 if pipes were needed for antenna placement, in addition to brackets. In this analysis, the distribution of installation costs was approximated by a triangular distribution with a minimum value of zero, a maximum value of $150, and a most likely value of $30. The mean of this distribution was $60, and this value was used to calculate aggregate costs.

VMS failure is discussed later. Conversations with vendors and recent NMFS discussion of VMS both suggest that failure rates may be higher for self-installed units. Problems may occur in the placement of antennas, or in the power hook-up. Thus, installation costs and repair costs may be negatively correlated.

Initialization fee

Skymate units require an initiation fee of about $149 dollars to make them operational, while Metocean units cost about $99. The Thrane & Thrane units do not require an initiation fee. Taken together, the cost of the Skymate unit and its initiation fee are very similar to the price of the Thrane & Thrane 3026-D unit. The initiation fee must be renewed, if a subscription to transmission services is allowed to lapse. Subscriptions can be held open with $5/month drydock fees.

Sales tax

Sales taxes may be applicable to the cost of the unit itself, the costs of brackets, and the costs of installation services. Sales taxes will vary by the jurisdiction within which the VMS unit is bought. Sales taxes in Alaska coastal communities in which fishermen are likely to find marine electronics stores selling VMS units tend to range between 3 and 6 percent. Fishermen may be able to get a VMS from a jurisdiction with no sales tax. A 6 percent rate has been used in this analysis. This is a real cost to the fishermen concerned, however in a cost-benefit analysis, taxes are treated as a transfer payment from one group to another. The sales tax, charged on the brackets and installation, is estimated to be $108 in this analysis.

[10] In the course of preparing this discussion paper NMFS learned of an instance where a self-install took about 10 hours over several days. The estimated cost of this would have fallen within the highend of the range of cost estimates, however.

[11] Assuming that a normal self-install has an opportunity cost of $25/hour and takes three hours, and that a professional installer charges $90/hour for two hours work, and that each approach is equally likely, the estimated weighted average cost for a normal install is $128. A minimum installation cost of two hours of self installation at $25/hour is $50. A maximum installation cost, in a worst case scenario, takes six hours of a professional's time at $90/hour, and comes to $540. In this analysis, the distribution of installation costs was approximated by a triangular distribution with a minimum value of $50, a maximum value of $540, and a most likely value of $128. The mean of this distribution was $239, and this value was used to calculate aggregate costs.The mean of a triangular distribution is equal to the average of the low, high, and most likely values.

OLE Notification

Before participating in a VMS fishery, participants are required to notify OLE that their VMS transmitter is activated. Upon completion of purchase and installation of the VMS units, and at least 72 hours prior to participation in a fishery that requires VMS, the participant must supply power to the transponder and fax a check-in report to OLE. The information on this report will enable NMFS to verify that the VMS system is functioning and that VMS data are being received. NMFS estimates that this would take the vessel operator about 15 minutes and cost $6 for a fax. Total cost is estimated to be $11.

Transmission costs

Vessels that will be expected to acquire VMS under the rule implementing the EFH/HAPC protection measures are assumed to use a transmission package based on the package sold in conjunction with the Skymate unit.[12] The Skymate unit comes with various transmission packages, ranging in cost from about $20 to about $74 per calendar month for different levels of transmission activity. Additional costs are incurred if the monthly transmission level is exceeded. The highest priced package provides for more transmission capacity per month than is necessary to meet NOAA requirements. The packages from this manufacturer offer "dry dock" fees of $5/month to cover months during which the vessel is not expected to transmit (this would allow the fishing firm to avoid paying a new activation fee if it stopped transmitting for a long period).

Vessels that acquired VMS under the EFH/HAPC rule are assumed to see their VMS costs for "active" months billed as follows. Units that will have to acquire VMS, were assumed to purchase a VMS coverage package costing $38.99 a month. This buys the transmission of an estimated 20,000 characters. Transmission every half hour for 31 days requires an estimated 29,760 characters. Under this package, additional characters cost $1.70 per 1,000. Operations were assumed to buy an additional 10,000 characters for $17. Total cost per month of fishing activity was estimated to be about $56. These operators were assumed to pay a "drydock fee" of $5/month for the remaining months. The drydock fee provides for months without transmissions, and allows the fishermen to avoid paying a new activation fee of $150 upon returning to active operation.

Annual transmission costs are the sum of transmission and drydock costs. Some participants in the fishery target only in the EYKT directed fishery. For fishermen acquiring VMS for the this area only in the dinglebar fishery, and who will only use it in one calendar month, total annual transmission costs for a fisherman who operated subject to a VMS requirement for one month and did not make VMS transmissions in the other eleven months, would be estimated to be $111 ($56/month for one month and $5/month for eleven months). This region has the highest participation and is usually closed in 10 to 12 days, so most vessels would only require VMS for 1 month. Moreover, as noted in Figure 5, most vessels made only one week's worth of landings in 2007. It is possible through error or paperwork problems that some fishermen may end up paying for more months of transmissions than they really require to meet regulatory requirements. There are a few landings that usually occur in Federal waters throughout the summer in CSEO and SSEOC so the VMS operation may be necessary for a longer period than one month. The season goes until November 30.

[12] This assumption does not imply NOAA endorsement for the Skymate unit. One of the other units might have been chosen to make this comparison, or some hypothetical unit, with characteristics combined from several units might have been used.

Maintenance and repairs

VMS units require maintenance. Batteries will need to be monitored and replaced periodically. Operators of smaller vessels with limited electrical systems, who may be operating the VMS units off of the unit's rechargeable battery, may have to periodically recharge the battery. This could be done, for instance, off of a car's cigarette lighter. Owners may also have to monitor antenna and power connections for corrosion, and clean them as necessary. In addition, some systems may require software to be updated. Many of the transponders can have their features upgraded by being reloaded/flashed with updated versions. Some vessel owners have found that data from apparently functioning VMS units is not reaching OLE. These cases may require troubleshooting.

A certain number of units will break down each year. Future breakdown rates and associated costs are unknown. OLE experience with the units installed under the Steller sea lion protection program suggests a breakdown rate of about 3 percent to 5 percent per year for those units.

Operations that already have VMS units, or that will acquire them independently of this action, won't incur more breakdowns because of this action. VMS units already operating would face these costs whether or not this action is taken. Breakdown costs will be incurred by operations making new VMS installations because of this action.

As noted earlier many of the problems arising with these units are caused by mistakes made during self-installs. These may occur early in the unit life cycle. Problems mentioned include positioning of antennas, and problems with power supply.

New units will initially be under warranty. Thus a large part of the risk of replacement costs and service charges is transferred from fishermen to vendors. Since cost of the warranty is included in the purchase price, it is similar to the purchase of an insurance policy. Thrane & Thrane units carry a two-year warranty, while Skymate units carry a one-year warranty. Skymate vendors generally address warranty responsibilities by swapping out the defective unit for a new one.

NMFS estimates the time required to maintain the antennas and electrical systems on the vessel operator is estimated to be approximately 2 hours per year. This comes to $50 if done by the vessel's personnel, or $180 if professionally serviced (using the estimates of opportunity costs and professional service used in the installation discussion earlier). Unit failures are assumed to be covered by warranty, and to be infrequent after the first year of operation. Units will be replaced at some point; replacement is discussed below.

The low end cost for maintenance and repairs is expected to be zero in a situation where no repairs and minimal maintenance are needed. The most likely cost is estimated to be two hours of maintenance by the vessel's crew, estimated to be about $50. The high end cost is assumed to be two hours of professional assistance, costing $180. Note that many problems are likely to be dealt with under warranty by switching out an old unit for a new one. In these cases, the replacement should be able to take advantage of the cables and brackets placed for the original installation. In this analysis, the distribution of maintenance and repair costs was approximated by a triangular distribution with a minimum value of zero, a maximum value of $180, and a most likely value of $50. The mean of this distribution was $77, and this value was added to transmission expenses to estimate annual operating costs.

