Crab bycatch in BSAI groundfish fisheries

Staff Discussion paper

The BSAI Crab FMP applies to 10 crab stocks in the BSAI: 4 red king crab, *Paralithodes camtschaticus*,(Bristol Bay, Pribilof Islands, Norton Sound and Adak), 2 blue king crab, *Paralithodes platypus* (Pribilof District and St Matthew Island) 2 golden (or brown) king crab *Lithodes aequispinus* stocks (Aleutian Island and Pribilof Islands), EBS Tanner crab *Chionoecetes bairdi*, and EBS snow crab *C. opilio*. All other BSAI crab stocks are exclusively managed by the State of Alaska. Following approval of amendment 24 to the BSAI Crab FMP, these stocks now have annually-specified overfishing limits (OFLs). For all stocks for which information is available, these OFLs are intended to cover total removals from the stock, including bycatch in groundfish and scallop fisheries. Additional requirements for catch removals for crab stocks will be necessary to comply with ACLs. The Crab Plan Team discussed relative bycatch management measures in groundfish and scallop fisheries at the May 2009 meeting (CPT minutes on this attached as Appendix A). The Team recommended further consideration of bycatch in groundfish fisheries by the Council. The Team reiterated this request and discussed specific bycatch concerns related to individual stocks at their recent September 2009 meeting (see draft CPT report under agenda item C-4e to be made available at the Council meeting). At the June 2009 meeting, the Council recommended that staff prepare a discussion paper summarizing the current bycatch by crab stock in groundfish fisheries as well as the current measures under the BSAI groundfish FMP to control crab bycatch.

1. Current crab bycatch measures in BSAI groundfish fisheries

The BSAI groundfish FMP specifies crab bycatch management measures for protection of Bristol Bay red king crab, EBS Tanner crab, EBS snow crab, Pribilof blue king crab and St. Matthew blue king crab stocks (Table 1). These measures consist of triggered or fixed time and area closures for trawl fisheries. No measures are currently in place for any fixed gear fisheries nor are overall limits placed on bycatch of any crab species. Bycatch management measures are not linked to new BSAI crab FMP requirements to account for total removals from all fisheries under new OFLs.

The sections below describe the individual existing time and area closures in more detail for those crab stocks and where applicable the limits that trigger the closure (using 2009 as an example where limits are annually varying). Information on relative bycatch levels for each stock is then summarized in the subsequent section by gear type and where available (2008/09 data) by fishery.

Table 1 Summary of groundfish management measures to address crab bycatch in the trawl fisheries

Stock	Area	Gear type	Timing	For trigger closures		
				Allocation by sector or target fishery in 2009	How catch accrues	2009 PSC limit
Bristol Bay red king crab	Red King Crab Savings Area	nonpelagic trawl	closed year-round, except subarea			
	Nearshore Bristol Bay Trawl Closure	nonpelagic trawl	closed year-round, except Togiak subarea open 4/15-6/15			
	Zone 1	all trawl	when limit is reached, area closes to target fishery	Amd 80 sector yellowfin sole Pacific cod pollock/mackerel/ other species	RKC bycatch in Zone 1, by fishery	197,000 allocated among target fisheries
EBS Tanner crab	Zone 1	all trawl	when limit is reached, area closes to target fishery	Amd 80 sector yellowfin sole rockfish Pacific cod pollock/mackerel/ other species	Tanner crab bycatch in Zone 1, by fishery	980,000 allocated among target fisheries
	Zone 2	all trawl	when limit is reached, area closes to target fishery	Amd 80 sector yellowfin sole rockfish Pacific cod pollock/mackerel/ other species	Tanner crab bycatch in Zone 2, by fishery	2,970,000 allocated among target fisheries
Pribilof Islands blue king crab	Pribilof Islands Habitat Conservation Area	all trawl	year-round			
EBS snow crab	*C. opilio* Bycatch Limitation Zone (COBLZ)	all trawl	when limit is reached, area closes to target fishery	Amd 80 sector yellowfin sole rockfish Pacific cod pollock/mackerel/ other species	Snow crab bycatch in the COBLZ, by fishery	4,350,000 allocated among target fisheries
	Northern Bering Sea Research Area	nonpelagic trawl	currently year-round; fishing may resume in future under a research plan			
St Matthew blue king crab	St Matthew Island Habitat Conservation Area	nonpelagic trawl	year-round			

1.1. Bristol Bay red king crab measures

Fixed closures and a triggered time/area closure close to trawling to protect Bristol Bay red king crab stocks and habitat.

1.1.1. Red King Crab Savings Area

Non-pelagic trawling is prohibited year round within the area indicated in Figure 1**Error! Reference source not found.** with the exception that a subarea of the Red King Crab Savings Area between 56°00' N. and 56°10' N. latitude and 162° W. and 164° W. longitude may be opened to non-pelagic by the Regional Administrator in consultation with the Council. This is done during the annual specifications process by the Council in December 2009.

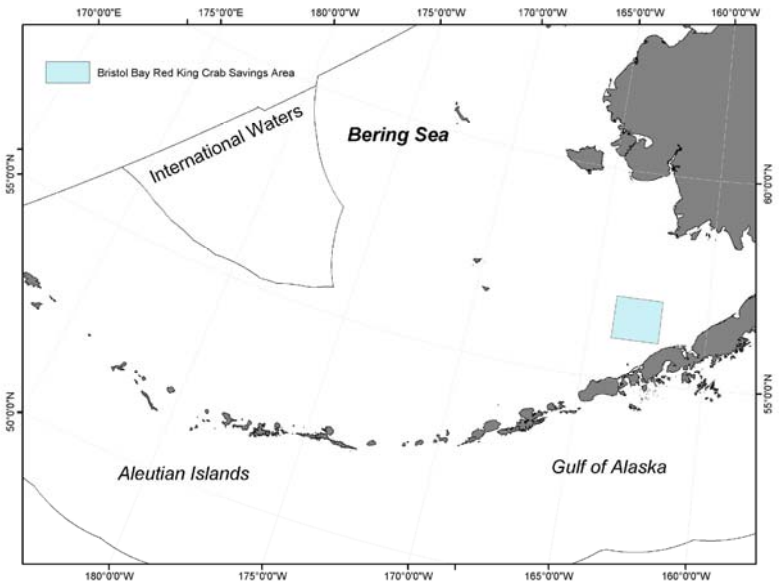

Figure 1 Bristol Bay red king crab savings area.

1.1.2. Nearshore Bristol Bay Trawl Closure

All trawling is prohibited year round in Bristol Bay east of 162° W. longitude, except the subarea that is open to trawling during the period April 1 to June 15 each year (Figure 2).

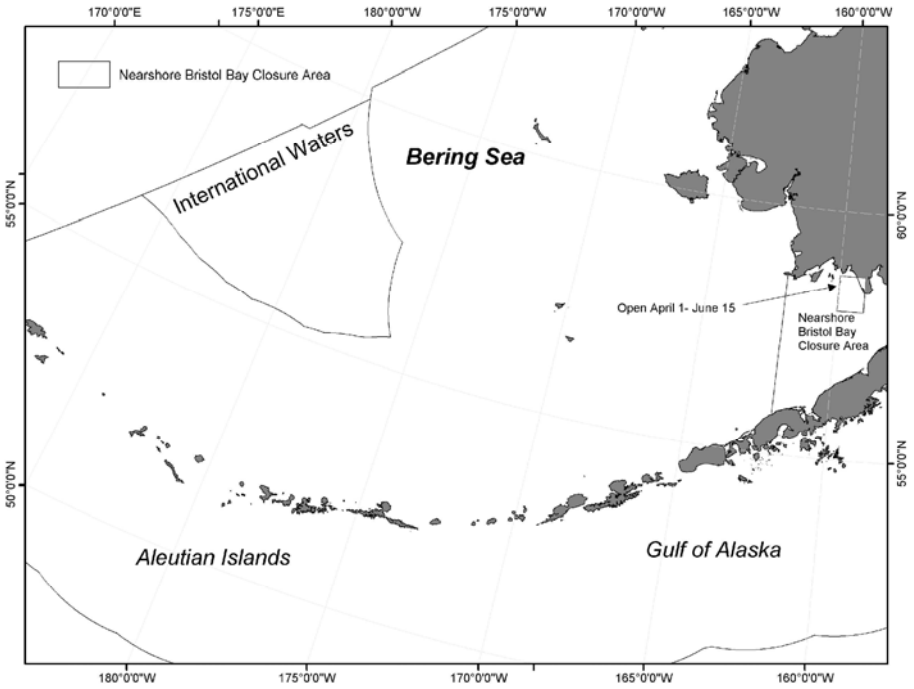

Figure 2 Nearshore Bristol Bay trawl closure

1.1.3. Zones 1 and 2

Zones 1 and 2 are closed to directed fishing when the crab bycatch caps (red king crab and EBS Tanner crab) are attained in specified fisheries (Figure 3). Species-specific caps are described below.

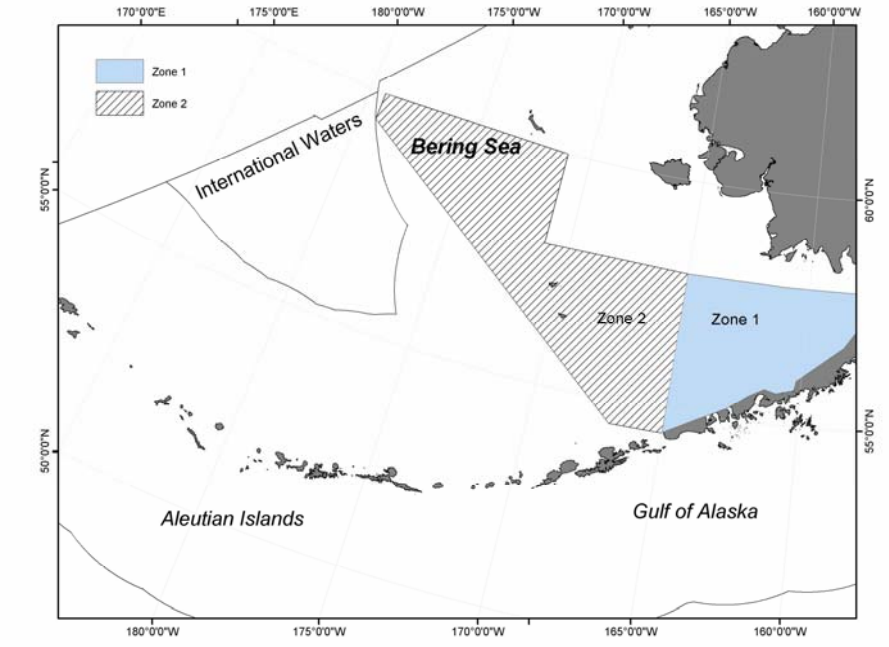

Figure 3 Zones 1 and 2 area for closures (Bristol Bay red king crab and EBS Tanner crab)

Table 2 PSC limits for red king crab

PSC limits for Zone 1 red king crab (No Zone 2 RKC)	
Abundance	**PSC Limit**
Below threshold or 14.5 million lbs of effective spawning biomass (ESB)	33,000 crabs
Above threshold, but below 55 million lbs of ESB	97,000 crabs
Above 55 million lbs of ESB	197,000 crabs

The stair step procedure for determining PSC limits for red king crab taken in Zone 1 trawl fisheries is based on abundance of Bristol Bay red king crab (Table 2). Based on the 2008 estimate of effective spawning biomass of 75 million pounds, the PSC limit for 2009 is 197,000 red king crabs. Up to 25% of the red king crab PSC limit can be used in the 56º - 56º10'N strip of the Red King Crab Savings Area. The red king crab cap has generally been allocated among the pollock/mackerel/other species, Pacific cod, rock sole, and yellowfin sole fisheries.

