FINAL

Environmental Assessment/ Regulatory Impact Review
for Proposed Amendment 117(BSAI) and 106 (GOA)
to the Fishery Management Plans for Bering Sea Aleutian Islands Groundfish and Gulf of Alaska Groundfish

Reclassifying Squid Species in the BSAI and GOA

June 2018

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Abstract: This document analyzes alternatives pertaining to an action that could move all species of squid (see Table 3-2 for list of species found in the BSAI and GOA) in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) to a non-target category in need of conservation and management or to the non-target ecosystem component category, not in need of conservation and management. Options are included for a range of maximum retainable amount (MRA) of squid per target groundfish catch should squid management be modified to non-target status or be moved to the EC in both FMPs. There are no significant (beneficial or adverse) impacts on squid stocks, salmon or herring prohibited species catch (PSC) or significant (beneficial or adverse) socio-economic impacts on the groundfish fisheries.

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List of Acronyms and Abbreviations

AAC	Alaska Administrative Code
ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AEQ	adult equivalent
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AGDB	Alaska Groundfish Data Bank
AKFIN	Alaska Fisheries Information Network
ANILCA	Alaska National Interest Lands Conservation Act
BASIS	Bering Sea-Aleutian Salmon International Survey
BEG	biological escapement goal
BOF	Board of Fish
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COAR	Commercial Operators Annual Report
Council	North Pacific Fishery Management Council
CP	catcher/processor
CV	catcher vessel
CWT	coded-wire tag
DPS	distinct population segment
E	East
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FMA	Fisheries Monitoring and Analysis
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis
ft	foot or feet
GHL	guideline harvest level
GOA	Gulf of Alaska
ID	Identification
IRFA	Initial Regulatory Flexibility Analysis
IPA	Incentive Plan Agreement
IQF	individually quick frozen
JAM	jeopardy or adverse modification
lb(s)	pound(s)
LEI	long-term effect index
LLP	license limitation program
LOA	length overall
m	meter or meters

Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
MSST	minimum stock size threshold
t	tonne, or metric ton
NAICS	North American Industry Classification System
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NPFMC	North Pacific Fishery Management Council
NPPSD	North Pacific Pelagic Seabird Database
Observer Program	North Pacific Observer Program
OEG	optimal escapement goal
OMB	Office of Management and Budget
PBR	potential biological removal
PSC	prohibited species catch
PPA	Preliminary preferred alternative
PRA	Paperwork Reduction Act
PSEIS	Programmatic Supplemental Environmental Impact Statement
PWS	Prince William Sound
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
RPA	reasonable and prudent alternative
RSW	refrigerated seawater
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SBA	Small Business Act
Secretary	Secretary of Commerce
SEG	sustainable escapement goal
SET	sustainable escapement threshold
SNP	single nucleotide polymorphism
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SRKW	Southern Resident killer whales
SSFP	Sustainable Salmon Fisheries Policy
SW	southwest
TAC	total allowable catch
U.S.	United States
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system
W	West

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Executive Summary

This document analyzes alternatives pertaining to an action regarding appropriate management classification of several species of squid in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP). Options for classification and management of non-target stocks include identification of the species as "non-target species in need of conservation and management," or as "non-target ecosystem component species, not in need of conservation and management."

Purpose and Need

The Council adopted the following purpose and need statement in June 2017:

Squids are short-lived, highly productive, and important prey species. No conservation concerns exist for squid populations in the BSAI and GOA. Squid are thought to be substantially more abundant than can be estimated from trawl survey data. Current OFLs for squid are based on average catch calculations that are poorly linked to abundance. Although limited life-history information exists, the best available scientific information suggests that squid biomass estimates are substantial underestimates of true biomass. Squid are currently managed as target species despite being caught only incidentally under status quo, and an annual OFL, ABC, and TAC for the squid complex is specified separately for the BSAI and GOA. While there are no directed fisheries for squid in either the BSAI or GOA, squid bycatch is retained in some fisheries and often utilized to prevent waste. If the total TAC of squid is caught, retention is prohibited for the remainder of the year.

The purposes of this action are to identify the appropriate level of conservation and management required for squid and to accurately classify the squid complex in the BSAI and GOA groundfish FMPs based on the best available scientific information. The revised National Standard 1 (NS1) guidelines include options for classification and management of target and non-target species in FMPs. Options for classification and management of non-target stocks include identification of the species as "non-target species in need of conservation and management," or as "non-target ecosystem component species, not in need of conservation and management."

Alternatives

Three alternatives are considered in this analysis.

Alternative 1 would continue to manage squids in both the BSAI and GOA groundfish FMPs as a target species. OFL, ABC, and TAC would continue to be set for squid in both areas. Stock assessments for squid would continue to be done annually. Directed fishing for squid is allowed, however given the low TAC established annually for both the BSAI and GOA groundfish specifications, NMFS has determined that existing TAC levels are not sufficient to support a directed fishery in either management area and thus continues to place squid in both areas on bycatch-only status. Therefore squid are taken only as

incidental catch in groundfish fisheries (primarily pollock fisheries) in both regions. Vessel operators and processors are required to report the catch, discard, and retention of squid on logbooks, landing reports, and production reports.

Under Alternative 1, maximum retainable amounts (MRAs) for squids as incidental catch species are established at 20%. This allows vessels fishing for groundfish to retain a quantity of squid equal to, but no more than, 20% percent of the round weight or round weight equivalent of groundfish species open to directed fishing that are retained on board the vessel at any time during a fishing trip. In the BSAI, squid is a separate category for application of MRAs, however, in the GOA, squid is combined with sculpins, octopus, and sharks in an "other species" category and the 20% MRA applies to the category as a whole rather than to squid individually.

Alternative 2 [Preferred Alternative] would move squid species (squids) in both BSAI and GOA FMPs into the 'Ecosystem Component,' which is a category of non-target species that are determined not in need of conservation and management. Catch specifications (OFL, ABC, TAC) will no longer be required. Under Alternative 2, regulations would prohibit directed fishing for squids, continue to require recordkeeping and reporting to monitor and report catch of squids annually, and establish a squid MRA when directed fishing for groundfish species at a level (2-20%) to discourage retention while allowing flexibility to prosecute groundfish fisheries. **(20% MRA is the preferred option).**

The options for lower MRAs are considered to discourage any targeted fishing for squids. The lower range MRA has been used in the forage fish classification with the rationale being to ban targeted fishing of these ecologically important species.

Alternative 3 would designate squids in both BSAI and GOA FMPs as non-target species that are still in need of conservation and management. Establishment of a squid TAC will no longer be required, however OFL and ABC would still be required. Under Alternative 3, regulations would prohibit directed fishing for squids, require recordkeeping and reporting to monitor and report catch of squids annually, and establish a squid MRA when directed fishing for groundfish species at a level (2-20%) to discourage retention while allowing flexibility to prosecute groundfish fisheries.

Environmental Assessment

Environmental impacts of this action are limited to direct impacts on squids and squid management and indirect impacts on Chinook and chum salmon and herring prohibited species catch (PSC). No other impacts are anticipated to other resource categories.

Squids

Squids have short, sometimes less than 1 year, life-spans. Limited life-history information exists and the Council's Scientific and Statistical Committee (SSC) has determined that there are no reliable biomass estimates in the BSAI and GOA. Annual stock assessments have indicated that bottom trawl survey biomass estimates are considered substantial underestimates of true biomass in both the BSAI and GOA.

Squids are important prey species and food web models have indicated substantially higher biomass of squids than any of the trawl survey biomass estimates based on their role in the ecosystem. Use of food web models gives an indication of the relative impact of fishing mortality as compared with predation mortality on squids, and as noted, fishing mortality is extremely low compared with the estimated predation mortality (Ormseth 2011, 2012). Therefore the effects of the current fishing mortality on squids are considered insignificant at a population level to affect the squid stock status under either FMP.

The spatial and temporal distribution of squid is variable, and on a local-scale fishing removals should be monitored to ensure that spatial and temporal impacts with respect to localized depletion are minimized. There is some potential for localized depletion in specific areas where squid catch is concentrated. However, while this may affect a cohort spatially and temporally in a discrete area, this is not thought to have a population effect on squid as a whole and impact the overall biomass and reproductive capacity. Therefore spatial and temporal effects under status quo on squids are considered insignificant.

Alternatives 2 **(Preferred Alternative)** and 3 would neither decrease nor likely substantially increase the incidental catch of squids in groundfish fisheries as squids do not appear to be targeted in any way. Given that squids do not appear to be targeted in any way, it is likely that bycatch of squids in the groundfish fisheries under Alternatives 2 and 3 would be similar to that under status quo.

NMFS in-season management already monitors squid catches in the Catch Accounting System (CAS) thus there is no additional burden to continue to monitor and report squid catches. A periodic stock assessment is recommended with additional information provided on a schedule consistent with stock assessment protocols for all other stocks in the BSAI and GOA FMPs. Under Alternative 3, OFL and ABC would continue to be specified thus the periodic stock assessment would provide these recommendations on the schedule determined for assessment purposes. The assessment information would be similar under Alternatives 2 and 3 but would contain OFL and ABC recommendations under Alternative 3. A periodic stock assessment under Alternative 2 is consistent with current protocols for Forage Fish assessments and for Grenadiers which are also in the EC in both FMPs.

Alternatives 2 **(Preferred Alternative)** and 3, Options 1-3 provides options for MRAs including a 2% (option 1), 10% (option 2) and 20% MRA (option 3: status quo **(Preferred Alternative)**). Based on observed retention rates, it is likely that the options for a 2% or 10% MRA would be constraining. It is not clear that there is any benefit to a constraining MRA when squid are not being targeted as bycatch because a more constraining MRA would simply increase discards, and with the assumption of 100% mortality in the squid catch there is no conservation benefit. Thus, any constraining MRA is most likely to simply increase discards of dead squid rather than discourage targeting.

Predation on squids is not well understood, particularly because the size of squids (and therefore the age and species) that are preyed upon is very uncertain however squids are short-lived, highly productive and the squids encountered by the fishery are likely dissimilar to those preyed upon by predators. There are no significant impacts (beneficial or adverse) to squid stocks under either of the alternatives.

Chinook and chum salmon PSC

Impacts to salmon PSC result from movement of the pollock fleet to avoid squid. These constraints are only in the BSAI where management measures have been adopted by the fleet voluntarily to close areas of high squid bycatch to avoid reaching an OFL. There are no anticipated impacts to salmon PSC in the GOA, as squid incidental catch has not been constraining nor caused any avoidance measures. In the EBS pollock fishery, in response to potentially constraining Chinook PSC limits combined with stringent vessel-level Incentive Plan Agreement requirements, the pollock industry has been extremely responsive to incidences of increased salmon bycatch. However, recent catches of squid have resulted in additional requirements to move away from areas of high squid bycatch and industry closures of productive pollock fishing grounds, which have compromised the fleet's ability to avoid chum and Chinook salmon. Alternative 2 **(Preferred Alternative)**, moving squids to the EC category, has the potential to reduce the adverse impact on chum and Chinook salmon as it would allow the EBS pollock fleet additional flexibility in fishing in areas where fishing rates are good and salmon bycatch is low while Alternative 3 is likely to be more similar to status quo as there remains OFL and ABC specified for squid stocks which has the potential to be more constraining on the pollock fishery as the OFL is approached. There are no significant impacts (beneficial or adverse) to salmon PSC under either of the alternatives.

Herring PSC

Impacts to herring result from incidental catch of herring and movement of the pollock fleet to avoid squid in the BSAI and as a result of incidental catch only in the GOA. There are no herring PSC limits in the GOA thus no anticipated impacts to herring stocks as squid has neither been constraining nor caused any avoidance measures. To avoid a closure of the herring savings areas in the BSAI, the pollock fleet may move off high herring rates into areas of higher squid or salmon bycatch. However, while this is an indirect result of PSC management in the BSAI, the catches of herring are well below any conservation concerns for herring stocks thus there are no significant impacts (beneficial or adverse) to herring PSC under either of the alternatives.

Regulatory Impact Review

Alternative 1, No Action

At present, the optimum yield (OY) cap established in the Groundfish FMP for the GOA is substantially greater than the total of all GOA TACs. Thus, continuing to require conservation and management of squid in the GOA does not require "funding" of squid TAC via reductions in TACs of any other groundfish species. Further, since the present and past harvests of squid taken incidentally are well below the current ABCs calculated for squid, there would be no significant effects (either adverse or beneficial) on the stock biomass, fishing mortality, spatial or temporal distribution, or changes in prey availability for squids and groundfish target species in the GOA. There would be no significant (either beneficial or adverse) socioeconomic effects on those who harvest squids or other groundfish targets in the GOA.

In contrast to the potential effects of Alternative 1 in the GOA, current management in the BSAI FMP does result in less TAC available for other groundfish species. The BSAI Groundfish FMP specifies a total OY cap of 2 million mt. The total of all BSAI groundfish TACs may not exceed this 2 million mt cap. Thus, continuing to provide for conservation and management measures under the FMP means that squid incidental catch would continue to be "funded" from reduced TAC of other, presently more valuable, BSAI groundfish species. In past years, the actual amount of reduction in TAC in other BSAI groundfish target fisheries for setting specifications for squid in the BSAI has ranged from a low of 310 mt in 2014 to high of 1,970 mt for 2007-2010. However, while a specific amount of benefit cannot be predicted, it is also the case that TAC amounts for some groundfish species in the BSAI are not fully utilized under current conditions thereby reducing any impact of continuing to fund a squid TAC. In addition, the current OFL could constrain fishing for other species that incidentally take squid.

Alternative 2 (Preferred Alternative)

One of the advantages of this alternative is that pollock vessels would not have to relocate to other areas of the BSAI and GOA to avoid catching squid. The BSAI pollock fleet has a voluntary squid agreement to reduce squid catch to avoid closing the pollock fishery. This action would allow greater flexibility for the pollock fleet to seek areas of higher pollock CPUE and lower salmon bycatch without the limitations associated with catching squid incidentally.

The options included in this alternative would establish an MRA for squids as incidental catch in the BSAI and GOA using the MRAs of 2%, 10%, or 20% **(Preferred Option)**, when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries. Currently the MRA is 20% for the basis species and retention rates greater than 20% have been rare in the BSAI and GOA pollock fisheries, which have the highest squid catch. From 2013-2016, there were 55,199 hauls in the BSAI and 2,962 hauls in GOA. Of those total hauls in the BSAI, 15 hauls would have exceeded a 20% MRA during the 2013-2016 period, while in the GOA, 2 hauls would have exceeded a 20% MRA. Factors that discourage pollock vessels from retaining and marketing more squid beyond their current levels is the relatively low value of squid and the cost to pollock production when encountering squid on the fishing grounds. Overall, given the limited economic value of squid and the increased cost factor in separating squid from pollock prior to processing, maintaining an MRA of 20 percent would likely result in similar retention amounts of squid and likely not result in topping off behavior.

The option also includes establishment of an MRA at 2% or 10%. There appears to be no conservation issue that would necessitate reducing the MRA from the existing 20%. The amount of squid that are caught and retained currently is limited and the economic value of the retained squid is also limited. Lower MRA percentages would likely have some negative impacts on individual vessels due to the need to sort and discard squid at sea to stay below a 2% MRA or 10% MRA. From 2013-2016, there were 55,199 hauls in the BSAI and 2,962 hauls in GOA. Of those total hauls in the BSAI, 514 hauls would have exceeded a 2% MRA and 38 hauls would have exceeded a 10% MRA during the 2013 through 2016 period. In the GOA, 59 hauls would have exceeded a 2% MRA and 6 hauls would have exceeded a 10% MRA during the 2013 through 2016 period. Since there is insufficient information to determine whether a

conservation issue exists that would necessitate reducing the squid MRA from its existing 20% in the BSAI and GOA, and considering the limited economic value of squid, reducing the MRA to 2% or 10% would increase operating costs for vessels while not providing any perceivable conservation benefit.

Alternative 3, Include squid in the FMP as non-target species

Like Alternative 2, a benefit of Alternative 3 is that BSAI squid would not be 'funded' from reduced TAC of other, presently more valuable groundfish species. As noted in Section 4.6.1, in the past, the amount of TAC that could be been funded with moving squid to the Ecosystem Component has ranged from a low of 310 mt in 2014 to a high of 1,970 mt in 2007 through 2010.

However, like Alternative 1, this alternative would still require pollock vessels to continue their effort to move from squid grounds to reduce squid bycatch in order to avoid having the pollock fishery closed. As noted in Section 4.6.1, squid bycatch has constrained pollock vessels in the past. It is likely that pollock vessels will continue voluntary closures for regions with high squid catch that are devised in concert with NMFS to avoid reaching the OFL for squid. As a result, given the reduced flexibility for pollock vessels under this alternative, it will be more difficult for vessels to balance higher pollock CPUE, lower salmon bycatch, and lower squid catch.

The options included in this alternative would establish an MRA for squid species as incidental catch in the BSAI and GOA using the MRAs of 2%, 10%, or 20% when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries. Since the MRA options in this alternative are the same as those in Alternative 2, the impacts will likely be the same.

Comparison of Alternatives for Decision-making

This summary table provides a summary of key decision points under Alternatives 1, 2, and 3 with a summary of associated management and enforcement issues following the table.

Summary of Management Measures in Alternatives 1, 2, and 3

Management Measure	Alt 1- No Action	Alt 2 - Ecosystem Component (Preferred Alt)	Alt 3 – Non-target
Prohibit a Directed Fishery	**No** However, NMFS has not opened squid to directed fishing since 2011	**Yes** prohibit directed fishing in regulations at 679.20(i)	**Yes** prohibit directed fishing in regulations at 679.20(i)
Retention and sale	**Yes** Retention and sale allowed, subject to MRA limits	**Yes** Retention and sale allowed, subject to MRA limits	**Yes** Retention and sale allowed, subject to MRA limits
Annual Harvest Specifications	**Yes** - annual stock assessment - TAC assessed in optimum yield	**No** - Periodic stock assessment - catch not assessed in optimum yield	**Yes** - TAC not required - OFL and ABC still required - catch not assessed in optimum yield
Incidental Catch Management	**Yes** - MRA as incidental catch species = 20%	**Yes** - MRA as incidental catch species = options for 20% **(Preferred Option)**, 10%, 2%	**Yes** - MRA as incidental catch species = options for 20%, 10%, 2%
Recordkeeping and Reporting	**Yes** - require catch reporting	**Yes** - require catch reporting	**Yes** - require catch reporting

Some management and enforcement issues are identified with management under Alternative 1 including:

- Monitoring catch at the individual trip level to ensure that the squid MRA is not exceeded;
- Monitoring cumulative catch to ensure that catch is not approaching the ITAC;
- Determining if additional TAC is available to be added to the ITAC;
- Placing squid on prohibited species status when total TAC is exceeded or projected to be exceeded;
- Considering further directed fishery closures when harvest approaches the OFL;
- Challenge for enforcement to determine appropriate penalty for squid MRA overages due to low price of squid; and
- Marked increase in enforcement actions when BSAI squid were place on prohibited species status in 2015.

Depending upon the selection of an MRA option under Alternative 2 many of these management and enforcement issues would be alleviated. However, NMFS's enforcement burden is likely to increase should the Council select any MRA lower than the status quo.

1 Introduction

This document analyzes alternatives pertaining to an action that could move all species of squid (see Table 3-2 for list of species found in the BSAI and GOA) in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) to the non-target category in need of conservation and management or to the non-target ecosystem component (EC) category, not in need of conservation and management.

This document is an Environmental Assessment/Regulatory Impact Review (EA/RIR). An EA/RIR provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), and the economic benefits and costs of the action alternatives, as well as their distribution (the RIR). This EA/RIR addresses the statutory requirements of the Magnuson Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, and Presidential Executive Order 12866. An EA/RIR is a standard document produced by the North Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) Alaska Region to provide the analytical background for decision-making.

1.1 Purpose and Need

The Council adopted the following revised purpose and need statement in June 2017:

Squid are short-lived, highly productive, and an important prey species. No conservation concerns exist for squid populations in the BSAI and GOA. Squid are thought to be substantially more abundant than can be estimated from trawl survey data. Current OFLs for squid are based on average catch calculations that are poorly linked to abundance. Although limited life-history information exists, the best available scientific information suggests that squid biomass estimates are substantial underestimates of true biomass. Squid are currently managed as target species despite being caught only incidentally under status quo, and an annual OFL, ABC, and TAC for the squid complex is specified separately for the BSAI and GOA. While there are no directed fisheries for squid in either the BSAI or GOA, squid bycatch is retained in some fisheries and often utilized to prevent waste. If the total TAC of squid is caught, retention is prohibited for the remainder of the year.

The purposes of this action are to identify the appropriate level of conservation and management required for squid and to accurately classify the squid complex in the BSAI and GOA groundfish FMPs based on the best available scientific information. The revised National Standard 1 (NS1) guidelines include options for classification and management of target and non-target species in FMPs. Options for classification and management of non-target stocks include identification of the species as "non-target species in need of conservation and management," or as "non-target ecosystem component species, not in need of conservation and management."

1.2 History of this Action

The Magnuson-Stevens Act (MSA) requires that each regional fishery management council develop annual catch limits (ACLs) and accountability measures (AMs) for each of its managed fisheries designated as being in the fishery, such that each FMP under its jurisdiction has a mechanism for specifying ACLs at a level that overfishing does not occur in the fishery. The reauthorized MSA strengthened provisions to prevent and end overfishing and rebuild depleted fisheries. NMFS revised NS1 guidelines at 50 CFR 600.310, to integrate these new requirements intended to reduce overfishing with existing provisions related to overfishing, rebuilding overfished stocks, and achieving optimum yield. On January 16, 2009, NMFS issued final guidelines for NS1 (74 FR 3178). These guidelines have been recently revised again with NMFS issuing final guidelines for NS1 revisions on October 18, 2016 (81 FR 71858). Information in this document regarding the NS1 guidelines reflects the recent revisions, however the background on the history of this action reflects the 2009 guidelines as the basis for this action initially.

Amendments 96/87 established the EC category and designated prohibited species (defined in Table 2b to Part 679, and includes salmon, steelhead trout, crab, halibut, and herring) and forage fish (as defined in Table 2c to part 679 and § 679.20(i)) as EC species in both the BSAI and GOA FMPs. These amendments also moved all species in the "other species" category, which included squid, to the "target species" category, removed the "other species" category from the FMPs, and establish catch specifications, including TAC, for squid. For EC species, NMFS retained the existing conservation regulations (such as no retention of prohibited species and the maximum retainable amount of 2 percent for forage fish).

Since approximately 2010, the NPFMC non-target committee, the Plan Teams, and the SSC have at various times recommended that the NPFMC explore moving squid to the EC category. The rationale was always that as an extremely short-lived and highly productive group of species, it is very unlikely that squid could be overfished in the absence of a directed fishery. Thus, squid bycatch (from a population perspective) is not a conservation concern.

In 2015, the groundfish plans teams for the BSAI and GOA recommended again that consideration be given to moving squid into the EC category. These recommendations were based upon the difficulty in establishing catch specifications for squid in both management regions, as well as concerns that in the EBS pollock fishery, moving away from areas of squid incidental catch interfered with the fleet's avoidance of Chinook and chum salmon, and herring PSC. Squid are managed under Tier 6 because the SSC has determined that groundfish bottom trawl surveys do not provide reliable biomass estimates, and thus specifications are recommended based upon different calculations based upon average catch. In some years, this has led to actual catches which well exceed the TAC and sometimes the ABC particularly in the BSAI. While catches have not exceeded the OFL, they have exceeded the ABC and approached the OFL in the BSAI. This has prompted additional in-season management actions and industry-led voluntary area closures in the EBS pollock fishery to prevent catch exceeding the OFL, which would result in BSAI groundfish fishery-wide closures. The assessment author, the Plan Teams, and the SSC are in agreement that it is highly unlikely that current catch levels or catches approaching the

revised 2016-2017 harvest specifications would result in a conservation concern for BSAI or GOA squid. Therefore, the Council initiated an amendment to consider moving squid into the EC category in October 2015.

The Council took initial review of an EA/RIR/IRFA to address moving squid into the EC in both FMPs in June of 2016. Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to describe the economic impacts of proposed actions on small entities. At that time and based upon some questions from staff regarding meeting the NS1 guideline provisions for EC species, the Council revised its purpose and need statement and Alternative 2 to better reflect its intent in this action. The Council then requested that further analysis of these alternatives be delayed until the revised NS1 guidelines were final better assess to what extent this action meets the intent of those guidelines. The revised guidelines became final on October 18, 2016 and new information on the revisions is incorporated into this document. The Council took initial review of the EA/RIR/IRFA in February 2017 and moved to include an additional alternative (Alternative 3) as well as request some consideration of a Magnuson Act provision whereby specifications under an FMP are not necessary for some short-lived species. Additional information on this provision and its applicability to squid species is provided in section 2.4. The Council took final action to select its preferred alternative in June of 2017. At that time the Council adopted a a revised purpose and need statement to, again, better reflect its intent for this action, and recommended Alternative 2, Option 3 as its preferred alternative: designate squid in both the BSAI and GOA FMPs as non-target "Ecosystem Component Species" and maintain the current MRA of 20%.

1.3 Description of Management Area

This action pertains to all management areas in the GOA (Figure 1-1) and BSAI (Figure 1-2). In both regions squid are managed area-wide (i.e. Gulf-wide specifications and BSAI-wide specifications) rather than by specific regulatory areas or sub-areas.

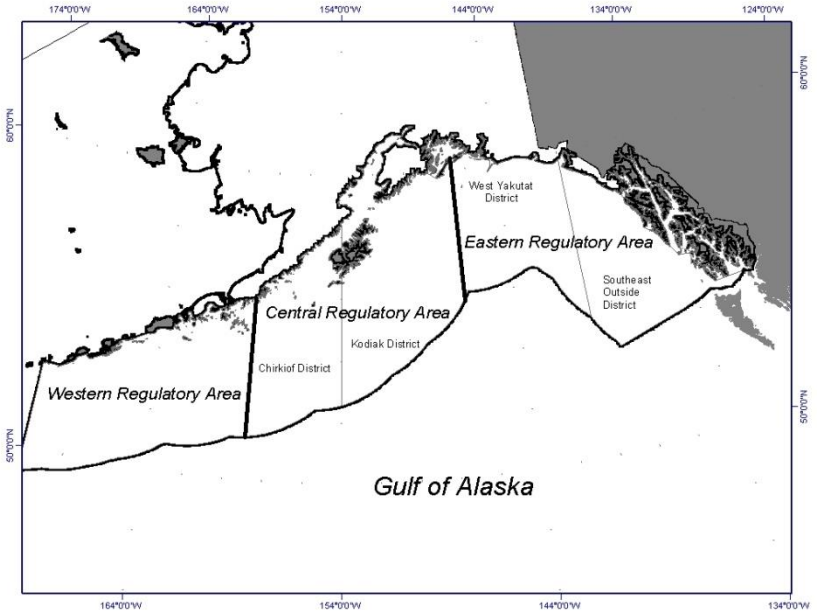

Figure 1-1: Regulatory and reporting areas in the GOA.

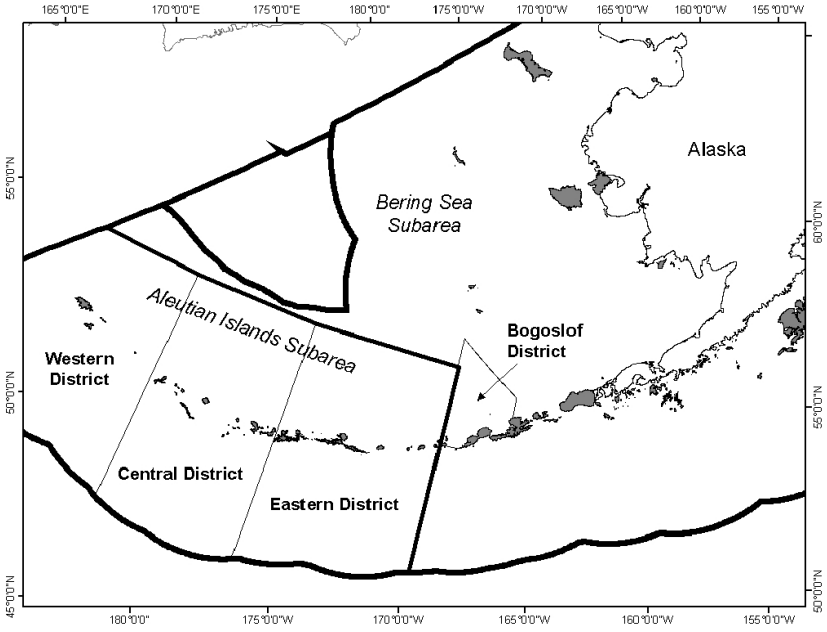

Figure 1-2: BSAI sub-areas for management

2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The alternatives in this chapter were designed to accomplish the stated purpose and need for the action. All of the alternatives were designed to provide for appropriate management and monitoring for squid stocks in the BSAI and GOA without unnecessarily constraining groundfish fisheries.

The Council adopted the following alternatives for analysis in October 2015 and revised Alternative 2 in June 2016.

Alternative 1: No Action

Alternative 2: Move squid to Ecosystem Component in both BSAI and GOA and establish an MRA for squids as incidental catch

Alternative 3: Designate squids in both BSAI and GOA FMPs as non-target species. Establishment of a squid TAC will no longer be required

Under both alternatives 2 and 3 options to establish MRAs are as follows:

Option 1 MRA = 2%
Option 2 MRA = 10%
Option 3 MRA = 20%

Individual alternatives and options are described in detail below.

2.1 Alternative 1, No Action

Under Alternative 1, squids would continue to be managed as target species in both the BSAI and GOA groundfish FMPs. OFL, ABC, and TAC would continue to be set for the squidcomplex in both areas. Stock assessments for squid would continue to be done annually. Directed fishing for squid is allowed however given the low TAC established annually for both the BSAI and GOA groundfish specifications, NMFS has determined that existing TAC levels are not sufficient to support a directed fishery in either management area and thus continues to place squid in both areas on bycatch-only status. Therefore, squids are actually non-target species as they are taken only as incidental catch in groundfish fisheries (primarily pollock fisheries) in both regions. Vessel operators and processors are required to report the catch, discard, and retention of squid on logbooks, landing reports, and production reports.

Under Alternative 1, MRAs for the squid complex as an incidental catch species are established at 20% (Table 10, GOA Retainable Percentages, and Table 11, BSAI Retainable Percentages, to 50 CFR 679). This allows vessels fishing for groundfish to retain a quantity of squid equal to, but no more than, 20% percent of the round weight or round weight equivalent of groundfish species open to directed fishing that

are retained on board the vessel at any time during a fishing trip. In the BSAI, squid is a separate basis species for application of MRAs, however, in the GOA, squids are combined with sculpins, octopus, and sharks in an "other species" category and the 20% MRA applies to the category as a whole rather than to squids separately.

2.2 Alternative 2, Move squid to the Ecosystem Component category in both FMPs [Preferred Alternative].

This alternative would move squid to the Ecosystem Component in both BSAI and GOA groundfish FMPs. Catch specifications (OFL, ABC, TAC) would no longer be required. Directed fishing for squid species would be prohibited. Recordkeeping and reporting would be required under this alternative to monitor catch of squids annually. A periodically updated stock assessment for squids in both the GOA and BSAI would also be provided under this alternative. This would be completed on the recommended assessment frequency timing decided upon by the Council and the Alaska Fisheries Science Center.

This alternative would also establish an MRA for squids. MRAs for squids caught incidentally by other BSAI and GOA groundfish fisheries would be derived pursuant to Tables 10 and 11 of 50 CFR 679. The MRA for the squid complex would minimize bycatch to the extent practicable consistent with National Standard 9 and discourage retention of squid while allowing flexibility to prosecute groundfish fisheries. Three options for MRAs are considered

Option 1 MRA = 2%
Option 2 MRA = 10%
Option 3 MRA = 20% **[Preferred Alternative]**

Option 3 is the status quo MRA for squids caught incidentally when fishing for groundfish while lower MRAs under options 1 and 2 are considered to discourage any targeted fishing for squid. The lower range MRA in option 1 of 2% has been used in the forage fish classification with the rationale being to ban targeted fishing of these ecologically important species.

2.2.1 Meeting the requirements for EC

Section 302(h)(1) of the MSA requires a Council to prepare an FMP for each fishery under its authority that requires (or in other words, is in need of) conservation and management. Section 3(5) of the MSA defines "conservation and management" as "all of the rules, regulations, conditions, methods, and other measures:

(A) which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment; and

(B) which are designed to assure that –

i. a supply of food and other products may be taken, and that recreational benefits may be obtained, on a continuing basis;

ii. irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and

iii. there will be a multiplicity of options available with respect to future uses of these resources."