Lost fishing time due to unforeseen breakdowns

Unit breakdown may cause vessel operators to lose fishing time and revenues. A an operator who becomes aware that transmission of automatic position reports has been interrupted, or when notified by NMFS that automatic position reports are not being received, must contact OLE and follow the instructions provided.

OLE handles breakdowns on a case-by-case basis. Their requirements may depend on such considerations as whether or not the vessel is at the dock or is fishing, and if it is fishing, where it is fishing and how much longer it wants to stay out. NMFS does not normally require a vessel to interrupt a fishing trip and return to port when a breakdown is identified. In the twelve months ending in early August 2006, there were about ten instances of VMS reporting failures aboard vessels that were away from port and engaged in some aspect of fishing operations. When this happened, OLE communicated directly with owners or operators and provided direction that usually included the allowance to finish up their operation (e.g., finish pulling their gear) and to obtain service once in port to rectify the VMS reporting issue(s). In a recent instance, OLE directed the vessel to provide periodic position reports until they were back in port and obtaining VMS service/repair. A vessel with a defective VMS unit will have to get it repaired before it begins a new trip.

As noted, experience with the ARGOS VMS units, adopted to enforce the Steller sea lion protection measures, but now being phased out, demonstrated that unit replacement rates were about 3 to 5 percent per year. Because of the low apparent breakdown rate, and OLE's policy for when they do, only a small number of fishing vessels with VMS are expected to experience fishing interruptions because of unit breakdown during a year.

Quantitative estimates of the size of these costs cannot currently be made. Based on OLE experience and practice, it is likely that the costs imposed on fishing operations underway will be small. It is impossible to estimate the potential cost to vessels that must repair a VMS unit before departing to go fishing. These will depend on the numbers of unit breakdowns, the distribution of VMS vendors along in communities along the Alaska coast, on the ease with which repair work can be completed or replacement units supplied.

Replacement cost

The proposed rule would be a permanent change in regulations. Fishermen would have to replace their VMS units as they wear out, as they become technologically obsolete, or as regulatory requirements changes. Thus the initial purchase cost does not represent the full lifetime cost of this requirement for fishermen.

NMFS has had a relatively short period of experience with VMS, and information has not yet been compiled which would permit estimation of typical VMS lifetimes on different classes of vessels under normal working conditions. Based on anecdotal information, NMFS estimates the typical VMS lifetime to be 4-5 years. Because of advances in VMS systems, some models may become obsolete in less than five years. Units may become technologically obsolete, and/or find their OLE type-approval withdrawn. For example, in the case of the ARGOS system, type-approval was withdrawn and new installations were not permitted after early 2004. Fishermen may also retire older units and adopt new ones if the combination of new unit costs and monthly transmission fees would be less expensive for them, or if new features make this attractive. Anecdotal evidence suggests that, in some instances, ARGOS units have been replaced for this reason.

Over the medium to long term, it is likely that technological change and increasing competition will reduce the prices of replacement units. While price indices have not been prepared, some experience bears this out. Despite this long-run expectation of declining prices, prices have been known to increase in the short run, although some of these price increases may have been associated with changes in unit quality.

Only four manufacturers are currently type approved to serve the Alaskan market. In some instances, small numbers of businesses in an industry may be very competitive. However, small numbers, and concentration of sales among a few firms, are often indicators of relatively low levels of competition. It is possible that competitive pressure on vendors to reduce prices is limited.

Purchase, installation and repair in remote communities

Fishermen operating out of small and remote home ports may face higher costs for purchase, installation, and repair of VMS units. This may also apply to some who live in larger communities, but off the road systems of those communities. Fishermen operating out of these ports may not have access to a local marine electronics shop, may have to order equipment by mail, self-install, or travel to and from a larger port for installation and service. If they tend to self-install proportionately more, they may tend to have a greater frequency of VMS breakdown. Fishermen are likely to address these cost considerations by "piggy-backing" VMS related tasks on top of other activities that take them to larger ports. As shown in Figure 6, in recent years a disproportionate share of active vessels in this fishery have Sitka and Juneau home ports. These issues should not be as serious in these ports. Other vessels have been homeported in Washington State. Since 2003, small numbers of vessels have been homeported in Hoonah, Wrangell, and Yakutat.

Present value of VMS investments

As noted, the VMS requirements under consideration in this analysis are expected to be permanent. After their initial investment in VMS units, fishermen will still be expected to incur annual transmission costs, and to purchase new VMS units as existing units fail, or become technologically obsolete. Thus, VMS units represent a long-term financial commitment by fishermen. The present value of the cost of an individual VMS investment is estimated here for a vessel acquiring a VMS for use only in the dinglebar ling cod fishery in Federal waters. This unit is only expected to be used during one month a year.

As summarized in Table 2, the cost of acquiring and installing a VMS unit is estimated to be $2,068 ($1,500 for purchase and freight, $239 for installation, $60 for brackets, $150 for initiation fees, $108 for additional sales taxes, and $11 to notify NOAA). Of this, $1,500 is assumed to be reimbursable by the Pacific States Marine Fisheries Commission. Annual expenses are estimated to be $56 for one month of transmission costs, $55 for "dry-dock" fees in each of eleven other months, and $77 to maintain the units in working order. Units are assumed to be replaced every four years.

Assuming no decline in the price of VMS units or annual operating costs over this period, and reimbursement for the initial purchase cost of the VMS, the present value of the cost of the VMS requirement over a 20 year period, at an estimated real rate of interest of 3.92 percent[13], would be

[13] Based on an estimated recent real return on Baa bonds.

$9,000. This estimate may be high if VMS prices decline over the 20 year period, or if unit life times are longer than assumed. Shorter unit lifetimes would increase the present values.

Cost Estimates for 2007

An examination of landings records and VMS tracks indicates that eight vessels fished for lingcod with dinglebar gear in Federal waters off of Southeast Alaska in 2007. All of these carried transmitting VMS units. None of these appear to have been required to carry VMS units with other regulations, thus the VMS requirement can be attributed to their participation in this fishery. Five of these vessels appear to have applied for and received reimbursements for the unit purchase costs; the three additional vessel owners have all indicated an intention, or actually begun, to apply for reimbursement.[14]

This section discusses the total costs of implementing the VMS requirement for the 2007 fishery. Two separate perspectives on costs are taken: costs are estimated first from the viewpoint of the fishermen themselves, and second from the viewpoint of society as a whole. These different accounting perspectives generate somewhat different pictures of the costs. The costs to the individual fishermen include the costs to the fishermen who installed and operated the VMS units and went fishing for lingcod in Federal waters, and the costs to the fishermen who might have gone fishing, had they not found that, for them, the additional costs of the VMS units were greater than the benefits of fishing.

Costs to participating fishermen

Total costs of purchase for those who found it cost-effective to buy the units and fish in 2007 are estimated to have been $2,068/boat for eight boats, or about $16,500. It was assumed that PSMFC would reimburse vessel owners the assumed purchase price, or $1,500/boat. All fishermen are assumed to apply for and receive these reimbursements. The total net costs to the fishermen are therefore estimated to be about $4,500. An additional allowance should be made for the additional income tax deduction associated with these business purchases. In addition to acquisition costs, fishermen are estimated to have incurred about $188/year in transmission, repair, and maintenance costs for the units. With eight active units, this suggests a cost of about $1,500. Thus the total costs to these operators in 2007 are estimated to have been about $6,000.

It is possible that some vessels were deterred from fishing for lingcod in Federal waters this year as a result of this requirement. These vessels would have been used in their next best activity. This activity, for example, may have been fishing for lingcod solely in State waters, or fishing for some other species. Vessels may also have been left idle when they would otherwise have been fishing for lingcod in Federal waters. The difference between the profits they might have generated fishing for lingcod and in their next best activity provides an estimate of the potential social loss from this source. Based on activity in recent years (nine vessels in most years since 2001, it seems unlikely that more than one vessel may have been deterred from fishing in Federal waters for this reason. Twelve vessels did operate in 2005, so it is possible that as many as four vessels may have been deterred.

