Evaluating Potential Fishery Effects of Changes to Other Species Management

A Discussion Paper

Scott A. Miller
Economist
NOAA Fisheries, Alaska Region, Analytical Team
September 2007

With Contributions by

Andy Smoker, NOAA Fisheries Alaska Region In-season Management
Jane DiCosimo, North Pacific Fisheries Management Council Staff.

Table of Contents

List of Figures

Introduction

The Council has been discussing management of some species groups in the other species groundfish complexes since a proposal was submitted to the Council by the Alaska Department of Fish and Game in 1998. The proposal was to set sharks and skates as bycatch in directed commercial fisheries. Over years of development, the proposed management action was expanded from sharks and skates to all other species, and then to all non-target groundfish species under the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI) Groundfish Fishery Management Plans (FMP). In December 2004 the Council requested that staff develop a discussion paper of a proposal from the Groundfish Plan Teams and Science and Statistical Committee. Those bodies, along with the ad hoc group and Non-Target Species Committee have collectively developed three separate management actions that were combined into one proposed analysis.

The first action was split off and implemented in 2006. This action amended the GOA Groundfish FMP to set the total allowable catch (TAC) for the GOA other species complex less than or equal to 5 percent of the sum of all Groundfish TACs. It allows the Council to reduce the TAC to a level that allows NMFS to set the complex on bycatch status at the beginning of the year.

The second proposed action would set an overfishing level (OFL) and allowable biological catch (ABC) for the GOA "other species" category to match the BSAI Groundfish FMP. The third proposed action would set specifications for some or all of the component groups contained in the assemblage, with an option to add specifications for grenadier. In April 2005 the Council initiated an analysis for the latter two actions. Council staff developed a discussion paper of the proposed actions as a first step in the development of the combined analysis in October 2005[1]. National Marine Fisheries Service (NMFS) Regional Office staff previewed the effect of five possible management alternatives in a March 2007 paper.[2] The author applied proxy OFLs and ABCs that were developed by the NMFS Alaska Fishery Science Center and reviewed by the Plan Teams and SSC in 2006 to identify the relationships between certain other species groups and directed commercial fisheries.

Staff is once again recommending that the two proposed actions be split into separate analyses so as to fast track the GOA Plan Amendment. Revised action plans for the two analyses are scheduled for review by the Council in October 2007. The following constitutes a preliminary analytical approach that will be the basis of the analysis of the third action to revise management of the other species complex. Once approved by the SSC, staff will develop the initial review draft of the analysis over the winter of 2007.

Focus of this Discussion Paper

The topic of independent management of the individual species that comprise the "other species" group and of grenadiers has received considerable analytical attention over the past several years. This effort has resulted in extensive analysis of the topic by Andy Smoker, head of NOAA Fisheries Alaska Region Inseason Management, which was presented to the Council earlier this year. That treatment provided information on the tier system and an overview of how the "other species" group is presently managed.

This paper depends heavily on the previous analysis, but attempts to focus the discussion to answer the following questions:

1. Is the species in question, if managed independently, likely to be of management concern such that management measures would be necessary to prevent overfishing?
2. Which fisheries (gear/target species) are primarily responsible, and thus most likely to be affected by management measures, for the incidental catch of the species in question?

[1] http://www.fakr.noaa.gov/npfmc/current_issues/non_target/OSpeciesDiscPaperOct05.pdf
[2] http://www.fakr.noaa.gov/npfmc/current_issues/non_target/SmokerOtherSpecies307.pdf

3. What are the implications of spatial and temporal aspects of the incidental catch?
4. In light of the answers to the above questions, what methodology would be appropriate to analyze the likely effects on fishery revenue of potentially needed management measures?

To answer these questions, this paper will discuss pertinent aspects of each individual species under consideration in the alternative set. This information will then be summarized in tabular form. Each alternative will then be discussed. Finally, the methodology that would need to be employed to more formally evaluate these alternatives will be discussed.

The Alternative Set

The alternative set presently under consideration is as follows:

Alternative 1. No Action
Alternative 2. Eliminate "other species" assemblage and manage squids, skates, sculpins, sharks, and octopi as separate assemblages.
Alternative 3. Manage only BSAI skates and BSAI and GOA sculpins as separate assemblages.
Alternative 4. Manage only BSAI skates as a separate assemblage.
Alternative 5. Add grenadiers to BSAI and GOA TAC specification process:
Option 1. separate assemblage
Option 2. in other species assemblage

This alternative set differs in order and content from that presented in the previous discussion paper. Alternatives 3 and 4 have been reversed in order. Previously, an alternative (alternative 2) was included in the alternative set that would have set aggregate "other species" OFL and ABC for the GOA. That alternative is being treated in a separate analytical process and is no longer a part of this alternative set. In addition, the alternatives have been reordered by renaming, as alternative 2, what was previously alternative 5, and by naming the Grenadier option alternative 5 with its suboptions as shown above.

Key Characteristics of Incidental Catch of Other Species

This section identifies, based on Andy Smoker's previous discussion paper, the key characteristics of incidental catch of the various species in the other species group and of grenadiers. The treatment begins with the species in the BSAI and then covers those in the GOA. Note, the descriptive graphics, and excerpts of the text, used here are "borrowed" from the previous discussion paper but have been reorganized and re-numbered.

BSAI Skates

Figure 1 shows that cumulative BSAI Skate catch by year (2004-06), relative to the Skate ABC and OFL, has been below ABC by more than 10,000 mt each of the past three years. BSAI Skate catch tends to accelerate in the January to March timeframe, tapers off in the early summer months, and then increases in late summer through October.

Figure 2 shows that the hook-and-line Pacific cod fishery dominate BSAI Skate catch.

Figure 3 shows that skate catch is broadly distribution in the BSAI. Thus, it may not be possible to identify a discrete area for closure. In the event of an overfishing concern, broad area closures could be required.

If the ABC and directed fishery for Pacific cod with hook-and-line gear increases, the incidental catch needs for skate would likely increase as well. Given that incidental catch is substantially less than than ABC, a directed fishery for skate could be considered.

Figure 1: Cumulative BSAI Skate Catch by Year (2004-6) Relative to Skate ABC and OFL

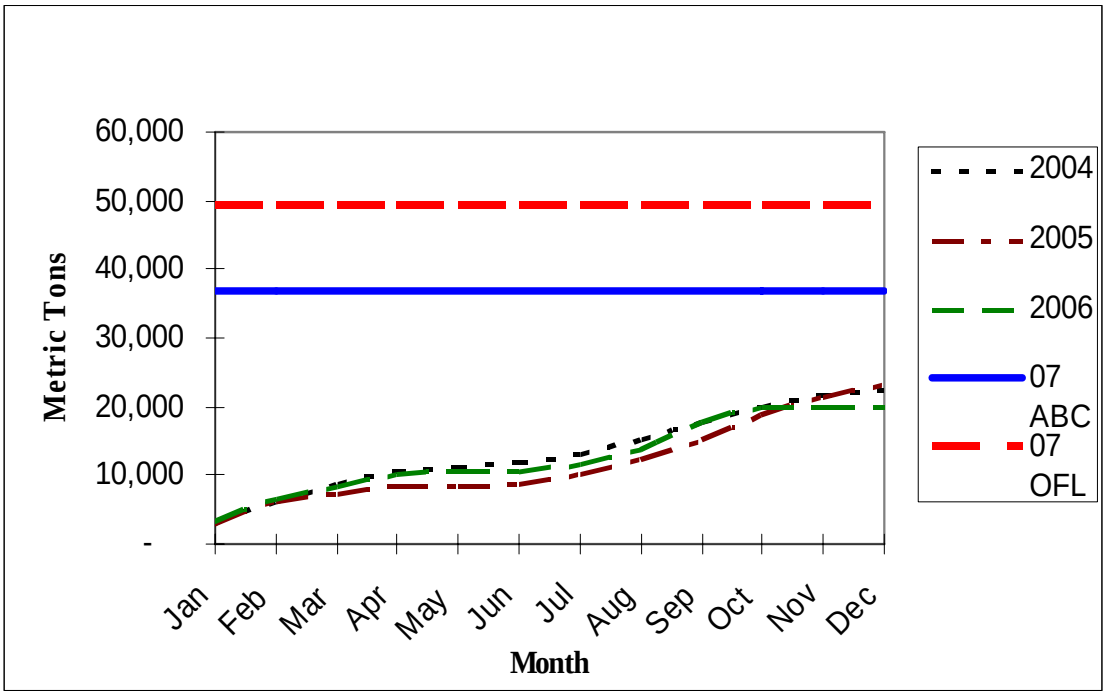


Figure 2: BSAI Skate Average Catch by Gear and Target

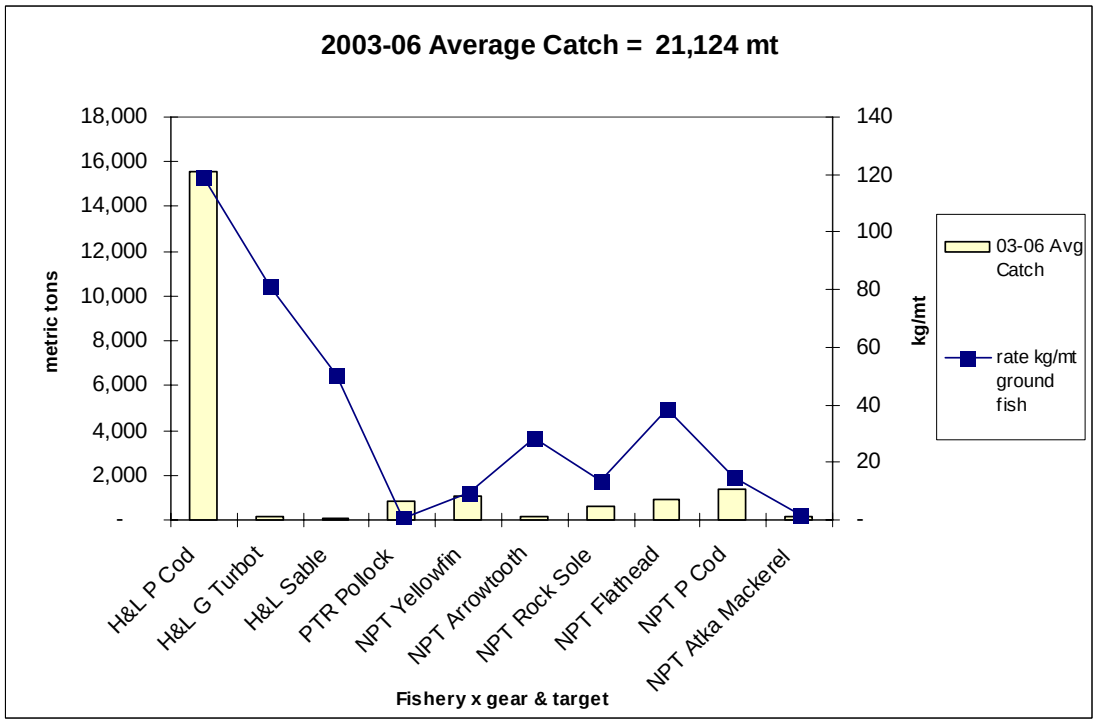
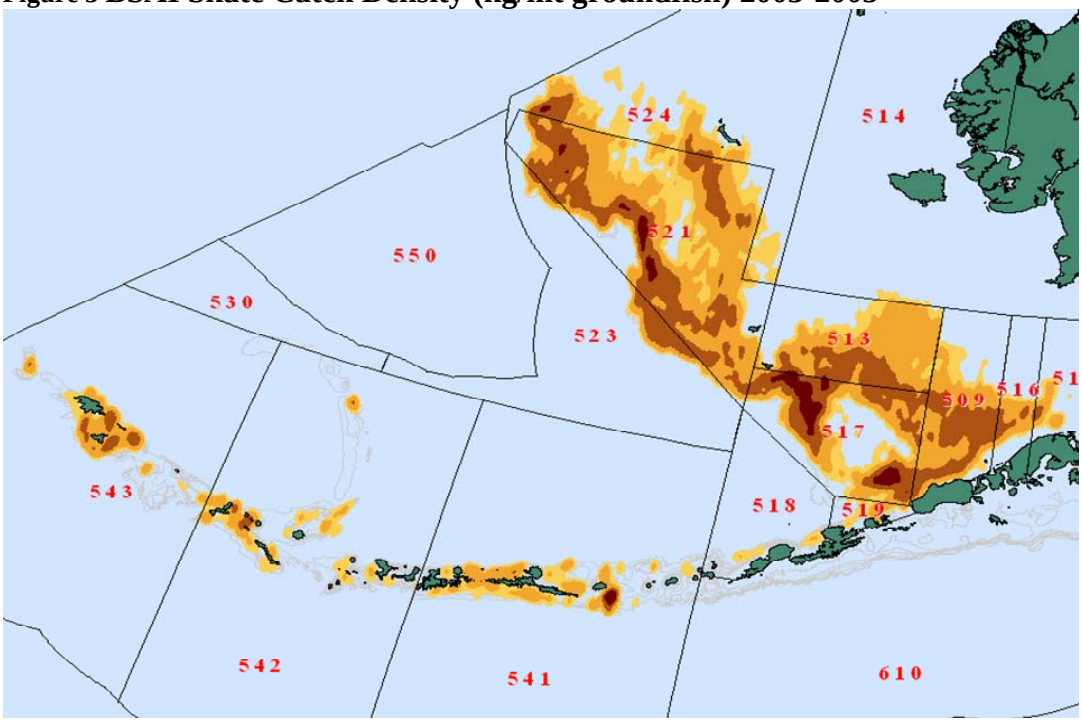


Figure 3 BSAI Skate Catch Density (kg/mt groundfish) 2003-2005



BSAI Sharks

Figure 4 shows that the cumulative annual catch of BSAI sharks approached the ABC (617mt) in 2005, exceeded the ABC in 2004, and exceeded the OFL (463mt) in 2006. BSAI shark catch in 2004 and 2005 was constant during the year; however, the 2006 catch increased sharply in August and exceeded the OFL by September.