NMFS has recently published guidelines to aid the Councils as they consider whether a stock requires conservation and management, and if so, how the Councils should meet the requirements of the National Standards (NS) in section 301(a) of the MSA. Revised NS guidelines describe the fact that FMPs typically include certain target species, and certain non-target species, that the Councils and/or the Secretary believed require conservation and management. The NS general guidelines in 50 CFR §600.305(d) define how stocks should be classified in an FMP:

(11) *Target stocks* are stocks or stock complexes that fishers seek to catch for sale or personal use, including such fish that are discarded for economic or regulatory reasons as defined under Magnuson-Stevens Act section 3(9) and 3(38).

(12) *Non-target species* and *non-target stocks* are fish caught incidentally during the pursuit of target stocks in a fishery. Non-target stocks may require conservation and management and, if so, must be included in a FMP and be identified at the stock or stock complex level. If non-target species are not in need of conservation and management, they may be identified in an FMP as ecosystem component species.

(13) *Ecosystem Component Species* (*see* §§ 600.305(c)(5) and 600.310(d)(1)) are stocks that a Council or the Secretary has determined do not require conservation and management, but desire to list in an FMP in order to achieve ecosystem management objectives.

While squid are currently classified as a target species in both the BSAI FMP and the GOA FMP, and NMFS allowed directed fishing for squid in the BSAI through 2011, there is no indication that anyone has conducted a directed fishery for squid since squid were included in these FMPs. In addition, as shown in Table 3-20, even when open to directed fishing in the BSAI, the incidental catch of

squid has represented a small proportion of total catch in the pollock fisheries, the fisheries with the greatest amount of squid catch. Therefore, there is no indication that squids have been or are actively "targeted" in the BSAI or GOA. A decision to reclassify squids as EC species as a special sub-set of non-target stocks would be based upon a determination that conservation and management measures are not required for these stocks. The EC designation is considered a discretionary provision of FMPs. Section 303(b)(12) of the MSA states that Councils may "include measures in [FMPs] to conserve target and non-target species and habitats, considering the variety of ecological factors affecting fishery populations." In order for a stock to be considered an EC species, the Council must determine that conservation and management measures are not required but that retaining these stocks within the FMP itself will assist in achieving ecosystem management objectives. The NS guidelines under section 600.305 (c) provide direction for determining which stocks will require conservation and management as well as providing direction to Councils for how to consider these factors in making this determination.

> *Not every fishery requires Federal management. Any stocks that are predominately caught in Federal waters and are overfished or subject to overfishing, or likely to become overfished or subject to overfishing, are considered to require conservation and management. Beyond such stocks, Councils may determine that additional stocks require "conservation and management." (See Magnuson-Stevens Act definition at 16 U.S.C. 1802(5)). Based on this definition of conservation and management, and other relevant provisions of the Magnuson-Stevens Act, a Council should consider the following non-exhaustive list of factors when deciding whether additional stocks require conservation and management:*
>
> *(i) The stock is an important component of the marine environment.*
>
> *(ii) The stock is caught by the fishery.*
>
> *(iii) Whether an FMP can improve or maintain the condition of the stock.*
>
> *(iv) The stock is a target of a fishery.*
>
> *(v) The stock is important to commercial, recreational, or subsistence users.*
>
> *(vi) The fishery is important to the Nation or to the regional economy.*
>
> *(vii) The need to resolve competing interests and conflicts among user groups and*
>
> *whether an FMP can further that resolution.*
>
> *(viii) The economic condition of a fishery and whether an FMP can produce more*
>
> *efficient utilization.*
>
> *(ix) The needs of a developing fishery, and whether an FMP can foster orderly*

growth.

(x) The extent to which the fishery is already adequately managed by states, by state/Federal programs, or by Federal regulations pursuant to other FMPs or international commissions, or by industry self-regulation, consistent with the requirements of the Magnuson-Stevens Act and other applicable law.

(2) In evaluating factors in paragraphs (c)(1)(i) through (x) of this section, a Council should consider the specific circumstances of a fishery, based on the best scientific information available, to determine whether there are biological, economic, social and/or operational concerns that can and should be addressed by Federal management.

(3) When considering adding a stock to an FMP, no single factor is dispositive or required. One or more of the above factors, and any additional considerations that may be relevant to the particular stock, may provide the basis for determining that a stock requires conservation and management. Based on the factor in paragraph (c)(1)(iii) of this section, if the amount and/or type of catch that occurs in Federal waters is a significant contributing factor to the stock's status, such information would weigh heavily in favor of adding a stock to an FMP. However, Councils should consider the factor in paragraph (c)(1)(x) of this section before deciding to include a stock in an FMP. In many circumstances, adequate management of a fishery by states, state/Federal programs, or another Federal FMP would weigh heavily against a Federal FMP action. See, e.g., 16 U.S.C. 1851(a)(7) and 1856(a)(3).

(4) When considering removing a stock from, or continuing to include a stock in, an FMP, Councils should prepare a thorough analysis of factors in paragraphs (c)(1)(i) through (x) of this section, and any additional considerations that may be relevant to the particular stock. As mentioned in paragraph (c)(3) of this section, if the amount and/or type of catch that occurs in Federal waters is a significant contributing factor to the stock's status, such information would weigh heavily in favor of continuing to include a stock in an FMP. Councils should consider weighting the factors as follows. Factors in paragraphs (c)(1)(i) through (iii) of this section should be considered first, as they address maintaining a fishery resource and the marine environment. See 16 U.S.C. 1802(5)(A). These factors weigh in favor of continuing to include a stock in an FMP. Councils should next consider factors in paragraphs (c)(1)(iv) through (ix) of this section, which set forth key economic, social, and other reasons contained within the MSA for an FMP action. See 16 U.S.C. 1802(5)(B). Finally, a Council should consider the factor in paragraph (c)(1)(x) of this section before deciding to remove a stock from, or continue to include a stock in, an FMP. In many circumstances, adequate management

of a fishery by states, state/Federal programs, or another Federal FMP would weigh in favor of removing a stock from an FMP. See e.g., 16 U.S.C. 1851(a)(7) and 1856(a)(3).

(5) Councils may choose to identify stocks within their FMPs as ecosystem component (EC) species (see § § 600.305(d)(13) and 600.310(d)(1)) if a Council determines that the stocks do not require conservation and management based on the considerations and factors in paragraph (c)(1) of this section. EC species may be identified at the species or stock level, and may be grouped into complexes. Consistent with National Standard 9, MSA section 303(b)(12), and other applicable MSA sections, management measures can be adopted in order to, for example, collect data on the EC species, minimize bycatch or bycatch mortality of EC species, protect the associated role of EC species in the ecosystem, and/or to address other ecosystem issues.

(6) A stock or stock complex may be identified in more than one FMP. In this situation, the relevant Councils should choose which FMP will be the primary FMP in which reference points for the stock or stock complex will be established. In other FMPs, the stock or stock complex may be identified as "other managed stocks" and management measures that are consistent with the objectives of the primary FMP can be established.

(7) Councils should periodically review their FMPs and the best scientific information available and determine if the stocks are appropriately identified. As appropriate, stocks should be reclassified within an FMP, added to or removed from an existing FMP, or added to a new FMP, through an FMP amendment that documents the rationale for the decision.

The table below lays out the NS non-exhaustive list of 10 factors a Council should consider when deciding whether stocks require conservation and management, and includes some considerations for each factor's relevance to squid.

Table 2-2-1: NS Guidance re: Whether Stocks Require Conservation and Management and Application to Squid

NS non-exhaustive list of factors a Council should consider when deciding whether stocks require conservation and management	Relevance to squid in Alaska
(i) The stock is an important component of the marine environment.	- Squid are an important prey species for marine mammals, fish, and other squid. (§ 3.2.2)

NS non-exhaustive list of factors a Council should consider when deciding whether stocks require conservation and management	Relevance to squid in Alaska
(ii) The stock is caught by the fishery.	- Squid are caught incidentally in the BSAI and GOA groundfish fisheries. (§ 1.1)
(iii) Whether an FMP can improve or maintain the condition of the stock.	- Squid are short-lived and highly productive (§ 3.2.1.1) - Bottom trawl surveys are considered substantial underestimates of true squid biomass in both the BSAI and GOA. (§ 3.2.5) - Fishing related mortality is extremely low compared with the estimated predation mortality in food web models. (Figure 3-6) - In the absence of a directed fishery, squid are very unlikely to become overfished. (§ 3.2.5) - Therefore, maintaining squid as a target species in the FMPs for conservation and management is not likely to improve or maintain stock condition.
(iv) The stock is a target of a fishery.	- While squid are currently classified as a target species, NMFS has not established a directed fishery for squid since squid were included in the GOA and BSIA FMPs. Therefore, squid is not actively "targeted." Squid bycatch is retained in some fisheries and often used to prevent waste. (§ 1.1)
(v) The stock is important to commercial, recreational, or subsistence users.	- Squid is not considered important to commercial, recreational, or subsistence users, however there is some limited use of squid as bait. (§ 4.6.2.1)

NS non-exhaustive list of factors a Council should consider when deciding whether stocks require conservation and management	Relevance to squid in Alaska
(vi) The fishery is important to the Nation or to the regional economy.	- Squid has limited economic value relative to many of the BSAI and GOA groundfish and is not considered an important fishery to the Nation or to the regional economy. - Nearly all of the squid harvested and retained are caught incidental to the directed pollock fishery by CVs. Relative to the value of the pollock fishery, squid are significantly smaller in value. **- The ex vessel price of CV-caught squid for all product forms combined (not including fish meal) in the BSAI has ranged from a low of $0.03 per pound for 2006, 2007, and 2013, to a high of $0.18 per pound in 2014. (Table 4-7Ex vessel price of CV caught squid for both all product forms combined (not including fish meal) and fish meal for both AFA and non-AFA sectors for BSAI and GOA from 2006 through 2015** -In GOA, ex vessel price for all product forms (not including fish meal) has ranged from a low of $0.05 per pound in 2008 and 2013, to a high of $0.10 per pound in 2015. (Table 34**).**
(vii) The need to resolve competing interests and conflicts among user groups and whether an FMP can further that resolution.	-There is no directed fishery for squid, no allocations to various user groups, and no competing interests or conflicts among user groups related to squid. - Therefore, there is no conflict for an FMP to resolve.

NS non-exhaustive list of factors a Council should consider when deciding whether stocks require conservation and management	Relevance to squid in Alaska
(viii) The economic condition of a fishery and whether an FMP can produce more efficient utilization.	- Squid has limited economic value relative to many of the BSAI and GOA groundfish. (§ 4.6.2.1) - Maintaining squid as a target species in the FMPs is unlikely to affect utilization because there is no directed fishery and maintaining squid in the FMP would not be expected to change the economic condition of the fishery.
(ix) The needs of a developing fishery, and whether an FMP can produce more efficient utilization.	- There is no current developing fishery for squid in the EEZ off Alaska, or in State of Alaska (State) waters.
(x) The extent to which the fishery is already adequately managed by states, by state/Federal programs, or by Federal regulations pursuant to other FMPs or international commissions, or by industry self-regulation, consistent with the requirements of the Magnuson-Stevens Act and other applicable law.	- Currently, there is no directed fishery authorized in State or Federal waters. Within State waters, the State's current practice is to adopt the MRAs established for the federal fisheries in the State parallel fisheries and the State would likely adopt the Council's selected squid MRA as it has with the existing MRA.

In accordance with the NS Guidelines, factors 1-3 in the table above should be considered first when the Council is determining whether squid need conservation and management. With regard to the first factor, any marine species could be considered an important component of the marine ecosystem. Similarly, with regard to the second factor, squid are one of many species caught incidentally in trawl fisheries, so this fact is not unique to squid. And finally, regarding the third factor and considering the MSA's definition of "conservation and management," squid are not in need of rebuilding, they are not targeted as a food product in Alaska, there are no conservation concerns to avoid, and future uses of squid remain available. Therefore, as noted above, maintaining squid as a target species in the FMPs for conservation and management is not likely to improve or maintain stock condition.

The decision of whether conservation and management is needed for a fishery and how that fishery should be defined remains within the authority and discretion of the relevant Council or the Secretary, as

appropriate. Stocks that require conservation and management need status determination criteria, other reference points, ACL mechanisms, and AMs; EC species would not need them.

The Council should consider measures for the fishery to minimize incidental catch and mortality of EC species consistent with National Standard 9, and to protect their role in the ecosystem. EC species do not require specification of biological reference points, but should be monitored as new, pertinent scientific information becomes available to determine changes in their status or their vulnerability to the fishery. By prohibiting directed fishing, maintaining the MRA, and maintaining record keeping and reporting requirements, the status quo would effectively be maintained while precluding any significant increase in bycatch. Retention of record keeping and reporting would provide information necessary should bycatch increase and conservation and management become necessary.

2.2.2 Rationale for selection of the preferred alternative

In June 2017, the Council selected Alternative 2, Option 3 as its preferred alternative in both the BSAI and the GOA. In doing so, the Council reviewed the scientific information in the analysis, referenced the newly revised National Standard guidelines which provide additional clarification on determining to what extent a stock requires conservation and management. The new National Standard guidelines aid the Council in determining whether a stock requires conservation and management. The Council also considered the 10 National Standards for consistency with this action as noted in Section 5 of this analysis.

In selecting the preferred alternative, the Council also revised the purpose and need statement slightly to clarify that the key decision point facing the Council was to identify the appropriate level of conservation and management for squid based on the best available scientific information. As noted throughout the analysis, there are no conservation concerns for squids. Squids are short-lived and highly productive. Bottom trawl surveys are considered substantial underestimates of true squid biomass in both the BSAI and GOA. Fishing related mortality is extremely low compared with the estimated predation mortality in food web models. In the absence of a directed fishery, squid are very unlikely to become overfished. There are no directed commercial fisheries for squid in Federal waters and squid are not directly important to the national or regional economy.

While squids are an important component of the marine ecosystem as a prey species, they are not in need of rebuilding, they are not targeted as a food product in Alaska, there are no conservation concerns to avoid, and future uses of squid remain available. Therefore, maintaining squid in a Federal FMP for conservation and management is not likely to improve or maintain the condition of the stock.

The Ecosystem Component species do not require specification of biological reference points, but should be monitored as new, pertinent scientific information becomes available to determine changes in their status or their vulnerability to the fishery. By prohibiting directed fishing, maintaining the MRA, and maintaining record keeping and reporting requirements, the status quo will effectively be maintained while precluding any significant increase in bycatch. Although squid do not require conservation and

management, it is still appropriate to take measures to minimize squid bycatch to the extent practicable. This is consistent with National Standard 9 and the Council's long-standing practice of minimizing the bycatch of species such as forage fish and grenadiers that are important to the ecosystem but that do not require conservation and management.

The preferred alternative would maintain the current MRA of 20%, Option 3, rather than imposing a more stringent MRA because a more restrictive MRA does not appear necessary. Table 3-20 and Section 4.6.2 note that the vast majority of time squid bycatch represents a small proportion of total catch in the pollock fishery, the fishery with the greatest amount of squid bycatch. There is no evidence suggesting "topping off" for squid. A more restrictive MRA would not be expected to further reduce squid bycatch, but could impose additional monitoring and enforcement costs if a 2% or 10% MRA were exceeded.

Maintaining record keeping and reporting requirements will provide information necessary should bycatch increase and conservation and management become necessary. Furthermore, as noted by the Council in selection of the preferred alternative, this action would not preclude the Council from moving squid out of the ecosystem component category and into a different management classification should conservation and management be required.

2.3 Alternative 3: Designate squid in both BSAI and GOA FMPs as non-target species. Establishment of a squid TAC will no longer be required.

This alternative would designate squids in both BSAI and GOA groundfish FMPs as a 'non-target' species complex whereby OFL and ABC would still be established but a TAC would no longer be necessary. Directed fishing for squids would be prohibited. Recordkeeping and reporting would be required under this alternative to monitor catch of squid species annually. A periodically updated stock assessment for squids in both the GOA and BSAI would also be provided under this alternative to provide OFL and ABC recommendations. This would be completed on the recommended assessment frequency timing decided upon by the Council and the Alaska Fisheries Science Center.

As with Alternative 2, this alternative would also establish a squid maximum retainable amount (MRA) for squids as incidental catch in the BSAI and GOA using the MRAs in Tables 10 and 11 of 50 CFR 679 when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries. Three options for MRAs are considered

Option 1 MRA = 2%
Option 2 MRA = 10%
Option 3 MRA = 20%

2.4 MSA provisions for short-lived species

Certain short-lived species may fall under the statutory exception from the requirement in MSA section 303(a)(15) to set ACLs and AMs. This exception states that the requirement for ACLs "shall not apply to a fishery for species that have a life cycle of approximately 1 year unless the Secretary has determined the fishery is subject to overfishing of that species" (Pub. L. 109-479(b)(2)). Squid may fall under this exception because they are extremely short-lived and highly productive, and it is very unlikely that squid could be overfished in the absence of a directed fishery. However, they would still be required to have an OFL and an ABC as noted under the required provisions for FMPs under MSA section 303(a).

This statutory language is bolstered by the NS1 Guidelines, which discuss the exclusion from ACL and AM requirements via the life cycle exception. The Guidelines under section 600.310(h)(1) state, "[w]hile exempt from the ACL and AM requirements, FMPs or FMP amendments for these stocks must have SDC, MSY, OY, ABC, and an ABC control rule."

The use of this statutory provision would lead to an outcome similar to that described under Alternative 3 in this analysis, wherein squid would be designated a non-target species still in need of conservation and management and still required to have an ABC and OFL.

2.5 Comparison of Alternatives

Table 2-2 provides a summary of the three alternatives, and options considered in this action.

Table 2-2: Summary of Management Measures in Alternatives 1, 2, and 3

Management Measure	**Alt 1- No Action**	**Alt 2 - Ecosystem Component [Preferred Alternative]**	**Alt 3 – Non-target**
Prohibit a Directed Fishery	**No** However, NMFS has not opened squid to directed fishing	**Yes** prohibit directed fishing in regulations at 679.20(i)	**Yes** prohibit directed fishing in regulations at 679.20(i)
Retention and sale	**Yes** Retention and sale allowed.	**Yes** Some small amount can be retained and sold.	**Yes** Some small amount can be retained and sold
Annual Harvest Specifications	**Yes** - annual stock assessment - TAC assessed in optimum yield	**No** - Periodic stock assessment - catch not assessed in optimum yield	**Yes** - Periodic stock assessment - OFL and ABC established but no TAC - catch not assessed in optimum yield
Incidental Catch Management	**Yes** - MRA as incidental catch species = 20%	**Yes** - MRA as incidental catch species = options for **20% (preferred alternative)**, 10%, 2%	**Yes** - MRA as incidental catch species = options for 20%, 10%, 2%
Recordkeeping and Reporting	**Yes** - require catch reporting	**Yes** - require catch reporting	**Yes** - require catch reporting

3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Chapter 1, and the alternatives in Chapter 2. This chapter addresses the probable environmental impacts of the proposed action and alternatives. A list of agencies and persons consulted is included in Chapter 6.

This chapter evaluates the direct, indirect, and cumulative impacts of the alternatives and options on the various resource components. The socio-economic impacts of this action are described in detail in the Regulatory Impact Review (RIR) portion of this analysis (Chapters 4).

Recent and relevant information, necessary to understand the affected environment for each resource component, is summarized in the relevant section. For each resource component, the analysis identifies the potential impacts of each alternative, and uses criteria to evaluate the significance of these impacts. If significant impacts are likely to occur, preparation of an EIS is required. Although an EA should evaluate economic and socioeconomic impacts that are interrelated with natural and physical environmental effects, economic and social impacts by themselves are not sufficient to require the preparation of an EIS (see 40 CFR 1508.14).

An environmental assessment must consider cumulative effects when determining whether an action significantly affects environmental quality. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

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

The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the CEQ guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful.

3.1 Methods

3.1.1 Documents incorporated by reference in this analysis

This EA relies heavily on the information and evaluation contained in previous environmental analyses, and these documents are incorporated by reference. The documents listed below contain information about the fishery management areas, fisheries, marine resources, ecosystem, social, and economic

elements of the groundfish fisheries. They also include comprehensive analysis of the effects of the fisheries on the human environment, and are referenced in the analysis of impacts throughout this chapter.

Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007).

This EIS provides decision makers and the public an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the GOA and the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the groundfish fishery. The EIS examines alternative harvest strategies that comply with Federal regulations, the Fishery Management Plan (FMP) for Groundfish of the GOA, the Fishery Management Plan (FMP) for Groundfish of the BSAI Management Area, and the Magnuson-Stevens Fishery Conservation and Management Act. These strategies are applied using the best available scientific information to derive the total allowable catch (TAC) estimates for the groundfish fisheries. The EIS evaluates the effects of different alternatives on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. A Supplemental Information Report was prepared in 2016 which considers new information, and affirms that the 2016 and 2017 harvest specifications, which were set according to the preferred harvest strategy, do not constitute a change in the action; and (2) the information presented does not indicate that there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. These documents are available from https://alaskafisheries.noaa.gov/fisheries/groundfish-harvest-specs-eis.

Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the BSAI/GOA (NPFMC 2015a, 2015b).

Annual SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. The SAFE report includes the acceptable biological catch (ABC) specifications used by NMFS in the annual harvest specifications. The SAFE report also summarizes available information on the ecosystems and the economic condition of the groundfish fisheries off Alaska. This document is available from http://www.afsc.noaa.gov/refm/stocks/assessments.htm.

Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004).

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole, and includes analysis of alternative management strategies for the GOA and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries. The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. A Supplemental Information Report (NPFMC and NMFS 2015) was prepared in 2015 which considers new information, and affirms that new information does not indicate that there is now a significant impact from the groundfish fisheries where the 2004 PSEIS

concluded that the impact was insignificant. The PSEIS document is available from https://alaskafisheries.noaa.gov/node/33552, and the Supplemental Information Report from https://alaskafisheries.noaa.gov/sites/default/files/sir-pseis1115.pdf.

Final Bering Sea Chinook Bycatch Management Environmental Impact Statement (EIS) (NMFS 2009)

This EIS provides decision-makers and the public with an evaluation of the environmental effects of alternative measures to minimize Chinook salmon bycatch in the Bering Sea pollock fishery. The alternatives analyzed in this EIS generally involve limits or "caps" on the number of Chinook salmon that may be caught in the Bering Sea pollock fishery and closure of all or a part of the Bering Sea to pollock fishing once the cap is reached. These closures would occur when a Chinook salmon bycatch cap is reached, even if the entire pollock total allowable catch has not yet been harvested. The EIS document is available from https://alaskafisheries.noaa.gov/fisheries/chinook-eis.

Final EA for Bering Sea Chinook salmon and Chum salmon bycatch management measures (NMFS 2016)

This Environmental Assessment/Regulatory Impact Review analyzes proposed management measures to address bycatch of Chinook salmon and chum salmon in the Bering Sea pollock fishery. The measures under consideration include modifying chum salmon bycatch management within existing industry incentive plan agreements, adding more incentives to avoid Chinook salmon, modifying season lengths for the summer pollock fishery, and reducing the prohibited species catch limit and/or performance standard threshold implemented in the existing Chinook salmon bycatch management program. All of the alternatives were designed to improve the current management for chum salmon and Chinook salmon bycatch by providing pollock fishery participants opportunities for increased flexibility to respond to changing conditions and greater incentives to minimize bycatch of both salmon species, to the extent practicable. This EA is available from https://alaskafisheries.noaa.gov/sites/default/files/analyses/bsai110finalearir.pdf.

3.1.2 Resource components addressed in the analysis

Table 3-1 shows the components of the human environment and whether the proposed action and its alternatives have the potential to impact that resource component and thus require further analysis. Extensive environmental analysis on all resource components is not needed in this document because the proposed action is not anticipated to have environmental impacts on all resource components.

The effects of the alternatives on the resource components would be caused by the removal of catch specifications for squid and the relaxation of potential constraints on the groundfish fisheries in the BSAI and GOA, particularly the pollock fisheries as the squid bycatch in the BSAI and GOA is primarily taken in the pollock fishery (e.g. 94% of squid in the BSAI is in the pollock target and 90% of squid in the GOA in 2015 in the pollock target (Ormseth 2016a, Ormseth 2016b). Thus, the alternatives have the potential to affect squids, salmon, herring, and social and economic components.

No effects are expected on marine mammals, seabirds, habitat, and the ecosystem. No effect is presumed for these components because current fishing regulations (e.g., season and gear types), harvest limits, or regulations protecting habitat and important breeding areas as described in previous NEPA documents (NMFS, 2004, NPFMC and NMFS 2015) would not be changed by any of the alternatives. No effects are presumed for marine mammals because existing protection measures would not be changed, nor would allowable harvest amounts for important prey species. The alternatives do not change the amount of pollock catch available for prosecution by the pollock fisheries in the GOA and BSAI nor the amount of squid caught annually as squid will continue to be caught incidentally similar to status quo. The relaxation of the potential constraint by moving squid into the EC category would only potentially impact squid management and the pollock fisheries responses to avoiding salmon bycatch. No change in any other groundfish fishery is anticipated as a result of this action as the pollock fisheries take over 90% of squid incidental catch in both FMPs. As a result, further analysis is included only for groundfish (squid), prohibited species (salmon, herring) and social and economic components, the only resource components which the proposed action may impact. Note that impacts to 'Ecosystem Component species' are addressed under Squid impacts (see section Effects of the Alternatives on Squid3.2.5) as there is no expected impact to other EC species (outside of salmon and herring which are addressed under Prohibited Species) under either Alternative 1 or 2.

Table 3-1: Resources potentially affected by the proposed action and alternatives.

Potentially affected resource component							
Groundfish	**Prohibited Species**	**Ecosystem Component Species**	**Marine Mammals**	**Seabirds**	**Habitat**	**Ecosystem**	**Social And economic**
Y-squid N-groundfish	Y-Salmon Y-Herring N-others	N	N	N	N	N	Y

N = no impact anticipated by each alternative on the component.

Y = an impact is possible if each alternative is implemented.

3.1.3 Methods used for the impact analysis

Data was sourced by using NMFS Alaska Region Catch Accounting System in Comprehensive_BLEND_CA, ADFG Commercial Operators Annual Report in

Comprehensive_ENCOAR_PROD and ADFG/CFEC Fish Ticket in Comprehensive_FT. The Comprehensive datasets are compiled by AKFIN. Catch Accounting was utilized to show total catch and total retained amounts. Fish Tickets provided the amount of retained fish coded as fish meal, is discarded by the processor or is processed into a product other than fish meal. Ex vessel values and prices were also provided by Fish Tickets. The Commercial Operators Annual Report provided product types, amounts and values.

3.1.4 Cumulative effects analysis

This EA analyzes the cumulative effects of each alternative and the effects of past, present, and reasonably foreseeable future actions (RFFA). Based on Table 3, the resources with potentially meaningful cumulative effects are groundfish, prohibited species, ecosystem component species, and social and economic components. The cumulative effects on the other resources have been analyzed in numerous documents and the impacts of this proposed action and alternatives on those resources is minimal, therefore there is no need to conduct an additional cumulative impacts analysis.

Each section below provides a review of the relevant past, present, and RFFA that may result in cumulative effects on the resource components analyzed in this document. A complete review of the past, present, and RFFAs are described in the prior NEPA documents incorporated by reference and the supplemental information report (SIR) NMFS prepares to annually review of the latest information since the completion of the Alaska Groundfish Harvest Specifications EIS. SIRs have been developed since 2007 and are available on the NMFS Alaska Region website. Each SIR describes changes to the groundfish fisheries and harvest specifications process, new information about environmental components that may be impacted by the groundfish fisheries, and new circumstances, including present and reasonably foreseeable future actions. NMFS reviews the reasonably foreseeable future actions described in the Harvest Specifications EIS each year to determine whether they occurred and, if they did occur, whether they would change the analysis in the Harvest Specifications EIS of the impacts of the harvest strategy on the human environment. In addition, NMFS considered whether other actions not anticipated in the Harvest Specifications EIS occurred that have a bearing on the harvest strategy or its impacts. The SIRs provide the latest review of new information regarding Alaska groundfish fisheries management and the marine environment since the development of the Harvest Specifications EIS and provide cumulative effects information applicable to the alternatives analyzed in this EA.

Actions are understood to be human actions (e.g., a designation of northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This requirement is interpreted to indicate actions that are more than merely possible or speculative. In addition to these actions, this cumulative effects analysis includes the effects of climate change.

Actions are considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or NMFS's publication of a proposed rule. Actions

only "under consideration" have not generally been included, because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives.

3.2 Squid

Squid are marine mollusks in the class Cephalopoda (Group Decapodiformes). They are streamlined animals with ten appendages (2 tentacles, 8 arms) extending from the head, and lateral fins extending from the rear of the mantle. Squid are active predators which swim by jet propulsion, reaching swimming speeds up to 40 km/hr, the fastest of any aquatic invertebrate. Squid also hold the record for largest size of any invertebrate (Barnes 1987).

In the BSAI and GOA regions there are at least 15 species of squid (Table 1). The most abundant species is *Berryteuthis magister* (magistrate armhook squid; Figure 3-1). Members of these 15 species come from six families in two orders and can be found from 10 m to greater than 1500 m. All but one, *Rossia pacifica* (North Pacific bobtail squid), are pelagic but *Berryteuthis magister* and *Gonatopsis borealis* (boreopacific armhook squid) are often found in close proximity to the bottom. The vertical distribution of these three species is the probable cause of their predominance in the NMFS bottom trawl surveys relative to other squid species, although no squid species appear to be well-sampled by NMFS surveys. Most species are associated with the slope and basin, with the highest species diversity along the slope region of the Bering Sea between 200 – 1500 m. Since most of the data come from groundfish survey bottom trawls, the information on abundance and distribution of those species associated with the bottom is much more accurate than that of the pelagic species (Ormseth, 2016b).

Table 3-2: Taxonomic grouping of squid species found in the BSAI and GOA.

Class Cephalopoda; Order Oegopsida	
Family Chiroteuthidae	
Chiroteuthis calyx	
Family Cranchiidae	"glass squid"
Belonella borealis	
Galiteuthis phyllura	
Family Gonatidae	"armhook squid"
Berryteuthis anonychus	minimal armhook squid
Berryteuthis magister	magistrate armhook squid
Eogonatus tinro	
Gonatopsis borealis	boreopacific armhook squid
Gonatus berryi	Berry armhook squid
Gonatus madokai	
Gonatus middendorffi	
Gonatus onyx	clawed armhook squid

Family Onychoteuthidae	"hooked squid"
Moroteuthis robusta	robust clubhook squid
Onychoteuthis borealijaponicus	boreal clubhook squid
Class Cephalopoda; Order Sepioidea	
Rossia pacifica	North Pacific bobtail squid

Figure 3-1: *Berryteuthis magister*, the magistrate armhook or red squid.

3.2.1 Status

3.2.1.1 Life history

The life histories of squids in this area are almost entirely unknown (Ormseth, 2016b). Of all the species, only *Rossia pacifica* has benthic larvae and only members of the family Gonatidae and Cranchiidae are known to spawn in the Bering Sea region.

Life history information for BSAI squid can be inferred from data on squid species elsewhere. Relative to most groundfish, squid are highly productive, short-lived animals. They display rapid growth, patchy distribution and highly variable recruitment (O'Dor, 1998). Unlike most fish, squid may spend most of their life in a juvenile phase, maturing late in life, spawning once, and dying shortly thereafter. Many squid populations are composed of spatially segregated schools of similarly sized (and possibly related) individuals, which may migrate, forage, and spawn at different times of year over a wide geographic area (Lipinski 1998; O'Dor 1998). Most information on squid refers to *Illex* and *Loligo* species which support

commercial fisheries in temperate and tropical waters. Of North Pacific squid, life history is best described for western Pacific stocks (Arkhipkin et al., 1995; Osako and Murata, 1983).

The most commercially important squid in the north Pacific is the magistrate armhook squid, *Berryteuthis magister*. This species is distributed from southern Japan throughout the Bering Sea, Aleutian Islands, and Gulf of Alaska to the U.S. west coast as far south as Oregon (Roper et al. 1984). A study completed in 2008 investigated life history and stock structure of this species in the EBS (Drobny 2008). In the EBS, *B. magister* appear to have an approximately 1-year life cycle. *B. magister* in the EBS appear to grow and mature more quickly than their conspecifics in Russian and Japanese waters. Squid growth appears to be heavily influenced by ocean temperature (Forsythe 2004), which may account for some of the regional and temporal variability.