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[14] One additional vessel may have fished in Federal waters with dinglebar gear, and carried a transmitting VMS unit, however, this vessel did not record dinglebar catch in Federal waters on landings records. The FFP for this vessel was endorsed for Pacific cod, therefore this vessel may have been carrying the VMS unit to comply with Steller sea lion protection regulations. This vessel has not been included in the cost calculations in this section.

If vessels were deterred, they were deterred because the additional benefits of fishing in Federal waters for dinglebar lingcod (over the benefits of their next best activity) were less than $756 (the value of purchase and installation costs minus PSMFC reimbursement plus annual costs for 2007). Thus, the maximum potential cost to the fishermen from this source is estimated to range from about $800 up to about $3,000 ($756*4).

Thus, total costs of the requirement to the fishermen in 2007 are estimated to be range between $6,800 and $9,000 (the sum of total net purchase costs and installation costs for the eight units, one year of transmission and maintenance, and the cost to vessels which were deterred from fishing for lingcod; the range is generated based on different assumptions about the number of vessels deterred – one or four). The lower end of the range appears more likely given estimated recent participation levels. Moreover, the method used to estimate losses for each of the vessels deterred from fishing generates a maximum total loss, and their actual losses were probably less.

This aggregate cost estimate for the whole fishery implies an average cost of about $756 for fishermen who participated in the 2007 fishery, and a maximum of $756 for fishermen shifting to another 2007 fishery. Average revenues from the dinglebar lingcod fishery were about $15,900 in 2007; median revenues were about $12,400. Average costs are likely to be less in each of the next few years because of the installed VMS capacity in existing vessels. Vessels that enter the dinglebar fishery in future years may have to incur purchase and installation costs if they do not carry VMS already to comply with other Federal regulations.

Total social costs

The social cost accounting is somewhat different. First, the value of the reimbursement payments to the fishermen plus their unreimbursed costs represents the full social cost of the units. On the other hand, sales tax payments represent a transfer, and not an actual cost. Tax considerations represent transfer payments from one party to another, and not the using up of actual labor and capital. Thus, the total social costs of the VMS use in 2007 would be between $17,900 and $20,200, depending on whether one or four vessels were deterred (the cost of eight units plus a year's operating costs, plus the costs imposed on those deterred from fishing, minus sales tax payments). As noted above, an estimate in the lower half of the range may be more likely.

For various reasons, this social cost estimate is believed to be high. The analysis assumes that the costs of the VMS units are equal to their true social marginal cost. If manufacturers can sell them above marginal cost because of the presence of market power in the Alaska market, this approach would overstate the true social costs. This estimate also ignores the costs associated with the reimbursement program. However, the additional costs from this source associated with reimbursing the dinglebar fishermen would be very small. Any overestimate of the costs to vessels deterred from the fishery would also tend to bias this estimate up, and as noted above, this cost estimate may be high.

As noted above, unless catch or market conditions lead a larger number of vessels to desire to enter this fishery, future annual costs, both to the fishermen and to society, are expected to be less than this, since several vessels will already have VMS units each year. A similar result is likely for costs incurred by the lingcod fishermen, unless the reimbursement program ends.

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AGENDA D-1(g)
DECEMBER 2007
Supplemental

Alaska Marine Conservation Council

November 28, 2007

Eric Olson, Chair
North Pacific Fishery Management Council
605 West 4th Ave., Suite 306
Anchorage, AK 99501-2252

Re: Agenda Item D-1(f) – Crab & salmon bycatch

Dear Mr. Olson and Members of the Council,

We appreciate the Council's interest in reviving discussion on salmon and crab bycatch in the Gulf of Alaska. **We urge you to develop measures to reduce bycatch of these species and encourage further development of the alternatives presented in the staff discussion paper.**

It is time to address longstanding concerns about salmon and crab bycatch associated with existing trawl fisheries in the Gulf of Alaska. We also draw your attention to recent events that create greater opportunity for bottom trawling and, thus, impact on crab. First, the Rockfish Pilot Program creates efficiencies in how allowable halibut bycatch is used among the various target fisheries, allowing more halibut PSC to be used in non-rockfish fisheries. Second, the higher MRA for the directed arrowtooth fishery will likely concentrate increased effort in areas important for Tanner crab. Three, the increasing use of halibut excluder devices allows the fleet to lower halibut bycatch rates such that they can shift halibut PSC into flatfish targets where halibut bycatch has been a limitation on effort in those fisheries. (There has been no reduction in the total halibut PSC cap.)

This dynamic of increasing bottom trawl effort raises concerns about greater impact on the struggling Tanner crab population. This fishery has been on the rebound after years of closures but it remains fragile and at this time stocks are barely strong enough to support a commercial fishery in 2008. The impact from bottom trawling is an unfortunate and unnecessary additional factor challenging their recovery.

This issue is not new and indeed Kodiak fishermen have done a lot of work in recent years to contribute useful information to the Council's discussions. We are re-submitting the following materials for your consideration in developing alternatives for addressing crab protection. Attached documents include:

- A letter and proposal signed by over 150 Kodiak Island fishermen from October 2004 to protect areas of biological importance to Tanner crab in the Gulf. As reiterated

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numerous times in testimony to the Council, there is concern that existing observer data is of questionable accuracy due to the minimal coverage required and the flexibility of a skipper to decide where and how to fish when carrying an observer.

- A local knowledge mapping project conducted in the spring of 2004 to identify Tanner crab areas. Twenty one fishermen with long standing crab experience participated in small groups to draw on charts the area's they identified as yielding high concentrations of crab.

- A sign-on letter from the spring of 2005 again requesting the Council to close area's of biological concern to enhance opportunity for crab recovery by minimizing bycatch, both observed and unobserved, and protecting bottom habitats they depend on.