Figure 4: Cumulative BSAI Sharks Catch by Year (2004-6) Relative to ABC and OFL

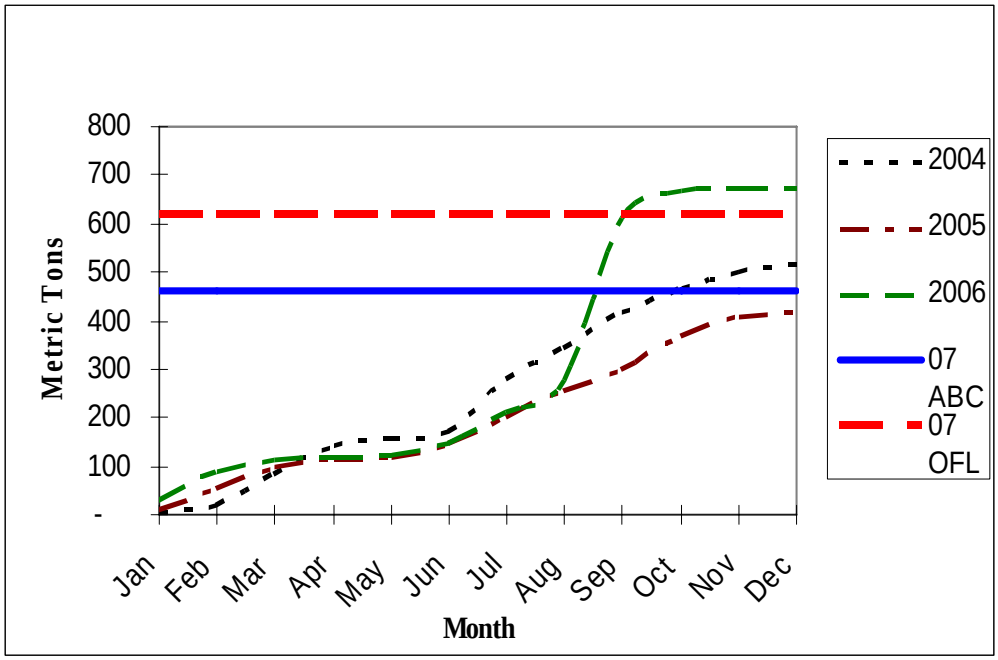


Figure 5 shows that the bulk of the shark incidental catch occurs in the mid-water pelagic trawl pollock and hook-and-line Pacific cod target fisheries. The hook-and-line Greenland turbot and sablefish fisheries catch sharks at high rates, but the tonnage of sharks caught in these fisheries is low.

The cumulative incidental catch of BSAI sharks regularly approaches one or both of the management benchmarks. Thus, a directed fishery is not possible without limiting incidental catch in other fisheries. Further, actions in the future to prevent overfishing and reduce the incidental catch of sharks would be likely if this species is managed on an individual basis.

Figure 5: BSAI Sharks Average Catch by Gear and Target

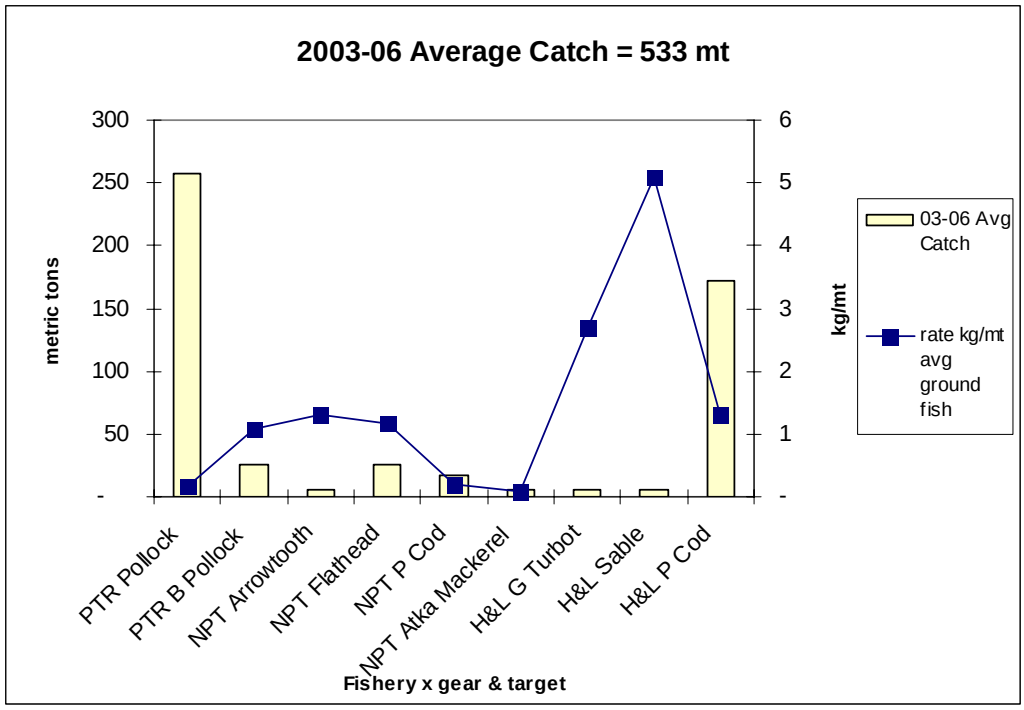
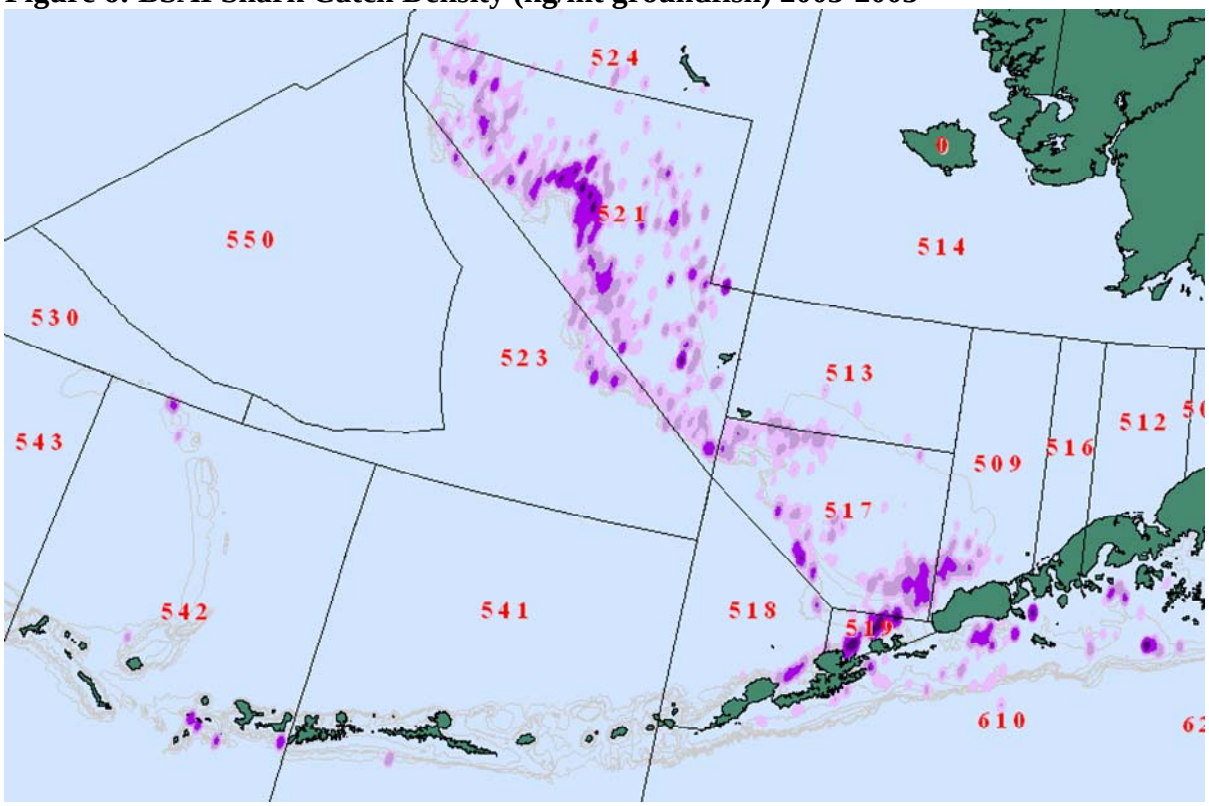


Figure 6: BSAI Shark Catch Density (kg/mt groundfish) 2003-2005



BSAI Sculpins

Figure 7 shows that cumulative BSAI sculpin catches, during 2003-2006 have averaged around 5,000 mt and are well below the 41,200 OFL and 30,900 mt ABC. Incidental catch would have to increase significantly for management concerns to develop that would impact the BSAI groundfish fishery. Thus, management of this species on an individual basis is not likely to require restrictions on fishing activity at present levels of harvest. Figure 7 also shows that the catch rate remains constant during the fishing year.

Given the difference of nearly 25,000 mt between present levels of incidental catch and the ABC, this species group could support a directed fishery. Management decisions would have to focus on the species of sculpin that would be targeted; perhaps developing a stock assessment for that particular species. Consideration would also need to be givne to incidental catch of other groundfish in a sculpin target, and implications of prohibited species bycatch among other considerations.

Figure 7: Cumulative BSAI Sculpins Catch by Year (2004-6) Relative to ABC and OFL

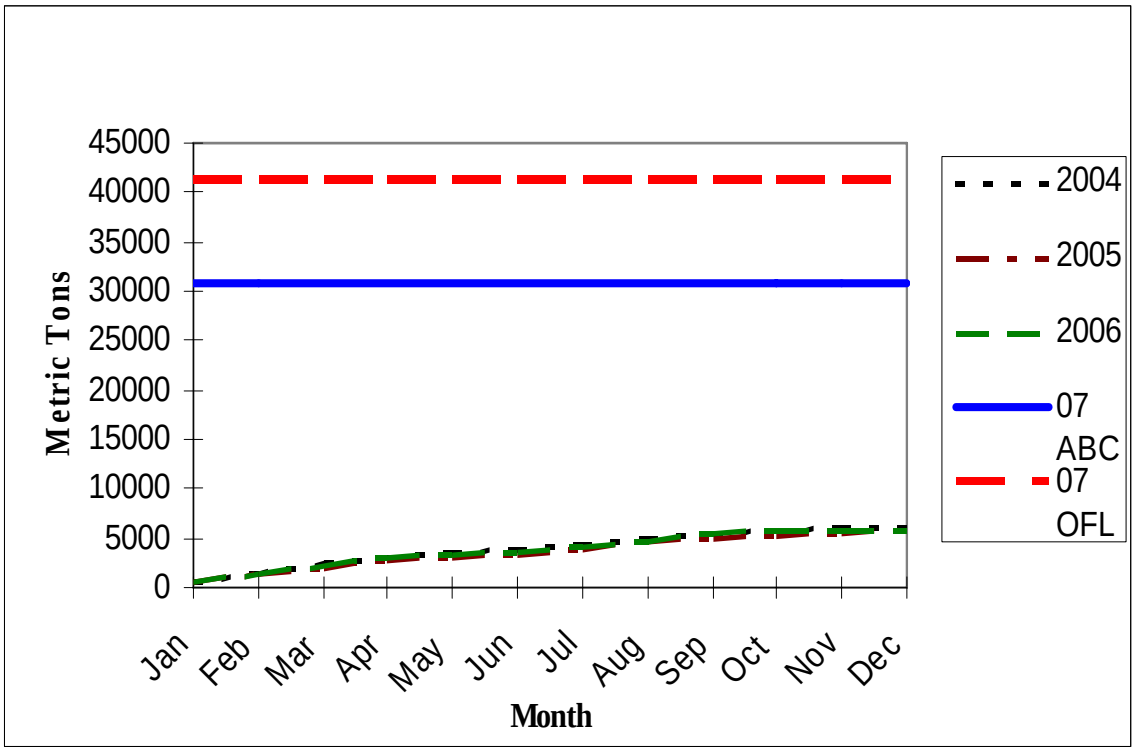


Figure 8 shows that this species group is primarily caught in gear and target combinations including non-pelagic trawl yellowfin sole, non-pelagic trawl Pacific cod, and hook-and-line Pacific cod. Several other fisheries also catch sculpins incidentally.