Populations of *B. magister* and other squid are complex, being made up of multiple cohorts spawned throughout the year. *B. magister* are dispersed during summer months in the western Bering Sea, but form large, dense schools over the continental slope between September and October. Three seasonal cohorts are identified in the region: summer-hatched, fall-hatched, and winter-hatched. Growth, maturation, and mortality rates vary between seasonal cohorts, with each cohort using the same areas for different portions of the life cycle. Juvenile and adult *B. magister* also appear to be separated vertically in the water column.

3.2.1.2 Trawl survey biomass estimates and distribution

The AFSC bottom trawl surveys are directed at groundfish species, and therefore do not employ the appropriate gear or sample in the appropriate places to provide reliable biomass estimates for most squid, which are generally pelagic or, if demersal, reside off bottom. The largest biomass of squid is found at depths below 200 m (Horne and Parker-Stetter 2010). Catches of squid in the EBS shelf survey are highly variable, and it is likely that few squid inhabit the bottom waters of the shelf (Ormseth, 2016b). The EBS slope survey, which samples the shelf break area and much deeper waters, generally catches greater numbers of squid (Table 3-3). *B. magister*, *G. borealis*, and *R. pacifica* are the most common squid in the slope survey (Ormseth, 2015b). In the AI, *B. magister* is the only squid species captured in abundance (Table 3-3).

Biomass estimates for the GOA have fluctuated considerably since 1984, with the 2015 biomass estimate (14,079 t) the highest ever observed (Table 3-4; Ormseth, 2015a). The survey also almost certainly underestimates squid biomass. For example, a mass-balance ecosystem model of the GOA estimates the squid population at 369,309 t (Ormseth, 2016a).

Squid records from these surveys tend to appear at the edges of the continental shelf in the eastern Bering Sea and in the Aleutian Islands (Figure 3-2). This is consistent with results from 1988 and 1989 Japanese / U.S. pelagic trawl research surveys in the EBS that indicated that the majority of squid biomass is distributed in pelagic waters off the continental shelf (Sinclair et al. 1999), beyond the current scope of the AFSC surveys. It is also consistent with the observation that the largest biomass of squid is found at

depths below 200 m (Horne and Parker-Stetter 2010). Catches of squid in the EBS shelf survey are highly variable, and it is likely that few squid inhabit the bottom waters of the shelf Table 3-3). The EBS slope survey, which samples the shelf break area and much deeper waters, generally catches greater numbers of squid. *B. magister*, *G. borealis*, and *R. pacifica* are the most common squid in the slope survey. In the AI, *B. magister* is the only squid species captured in abundance (Ormseth, 2016).

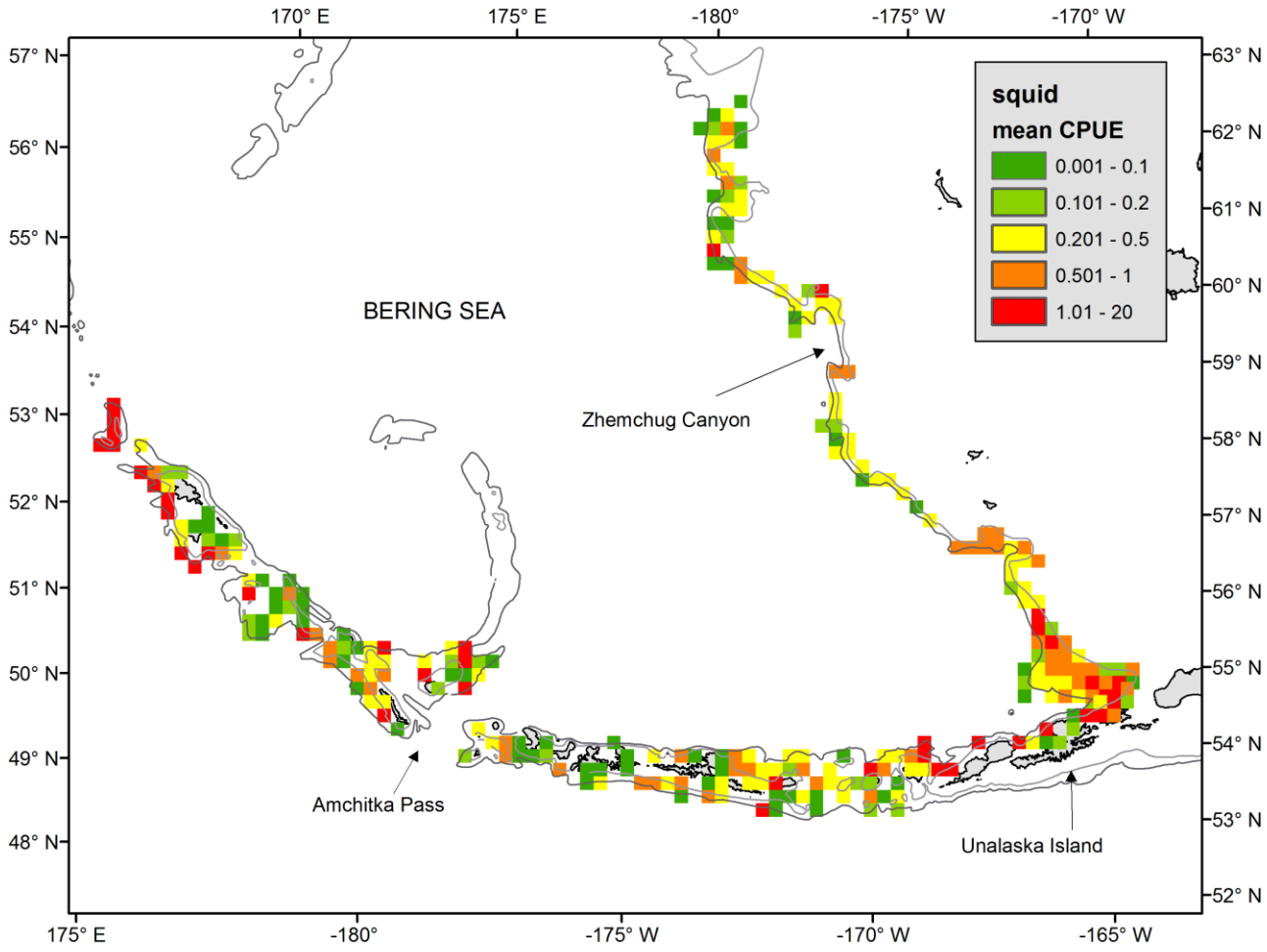

Figure 3-2: Mean trawl survey CPUE of all squid species combined in the BSAI, 2000-2012. Grid cells are 20 km X 20 km.

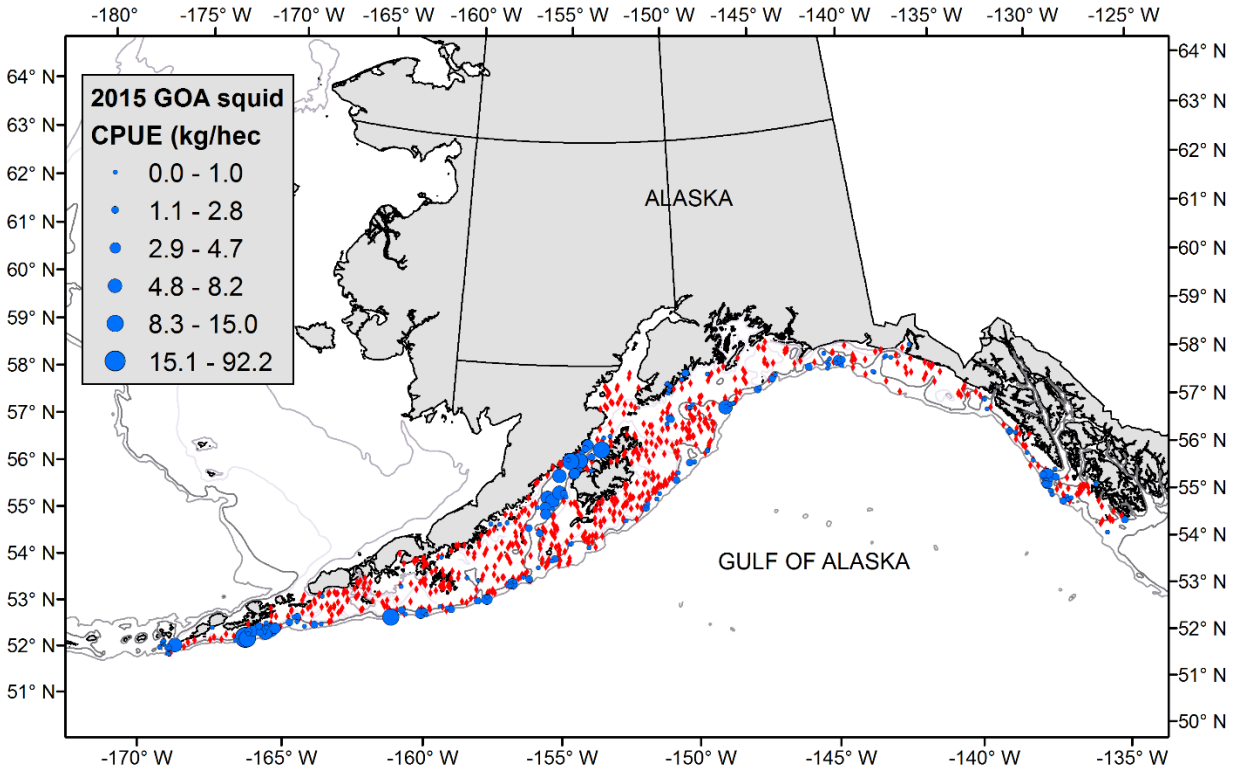

Figure 3-3: Distribution of survey catches of all squid in the GOA during 2015. Red diamonds indicate hauls with no squid catch.

Table 3-3: Survey biomass estimates ("bio", in metric tons) and coefficients of variation (CV) for the EBS shelf, EBS slope, and AI. Estimates are included for the principal species caught in each survey. Numerous species occur on the slope and are included in the "total squid" category for that region. From Ormseth, 2016a

	EBS shelf				**EBS slope**								**AI**	
	R. pacifica		*B. magister*		*R. pacifica*		*B. magister*		*G. borealis*		misc. squid		*B magister*	
	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV
1983	100	0.32	0	-									9,557	0.33
1984	61	0.30	14	0.94										
1985	4	0.75	13	1.00										
1986	34	0.35	0	-									15,761	0.51
1987	46	0.41	80	1.00										
1988	97	0.63	0	-										
1989	3	1.00	0	-										
1990	5,680	0.99	0	-										
1991	0	-	0	-									28,934	0.89
1992	0	-	0	-										
1993	0	-	0	-										
1994	0	-	0	-									11,084	0.84

	EBS shelf				**EBS slope**								**AI**	
	R. pacifica		*B. magister*		*R. pacifica*		*B. magister*		*G. borealis*		misc. squid		*B magister*	
	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV
1995	6	0.70	0	-										
1996	23	0.42	0	-										
1997	3	1.00	0	-									2,689	0.24
1998	60	0.46	0	-										
1999	19	0.48	0	-										
2000	13	0.45	42	0.82									2,758	0.18
2001	20	0.51	280	0.42										
2002	33	0.39	0	-	52	0.18	1,197	0.12	2	0.74	18	0.27	2,088	0.14
2003	27	0.37	16	1.00										
2004	6	0.82	0	-	58	0.19	1,418	0.14	52	0.37	114	0.78	3,250	0.37
2005	13	0.67	0	-										
2006	9	0.74	47	1.00									1,467	0.14
2007	11	0.71	0	-										

	EBS shelf				**EBS slope**								**AI**	
	R. pacifica		*B. magister*		*R. pacifica*		*B. magister*		*G. borealis*		misc. squid		*B magister*	
	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV	bio	CV
2008	8	0.52	0	-	35	0.33	1,675	0.10	52	0.41	22	0.26		
2009	19	0.41	623	1.00										
2010	42	0.60	9	1.00	67	0.25	1,831	0.10	8	0.32	17	0.36	2,444	0.22
2011	25	0.51	1	1.00										
2012	25	0.43	43	1.00	42	0.23	1,284	0.09	13	0.40	7	0.33	4,011	0.28
2013	146	0.84	28	1.00										
2014	21	0.49	0	-									6,178	0.30
2015	91	0.40	61	0.66										
2016	41	0.52	7	1.00	29	0.30	1,127	0.20	7	0.30	48	0.14	3,808	0.38

Table 3-4: Biomass estimates (t) of squid species from NMFS GOA bottom trawl surveys, 1984-2015. CV = coefficient of variation. From Ormseth, 2015b.

	miscellaneous squid		*B. magister*		all squid	
year	biomass (t)	CV	biomass (t)	CV	biomass (t)	CV
1984	546	0.35	2,762	0.15	3,308	0.14
1987	577	0.30	4,506	0.34	5,083	0.30
1990	276	0.43	4,033	0.17	4,309	0.16
1993	1,029	0.73	8,447	0.13	9,476	0.14
1996	26	0.28	4,884	0.14	4,911	0.14
1999	254	0.46	1,873	0.13	2,127	0.13
2001	703	0.62	5,909	0.30	6,612	0.27
2003	71	0.23	6,251	0.18	6,322	0.18
2005	249	0.51	4,654	0.18	4,903	0.18
2007	359	0.49	11,681	0.20	12,040	0.20
2009	188	0.61	8,415	0.16	8,603	0.16
2011	392	0.65	4,040	0.13	4,431	0.14
2013	568	0.80	9,675	0.16	10,243	0.16

	miscellaneous squid		*B. magister*		all squid	
year	biomass (t)	CV	biomass (t)	CV	biomass (t)	CV
2015	387	0.65	13,692	0.12	14,079	.12

Table 3-5: Biomass estimates and coefficients of variation (CV) for all squid combined in 6 depth zones of the GOA. Estimates are annual trawl survey estimates (surv est) or estimates from a random effects model fitted to each survey time series (RE est).

	GOA squid 1-100 m				GOA squid 101-200 m				GOA squid 201-300 m				GOA squid 301-500 m				GOA squid 501-700 m				GOA squid 701-1000 m			
	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV
1984	7	0.66	13	0.66	65	0.33	79	0.32	210	0.22	226	0.21	2,180	0.20	2,176	0.19	381	0.28	274	0.30	464	0.21	430	0.21
1985			34	0.82			115	0.45			409	0.53			2,156	0.39			207	0.30			258	0.50
1986			89	0.78			167	0.45			742	0.56			2,136	0.43			156	0.32			154	0.55
1987	301	0.54	233	0.49	233	0.40	243	0.33	1,797	0.41	1,343	0.37	2,609	0.47	2,117	0.36	75	0.32	118	0.34	69	0.48	92	0.45
1988			335	0.76			371	0.45			1,267	0.57			1,782	0.42			119	0.40			82	0.68
1989			482	0.74			567	0.45			1,195	0.56			1,500	0.38			120	0.45			73	0.82
1990	892	0.39	694	0.39	1,306	0.35	867	0.34	966	0.33	1,127	0.31	1,145	0.18	1,263	0.18			122	0.48			64	0.91
1991			336	0.74			668	0.44			1,799	0.54			1,772	0.37			123	0.49			57	0.97
1992			163	0.78			514	0.41			2,871	0.52			2,486	0.38			124	0.50			51	1.00

	GOA squid 1-100 m				GOA squid 101-200 m				GOA squid 201-300 m				GOA squid 301-500 m				GOA squid 501-700 m				GOA squid 701-1000 m			
	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV
1993	41	0.64	79	0.59	359	0.25	396	0.23	4,787	0.16	4,583	0.16	4,289	0.24	3,488	0.24			126	0.50			45	1.01
1994			112	0.80			419	0.41			3,778	0.51			2,643	0.38			127	0.49			40	1.00
1995			160	0.79			444	0.41			3,115	0.52			2,002	0.37			129	0.47			35	0.96
1996	278	0.60	228	0.52	487	0.26	471	0.24	2,648	0.22	2,568	0.21	1,498	0.17	1,517	0.16			130	0.44			31	0.90
1997			222	0.77			451	0.41			1,674	0.53			1,243	0.37			132	0.40			28	0.80
1998			217	0.75			432	0.41			1,090	0.53			1,018	0.37			133	0.33			25	0.66
1999	195	0.45	212	0.42	399	0.24	414	0.23	619	0.27	711	0.26	760	0.20	833	0.19	134	0.26	135	0.23	19	0.43	22	0.41
2000			274	0.79			447	0.43			963	0.57			1,013	0.39			137	0.30			24	0.62
2001			353	0.91			484	0.48			1,305	0.63			1,231	0.44			139	0.33			27	0.72

	GOA squid 1-100 m				GOA squid 101-200 m				GOA squid 201-300 m				GOA squid 301-500 m				GOA squid 501-700 m				GOA squid 701-1000 m			
	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV
2002			455	0.86			523	0.44			1,769	0.55			1,496	0.39			142	0.32			31	0.75
2003	1,064	0.75	586	0.63	640	0.27	566	0.25	2,431	0.21	2,397	0.20	2,065	0.20	1,818	0.20	123	0.37	144	0.27			34	0.73
2004			369	0.70			443	0.36			2,871	0.46			1,294	0.32			159	0.27			38	0.64
2005	213	0.43	232	0.39	280	0.26	346	0.25	3,340	0.25	3,438	0.23	855	0.14	920	0.14	163	0.29	175	0.22	53	0.56	43	0.45
2006			201	0.67			498	0.40			4,909	0.46			1,283	0.35			204	0.27			39	0.52
2007	172	0.60	174	0.49	1,064	0.59	717	0.38	7,411	0.20	7,009	0.19	3,017	0.53	1,788	0.35	351	0.41	239	0.27	26	0.52	36	0.43
2008			155	0.68			820	0.42			5,944	0.46			1,804	0.37			238	0.28			47	0.54
2009	123	0.50	138	0.44	1,113	0.33	939	0.29	5,224	0.23	5,041	0.21	1,840	0.23	1,820	0.21	228	0.33	236	0.24	74	0.68	62	0.51
2010			168	0.67			785	0.40			3,304	0.46			1,774	0.32			241	0.29			73	0.66

	GOA squid 1-100 m				GOA squid 101-200 m				GOA squid 201-300 m				GOA squid 301-500 m				GOA squid 501-700 m				GOA squid 701-1000 m			
	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV	surv est	surv CV	RE est	RE CV
2011	197	0.50	203	0.44	463	0.46	657	0.35	1,932	0.24	2,165	0.23	1,639	0.16	1,728	0.15	201	0.61	245	0.29			85	0.74
2012			269	0.67			766	0.40			3,056	0.46			2,473	0.33			259	0.29			100	0.75
2013	376	0.52	355	0.45	961	0.34	893	0.28	4,298	0.21	4,312	0.20	4,315	0.28	3,541	0.25	293	0.35	274	0.25			117	0.70
2014			409	0.65			914	0.37			6,245	0.45			3,243	0.34			279	0.27			138	0.59
2015	483	0.36	470	0.35	943	0.23	937	0.22	9,295	0.17	9,045	0.16	2,899	0.22	2,971	0.21	289	0.28	283	0.24	171	0.34	161	0.33

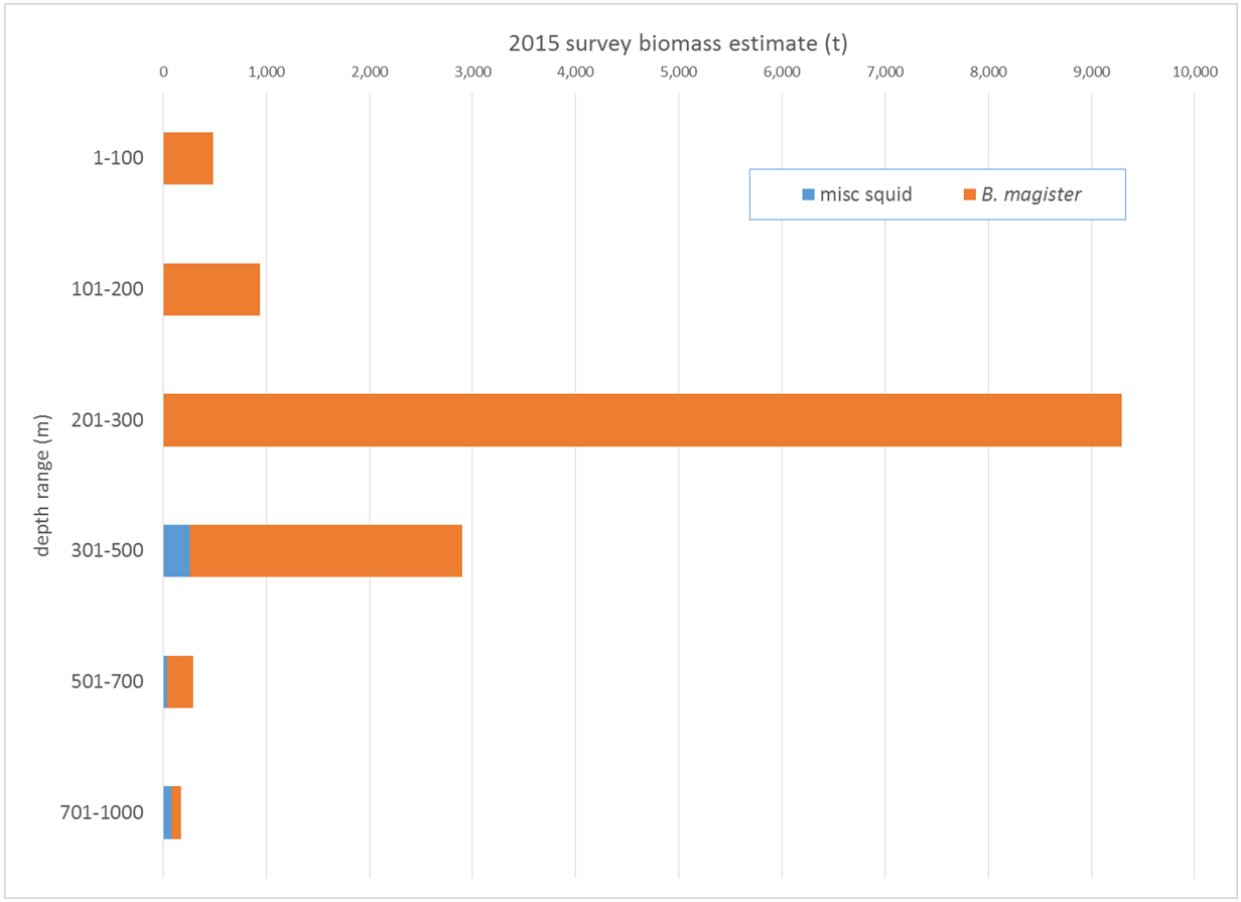

Table 3-6: Distribution by depth of squid observed in the GOA bottom trawl survey in 2015.

3.2.1.3 Size composition

In 2007, fishery observers began collecting data on the mantle length of squid captured in BSAI pollock fisheries. In the GOA, the size composition of squid varies among years and tends to lack a clearly defined size mode, and mantle lengths average less than 20 cm. This is in contrast to data from the BSAI that is consistently dominated by a single size mode at ~21 cm which likely corresponds to mature or maturing adults and a secondary mode at ~7 cm that likely corresponds to juveniles of a separate seasonal cohort (Figure 3-4). Aggregate length compositions in the catch records suggest that the representation of the two modes in the annual catch (whether as a result of differences in species or age) varies among years, and that the primary mode occurs consistently at ~21 cm (Ormseth, 2015b). In the western Bering Sea the size at 50% maturity is 25 cm (Arkhipin et al. 1996), so it is likely that the fishery is capturing mature squid that may soon be spawning.

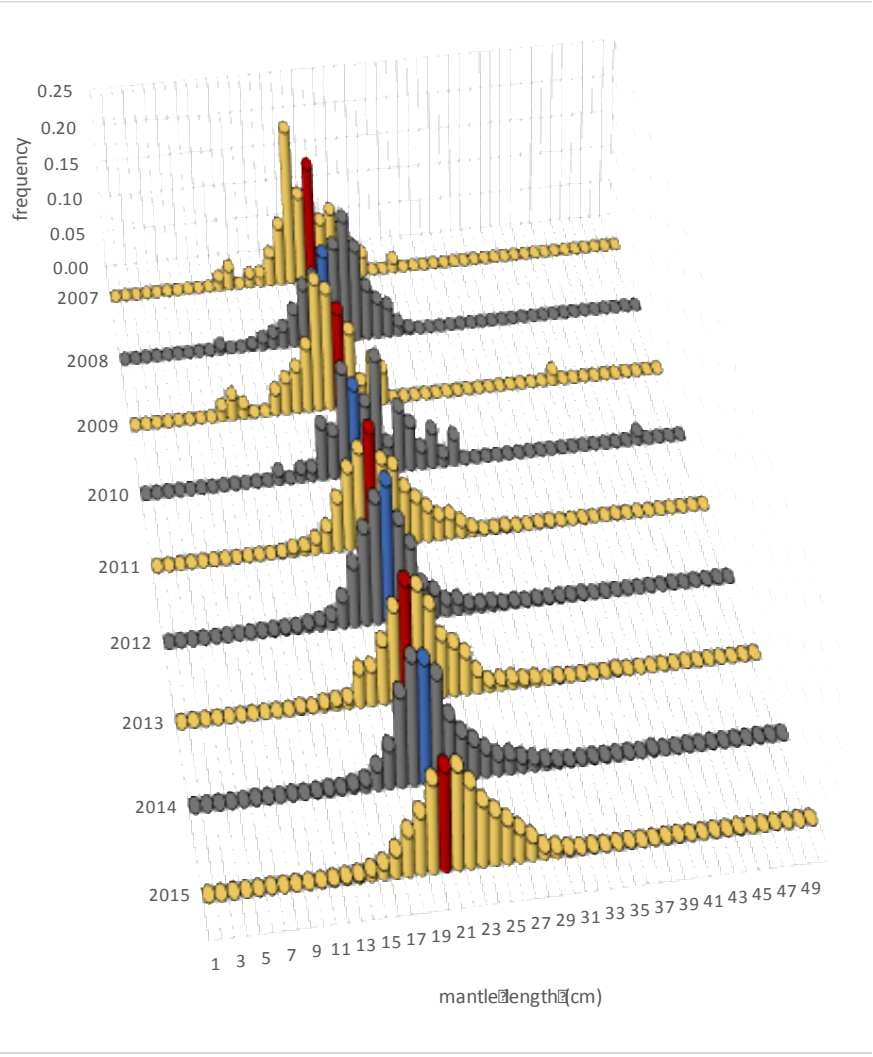

Figure 3-4: Length compositions (frequency at each cm) by year of squid captured during July in BSAI federal fisheries, 2007-2015. Data are from the AFSC's Fishery Monitoring and Analysis program. Individual colored bars (red and blue) indicate the 20-cm size bin.

3.2.1.4 Impacts of water temperature on squid growth

In 2016, the assessment author for BSAI squid provided the BSAI groundfish plan team with an overview of information on environmental effects on squid. The author noted the effect of warm temperatures on growth and maturation of squid, which are very sensitive to changing temperature. Squid are very fast growing, with a strong response to temperature. Warmer temperatures result in faster growth, shorter time to maturity, smaller size at maturity and senescence. Cooler temperatures result in life stages lasting longer. Squid are thus smaller sizes as adults in warmer conditions with the squid maturing quicker and at smaller sizes. It was noted that this high intrinsic growth rate is also dependent on dissolved oxygen and prey availability and may result in increased cohorts possible in warmer years. Additional spatial and temporal investigations are anticipated in the future (Ormseth, pers. comm.).

3.2.2 Squid role in the ecosystem

Squid are important components in the diets of many seabirds, fish, and marine mammals, as well as voracious predators themselves on zooplankton and larval fish (Caddy 1983, Sinclair et al. 1999). The prey and predators of squid depend on their life stage. Adult squid of many species will actively prey upon fish, squid, and crustaceans, while the larvae likely share the same prey items as larval fish, including copepods, euphausiids, and larval fish. Adult squid will be preyed upon by marine mammals, fish, and other squid, whereas, larval and juvenile squid will be taken by fish, squid, and seabirds.

3.2.2.1 Distribution and availability to predators and fisheries

Squid in the BSAI and GOA vary widely in their size and distribution, and these differences influence the extent to which they are susceptible to predation and how they are observed by trawl surveys and fisheries. Three species have vertical distributions that make them more susceptible to surveys and fisheries using bottom trawls: *R. pacifica*, *B. magister*, and *G. borealis* (Table 3-7 and Figure 3-5). *Rossia pacifica* is strictly benthic with behavior similar to octopus (Table 3-7) while adult *B. magister* and *G. borealis* are generally demersal. In addition to increasing their susceptibility to trawls, their association with the bottom makes these species less vulnerable to predators limited in their ability to access great depths (e.g. seabirds, salmon, and northern fur seals *Callorhinus ursinus*). The large size of adult *B. magister* and *G. borealis* similarly limits the number of animals that rely on these species for prey, and sperm whales Physeter microcephalus are thought to be the main predator on adults of these species. The remaining species, particularly members of the genus *Gonatus*, are truly pelagic (Table 3-7 and Figure 3-5) and their vulnerability is the inverse of the deeper species: they are much less likely to be observed in fishery and survey bottom trawls and are more likely to be predated by surface-oriented animals and those with relatively limited diving ability. In addition, the smaller sizes of many of these species makes them vulnerable to a wider range of predators. Juvenile *B. magister* and *G. borealis* have a pelagic distribution. This combined with their small size likely explains the abundance of these individuals in predator diets.

Table 3-7: Maximum size, habitat, and 2016 EBS slope survey biomass estimates for squid taxonomic groups in the BSAI.

taxonomic group	maximum size (cm)	habitat	2016 EBS slope survey biomass estimate (t)
squid unID			2.1
Rossia pacifica	10	benthic	29.4
Gonatidae unID			31.8
Gonatus sp			7.8
Gonatus onyx	13.5	pelagic, > 500 m	1.8
Gonatus berryi	19	pelagic, > 500 m	0.9
Gonatus pyros	12.5	pelagic, > 500 m	0.3
Gonatus madokai	39	pelagic, > 500 m	
Eogonatus tinro	12	pelagic, > 500 m	0.3
Gonatus middendorffi	35	pelagic, > 500 m	
Berryteuthis magister	34	demersal, 50-750 m	1,127
Gonatopsis sp			0.9
Gonatopsis borealis	20	demersal, 100-1000 m	6.8
Moroteuthis robusta	200	pelagic, > 500 m	

taxonomic group	maximum size (cm)	habitat	2016 EBS slope survey biomass estimate (t)
Galiteuthis phyllura	76	meso-, bathypelagic	0.4
Chiroteuthis calyx	24	epi- to bathypelagic	1.3
Cranchiidae		meso-, bathypelagic	
Belonella borealis		meso-, bathypelagic	

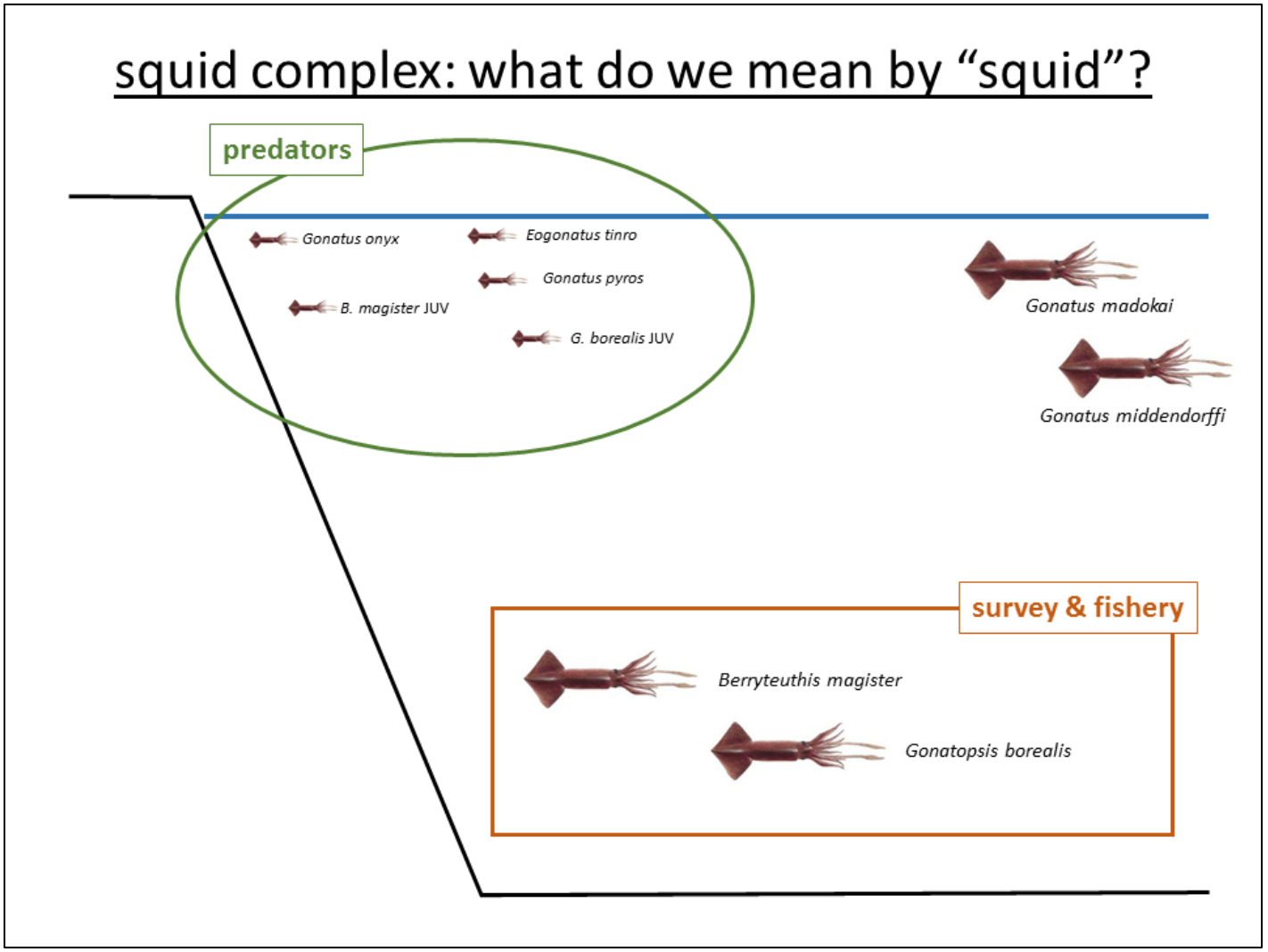

Figure 3-5: Schematic of vertical distribution of squid species in the BSAI and availability to predators, surveys, and fisheries.