1.2. EBS Tanner crab management measures

PSC limits for C. *bairdi* (EBS Tanner crab) in Zones 1 and 2 have been based on total abundance of *bairdi* crab as indicated by the NMFS trawl survey (Table 3). Based on 2008 abundance (435 million crab), and an additional reduction implemented in 1999, the PSC limit in 2009 for *C. bairdi* is 980,000 (1,000,000 minus 20,000) *bairdi* crab in Zone 1 and 2,970,000 (3,000,000 minus 30,000) crab in Zone 2.

Table 3 PSC limits for EBS Tanner crab

PSC limits for *bairdi* Tanner crab: Zone 1 and 2		
Zone	**Abundance**	**PSC Limit**
Zone 1	0-150 million crabs	0.5% of abundance
	150-270 million crabs	750,000
	270-400 million crabs	850,000
	over 400 million crabs	1,000,000
Zone 2	0-175 million crabs	1.2% of abundance
	175-290 million crabs	2,100,000
	290-400 million crabs	2,550,000
	over 400 million crabs	3,000,000

1.3. Pribilof Islands blue king crab management measures

Amendment 21a to the BSAI groundfish FMP established the Pribilof Islands Habitat Conservation Area, effective January 20, 1995 (Figure 4). This amendment prohibits the use of trawl gear in a specified area around the Pribilof Islands year-round. The intent of this closure was to protect the unique habitat and ecosystem surrounding the Pribilof Islands so that it could contribute long term benefits to the fisheries surrounding the waters of the Pribilof Islands area (NPFMC, 1994). The Pribilof Islands area provides habitat for commercially important groundfish species, blue king crab, red king crab, Tanner crab, snow crab, juvenile groundfish,

Korean hair crab, marine mammals, seabirds and their prey species. This area was established based upon the distribution and habitat of the blue king crab in the NMFS annual trawl surveys and based on observer data (NPFMC, 1994).

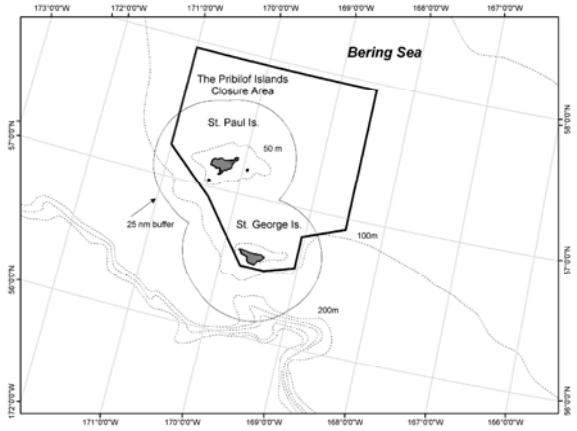

Figure 4 Pribilof Islands Habitat Conservation Zone

1.4. EBS Snow crab management measures

A triggered time/area closure (described below) closes to trawling to protect snow crab stocks and habitat.

1.4.1. *C. Opilio* Bycatch Limitation Zone (COBLZ)

A closure for EBS snow crab (*C. opilio*) is triggered if the limit (as described below) is reached in specified fisheries. The limit accrues for bycatch taken within the *C. opilio* Bycatch Limitation Zone (COBLZ) and that area then closes for the fishery that reaches its specified limit. (Figure 5).

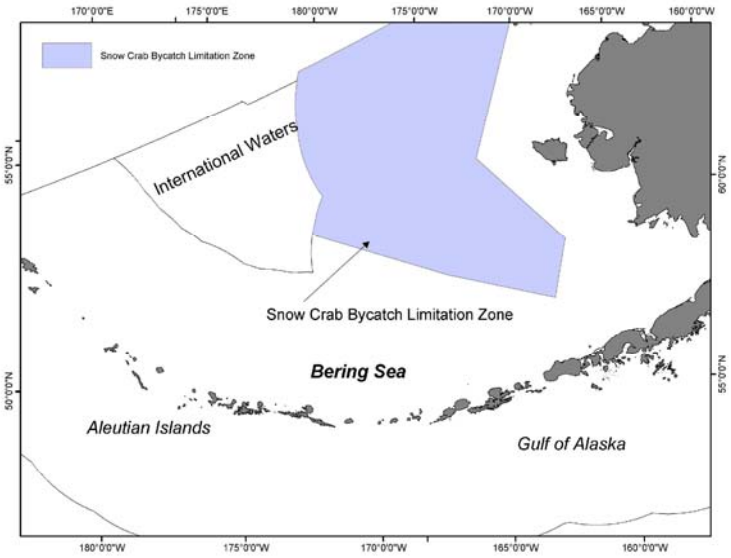

Figure 5 *C. opilio* Bycatch Limitation Zone (COBLZ)

EBS snow crab PSC limits are based on total abundance of snow crab as indicated by the NMFS standard trawl survey. The cap is set at 0.1133% of snow crab abundance index, with a minimum

of 4.5 million snow crab and a maximum of 13 million snow crab; the cap is further reduced by 150,000 crab. The 2008 survey estimate of 2.60 billion crabs resulted in a 2009 snow crab PSC limit of 2,943,421 crabs, if left unadjusted. However, the BSAI groundfish FMP mandates a minimum of 4,350,000 snow crab. Only snow crab taken within the COBLZ accrue toward the PSC limits established for individual trawl fisheries.

1.5. St. Matthew blue king crab management measures

A fixed closure (described below) prohibits bottom trawling in the vicinity of St. Matthew Island to protect blue king crab stocks and habitat. Additional habitat conservation area closures are also closed to bottom trawling as described below.

1.5.1. Habitat Conservation Areas

Non-pelagic trawl gear fishing is prohibited in St. Matthew Island Habitat Conservation Area, St. Lawrence Habitat Conservation Area, Nunivin, Kuskokwim, Etolin Habitat Conservation areas and the Bering Sea Habitat Conservation Area (Figure 6). Trawling is currently prohibited in the Northern Bering Sea Research Area, but sections of that region may open to trawling for research purposes in the future.

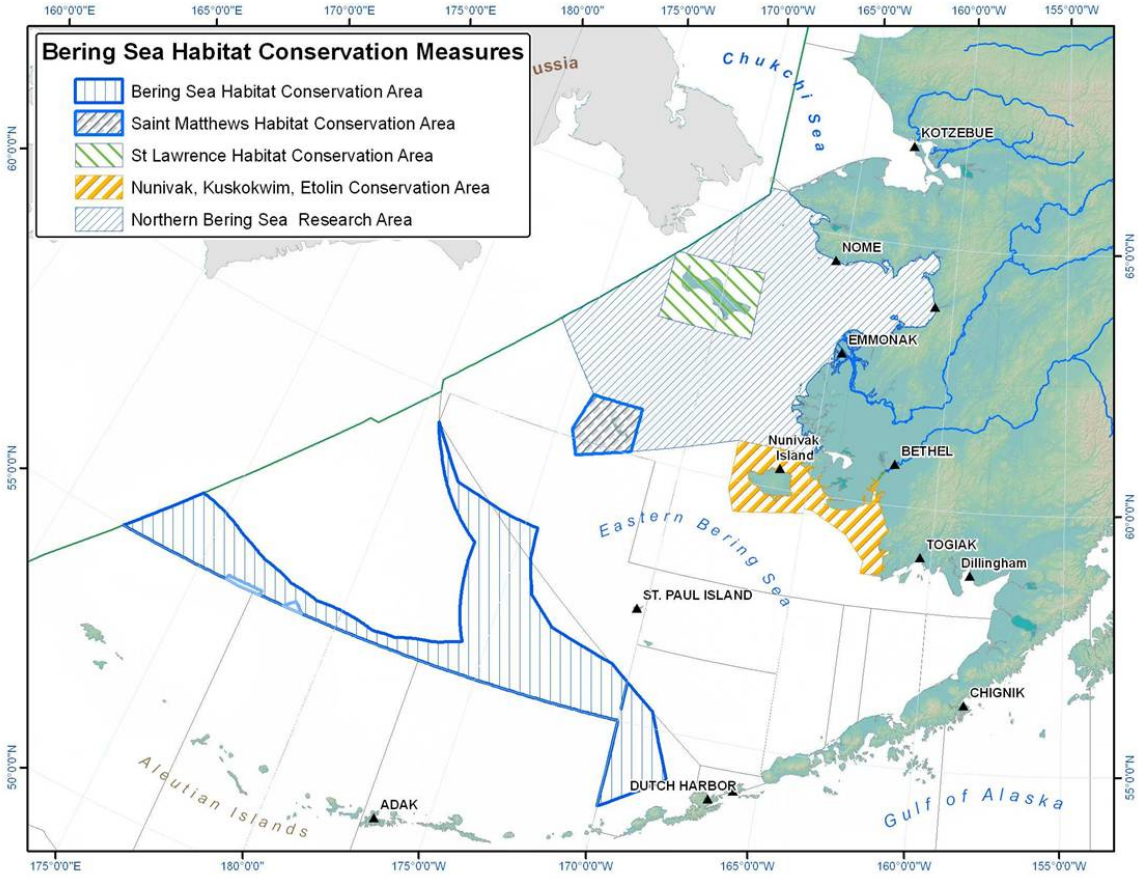

Figure 6 Bering Sea Habitat Conservation measures closure areas.

2. Groundfish bycatch by crab stock

Overall bycatch by species since 1991 is show in Figure 7. Here bycatch is listed in number of crab with no mortality rates applied by gear type. Once annual bycatch numbers by crab species are tabulated, they must be delineated by area (for stock-specific bycatch) and converted to a weight. Stock-specific boundaries are still being developed (for smaller scale bycatch accounting) thus currently delineations are by Federal reporting area distribution by stock. There is not perfect alignment between Federal reporting areas and crab management units thus smaller scale management units using ADF&G statistical areas are being developed for groundfish bycatch accounting in the future.

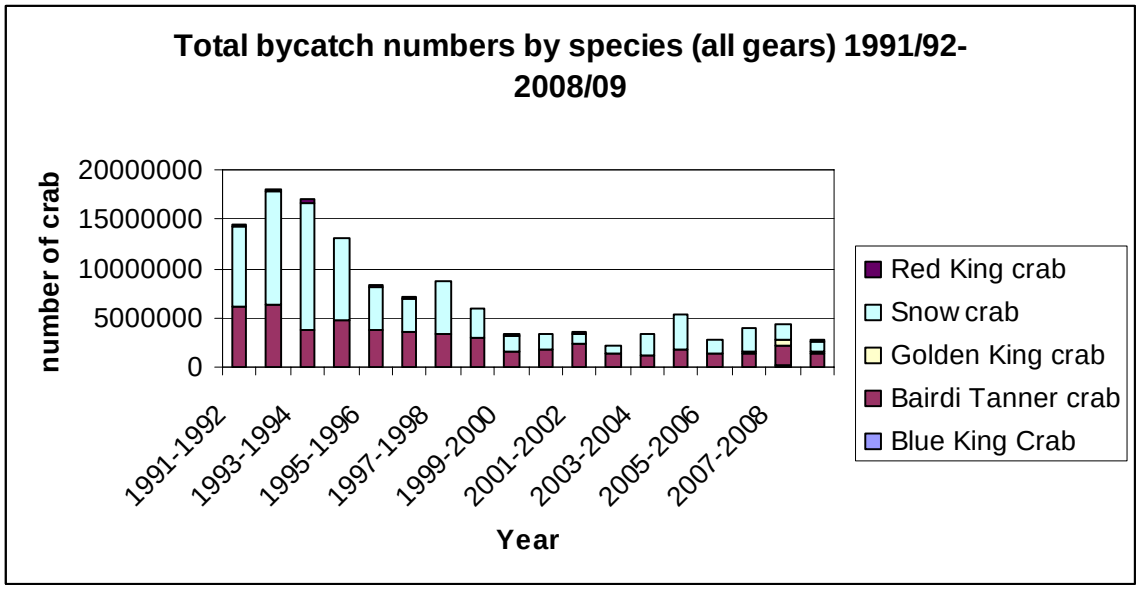

Figure 7 Total bycatch numbers by species (all gears). Numbers not adjusted for mortality.