Figure 8: BSAI Sculpins Average Catch by Gear and Target

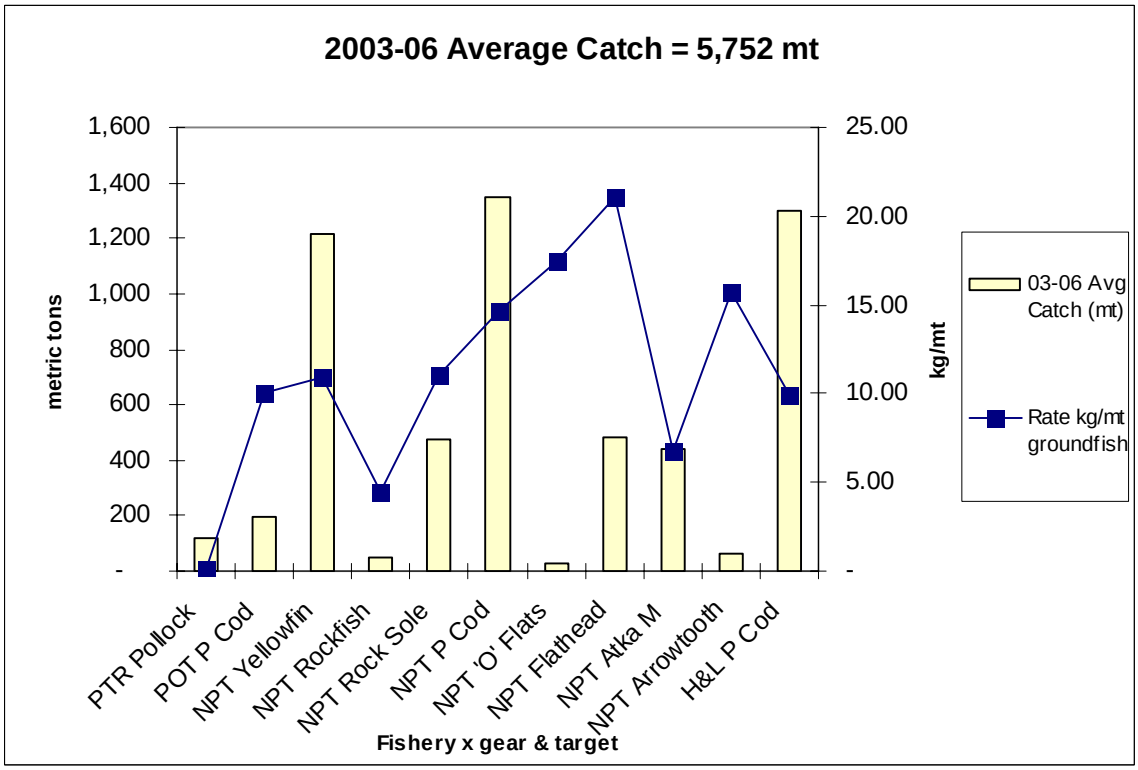
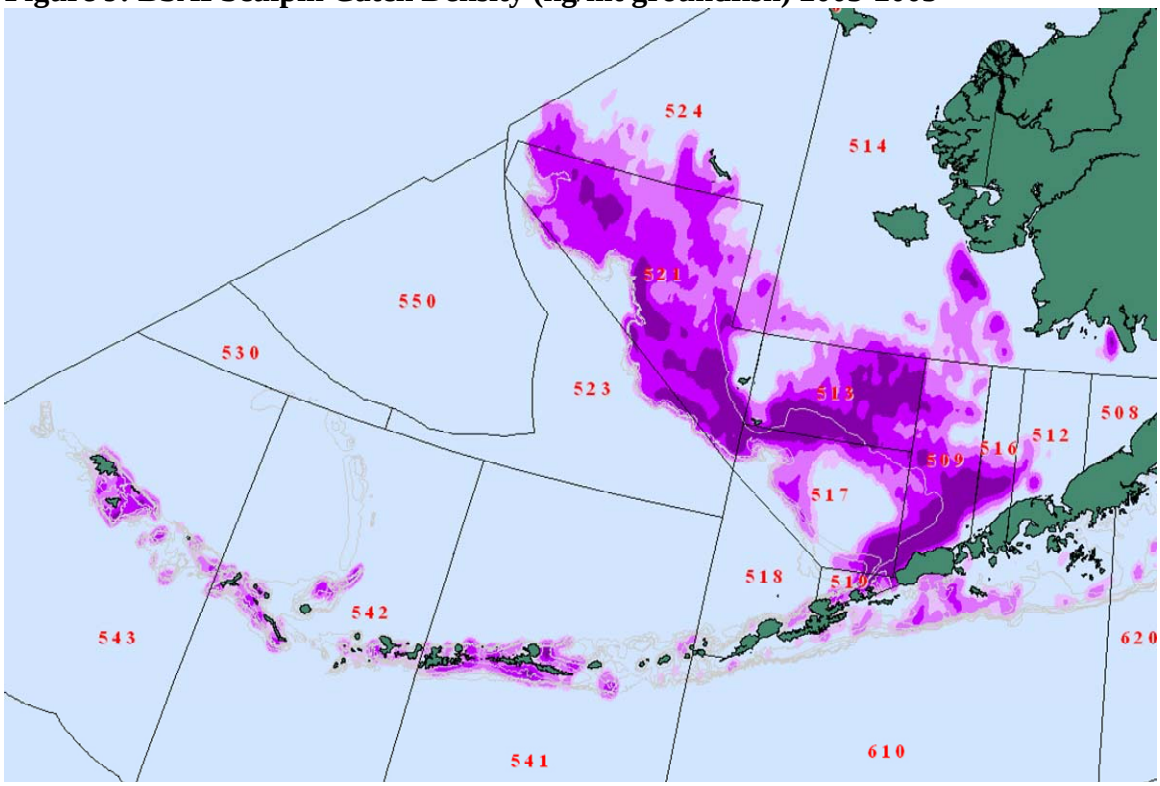


Figure 9 shows that the incidental catch of sculpins is distributed quite broadly throughout the BSAI. Were incidental catch to increase to amounts requiring restrictions to prevent overfishing, or were a directly fishery undertaken, broad areas of the BSAI would have to be considered for incidental catch closure in several trawl fisheries, as well as the hook-and-line Pacific cod fishery. Given that current catch rates are constant throughout the year, and well below management benchmark levels, it is not possible to identify when in the year such restrictions might become necessary.

Figure 9: BSAI Sculpin Catch Density (kg/mt groundfish) 2003-2005



BSAI Octopi

The BSAI octopus OFL and ABC are 688 mt and 516 mt, respectively. Figure 10 shows that the cumulative catch of BSAI octopi exceeded the 516mt ABC in 2004 but was considerably less than that level, about 300 mt per year, in 2005 and 2006. BSAI octopus incidental catch tends to accelerate in late winter and into spring before tapering off during the summer and then increasing sharply in late summer and fall.

Figure 10: Cumulative BSAI Octopi Catch by Year (2004-6) Relative to ABC and OFL

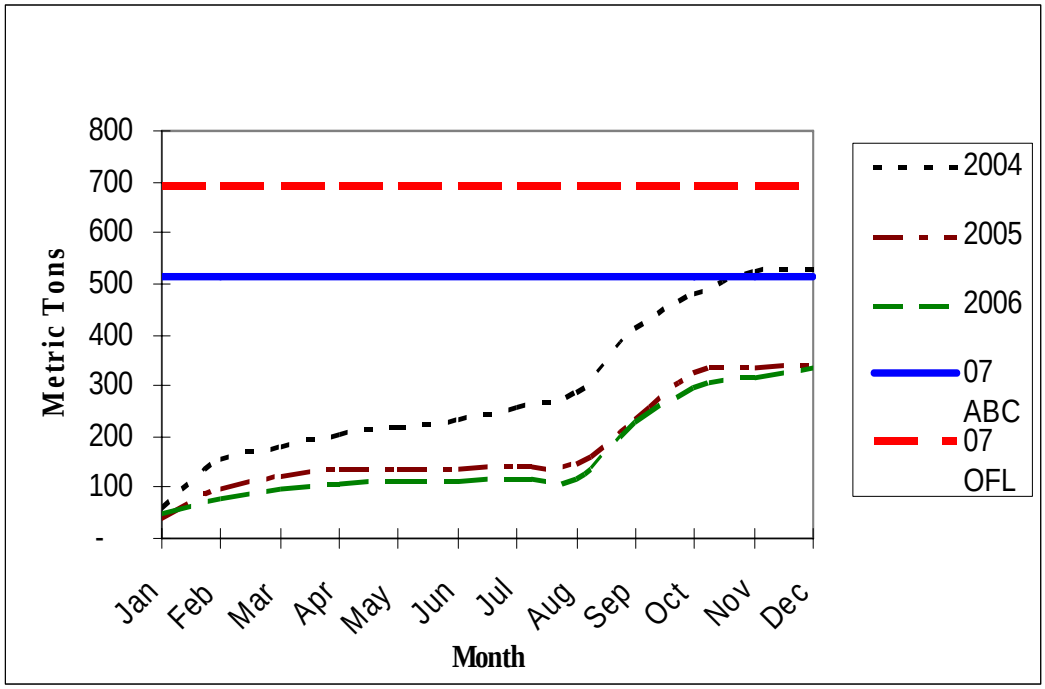
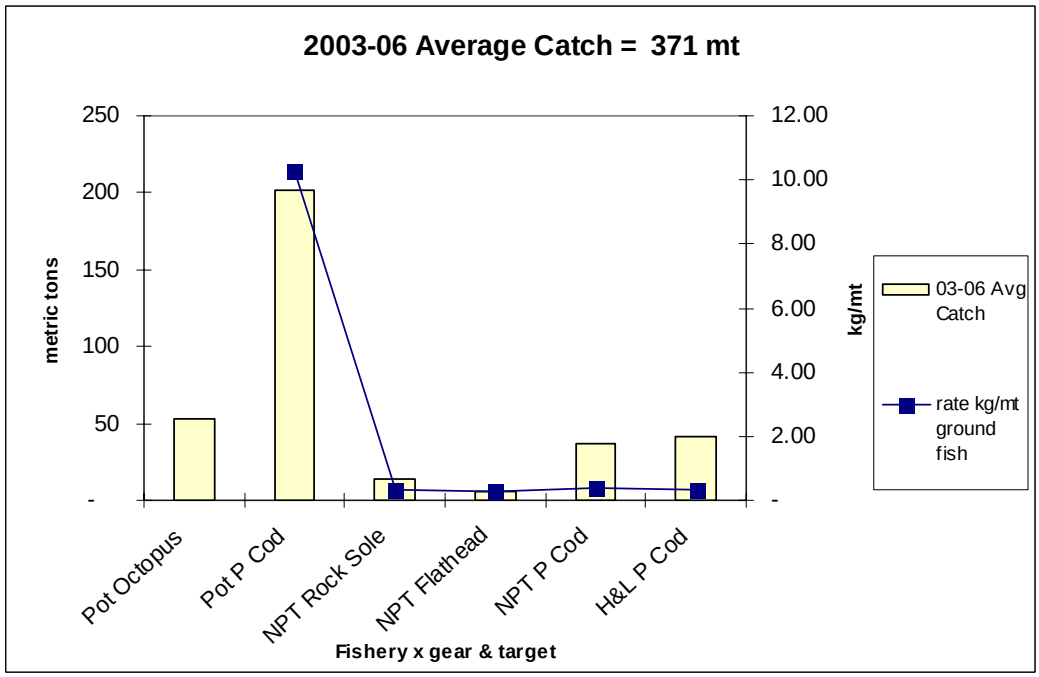


Figure 11: BSAI Octopi Average Catch by Gear and Target

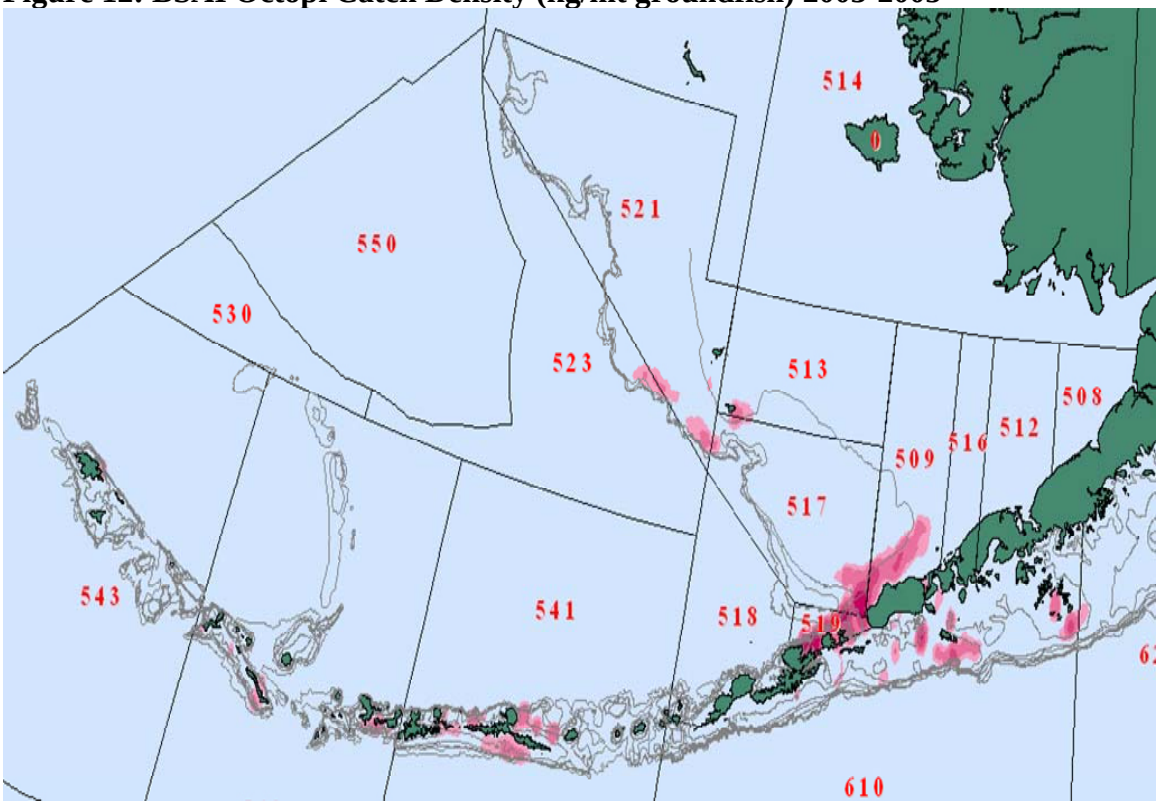


Octopi are predominately caught in pot gear Pacific cod fisheries (Figure 11). If incidental catch rates relative to Pacific cod tend to be consistent over years, octopus catch should fluctuate with the ABC for Pacific cod. If octopus biomass experiences rapid growth and expansion they can become more abundant relative to Pacific cod. Their catch rates are expected to increase as well. Occasionally enough octopi are caught and delivered with pot gear that it is identified as a target. Its target status is an artifact of the catch accounting system even though the directed fishery remains closed.

A market exists for octopus which promotes its retention. If the species group could be assessed at tier 5 or higher, a larger ABC and definition of a TAC could sustain a directed fishery. However, The lack of appropriate information, including a lack of accurate biomass estimates, means that octopi will likely remain in tier 6 and closed to directed fishing.

Over time catch is expected to meet the ABC and approach the OFL. If the OFL is approached fisheries shown in Figure 12 (Pacific cod fisheries with pot gear followed by hook-and-line and non-pelagic trawl gear) would be candidates for closure to prevent overfishing. The patchy distribution of octopus catch (Figure 13) may lead to discrete area closures if an overfishing closure were required. Such closures, if needed, would likely occur in October and could extend for the remainder of the fishing year.

Figure 12: BSAI Octopi Catch Density (kg/mt groundfish) 2003-2005



BSAI Grenadiers

The BSAI grenadier tier 5 OFL and ABC are 108,888 mt and 81,666 mt, respectively. Figure 13 shows that the cumulative catch of grenadier has been well below the ABC in recent years. Grenadier incidental catch tends to accelerate in spring and continues at a constant rate through the end of the year.

Incidental catch of grenadier occurs predominately in hook-and-line fisheries for Greenland turbot and sablefish (Figure 14). The incidental catch rates of over 800 kg/mt in the Greenland turbot target and over 1,000 kg/mt in the sablefish target indicate that grenadier average about half the catch in those fisheries.

Figure 15 shows the broad distribution of grenadier catch along bathymetric lines. Incidental catch of BSAI grenadiers would have to more than double in order to approach the ABC. If this were to happen, restrictions to prevent overfishing would likely cover broad areas of the BSAI. Such closures would likely affect the hook-and-line Greenland turbot and sablefish fisheries. Given that current catch rates are constant from May throughout the end of the year, and well below management benchmark levels, it is not possible to identify when in the year such restrictions might become necessary, for how long they might last, or how large an area might be affected.