Squid are central in food webs in the AI, EBS, and GOA (Figure 3-6). Here Box size is proportional to the biomass of the group in the Gulf of Alaska, and lines between boxes indicate the strength of the flow between groups. If a group is highlighted but there is no line connecting it to squid, then the flow between those groups is less than 5% of all energy flows into or out of squid. Wider lines indicate stronger flows, for instance the strongest prey flow into squid comes from large zooplankton, followed by copepods. These food webs were derived from mass balance ecosystem models assembling information on the food habits, biomass, productivity and consumption for all major living components in each system. The EBS, AI and GOA are physically very different ecosystems, especially when viewed with respect to available squid habitat and densities (Ormseth 2011, 2012). While direct biomass estimates are unavailable for squid, ecosystem models can be used to estimate squid densities based upon the food habits and consumption rates of predators of squid. The AI has much more of its continental shelf area in close proximity to open oceanic environments where squid are found in dense aggregations, hence the squid

density as estimated by predator demand in each system is much greater in the AI relative to the EBS and GOA (Figure 3-6).

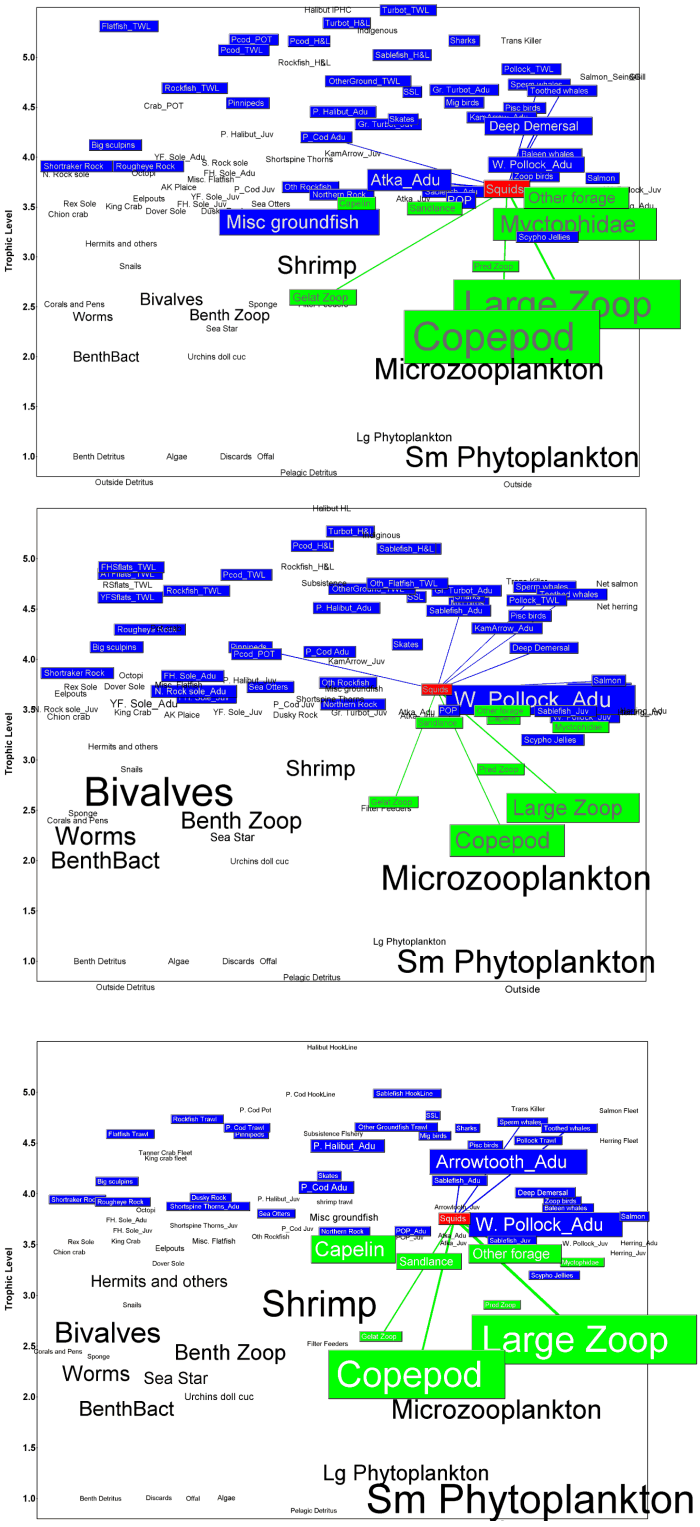

Figure 3-6: AI (top), EBS (middle), GOA (bottom) food webs of squid (red), predators (blue), and prey (green). From Ormseth, 2011 and Ormseth 2012.

In contrast with predation mortality, estimated fishing mortality on squid is similarly low in all three ecosystems. Figure 3-6 demonstrates the estimated proportions of total squid mortality attributable to fishing vs. predation, according to food web models built based on early 1990's information from the AI, EBS, and the GOA. Fishing mortality is so low relative to predation mortality that it is not visible in the plot, suggesting that current levels of overall fishery bycatch may be insignificant relative to predation mortality on squid populations (Ormseth 2011, 2012).

Many squid populations are composed of spatially segregated schools of similarly sized (and possibly related) individuals, which may migrate, forage, and spawn at different times of year (Lipinski 1998). The timing and location of fishery interactions with squid spawning aggregations may affect the availability of squid as prey for other animals as well as the age, size, and genetic structure of the squid populations themselves (Caddy 1983, O'Dor 1998). The assessment author has continually noted that "local-scale patterns of squid removals should still be monitored to ensure that fishing operations minimize impacts to both squid and their predators." (Ormseth 2011, 2012)

3.2.3 Harvest specifications

Establishing harvest specifications for squid is problematic given that the SSC has determined that reliable biomass estimates do not exist. Furthermore, squid are not the target of a directed fishery but are caught incidentally. Biomass estimation is further complicated by their short-life history. For BSAI and GOA, squid are a Tier 6 species. For the reasons described in section 3.2.1 reliable biomass estimates do not exist for squid thus information on average catch is used to establish OFL and ABC levels. The assessment author provided alternative approaches employing biomass-based estimates (as a minimum estimate, i.e., substantially underestimating the 'true' biomass) in 2015, but the Plan Teams and SSC have not recommended their use in establishing specifications due to the large uncertainty in these estimates.

For the BSAI, the harvest recommendations for BSAI squid had been made based on the best available information which is the average catch from 1978-1995. This approach was reviewed several times between 2010 and 2015, including by the Center for Independent Experts, however a suitable alternative methodology has not yet been approved for use in setting specifications by the SSC. While it is problematic, mainly because incidental catches are unlikely to reflect a sustainable level of fishing removals, the consensus has been that it is a precautionary harvest strategy: the OFL is likely to be much higher than the current harvest specifications.

Temporal and spatial patterns in catch and effort were examined in the 2016 assessment during two eras: foreign/joint venture (1977-1989) and domestic (1990-present). Although captured squid have not been identified to species, anecdotal evidence and current observer data strongly suggest that the vast majority of catches consisted primarily of *B. magister*.

Because historical catch is used to estimate a sustainable level of fishery removals of squid in the present day, the 2016 stock assessment (Ormseth 2016a) noted that it is important to understand the basis for the substantial decline in squid catches during 1982-1987. If this decline resulted from overfishing the population prior to the decline, catches during the years 1977-1981 could not be considered sustainable

fishing levels. Two approaches were taken to examine the relationship between catch levels and effort during the years 1977-1987. If the squid population had been reduced by fishing effort, it is likely that CPUE would have declined in a similar fashion to overall catch. Average CPUE declined during 1980-1983, when catches were falling, however average CPUE increased from 1983 to 1986 even though total squid catches continued to decline (Ormseth, 2016). Analysis of CPUE data is complicated by the potential for hyperstability, where animals continue to aggregate at similar densities despite overall population declines. Therefore a second analysis was performed focusing on changes in overall effort. The results of these two analyses indicate that the reduction in squid catches during 1982-1987 resulted from a decrease in fishery effort, not overfishing of squid during 1977-1981 (Ormseth, 2016a). Therefore the BSAI plan team selected this time period for establishment of average catch from which to derive an OFL for 2017/2018 specifications.

Overview of alternative approaches to harvest recommendations

For several years the plan teams and the SSC have considered alternative methods for setting harvest specifications for squid. None of these were recommended by the author, the Plan Teams or the SSC. The summary below pertains to BSAI squid but similar considerations have been pursued for the GOA as well and are found in Ormseth, 2015.

Historical catch: Numerous methods for using historical catch, including the use of different time periods and maximum vs. average catch, have been explored in previous assessments. The 2014 and 2015 assessments contain extensive detail regarding these alternatives.

Biomass-based approaches: Previous assessments have explored a wide range of alternatives based on the Tier 5 methodology where OFL is equal to *M* * biomass. These alternatives are problematic because biomass estimates for squid in the BSAI are highly uncertain, and because short-lived squid have extremely high mortality rates. In addition, squid life cycles are substantially different than most groundfish species for which the Tier 5 approach was developed. The 2015 assessment in particular explored many biomass-based approaches; all were considered to have flaws that barred their use in making harvest recommendations.

***Consumption**-based specifications*: For several years the SSC and others have suggested exploring the possibility that consumption rates of squid by predators could be used a proxy for a sustainable fishing level as is done for BSAI octopus. Ormseth (2015) noted that is problematic for two reasons. Diet data for predators consuming squid are highly uncertain. More importantly, there is a major difference between those species and life stages that are regularly consumed and those that are observed in surveys and captured in fisheries (see section 3.2.2.1). Adult B. magister are the main constituent of fishery catches, but it is juveniles of this species that are targets of numerous predators. Squid are terminal spawners and the mortality rate of juveniles consumed by predators is unlikely to be related to the mortality rate of the pre-spawning adults captured by fisheries.

Biomass estimates for acoustic surveys: The EBS acoustic survey samples areas that contain squid aggregations and thus serves as a potential source of information regarding squid abundance. A 2009

project in the Bering Canyon area confirmed that acoustic surveys can detect squid (Horne and Parker-Stetter 2010). However squid were often observed in association with other fish species and the species composition of echosign containing squid was difficult to establish. Therefore it is likely that the survey would need to be substantially redesigned to permit adequate ground-truthing of squid echosign. Additional survey time and increased expense would be required. Because squid are not targeted and do not appear to constitute a conservation concern, the author suggests this would not be an appropriate allocation of limited survey resources.

After reviewing all of the alternative approaches in 2015, the SSC concluded that none of these approaches were reliable, that biomass estimates derived from them were not reliable and continued to recommend harvest specifications based upon average catch estimates. As noted above, after considering an earlier time frame for calculating average catch, the BSAI Plan Team and the SSC recommended an alternative set of years (1977-1981) leading to an OFL of 6,912 t and an ABC of 5,184 t; = 0.75*6,912 t) for use in 2016-2017 and again in 2017-18. This OFL and ABC were considerably higher than ones recommended and in specifications in previous years (Table 3-13).

In the GOA, when squid in the GOA were separated from the "Other Species" group in 2011, a decision was made to make harvest recommendations for squid based on the maximum catch from 1997-2007 (i.e. OFL = maximum catch 1997-2007). While this approach is also problematic, mainly because incidental catches are unlikely to reflect a sustainable level of fishing removals, the consensus has been that it is a precautionary harvest strategy: the OFL is likely to be much higher than the current harvest specifications. This leads to an OFL of 1,530 t and an ABC of 1,148 t for use in 2017-2018. This approach has been employed since 2011.

3.2.4 Targeting, Catch, and Retention of Squid

Squid are non-target species which are caught incidentally in prosecution of groundfish fisheries in the BSAI and GOA. Table 3-8 and Table 3-9 show the overall catch of squid by groundfish targets. In both the BSAI and GOA, almost the entire incidental catch of squid is in the pollock fisheries. Catch of squid in all other targets is minimal.

Table 3-8: 2003-2016 total tons of squid catch by target fishery BSAI.

Target	catch	retained	% retained
Arrowtooth Flounder	593	6	1%
Atka Mackerel	196	5	2%
Flathead Sole	25	<1	1%
Greenland Turbot	41	1	1%
Kamchatka Flounder	276	1	0%
Other Flatfish	22		0%
Pacific Cod	22	1	4%
Pollock - bottom	4,519	3,480	77%
Pollock - midwater	9,065	4,873	54%
Rock Sole	1		0%
Rockfish	371	3	1%
Sablefish	3	<1	4%
Yellowfin Sole	3	0	0%
BSAI Total	15,139	8,370	55%

Source: AKFIN, December 2016 Table originates from SQUID_CATCH_CONF(12-20)

Table 3-9: 2003-2016 total tons of squid catch by target fishery GOA.

Target	catch	retained	% retained
Arrowtooth Flounder	134	2	1%
Deep Water Flatfish	2	<1	10%
Flathead Sole	3	<1	5%
Pacific Cod	18	4	22%
Pollock - bottom	2,536	2,277	90%
Pollock - midwater	1,797	1,537	86%
Rex Sole	10	<1	3%
Rockfish	153	5	3%
Sablefish	10	<1	1%
Shallow Water Flatfish	2	<1	4%
GOA Total	4,664	3,826	82%

Source: AKFIN, December 2016 Table originates from SQUID_CATCH_CONF(12-20)

Squid are caught incidentally while fishing for groundfish in both the BSAI and GOA almost exclusively in the pollock fisheries in both areas (Table 3-13 and Table 3-14). There is no directed fishery for squid in either region and as such it is put on bycatch status from the start of the year. For example, for 2016-17 the harvest specifications note that in accordance with § 679.20(d)(1)(i), the Regional Administrator may establish a directed fishing allowance (DFA) for a species or species group if the Regional Administrator determines that any allocation or apportionment of a target species has been or will be reached. If the Regional Administrator establishes a DFA, and that allowance is or will be reached before the end of the fishing year, NMFS will prohibit directed fishing for that species or species group in the specified subarea or district (see § 697.20(d)(1)(iii)). Based on historic catch patterns and anticipated fishing activity, the Regional Administrator has annually determined that the groundfish allocation amounts in BSAI Table 20[1] and GOA Table 29[2] will be necessary as incidental catch to support other anticipated groundfish fisheries for the 2016 and 2017 fishing years. Consequently, in accordance with § 679.20(d)(1)(i), the Regional Administrator established the DFA for the species and species groups in Table 20 as zero in 2016 and 2017. In accordance with § 679.20(d)(1)(iii), NMFS prohibited directed fishing for these sectors and species in the specified areas effective March 18, 2016, through December 31, 2017.

Incidentally caught squid are retained in fairly substantial amounts (Table 3-10). Further evaluation of whether retained squid are sold or turned into product (only, not including fishmeal) indicates that the relative proportion of retained squid processed to product types is also fairly substantial, particularly in the BSAI where it has ranged as high as 99% of retained catch in 2009. The proportion processed to product type is lower in the GOA but has still reached a high of 51% in 2005 (Table 3-11). In the first few years it was sold only as bait, but product types now being processed may include food quality products as well as bait[3]. Further information on the relative revenue stream from these products is contained in Chapter 4.6 of the RIR.

Table 3-10: Catch and retention of squid by all groundfish fisheries by FMP area BSAI and GOA (2003-2016)

BSAI				GOA		
year	catch	retained	% retained	catch	retained	%retained
2003	1,282	345	27%	77	39	51%

[1] https://alaskafisheries.noaa.gov/sites/default/files/16_17bsaitable20.pdf

[2] https://alaskafisheries.noaa.gov/sites/default/files/81fr14740.pdf

[3] Note that this is based on examining COAR production for multiple years showing squid as more than just meal and bait by multiple processors, however these data are being re-assessed as there are indications that it was mis-reported as product.

BSAI				GOA		
year	catch	retained	% retained	catch	retained	%retained
2004	1,014	368	36%	157	108	68%
2005	1,186	701	59%	632	554	88%
2006	1,418	631	45%	1,516	1,279	84%
2007	1,188	281	24%	412	375	91%
2008	1,542	882	57%	84	75	89%
2009	360	124	35%	337	291	86%
2010	410	238	58%	131	118	90%
2011	336	115	34%	232	176	76%
2012	688	437	64%	18	2	12%
2013	299	89	30%	321	292	91%
2014	1,678	607	36%	94	55	58%
2015	2,364	1,200	51%	411	317	77%
2016	1,378	234	17%	239	135	56%

Source: AKFIN, December 2016 Table originates from SQUID_CATCH_CONF(12-20)

Table 3-11: Proportion of AFA program (Bering Sea pollock fishery) squid retained catch that is processed to a product and sold (2006-2016). Squid retained catch from 2003-2006 includes all CV trawl targets. Note that this does not include retained catch, which is processed to fishmeal.

year	proportion of retained catch processed to product	
	BSAI	GOA
2003	83%	4%
2004	92%	9%
2005	47%	51%
2006	37%	40%
2007	84%	25%
2008	50%	12%
2009	99%	16%
2010	91%	25%
2011	93%	42%
2012	57%	40%
2013	98%	44%
2014	72%	0%
2015	40%	0%
2016	NA	NA

Source: AKFIN, December 2016 Table originates from SQUID_CATCH_CONF(12-20)

Incidental catch of squid in the pollock fishery is concentrated in certain months of the year, largely consistent with the operations of the pollock fisheries in both regions. In the GOA, catch is almost exclusively in the inshore CV sector and primarily occurs in February and March (Table 3 12). In the GOA directed fishing for pollock is only open for the inshore sector. For the BSAI some catch occurs in the offshore section in February and March, but the majority of catch is in the inshore sector between July and September. In the BSAI, directed fishing for pollock is prohibited inside the Catcher Vessel Operational Area during the B season (June 10 to November 1) for catcher/processors authorized to fish for BSAI pollock, unless it is directed fishing for pollock CDQ.

Table 3-12: 2003-2015 total tons of squid catch in the pollock fishery by month and sector

	BSAI			GOA		
Month	**CV**	**CP**	**Total**	**CV**	**CP**	**Total**
Jan	31	14	45	53		53
Feb	139	1,348	1,487	874	7	881
Mar	79	912	991	2,980	4	2,984
Apr	5	26	31	114	10	124
May	1	373	374	9	7	16
Jun	1,319	452	1,771	3	4	7
Jul	2,680	826	3,506	7	88	95
Aug	2,560	313	2,873	21	30	51
Sep	1,425	574	1,999	94	16	110
Oct	600	126	726	256	7	263
Nov	3	61	64	8	3	11
Dec		4	4	0		0
Total	8,843	5,028	13,871	4,418	176	4,594

Source: AKFIN, May 2016 Table originates from SQUID_CATCH_CONF(5-6)

The majority of catches in the BSAI occur in the Bering Canyon region of the southeastern Bering Sea (areas 517 & 519). Figure 3-7 through Figure 3-11 show panels of pollock catch and squid catch concentrations from 2011-2015. These years are selected because operational changes in the pollock fleet since 2011 for Chinook salmon avoidance make these years more comparable for spatial behavior in the fleet than years prior. In the BSAI, the majority of catches occur in the Bering Canyon region of the southeastern Bering Sea, and is concentrated in the southeastern portion of NMFS Area 517 and Area 519 (Figure 3-7 through Figure 3-11). In the EBS, the distribution of squid catch appears to have remained fairly constant over time. While squid were caught throughout the EBS slope, the outer domain of the EBS shelf, and the Aleutian Islands, the highest catches consistently occurred near the major canyons ((Figure 3-7 through Figure 3-11). A survey conducted in 2009 in the Bering Canyon region suggested that the density of *B. magister* increases considerably below 200 m (Horne and Parker-Stetter 2010). This

is supported by the depth distribution of *B. magister* in the AI trawl survey. Incidental catches of squid may thus increase when fishing activity occurs at greater depths. These results suggest a possible mechanism for voluntary avoidance of squid bycatch by the pollock fishery. Cumulative squid catch in relation to pollock catch by week in the EBS pollock fishery for 2014-2015 is shown in Figure 3-12. The majority of catches occur in July near the start of the pollock B season.

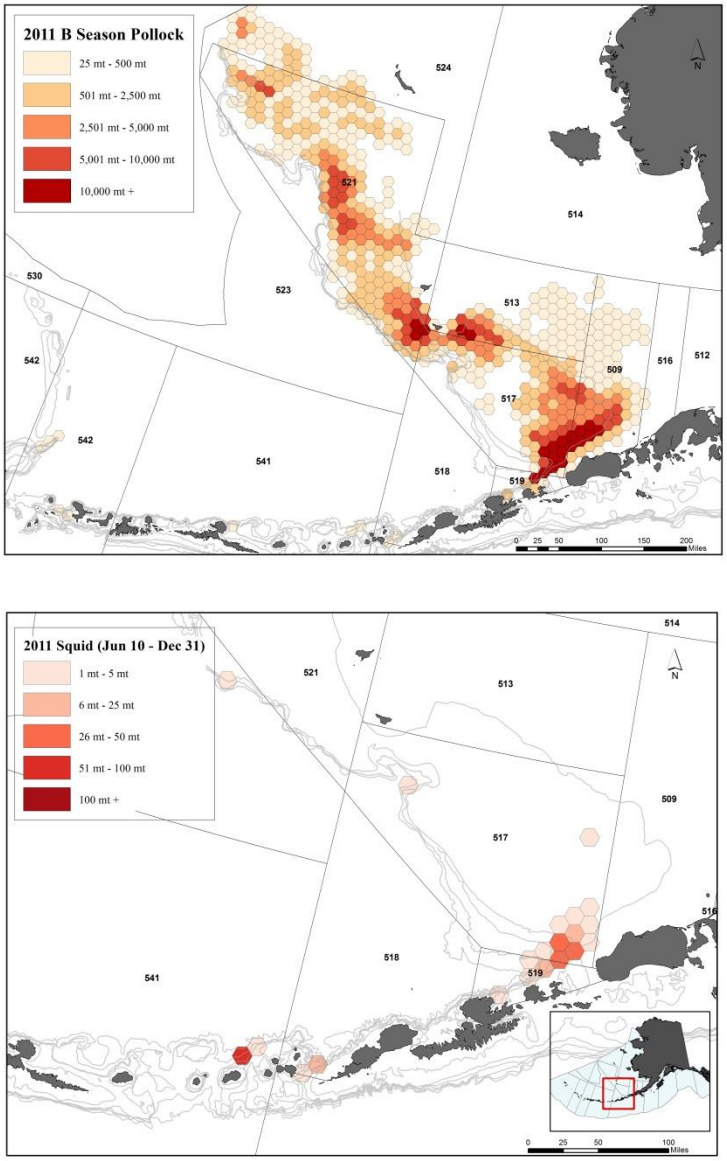

Figure 3-7: B-season Pollock catch (top panel) and Squid catch (bottom panel) by EBS pollock fleet in 2011. Note 2011 was the first year of implementation of a new program to address Chinook salmon bycatch in the EBS pollock fishery.

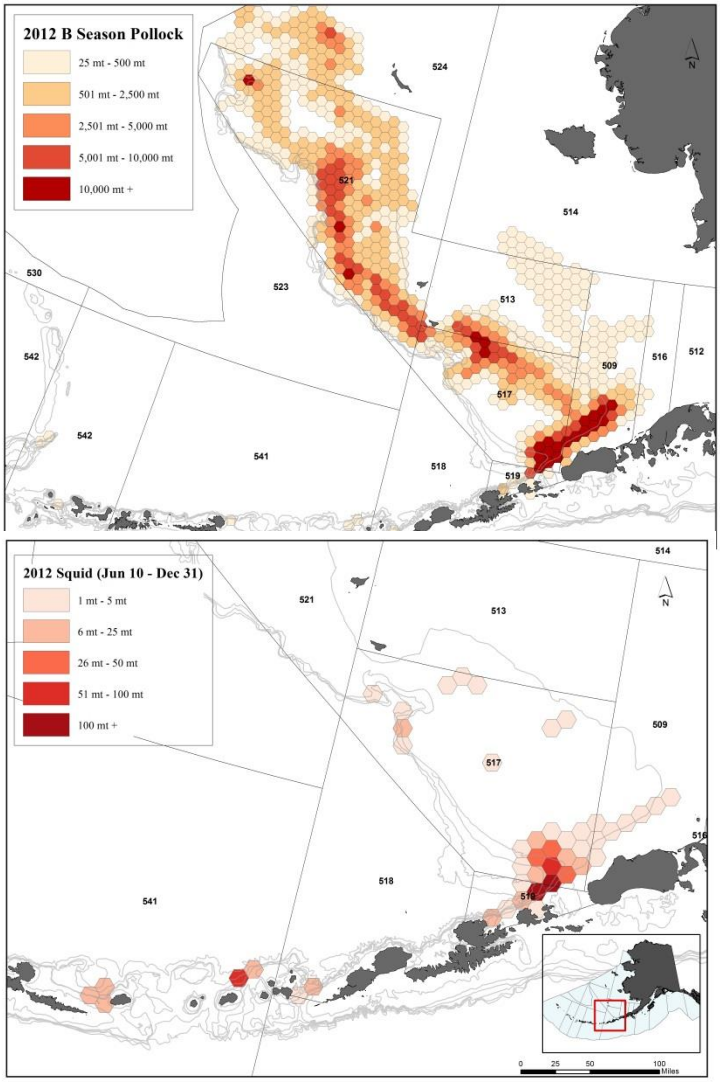

Figure 3-8: B-season Pollock catch (top panel) and Squid catch (bottom panel) by EBS pollock fleet in 2012

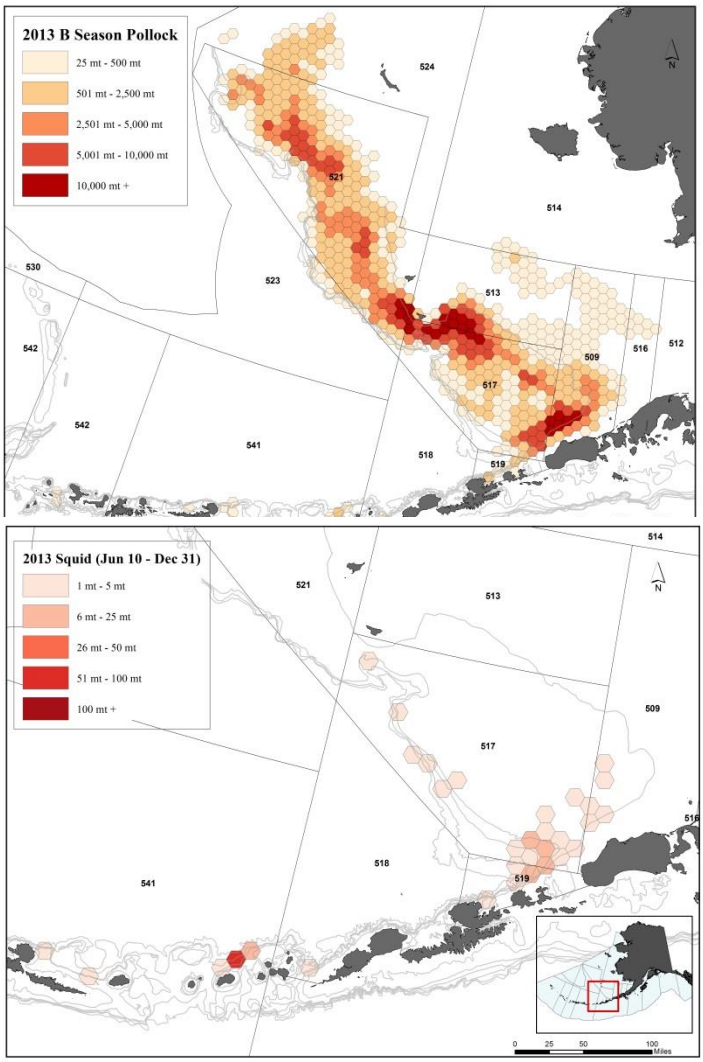

Figure 3-9: B-season Pollock catch (top panel) and Squid catch (bottom panel) by EBS pollock fleet in 2013.