2.1. Methodology to estimate crab mortality

In groundfish fisheries, crab bycatch is currently tabulated by number of crab, however in crab fisheries the overall weight of crab (in kilograms and lbs) is tabulated. For purposes of accruing against the stock-specific OFLs, the weight is the important measure. A procedure was developed by NMFS catch accounting for applying average crab weights by year against the extrapolated numbers of crab in the observer database. A general description of the procedure of moving from extrapolated numbers of crab to weight of crab for purposes of accruing against stock-specific OFLs is described below (excerpted from Gasper et al. 2009). Data have been compiled by stock from 1991/92-2008/09 crab fishing years. These data are now used in all assessments for which a total catch OFL is specified.

Observer information must be used to infer the total of weight of crabs because both the blend and catch accounting systems (CAS) only estimate the number of crabs. Observer data was obtained from the AFSC for each crab year between 1991 and 2009. The observer data consists of random samples taken within a haul on a vessel. These random samples contain the total weight of crabs and the number of crabs contained in a sample.

To calculate an average weight per crab, the number and total weight of crabs in observer samples were summed across gear types and averaged by year. Thus a nominal average by year

and crab species was used. This may not be the ideal method given potential gear selectivity for crab size/condition and differences in sample sizes between gear types. The distribution of sampled crab was unevenly divided, with trawl samples accounting for approximately 45 percent of the total sample weight and 35 percent of the total number of crab sampled across all years. In addition, the accuracy of crab weights representing whole crabs caught in trawl gear is largely unknown because these crabs may be crushed or incomplete due to missing body parts. Crab weights caught using fixed gear is likely generally whole crabs due to the nature of the gear used.

Once these estimates of total weights of crab are provided to stock assessment authors, authors apply a mortality rate by gear type to discount for handling mortality prior to inclusion in the assessment. Generally authors apply a 50% handling mortality for fixed gear and an 80% handling mortality for trawl gear (NPFMC 2009). Previously handling mortality rates used to estimate mortality in groundfish fisheries in conjunction with annual estimates of bycatch mortality by crab stock were 80% for groundfish trawl gear and 20% for groundfish fixed gear (NPFMC 2007). These are the rates employed by gear type in this summary paper thus they may underestimate fixed gear bycatch mortality in comparison to stock assessment chapters and actual accrual towards the crab stock specific OFL. Total mortality by species for the same time period is shown in Figure 8.

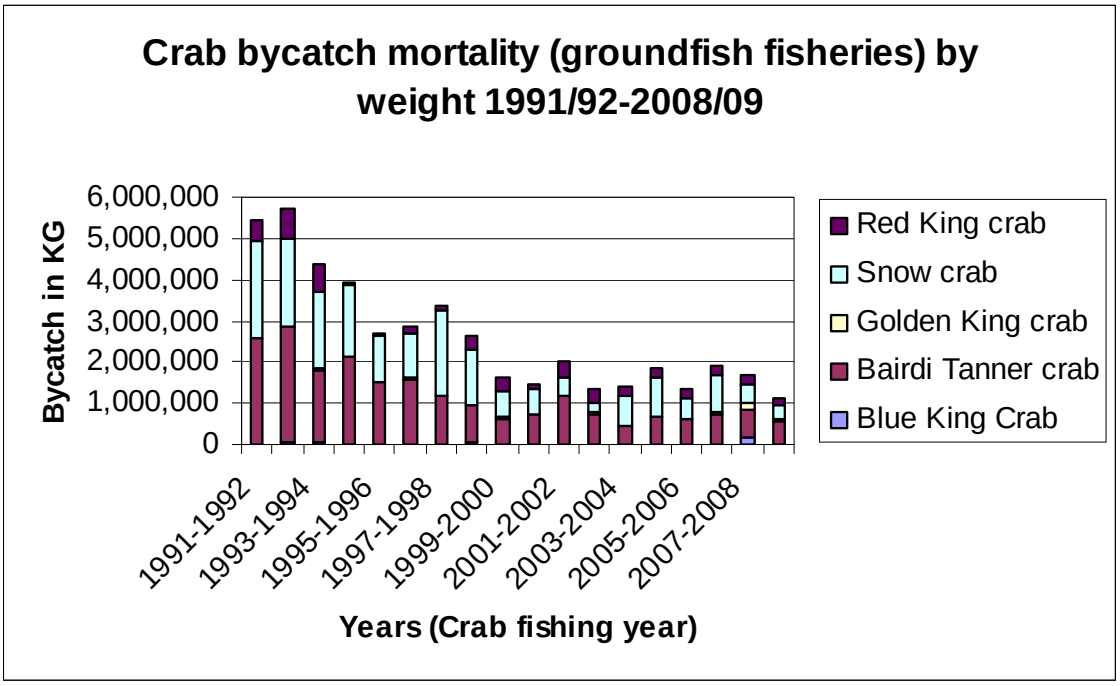

Figure 8 BSAI crab bycatch mortality (KG) 1991/92-2008/09 all species.

2.2. Relationship of BSAI Crab FMP to BSAI Groundfish FMP

Under the annual OFLs established by amendment 24 to the BSAI Crab FMP, all crab bycatch in groundfish (and scallop) fisheries counts against the OFL for each stock. There is no explicit linkage between the BSAI Crab FMP and the BSAI Groundfish FMP or Alaskan Scallop FMP. Scallop bycatch is almost entirely Tanner crab and at very low levels. Limits do exist in the Scallop fishery for Tanner crab and are based on abundance thresholds in relation to the Tanner crab stock status. Tanner crab removals by the scallop fishery will be explicitly considered in the

next EBS Tanner crab assessment but represent a very low ratio of total removals. Following Crab Plan Team discussion of the relative removals from the scallop fishery as compared with the groundfish fishery, the CPT recommended that examination of limits and bycatch by stock in the groundfish fisheries were a high priority and removals from the scallop fishery were minimal (see attached minutes from CPT meeting May 2009).

Absent any additional measures to establish limits and linkages between the Groundfish FMP and Crab FMP, if conservation concerns arise for these crab stocks, any resulting catch limitation can only come from the directed crab fishery. The EA for amendment 24 to the BSAI Crab FMP specifically noted that there is no link currently between the FMPs and highlighted the concern that this could pose in the case of an overfishing determination. As noted in the EA (NPFMC, 2008).

If an OFL for a crab species is exceeded in a given year, an overfishing determination will be found at the end of the crab fishing year, and a corresponding reduction in the harvest will be taken the following year so as to avoid a subsequent overfishing determination (see section 2.4 for more details). Amendment 24 does not provide an in-season mechanism for determining if overfishing is occurring or a response for management measures in the directed crab fisheries. Overfishing is prevented by setting the OFLs prior to the State setting the TAC for the up coming crab fishing year. The TAC is constrained by the OFLs. The State is not mandated to close directed crab fisheries for exceeding the OFL in-season. This is distinctly different from Federal groundfish fisheries management.

However, regardless of having an overfishing determination the following season, there are currently no corresponding management measures which occur in the groundfish or scallop fisheries to further limit crab bycatch. Crab catch in these fisheries is solely regulated by the bycatch limits as described in sections 10.1 – 10.4. Under all alternatives, regulations to reduce the bycatch of crab in groundfish and scallop fisheries would be considered when a crab stock becomes overfished and necessitates a rebuilding plan (or revisions to an existing rebuilding plan). Or, if the Council determines measure are necessary to end overfishing. In order for there to be any further feedback management mechanism in either the groundfish fisheries or scallop fisheries in the case that the catch of a particular crab stock exceeded its OFL, the respective BSAI groundfish FMP and Scallop FMP would need to be amended. Should a crab stock become overfished and necessitate the creation of a rebuilding plan (or revisions to an existing rebuilding plan), regulations on the bycatch of crab in groundfish and scallop fisheries would be considered again at that time and additional regulations under those FMPs may be considered in a new (or revised) rebuilding plan (pages 141-142 of the EA for Amendment 24 to the BSAI King and Tanner Crab FMP, NPFMC, 2008).

2.3. Bycatch by Crab Stock

The following sections provide an overview of groundfish bycatch by gear type from 1991/92 through 2008/09. Bycatch is listed by crab fishing year (July through the following June) consistent with the time period over which removals accrue against the OFL for crab stocks. All crab bycatch data are from the NMFS catch accounting and are consistent with the information provided to crab stock assessment authors for use in their most recent stock assessments. The dataset used to estimate crab bycatch consisted of Blend data and estimates generated from the Catch Accounting System for the BSAI. Blend data were used for the time period between 1991 and 2003, with CDQ data originated from a separate table for 1998. The catch accounting system estimates were used for 2003-2009. Crab estimates for 2003 were a combination of blend and catch accounting estimates (for more information see Gasper et al., 2009).

In addition to general trends from 1991/92-2008/09 for each stock, bycatch for 2008/09 by groundfish fishery is also summarized. This provides only a snapshot of the removals by fishery under the first year that these removals accrued against the OFL for crab stocks. Further investigation would need to be done of trends by fishery over time in order to determine if the single year is representative of trends in fishery removals by stocks. Nonetheless it does provide some indication of which fisheries are most likely to be affected by any subsequent limitation of crab bycatch by stock should the Council move forward with an analysis of additional crab bycatch measures.

Bycatch for stocks under a total catch OFL are all summarized here. Not all crab stocks have a total catch OFL at this time. Crab stocks which are currently managed (through the 2009/10 crab fishing year) under a retained catch OFL include the Aleutian Islands golden king crab (AIGKC), Pribilof Islands golden king crab and Adak red king crab stocks. Bycatch information for Aleutian Islands golden king crab and Adak red king crab are nonetheless summarized in this paper as AIGKC is likely to move to a total catch OFL in the subsequent assessment cycle (whereby all removals would accrue against the OFL) and Adak red king crab is an extremely depressed, information-poor stock where bycatch in other fisheries may be contributing to its inability to recover to historical levels.

Bycatch data are summarized by removals in kilograms (with mortality applied as 20% for fixed gear and 80% for trawl gear) as well as in overall numbers of crab (no mortality applied). Fisheries accounting for the majority of removals in 2008/09 are noted and timing of bycatch by fishery over the crab fishing year is shown for some fisheries. Groundfish fishing patterns in 2008/09 changed as a result of the implementation of amendment 80 which created sector allocations and cooperatives for the head and gut trawl catcher/processor fleet for the following five species: Atka mackerel, Pacific ocean perch, yellowfin sole, flathead sole and rocksole. Additionally, 2008/09 is the first year of implementation of amendment 24 to the Crab FMP whereby all crab removals from groundfish, crab and scallop fisheries accrue against stock-specific OFLs. In each section below, a single comparison is made for stocks indicating what percentage the total catch in 2008/09 in groundfish fisheries was compared to the OFL for that stock.

2.3.1. Aleutian Islands Golden King Crab

Bycatch mortality of AIGKC by year and gear type are shown in Figure 9 and Figure 10. Fishery-specific bycatch (screened for confidentiality) for 2008/09 is shown in Table 4.