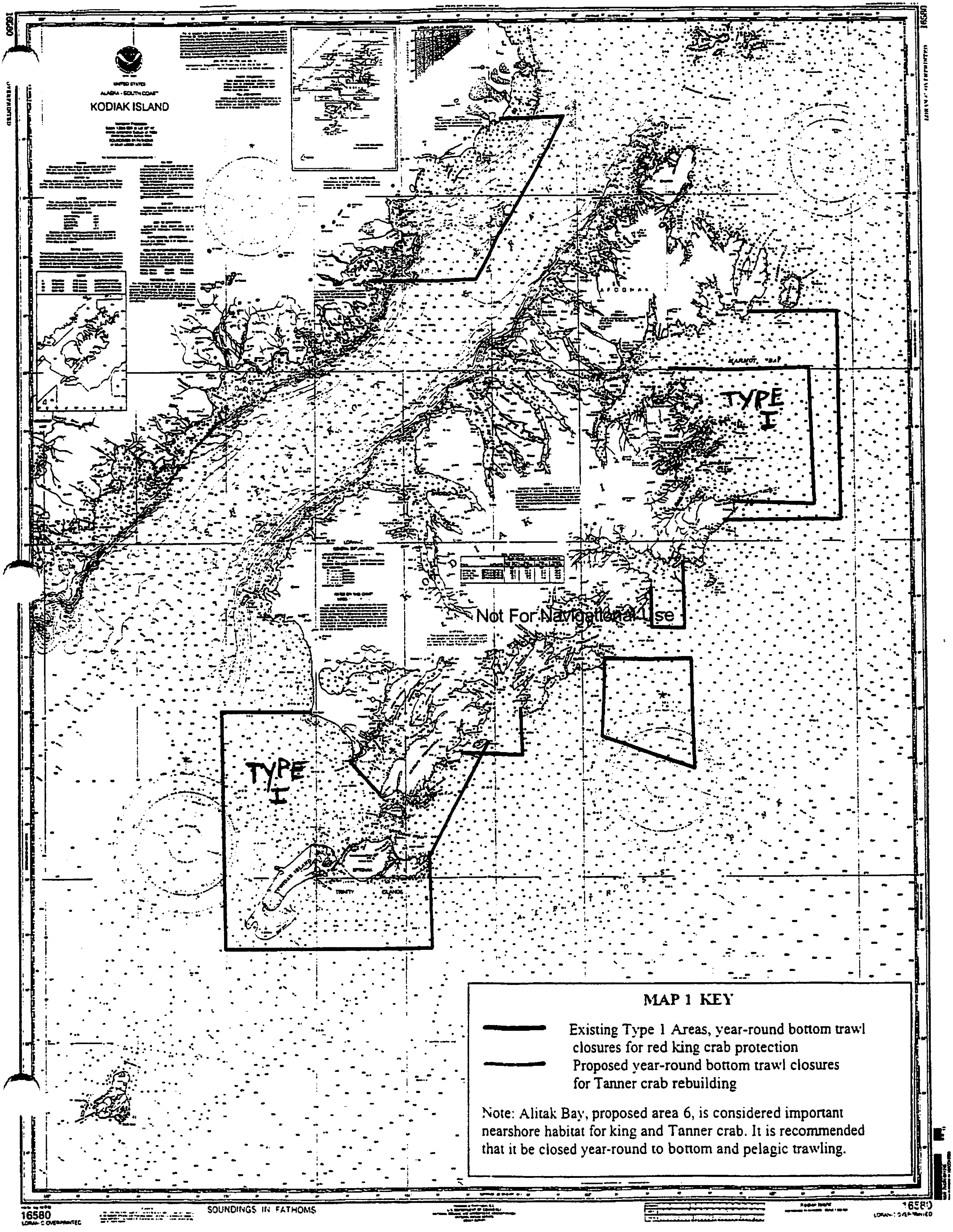
Sincerely,

Theresa Peterson

Theresa Peterson
Kodiak Coordinator

Proposed Bottom Trawl Closures to Protect Tanner Crab

MAP 1



October 2004

Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 West 4th Ave., Suite 306
Anchorage, AK 99501-2252

Re: Agenda Item C-1, Gulf of Alaska Groundfish Rationalization – Crab and Salmon Bycatch

Dear Members of the NPFMC,

We are glad to see that the NPFMC has decided to address salmon and crab bycatch in the Gulf groundfish rationalization program. In the groundfish trawl fisheries, salmon bycatch has averaged 39,122 chinook and chum salmon over the past 12 years, and Tanner (*C. bairdi*) crab bycatch has averaged 79,238 crabs over the past 10 years. It is important and appropriate that the NPFMC address this situation as part of the overall design of the Gulf groundfish program.

This letter addresses our concerns about Tanner crab and recommends an improvement to the options for analysis.

Concerns about Tanner Crab

The Gulf of Alaska Tanner crab fishery was once lucrative but closed in 1994. It is currently showing signs of recovery and the State has managed a small GHL since 2001. We are optimistic that this population can recover given the right combination of favorable environmental factors and protection from bottom trawl impacts.

- Bycatch Data – We are not confident that the existing bycatch data represents reality. A large portion of the trawl fishery is not observed because most vessels receive either 30% observer coverage or no observer coverage. Given the condition of the Tanner crab population in the Gulf, their sensitivity to bottom trawl gear, the high mortality rate of crab bycatch in the trawl fishery and questions about the accuracy of observer data in the trawl catcher vessel fleet, the impact of crab bycatch is a significant concern.

- Crab Habitat – Research shows that bottom trawling in sensitive areas alters benthic habitat, diminishes habitat features needed for shelter and other functions and changes species composition and abundance of the area affected. A study around Kodiak Island compared areas closed to bottom trawling with adjacent areas open to trawling. Inside the closed areas there were high-density sea whip groves containing 33% more Tanner crab than the adjacent areas and an increased abundance of gadids and prey species. [1]

[1] Stone, R., M. Masuda and P. Malecha. In Press. Spatial distribution and abundance of epifauna on adjacent soft-bottom areas open and closed to bottom trawling in the Gulf of Alaska. Proceedings of the Symposium on Effects of fishing activities on benthic habitats. Tampa, FL. 2002.

Increased Bottom Trawling will Increase Impacts on Tanner Crab

We have reviewed the range of elements and options under development for the Gulf analysis. We note that the NPFMC's approach is to encourage halibut bycatch quotas to be transferred between fisheries, allowing trawl vessels to expand their participation in flatfish fisheries. The NPFMC envisions an incentive to fish cleaner in some trawl fisheries in order to fish more in flatfish fisheries, which are currently very limited by available halibut bycatch. In 2003, the Central Gulf fleet harvested only 42% of the combined TAC for shallow and deep water flatfish, rex sole and flathead sole. The catch was 20% of the acceptable biological catch (ABC). Indeed, if halibut bycatch is used efficiently, there could be a very large increase in flatfish trawling.

Species groups for management (not including arrowtooth flounder**):

- Shallow water flatfish (rocksole, yellowfin sole, starry flounder, butter sole, English sole, Alaska plaice, sand sole)
- Deep water flatfish (Dover sole, Greenland turbot, deep sea sole)
- Rex sole
- Flathead sole

In 2003, the Central Gulf fleet harvested only 42% of the combined flatfish TAC. The catch was only 20% of the ABC.

Central Gulf Flatfish ABC	50,320 mt
Central Gulf Flatfish TAC	23,760 mt
Actual Central Gulf Flatfish Catch	9,984 mt

(Source: NMFS 2003 groundfish specifications & catch reports.)

**Note: Arrowtooth is included in the list of "incentive fisheries". However, we are not including it here to illustrate potential increase in trawling because it is difficult to know how much of the large biomass will actually be targeted.

In addition to increasing harvest of flatfish, the incentive fisheries will also increase crab bycatch, increase bottom trawl intensity and potentially subject more area of the seafloor to bottom trawl impacts.

Recommendation for Gulf Groundfish Analysis

The draft groundfish program alternatives currently contain three alternatives for reducing Tanner crab bycatch:

1) Status quo (no action)
2) Trigger bycatch caps. Specific areas with high bycatch or bycatch rates would be closed to flatfish trawling for the remainder of the year if bycatch cap is reached.
3) Year round bottom trawl closure in areas with high bycatch or bycatch rates.
4) Voluntary bycatch cooperative for hotspot management.

We recommend that you add the following alternative:

5) Year-round bottom trawl closures for selected areas of biological importance to Tanner crab. Attached is Map 1 proposing areas to consider in the analysis. These sites are based on local knowledge about Tanner crab as illustrated in Map 2.

Alternative 5 would:

- Mirror the year round closures (Type I areas) the NPFMC adopted in 1986 to protect Kodiak Island red king crab; and preventative steps that ADFG proposed and NPFMC adopted in 2002 to close state and federal waters of Cook Inlet to bottom trawling to protect Tanner crab stocks (Final Rule, Fed. Reg. vol. 67, no. 229);

- Provide better conservation benefits than using only observed bycatch or bycatch rates as an indicator of important areas for crab. Existing bycatch data is of questionable accuracy. Moreover, it does not include areas of high importance to crab that may be heavily trawled but where vessels have not had observers.

- Eliminate problems associated with bycatch caps, such as ensuring accurate monitoring of bycatch;

- Provide better conservation benefits than bycatch caps or seasonal closures. Caps are based on observer data and do not take into account unobserved mortality of crab (crab affected by bottom trawl gear but not actually brought up in a net to be counted). Neither caps nor seasonal closures protect habitat features that are vulnerable to bottom trawl gear.