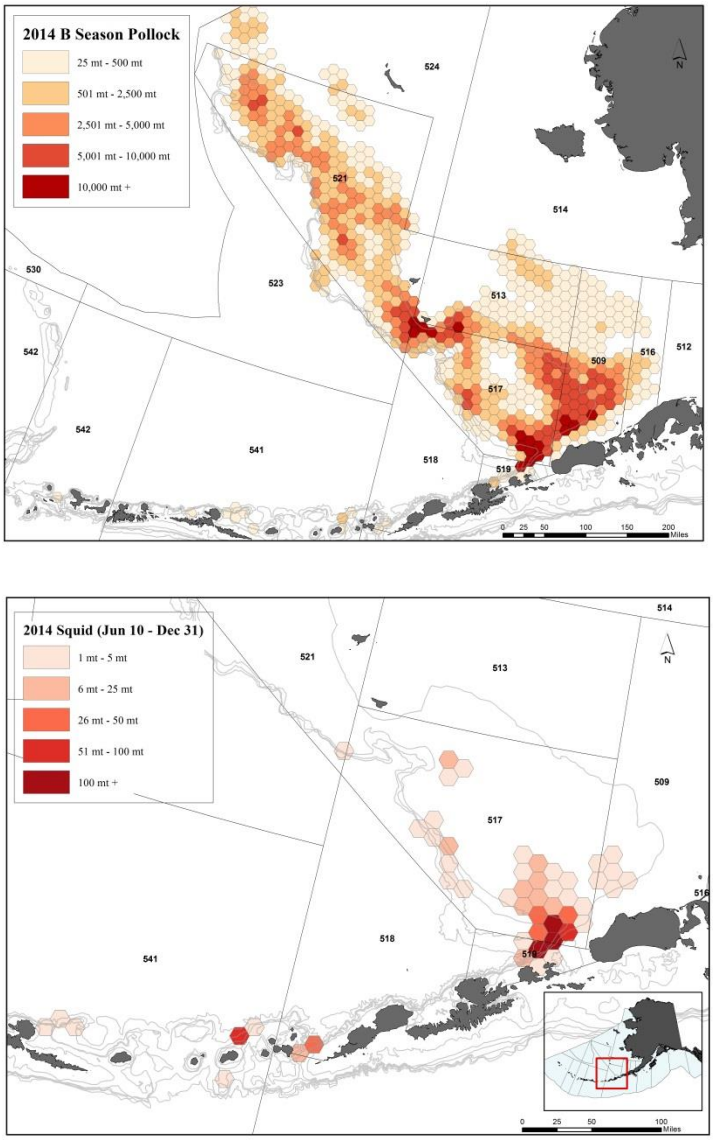

Figure 3-10: B-season Pollock catch (top panel) and Squid catch (bottom panel) by EBS pollock fleet in 2014

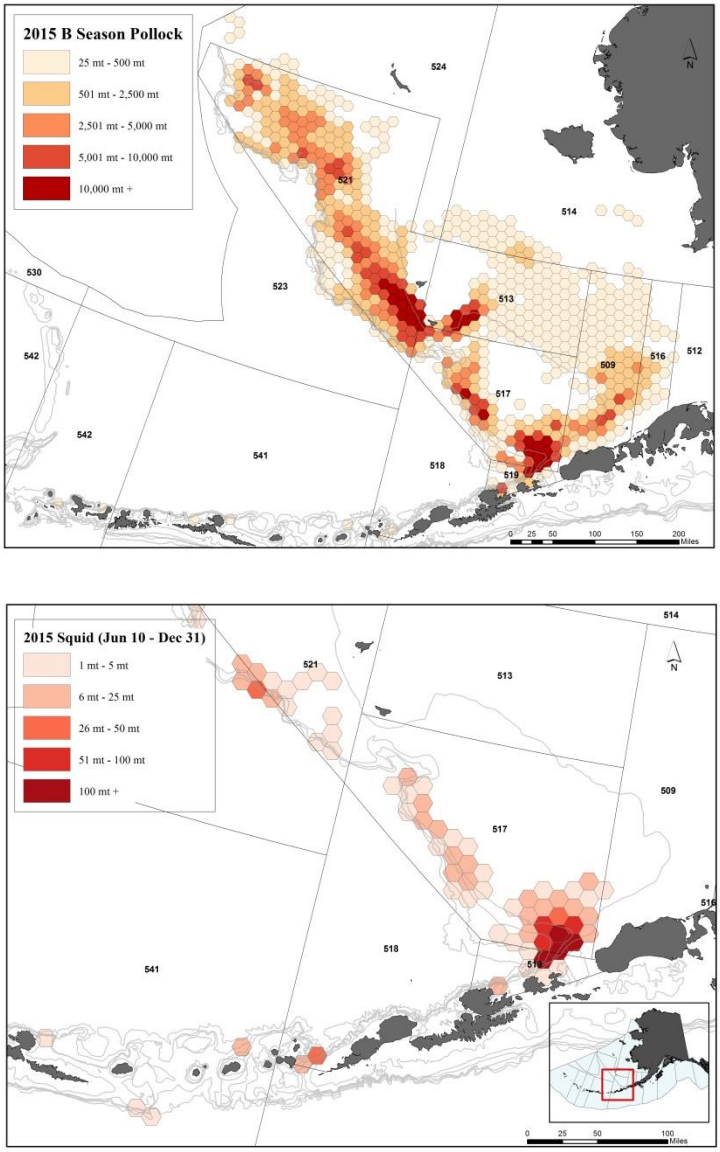

Figure 3-11: B-season Pollock catch (top panel) and Squid catch (bottom panel) by EBS pollock fleet in 2015

In the BSAI, the squid TAC is usually set at a level estimated to meet incidental catch needs in the groundfish fisheries. However, squid catch in many years has exceeded the original TAC set by the Council (Table 3-13) and additional catch from the non-specified reserve has been reallocated to squid (See section 0 for additional information on how NMFS management re-specifies catch levels to adjust the TAC). In 2010 the TAC was set at a lower level as incidental catch in previous years had been low and the TAC was used to 'fund' other groundfish fisheries that would otherwise be unfunded due to the constraint from the 2 million ton OY cap. Incidental catch levels rose from 2013 on, requiring a reallocation from the non-specified reserve (Table 3-13).

In 2015 notably, catch exceeded the ABC for the first time historically and was approaching the OFL. NMFS in-season management has the authority to close areas of high catch which covers a portion of Areas 519 and 517 as catch approaches the OFL to preclude exceeding it and closing down other fisheries. However, the pollock fleet has voluntarily enacted a similar closure in years where squid catch is elevated and moves the fleet out of their squid closure area (squid box) prior to NMFS taking action (Table 3-13). In years where a closure by the pollock fleet is not listed, frequently the fleet has been notified previously by SeaState that catch is becoming high in the region and they move from that area anyways thus the notation of closure or non-closure in Table 3-13 does not provide all of the information regarding the fleet's avoidance measures to reduce catch. As noted in section 3.3.3, the fleet frequently must balance moving the fleet from the squid closure area with resulting increased catch of chum salmon, Chinook salmon, and herring. Also, the pollock fishing can be better (larger fish, higher CPUE) in the area of high squid catch.

Table 3-13: BSAI Squid Catch, TAC, associated NMFS AKRO management measures and years in which the SeaState closure was enacted

Year	Catch	Council TAC	ITAC (minus 15% reserve	Released non-specified reserve	Final TAC	ABC	Final TAC Remaining	ABC Remaining	Final TAC increase over Council TAC?	SeaState Closure?
2003	1,282	1,970	1,675	-	1,675	1,970	393	688	None	
2004	1,014	1,275	1,084	-	1,084	1,970	70	956	None	
2005	1,186	1,275	1,084	100	1,184	1,970	(2)	784	None	
2006	1,418	1,275	1,084	-	1,084	1,970	(334)	552	None	Yes
2007	1,188	1,970	1,675	-	1,675	1,970	487	782	None	
2008	1,542	1,970	1,675	-	1,675	1,970	133	428	None	
2009	360	1,970	1,675	-	1,675	1,970	1,315	1,610	None	
2010	410	1,970	1,675	-	1,675	1,970	1,265	1,560	None	
2011	336	425	361	-	361	1,970	25	1,634	None	
2012	688	425	361	339	700	1,970	12	1,282	275	
2013	299	700	595	-	595	1,970	296	1,671	None	
2014	1,678	310	264	1,500	1,764	1,970	86	292	1,454	
2015	2,364	400	340	1,630	1,970	1,970	(394)	(394)	1,570	Yes
2016	1,378	1,500	1,275	30	1,305	5,184	(73)	3,806	None	

Source NMFS AKRO, 2016 catch through December 31, 2016

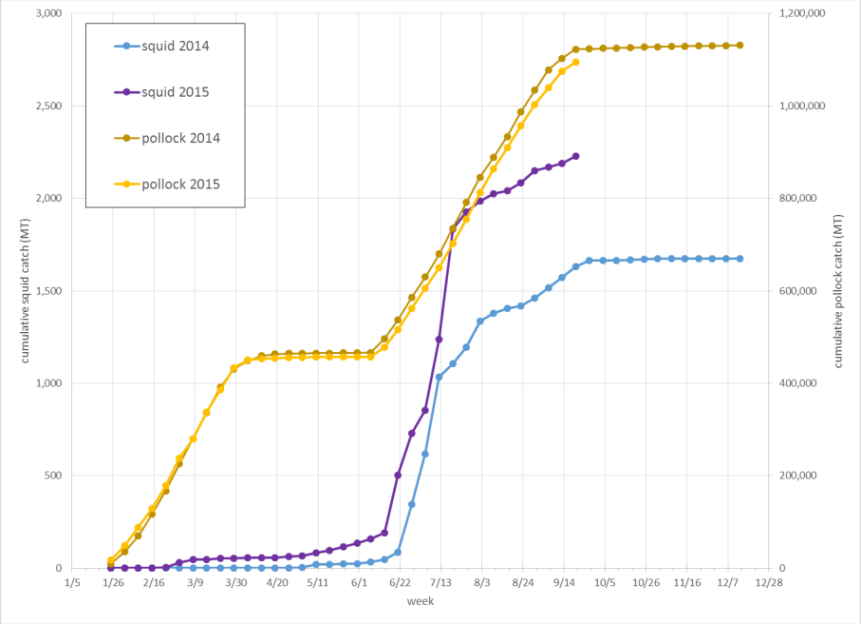

Figure 3-12: Cumulative catch of squid and pollock in the BSAI by week, 2014 & 2015 (from Ormseth, 2016b).

In the GOA, TAC-levels are also set to meet incidental catch needs (Table 3-14). Since 2006 when an unusually high catch of squid occurred, squid catches have been low in relation to the TAC. Nearly all of this catch occurs in the pollock fishery (Table 3-9), and is concentrated in Shelikof Strait where the fishery is more concentrated (Figure **3-13**). In contrast to the BSAI, catch levels have not exceeded the TAC and no additional management measures have been enacted by NMFS or the pollock fleet.

Table 3-14: GOA squid catch and TAC 2003-2016*. Note TAC for 2003-2010 was for the 'other species' complex.

YEAR	Catch	TAC
2003	77	11,260
2004	157	12,942
2005	632	13,871
2006	1,516	13,856
2007	412	4,500
2008	84	4,500
2009	337	4,500
2010	131	4,500
2011	232	1,148
2012	18	1,148
2013	321	1,148
2014	94	1,148
2015	411	1,148
2016	239	1,148

Source NMFS AKRO, 2016 catch through December 31, 2016

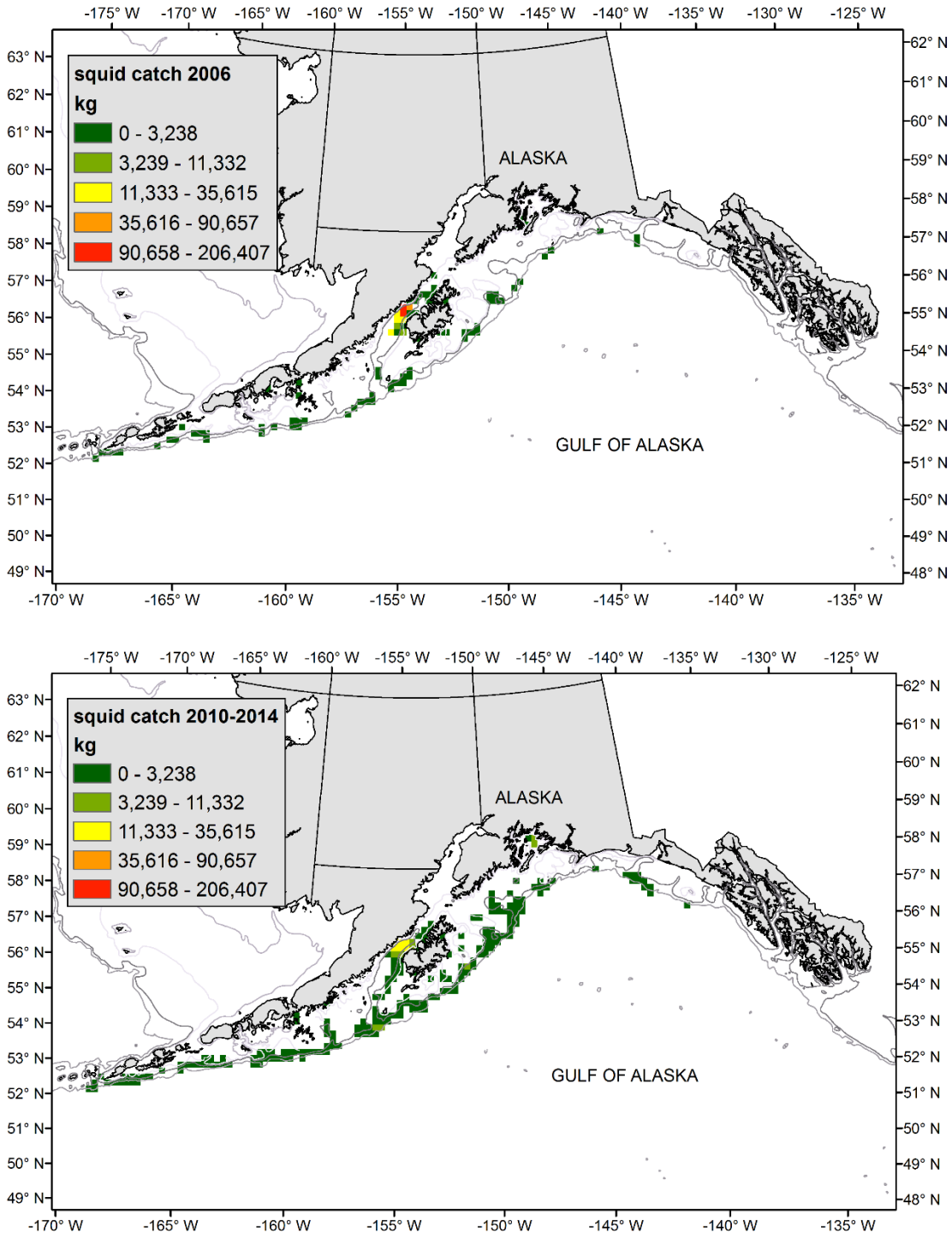

Figure **3-13: Distribution of squid catches in the GOA in 2006 (top panel) and during 2010-2014 (bottom panel). Data are total catch per 20 km x 20 km grid cell. (From Ormseth, 2016a)**

3.2.5 Effects of the Alternatives on Squid

Squid are assessed annually in the GOA SAFE report (Ormseth, 2016a), the BSAI SAFE (Ormseth, 2016b) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). Table 3-15 describes the criteria used to determine whether the impacts on squid stocks are likely to be significant.

Table 3-15: Criteria used to determine significance of effects on target groundfish stocks.

	Criteria			
Effect	**Significantly Negative**	**Insignificant**	**Significantly Positive**	**No Indication for Concern**
Fishing mortality	Changes in fishing mortality are expected to jeopardize the stock's ability to sustain itself.	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself.	Changes in fishing mortality are expected to enhance the stock's ability to sustain itself.	Magnitude and/or direction of effects do not provide indication for concern.
Spatial or temporal distribution	Reasonably expected to adversely affect the distribution of squid either spatially or temporally such that it jeopardizes the ability of the stock to sustain itself.	Unlikely to affect the distribution of squid either spatially or temporally such that it has an effect on the ability of the stock to sustain itself.	Reasonably expected to positively affect the squid through spatial or temporal increases in abundance such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects do not provide indication for concern.

Impacts to squid species under Alternative 1:

As noted in section 3.2.1, squid have short, sometimes less than 1-year life-spans, limited life-history information exists and there are no reliable biomass estimates. Bottom trawl survey biomass estimates are considered substantial underestimates of true biomass in both the BSAI and GOA. Squid are important prey species and based on their role in the ecosystem food web models have indicated substantially higher biomass of squid than any of the trawl survey biomass estimates. Use of food web models gives an indication of the relative impact of fishing mortality as compared with predation mortality on squid (Figure 3-6, section 3.2.2) and as noted fishing mortality is extremely low compared with the estimated predation mortality (Ormseth 2011, 2012). Therefore the current fishing mortality is considered insignificant at a population level to affect the squid stock status under either FMP.

While reliable biomass estimates are lacking for squid species in the BSAI and GOA, estimates of survey biomass using the random effects model, the long-term average of the surveys and the double the random effects estimate were presented in the BSAI and GOA assessments in 2015. As noted by the assessment author estimates from ecosystem models indicate that these biomass estimates would represent a substantial underestimate of overall biomass (Ormseth, 2015a). Estimates from mass-balance ecosystem models indicate that squid biomass may be two orders of magnitude higher (880,000 t in the BSAI and 369,000 t in the GOA; Aydin et al. 2007) but these estimates are also highly uncertain. Nonetheless, to show some indication of relative exploitation rates, these estimates (Table 3-16) were used to calculate an exploitation rate for squid by year and area (**Error! Reference source not found.**; **Figure 3-14**). Note that these exploitation rates should be considered a substantial over-estimate given that the biomass estimates in the denominator are representative of substantial underestimates. The random effects and long-term would be taken to be a minimum rate. Additional information is provided for contrast using the mass balance estimates calculated in Aydin et al., 2014 and Ormseth 2014. These represent the biomass of squid that would be estimated by food web models to support the predator base and indicate substantially lower exploitation rates than calculated using the other biomass estimates (**Figure 3-14**).

Table 3-16: Biomass estimates as a result of four different methodologies for BSAI and GOA. Note that these both RE and LT represent substantial underestimates in both regions. For the long-term average the years employed were BSAI (1983-2015), GOA (1984-2015). From Ormseth 2015a, b. Mass balance estimates originate from ecosystem modeling referenced in Aydin et al 2014 and Ormseth 2014.

Biomass estimate methodology	*Biomass estimate (mt)* *BSAI*	*Biomass estimate (mt)* *GOA*
Random effects model (RE)	6,803	13,867
Long-term survey average (LT)	9,221	6,889
Random effects model x 2 (2xRE)	13,606	28,160
Mass balance estimate (MB)	880,309	369,309

Table 3 17: Estimated maximum exploitation rate by region and year for squid (catch mt/biomass mt) using the biomass estimates listed in Table 3 16. Column headers refer to the methodologies employed: random effects (RE). long-term average (LT) and random effects multiplied by 2 (2XRE) and mass balance (MB)for each area.

	BSAI									
year	***catch***	***RE***	***LT***	***2xRE***	***MB***	***catch***	***RE***	***LT***	***2xRE***	***MB***
2003	1,282	0.19	0.14	0.09	0.001	77	0.01	0.01	0.00	0.000
2004	1,014	0.15	0.11	0.07	0.001	157	0.01	0.02	0.01	0.000
2005	1,186	0.17	0.13	0.09	0.001	632	0.05	0.09	0.02	0.002
2006	1,418	0.21	0.15	0.10	0.002	1516	0.11	0.22	0.05	0.004
2007	1,188	0.17	0.13	0.09	0.001	412	0.03	0.06	0.01	0.001
2008	1,542	0.23	0.17	0.11	0.002	84	0.01	0.01	0.00	0.000
2009	360	0.05	0.04	0.03	0.000	337	0.02	0.05	0.01	0.001
2010	410	0.06	0.04	0.03	0.000	131	0.01	0.02	0.00	0.000
2011	336	0.05	0.04	0.02	0.000	232	0.02	0.03	0.01	0.001
2012	688	0.10	0.07	0.05	0.001	18	0.00	0.00	0.00	0.000
2013	299	0.04	0.03	0.02	0.000	321	0.02	0.05	0.01	0.001
2014	1,678	0.25	0.18	0.12	0.002	77	0.01	0.01	0.00	0.000
2015	2,364	0.35	0.26	0.17	0.003	157	0.03	0.06	0.01	0.000
2016	1,378	0.20	0.15	0.10	0.002	632	0.02	0.03	0.01	0.002

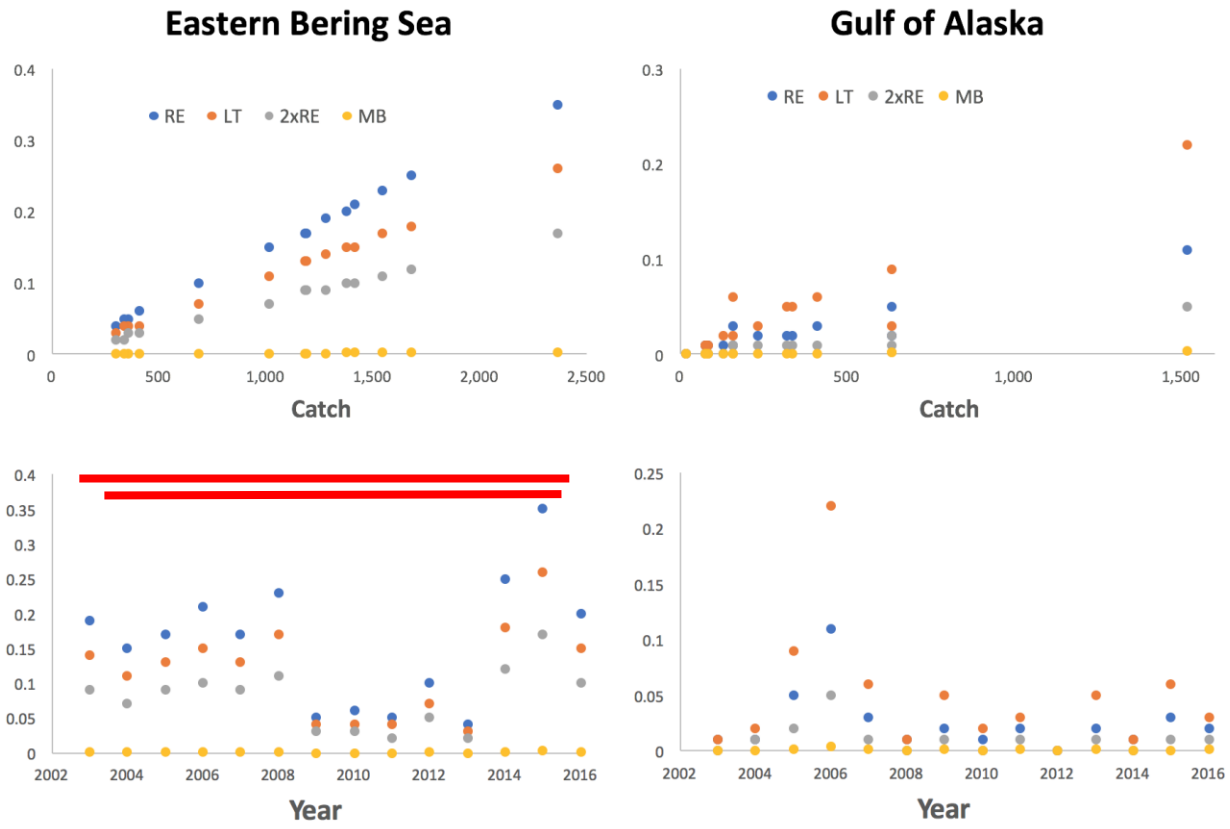

Figure 3-14: Estimated maximum exploitation rate by region by catch (as shown in Error! Reference source not found.**) and year for squid (catch mt/biomass mt) using the biomass estimates listed in Table 3-16. For BSAI these rates are shown against a reference exploitation rate of 0.4. Left panel is BSAI and right panel is GOA.**

While reliable biomass estimates to set biological reference points are lacking for squid species, there are observations that squid have inherently high stock productivity due to their rapid growth, maturation, and short lives, and evidence from other areas (e.g., NEFMC 2010) suggest it is unlikely a highly productive stock could be overfished in the absence of an intensive directed fishery. As shown in **Error! Reference source not found.**, the maximum exploitation rate in both areas is quite low, especially for a short-lived highly productive species such as squid. The highest rate in **Error! Reference source not found.** is for 2015 for the BSAI using only the random effects biomass resulting in exploitation rate of 0.35. Caddy (1983) proposed that a reasonable management objective for squid would be to allow for 40% of the catchable biomass to be removed in each year. Thus the calculated rate (as noted representative of a substantial overestimate) is well below conventional management advice for squid removals. Untargeted, squid are unlikely to pose a conservation concern. As noted by the SSC in December 2015, 'Current levels of incidental catch in the BSAI and GOA are well below those that would pose a conservation concern, and likely much less than MSY.' Given that squid are truly an incidentally caught species with retention primarily due to full-retention requirements and processing for bait it seems unlikely that current catch levels pose any conservation concern regardless of catch limits.

The spatial and temporal distribution of squid is variable, and as discussed in Section 3.2.2, on a local-scale, removals should be monitored to ensure that impacts spatially and temporally are minimized. There is some potential for localized depletion in specific areas where squid catch is concentrated. However, while this may affect a cohort spatially and temporally in a discreet area, this is not thought to have a population effect on squid as a whole. Therefore spatial and temporal effects under status quo on squid are also considered insignificant.

Additional information on the ecosystem effects on squid in the GOA and BSAI as well as relative impacts of groundfish fisheries on squid and predator/prey interactions are summarized in the annual stock assessment.

Table 3 18: Ecosystem effects on BSAI and GOA Squid (evaluating level of concern for squid populations)

Indicator	Observation	Interpretation	Evaluation
Prey availability or abundance trends			
Zooplankton Forage fis	Trends are not currently measured directly, only short time series of food habits data exist for potential retrospective measurement	Unknown	Unknown
Predator population trends			
Salmon	Increased populations since 1977, stable throughout the 1990s to present	Mortality higher on squid since 1977, but stable now	Probably no concern
Toothed whales	Unknown population trend	Unknown	Unknown
Sablefish	Cyclically varying population with a downward trend since 1986	Variable mortality on squid slightly decreasing over time	Probably no concern
Grenadiers	Unknown population trend	Unknown	Unknown

Indicator	Observation	Interpretation	Evaluation
	Changes in habitat quality		
North Pacific gyre	Physical habitat requirements for squid are unknown, but are likely linked to pelagic conditions and currents throughout the North Pacific at multiple scales.	Unknown	Unknown

Groundfish fishery effects on ecosystem via squid bycatch *(evaluating level of concern for ecosystem)*

Indicator	Observation	Interpretation	Evaluation
Fishery contribution to bycatch			
Squid catch	Stable, generally <100 tons annually except for 2005, 2006, and 2007	Extremely small relative to predation on squid	No concern
Forage availability for salmon	Depends on magnitude of squid catch taken in salmon foraging areas	Squid catch generally low, small change to salmon foraging at current catch	Probably no concern

Indicator	Observation	Interpretation	Evaluation
Forage availability for toothed whales	Depends on magnitude of squid catch taken in toothed whale foraging areas	Squid catch generally low, small change to toothed whale foraging at current catch	Probably no concern
Forage availability for sablefish	Depends on magnitude of squid catch taken in sablefish foraging areas	Squid catch generally low, small change to sablefish foraging at current catch	Probably no concern
Forage availability for grenadiers	Squid catch overlaps somewhat with grenadier foraging areas along slope	Small change in forage for grenadiers	Probably no concern
Fishery concentration in space and time	Bycatch of squid is mostly in shelf break and canyon areas, no matter what the overall distribution of the pollock fishery is	Potential impact to spatially segregated squid cohorts and squid predators	Possible concern
Fishery effects on amount of large size target fish	Effects of squid bycatch on squid size are not measured	Unknown	Unknown

Indicator	Observation	Interpretation	Evaluation
Fishery contribution to discards and offal production	Squid discard an extremely small proportion of overall discard and offal in groundfish fisheries	Addition of squid to overall discard and offal is minor	No concern
Fishery effects on age-at-maturity and fecundity	Effects of squid bycatch on squid or predator life history are not measured	Unknown	Unknown

Table 3-17 provides an overview of these two factors and their interpretation and evaluation to assess the impacts of alternative 1 on squid populations relative to the significance criteria in **Table** 3-15. This table is modified from information contained in the ecosystem considerations sections of BSAI and GOA squid stock assessments (Ormseth 2011, 2012).

Table 3-17 Impacts on squid and evaluation of overall impacts to squid related to Alternative 1 squid incidental catch (excerpted from Omseth, 2011, 2012).

Groundfish fishery effects of squid catch

Indicator	Observation	Interpretation	Evaluation
Incidental catch of squid	Stable, generally <100 tons annually except for 2005, 2006, and 2007 (GOA) and < 1000 tons except for 2000-2007 and 2014-2015(BSAI)	Extremely small relative to estimated predation on squid	No concern on a population level.
Fishery concentration in space and time	Catch of squid is mostly in shelf break and canyon areas, no matter what the overall distribution of the pollock fishery is	Potential impact to spatially segregated squid cohorts and squid predators	Possible concern for localized depletion but not on a population level.

Impacts to squid under Alternatives 2 and 3:

Alternatives 2 **(Preferred Alternative)** and 3 would neither decrease nor substantially increase the incidental catch of squid in groundfish fisheries as squid do not appear to be targeted in any way, thus catch is likely truly incidental. Predation on squid is not well understood, particularly because the size of squid (and therefore the age and species) that are preyed upon is unclear. Northern fur seals from St. George and Bogoslof Islands consume a large amount of squid, but it appears that most of these are small (either juveniles or smaller species) relative to adult Berryteuthis magister that are the main species caught as bycatch. However while the potential exists, there is as yet no evidence that exists of localized depletions. Fur seal diets vary by area, but heavily-targeted pollock are the most prevalent diet item in all areas.

The pollock fishery has already and will likely continue to take voluntary measures to avoid high concentrations of squid. For example, Figure 3-15 below, shows the squid catch by week with pollock in 2014 and 2015. The majority of the squid catch came in a very short period of time in July and was highly concentrated in Bering Canyon (Figure 3-10 and Figure 3-11). Squid catch dropped off following the peaks in both years likely due to voluntary measures by the pollock fleet to move away from high concentrations. This decreases the likelihood of any localized depletions as the fleet moves away from squid concentrations.

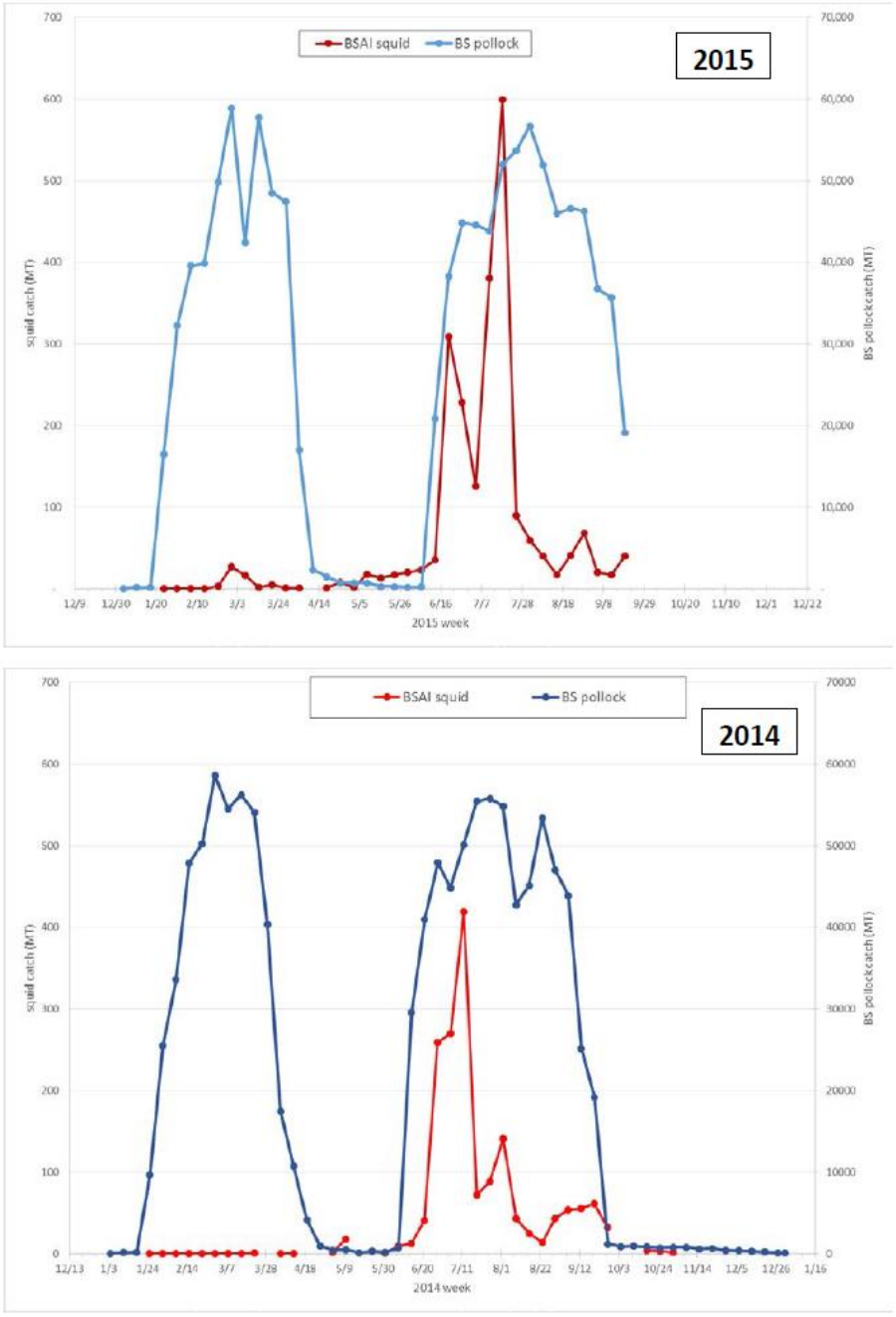

Figure 3-15 BSAI squid catch in the pollock target and related pollock catch by week-ending date in 2014 and 2015.