Figure 13: Cumulative BSAI Grenadier Catch by Year (2004-06) Relative to ABC and OFL

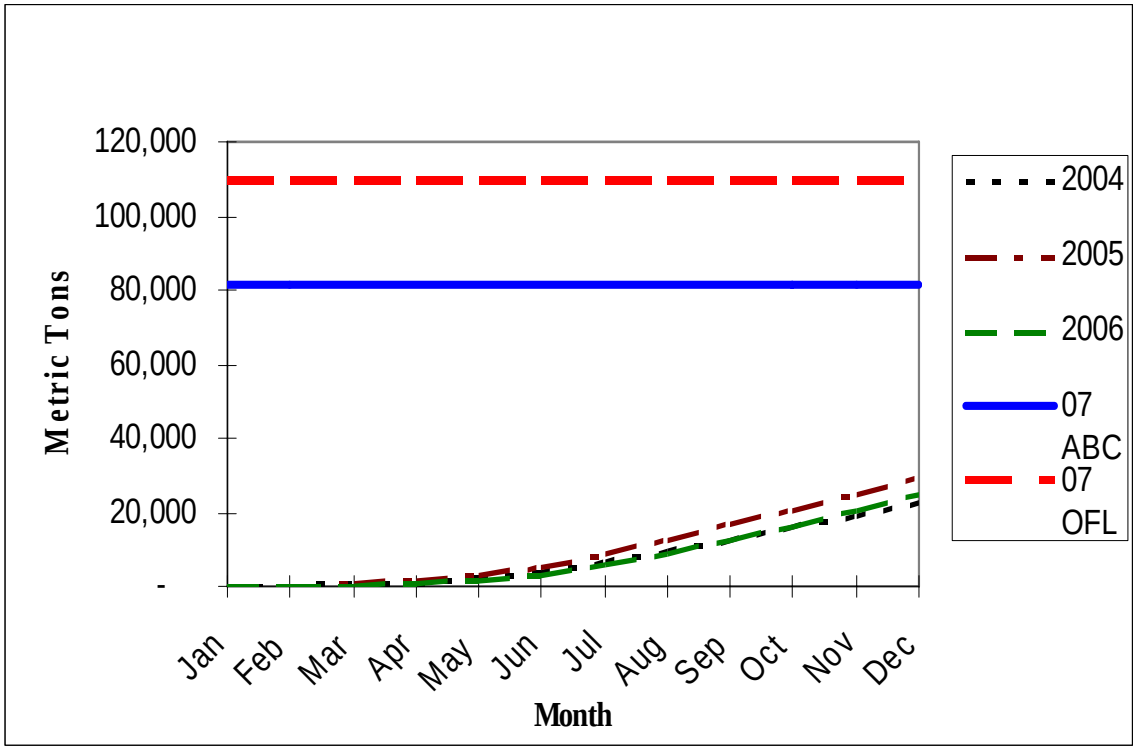


Figure 14: BSAI Grenadier Average Catch by Gear and Target

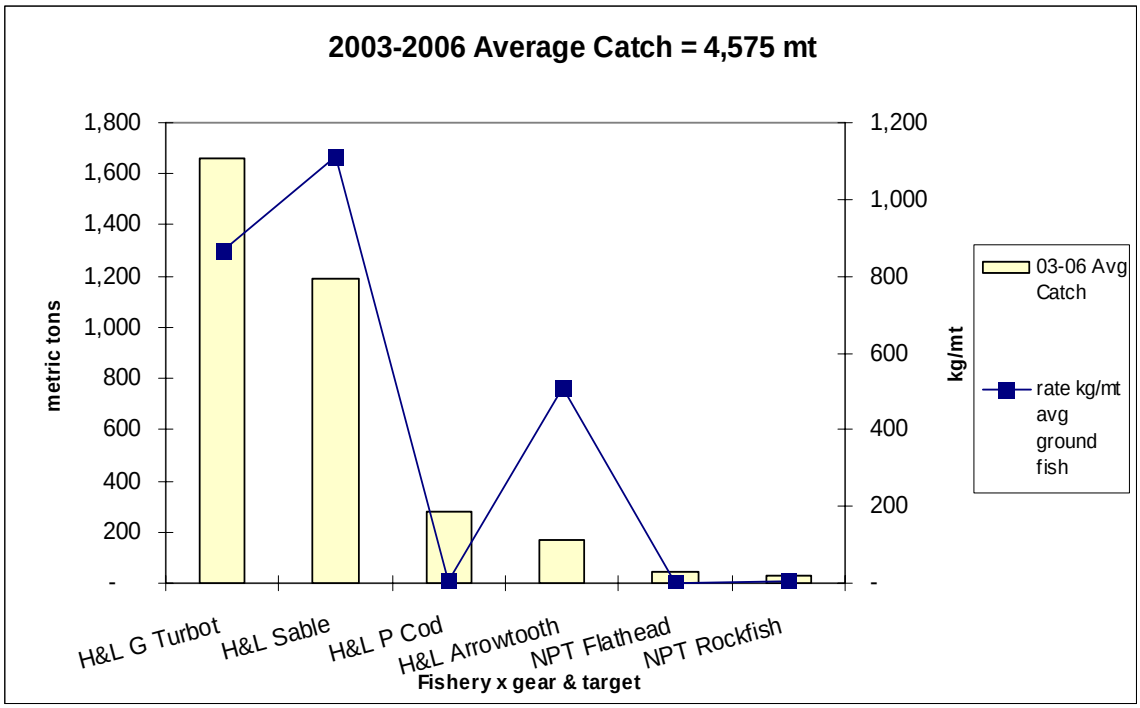
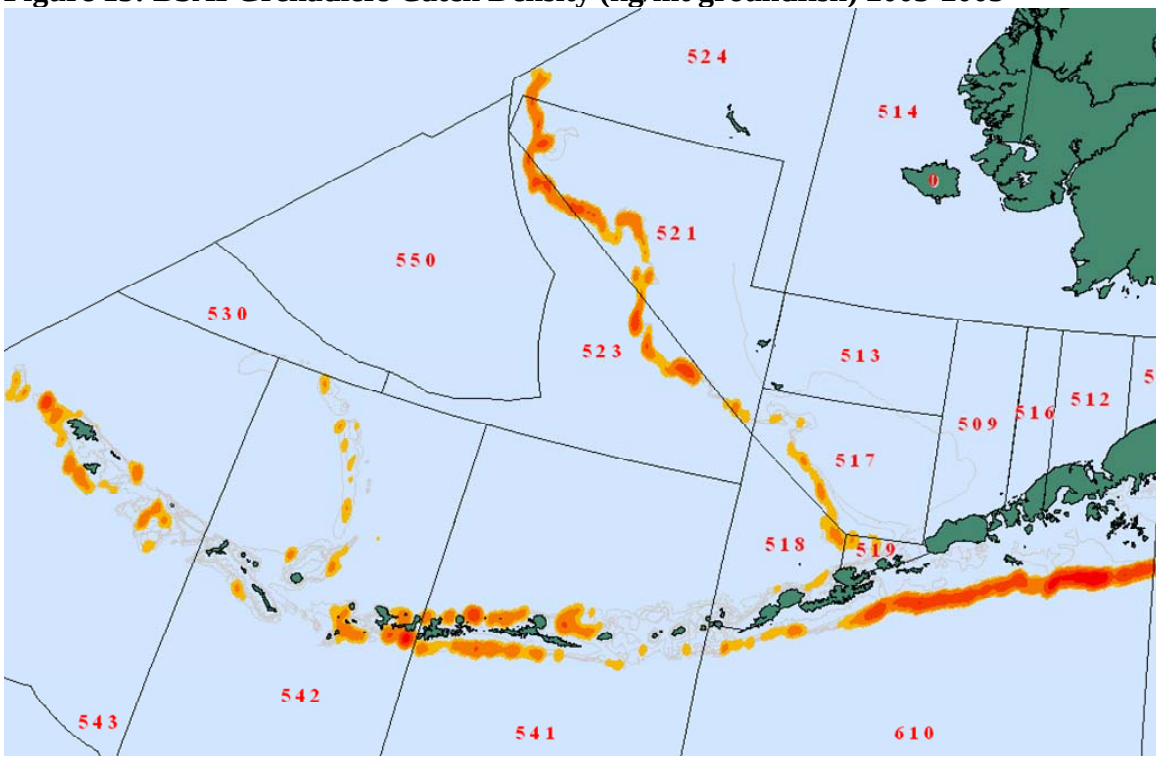


Figure 15: BSAI Grenadiers Catch Density (kg/mt groundfish) 2003-2005



GOA Squid

Figure 16 shows that cumulative GOA incidental squid catch has, prior to 2006, been below both the tier 6 OFL and ABC of 2,030 mt and 1,526 mt, respectively. However, GOA incidental squid catch has been steadily increasing over the last several years and attained the ABC in 2006.
Figure 16 also shows that the timing of the squid catch is somewhat unique within the GOA other species group. Squid catch accelerates during the pollock A season and remains flat for the remainder of the year.

Figure 16: Cumulative GOA Squid Catch by Year (2004-6) Relative to ABC and OFL

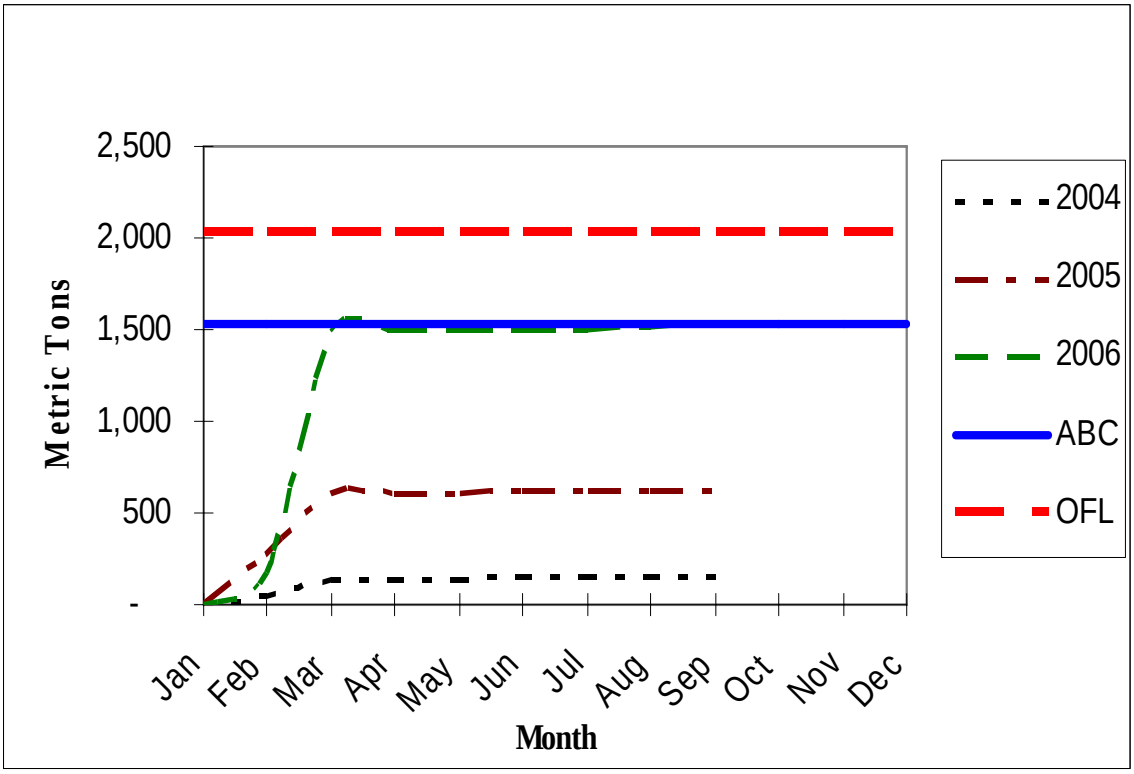


Figure 17 shows the GOA incidental squid catch occurs nearly entirely in the pollock fishery. And Figure 18 shows that the geographic distribution of GOA incidental squid catch is very discrete. Nearly the entire catch of squid occurs in a relatively small portion of Shelikof Strait (Area 620) during February and March. Thus, any actions undertaken by Inseason Management to prevent overfishing of GOA squid would likely be taken early in the year, would likely be of limited duration, and would focus on a discrete area of Shelikof Strait.

With use of information from vessel operators, reported catch, VMS, and observer data, a squid hot spot can probably be identified by Inseason Management. That area could be closed by NMFS, or closure could possibly be avoided through voluntary avoidance by vessel operators. If vessel operators can cooperatively reduce incidental catch they can preserve more flexibility to their fishing operations than if NMFS closes the pollock fishery. This would be an important consideration as the area described is very popular for high-value roe-bearing pollock. Thus, closure of the area could affect the value of the GOA pollock fishery.