Economic Benefits

Kodiak is a fishery dependent community reliant on salmon, halibut and sablefish, herring, groundfish and crab. The key to success is maintaining this economic diversity. In creating economic efficiencies for groundfish, we urge you to consider enhancing opportunities for crab recovery by minimizing bycatch, both observed and unobserved, and protecting bottom habitats they depend on. Healthy crab populations will provide jobs and increase Kodiak's raw fish tax base. This is one way a well-designed groundfish plan can benefit all fisheries and the community as a whole.

Sincerely,

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Linda Suydam	Box 4367	Kodiak	F/V Crimson Beauty
ROBERT HOLMAN	BOX 3	KODIAK	F/V SERVANT
PETER J LONGRICH	P.O. BOX 4234	KODIAK	SHUYAK LONGLINE CRAB
Steve Branson	Box 451	Kodiak	independent crewman
Mark Hancock / Mark Hancock	BOX 325	Kodiak	fisherman extroidinaire
SARMOD COLLIER	PO BOX 8152 KODIAK AK 99615	KODIAK.	CAPTAIN.
Bryan Wright	Pobox 8861 Kodiak	K-town	F/V New Dawn
TERRY HAINES	PO Box 8112	KODIAK	SHUYAK DECKHAND
Gino D. Wachter	258 Strawberry Circle LANGHORNE PA 19047	Kodiak	FN Tenacious
Brett Lounsbury	Box 8947 Kod AK 99615	Kodiak	F/U KARMA
Debra Nielsen	Box 8381 Kodiak AK	Kodiak	Ex-Vessel owner
[illegible]			
Steven Suydam	3540 Sprucecape	Kod.	Crimson Beauty
Ann J. Spaeth / ANN J. SPAETH	P.O. BOX 8814 KODIAK, AK 99615	KODIAK	
Mary Lund / Mary Lund	Po Box 523	Kodiak	office Coordinator
Ken Christiansen / KEN CHRISTIANSEN	P.O. Box 1808	Kodiak	McKENNA C
CARL Gronn Jr	2369 Beaver lk	Kodiak	Polar Star
Jerry D. Christ / Jerry D. Christ	P.O. Box 22 Old Harbor AK.	Old Harbor	McKenna C crew
Dale Robertson	P.O. Box 1808	KODIAK	McKenna C crew
Pete Hannah	Box 3808	Kodiak	Mikado

October 2004 Letter to the NPFMC

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[signature] Charles P Pietersen	Box 347 Kodiak, AK 99615	Kodiak	F/V Patricia Sue Owner/operator
Victor Buchanan	Box 4114 Kodiak AK 99615	Kodiak	Apriana Chiniak Island Jade Alaska
Victor Buchanan			
[signature] Richard E. Collins Jr.	P.O. Box 2780 Kodiak, Alaska 99615	Kodiak, Alaska	F/V Mary Jane and F/V Juliet
[signature] Patricia J. Collins	P.O. Box 2780 Kodiak, AK 99615	Kodiak Alaska	F/V Mary Jane owner/operator
[signature] Mark C. Alwert	P.O. Box 1711 Kodiak, AK 99615	Kodiak	F/V Katherine Owner/Operator
[signature] J. Schmeisser	P.O. Box 285 Kodiak AK 99615	Kodiak	Kema Sue Shemya Owner/Operator
[signature] Clint Johnson	Box 909 Kodiak AK 99615	Kodiak	owner F/V Kainik
[signature] Charles Hochmuth	2682 Box Kodiak AK 99615	Kodiak	F/V Kainik
Joe Hochmuth [signature]	2682 Box Kodiak AK 99615	Kodiak	F/V Kainik
Glenn Hochmuth	8623 Box Kodiak AK 99615	Kodiak	North Pacific Fuel
[signature] Mike Clark	B 10009 Kodiak, AK	Kodiak	F/V Linnea
[signature] Severin Thissen	316 Upper Mill Bay Kodiak AK 99615	Kodiak	Blue Print Construction
[signature] Peter Allan	PO B 2160 Kodiak	"	F/V Orion
[signature] Scott Stout	General Delivery Kodiak	"	Orion
Mike Woodruff [signature]	105 Marine Way Kodiak	"	Asst. Manager AFS
[signature]	2585 Metrokin Kodiak	Kodiak	F/V Mikido
[signature]	Box 634 Chiniak AK	Chiniak	F/V Mikado
[signature]	P.O. 2503 Kod, AK 99615	Kod	"
[signature] Johnston			

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Robert W. Locke	P.O. Box 319	Kodiak	F/V Sea Dream crewmember
Rochelle Atwood	P.O. Box 5535	Chiniak	Bartender
CHRis Flickinger	P.O. box 351	Chiniak	Rancher/Fisher
Neal C Levensen	Box 1284	Kodiak	F/V Sea Dream Fisherman
Thad – [illegible]	716 Thorsheim	Kodiak	F/V Fisherman
Brian Thomas	326 Shelikof	Kodiak	Retired
[illegible]	807 Schlief	Kodiak	Wife
Antonia Bravo	1014 Larch St	Kodiak	manager
Jeana Bryant	1820 D1 Larch st	Kodiak	Bartender
Deana L. Arkus / Deana L Arkus	Box 2843	Kodiak	Polar Star
Salaa L. Stager / Julia J. Stager	Box 8243	Kodiak	Sisint/Fishing
Fred Stager	"	"	"
T. IVAN WINKLER	3111 PENINSULA RD	"	SULINA
Roger Corriere / Roger Corriere	Po Box 8338	Kodiak	& Fishing
Margaret Holm / Margaret Holm	303 Cope St.	Kodiak	librarian
JANE PETRICH / Jane Petrich	Box 2842	Kodiak	fishing/educ.
Oliver M Holm / Oliver M Holm	Box 3865	Kodiak AK	F/V Salona fishing
Eva L Holm / Eva L. Holm	Box 3865	Kodiak AK	Fishing setnet site Salmon

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Nina Sims	11455 Crazy Horse Dr.	Lakeside CA 92040	
Alexandria Troxell Alexandria Troxell	10853 Kalsin Dr. Kodiak, AK 99615	Kodiak, AK	
Alexandria Elinder Alexandria Elinder	734 Willow, Cr Kodiak, AK.	Kodiak, AK	Lucky Pierre
Walter Erickson Walter Erickson	P.O. Box 187 Old Harbor AK, 99643	Old Harbor.	
Shawn Holland Shawn Holland	206 Alder Kodiak AK 99615	Kodiak AK	Point Omega
Kory Anderson [signature]	3521 Sharatin Rd.	Kodiak AK	Point Omega
Wayne Meloranick Wayne Meloranick	3629 E. Rezanof #40	Kodiak AK	Point Omega
James Zurfluh [signature]	373 Teal Way	Kodiak AK	Bottoms Up Driver/owner
Meaghan K Christiansen [signature]	PO Box 1808 Kodiak AK 99615	Kodiak	F/V McKenna C
Sarah Zurfluh Sarah Zurfluh	373 Teal Way	Kodiak	Bottoms up owner
Michael Kinnear [signature]	P.O. Box 2438 Kodiak	Kodiak	Miss Taylor
Robert Nelson Sr. [signature]	P.O. Box 8836	Kodiak	Miss Taylor
Kelley Miller Kelley Miller	Kodiak General Delivery 99615	Kodiak	Miss Taylor
Steven Ivanoff Steven Ivanoff	1327 Mount View Dr	Kodiak	Hungry Raven
Teresa Medina T. Medina	Box 3038 Kodiak	Kodiak	cashier/KB
Karleton Short Karleton Short	3496 Sitkinak Kodiak	Kodiak	—
Bob Scholze Bob Scholze	Box 8571. Kodiak, Ak	Kodiak	
Jim Cole J. Cole	Box 8572 Kodiak, Ak		contractor
M. L. McFarland Marilyn McFarland	P.O. Box 8802 Kodiak, AK 99615	Kodiak	resident of Kodiak
Charles E [illegible]	Box 2411 Kodiak, AK 99615	Kodiak	Gov (Local) Employee