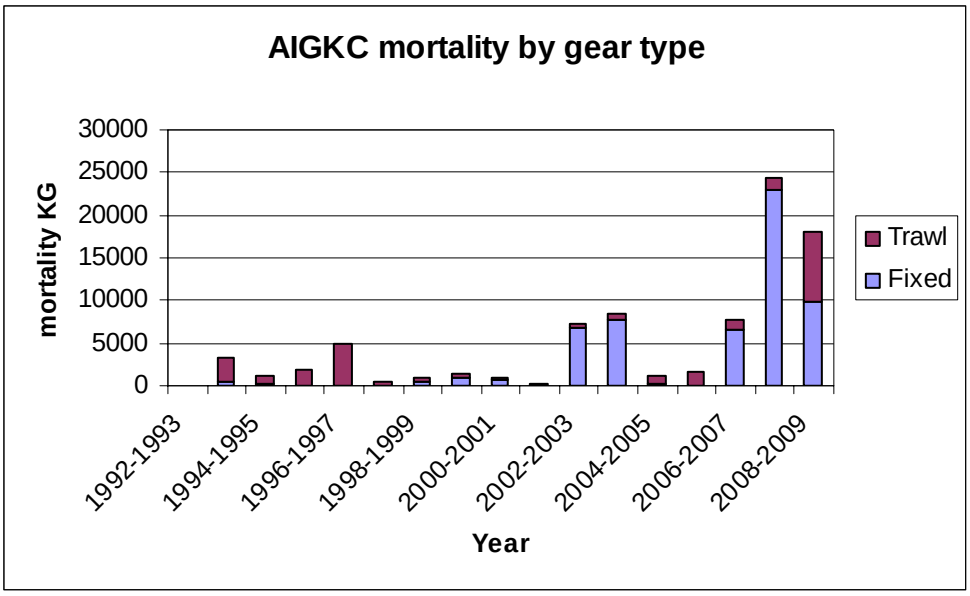

Figure 9 Bycatch mortality for Aleutian Islands golden king crab, all gears

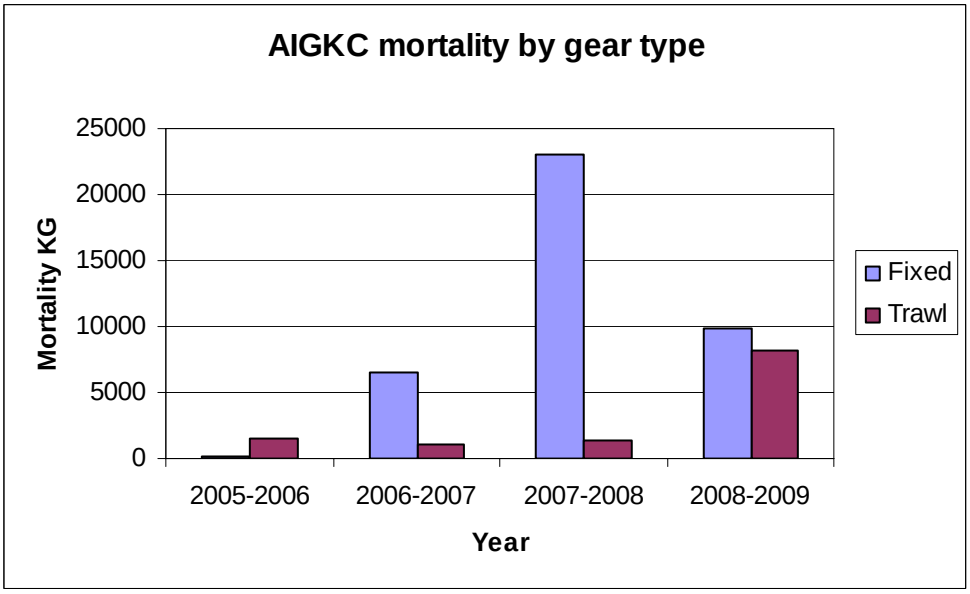

Figure 10 Bycatch mortality for Aleutian Island golden king crab all gears, 2005/06-2008/09

Table 4 Bycatch mortality by fishery and gear type and overall bycatch numbers (no mortality applied) for Aleutian Islands golden king crab 2008/09

2008/09 AIGKC mortality by fishery

Fishery	HAL	NPT	POT	Total mortality KG	Total # crab
Sablefish	**24**		**9,787**	**9,811**	**128,372**
Atka mackerel		**6,684**		**6,684**	**21,864**
arrowtooth flounder		356		356	1,166
Greenland turbot		249		249	814
Pacific cod	34	24		58	529
Rockfish		928		928	3,037
Shallow-water flatfish	14			14	186
Grand Total	73	8,242	9,787	18,101	155,968

Aleutian Islands golden king crab in 2008/09 crab fishing year operated under a retained catch OFL of 9.18 million pounds. For comparison against this amount, the total groundfish crab bycatch mortality in 2008/09 was approximately 39,906 lbs or 0.4% of the retained catch OFL. The highest mortality occurred in the sablefish pot fishery, followed by the Atka mackerel trawl fishery. Bycatch by month in numbers of crab (not discounted for mortality) in the sablefish pot fishery indicated the highest bycatch in May (Figure 11). Bycatch was primarily taken in Area 541. In contrast, bycatch in the Atka mackerel trawl fishery in 2008/09 was highest in September/October. Observer coverage in the sablefish pot fishery is low. Relative levels of observed catch from 2004 to 2007 indicate that 28-59% of the catch was observed in the sablefish pot fishery (http://www.fakr.noaa.gov/npfmc/current_issues/observer/percent_observed.pdf). Sablefish pot fishing has increased dramatically in the Aleutian Islands and the Bering Sea since 1999. In 2007, pot gear accounted for 81% of the Bering Sea fixed gear IFQ catch and 56% of the catch in the Aleutians (Hanselman et al, 2008). The atka mackerel trawl fishery has high observer coverage (100% over the time frame 2004-2007) given that it is mainly prosecuted by vessels >125'.

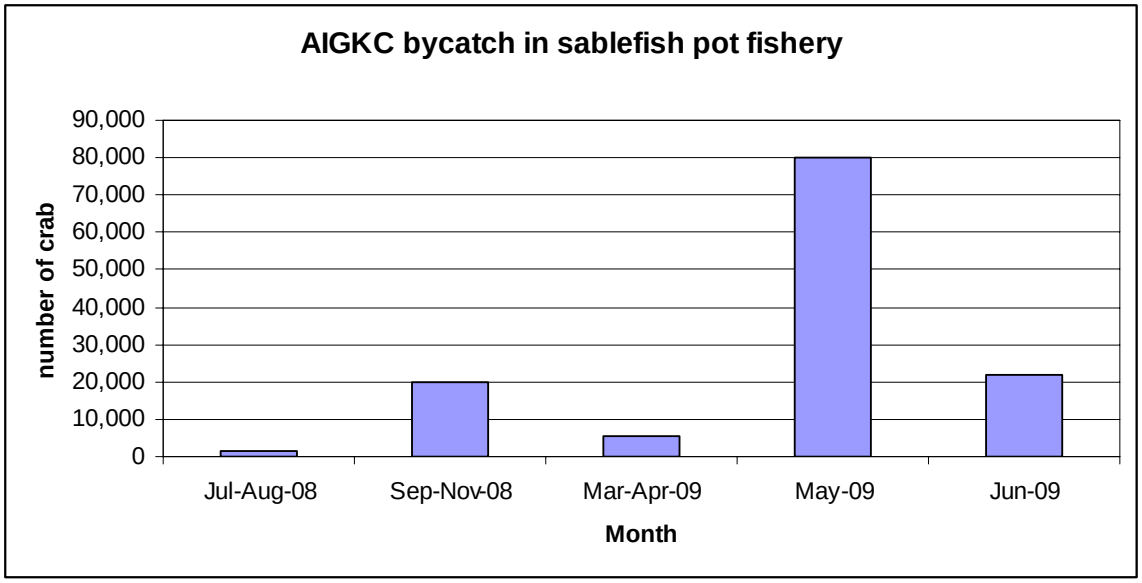

Figure 11 Bycatch of AIGKC in the sablefish pot fishery (numbers of crab, not discounted for mortality) 2008/09 crab fishing year.

2.3.2. EBS snow crab

Bycatch mortality from groundfish fisheries by gear type from 1991/92 to 2008/09 is shown in Figure 12 with the most recent 5 years shown in Figure 13. Fishery-specific bycatch (screened for confidentiality) for 2008/09 is shown in Table 5

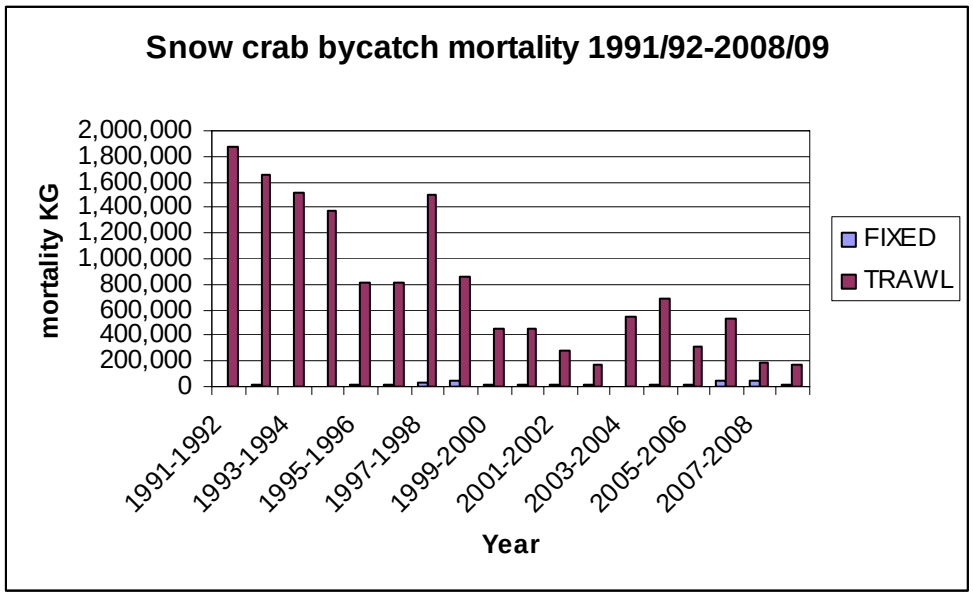

Figure 12 Bycatch mortality (KG) by gear type for EBS snow crab

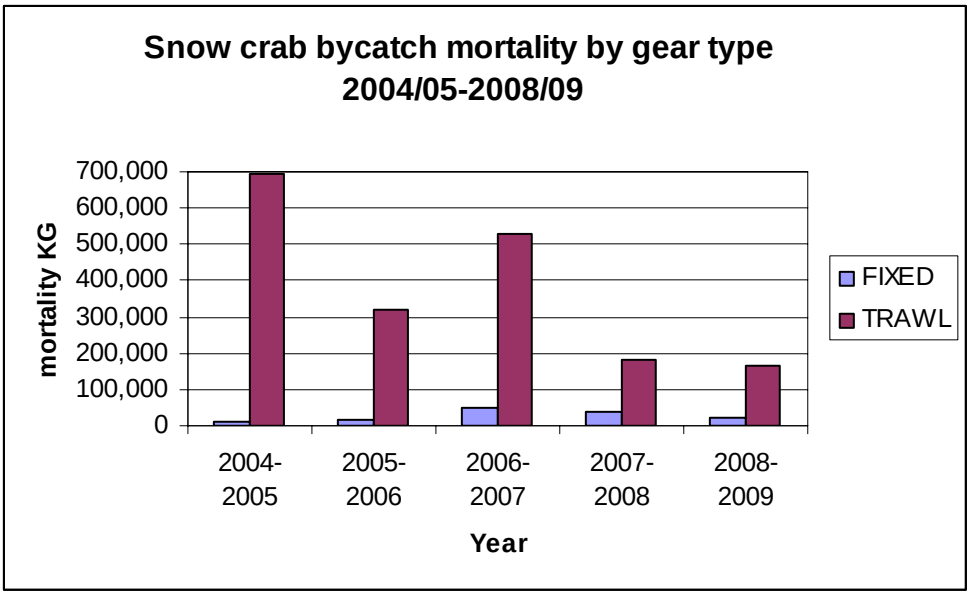

Figure 13 Bycatch mortality by gear type for EBS snow crab, most recent 5 years (2005/06-2008/09)

Table 5 Bycatch mortality by fishery and gear type and overall bycatch numbers for EBS snow crab 2008/09.