Figure 17 GOA Squid Average Catch by Gear and Target

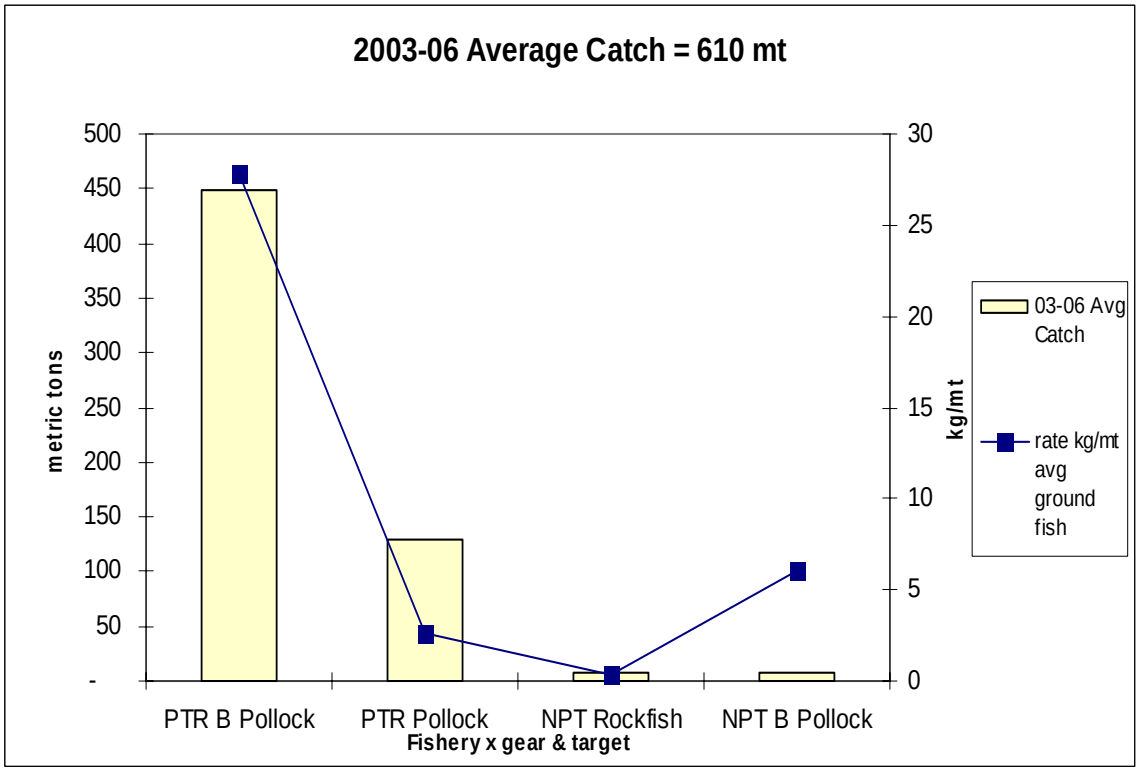
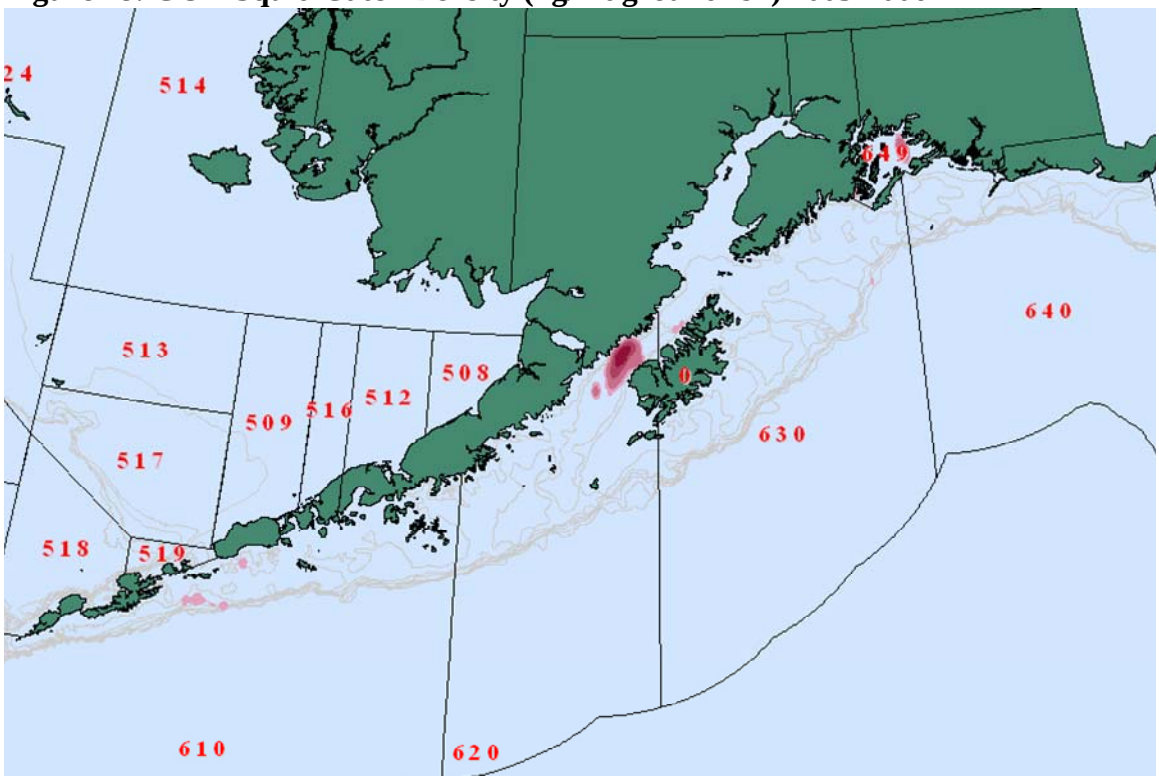


Figure 18: GOA Squid Catch Density (kg/mt groundfish) 2003-2006



GOA Sculpins

Incidental sculpin catch in the GOA, between 2004 and 2006, has consistently averaged about 15 percent of the 5,770 mt ABC (Figure 19).

Figure 20 shows that average incidental catch of GOA sculpins by species and gear combinations is concentrated in the Pot gear Pacific Cod fishery, non-pelagic trawl shallow water flatfish fishery, and the hook-and-line gear Pacific cod fishery. Several other non-pelagic trawl fisheries take the remainder. The variety of fisheries that share in the incidental catch of sculpins reflects the broad geographical distribution of the species group and the importance of incidental catch of this species in those fisheries.

Figure 21 shows that sculpins have an irregular distribution in the GOA compared to other species and generally reflect the preferred areas for many of the gear and target combinations identified in Figure 20. Because of the high sculpin management benchmarks relative to catch, restrictions on fishing are not a current concern.

Figure 19: Cumulative GOA Sculpins Catch by Year (2004-6) Relative to ABC and OFL

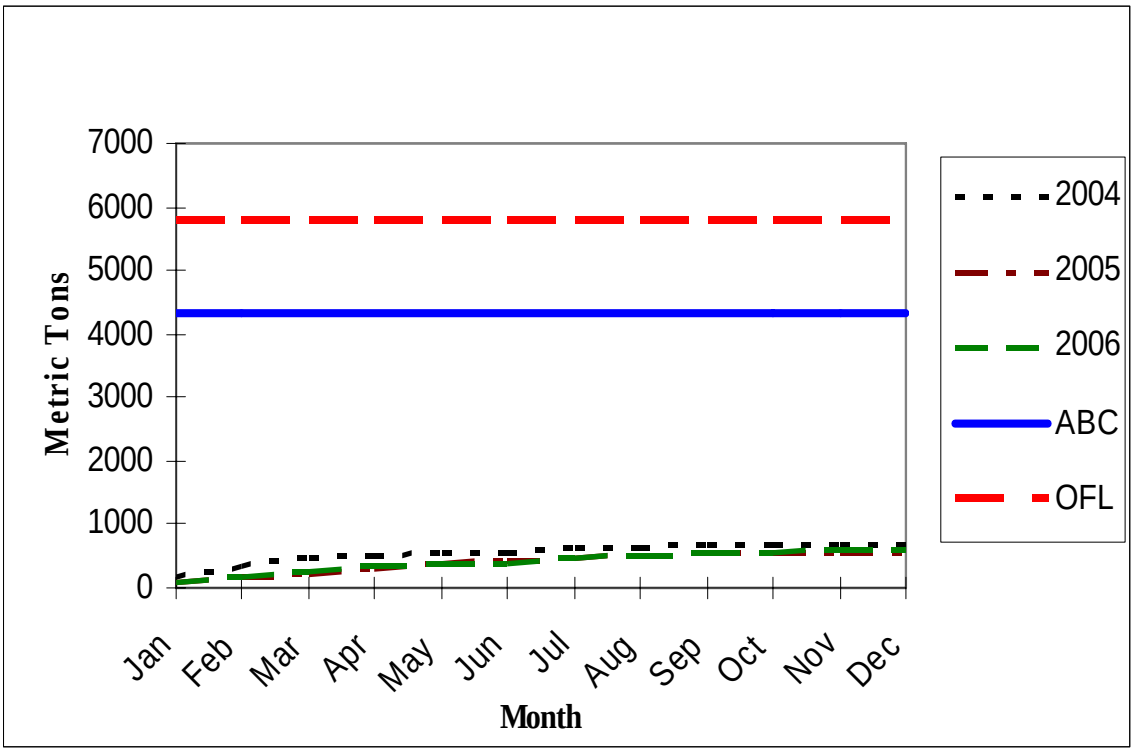


Figure 20: GOA Sculpins Average Catch by Gear and Target

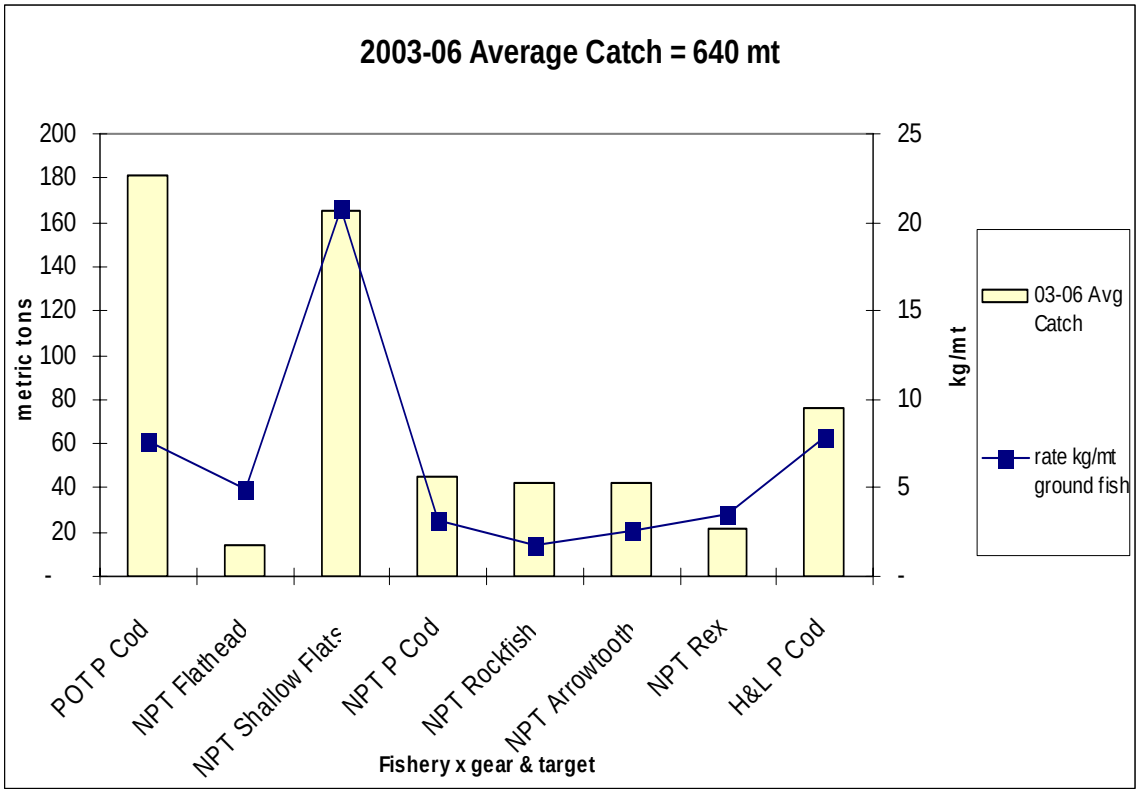
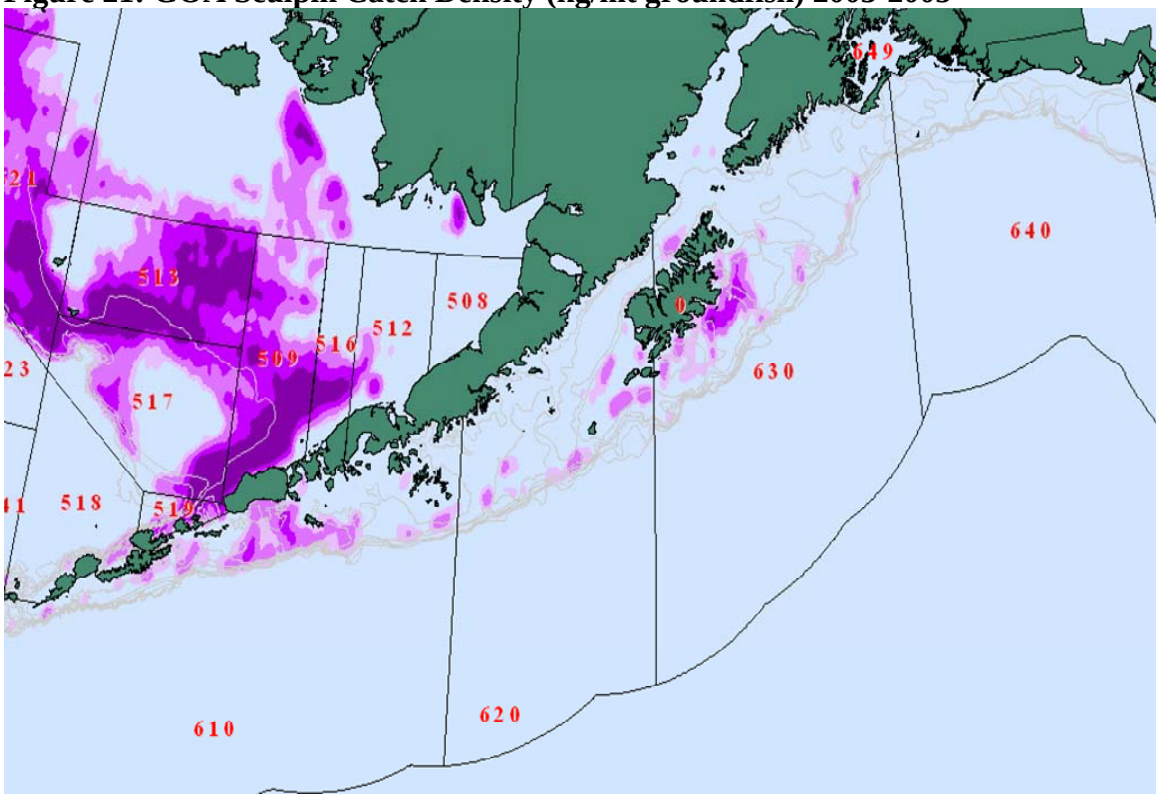


Figure 21: GOA Sculpin Catch Density (kg/mt groundfish) 2003-2005



GOA Sharks

Cumulative incidental shark catch in the GOA has increased over the last three years. Figure 22 shows that, while GOA shark catch is still below the tier 6 OFL of 2,390 mt and the ABC of 1,792, the ABC will be reached and the OFL may be approached if the increasing trend continues. Cumulative GOA shark catch accelerates between January and April, tapers off in the summer months, and then increases in the fall such that trigging of management benchmarks would be most likely late in the year.