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Ludger Dochtermann	P.O. Box 714 Kodiak	Kodiak	North Point Sportfishing Fisherman
Kitty Jorritsma	3430 Antone Way	Kodiak	Small Business Owner
Bob Bowhay	Pruitt Lane	Kodiak	Owner [illegible] operator
Tim Gossett	1526 Kuskov	Kodiak	Owner/Operator
[illegible] Jolin	Box 2022	Kodiak	Owner/operator
Aaron Jolin	Box 2022	Kodiak	crewmember
Fayette Jolin	Box 2022	Kodiak	owner/crew
Walter Sargent	1830 Mission Rd	Kodiak	[illegible]
Leigh Thomet	P.O. Box 3258	Kodiak	Setnet
Kevin Thomet	P.O. Box 3258	Kodiak	Setnet
Tim [illegible]	PO Box 4441	Kodiak	Sea Dream Captain
Maria Drinkwine	PO Box 8937	Kodiak	Seadream
Joe Macinko	2625 Spruce Cape Rd	Kodiak	Nakat
Peter Thompson	P.O. Box 3037	Kodiak	F/V Dues Payer II
Robert Nelson	PO Box 3086	Kodiak	Small Business Owner
Thor Olsen	Box 322	Kodiak	F/V Viking Star
Andy Christofferson	1516 E. Rezanof	Kodiak	
Brian Kenyon	3320 [illegible]	Kodiak	
Paul S Yatsik	PO Box 9016 Kodiak AK	Kodiak	
Erik E Hanson	11147 Womens Dr Kodiak AK	Kodiak	Teacher.

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Rob Hoedel	Box 3593	Kodiak	fisherman
Norman Mullan	BOX 92	KODIAK AK	CINDRIA GENE 100% FISHING
William Schaaff	Box 8774	Kodiak, AK	Jaime Marie
WES MULLAN	8117 148TH ST. CT. EAST	PUYALLUP, WA.	CINDRIA GENE FISHERMAN
SID HOEDEL	BOX 3593	KODIAK	CINDRIA GENE Fisherman
Becky Bean	PO Box 92	KODIAK	CINDRIA GENE
Michael Nelson	1522 Kouskov K.	Kodiak	
[illegible]	Box 5533	Kodiak	[illegible]
JONATHAN WALLACE	P.O BOX 7 KODIAK, AK		F/V EVELYN O.
Mike Keplinger	Box 4064 KODIAK AK		F/V TIBURON
Bill Fedo	Box 2933 Kodiak Ak		Fuller Boatyard
JEFF POVELITE	BOX 218 KODIAK		F/V LUNA
Nick Cline	Box 218 Kodiak		F/V Luna
Rob Gatty	Box 85 Old Harbor		Crew
Janelle A. Christiansen	Box 22 Old Harbor		
[illegible]	Box 8803 KODIAK AK		
[illegible]	CRAZY HORSE LAKESIDE		CONSULTANT.

October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Bobbie Swan	PO Box 2394	Kodiak	office
[illegible]	PO Box	Kodiak	
Malina R. Nicklas	PO Box 8798	Kodiak	setnet/barista
Dave Woodruff DAVE WOODRUFF	105 marine way	Kodiak	Seafood Processor
Harvey E. Goodell HARVEY E. Goodell	Box 3108	Kodiak	setnet
CLAUDIA ANDERSON	POB 310	KODIAK	set netter teacher
Randy Busch	PO Box 1162	Kodiak	self-employed
Mary Forbes	418 Mill Bay Rd	Kodiak	self employed
LAVENDER BEATTIE	3248 KATMAI DR.	KODIAK	self-employed
Kenneth Holland Jr.	PO Box 608	Kodiak	F/V POINT OMEGA OWNER
Christine Holland	PO BOX 608	Kodiak	F/V POINT OMEGA OWNER
TJ Anderson	PO Box 310	Kodiak	Deck Hand
Zoya Saltonstall	Box 3553	Kodiak	Physical Therapist
Stacy Studebaker	Box 970	Kodiak	Teacher
Mike Litzow	PO Box 4436	Kodiak	Biologist
Margaret Bosworth	P.O. Box 1803 ~~Kodiak~~	Kodiak	Fisherman
Karik Anderson	12218 Gora 99615	Kodiak AK	Fisherman

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October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
Robin Stevens	1212 Purtov St. #24 Kodiak, AK 99615	KODIAK	Waitress
Josh Keesee	50 Ionic Cr Range Rd Kodiak Ak	Kodiak	Refrigeration
James Houston	Box 8399	"	F/V NAOMI
Mark Montein	P Box 2395	KODIAK	Fairley Point
John H. Schroeder	326 Shelikof	Kodiak	Beverly J.
Nick Brigman	Hidden Basin/Ugak Bay	KODIAK	Wilderness Guide/Outfitter
Roy Lesher	"Hidden Basin	Kodiak	Fisherman/Guide
Joe Hochmuth	121 BIRCH ST	KODIAK	M/V Evelyn H
Alex Soake	Po box 319	Kodiak	
Brian Young (Brian Young)	P.O. box 4356	Kodiak	Bold Pacific Company's Heritage
Kevin O'Leary (KEVIN O'LEARY)	4044 CLIFFSIDE RD KODIAK	KODIAK	KODIAK ISLE OWNER
J. Yeoman (J. YEOMAN)	51053 EVENS Rd.	Homer	Kodiak Isle MASTER
Kenneth C Muller (KENNETH C MULLER)	Po Box 1733 Soldotna AK99669	Soldotna	Kodiak Isle CREW
Tim Longrich (TIM LONGRICH)	BOX 2494 KODIAK Ak. 99615	KODIAK	SHUYAK Owner/Operator
Matt Shadle (MATT SHADLE)	P.O. BOX 312 HOMER AK 99603	KODIAK	F/V RISKY BUSINESS
Jon Brown (JON BROWN)	3951 LAKEHURST CIR UNIT A ANCHORAGE AK 99502	KODIAK	F/V SHEMYA
Dan Leithead	3439 ANTONE WAY KODIAK, AK 99615	KODIAK	DECKHAND
Chuck Thompson	Box 2193 Kodiak	Kodiak	STARGAZER FISHERMAN
Donald E Roberts Jr	264 Lilly Dr/Apt C-2	Kodiak	

October 2004 Letter to the NPFMC

Please sign & print name under

	Address	Community	Vessel/Occupation	
[illegible signature]	[illegible] 33	[illegible]	[illegible]	
Lena Amason				
[signature]	Box 47	old Harbor	Deckhand	Ashlee Christine
Ron Ablama				
[signature] Lisa Christiansen	Box 96	Old Harbor	OLH Tribal	
Angela Christiansen [signature]	Box 94	Old Harbor	OLH Tribal	
[signature] Valerie L. Maxwell	Box 69	Old Harbor	KANA	
Gwen Sargent [signature]	Box 78	Old Harbor	OH Tribal	
	Box [illegible]	Old Harbor	~~[illegible]~~ Old Harbor	
Ivan Christiansen [signature]	Box 96	Old Harbor	Deckhand / [illegible] Various boat	
Thomas Ignatin [signature]	P.O. Box 23	Old Harbor	OLH Tribal	
Ryan Johnson [signature]	1125 Mission Rd. Kodiak	Kodiak	Owner/Operator F/V Cyclone	Tanner Permit Holder
Gary Sampson	P.O. Box 155	old harbor		
Allen Christiansen	PO Box 135	Old Harbor	Crew	
[signature]	PO Box 55	Old Harbor	Crew	
Glenn Christiansen	P.O. Box 6	Old Harbor	Partowner Boat	
George Inga Sr.	P.O. Box 166	old Harbor		
[signature]	PO Box 17	Old Harbor		
Tarrissa Jean Christiansen	P.O. Box 6	Old Harbor	Crew	
[signature] (Travis Berns)	Box 33	Old Harbor	Leona Renee	
[signature] (Al Cratty)	Box 1	Old Harbor	Ashlee	Christine C