2008/09 Snow crab mortality by fishery

Fishery	HAL	NPT	POT	PTR	Total mortality	Total # crab
arrowtooth flounder	0	2,190			2,190	9,531
Deepwater Flat		86			86	374
Flathead sole		**44,595**			**44,595**	**194,115**
Greenland turbot	2	0			2	30
Other Flatfish		18			18	79
Pacific cod	**4,963**	**3,449**	**16,828**		**25,239**	**394,409**
Pollock	0	0		1,300	1,300	5,664
Rock sole		3,027		0	3,027	13,175
Sablefish	0	0	12		12	207
yellowfin sole		**109,614**			**109,614**	**477,127**
Total	4,966	162,980	16,839	1,300	186,085	1,094,727
COBLZ limit = 4,350,000					COBLZ catch	677,169

The 2008/09 OFL for EBS snow crab was 77.30 million pounds. Total groundfish fishery mortality of snow crab in 2008/09 was approximately 410,240 lbs or approximately 0.5% of the OFL. Mortality occurred primarily in the yellowfin sole trawl fishery, with lesser amounts in the flathead sole trawl fishery and the Pacific cod pot fishery. Timing of bycatch in 2008/09 (aggregated by month) in the yellowfin sole fishery indicates the majority of the bycatch occurs between August and November with additional high numbers in April (Figure 14).

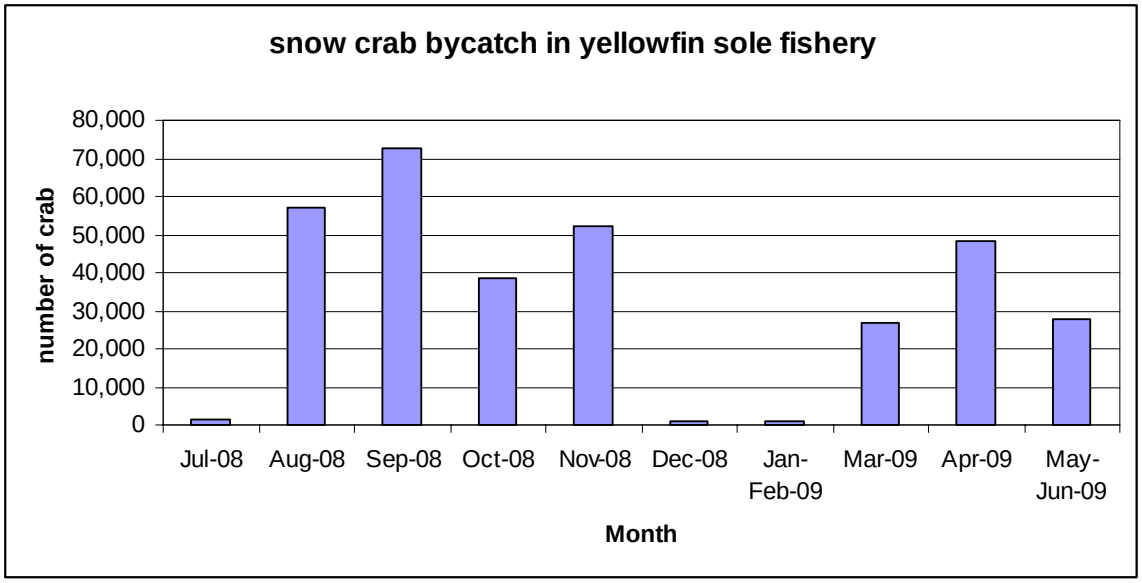

Figure 14 Bycatch by month (numbers of crab, no mortality applied) of snow crab in the yellowfin sole fishery 2008/09 (crab fishing year).

2.3.3. Bristol Bay red king crab

Bycatch mortality from groundfish fisheries by gear type from 1991/92 to 2008/09 is shown in Figure 15 with the most recent 5 years shown in Figure 16.

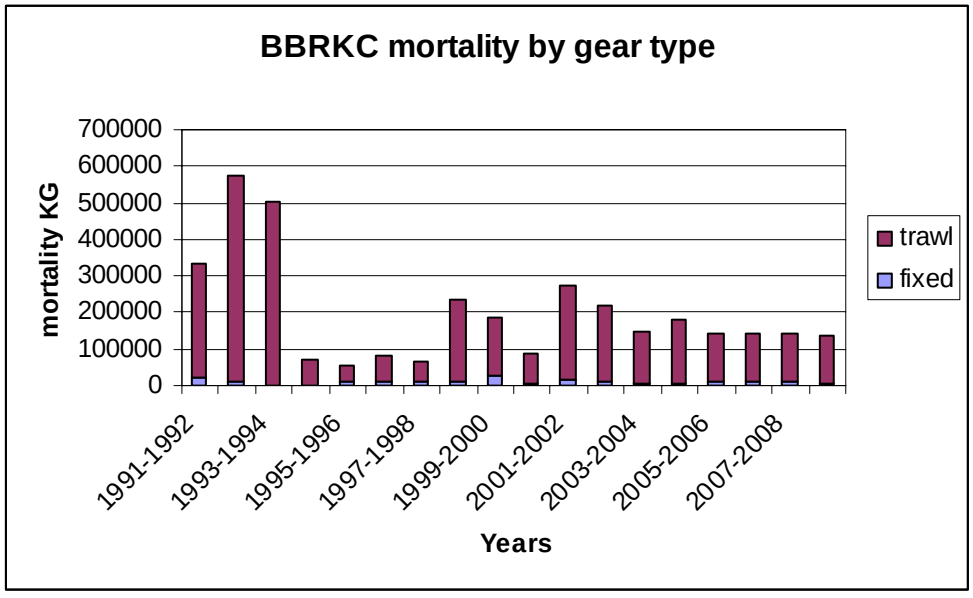

Figure 15 Bycatch mortality by gear type Bristol Bay red king crab

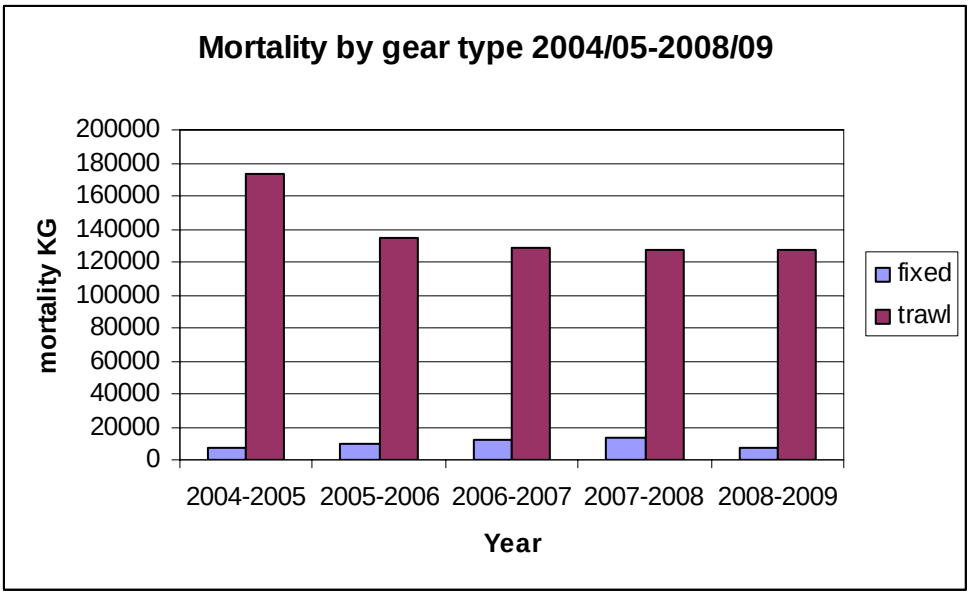

Figure 16 Bycatch mortality by gear type, most recent 5 year years (2005/06-2008/09)

Table 6 Bycatch mortality by fishery and gear type and overall bycatch numbers for Bristol Bay red king crab 2008/09.

2008/09 mortality of BBRKC by fishery

Fishery	HAL	NPT	POT	PTR	Total mortality	Total # crab
Arrowtooth flounder		460			460	300
Atka mackerel		2,578			2,578	1,680
Flathead sole		6,310			6,310	4,112
Other Flatfish		132			132	86
Pacific cod	2,572	2,843	5,125		10,540	21,914
Pollock				41	41	27
Rock sole		**78,733**			**78,733**	**51,305**
Rockfish		364			364	237
Sablefish	9		24		33	85
yellowfin sole		**35,828**			**35,828**	**23,347**
Grand Total	2,582	127,249	5,149	41	135,020	103,096

The Bristol Bay red king crab OFL in 2008/09 was 24.20 million lbs. Groundfish bycatch over this time period accruing towards the OFL was approximately 297,670 lbs or approximately 1.2% of the OFL. The highest source of mortality by fishery was in the rocksole trawl fishery, followed by the yellowfin sole trawl fishery and the Pacific cod fisheries (fixed gear and trawl) (Table 6). Bycatch by month for July 2008-June 2009 (crab fishing year) in the rock sole trawl fishery indicates the majority of bycatch was taken in January and February (Figure 17)

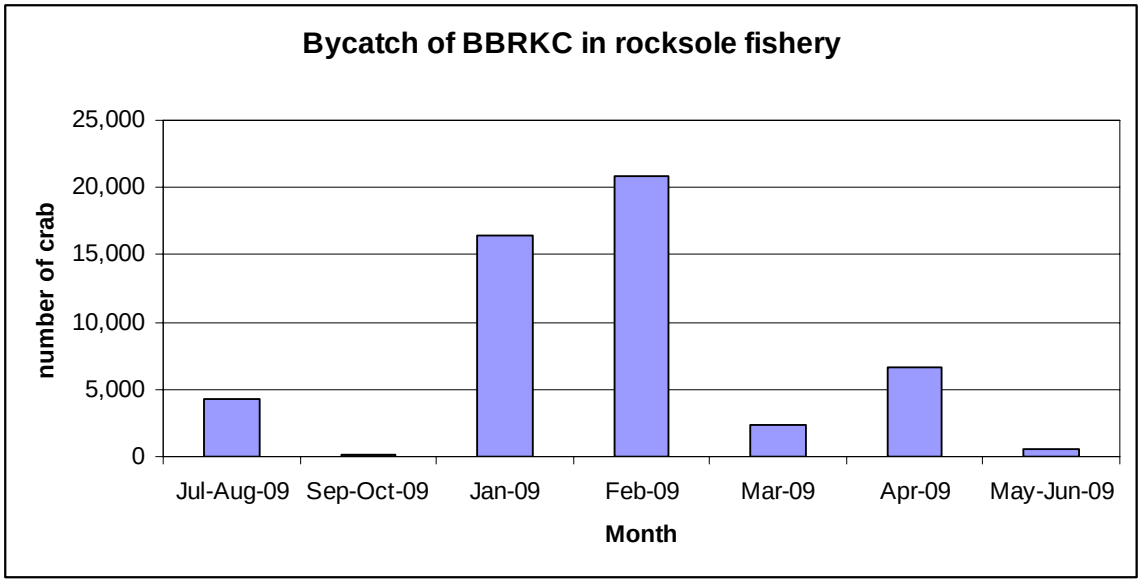

Figure 17 Bycatch by month of Bristol Bay red king crab in the rocksole trawl fishery July 2008-June 2009 (Crab fishing year). Numbers of crab aggregated by month (not discounted for mortality).