In conjunction with their review of the 2016 squid stock assessment, BSAI Groundfish Plan Team discussed how to evaluate the potential impact of any localized depletion on predators. The Team discussed the potential to look at whale diet data for Bering canyon, and the size and depth

considerations. Some discussion was held with respect to movement and the notion that if prey are moving around substantially then the localized depletion would not persist. The Team discussed the persistent nature of spawning aggregations of squid with respect to whether temporal and spatial closures are effective at reducing bycatch. In relation to localized depletion concerns, however, there is no evidence that sperm whales are locally dependent on aggregations. In general, the team indicated that inferences regarding localized depletion and impacts on the food web are likely to be somewhat speculative given the limited data available.

Alternative 2 **(Preferred Alternative)** and 3 would provide for continued recordkeeping and reporting of squid catches as well as a periodically updated stock assessment. NMFS in-season management already monitors squid catches in the Catch Accounting System (CAS) thus there is no additional burden to continue to monitor and report squid catches. An annual stock assessment is produced with additional information added in survey "off-years" consistent with stock assessment protocols for all other stocks in the BSAI and GOA FMPs. Under Alternative 3, an OFL and ABC would be established for squid species in both FMPs but TAC would not be specified. This may reduce the discards of squid when TAC is reached and NMFS in-season places them on prohibited species status.

Options 1-3

Alternative 2 **Preferred Alternative)** options 1-3 would manage squid in the EC under an MRA. The options for MRAs include a 2% (option 1), 10% (option 2) and 20% MRA (option 3: status quo and **preferred alternative**). Table 3-18 provides the percentage range of squid in the pollock target by haul in the GOA and BSAI from 2013-2016. The majority of the hauls are less than 2% squid and of these most (>86% in both areas) are 0 (48,212 hauls in BSAI and 2,599 hauls in GOA). There are a number of hauls greater than 2% (514 in the BSAI and 59 in the GOA) thus option 1 has the potential to be highly constraining. Likewise, while infrequent there are hauls are greater than 10% (57 in the BSAI and 7 in the GOA) therefore this option also has the potential to be constraining. While a limited number of hauls are greater than 20% (15 in the BSAI and 2 in the GOA), some of the hauls in that category range as high as 49% squid. Thus even the 20% MRA under status quo can be constraining. For CVs in the GOA, it is difficult to separate squid from the pollock catch to avoid reaching a constraining MRA. Likewise full retention requirements on CVs in the EBS pollock fishery prevent the sorting of catch at sea.

Table 3-18 Number of hauls in the pollock target with squid catch as a proportion of pollock catch by area (2013-2016)

Percentage range of squid in pollock catch by haul	Number of hauls (2013-2016) by FMP area	
PCT	BSAI	GOA
0-2%	55199	2962
2-4%	275	34
4-6%	98	10
6-8%	57	6
8-10%	27	2
		1
10-12%	19	
12-14%	6	2
14-16%	8	1
16-18%	4	
18-20%	5	1
>20%	15	2
Grand Total	55713	3021

Source: AKFIN, May 2016 Table originates from Squid_Haul_Conf(12-20)

As noted in Section 0, exceeding the current 20% MRA for squid has resulted in some enforcement considerations and this would likely be more common under the more constraining MRA options. It is not clear that there is any conservation benefit to a constraining MRA when squid are not being targeted and with the assumption of 100% mortality in the squid catch. Thus any constraining MRA is most likely to simply increase discards of dead squid rather than discourage targeting.

Cumulative Effects on Squid Species

The following RFFAs are identified as likely to have an impact on squid species within the action area and timeframe. Amendment 110 to the BSAI FMP modified how Chinook and chum salmon PSC are managed, which impacts behavior in the EBS pollock fleet. One provision of Amendment 110 moved chum salmon PSC management into the Incentive Plan Agreements which should allow for some additional flexibility in the designation of chum salmon closures which could have some associated effect on squid catch. Another provision would allow for an additional 5% of the pollock TAC to be taken in the A-season if fishing conditions are good and Chinook salmon bycatch is low. This would reduce some fishing pressure in the B-season and could also alleviate some of the incidental catch of squid. The Council is also considering modified management of trawl fisheries in the GOA which would change the behavior of the trawl fleet and could also have some minor effect on the incidental catch of squid. Annual specifications changes for pollock in both the BSAI and GOA can also potentially affect squid catch.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

3.3 Prohibited species

The only prohibited species that are likely to be affected by the proposed action are limited to Chinook and chum salmon species and herring stocks in the BSAI and GOA. Of those, the focus is more on the BSAI as that is where squid catch has historically been a potential constraint on the EBS pollock fishery and impacted their ability to move away from areas of higher salmon PSC. Thus this section focusses primarily on the EBS pollock fishery impacts to Chinook and chum PSC.

3.3.1 Status of salmon stocks

Western Alaska Chinook salmon stocks are in a period of extremely low abundance, and further reductions of all sources of mortality are being consistently considered. The Bering Sea pollock fishery catches substantial numbers of Chinook salmon in both A and B seasons in some years, although recent levels are much lower than historical bycatch levels. Genetic information indicates that the majority (~65%) of the Chinook salmon caught in the Bering Sea pollock fishery originate from a single geographic region encompassing several western Alaskan rivers, including a genetically distinct group from the Canadian portion of the Yukon River.

Chum salmon stocks in Alaska are generally at higher abundance than during historical periods with some stocks in Norton Sound still in decline. The EBS pollock fishery catches chum salmon predominantly in the B-season. Genetic information indicates that the majority of the chum salmon caught in the pollock fishery are of Asian –origin (~60%), while over one-fifth (~21%) originate from aggregate streams in western Alaska. The pollock fishery has caught large numbers of chum PSC historically (~700,000 in

2005), with levels in recent years quite variable. Catch in 2015 was ~200,000, with approximately 40,000 of Western Alaska origin.

3.3.2 Status of herring stocks

Herring are distributed broadly throughout Alaska marine waters with variable abundance. Commercial fisheries in the BSAI, mainly for herring roe, exist along the western coast of Alaska from Port Moller north to Norton Sound (Figure 3-16). These fisheries target herring returning to nearshore waters for spawning, and herring in different areas are managed as separate stocks.

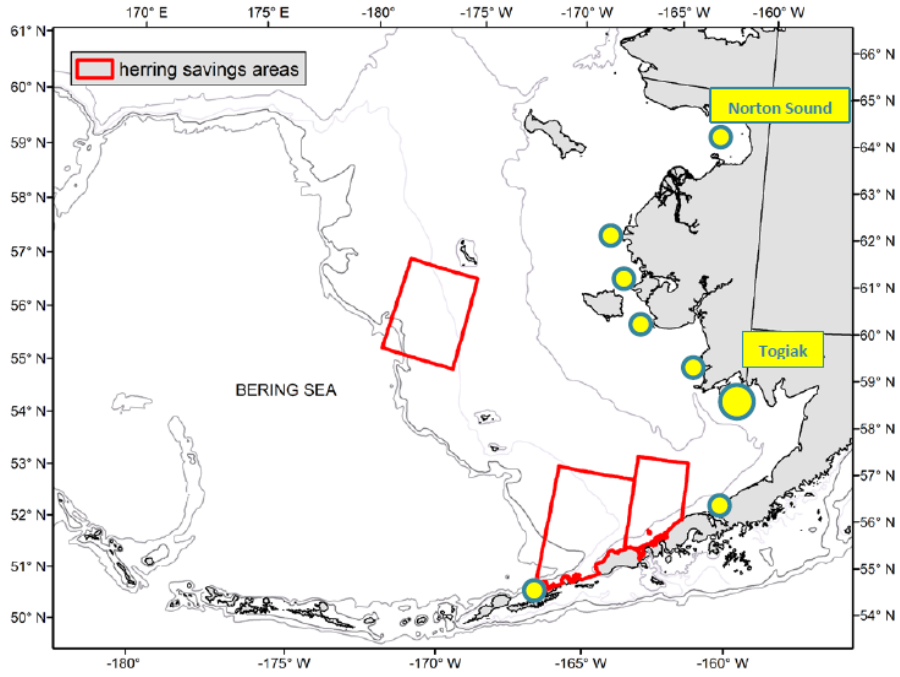

Figure 3-16 Herring savings areas and location of major herring fisheries in the BSAI. From Ormseth 2015c.

The largest stock in the BSAI spawns in Togiak Bay in northern Bristol Bay: the spawning biomass was estimated at 163,480 short tons in 2015 and at 142,453 metric tons in 2017. The next largest stock, in Norton Sound, has a 2017 biomass estimate of 31,007 metric tons (Table 3-19). Herring are hypothesized to migrate seasonally between their spawning grounds and two overwintering areas in the outer domain of the eastern Bering Sea (EBS) continental shelf (Figure 3-17; Tojo et al. 2007).

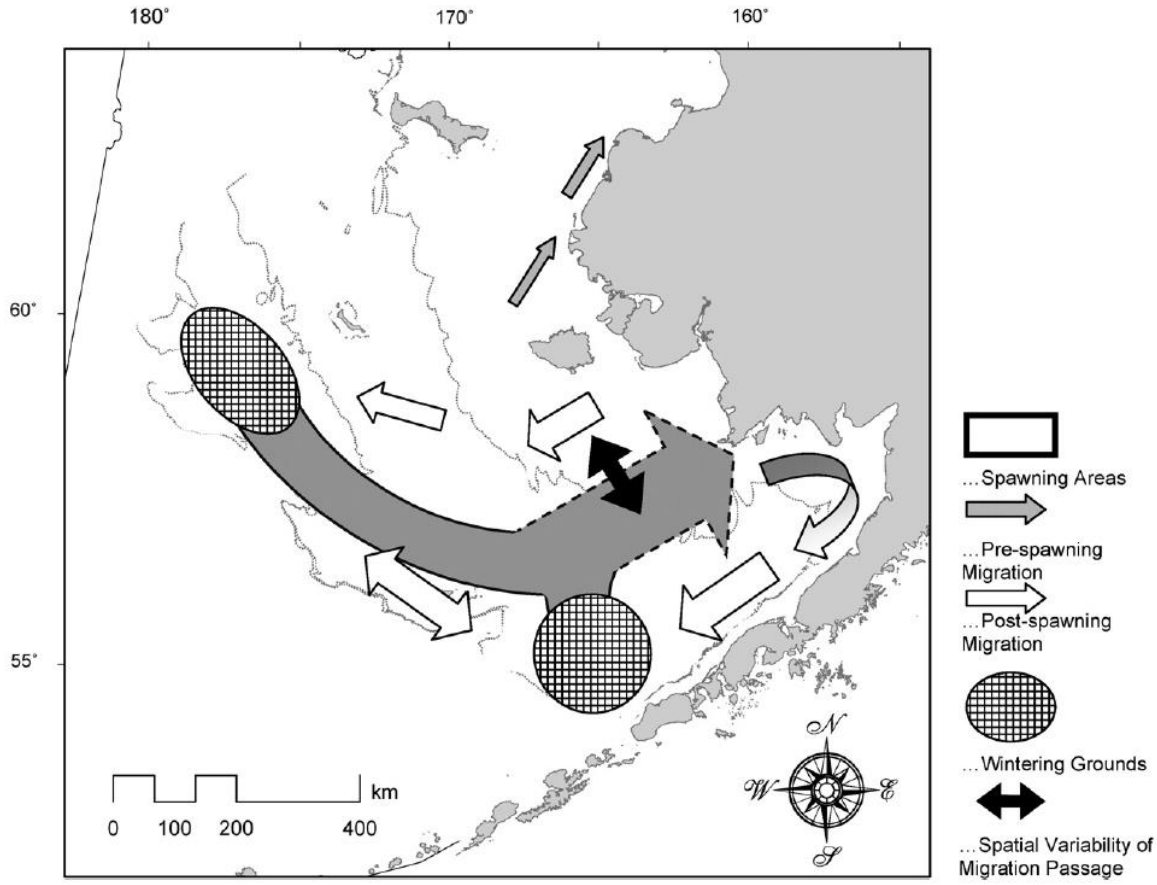

Figure 3-17 Hypothesized migration routes and seasonal distributions of herring. From Tojo et al, 2007

Commercial fisheries, mainly for herring roe, exist throughout the GOA. Sitka Sound in Southeast Alaska and Kodiak Island had the highest commercial catches during 2007-2011 (19,429 and 2,937 short tons, respectively, in 2011). Herring stocks in Prince William Sound fell dramatically following the Exxon Valdez Oil Spill and have yet to recover sufficiently to permit a directed fishery. The herring fisheries are managed by the Alaska Department of Fish & Game (ADFG), which uses a combination of various types of surveys and population modeling to set catch limits. In federal fisheries herring are managed with forage fish as prohibited species, all directed fishing is banned and any bycatch must be returned to the sea immediately. There is a 2% MRA for forage fish to discourage any targeting on this category. Periodic stock assessments for forage fish including Pacific herring are conducted for the BSAI and GOA in alternate years (Ormeth, 2015c,d).

Table 3-19 Pacific herring mature spawning biomass aggregations (mt) provided by ADF&G to the NPFMC annually for use in establishing PSC limits for the BSAI groundfish fisheries.

Spawning area	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Norton Sound	33,930	33,491	34,434	38,534	39,396	48035	47,299	48,794	48,794	31,007
Cape Romanzof	3,512	4,402	3,606	5,024	4,349	4,349	2,634	4,366	4,366	4,678
Nunivak Island	3,346	2,849	4,176	3,014	2,612	2,612	2,068	5,132	140	3,540
Nelson Island	3,106	4,674	4,187	4,765	4,267	4,266	3,882	27,422	27,422	4,785
Cape Avinof	731	2,042	1,789	2,171	1,901	1,901	1,200	9,456	9,456	3,126
Goodnews Bay	2,957	5,204	6,259	33,393	29,944	29,944	7,116	16,812	8,263	4,724
Security Cove	5,844	5,158	9,696	11,901	11,061	18,144	7,852	11,681	8,540	4,781
Togiak	118,402	110,495	133,152	127,786	112,260	152,169	142,834	148,306	147,185	142,453
Port Moller/Port Heiden	816	1,361	136	680	3,629	3,382	2,268	2,268	8,932	2,184
Total	172,644	169,675	197,435	227,269	209,419	264,802	217,153	274,236	263,098	201,278

In addition to the prohibition on targeting and MRA restrictions, in the BSAI (only) there are also PSC limits established for herring in BSAI groundfish fisheries. The current herring PSC management measures were implemented in 1991 following amendment 16A to the BSAI Groundfish FMP. This established a PSC limit set equal to 1% of the eastern Bering Sea herring biomass established by the State of Alaska. This PSC limit is further apportioned to fishery categories by NMFS. Upon attainment of a fishery limit, the herring savings areas are then closed that fishery. The herring savings areas were last reached by the Pollock fishery in 2012, resulting in a closure to the pollock fleet of the winter herring savings area. The herring areas and their closure timing are shown in Figure 3-18.

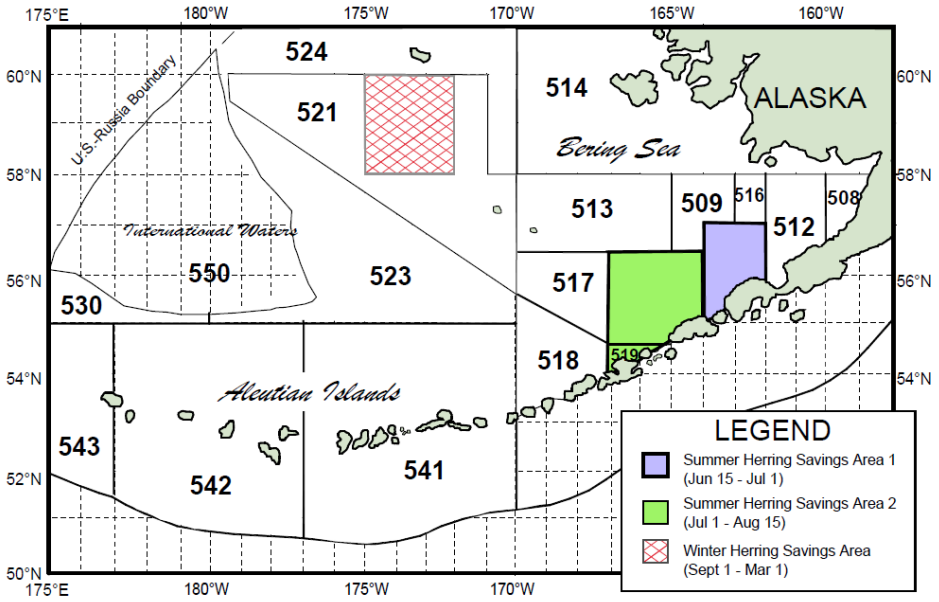

Figure 4 to Part 679. BSAI Herring Savings Areas
a. Map.

Figure 3-18 Herring savings areas in the BSAI Groundfish FMP

3.3.3 Effects of the Alternatives on prohibited species

Table 3-20 describes the criteria used to determine whether the impacts on Chinook and chum salmon and herring stocks are likely to be significant.

Table 3-20 Criteria used to estimate the significance of impacts on incidental catch of Chinook and chum salmon and herring.

No impact	No incidental take of the prohibited species in question.
Adverse impact	There are incidental takes of the prohibited species in question
Beneficial impact	Natural at-sea mortality of the prohibited species in question would be reduced — perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	An action that diminishes protections afforded to prohibited species in the groundfish fisheries.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the prohibited species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

Chinook and Chum salmon PSC are taken in the BSAI and GOA pollock fishery. Highest amounts are taken in the EBS pollock fishery (Table 3-21). For Chinook PSC, catch in 2016 was 25,265 and chum PSC was 343,598 (Table 3-21). In the GOA for chum salmon PSC catch in was 8,316 with chum PSC at 1,116.

Table 3-21 Chinook and chum bycatch in pollock fisheries of the BSAI and GOA in numbers of fish

	BSAI		GOA	
Year	Chinook	Chum	Chinook	Chum
2000	3,216	4,975		
2001	16,900	20,452	77	
2002	9,453	9,372		

	BSAI		GOA	
Year	Chinook	Chum	Chinook	Chum
2003	43,096	139,003	3,963	2,852
2004	54,345	446,427	5,318	1,033
2005	69,861	707,930	10,139	2,297
2006	84,007	302,210	7,058	1,645
2007	125,263	91,819	6,963	501
2008	22,707	15,544	6,563	407
2009	13,197	45,945	3,220	656
2010	10,940	13,292	11,263	492
2011	25,895	191,767	6,159	137
2012	12,187	22,513	5,730	121
2013	13,862	125,805	8,150	1,555
2014	16,191	220,571	5,013	896
2015	19,893	238,551	7,379	554
2016	25,265	343,598	8,316	1,116

BSAI Amendments 91 and 110 collectively restructured Chinook and Chum salmon bycatch management in the EBS pollock fishery (NPFMC/NMFS 2009; NPFMC 2015). In response to potentially constraining Chinook PSC limits combined with stringent vessel-level Incentive Plan Agreement requirements, the pollock industry has been extremely responsive to incidences of increased salmon bycatch. However, recent catches of squid have resulted in additional movement away from areas of high squid bycatch and have compromised the fleet's ability to avoid chum and Chinook salmon (Hafling and Gruver, 2015). Figure 3-19 shows the relative catches of squid and chum salmon by the pollock fleet and the increase in chum salmon bycatch just after the IC squid closure to the fleet. Chum salmon is often encountered in higher amounts beginning in August thus it is not known to what extent the large observed increase in bycatch of chum is a direct result of movement away from the squid closure. However the movement did result in reduced flexibility by the fleet in fishing operations. This is further complicated by the overlaying closures to the fleet for chum, squid and efforts to likewise avoid herring (Figure 3-20). Amendment 110 was specifically designed to increase the flexibility of the fleet to avoid salmon bycatch at all levels of encounters. The current status quo under Alternative 1 for squid management has an adverse impact on salmon. Alternative 2 **(Preferred Alternative)**, moving squid to EC, has the potential to reduce the adverse impact on chum and Chinook salmon as it would allow the pollock fleet additional flexibility in fishing in areas where fishing rates are good and salmon bycatch is low. There are no significant adverse impacts to BSAI Chinook and chum salmon PSC as a result of this action.

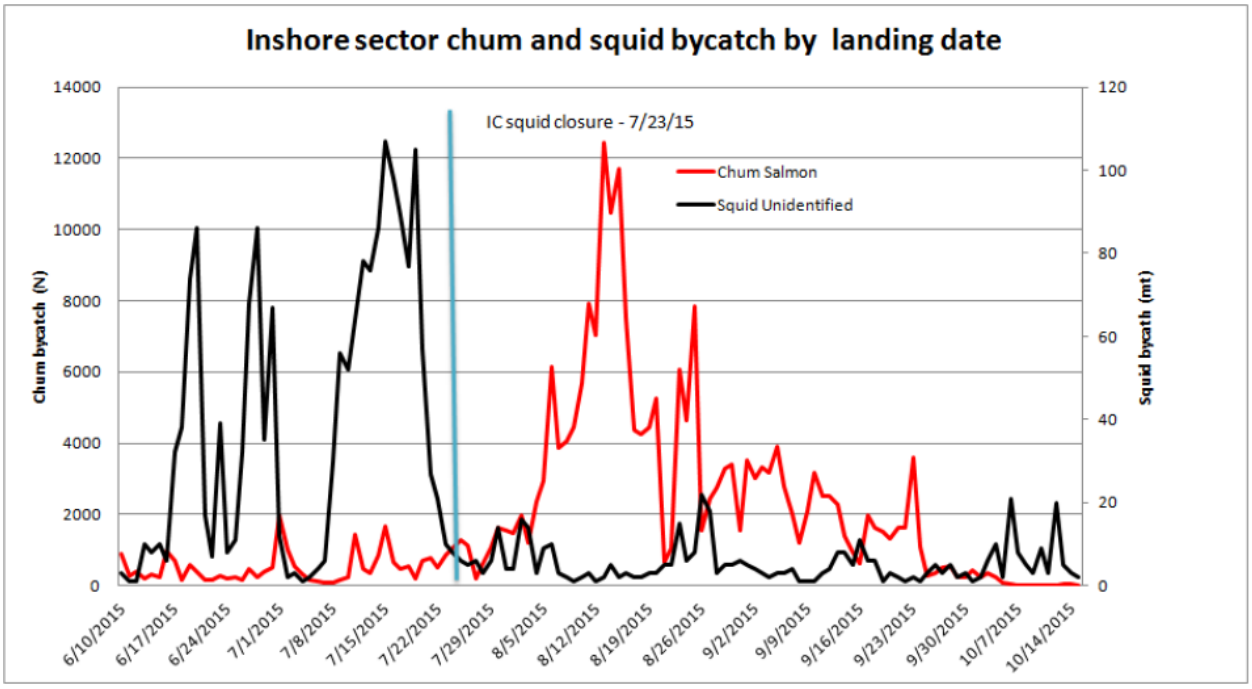

Figure 3-19 Inshore pollock sector chum salmon bycatch and squid incidental catch by week-ending date in the B-season, 2015 (from Haflinger and Gruver, 2015). The blue line notes the IC squid closure on 7/23/2015.

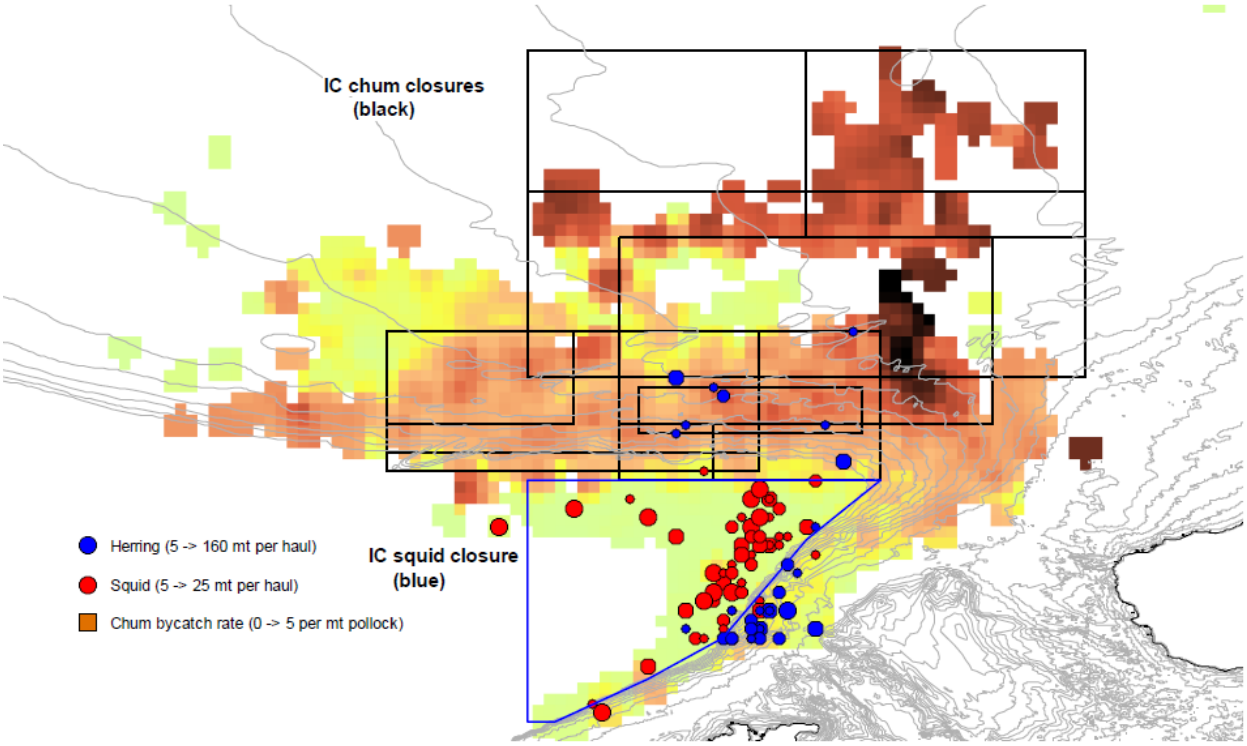

Figure 3-20 Inshore pollock sector chum salmon bycatch, squid incidental catch rates and herring PSC rates observed in the 2015 B-season in conjunctions with closures to the fleet for chum (black boxes) and squid (blue) (from Haflinger and Gruver, 2015).

In the GOA, squid catch has not been constraining, thus while there are limits by area and season for Chinook PSC, there has been no evidence that squid avoidance has impacted Chinook PSC rates. There are no management measures in the GOA to limit chum salmon PSC, thus the adverse impact to Chinook and chum salmon in the GOA is expected to be similar under both alternatives 1, 2**(Preferred Alternative)** and 3. There are no significant advrse impacts to GOA Chinook and chum salmon PSC as a result of this action.

Herring

Herring bycatch also occurs in trawl fisheries. Table 3-22 shows the herring PSC limit in the BSAI, the catch towards that limit by all trawl fisheries and the percentage of the limit remaining by year. As described previously, when reached by trawl fishery categories, the limit closes the herring savings area for specific times of the year.

Table 3-22 Herring PSC limit and catch (mt) by BSAI trawl fisheries towards that limit annually 2003-2016.

Year	Herring PSC limit	PSC	Remaining	% taken
2003	1,526	962	564	63%
2004	1,876	1,208	668	64%
2005	2,012	692	1,320	34%
2006	1,770	486	1,284	27%
2007	1,787	418	1,369	23%
2008	1,726	215	1,511	12%
2009	1,697	88	1,609	5%
2010	1,974	356	1,618	18%
2011	2,273	397	1,876	17%
2012	2,094	2,376	(282)	113%
2013	2,648	988	1,660	37%
2014	2,179	186	1,993	9%
2015	2,742	1,531	1,211	56%
2016	2,630	1,485	1,145	56%

For comparison, very little catch of herring occurs in the GOA (Table 3-23).

Table 3-23 Catch of herring in the GOA trawl fisheries (mt) 2004-2016

Year	Catch mt
2004	118
2005	4
2006	3
2007	10
2008	1
2009	3
2010	1
2011	6

2012	0
2013	6
2014	4
2015	42
2016	77

As noted previously, particularly in the BSAI pollock fishery, trade-offs must be made between avoidance of squid incidental catch, salmon PSC and herring PSC. Impacts to herring result from incidental catch of herring and movement of the pollock fleet to avoid squid in the BSAI and as a result of incidental catch only in the GOA. There are no herring PSC limits in the GOA thus squid catch has neither not caused any additional avoidance measures and forced fleets into areas of higher herring bycatch. To avoid a closure of the herring savings areas in the BSAI, the pollock fleet may more off of high herring rates into areas of higher squid or salmon bycatch. However while this is an indirect result of PSC management in the BSAI, the catches of herring are well below any conservation concerns for herring stocks thus there are no significant impacts (beneficial or adverse) to herring PSC under either of the alternatives. There is the potential for a reduced adverse impact to herring in the BSAI if the pollock fleet has additional flexibility in fishing operations to avoid herring.

Cumulative Effects on Prohibited Species

The following RFFAs are identified as likely to have an impact non-target species within the action area and timeframe. Amendment 110 to the BSAI groundfish FMP was implemented in 2016. This amendment as discussed will directly modify the EBS pollock fishery bycatch of Chinook and chum salmon. Provisions of Amendment 110 include lower PSC caps in times of low western Alaska Chinook abundance, modified management of chum PSC within the IPAs, mandatory use of salmon excluders within the IPAs, more stringent measures in September and October to reduce times of high salmon encounters and the flexibility to catch 5% more of the quota in the A-season to allow for more fishing at times when Chinook salmon encounters are low and less fishing pressure late in the B-season. These measures are all anticipated to improve flexibility to avoid Chinook and chum salmon PSC and reduce the adverse impact of the fishery on salmon. Measures to address GOA trawl bycatch in the GOA will also address Chinook salmon caps in the future and may also reduce the adverse impact of those fisheries on salmon species.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

4 Regulatory Impact Review

This Regulatory Impact Review (RIR) examines the benefits and costs of a proposed alternatives pertaining to an action that could move several species of squid in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) to the ecosystem component in the BSAI and GOA

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735, October 4, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

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

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A "significant regulatory action" is one that is likely to:

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

4.1 Statutory Authority

Under the Magnuson-Stevens Fishery and Conservation Act (Magnuson-Stevens Act) (16 U.S.C. 1801, *et seq*.), the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in

the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the Council has the responsibility for preparing fishery management plans (FMPs) and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The squid fishery in the EEZ off Alaska is managed under the FMP for Groundfish of the GOA and BSAI. The proposed action under consideration would amend this FMP and Federal regulations at 50 CFR 679. Actions taken to amend FMPs or implement other regulations governing these fisheries must meet the requirements of Federal law and regulations.

4.2 Purpose and Need for Action

The Council adopted the following revised purpose and need statement in February 2017:

Squid are short-lived, highly productive, and an important prey species. No conservation concerns exist for squid populations in the BSAI and GOA. Squid are thought to be substantially more abundant than can be estimated from trawl survey data. Trawl surveys do not employ the proper gear or sample in locations that can provide reliable biomass estimates for most squid. Limited information hinders the development of reliable biological reference points, particularly OFLs and ABCs. As a result, current OFLs for squid are based on average catch calculations that are poorly linked to abundance. OFLs that are not representative of abundance do not achieve management goals for squid and could constrain groundfish fisheries unnecessarily. There are no directed fisheries for squid in either the BSAI or GOA, however squid bycatch is retained in some fisheries and often utilized to prevent waste. The NS1 guidelines include options to identify non-target species in FMPs (species caught incidentally during the pursuit of target stocks in a fishery) that do not require the establishment of a TAC. These options include identifying species as non-target and in need of conservation and management, or as non-target ecosystem component species, not in need of conservation and management. Identifying squid as a non-target species in the FMPs would more accurately reflect the nature of squid catch while protecting squid from fishing effects and alleviating unnecessary constraints on other groundfish fisheries.

4.3 Alternatives

Alternative 1, No Action

Under Alternative 1, squid would continue to be managed as a target species in both the BSAI and GOA groundfish FMPs. OFL, ABC, and TAC will continue to be set for squid as a species group in both areas. Stock assessments for squid would continue to be done annually. Directed fishing for squid is allowed however given the low TAC established annually for both the BSAI and GOA groundfish specifications, NMFS has determined that existing TAC levels are not sufficient to support a directed fishery in either region and thus continues to place squid in both areas on bycatch-only status. Therefore squid are actually a non-target species as they are taken only as incidental catch in groundfish fisheries (primarily pollock fisheries) in both regions.

Under Alternative 1, MRAs for squid as an incidental catch species are established at 20% (Table 10, GOA Retainable Percentages, and Table 11, BSAI Retainable Percentages, to 50 CFR 679). This allows vessels fishing for groundfish to retain a quantity of squid equal to, but no more than, 20% percent of the round weight or round weight equivalent of groundfish species open to directed fishing that are retained on board the vessel at any time during a fishing trip.