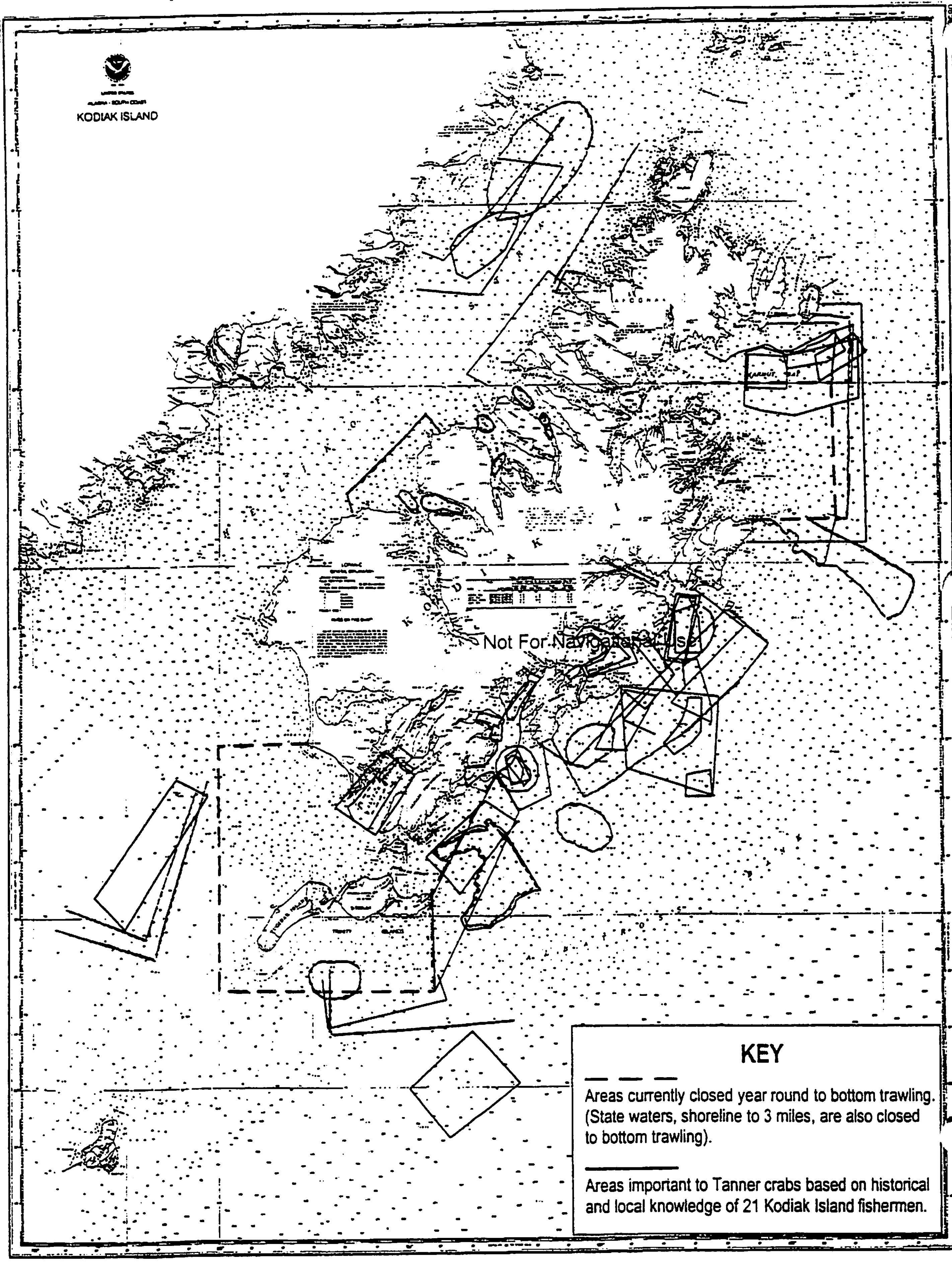
October 2004 Letter to the NPFMC

Name	Address	Community	Vessel/Occupation
[signature] PATRICK PIKUS	Box 2843	Kodiak, AK	owner/operator, POLAR STAR
[signature] LAURIE PIKUS	BOX 8625	Kodiak, AK	PolarSTAR deckHAND
[signature] Edwar Gupta-Correa	BOX 8625	Kodiak AK	POLARSTAR deck Hand
[signature] D GERRIT HINTZ	3331 TUNA LN KODIAK AK	KODIAK AK	POLAR STAR deck HAND
[signature] Jack Lawkins	58825 Deitz Ln Homer, AK	Homer	owner [illegible]

MAP 2

Kodiak Island Local Knowledge about Areas Important for Tanner Crab

Prepared by Alaska Marine Conservation Council with Participating Crab Fishermen – 2004



Kodiak Island Local Knowledge about Areas Important for Tanner Crab

Project of Alaska Marine Conservation Council with Participating Crab Fishermen

Project conducted April – May 2004

Project Coordinator – Theresa Peterson, Alaska Marine Conservation Council

Methodology

Twenty-one crab fishermen in Kodiak and Old Harbor participated in this mapping project to identify areas of importance for Tanner crab (*C. bairdi*). A series of four meetings took place with 4-6 fishermen in each group. Each group worked from a clean chart overlaid with an unmarked transparency. Participating fishermen were asked to draw on the transparency areas they believe to be important for Tanner crab based on their historical and recent knowledge and experience. They explained what they saw and where they saw it, including areas used for brooding or rearing, areas with juvenile crab aggregations and areas with high yield of adult crab.

The information from each of the four groups was then transferred to one chart showing a compilation of all the participants' input. The hand drawn lines were digitized using ArcView. Each group was color-coded. As shown in this compilation of all the groups, numerous areas overlap indicating that they were recognized by multiple crab fishermen as important. These grounds prove to be preferred habitat where Tanner crab are regularly found. The local knowledge maps were found to closely reflect information from the crab surveys conducted by the Alaska Department of Fish and Game.

Selected comments shared by fishermen during the process:

"The bays are full of crab and areas out of front of bays like Kiliuda and Kaiugnak need protection too. These bays should be closed out to 10-12 nautical miles."

"There are high concentrations of crab in the 'sandbox'. The gut sweeps down out of Ugak bay and the crab move through this area. There are many large and small crab between Black Point and Two-Headed Island, due east offshore 6-7 nautical miles."

"Outside of the current Type 1 closure zone in Marmot Bay is a key population center for remaining Tanner crab and has had partial protection from closures in place due to the Sea Lion rookery. With full protection the crab population would likely expand."

For further information: Please contact Theresa Peterson, AMCC Community Outreach Coordinator at (907) 486-2991.

Kodiak Island Tanner Crab Local Knowledge Mapping Project

Participants - April 2004

1. Oliver Holm-*F/V Sulina*
2. Walter Sargent- *F/V Major*
3. Alexus Kwachka- *F/V Major*
4. Pat Pikus- *F/V Polar Star*
5. Chris Berns- *F/V Kwiavak*
6. Harvey Goodell
7. Norman Mullins- *F/V Cindria Gene*
8. Jerry Bongen- *F/V Genoa*
9. Mitch Keplinger- *F/V Tiburon*
10. Al Cratty- *F/V Ashley Chistine C*
11. Freddy Christianson- *F/V Tarrissa Jean C*
12. Rick Berns- *F/V Melissa Rae*
13. *Harold Christianson- F/*V Glennette C
14. Dave Kubiak- *F/V Mythos*
15. Ken Chistianson- *F/V Mekenna C*
16. Tim Longrich- *F/V Shuyak*
17. Ken Holland- *F/V Point Omega*
18. Mike Steelman- *F/V Cougar*
19. Travis Berns- *F/V Melissa Rae*
20. Charlie Peterson- *F/V Patricia Sue*
21. Pete Hannah- *F/V Mikado*

Spring 2005

Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 W. 4th Avenue
Anchorage, AK 99501

Re: Agenda Item C-2, Gulf Rationalization

Dear Ms. Madsen and Members of the Council,

We strongly urge the Council to include protection for Tanner crab as part of the Gulf groundfish rationalization program. The Gulf Tanner crab population is showing positive signs of recovery around Kodiak Island. However, we are concerned that the groundfish plan you are developing will increase bottom trawl effort in areas important to Tanner crab. This will put unnecessary pressure on the crab population to the detriment of our fishery.