2.3.4. EBS Tanner crab

Bycatch mortality from groundfish fisheries by gear type from 1991/92 to 2008/09 is shown in Figure 18 with the most recent 5 years shown in Figure 19.

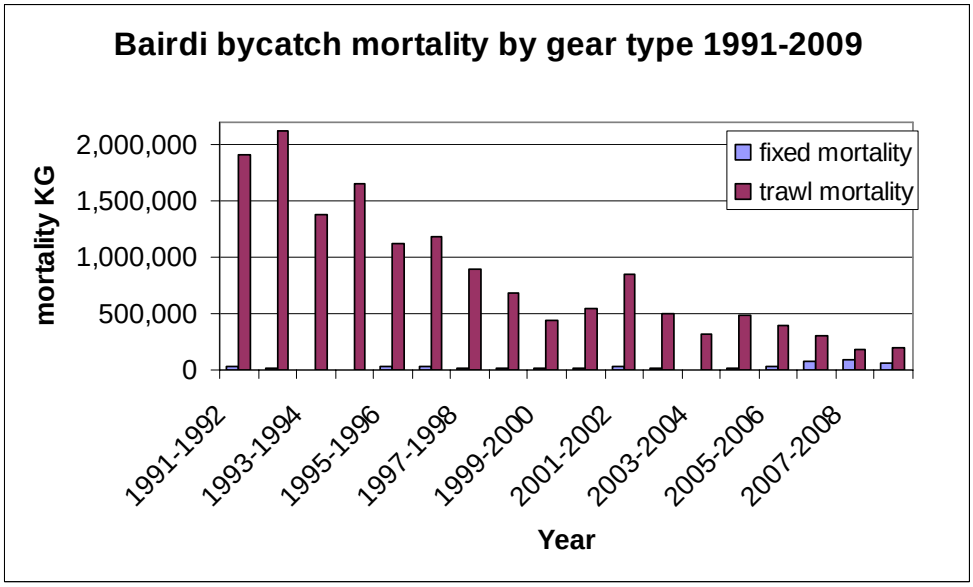

Figure 18 Bycatch mortality by gear type for EBS Tanner crab

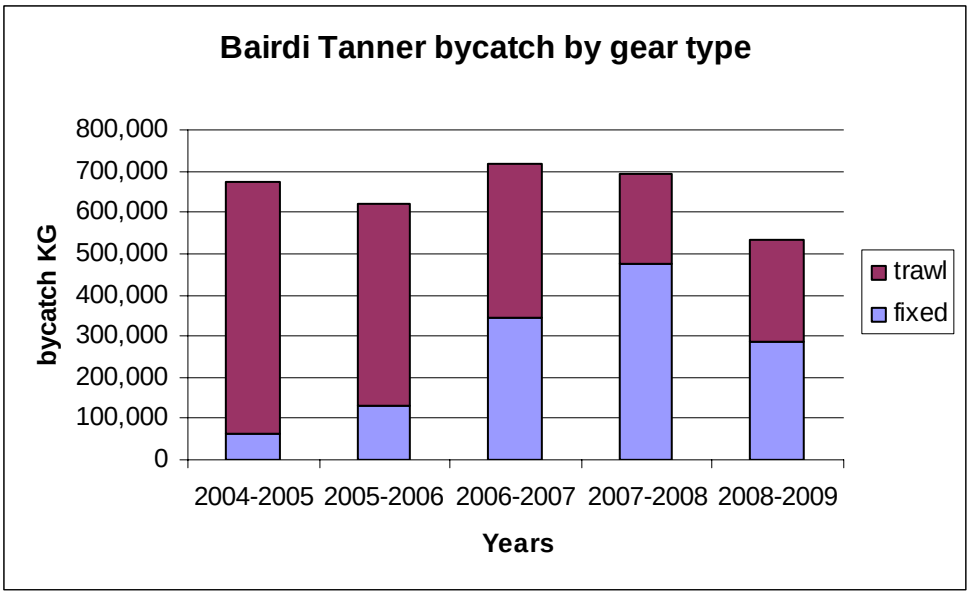

Figure 19 Bycatch mortality by gear type for EBS Tanner crab, most recent 5 years (2005/06-2008/09)

The 2008/09 OFL for EBS Tanner crab was 15.52 million pounds. Total groundfish fishery bycatch over this time period was approximately 559,440 lbs or 3.6% of the OFL. Bycatch mortality was primarily in the yellowfin sole trawl fishery, the Pacific cod pot fishery and the rocksole trawl fishery. Here the mortality assumption of 20% for the Pacific cod pot fishery may be an underestimate of the actual mortality accruing against the OFL (the 2009/10 crab assessments use 50% for all pot gear), thus mortality as represented in this paper for fixed gear may be an underestimate of the actual mortality accruing against the OFL for crab stocks.

Table 7 Bycatch mortality by fishery and gear type and overall bycatch numbers for EBS Tanner crab 2008/09.

2008/09 EBS Tanner crab mortality by fishery

Fishery	HAL	NPT	POT	PTR	Total mortality	Total # crab
arrowtooth flounder		11,192			11,192	35,584
Deepwater Flat		79			79	250
Flathead sole		26,498			26,498	84,240
Other Flatfish		319			319	1,014
Pacific cod	**2,955**	**4,445**	**36,183**		**43,584**	**511,844**
Pollock	*			342	*	*
Rock sole		30,427			30,427	96,731
Rockfish/other species/ sablefish/ Shallow-water flatfish/Greenland turbot	31	16			46	445
yellowfin sole		**122,369**			**122,369**	**389,028**
Total		195,343	36,184	342		1,120,234

*confidential

Bycatch by month in the yellowfin sole fishery from July 2008-June 2009 shows that the highest bycatch was taken in the spring from March –May 2009 (Figure 20). Bycatch was also taken in this fishery in the fall between September and November 2008. This is the first year of rationalized flatfish fisheries (under amendment 80) thus for these fisheries the snapshot of bycatch (timing and amounts) may be representative of future conditions given the transition form open-access to rationalization in these fisheries. Observer coverage is also increased as a result of implementation of amendment 80. Bycatch in the Pacific cod pot fishery was highest in January 2009, with bycatch also taken in high numbers in September and October of 2008 (Figure 21). Observer coverage in the Pacific cod pot fishery is variable (http://www.fakr.noaa.gov/npfmc/current_issues/observer/percent_observed.pdf) but much of the catch is taken in the shoreside sector with lower observer coverage. The observed catch percentages from 2004-2007 in the shoreside sector for Pacific cod pot fishery ranged from 0-41% of the catch observed depending upon vessel size (0% in the <60' and a high of 41% observed catch in 2007 in the >125' class in 2007.

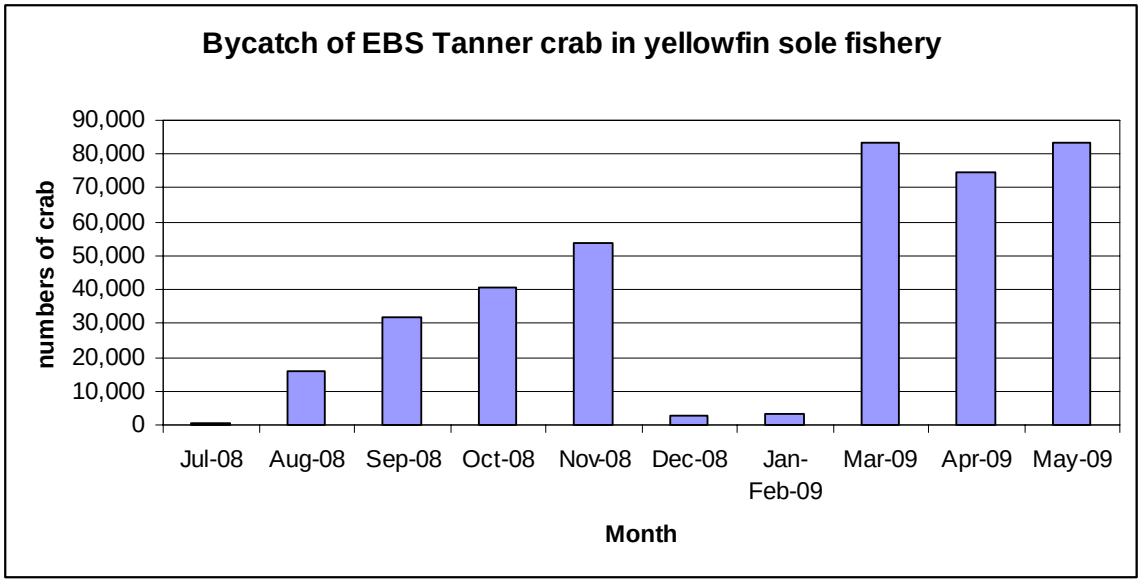

Figure 20 Bycatch of EBS Tanner crab in the Yellowfin sole fishery from July 2008-June 2009 (crab fishing year). Numbers of crab, not discounted for mortality.

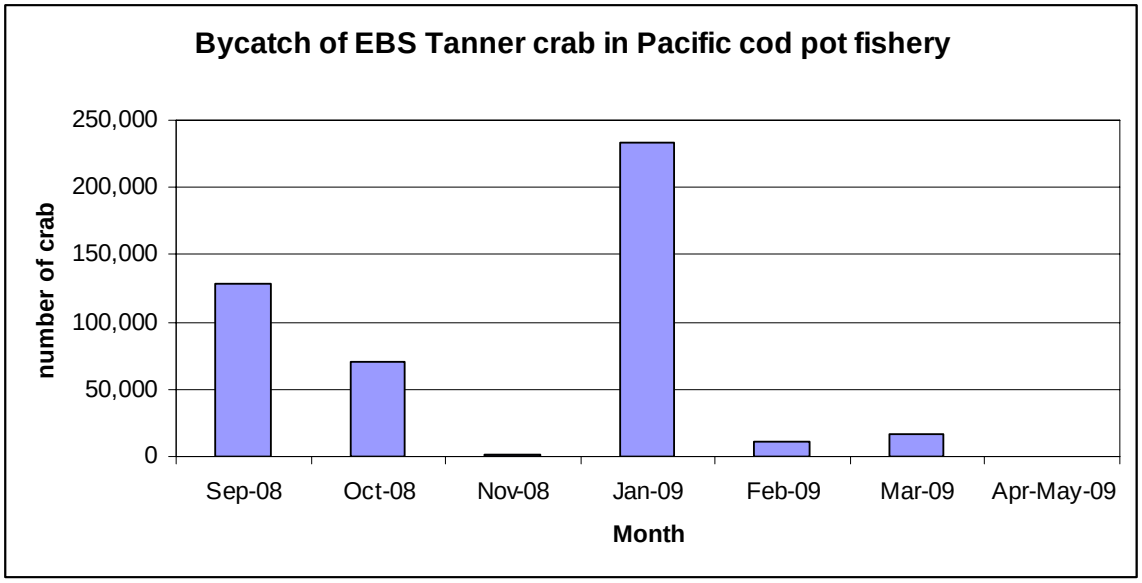

Figure 21 Bycatch of EBS Tanner crab in the Pacific cod pot fishery from July 2008-June 2009 (crab fishing year). Numbers of crab, not discounted for mortality.