Alternative 2 (Preferred Alternative) - Move squid to the Ecosystem Component category in both FMPs.

This alternative would move squid to the Ecosystem Component in both BSAI and GOA groundfish FMPs. Catch specifications (OFL, ABC, TAC) would no longer be required. Directed fishing for squid species would be prohibited. Recordkeeping and reporting would be required under this alternative to monitor catch of squid species annually. A periodically updated stock assessment for squid species in both the GOA and BSAI would also be provided under this alternative. This would be completed on the recommended assessment frequency timing decided upon by the Council and the Alaska Fisheries Science Center.

This alternative would also establish an MRA for squid species as incidental catch in the BSAI and GOA using the MRAs in Tables 10 and 11 of 50 CFR part 679 when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries. Three options for MRAs are considered:

Option 1 MRA = 2%
Option 2 MRA = 10%
Option 3 MRA = 20% **(Preferred Option)**.

Option 3 is the status quo MRA for squid species as incidental catch when fishing for groundfish while options for lower MRAs under options 1 and 2 are considered to discourage any targeted fishing for squid. The lower range MRA in option 1 of 2% has been used in the forage fish classification with the rationale being to ban targeted fishing of these ecologically important species.

Alternative 3 – Designate squid in both BSAI and GOA FMPs as non-target species. Establishment of a squid TAC will no longer be required.

This alternative would designate squid in both BSAI and GOA groundfish FMPs as a 'non-target' species whereby OFL and ABC would still be established but a TAC would no longer be necessary. Directed fishing for squid species would be prohibited. Recordkeeping and reporting requirements would be required under this alternative to monitor and report catch of squid species annually. A periodically updated stock assessment for squid species in both the GOA and BSAI would also be provided under this alternative. This would be completed on the recommended assessment frequency timing decided upon by the Council and the Alaska Fisheries Science Center.

As with Alternative 2, this alternative would also establish a squid maximum retainable amount (MRA) for squid species as incidental catch in the BSAI and GOA using the MRAs in Tables 10 and 11 of 50 CFR 679 when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries. Three options for MRAs are considered:

Option 1 MRA = 2%
Option 2 MRA = 10%
Option 3 MRA = 20%.

4.4 Methodology for analysis of impacts

The evaluation of impacts in this analysis is designed to meet the requirement of E.O. 12866, which dictates that an RIR evaluate the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. Additionally, the analysis should provide information for decision makers "to maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." The costs and benefits of this action with respect to these attributes are described in the sections that follow, comparing the No Action Alternative 1 with the action alternatives. The analyst then provides a qualitative assessment of the net benefit to the Nation of each alternative, compared to no action.

This analysis was prepared using data from the NMFS catch accounting system, which is the best available data to estimate total catch in the groundfish fisheries off Alaska. Total catch estimates are generated from information provided through a variety of required industry reports of harvest and at-sea discard, and data collected through an extensive fishery observer program. In 2003, NMFS changed the methodologies used to determine catch estimates from the NMFS blend database (1995 through 2002) to the catch accounting system (2003 through present).

The catch accounting system was implemented to better meet the increasing information needs of fisheries scientists and managers. Currently, the catch accounting system relies on data derived from a mixture of production and observer reports as the basis of the total catch estimates. The 2003 modifications in catch estimation included providing more frequent data summaries at finer spatial and fleet resolution, and the increased use of observer data. Redesigned observer program data collections were implemented in 2008, and include recording sample-specific information in lieu of pooled information, increased use of systematic sampling over simple random and opportunistic sampling, and decreased reliance on observer computations. As a result of these modifications, NMFS is unable to recreate blend database estimates for total catch and retained catch after 2002. Therefore, NMFS is not able to reliably compare historical data from the blend database to the current catch accounting system.

4.5 Description of Fisheries

4.5.1 Harvests

Squid in the BSAI are currently managed as a single stock complex that includes all known squid species in the management area. Although no directed fishery exists for squid, they are caught and retained in sufficiently large numbers for them to be managed as target species.

In the BSAI, from 2003 - 2008 squid catches fluctuated around an average of approximately 1,000 mt, with anomalously high catches in some years (Table 4-1). From 2009 to 2013 catches were much smaller, ranging from 209 mt to 495 mt. In 2014, the catch was 1,478 mt, exceeding the TAC (prior to the increase from the non-specified reserves) which had been set at a low level based on the low catch levels of recent years. The 2015 catch was even higher (2,206 mt) and for the first time exceeded the ABC of 1,970 mt. In 2016, catch declined to 1,251 mt. Nearly all of the BSAI squid catch continues to be in the walleye pollock fishery (~90%, Table 3-8). In 2014 and 2015, the majority of the catches occurred in July near the start of the pollock B season. In both years catch rates declined dramatically after the pollock fleet adopted a voluntary special closure in the Bering Canyon area. Retention rates of squid by BSAI groundfish fisheries have ranged between 37% and 66% since 2008, with much of the retained squid being landed into whole fish.

In the GOA, nearly all squid (~90%) are caught incidentally in the pollock fishery and in the central GOA (Table 3-9). Since 2006 when an unusually high catch of squid occurred, squid catches have ranged from 3 mt to 405 mt (Table 4-1). Most of this catch occurs in the pollock fishery, and because the pollock fishery is concentrated in Shelikof Strait this is also where most of the squid catch occurs.

Table 4-1 Catch (mt) and retention (mt) of squid by all groundfish fisheries by FMP area BSAI and GOA (2003-2016)

Year	BSAI			GOA		
	Catch (mt)	Retained (mt)	%Retained	Catch (mt)	Retained (mt)	%Retained
2003	1,226	910	74%	48	39	81%
2004	977	430	44%	139	108	77%
2005	1,150	839	73%	628	554	88%
2006	1,399	867	62%	1,504	1,279	85%
2007	1,169	689	59%	405	375	92%
2008	1,452	1,033	71%	78	75	96%
2009	209	181	86%	314	291	93%
2010	277	260	94%	121	118	97%
2011	178	142	79%	202	176	87%
2012	495	452	91%	3	2	75%
2013	118	111	94%	307	292	95%
2014	1,478	681	46%	65	55	84%
2015	2,206	1,302	59%	356	317	89%
2016	1,251	458	37%	162	135	83%

Source: AKFIN, December 2016 Table originates from SQUID_CATCH_CONF(12-20)

4.5.2 Description of management

As mentioned above, there are no squid directed fisheries in the waters off Alaska at present. Under status quo, squid harvest is managed on bycatch status. Most of the squid bycatch in the BSAI and GOA is taken in the pollock fishery (e.g. 94% in the BSAI and 90% in the GOA in 2015, Ormseth 2015a, Ormseth 2015b). Squid are managed as target species despite being caught only incidentally under status quo and an annual OFL, ABC, and TAC for the squid complex is specified separately for the BSAI and GOA. If the total TAC of any squid is caught, retention of squid is prohibited for the remainder of the year. In the BSAI, a TAC reserve system plays an important role in managing the groundfish TACs. Annually, 15 percent of each TAC is put into a reserve.[4] The TAC remaining after deductions to the reserve is referred to as the ITAC. The reserve system provides a limited amount of flexibility to respond to yearly fluctuations in catch rates and maximize value to the industry. For species that contribute to the reserves, NMFS's Regional Administrator has the option of increasing an individual ITAC with TAC from the reserve, as long as the ABC and OY are not exceeded.

In 2014 and 2015, BSAI squid catch exceeded the ITAC. When the ITAC was exceeded in 2014 and 2015, NMFS increased the BSAI squid ITAC with TAC from the reserve to allow retention of squid bycatch in pollock and other directed fisheries. In 2015, the BSAI squid catch exceeded the total revised TAC set equal to the ABC, and retention of squid in the BSAI pollock fishery was prohibited from July 29, 2015 through the remainder of the year. The prohibition on squid retention was problematic for many BSAI pollock vessel operators in 2015 because squid are caught together with pollock and it is difficult to sort squid from pollock onboard the vessel. NMFS OLE received numerous reported violations of the non-retention requirement for the remainder of the 2015 BSAI pollock B season.

Under status quo, the BSAI and GOA squid complexes are assessed as a Tier 6 species complex. The Tier 6 approach to prescribing the OFL is the least preferred method to specify an overfishing limit as it is based on the least amount of information and is not likely to accurately reflect a level of fishing that would jeopardize the capacity of a stock complex to produce MSY on a continuing basis. Tier 6 OFLs are based solely on fishery catch information rather than the biological reference points which form the basis for Tier 1 through 5 limits. Nonetheless, specification of OFL for Tier 6 species reflects the best estimate possible with the available data.

The Council increased the 2016 BSAI squid TAC to account for the higher incidental catch that occurred in 2014 and 2015. The 2016 ABC and TAC for BSAI squid are 5,184 mt and 1,500 mt, respectively. The BSAI squid ABC was 1,970 mt in 2014 and 2015; the TACs were set at 310 mt and 400 mt, respectively. The GOA squid ABC and TAC have been set at 1,148 mt since 2011 when the squid complex was first

[4] Except for pollock, the portion of the sablefish TAC allocated to hook-and-line and pot gear, and Amendment 80 species.

split out from the "other species" complex. From 2011 through 2015, squid catch in the GOA ranged from a low of 2% of the squid TAC in 2012 to 31% in 2015 (Ormseth 2015b).

At the start of the fishing year, directed fishing for squid is prohibited (also referred to as incidental catch or bycatch status) and may be retained up to an MRA of 20%. MRA regulations establish the calculation method and set individual MRAs for groundfish species, when directed fishing for that species is closed. MRAs are the primary tool NMFS uses to regulate the catch of species closed to directed fishing[5]. NMFS closed directed fishing for such species to avoid reaching a TAC, reaching an amount or percentage of groundfish included in the annual specifications for a gear and species, or when a directed fishery has attained a prohibited species limit (e.g., halibut limits).

Specifically, the MRA is the percentage of the retained amount of a species closed to directed fishing, relative to the retained amount of basis species or species group open for directed fishing. There are three basic steps to calculating an MRA. First, the vessel operator identifies and calculates the rough weight of the basis (or target) species onboard. Next, they identify the appropriate percentage from the MRA table (Tables 10 and 11 to 50 CFR part 679), and finally, multiply that percentage against the calculated rough weight of the basis species. The calculated maximum amount limits retention of the incidental catch. A vessel will typically discard catch of the incidental species in excess of that amount, to avoid violation of current regulation. Except for pollock harvested by non-American Fishing Act (AFA) vessels, the vessel operator must calculate the MRA in real time, at any time during the fishing trip, often referred to as an "instantaneous" calculation. The one exception, pollock harvested by non-AFA vessels, is calculated at the end of each offload. Shoreside catcher vessel operator calculates their MRA upon returning to port for delivery of retained catch.

When NMFS prohibits directed fishing on a groundfish species, MRAs buffer the amount of catch of that species occurring in directed groundfish fisheries that remain open. Ideally, the application of an MRA rate slows catch of a species, so that harvest can be managed up to the TAC by the end of the year. Beyond management of a TAC to obtain optimum yield, MRA calculations perform two additional functions. First, MRAs limit retention to a species' expected or accepted incidental catch rate. Alternately, the MRA functions as a trip limit for retention of incidental catch of a species. This function allows for limited targeting of a species up to the MRA ("topping off").

The requirement to not exceed an MRA at any time during a trip, limits the vessel operator's ability to fully utilize catch. This restriction is intended to limit total catch of groundfish species (1) with low TACs (relative to the target species caught in the directed fisheries), (2) at greater risk of being caught in excess

[5] Directed fishing is generally defined in regulations as any fishing activity that results in the retention of an amount of a species or species group on board a vessel that is greater than the MRA for that species or species group as calculated under § 679.20.

of the overfishing level, and (3) of sufficiently high value to induce covert targeting. Atka mackerel, Pacific cod, Greenland turbot, sablefish, and several rockfish species meet these criteria in the BSAI.

A vessel is not required to retain squid up to the MRA, however the difficulty of manually sorting squid from the pollock catch at-sea has likely contributed to higher retention of squid than may occur under different operational conditions. Historical squid retention amounts in the BSAI and GOA are presented in Table 3-18. Since 2003, the squid TAC has only been exceeded in the BSAI in 2015, 2006, and 2005. The squid TAC has not been reached in the GOA. As mentioned above, when the total TAC has been taken, squid may no longer be retained.

4.5.3 Harvesting Vessels

In the BSAI, both offshore sector and the CV sector catch squid (Table 4-2). During 2006 through 2016, the number of vessels that retained squid for the offshore sector in the BSAI ranged from a low of 13 vessels in 2013 to high of 23 vessels in 2006, while the retained catch ranged from a low of 18 mt in 2012 to a high of 410 mt in 2007. For the CV sector in the BSAI, the number of vessels that retained squid ranged from a low of a 48 vessels in 2009 to a high of 97 vessels in 2015, while retained catch for the sector ranged from a low of 89 mt in 2013 to a high of 1,200 mt in 2015. Although both sectors retained BSAI squid, the CV sector retained a larger share of their total catch than the offshore sector.

In the GOA, the offshore sector did not catch any squid during the 2006 through 2016 period, while retained catch for the CV sector ranged from a low of 2 mt in 2012 to high of 1,279 mt in 2006 with a vessel count that ranged from a low of 36 vessels in 2012 to a high of 80 vessels in 2006.

Table 4-3 provides combined BSAI and GOA total catch and retained catch of squid in addition to the number of vessels that retained squid by sector from 2006 through 2016.

Table 4-2 Total catch (mt) and retained catch (mt) of squid, and the number of vessels that retained squid by sector and FMP area from 2006 through 2016

FMP area	Sector	Year	Total catch (mt)	Retained catch (mt)	Vessel count that retained squid
BSAI	Offshore	2006	439	236	23
		2007	672	410	20
		2008	206	151	21
		2009	64	56	14
		2010	24	22	16
		2011	59	27	21
		2012	44	18	21
		2013	28	22	13
		2014	563	78	14
		2015	261	102	20
		2016	705	226	20
	CVs	2006	959	631	58
		2007	497	279	61
		2008	1,246	882	55
		2009	145	124	48
		2010	254	238	51
		2011	119	115	66
		2012	452	434	88
		2013	90	89	58
		2014	916	603	79
		2015	1,945	1,200	97
		2016	546	232	54
GOA	Offshore	2006	0	0	0
		2007	0	0	0
		2008	0	0	0
		2009	0	0	0
		2010	0	0	0
		2011	0	0	0
		2012	0	0	0
		2013	0	0	0
		2014	0	0	0
		2015	0	0	0
		2016	0	0	0
	CVs	2006	1,504	1,279	80
		2007	405	375	75
		2008	78	75	60
		2009	314	291	64
		2010	121	118	57
		2011	202	176	53
		2012	3	2	36
		2013	307	292	72
		2014	65	55	60
		2015	356	317	78
		2016	162	135	53

Source: AKFIN, December 2016

Table orginates from SQUID_CATCH_CONF(12-20)

Table 4-3 Total catch (mt) and retained catch (mt) of squid, and the number of vessels that retained squid in the combined BSAI and GOA by sector from 2006 through 2016

Sector	Year	Total catch (mt)	Retained catch (mt)	Vessel count that retained squid
Offshore	2006	439	236	23
	2007	672	410	20
	2008	206	151	21
	2009	64	56	14
	2010	24	22	16
	2011	59	27	22
	2012	44	18	21
	2013	28	22	13
	2014	563	78	14
	2015	261	102	20
	2016	705	226	20
CVs	2006	959	631	89
	2007	497	279	83
	2008	1,246	882	77
	2009	145	124	75
	2010	254	238	72
	2011	119	115	83
	2012	452	434	99
	2013	90	89	95
	2014	916	603	110
	2015	1,945	1,200	111
	2016	546	232	90

Source: AKFIN, September 2017

Since nearly all of the offshore squid that is retained is processed into bait, while a good share of the squid that retained by the CV sector is processed into whole fish/food fish, the next section focuses only on the CV sector's production of squid. To illustrate the CV sector's production of squid, the next series of tables (Table 4-4, Table 4-5, and Table 4-) show the amount of CV sector squid processed into a product forms other than fish meal, squid that is processed into fish meal, and squid that is discarded at the shoreplant for CV sectors for BSAI and GOA from 2006 through 2015. As seen in all three tables, primary amongst the CVs in the BSAI was the AFA CVs, while in the GOA, both CV sectors were participants in the squid fishery.

Amongst the three tables, the most interesting is Table 4-4, which shows the amount of squid harvested by the CV sector that was produced into product forms other than fish meal. In the BSAI, the amount of squid processed into product forms other than fish meal ranged from a low of 87 mt in 2013 to a high of 493 mt in 2015. In GOA, production ranged from a low of 0 mt in 2014 and 2015 to a high of 505 mt in 2006.

Table 4-4 Total amount of squid processed into product forms other than fish meal by CV sector from 2006 through 2015 for the BSAI and GOATotal amount of squid processed into product forms other than fish meal by CV sector from 2006 through 2015 for the BSAI and GOA

FMP area	Year	Total CV processed squid (does not include squid processed into fish meal)					
		All CVs		AFA CVs		Non-AFA CVs	
		MT	Vessel count	MT	Vessel count	MT	Vessel count
BSAI	2006	265	45	237	26	29	19
	2007	234	32	234	32	0	0
	2008	440	31	440	31	0	0
	2009	123	25	*	24	*	1
	2010	216	28	216	28	0	0
	2011	107	30	107	30	0	0
	2012	251	55	251	55	0	0
	2013	87	25	87	25	0	0
	2014	437	51	437	51	0	0
	2015	466	64	466	60	0	4
GOA	2006	505	33	178	14	328	19
	2007	94	15	23	5	72	10
	2008	9	5	0	0	9	5
	2009	46	11	22	6	24	5
	2010	30	19	22	9	8	10
	2011	74	31	34	16	40	15
	2012	*	2	*	2	*	0
	2013	127	27	44	15	83	12
	2014	0	0	0	0	0	0
	2015	*	1	0	0	*	1

Source: AKFIN, May 2016

Table orginates from SQUID_EV_CONF(05-6) and SQUID_EV_CONF(05-10)

* denotes confidental data

Table 4-5 Total amount of squid processed into fish meal by CV sector from 2006 through 2015 for the BSAI and GOA

FMP area	Year	Total amount of CV squid processed into fish meal					
		All CVs		AFA CVs		Non-AFA CVs	
		MT	Vessel count	MT	Vessel count	MT	Vessel count
BSAI	2006	353	50	346	30	7	20
	2007	46	32	*	31	*	1
	2008	442	28	442	28	0	0
	2009	2	29	*	28	*	1
	2010	22	29	22	29	0	0
	2011	8	40	8	40	0	0
	2012	186	50	*	49	*	1
	2013	2	42	2	42	0	0
	2014	166	48	166	48	0	0
	2015	734	48	734	48	0	0
GOA	2006	806	60	465	28	341	32
	2007	280	58	162	28	118	30
	2008	66	51	43	27	24	24
	2009	245	54	111	24	134	30
	2010	89	53	32	26	56	27
	2011	102	49	47	23	55	26
	2012	1	43	1	19	1	24
	2013	188	65	62	29	126	36
	2014	56	65	32	27	24	38
	2015	318	67	177	28	141	39

Source: AKFIN, May 2016

Table orginates from SQUID_EV_CONF(05-6) and SQUID_EV_CONF(05-10)

* denotes confidental data

Table 4-6Total amount of squid discarded at the shoreplant from 2006 through 2015 for the BSAI and GOA

FMP area	Year	Total amount of squid discarded at shoreplants					
		All CVs		AFA CVs		Non-AFA CVs	
		MT	Vessel count	MT	Vessel count	MT	Vessel count
BSAI	2006	309	83	286	61	23	22
	2007	214	40	*	39	*	1
	2008	330	26	*	24	*	2
	2009	15	19	15	19	0	0
	2010	10	17	10	17	0	0
	2011	4	24	4	24	0	0
	2012	17	36	*	34	*	2
	2013	1	26	1	26	0	0
	2014	311	52	311	52	0	0
	2015	650	68	*	66	*	2
GOA	2006	185	36	37	12	148	24
	2007	23	16	7	5	16	11
	2008	2	8	*	2	*	6
	2009	4	7	*	1	*	6
	2010	*	2	*	1	*	1
	2011	12	7	8	3	4	4
	2012	0	4	*	1	*	3
	2013	10	7	*	5	*	2
	2014	7	10	3	6	5	4
	2015	11	11	7	6	4	5

Source: AKFIN, May 2016

Table orginates from SQUID_EV_CONF(05-6) and SQUID_EV_CONF(05-10)

* denotes confidental data

Error! Reference source not found. provides ex vessel price of CV caught squid for all product forms c ombined (not including fish meal) and fish meal by CV sector for both the BSAI and GOA from 2006 through 2015. For product forms other than fish meal, the ex vessel price in the BSAI has ranged from a low of $0.03 per pound for 2006, 2007, and 2013, to a high of $0.18 per pound in 2014. The high ex vessel price for CV squid in 2014 could be due in part to low catches of squid international fisheries brought about by La Nina, which causes ocean temperature changes and shifts squid from their normal habitat (Undercurrentnews, 2014). In GOA, ex vessel price for product forms other than fish meal has ranged from a low of $0.05 per pound in 2008 and 2013, to a high of $0.10 per pound in 2015. Ex vessel price for fish meal has routinely been $0.02 per pound in the BSAI and GOA.

Table 4-7Ex vessel price of CV caught squid for both all product forms combined (not including fish meal) and fish meal for both AFA and non-AFA sectors for BSAI and GOA from 2006 through 2015

Year	Ex vessel price of CV squid (not including fish meal) ($)				Ex vessel price of AFA CV squid that was processed into fish meal ($)			
	BSAI		GOA		BSAI		GOA	
	AFA	Non-AFA	AFA	Non-AFA	AFA	Non-AFA	AFA	Non-AFA
2006	0.03	0.00	0.07	0.07	0.02	0.00	0.02	0.02
2007	0.03	0.00	0.06	0.07	0.02	0.00	0.02	0.02
2008	0.06	0.00	0.00	0.05	0.02	0.00	0.02	0.02
2009	0.04	0.00	0.07	0.06	0.02	0.00	0.02	0.02
2010	0.07	0.00	0.07	0.07	0.02	0.00	0.02	0.02
2011	0.16	0.00	0.07	0.07	0.02	0.00	0.02	0.02
2012	0.11	0.00	0.07	0.00	0.02	0.00	0.02	0.02
2013	0.03	0.00	0.06	0.05	0.02	0.00	0.02	0.02
2014	0.18	0.00	0.00	0.00	0.02	0.00	0.00	0.00
2015	0.12	0.00	0.00	0.10	0.02	0.00	0.00	0.00

Source: AKFIN, May 2016

Table orginates from SQUID_EV_CONF(05-6) and SQUID_EV_CONF(05-10)

4.5.4 Production of Squid

This section provides a brief overview of squid production and the value of that production. Specifically, Table 4- and Table 4-8 provide total and annual production of squid, gross first wholesale value, and gross first wholesale price by product form from 2006 through 2015. As noted in the tables, the number of processors processing squid is limited, so some production data was confidential. Looking at total squid production from 2006 through 2015, whole bait had the highest production weight at 4 mt and the highest gross first wholesale value at $2.5 million. The next largest production weight was whole fish/food fish at 2.4 mt for a gross first wholesale value of $873 thousand. The product form with the highest gross first wholesale price was whole bait at $0.62 per pound.

Table 4-8 Total production of all squid, gross first wholesale value, and gross first wholesale price by product form from 2006 through 2015

Product type	Production weight (mt)	Gross first wholesale value ($)	Gross first wholesale price ($)	Processor count
Fish meal	*	*	*	2
Gutted only	*	*	*	2
Octopus/Squid mantles	161,639	99,845	0.6177	3
Other-specify	*	*	*	2
Stomachs (internal organs)	*	*	*	1
Whole bait	3,995,407	2,507,179	0.6275	47
Whole fish/food fish	2,422,503	873,520	0.3606	27

Source: AKFIN, December 2016

Table orginates from SQUID_PROD_CONF(12-20)

* denotes confidental data

Table 4-9 Annual Production of all squid, gross first wholesale value, and price by product type from 2006 through 2015

Year	Product type	Production weight (mt)	Gross first wholesale value ($)	Gross first wholesale price ($)	Processor count
2006	Fish meal	*	*	*	1
	Gutted only	*	*	*	1
	Octopus/Squid mantles	*	*	*	1
	Whole bait	318	526,679	0.7517	5
	Whole fish/food fish	268	150,233	0.2541	6
	Total	754	**855,510**	**0.5144**	**14**
2007	Octopus/Squid mantles	*	*	*	1
	Other-specify	*	*	*	1
	Whole bait	112	77,058	0.3114	8
	Whole fish/food fish	188	179,746	0.4348	4
	Total	311	**268,457**	**0.3916**	**14**
2008	Fish meal	*	*	*	1
	Whole bait	34	28,574	0.3762	3
	Whole fish/food fish	346	250,225	0.3281	3
	Total	380	**278,803**	**0.3324**	**7**
2009	Other-specify	*	*	*	1
	Whole bait	39	48,036	0.5538	3
	Whole fish/food fish	142	165,762	0.5284	3
	Total	186	**222,351**	**0.5433**	**7**
2010	Whole bait	177	211,811	0.5442	5
	Whole fish/food fish	*	*	*	1
	Total	186	**221,732**	**0.5420**	**6**
2011	Gutted only	*	*	*	1
	Whole bait	119	135,137	0.5140	5
	Whole fish/food fish	*	*	*	2
	Total	168	**170,390**	**0.4593**	**8**
2012	Whole bait	136	154,723	0.5171	7
	Whole fish/food fish	1	1,374	0.5108	3
	Total	137	**156,097**	**0.5171**	**10**
2013	Octopus/Squid mantles	*	*	*	1
	Stomachs (internal organs)	*	*	*	1
	Whole bait	126	141,500	0.5100	5
	Whole fish/food fish	11	10,982	0.4439	3
	Total	187	**227,731**	**0.5517**	**10**
2014	Whole bait	*	*	*	3
	Whole fish/food fish	*	*	*	1
	Total	411	**560,129**	**0.6185**	**4**
2015	Whole bait	*	*	*	3
	Whole fish/food fish	*	*	*	1
	Total	434	**705,835**	**0.7377**	**4**

Source: AKFIN, December 2016

Table orginates from SQUID_PROD_CONF(12-20)-1

* denotes confidental data

4.6 Analysis of Impacts

This section provides an analysis of two alternatives: (1) Status Quo/No Action, (2) include squid in the FMP as an Ecosystem Component species, (3) designate squid in both BSAI and GOA groundfish FMPs as a 'non-target' species whereby OFL and ABC would still be established but a TAC would no longer be necessary. Assessing the effects of the alternatives and options involves some degree of speculation. In general, the effects arise from the actions of individual participants in the fisheries, under the incentives

created by different alternatives and options. Predicting these individual actions and their effects is constrained by incomplete information concerning the fisheries, including the absences of complete economic information and well-tested models that predict behavior under different institutional structures. In addition, exogenous factors, such as stock fluctuations, market dynamics, and macro conditions in the global economy, will influence the response of the participants under each of the alternatives and options.

4.6.1 Alternative 1 - No Action

Alternative 1 would continue to manage squid as a target species in both the BSAI and GOA groundfish FMPs. OFL, ABC, and TAC will continue to be set for squid as a species group in both areas. Stock assessments for squid would continue to be done annually. Directed fishing for squid could be allowed however given the low TAC established annually for both the BSAI and GOA groundfish specifications, NMFS has determined that existing TAC levels are not sufficient to support a directed fishery in either management area and thus continues to place squid in both areas on bycatch-only status. Therefore squid are actually a non-target species as they are taken only as incidental catch in groundfish fisheries (primarily pollock fisheries) in both regions.

At present, the OY cap established in the Groundfish FMP for the GOA is substantially greater than the total of all GOA TACs. Thus, continuing to manage squid as a target species group in the GOA does not require "funding" of squid TAC via reductions in TACs of any other groundfish species. Further, since the present and past harvests of squid taken incidentally are well below the current ABCs calculated for squid, there would be no significant effects (either adverse or beneficial) on the stock biomass, fishing mortality, spatial or temporal distribution, or changes in prey availability for squid and groundfish target species in the GOA. There would be no significant (either beneficial or adverse) socioeconomic effects on those who harvest squid or other groundfish targets in the GOA.

In contrast to the potential effects of Alternative 1 in the GOA, continuing to manage squid as a target species in the BSAI FMP may have adverse effects on fishery total revenue. The BSAI Groundfish FMP specifies a total OY cap of 2 million mt. The total of all BSAI groundfish TACs may not exceed this 2 million mt cap. Thus, continuing to manage BSAI squid as a target fishery means that squid incidental catch would continue to be "funded" from reduced TAC of other, presently more valuable, BSAI groundfish species. In past years, the actual amount of reduction in TAC in other BSAI groundfish target fisheries with squid managed as a target species in the BSAI has ranged from a low of 310 mt in 2014 to high of 1,970 mt for 2007-2010. However, it is also the case that TAC amounts for some groundfish species in the BSAI are not fully utilized under current conditions thereby reducing any impact of continuing to fund a squid TAC.

It is important to recognize that these impacts would continue to be spread across all Federal groundfish participants, including BSAI Community Development Quota (CDQ) entities, via the allocation made to sectors in the harvest specifications process. Thus, the impacts of continuing to fund a squid TAC would be borne by all harvesting platforms in an affected sector and gear type, further ameliorating potential impacts. The likely potential economic impacts of the continuation of squid being managed as a target species in the BSAI are not significant in comparison to the overall value of the BSAI groundfish fishery;

however, the impacts may be significant to individual operators and/or target fishery sectors depending on how squid TAC continues to be funded.

Under status quo, pollock vessels are also likely to continue their effort to move from squid grounds to reduce squid bycatch in order to avoid having the pollock fishery closed. In recent years, squid bycatch has constrained pollock vessels, so pollock vessels instituted voluntary closures of regions with potentially high squid catch devised in concert with NMFS to prevent reaching the OFL on squid.

Finally, Alternative 1 will continue to impose recordkeeping and reporting requirements on the groundfish fishing industry, as well as other fisheries management measures that apply to all groundfish fisheries depending on the gear type, area, and time of year that fishing occurs. The MRA for squid in the BSAI is 20%. In the GOA, squid is combined with sculpins, octopus, and sharks, and an MRA of 20% is applied to this category as a whole.

4.6.2 Alternative 2 (Preferred Alternative) - Include squid in the FMP as an Ecosystem Component species

Under Alternative 2, which would include squid in the groundfish FMP as "ecosystem component" species, OFLs, ABCs, and TACs, would not need to be established. However, current recordkeeping and reporting requirements and other other management measures that apply to the groundfish fisheries would continue. Since past harvests of squid taken incidentally are generally below the ABCs calculated for squid, there would be no significant effects on the stock biomass, fishing mortality, spatial or temporal distribution, or changes in prey availability for squid and groundfish target species in either the BSAI or GOA.

Alternative 2 prevents targeting of squid and prevents a "directed fishery" from being developed as well. To the degree that any fishermen would like to conduct directed fishing for squid in the future, these fishermen would be unable to do so. However, if significant interest in targeting squid developed in the future, the Council could re-evaluate the status of squid at that time. Alternative 2 allows for a continued small amount of squid to be retained and marketed through MRA regulations, as noted below. The action alternative would also prevent use of squid incidental catch as a basis species for retention of other groundfish.

A primary benefit of this alternative is pollock vessels would not have to relocate to other areas of the BSAI and GOA in order to avoid catching squid. The BSAI pollock fleet has a voluntary squid agreement to reduce squid catch in order to avoid closing the pollock fishery. This action would allow greater flexibility for the pollock fleet to seek areas of higher pollock CPUE and lower salmon bycatch without the limitations associated with catching squid incidentally.

Another benefit of this alternative is that BSAI squid would not be 'funded' from reduced TAC of other, presently more valuable groundfish species. As noted in Section 4.6.1, in the past, the amount of TAC that could be been funded with moving squid to the Ecosystem Component has ranged from a low of 310 mt in 2014 to a high of 1,970 mt in 2007 through 2010.

4.6.2.1 MRA Options: Establish an MRA for squid species as incidental catch in the BSAI and GOA at Option 1 = 2%, Option 2 = 10%, or Option 3 = 20% (Preferred Option)

The options included in this alternative would establish an MRA for squid species as incidental catch in the BSAI and GOA using the MRAs of 2%, 10%, or 20%, as in tables 10 and 11 of 50 CFR 679 when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries.