The groundfish program should be designed in a manner that is beneficial for all the fisheries important to our communities. While creating economic efficiencies for groundfish, we urge you to adopt the proposed bottom trawl closures. This will enhance opportunities for crab recovery by minimizing bycatch, both observed and unobserved, and protecting bottom habitats they depend on.

Thank you.

Name	Community	Vessel/Occupation
Mike Murdock	Kodiak	AFS - Assistant Manager
Walter Sargent	Kodiak	F/V Major Fisherman F/V Hermit Cove
Andrew Lundquist	Kodiak	Self-employed
Paul Agostine	Kodiak	Crewman
Dell D. Jackson	Kodiak	Crewman
Colin Trueman	Kodiak	Crewman
Jerry Sparrow	Blue Fox Bay	Lodge Operator
Tammy Beckwith	Kodiak	Crew F/V Hermit Cove
Bob Perkins	Kodiak	Crewman
Shane Rupe	Kodiak	Crewman
[illegible]	Kodiak	Crewperson
[illegible]	Kodiak	M/V Black Jack
Margaret S. Cook	Kodiak	teacher - Main Elm.
Cindy Harrington	Kodiak	Director - U of AK
Bill Berry	Kodiak	Capt - F/V Miss Lori

Sign and Print Name	Community	Vessel/Occupation
David J. Matthisen	Kodiak	F/V Perseverance / Commercial Fisherman
Kenneth Holland	Kodiak	F/V Point Omega
[illegible]	Kod.	F/V Heritage
Tena Brune	Kodiak	Homeowner
Joseph MacTavish	Kodiak	Baker
Joel Cheatt	Kodiak	Kodiak Sa[illegible]
Robin Clark	Kodiak	F/V Linnea
Jerry Bonsen	Kodiak	F/V Jeanoah
Terry Haines	Kodiak	Fish Heads
Marc Majdic	Kodiak	[illegible]
Mark A. Daley	Kodiak	Store mngr
KJ Herman	Kodiak	Windward
Ed West	Kodiak	Sherpa

Name	Community	Vessel/Occupation
[illegible]	PO Box 714 907 4805492 Kodiak	F/V [illegible] F/V North Point [illegible]
Pete Hannah	Kodiak	F/V Mikado
Robert Carter	Kodiak	F/V Maggie B
Stan Van Matre	Kodiak	FV [illegible]
Kirk Van Dyken	Homer	FV Heather Kay
Joe Macinko	Kodiak	F/V Nika 2
Ann Spaeth	Kodiak	Spec. Ed. Aide
Ron Zeeder	Kodiak	Commercial Fishing
Peter Freier	Kodiak	FV Kemasue
Mark Thissen	Larsen Bay	Store Owner
Mike Patitucci	Kodiak	F/V Lady Kathryn (Com Fish)
Selina L. Stager	Kodiak, AK	F/V Sisiutl
Andy Berestoff	Kodiak, AK	crew member

Sign and Print Name	Community	Vessel/Occupation
[illegible]	P.O. Box 3846 Kodiak AK 99615	F/V [illegible]
[illegible]	P.O. Box [illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] Allen	Kodiak	[illegible]
Dave Woodruff	Kodiak	Alaska Fresh Seafoods Inc
[illegible]	Kodiak	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] Thomson	Kodiak	[illegible]
[illegible] Mattews	Kodiak	F/V [illegible]
Kenneth N Holland	Kodiak	F/V [illegible]
Eva L Holm	Kodiak	F/V Selma Fishing
Lara L Mulligan	Kodiak / [illegible]	F/V [illegible], Crewmember

Sign and Print Name	Community	Vessel/Occupation
[signature] MARIAN JOHNSON	Kodiak	[illegible]
Emily Erickson [signature]	Kodiak	
Jennifer Pemberton [signature]	Kodak	
DENNIS LAWHEAD JR [signature]	Kodiak	THUNDERBOLT RAMBLING ROSE
Patty Delate Ken Reinke	Kodiak	
Jena Lawhead [signature]	Kodiak	THUNDERBOLT Rambling Rose
[signature] KIP THOMET	KODIAK	F/V MAJOR SET-NET SITE KODIAK
MARK Alwert	KODIAK	F/V BUCCANEER F/V Katherine
LEONARD CARPENTER [signature]	KODIAK	F/V FISHTALE OWNER/OPERATOR
Anita R Carpenter [signature]	Kodiak	f/v fishtale owner/operator
[signature]	[illegible]	[illegible]
Shawn Koson [signature]	Chiniak	[illegible]
Melony Lechner [signature]	[illegible]	F/V Kata
Steven P Mathieu [signature]	Kodiak	President Alaska Jig Ass.
[signature]	KODIAK	FISHERMAN ARTIST

Sign and Print Name	Community	Vessel/Occupation
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	Kodiak	[illegible]
[illegible]	Kodiak	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	fishing
[illegible]	[illegible]	[illegible]
[illegible]	Kodiak	[illegible]
[illegible]	Kodiak	
[illegible]	Kodiak	
[illegible]	# Kodiak	

Please sign &
then print your name

Name	Community	Vessel/Occupation
Calvin [illegible]	Kodiak	Rosalie fishing
[illegible]	Kodiak	Sylva Star
[illegible]	Kod.	[illegible]
[illegible]	KODIAK	LORI ANN
[illegible]	Kodiak	Marina D
James M [illegible]	Kodiak	SHEARWATER
Luke [illegible]	Kodiak	KETA
[illegible]	Kodiak	Anna D
[illegible]	Kodiak	ADRINA - Jade AK CHISIK ISLAND - [illegible]
John [illegible]	Kodiak	Aquarius / fishing
[illegible]	Kodiak	New Song / fishing
[illegible]	KODIAK	TRAP SIX
Robert [illegible]	Kodiak	POLAR STAR
[illegible] Don Fox	Kodiak	set-net site Halibut long line
[illegible]	Kodiak	Kema-Sue
[illegible] Theresa A Peterson	Kodiak	F/V Patricia Sue

Name	Community	Vessel/Occupation
Bob Bowhay [signature]	Box 187 Kodiak AK	F/V Mc.Nbone
FREDERICK R DEVEAU JR [signature]	Box 804 Kodiak AK 99615	M/V DESPERADO
DAN OLSEN [signature]	Box 1943 Kodiak AK	M/V SUSAN
[signature] Bob Tolin	Box 2022 Kodiak AK	M/V Tayete
[signature]	P.O. Box 896 Delta Junction AK	CORAL
[signature]	Box 26 Kodiak	[illegible]-Kinnuk
Mike Steelman	Box 2603 Kodiak	F/V Cougar
Ty Rance [signature]	Box 2775 Kodiak	F/V Slashers
Julie Miller [signature]	614 Hillside Kodiak AK.	F/V Kenu Sue
Charles P Peterson [signature]	Box 347 Kodiak AK	F/V Patrician
FRED SARGENT [signature]	Box 3003 Kodiak, AK 99615	F/V NORTHWIND
[signature] Cossett	PO Box 8196 Kodiak AK	F/V Red Rider
Eric Sumberg	PO Box 3053 Sitka	F/V Reiver