2.3.5. Pribilof Island blue king crab

Bycatch mortality of Pribilof Island blue king crab 1991/92-2008/09 are shown in Figure 22. Additional discussion of fisheries contributing to this bycatch and alternatives for consideration in a revised rebuilding plan are contained in the stock assessment and not repeated here. The majority of the bycatch in 2008/09 occurred in the Pacific cod hook and line fisheries, and flatfish trawl fisheries.

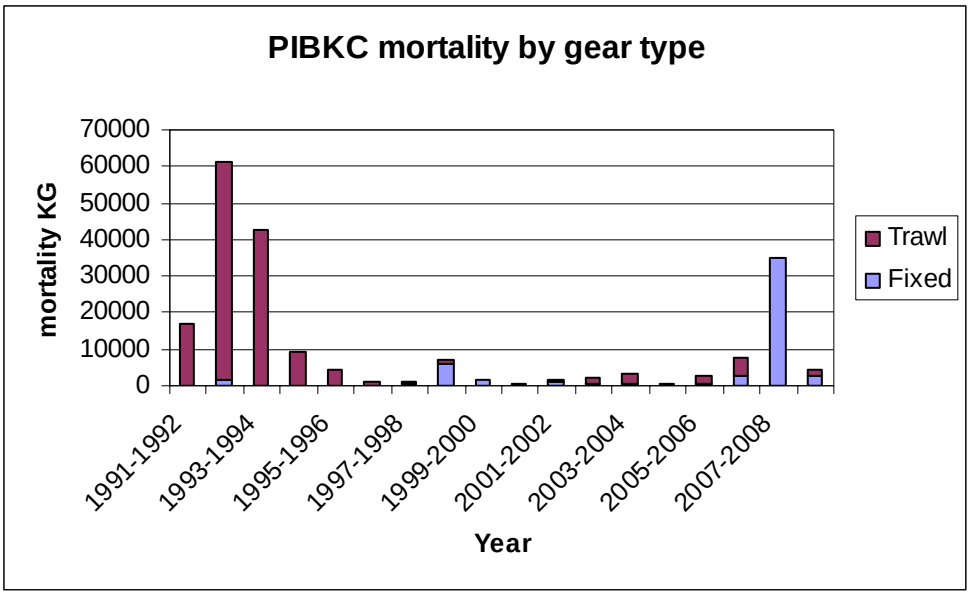

Figure 22 Bycatch mortality by gear type for Pribilof Island blue king crab

2.3.6. Pribilof Island red king crab

Bycatch mortality from groundfish fisheries by gear type from 1991/92 to 2008/09 is shown in Figure 23.

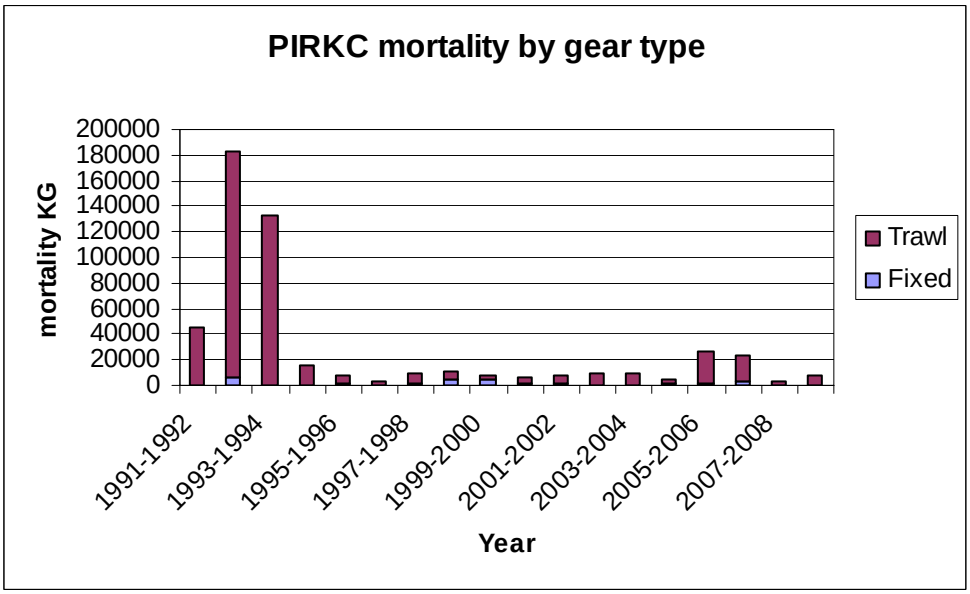

Figure 23 Bycatch mortality by gear type for Pribilof Islands red king crab

The 2008/09 OFL for Pribilof Islands red king crab was 3.32 million pounds. The total mortality from bycatch in groundfish fisheries applied towards this OFL is approximately 16,750 lbs or 0.5% of the OFL. Given the observed decrease in biomass for this stock, the recommended 2009/10 OFL is 0.50 million pounds (NPFMC 2009) and similar groundfish bycatch levels would represent a greater portion of the OFL in the 2009/10 assessment cycle.

Table 8 Bycatch mortality by fishery and gear type and overall bycatch numbers for Pribilof Islands red king crab 2008/09.

2008/09 mortality of PIRKC fishery					
Fishery	HAL	NPT	POT	Total mortality	Total # crab
Flathead sole		**1,577**		**1,577**	**1,028**
Pacific cod	**98**	**655**	**557**	**1,310**	**2,134**
Rock sole		864		864	563
yellowfin sole		**3,843**		**3,843**	**2,505**
Total	100	6,940	557	7,597	6,234

2.3.7. St. Matthew blue king crab

Bycatch mortality from groundfish fisheries by gear type from 1991/92 to 2008/09 is shown in Figure 24 with the most recent 5 years shown in Figure 25.

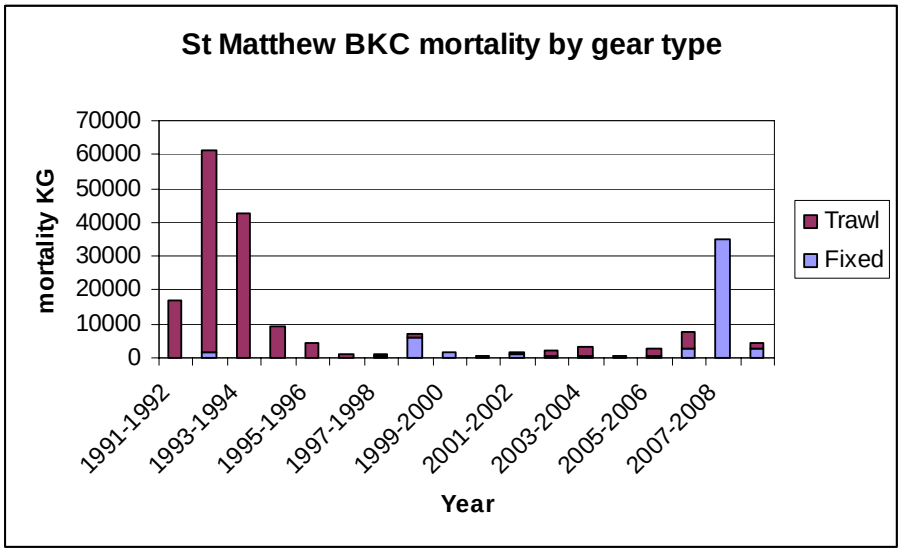

Figure 24 Bycatch mortality by gear type for St. Matthew blue king crab stock

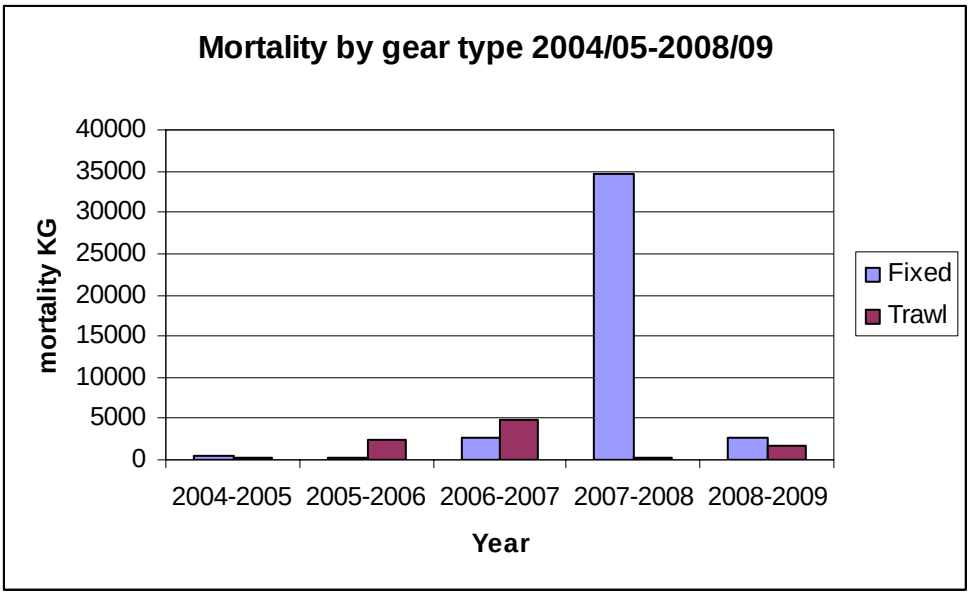

Figure 25 Bycatch mortality for St. Matthew blue king crab, most recent 5 years (2005/06-2008/09)

The retained catch OFL for St. Matthew blue king crab in 2008/09 was 1.63 million pounds. For comparison the total bycatch mortality in the groundfish fisheries for 2008/09 was approximately 6,885 lbs or 0.4% of the OFL. This was primarily from the Pacific cod fishery. This amount did not accrue towards the OFL however as the OFL for that year was retained-catch only. In 2009/10 it is anticipated the OFL would be for all catch. For comparison the previous year (where the bycatch in groundfish fisheries, especially fixed gear, was quite high) the total catch was approximately 77,200 lbs (which when compared against an OFL of 1.63 million pounds would have represented approximately 4.7% of the OFL).

Table 9 Bycatch mortality by fishery and gear type and overall bycatch numbers for St. Matthew blue king crab 2008/09.

2008/09 St. Matthew blue king crab mortality by fishery

Fishery	HAL	NPT	POT	PTR	Total mortality	Total # crab
arrowtooth flounder		106			106	85
Flathead sole		49			49	39
Pacific cod	**2,677**	**184**	**0**		**2,861**	**8,748**
Pollock				10	10	8
yellowfin sole		97			97	78
Grand Total	2,677	436	0	10	3,123	8,958

2.3.8. Adak red king crab

Adak red king crab are a Tier 5 stock and thus have a retained catch OFL only. However, given conservation concerns regarding this stock, bycatch from the groundfish fisheries of Adak red king crab is summarized below by number (no mortality applied, Figure 26) and mortality by gear type (Figure 27).