Figure 22: Cumulative GOA Sharks Catch by Year (2004-6) Relative to ABC and OFL

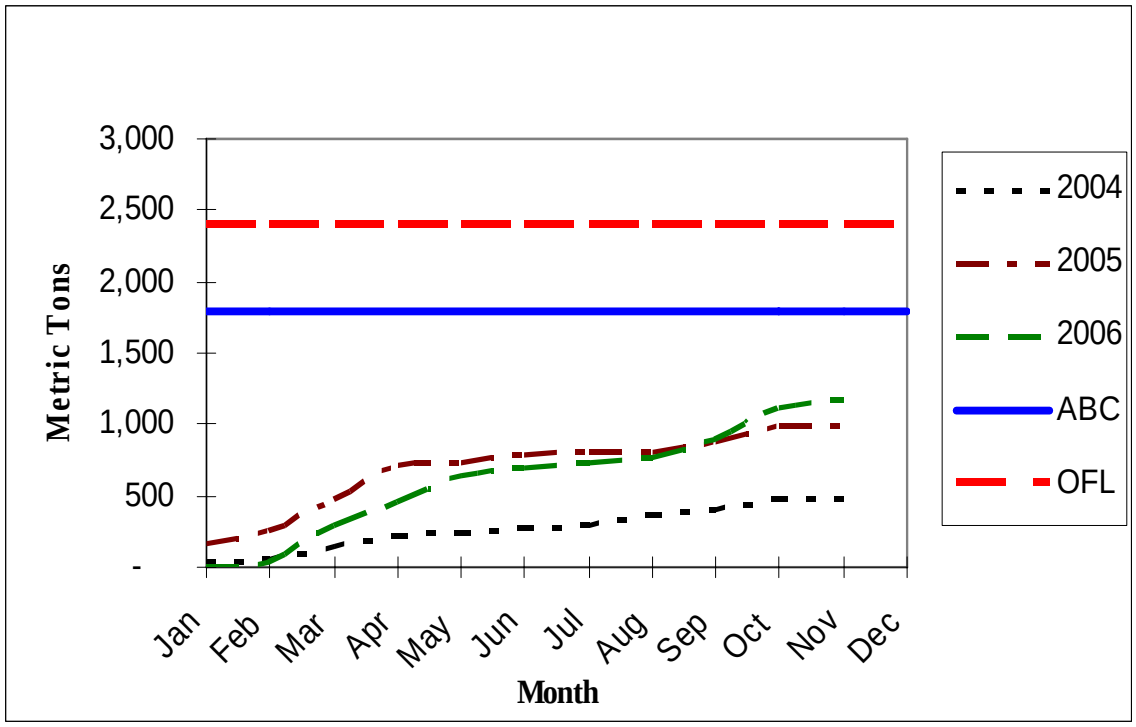


Figure 23 shows that multiple gear and target combinations take sharks in the GOA; hook-and-line Sablefish accounting for the single largest catch of GOA sharks. Pollock trawl fisheries, the hook-and-line Pacific cod fishery, and multiple non-pelagic trawl flatfish target fisheries also harvest GOA sharks incidentally.

Figure 24 shows that Shark catch in the GOA is distributed broadly enough that distinct hot spot closures, in the event of overfishing, are unlikely. The distribution of catch among fisheries (Figure 23) combined with the geographically broad distribution of that catch implies that if a closure to prevent overfishing were warranted, the hook-and-line sablefish, trawl pollock, and multiple flatfish fisheries would be vulnerable to restrictions ranging from NMFS reporting area closures to complete closures of the fisheries throughout the GOA. Temporal context of the catch (Figure 22) suggest that such restrictions would most likely occur in late summer or early fall, however, such speculation is highly dependent on whether cumulative catch in the January-April timeframe were to increase enough to reach management benchmarks.

Figure 23 GOA Shark Average Catch by Gear and Target

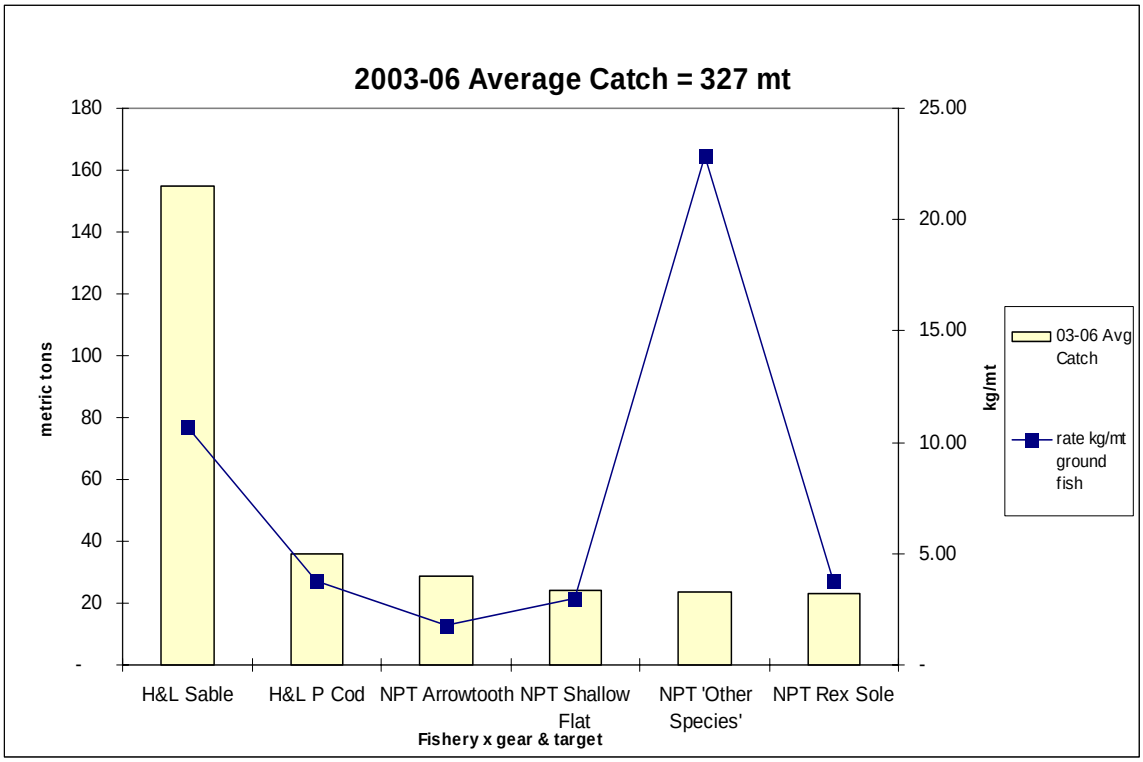
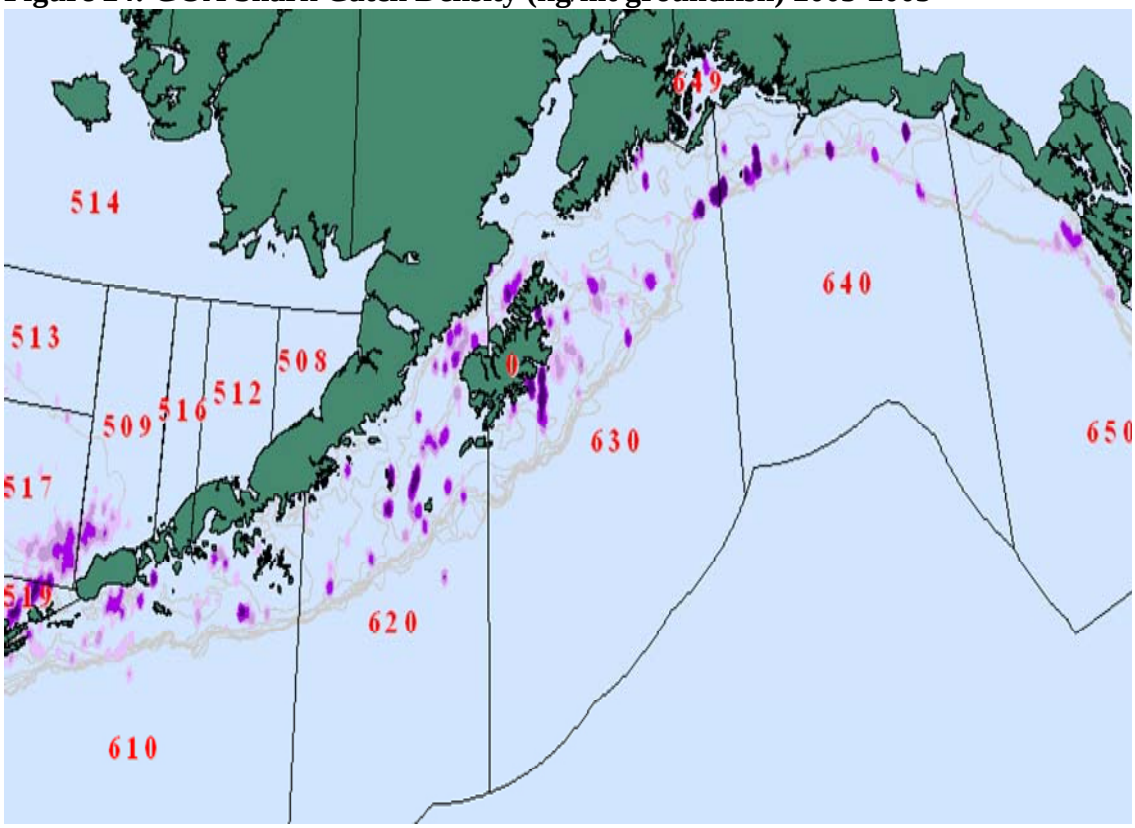


Figure 24: GOA Shark Catch Density (kg/mt groundfish) 2003-2005



GOA Octopi

In 2004 cumulative GOA octopus catch approached the 290 mt ABC in November, but was well below the ABC, and the 290 mt OFL, in 2005 and 2006 (Figure 25). The proximity of the 2004 catch to the ABC shows that catch can approach the ABC late in the year.

Figure 26 shows that incidental GOA octopus catch occurs primarily in the Pacific cod pot gear fishery. A moderate amount is also assigned to an octopus target, but is also taken during the Pacific cod pot fishery. Geographic distribution of incidental catch of GOA octopi (Figure 27) is limited to several relatively discrete areas in the GOA. If GOA octopi are managed independently from the other species group, and given the nature of tier 6 stock assessments, incidental catch of GOA octopi can occasionally be expected to attain the ABC or OFL. Thus, management actions to prevent overfishing would likely consist of VMS and observer data derived 'hot spot' closures occurring late in the fishing year in the Pacific cod pot fishery

Figure 25 Cumulative GOA Octopi Catch by Year (2004-2006) Relative to OFL and ABC