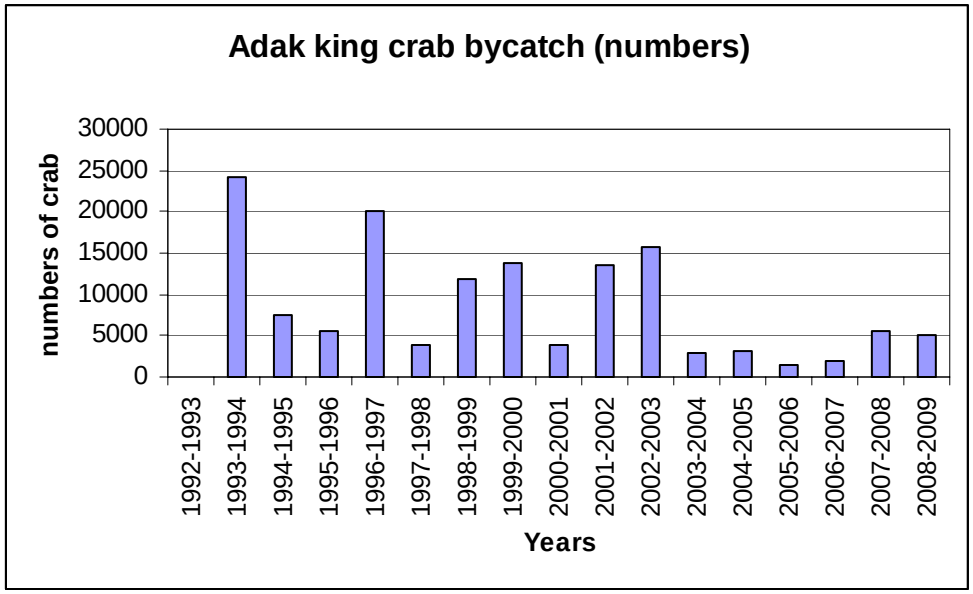

Figure 26 Total groundfish bycatch numbers (no mortality applied) all gear types for Adak red king crab

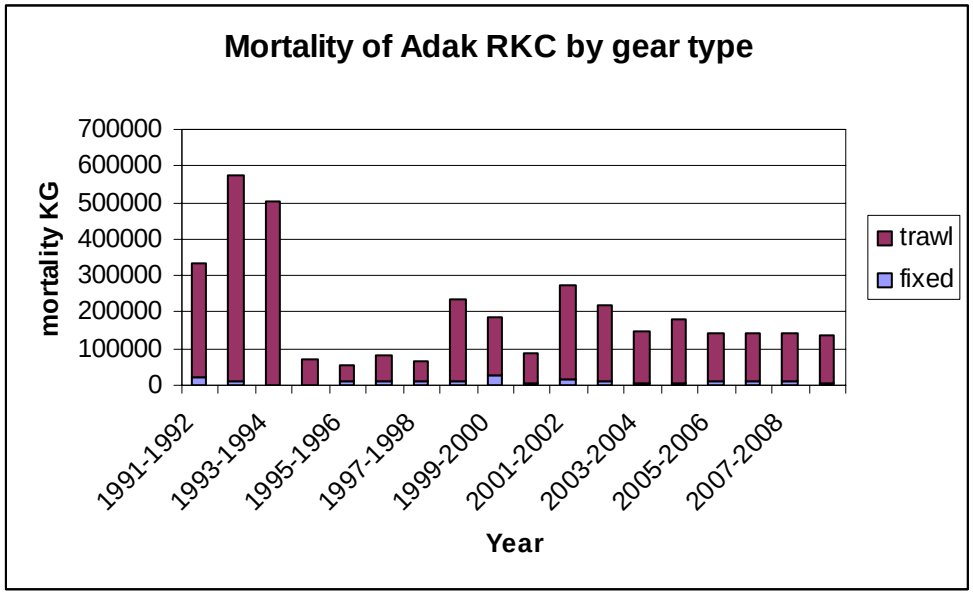

Figure 27 Bycatch mortality by gear type, Adak red king crab

In 2008/09 mortality of Adak red king crab was primarily in the atka mackerel fishery, followed by the Pacific cod fishery.

Table 10 Bycatch mortality by fishery and gear type and overall bycatch numbers for Adak red king king crab 2008/09.

2008/09 mortality of Adak red king crab by fishery					
Fishery	HAL	NPT	POT	Total mortality	Total # crab
Atka mackerel		**2,578**		**2,578**	**1,680**
Pacific cod	25	792	946	1,763	3,047
Rockfish		364		364	237
Sablefish	7			7	18
Grand Total	32	3,734	946	4,712	4,982

2.3.9. Northern District red king crab bycatch

Red king crab bycatch in the Northern District (514) is not counted towards any stock. A summary of bycatch in groundfish fisheries in this area is shown below by number (no mortality applied, Figure 28). Bycatch in this area is almost entirely by trawl gear.

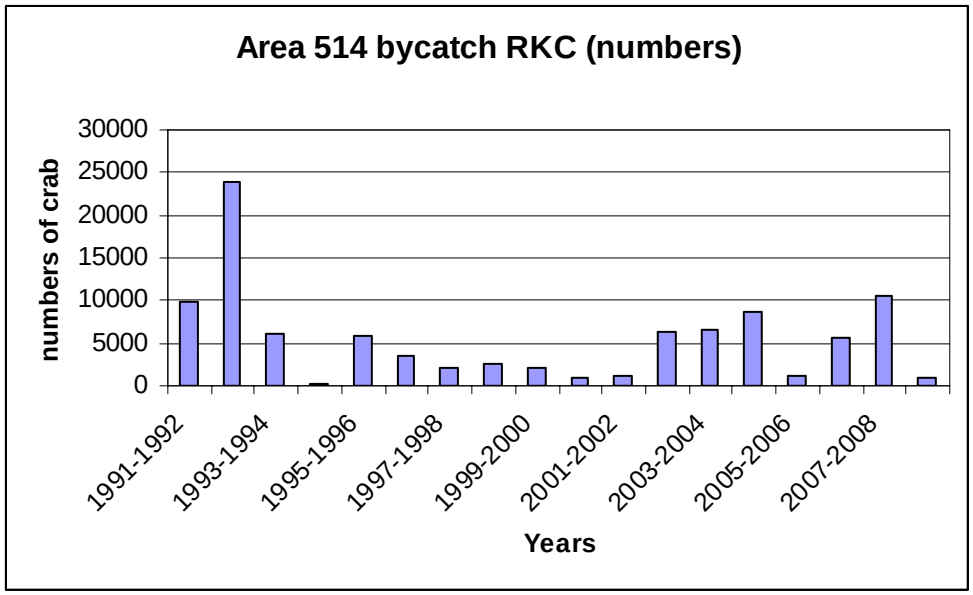

Figure 28 Total bycatch numbers all groundfish gear types, no mortality applied, for red king crab in Northern District

Bycatch of red king crab in Area 514 in 2008/09 was in the yellowfin sole and rock sole trawl fisheries (Table 11).

Table 11 Bycatch mortality by fishery and gear type and overall bycatch numbers for Northern District red king king crab 2008/09.

2008/09 mortality of red king crab in area 514 by fishery			
Fishery	Gear: NPT	Total mortality KG	Total # crab
Rock sole	608	608	396
yellowfin sole	861	861	561
Total	1,469	1,469	957

3. Considerations for Council

At this meeting the Council will discuss the current trends in crab bycatch in the groundfish fisheries. All crab bycatch in groundfish fisheries counts against the OFL for that stock (except where noted as retained catch only OFLs for three crab stocks in 2009/10). As mentioned throughout the Amendment 24 analysis, the Council should consider that there is no explicit linkage between the BSAI Crab FMP and the BSAI Groundfish FMP. Absent any additional measures to establish limits and linkages between the Groundfish FMP and Crab FMP, if conservation concerns arise for these crab stocks, any resulting catch limitation can only come from the directed crab fishery. Furthermore, existing measures to control bycatch in trawl fisheries were enacted prior to the current management system for OFLs by crab stock, thus they may not be responsive to current conditions and management of these stocks.

The Council should consider the following issues:

1. Should there be an overall limit on bycatch in groundfish fisheries of crab as it relates to the OFL for those crab stocks under the BSAI Crab FMP?
    a. If so for which crab stocks? Absent overall limits any increase in groundfish bycatch annually must always be accounted for by a greater buffer between OFL and TAC (and eventually with ACLs, OFL and ABC) for those crab stocks in annual specifications. Note that for stocks under rebuilding plans (to be revised) bycatch in groundfish fisheries will be examined in conjunction with alternatives for rebuilding these stocks.
    b. If not, are there issues with otherwise limiting or controlling bycatch of crab species in groundfish fisheries (time/area closures, fixed closures, other measures?)? If so for which species?
2. Should current trawl closures as listed in this paper be re-examined for their effectiveness?
3. Should additional measures be considered (limits or time/area closures) for fixed gear fisheries? If so for which stocks?
4. Catch accounting issues:
    a. PSC accounting timing: crab is accounted on a crab fishing year (June-May). Current bycatch for groundfish fisheries must be accounting over this time

period. However current accounting if for a calendar year, and crab limits for time/area closures are accounted on a calendar year.

b. Bycatch numbers as recorded in groundfish fishery vs weight of crab accrued towards OFL. Currently average weight of crab is multiplied by number for the total estimated weight to apply against crab OFL.

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Appendix A: Crab Plan Team discussion of groundfish bycatch (excerpt from May 2009 CPT meeting minutes)

Crab Prohibited Species Catch limits in Groundfish and Scallop Fisheries:
Diana Stram summarized the existing crab catch limits in the BSAI groundfish and scallop fisheries. The team has noted multiple times that these limits should be reevaluated in the context of new crab OFLs and the lack of feedback between crab and groundfish FMPs, particularly with respect to crab bycatch in the BSAI groundfish fisheries, and that these catches currently accrue towards crab OFLs under the Crab FMP. Any impact on catch levels as a result of an overfishing determination for exceeding a crab OFL will only be counted against the directed crab fishery regardless of what caused the catch to exceed that level (e.g., even if it was caused by excess bycatch in the groundfish fisheries). Currently PSC limits in the BSAI groundfish FMP exist for red king crab, Tanner crab and EBS snow crab in the trawl fisheries only as time/area closures triggered by PSC caps. There are no crab bycatch limits in any fixed gear groundfish fisheries.

Given the issues brought forward from the NMFS RO on fixed gear bycatch, the team recommends a reevaluation of groundfish and scallop PSC limits in light of crab stock sizes, total catch OFL structure and changes in the groundfish fisheries fishing practices, fleet sizes, etc. For all stocks with a total catch OFL, a means is needed to allocate shares of total catch between directed and non-directed catch, including all gears. Consideration should also be given to the actual sizes of crabs caught since currently limits are formulated solely on number of crab (with no distinction on size, sex, or maturity). The CPT encourages the Council to initiate an analysis of all PSC limits for crab species under the new catch OFLs.

The team further notes that the use of total catch OFLs allow for setting upper limits (caps) to bycatch and that upper limits (caps) may be needed to assure that the total catch OFL is not exceeded. The team further noted these catches may or may not represent a conservation problem but regardless the current system may cause problems for the directed crab fishery as populations decline and this could be affecting crab stock recovery. An analysis of the appropriateness of the current bycatch and limits would indicate to what extent this additional catch in other fisheries is affecting individual crab stocks.

While this may be primarily an allocation issue in terms of who catches the crab and where the control mechanisms lie with no feedback to other FMPs, it could hypothetically drive an overfishing determination. All sources of fishing mortality should have controls, including bycatch from the non-directed fishery.

Jim Stone noted that scallop bycatch limits are structured based upon biomass thresholds and fishery closures have occurred in the past for crab bycatch. He also commented that the fleet operates responsively to avoid areas of high crab bycatch. The team noted that bycatch of Tanner crabs in the scallop fishery is not the dominant issue, and clarified that the primary concern is crab bycatch in groundfish fisheries in terms of the potential to drive overfishing. The team does recommend however that assessment authors consider all sources of crab mortality, including bycatch in the scallop fishery, when compiling assessments, something that has not always been done.