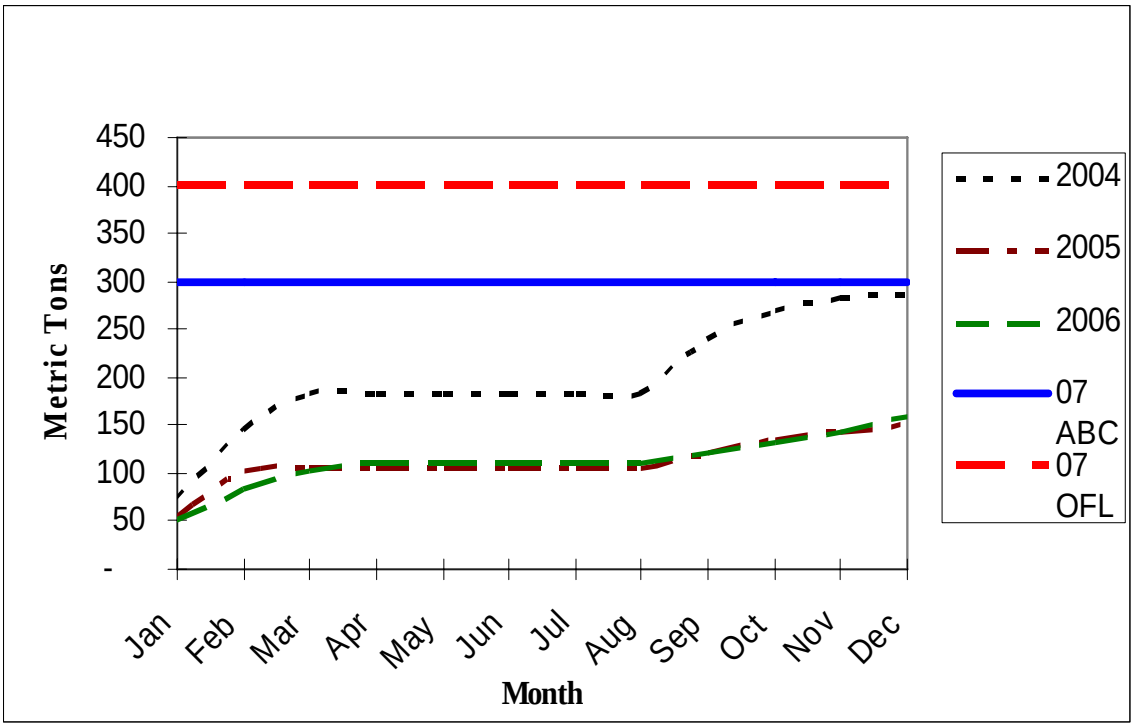


Figure 26: GOA Octopi Average Catch by Gear and Target

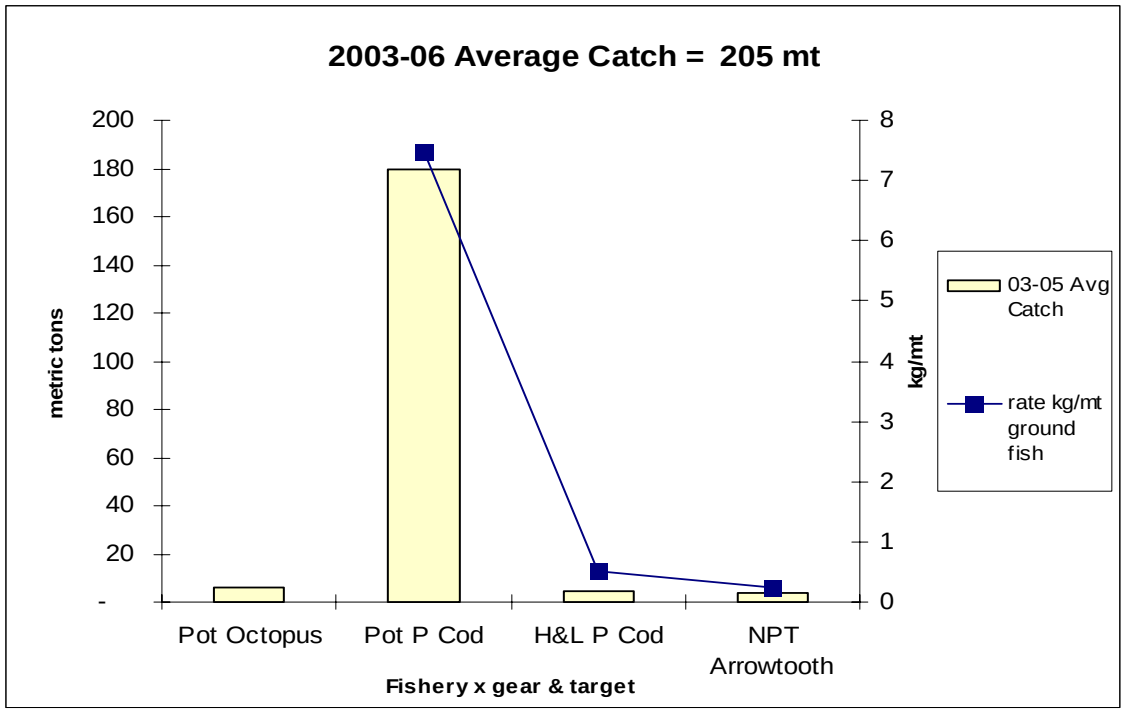
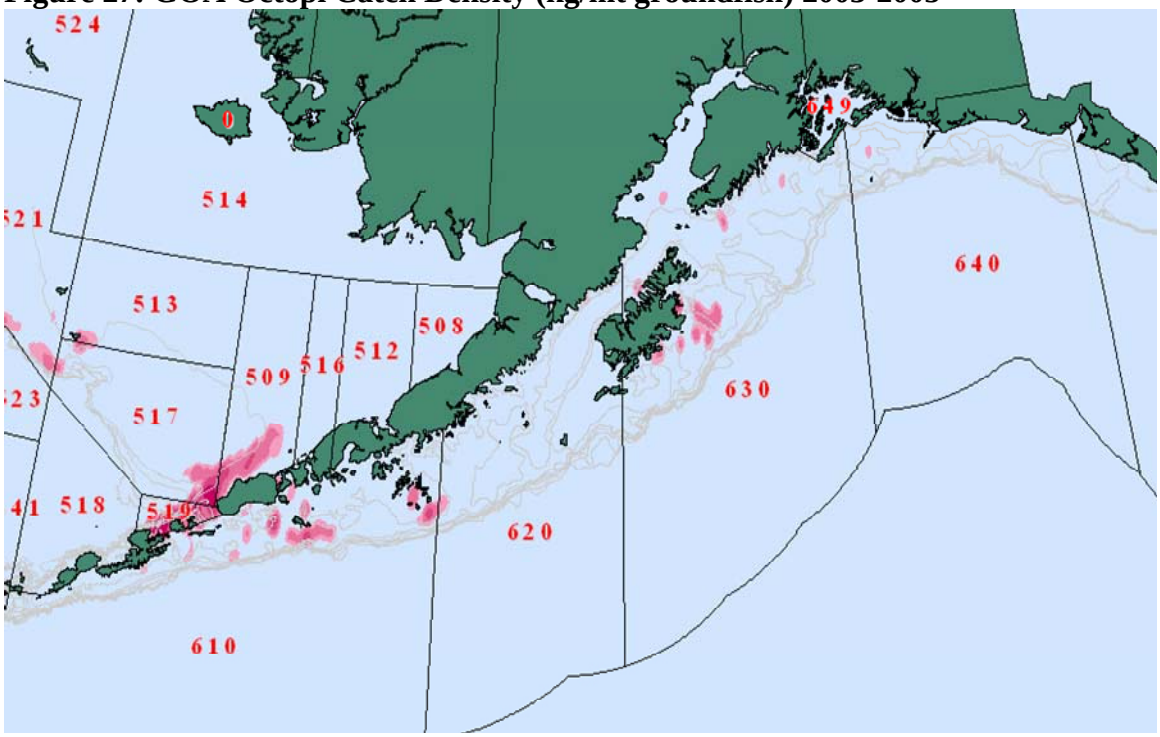


Figure 27: GOA Octopi Catch Density (kg/mt groundfish) 2003-2005



GOA Grenadiers

The GOA grenadier tier 5 OFL and ABC are 27,852 mt and 20,889 mt, respectively. Figure 28 shows that cumulative grenadier catch increases in February and March, as the IFQ fisheries for halibut and sablefish begin, and tends to remain fairly constant into October. Cumulative annual incidental catch of GOA grenadiers has consistently been about half of the ABC from 2004-2006. Thus, grenadiers, if managed independently, are not likely to require restrictions or closures in the fisheries that harvest them incidentally.

Grenadier are most often caught in the GOA hook-and-line sablefish target fisheries, followed distantly by non-pelagic trawl gear in the rockfish, deep-water flatfish, and flathead sole targets (Figure 29). The rate of more than 500 kg/mt groundfish in the hook-and-line sablefish target indicates that, on average, about a quarter of the catch in that fishery is grenadier.

Figure 30 shows grenadier catch tracking the distribution of most of the sablefish fishery, which is broadly distributed along bathymetric lines.

Figure 28: Cumulative GOA Grenadier Catch by Year (2004-06) Relative to ABC and OFL

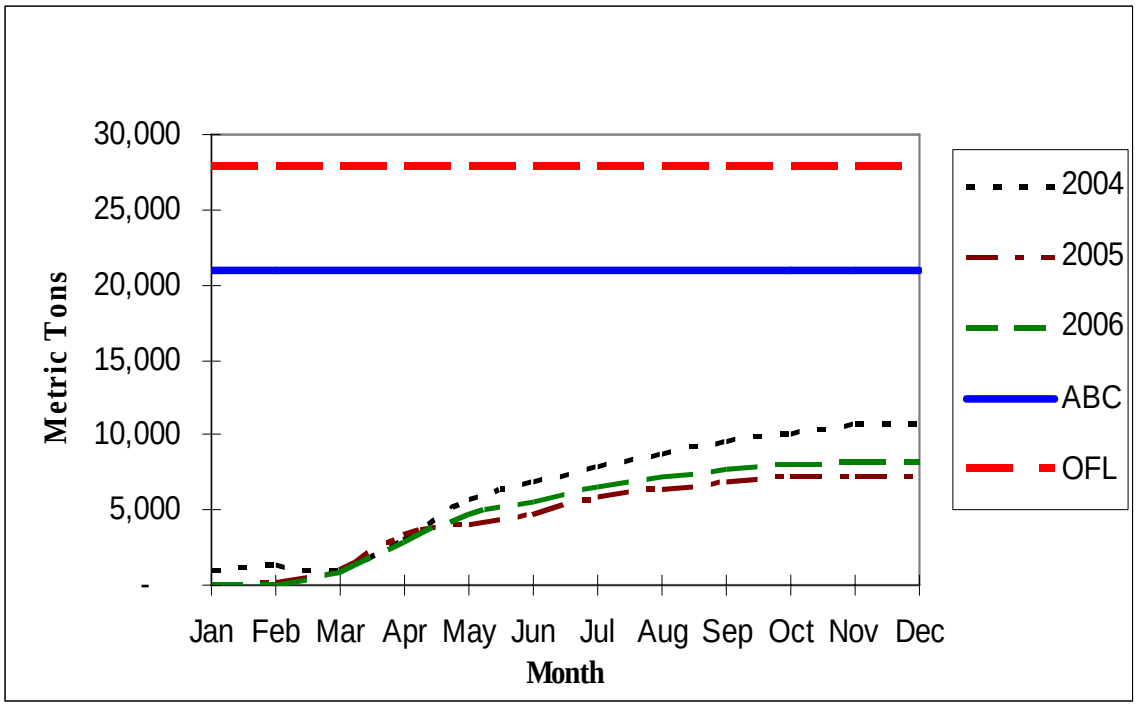


Figure 29: GOA Grenadier Average Catch by Gear and Target

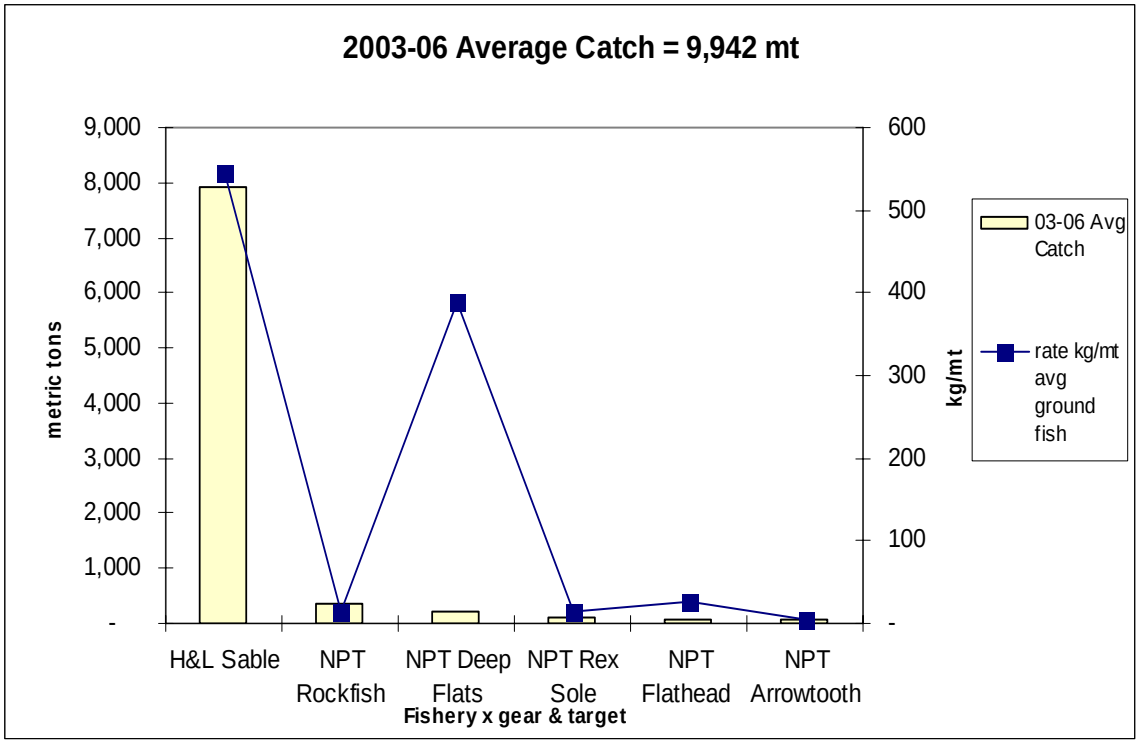
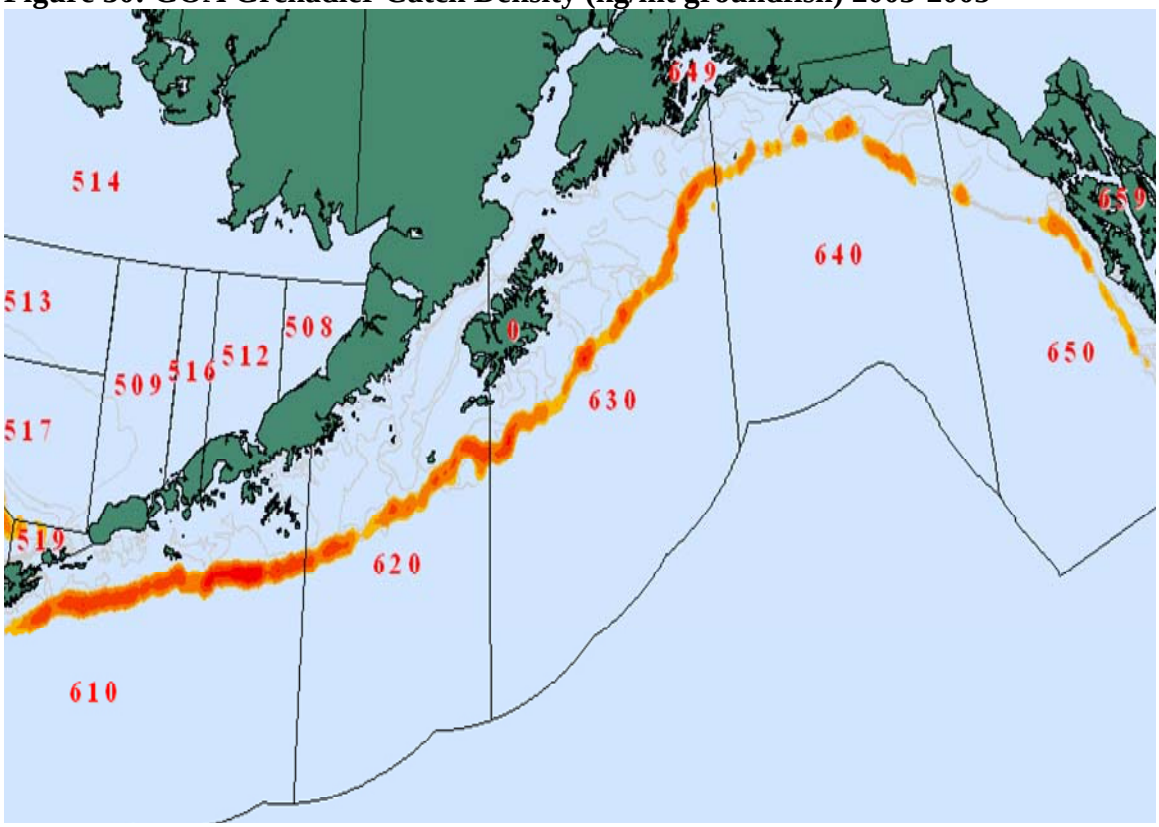


Figure 30: GOA Grenadier Catch Density (kg/mt groundfish) 2003-2005



Summary of Key Characteristics

The review, presented above, of cumulative incidental catch, distribution of catch by fishery, and geographic distribution of catch identifies several potential management actions that might be needed to prevent overfishing of some species. In recent years, however, most of the species in question have been incidentally caught at levels well below presently established management benchmarks. Thus, in most cases, management actions to prevent overfishing of the species, if managed independently of the other species group, are not likely to be needed. There are, however, several cases where management actions are perceived as being needed if the species is managed independently. There are also several species that could be candidates for a directed fishery. In addition, information on the distribution of incidental catch by target fishery has identified several fisheries most likely to be affected by management measures, should they become necessary.

Table 1, below, summarizes this information in order to provide a clearer picture of which species and fisheries are most likely to be directly affected by the proposed alternatives. The table indicates whether the species is of present management concern. If so, the species is presently reaching management benchmarks or could possibly reach them if recent catch trends continue. Also shown is whether the species could support a directed fishery or not. The gear/species combinations responsible for most of the catch of the species in question are also identified. These fisheries would likely be restricted in some way if management measures to prevent overfishing of the species are, or become, necessary. The spatial context of the distribution of the incidental catch of the species, as discussed above, is also provided. The spatial context largely determines the type and extent of potential management measures that would be employed if incidental catch of the independently managed species were to approach management benchmarks. Finally, the table identifies the time of year when management measures are most likely to be employed to prevent overfishing.

Table 1: Potential Effects Summary by Region and Species

BSAI Species	Management Concern	Directed Fishery Possible	Gear/Target Potentially Affected	Spatial Context	Potential Management Measures	Potential Closure Timing
Skates (Tier 5)	No	Yes	Pacific cod H&L	Broad	Broad Closures	n/a
Sharks (Tier 6)	Yes	No	Pollock Pelagic Trawl, Pacific cod H&L	Broad	Broad Closures	Aug.-Sept.
Sculpins (Tier 5)	No	Yes	Yellowfin sole NPT, Pacific cod NPT, Pacific cod H&L	Broad	Broad Closures	n/a
Octopi (Tier 6)	Possibly	Possibly	Pacific cod pot, Pacific cod H&L, Pacific cod NPT	Patchy / Discrete	Voluntary / Discrete Closures	October
Grenadiers (Tier 5)	No	Possibly	G.Turbot H&L, Sablefish H&L	Broad / Bathymetry	Broad Closures	n/a
GOA Species	**Management Concern**	**Directed Fishery Possible**	**Gear/Target Potentially Affected**	**Spatial Context**	**Potential Management Measures**	**Potential Closure Timing**
Squid (Tier 6)	Possibly	No	Pollock Pelagic Trawl	Very Discrete	Voluntary / Hot Spot	March
Sculpins (Tier 5)	No	No	Multiple Pot, NPT, H&L fisheries	Irregular	Broad Closures	n/a
Sharks (Tier 6)	Possibly	No	Sablefish H&L, Pollock Trawl, Pacific cod H&L, multiple NPT flatfish	Broad	Broad Closures	October
Octopi (Tier 6)	Possibly	No	Pacific cod Pot	Discrete	Voluntary/ Hot Spots	October
Grenadiers (Tier 5)	No	No	Sablefish H&L, NPT Deep Flats	Broad / Bathymetry	Broad Closures	n/a

Notes: H&L= hook-and-line, NPT= non-pelagic trawl,

Preliminary Assessment of Potential Affected Fisheries.

Alternative 2:

Alternative 2 would eliminate the "other species" assemblage and manage squids, skates, sculpins sharks, and octopi as separate assemblages. It is important to note that squid is presently managed individually in the BSAI, but not in the GOA. In addition, skates are presently managed individually in the GOA but not in the BSAI. Thus, this alternative would manage skates, sculpins, sharks, and octopi as separate assemblages in the BSAI, while individually managing squids, sculpins, sharks, and octopi as separate assemblages in the GOA.

Of the species addressed by this alternative, only BSAI sharks would likely require management measures to prevent overfishing if managed individually (see Table 1). BSAI sharks are managed under tier 6 and are not presently a candidate for a directed fishery.

BSAI sharks are incidentally caught across a broad geographic distribution primarily in the pelagic pollock trawl and hook-and-line Pacific cod fisheries. Closures of those fisheries in broad areas in the BSAI would be the most likely management measures employed to prevent overfishing of BSAI sharks. Such closures would likely need to occur in the August to September timeframe. Timing of closures would depend heavily on the rate of shark catch related to the level of effort being employed in these two fisheries.

In addition to BSAI sharks, BSAI Octopi are a possible species of management concern if individually managed. This is so because incidental catch of BSAI octopi exceeded ABC late in the 2004 fishing year. Thus, it is possible that BSAI octopus catch could exceed management benchmarks in the future. This is, of course, a function of octopi being managed under tier 6, with management benchmarks based on historic catch.

The patchy distribution of BSAI octopus catch, which occurs primarily in the Pacific cod pot fishery, implies that potential management measures could be limited to discrete areas closures beginning in October. It may be possible to identify hot spots earlier in the season. Voluntary avoidance of hot spots by vessels in the Pacific cod pot fishery, and possibly the Pacific cod hook-and-line and non-pelagic trawl fisheries may reduce or eliminate the need for area closures.

In the GOA, none of the species that would be managed individually under Alternative 2 are of immediate management concern. However, squid, sharks and octopi are all tier 6 species in the GOA. Thus, by the very nature of the setting of benchmarks based on historic catch, these species could approach or exceed management benchmarks in the future. Thus, they are all identified (Table 1) as possibly being of management concern.

GOA squid are somewhat unique among these species in that they are caught in a very discrete area of Shelikof Strait and only during the early part of the year by the pollock trawl fishery. Thus, it is possible that a hot spot can be identified and voluntary avoidance be used to mitigate the potential for overfishing of GOA squid. However, if a closure of the hot spot becomes necessary, potentially in March, it would likely affect GOA pollock catch during the highly valued roe season.

GOA octopi are caught in discrete areas in the Pacific cod pot fishery and, while only possibly being of management concern, could be managed with voluntary avoidance of hot spots. If closures of these hot spots become necessary, such closures would be most likely in the Pacific cod pot fishery possibly in October.

As a tier 6 species, GOA sharks are also possibly a species of management concern. However, recent incidental GOA shark catch has been below the management benchmarks. If GOA shark catch approaches the benchmarks, management measures to prevent overfishing could affect several fisheries across a broad geographic area. Sablefish hook-and-line, pollock trawl, Pacific cod hook-and-line, and multiple flatfish non-pelagic trawl fisheries harvest GOA sharks incidentally. The distribution of that harvest occurs broadly across the GOA, but in somewhat localized areas of high density. It is possible that some of these localized areas could be identified as areas to be voluntarily avoided. However, it is also possible that broad closures in a multitude of fisheries might be needed. The timing of such closures would be a function of the timing of the increased catch, which is not known.

Alternative 3:

Alternative 3 would separate management of BSAI skates, BSAI sculpins, and GOA sculpins from the other species assemblage. These changes are best discussed regionally, as they affect the remaining species in the other species group.

BSAI skates and BSAI sculpins are both managed under tier 5. As shown in Table 1, neither has been identified as being of management concern if managed individually. In fact, Both species could support a directed fishery, and both are broadly distributed. BSAI skates are taken dominantly in the Pacific cod hook-and-line fishery, while BSAI sculpins are taken in several fisheries including the Yelllowfin sole and Pacific cod non-pelagic trawl fisheries and in the Pacific cod hook-and-line fishery (see Table 1)

While BSAI skates and BSAI sculpins are not of management concern, the species that would remain in the other species group, sharks and octopi, are both potentially of management concern. As has been discussed under Alternative 2 above, closures in the pelagic pollock trawl and hook-and-line Pacific cod fisheries in broad areas in the BSAI would be the most likely management measures employed to prevent overfishing of BSAI sharks. Such closures would likely need to occur in the August to September timeframe.

The patchy distribution of BSAI octopus catch, which occurs primarily in the Pacific cod pot fishery, implies that potential management measures could be limited to voluntary avoidance and/or discrete areas closures beginning in October.

Separation of BSAI skates and sculpins from the BSAI other species group would likely mean management measures to prevent overfishing of the other species group (now sharks and octopi) would be similar to the management measures potentially needed to prevent overfishing of each of these species individually. This is because these species are incidentally caught in different fisheries with different geographic catch characteristics. Thus, management measures would need to focus on the individual species in the other species group to be effective. As a result, there does not appear to be a difference in potential effect on fisheries between Alternatives 2 and 3 in the BSAI.

Separation of GOA sculpins from the other species group appears to result in a similar outcome as separating BSAI skates and sculpins. As is the case in the BSAI, sculpins are not of management concern in the GOA and the remaining species in the other species group, squid, sharks, and octopi, are all managed under tier 6 and are all potentially of management concern if managed individually. Further, the spatial contexts of incidental catch of the three remaining species in the other species group differ from on another. Squid has a very discrete and temporally limited hot spot, octopi also have potential for hot spot management in several hot spots, while incidental catch of sharks is broadly distributed. The fisheries that catch these three species are also somewhat different (see Table 1). Thus, as is likely the case in the

BSAI, management measures employed to prevent overfishing of the GOA other species group under this alternative (squid, sharks, and octopi) would likely be similar to that used to manage each of these species individually under Alternative 2. Therefore, there does not appear to be a difference in potential effect on fisheries between Alternatives 2 and 3 in the GOA.

Alternative 4:

Alternative 4 would manage only BSAI skates as a separate assemblage. BSAI skates, if managed individually, would not be of management concern and could possibly support a directed fishery by vessels participating in the Pacific cod hook-and-line fishery. Thus, at the present level of harvest, no management measures to prevent overfishing of BSAI skates would be needed under this alternative.

Under this alternative, the BSAI other species group would consist of sharks, sculpins, and octopi. Given that a relatively high proportion of other species TAC comes from sculpins, and that available sculpin incidental catch is not heavily utilized, the remaining other species group would not likely be of management concern under this alternative. In essence, the large proportion of unused other species TAC coming from sculpins would mask the potential management concerns identified for sharks and octopi.

Alternative 5:

Alternative 5 would add grenadiers, a tire 5 species, to both the BSAI and GOA TAC specifications processes via two options. Option 1 would add grenadiers as separate assemblages and Option 2 would add them into the other species assemblage.

As summarized in Table 1, grenadiers, if managed independently of the other species group are not of present management concern in either the BSAI or GOA. BSAI incidental catch of grenadiers has averaged, in recent years, less than 5,000 mt out of an 80,000 mt ABC. In the GOA, the average catch of just under 10,000 mt is less than half of the ABC. They are caught in fisheries that are associated with their broad geographic distribution along bathymetric lines. Specifically, grenadiers are caught primarily in the BSAI Greenland turbot and sablefish hook-and-line fisheries and in the GOA sablefish hook-and-line and non-pelagic trawl deepwater flatfish fisheries. Management of grenadiers as separate assemblages in both the BSAI and GOA is not likely to have direct effect (i.e. imposition of management measures to prevent overfishing) on the fisheries that incidentally catch them.

Option 2 would add grenadiers to the other species groups. The addition of grenadiers to the other species groups would add a species with a relatively large, and lightly used, ABC under tier 5 management to these groups. It seems that this would have a similar effect as having the other tier 5 species (BSAI skates and sculpins in the BSAI and GOA) within the other species groups. That is, it would tend to mask catch of tier 6 species in excess of their individual ABCs and OFLs. Thus, adding grenadiers to the other species assemblage would not result in additional management measures affecting groundfish fisheries.

Proposed Methodology for Evaluation of Potential Effects

This discussion paper has helped to identify several species that could be of management concern under the various alternatives and has identified the spatial and temporal nature of management measures that may be taken to prevent overfishing of those species. In addition, the target fisheries most likely to be

directly affected by any needed management measures have been identified. This information is summarized in Table 1 and the discussion of the alternatives above.

The next step in the process of determining the potential effects of management actions on target fisheries is to create a fisheries activity model. This will require detail mapping of weekly fishing activity in potentially affected target fisheries. This will be done using Vessel Monitoring System (VMS) data, fisheries observer data, weekly production reports, and fish ticket data. The goal of this process is to create a database, with geographical information system (GIS) interconnectivity, that determines catch composition, catch rates (of all species, including prohibited species), and effort level at a 5 kilometer grid level of spatial resolution. This product would allow spatial (5 km blocks) and temporal (weekly) evaluation of fishing activity in potentially affected fisheries both within areas that could be considered for closure as well as in adjacent areas that would likely remain open. This product has been referred to in the past as the Catch-in-Areas database, and associated GIS output. This effort will be an advance of the previous product to update it with new and better data (e.g. VMS).

Concurrent with developing of the fishery activity model, identification of the geographic polygons of potential closure areas will be undertaken. This will be done with the assistance of Inseason Mangement staff. This process will review cumulative incidental catch and catch rate data to determine the spatial and temporal extent of closures that Inseason management staff might take to prevent overfishing of species potentially of management concern. This process may provide a range of closures from broad to fine so that potential effects can be determined across a range of potential actions.

The final step in the evaluation process is the assessment of Revenue at Risk. Revenue at Risk is simply the revenue that could be expected to be earned in the area being considered for closure. It is based on the recent past levels of fishing activity in the areas in question. The revenue expected to occur in that areas is "placed at risk" by the closure. This is not to say that the revenue at risk is not earned. It is assumed that, to the extent practicable, the industry will mitigate the revenue at risk by moving fishing effort to adjacent areas that remain open. Thus, the analysis will also have to consider catch rates and effort levels in adjacent areas to determine whether revenue at risk can be mitigated. The analysis will also need to consider whether the mitigation would tend to increase operational costs (i.e. via lower catch rates and/or higher levels of required effort), affect prohibited species catch, or create operational burdens (e.g. fishing in areas of bad weather).

The revenue at risk analysis must convert catch in areas into revenue in areas. This will be done by applying species group pricing data developed annually for the TAC specifications gross revenue model. This data is developed by the Alaska Fisheries Science Center as part of the annual Economic SAFE report preparation process. In this case, however, there will be a need to collect some additional market data on several species that could be candidates for a directed fishery and/or have marketability as incidental catch. This is because pricing data for the individual species in the other species group is not collected.

Equipped with the output of the catch-in-areas database and fishery activity model, the range of closure areas, and the revenue at risk analysis, a formal regulatory impact review (RIR) will be developed to accompany an Environmental Assessment and in Initial Regulatory Impact Assessment of potentially affected small entities. The RIR would inform the Council process by providing a detailed description of how potentially affected fisheries operate under the status quo, as well as assessing potential effects on fishing activity, revenue, and operational costs that each of the alternatives may have.