In general, MRAs are the primary tool to regulate the catch of species closed to directed fishing. These rates do not necessarily reflect an "intrinsic" incidental catch rate, but reflect a balance between the recognized need to slow harvest rates, minimize the potential for discards, and, in some cases, provide an increased opportunity to harvest available TAC through limited topping off fishing behavior. The incentive for vessels to engage in topping off activity is directly related to the value of, and available market for, the incidental catch species relative to the associated operation costs of fishing for retaining the target species. To reduce the incentive for vessels to top off on an incidental catch species due to conservation issues, low MRA rates are often utilized.

Since an ecosystem component species allows for a small amount of squid to be retained and marketed, and would leave in place the existing MRA of 20 percent, it is likely that the retention of squid would continue at current levels or increase slightly given vessels would not be required to relocate from areas of high squid bycatch. As noted in Table 4-1, retained catch of squid in the BSAI and GOA has generally ranged between 100 mt to 1,000 mt from 2003 through 2015. Much of the retained catch of squid has been processed into whole bait and whole fish/food fish in the past, and these production types would likely continue to be processed under this option. Currently the MRA is 20% for the basis species and retention rates greater than 20% have been rare in the BSAI and GOA pollock fisheries, which have the highest squid catch. As noted in Table 3-18, from 2013-2016, there were 55,199 hauls in the BSAI and 2,962 hauls in GOA. Of those total hauls in the BSAI, 15 hauls would have exceeded a 20% MRA during the 2013-2016 period, while in the GOA, 2 hauls would have exceeded a 20% MRA.

One factor that discourages pollock vessels from retaining and marketing more squid beyond their current levels is the value of squid. The ex vessel price of CV caught squid for all product forms combined (not including fish meal) in the BSAI has ranged from a low of $0.03 per pound for 2006, 2007, and 2013, to a high of $0.18 per pound in 2014 (Table 7). In GOA, ex vessel price for all squid product forms (not including fish meal) has ranged from a low of $0.05 per pound in 2008 and 2013, to a high of $0.10 per pound in 2015. Table 8 shows whole bait had the highest production weight at 4 mt and the highest gross first wholesale value at $2.5 million during the 2006 through 2015 period. The next largest production weight was whole fish/food fish at 2.4 mt for a gross first wholesale value of $873 thousand.

Another factor that discourages pollock vessels from expanding the retention and marketing of squid greater than the existing levels is the cost to pollock production when encountering squid on the fishing grounds. As noted by the pollock industry, catching incidental squid while targeting pollock is costly to the pollock fleet since squid must be separated from pollock prior processing, which slows the rate of pollock processing. The cost of separating squid from pollock prior to processing can be so high that the

pollock fleet has often forgone areas of high pollock CPUE if there is high incidental catch of squid in the same area. Overall, given the limited economic value of squid and the increased cost factor in separating squid from pollock prior to processing, maintaining an MRA of 20 percent would likely result in similar retention amounts of squid and likely not result in topping off behavior.

Option 3, establishing the 20 percent MRA for squid, should not negatively affect any fishery participants. The Council's recommended 20 percent MRA is already in effect in the BSAI, so no change would occur in that management area. Squid is included with "other species" for purposes of MRAs in the GOA. The MRA for "other species" in the GOA currently is set at 20 percent. Option 3 would create a new category for squid in GOA MRA table and establish that MRA at 20 percent. This would allow a slight increase in the amount of squid that may be retained in the GOA relative to the status quo. This could be perceived as a benefit for fishermen wishing to retain squid in the GOA.

Finally, the option also includes establishment of an MRA at 2% or 10%. There appears to be no conservation issue that would necessitate reducing the MRA from the existing 20%. The amount of squid that are caught and retained currently is limited and the economic value of the retained squid is also limited. Lower MRA percentages would likely have some negative impacts on individual vessels due to the need to sort and discard squid at sea to stay below a 2% MRA or 10% MRA. As noted in Table 3-18, from 2013-2016, there were 55,199 hauls in the BSAI and 2,962 hauls in GOA. Of those total hauls in the BSAI, 514 hauls would have exceeded a 2% MRA and 38 hauls would have exceeded a 10% MRA during the 2013 through 2016 period. In the GOA, 59 hauls would have exceeded a 2% MRA and 6 hauls would have exceeded a 10% MRA during the 2013 through 2016 period. Since there appears to be no conservation issue that necessitates reducing the squid MRA from its existing 20% in the BSAI and GOA, and the limited economic value of squid, reducing the MRA to 2% or 10% would increase operating costs for vessels while not providing any perceivable conservation benefit.

4.6.3 Alternative 3 - Designate squid in both BSAI and GOA FMPs as non-target species

Under Alternative 3, which would designate squid in the groundfish FMPS as 'non-target' species, OFLs and ABCs would still be established but TAC would longer be necessary. Recordkeeping and reporting requirements would be maintained under this alternative. Like Alternative 2, past harvest of squid, taken incidentally, are generally below the ABCs, and therefore there would be no significant effects on the stock biomass, fishing morality, spatial or temporal distribution, or changes in prey availability for squid and groundfish target species in either the BSAI or GOA.

Alternative 3, prevents targeting of squid and prevents a "directed fishery" from being developed as well. This alternative allows for a small amount of squid to be retained and marketed through MRA regulations, as noted below. The action alternative would also prevent the use of squid incidental catch as a basis species for retention of other groundfish.

Like Alternative 2, a benefit of Alternative 3 is that BSAI squid would not be 'funded' from reduced TAC of other, presently more valuable groundfish species. As noted in Section 4.6.1, in the past, the amount of

TAC that could be been funded with moving squid to the Ecosystem Component has ranged from a low of 310 mt in 2014 to a high of 1,970 mt in 2007 through 2010.

However, like Alternative 1, this alternative would still require pollock vessels to continue their effort to move from squid grounds to reduce squid bycatch in order to avoid having the pollock fishery closed. As noted in Section 4.6.1, squid bycatch has constrained pollock vessels in the past. It is likely that pollock vessels will continue voluntary closures for regions with high squid catch that are devised in concert with NMFS to avoid reaching the OFL for squid. As a result, given the reduced flexibility for pollock vessels under this alternative, it will be more difficult for vessels to balance higher pollock CPUE, lower salmon bycatch, and lower squid catch.

4.6.3.1 MRA Options: Establish an MRA for squid species as incidental catch in the BSAI and GOA at Option 1 = 2%, Option 2 = 10%, or Option 3 = 20%

The options included in this alternative would establish an MRA for squid species as incidental catch in the BSAI and GOA using the MRAs of 2%, 10, or 20%, as in tables 10 and 11 of 50 CFR 679 when directed fishing for groundfish species at a level to discourage retention while allowing flexibility to prosecute groundfish fisheries.

Since the MRA options in this alternative are the same as those in Alternative 2, the impacts will likely be the same as those in Alternative 2. For impacts concerning the MRA options under Alternative 3, see the impacts under Alternative 2 in Section 4.6.2.1.

4.6.4 Affected Small Entities

Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to describe the economic impacts of proposed actions on small entities. As of January 2017, NMFS Alaska Region will prepare the IRFA in the Classification section of the proposed rule for an action. Therefore, the preparation of a separate IRFA is not necessary for the Council action on this issue. This section provides information for the IRFA about the directly regulated small entities that may be adversely affected by the preferred alternative.

All of the alternatives would directly regulate any vessel operator harvesting squid in the federally managed groundfish fisheries in the BSAI and GOA. As described above, for operators of vessels currently participating in these fisheries, the economic impacts of the preferred alternative are primarily beneficial or neutral. The only potential adverse economic impact that has been identified for the preferred alternative is that vessel owners or operators who may wish to conduct directed fishing for squid in the future, and who would wish to retain more squid than they would be allowed to retain under the 20 percent MRA, would not be able to do so. To the degree that the preferred alternative represents a limitation on future economic activity by small entities, this could be viewed as an adverse impact. This adverse economic impact could affect any future participant in these groundfish fisheries. Therefore, any small entities currently participating in the BSAI and GOA groundfish fisheries could be adversely impacted by the movement of squid from the target species category to the ecosystem component.

The thresholds applied to determine if an entity or group of entities are "small" under the RFA depend on the industry classification for the entity or entities. Businesses classified as primarily engaged in commercial fishing are considered small entities if they have combined annual gross receipts not in excess of $11.0 million for all affiliated operations worldwide (81 FR 4469; January 26, 2016). The most recent estimates of the number of fishing vessels participating in the BSAI and GOA groundfish fisheries that are small entities are provided in Table 2 in the Initial Regulatory Flexibility Analyses for the BSAI and GOA Harvest Specifications for 2018-2019 (NMFS 2017). In 2016, there were 119 catcher vessels and 5 catcher/processors in the BSAI, and 920 catcher vessels and 3 catcher/processors in the GOA. These estimates likely overstate the number of small entities in the groundfish fisheries off Alaska because some of these vessels are affiliated through common ownership or membership in a cooperative and the affiliated vessels together would exceed the $11.0 million annual gross receipts threshold for small entities.

Although any of the small entities currently participating in the BSAI or GOA groundfish fisheries could be adversely impacted by this action in the future, the actual number of small entities that may be adversely impacted is expected to be zero or very few. This potential adverse impact would not affect any current participants relative to opportunities available to them in recent years, because directed fishing for squid has been closed in recent years in both the BSAI and GOA, and there has been very little indication of interest in target squid in the domestic groundfish fisheries. Based on the limited interest in directed fishing for squid in the past, analysts expect limited interest in the future. However, technology and market conditions can change, so this potential future adverse impact cannot be completely dismissed.

Current participants in the BSAI and GOA groundfish fisheries are not losing an economic opportunity that is available to them today or has been available to them in recent years. Vessel operators may continue to catch and retain squid in the BSAI and GOA groundfish fisheries as long as they maintain their catch within the 20% MRA.

4.7 Management and Enforcement Considerations

4.7.1 Alternative 1, No Action

Currently, there are no squid directed fisheries in the waters off Alaska. Under status quo, squid harvest is managed on bycatch status. Most of the squid bycatch in the BSAI and GOA is taken in the pollock fishery (e.g. 94% in the BSAI and 90% in the GOA in 2015, Ormseth 2015a, Ormseth 2015b). Squid are managed as target species under status quo and an annual OFL, ABC, and TAC for the squid complex is specified separately for the BSAI and GOA. If the total TAC of any squid is caught, retention of squid is prohibited for the remainder of the year. In the BSAI, a TAC reserve system plays an important role in

managing the groundfish TACs. Annually, 15 percent of each TAC is put into a reserve.[6] The TAC remaining after deductions to the reserve is referred to as the Initial Total Allowable Catch (ITAC). The reserve system provides a limited amount of flexibility to respond to yearly fluctuations in catch rates and maximize value to the industry. For species that contribute to the reserves, NMFS's Regional Administrator has the option of increasing an individual ITAC with TAC from the reserve, as long as the ABC and OY are not exceeded.

In 2014 and 2015, BSAI squid catch exceeded the ITAC. When the ITAC was exceeded in 2014 and 2015, NMFS increased the BSAI squid ITAC with TAC from the reserve to allow retention of squid bycatch in pollock and other directed fisheries. In 2015, the BSAI squid catch exceeded the total revised TAC set equal to the ABC, and retention of squid in the BSAI pollock fishery was prohibited from July 29, 2015 through the remainder of the year. The prohibition on squid retention was problematic for many BSAI pollock vessel operators in 2015, and NMFS OLE received numerous reported violations of the non-retention requirement for the remainder of the 2015 BSAI pollock B season.

Under status quo, the BSAI and GOA squid complexes are assessed as a Tier 6 species complex. The Tier 6 approach to prescribing the OFL is the least preferred method to specify an overfishing limit as it is based on the least amount of information and is not likely to accurately reflect a level of fishing that would jeopardize the capacity of a stock complex to produce MSY on a continuing basis. Tier 6 OFLs are based solely on fishery catch information rather than the biological reference points which form the basis for Tier 1 through 5 limits. Nonetheless, specification of OFL for Tier 6 species reflects the best estimate possible with the available data.

The Council increased the 2016 BSAI squid TAC to account for the higher incidental catch that occurred in 2014 and 2015. The 2016 ABC and TAC for BSAI squid are 5,184 mt and 1,500 mt, respectively. The BSAI squid ABC was 1,970 mt in 2014 and 2015; the TACs were set at 310 mt and 400 mt, respectively. The GOA squid ABC and TAC have been set at 1,148 mt since 2011 when the squid complex was first split out from the "other species" complex. From 2011 through 2015, squid catch in the GOA ranged from a low of 2% of the squid TAC in 2012 to 42% in 2015 (Ormseth 2015a).

At the start of the fishing year, directed fishing for squid is prohibited (also referred to as incidental catch or bycatch status) and incidentally caught squid may be retained up to a Maximum Retainable Amount (MRA) of 20%. The MRA is the percentage of the retained catch of an incidental catch species to the retained catch of a species open for directed fishing (basis species). MRAs apply at any time for the duration of the fishing trip for each vessel, and are calculated on a trip-by-trip basis. A vessel is not required to retain squid up to the MRA, however the difficulty of manually sorting squid from the pollock catch at-sea has likely contributed to higher retention of squid than may occur under different operational

[6] Except for pollock, the portion of the sablefish TAC allocated to hook-and-line and pot gear, and Amendment 80 species.

conditions. Historical squid retention amounts in the BSAI and GOA are presented in Table 3-18. Since 2003, the squid TAC has only been exceeded in the BSAI in 2015, 2006, and 2005. The squid TAC has not been reached in the GOA. As mentioned above, when the total TAC has been taken, squid may no longer be retained.

Summary of Alternative 1 Management and Enforcement Considerations

Primary management considerations:

- Monitoring catch at the individual trip level to ensure that the squid MRA is not exceeded
- Monitoring cumulative catch to ensure that catch is not approaching the ITAC
- Determining if additional TAC is available to be added to the ITAC
- Placing squid on prohibited species status when total TAC is exceeded or projected to be exceeded
- Considering further directed fishery closures when harvest approaches the OFL

Primary enforcement considerations:

- Challenge for enforcement to determine appropriate penalty for squid MRA overages due to low price of squid.
- Marked increase in enforcement actions when BSAI squid were place on prohibited species status in 2015.

4.7.2 Alternative 2 (Preferred Alternative), Move Squid in BSAI and GOA to EC

Under Alternative 2, squid would be added to the Ecosystem Component of the BSAI and GOA groundfish FMPs. Under this alternative, OFL, ABC, and TAC would not be specified and directed fishing for squid would be prohibited. Reporting of squid incidental catch would continue to be required for purposes of continued monitoring of the squid complex.

In addition to reducing constraints on directed fisheries that catch squid incidentally, Alternative 2 would reduce NMFS's inseason management burden. NMFS would not have to track total squid catch during the fishing year; there would be no need for inseason actions (e.g., placing squid on prohibited species status) to avoid exceeding a squid TAC or OFL. Because directed fishing on species in the Ecosystem Component is not allowed, NMFS would use an MRA for determining the amount of squid allowed to be retained by directed fisheries. The MRA is calculated as the proportion of an EC species that is retained/landed relative to the target species retained/landed. MRA options included in Alternative 2 are 2%, 10%, or 20%.

The MRA for squid is 20% under status quo and retention rates greater than 20% have been rare in the BSAI and GOA pollock fisheries which have the highest squid catch (Table 3-18). An MRA of 20% (or greater) would reduce the burden for enforcement and industry by reducing the number of trips that are likely to exceed the MRA.

An MRA smaller than 20% would increase the burden on enforcement and industry and may create new problems in the execution of the directed fisheries that incidentally catch squid. If an MRA below 20% is selected, vessel crew would have to sort and discard squid at sea. Discarded squid do not survive. Sorting catch to discard squid at sea would introduce opportunities for vessel crew to discard salmon before they are counted by an observer (BSAI) or delivered to a processor (GOA). NMFS OLE is concerned about increased opportunities for crew to discard salmon, the increased burden on industry to discard squid at sea, the probability that processors will not report overages of squid catch, and the potential for increased MRA violations with an MRA less than 20%. In the absence of a conservation concern for squid, a low MRA is likely to create new problems and increase burden on industry and NMFS OLE.

Implications for State Fisheries

Adding squid to the Ecosystem Component of the BSAI and GOA FMPs would have no implications for State fishery management. The FMPs do not preclude development of directed fisheries in State waters. The State's current practice is to adopt the MRAs established for the federal fisheries in the State parallel fisheries and the State would likely adopt the Council's selected squid MRA as it has with the existing MRA.

In sum, adding squid to the Ecosystem Component of the FMPs would reduce NMFS's management burden as NMFS would not have to monitor a squid TAC or OFL. Adding squid to the Ecosystem Component would reduce NMFS's enforcement burden relative to 2015 when BSAI squid were placed on prohibited species status since the potential for that scenario would no longer exist. However, NMFS's enforcement burden is likely to increase should the Council select an MRA lower than the status quo.

4.7.3 Alternative 3, Move Squid in BSAI and GOA to Non-Target

Under Alternative 3, squid would still be considered in need of conservation and management, but would be moved to the non-target category. The requirement for TAC would be removed while requirements for ABC and OFL would remain.

Because directed fishing on non-target species is not allowed, NMFS would use an MRA for determining the amount of squid allowed to be retained by directed fisheries. The MRA is calculated as the proportion of non-target species that is retained/landed relative to the target species retained/landed. MRA options included in Alternative 3 are 2%, 10%, or 20%, and the implications of these options are further explained above in section 4.7.2 under Alternative 2.

A comparison of management considerations under Alternatives 1, 2, and 3 is provided in

Table 4-.

Table 4-10 Comparison of squid stock complex management under Alternatives 1, 2, and 3

	Alt 1 – No Action	Alt 2 (Preferred Alt) – Ecosystem Component	Alt 3 – Non-target
Directed Fishery	No	No	No
MRA	Yes	Yes	Yes
ABC/TAC/OFL	Yes	No	No TAC, but ABC and OFL still required
Frequently retained for use or sale	Yes	Yes	Yes
Total Catch Accounting	Yes	Yes [b]	Yes

[b] Through existing observer program and catch accounting protocols

4.8 Net Benefit to the Nation

Alternative 1 would continue to manage squid as a target species in both the BSAI and GOA groundfish FMPs. OFL, ABC, and TAC will continue to be set for squid as a species group in both areas. Given that squid has limited economic value as a marketable catch relative to many of the BSAI groundfish specification species, continuing to manage as a target species could decrease aggregate groundfish revenue.

Net benefits are would likely increase under the preferred Alternative 2. Alternative 2 would likely not affect current fishery revenue, as a small amount of squid is retained and marketed as food products, bait, and fish meal. A benefit of this alternative is that BSAI squid would not be 'funded' from reduced TAC of other, presently more valuable groundfish species. In addition, pollock vessels operating in the BSAI would not have to relocate to other areas of the BSAI to avoid squid catch, which allows greater flexibility for the BSAI pollock fleet to seek areas of higher pollock CPUE and lower salmon bycatch, thus potentially leading to higher gross revenues in the long term.

Alternative 3 would likely result in slightly lower net benefits to the Nation. Since this alternative would designate squid as a 'non-target' species that would still require OFLs and ABCs, the pollock fleet would not have the greater flexibility to seek areas of higher pollock CPUE and lower salmon bycatch. Relative to Alternative 2, the limited economic value of squid relative to many of the BSAI and GOA groundfish specifications species, and the lack of flexibility for the pollock fleet to seek fishing grounds with higher pollock CPUE and lower salmon bycatch, could result in lower aggregate groundfish revenue. Offsetting some of the decreased aggregate groundfish revenue is the benefit from not having to fund squid in the BSAI from reduced TAC of other more valuable groundfish species. Overall, this alternative would likely yield slightly lower net benefits to the Nation relative to Alternative 2.

5 Magnuson-Stevens Act and FMP Considerations

5.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Fishery and Conservation Act (Magnuson-Stevens Act). A brief discussion of how each alternative is consistent with the National Standards, will be provided in the Public Review draft of this analysis. In recommending a preferred alternative, the Council must consider how to balance the national standards.

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

Under alternative 1, the status quo, squid would remain a target species in the groundfish FMPs, however no directed fishing for squid would be allowed and squid would continue to be managed on a bycatch-only status. MRAs for squid as an incidental catch species would remain at 20% in order to prevent overfishing.

Alternative 2 would include squid in the BSAI and GOA groundfish FMPs as "ecosystem component" species that are not considered in need of conservation and management while alternative 3 would include squid as "non-target" species for which conservation and management measure are still required. The National Standard guidelines under section 600.305(c) provide direction for determining which stocks require conservation and management, and section 2.2.1 in this analysis applies that direction to squid.

As "ecosystem component" species under alternative 2, catch specifications (OFL, ABC, TAC) would no longer be required, but regulations would prohibit directed fishing for squid, require recordkeeping and reporting to monitor and report catch of squid species annually, and establish an MRA at a level (2-20%) to discourage retention while allowing flexibility to prosecute groundfish fisheries.

As "non-target" species under alternative 3, TAC would no longer be required; however, OFL and ABC would still be required. Regulations would prohibit directed fishing for squid, require recordkeeping and reporting to monitor catch of squid species annually, and establish an MRA at a level (2-20%) to discourage retention while allowing flexibility to prosecute groundfish fisheries.

At this time, squid are taken incidentally in the BSAI and GOA groundfish FMPs, and there are no directed fisheries targeting squid. Based on recent stock assessments prepared for squid they are not subject to overfishing. As noted in section 2.2.1 and elsewhere throughout the document, squid are short-lived and highly productive, and bottom trawl surveys are considered substantial underestimates of true squid biomass in both the BSAI and GOA. In addition, fishing related mortality is extremely low compared with the estimated predation mortality in food web models. Therefore, in the absence of a directed fishery, squid are very unlikely to become overfished. Under each of the action alternatives considered in this analysis, management measures could be adopted should recordkeeping and reporting indicate any vulnerability.

In terms of achieving optimum yield (OY) from the fishery, alternative 2 may enhance OY by taking into account marine ecosystems while continuing to provide the greatest overall benefit to the nation in terms of food production in the groundfish fisheries, and is consistent with management for maximum sustainable yield from the fishery while considering the ecological factors associated with squid. alternative 3 may enhance OY similar to alternative 2. Impacts to OY are discussed in more detail in sections 4.6 and 4.8 of this analysis.

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

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

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

Based on the most recent stock assessments prepared by NMFS for squid, the assessment authors have recommended OFLs and ABCs for squid in the BSAI and GOA management areas without further subdivision into smaller geographic areas. The annual TACs under Alternative 1 are set for squid according to the Council and NMFS harvest specification process. The Council would continue to recommend the TACs for squid be based on the most recent stock assessment and survey information, public testimony, and other socioeconomic considerations.

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

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

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

The wording of this standard was changed in the recent Magnuson-Stevens Act authorization, to consider rather than promote efficiency. Efficiency in the context of this change refers to economic efficiency, and the reason for the change, essentially, is to de-emphasize to some degree the importance of economics

relative to other considerations (United States Senate, 1996). The analysis presents information relative to these perspectives and provides information on the economic risks associated with the harvest specifications for squid.

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

Alternatives 1, 2, and 3, consider and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. No directed fishing would occur under any alternative, although squid may be retained up to the authorized MRA limit. Each alternative contains MRA options to limit bycatch and retention of squid in the groundfish fisheries. In addition, recordkeeping and reporting requirements under all alternatives ensure that changes in squid stock size, location, ecological interactions, and habitat changes, or changes in fishing practices will be noticed. Should it be determined that squid is not in need of conservation and management and therefore should be classified as an ecosystem component species under Alternative 2, conservation and management measures could be employed in the future to prevent overfishing, should the risk of overfishing arise.

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

Alternatives 2 and 3 will continue to impose recordkeeping and reporting requirements on the groundfish fishing industry that are contained in Alternative 1, as well as fisheries management processes; however, given the small relative amount of squid incidental catch, these reporting requirements will have *de minimus* effects on fishery participants. Thus, all of the alternatives under consideration appear to be consistent with this NS7.

National Standard 8 — Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The sustained participation of fishing communities is not put at risk by any of the alternatives being considered. Economic impacts to participating communities would not likely be noticeable at the community level, so consideration of efforts directed at a further minimization of adverse economic impacts to any given community is not relevant.

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

Regarding alternative 2, ecosystem component species do not require specification of biological reference points, but should be monitored as new, pertinent scientific information becomes available to determine changes in their status or their vulnerability to the fishery. Both alternatives 2 and 3 would, maintain the MRAs as tools to minimize bycatch of squid in other groundfish fisheries to the extent practicable. Retention of record keeping and reporting would provide information necessary to determine whether bycatch of squid is minimized to the extent practicable. .

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

The alternatives under consideration appear to be consistent with NS10. None of the alternatives or options proposed would change safety requirements for fishing vessels.

5.2 Section 303(a)(9) Fisheries Impact Statement

Section 303(a)(9) of the Magnuson-Stevens Act requires that a fishery impact statement be prepared for each FMP amendment. A fishery impact statement is required to assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for (a) participants in the fisheries and fishing communities affected by the plan amendment; (b) participants in the fisheries conducted in adjacent areas under the authority of another Council; and (c) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

The EA/RIR prepared for this plan amendment constitutes the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in the RIR chapter of the analysis (Chapters 4). The effects of the proposed action on safety of human life at sea are evaluated in Section 4.6.2, and above under National Standard 10, in Section 5.1 Based on the information reported in this section, there is no need to update the Fishery Impact Statement included in the FMP.

The proposed action affects the groundfish fisheries in the EEZ off Alaska, which are under the jurisdiction of the North Pacific Fishery Management Council. Impacts on participants in fisheries conducted in adjacent areas under the jurisdiction of other Councils are not anticipated as a result of this action.

5.3 Council's Ecosystem Vision Statement

In February 2014, the Council adopted, as Council policy, the following:

Ecosystem Approach for the North Pacific Fishery Management Council

Value Statement

The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation's seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.

Vision Statement

The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.

Implementation Strategy

The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.

The vision statement shall be given effect through all of the Council's work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

In considering this action, the Council is being consistent with its ecosystem approach policy. This action considers appropriate and conservative management of an important prey species in the BSAI and GOA and the interactions with target stocks, especially pollock stocks in light of squid management. This is directly related to the Council's intention to account for environmental variability, fluctuations in productivity and interactions between managed species.

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7 References

Agnew, D.J., C.P. Nolan, and S. Des Clers. 1998. On the problem of identifying and assessing populations of Falkland Islands squid *Loligo gahi*. In Cephalopod biodiversity, ecology, and evolution (A.I.L. Payne, M.R. Lipinski, M.R. Clark and M.A.C. Roeleveld, eds.), p.59-66. S. Afr. J. mar. Sci. 20.

Arkhipkin, A.I., V.A. Bizikov, V.V. Krylov, and K.N. Nesis. 1996. Distribution, stock structure, and growth of the squid Berryteuthis magister (Berry, 1913) (Cephalopoda, Gonatidae) during summer and fall in the western Bering Sea. Fish. Bull. 94: 1-30.

Aydin, K., S. Gaichas, I. Ortiz, D. Kinzey, and N. Friday. 2007. A comparison of the Bering Sea, Gulf of Alaska, and Aleutian Islands large marine ecosystems through food web modeling. NOAA Tech. Memo. NMFS-AFSC-178

Barnes, R.D. 1987. Invertebrate Zoology, Third edition. Saunders College Publishing, Fort Worth, TX: 893 pp.

Brodziak, J. 1998. Revised biology and management of long-finned squid (*Loligo pealei*) in the northwest Atlantic. CalCOFI Reports 39: 61-70

Caddy, J.F. 1983. The cephalopods: factors relevant to their populations dynamics and to the assessment and management of stocks. In Advances in assessment of world cephalopod resources (J.F. Caddy, ed.), p. 416-452. FAO Fish. Tech. Pap. 231.

Drobny, P. 2008. Life history characteristics of the gonatid squid Berryteuthis magister in the eastern Bering Sea. M.S. Thesis, University of Alaska Fairbanks.

Forsythe, J.W. 2004. Accounting for the effect of temperature on squid growth in nature: from hypothesis to practice. Mar Fresh Res 55: 331-339

Haflinger, K. and J. Gruver. 2015. Report to the North Pacific Fishery Management Council on the 2015 Bering Sea Pollock Intercooperative Salmon Avoidance Agreement. Available at NPFMC.org

Horne J and S Parker-Stetter. 2010. Evaluating acoustics for squid assessment in the Bering Sea. NPRB Project 717 Final Report.

Hunt, G.L., H. Kato, and S.M. McKinnell. 2000. Predation by marine birds and mammals in the subarctic North Pacific Ocean. PICES Scientific Report No. 14, North Pacific Marine Science Organization, Sidney, British Columbia, Canada. 164 p.

Lipinski, M.R. 1998. Cephalopod life cycles: patterns and exceptions. In Cephalopod biodiversity, ecology, and evolution (A.I.L. Payne, M.R. Lipinski, M.R. Clark and M.A.C. Roeleveld, eds.), p.439-447. S. Afr. J. mar. Sci. 20.

Lipinski, M.R., D.S. Butterworth, C.J. Augustyn, J.K.T. Brodziak, G. Christy, S. Des Clers, G.D. Jackson, R.K. O'Dor, D. Pauly, L.V. Purchase, M.J. Roberts, B.A. Roel, Y. Sakurai, and W.H.H. Sauer. 1998. Cephalopod fisheries: a future global upside to past overexploitation of living marine resources? Results of an international workshop, 31 August-2 September 1997, Cape Town, South Africa. In Cephalopod biodiversity, ecology, and evolution (A.I.L. Payne, M.R. Lipinski, M.R. Clark and M.A.C. Roeleveld, eds.), p. 463-469. S. Afr. J. mar. Sci. 20.

Macfarlane, S.A., and M. Yamamoto. 1974. The squid of British Columbia as a potential resource–A preliminary report. Fisheries Research Board of Canada Technical Report No. 447, 36 pp.

NMFS [National Marine Fisheries Service]. 2004. Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries Implemented Under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Gulf of Alaska and the Groundfish of the Bering Sea and Aleutian Islands Area. NMFS Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668. June 2004. Available at: http://www.alaskafisheries.noaa.gov/sustainablefisheries/seis/intro.htm.

NMFS. 2007. Environmental impact statement for the Alaska groundfish harvest specifications. January 2007. National Marine Fisheries Service, Alaska Region, P.O. Box 21668, Juneau, Alaska 99802-1668. Available at: http://www.alaskafisheries.noaa.gov/index/analyses/analyses.asp.

NMFS. 2009. EIS for Amendment 91 to the BSAI Groundfish FMP on Bering Sea Chinook Salmon Bycatch Management. NMFS, Juneau AK.

NMFS. 2014. EA/RIR/IRFA for Amendment 100 to the BSAI Groundfish FMP and Amendment 91 to the GOA Groundfish FMP to include Grenadiers. NMFS, Juneau AK.

NMFS. 2016. EA/RIR for Amendment 110 to the BSAI Groundfish FMP on Bering Sea Chinook salmon and Chum salmon bycatch management measures. NMFS, Juneau AK.

NMFS. 2017. IRFA for Gulf of Alaska Groundfish Harvest Specifiications for 2018 and 2019. NMFS, Juneau AK.

NPFMC [North Pacific Fishery Management Council]. 2015a. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/

NPFMC. 2015b. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Regions. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/.

NPFMC and NMFS. 2010. Essential Fish Habitat (EFH) 5-year Review for 2010: Summary Report, Final. April 2010. Available at: http://www.fakr.noaa.gov/habitat/efh/review.htm.

NPFMC and NMFS. 2016. 2016 Review of Essential Fish Habitat (EFH) in the North Pacific Fishery Management Council's Fishery Management Plans: Summary Report, Initial Review. April 2016. Available at: https://npfmc.legistar.com/View.ashx?M=F&ID=4354419&GUID=E57E2F6C-FAF7-4257-9A37-C870F5059DE2.

NPFMC and NMFS. 2015. Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement Supplemental Information Report, Final. November 2015. Available at: https://alaskafisheries.noaa.gov/sites/default/files/sir-pseis1115.pdf.

O'Dor, R.K. 1998. Can understanding squid life-history strategies and recruitment improve management? In Cephalopod biodiversity, ecology, and evolution (A.I.L. Payne, M.R. Lipinski, M.R. Clark and M.A.C. Roeleveld, eds.), p.193-206. S. Afr. J. mar. Sci. 20.

Ormseth, O. 2016a Assessment of the squid stock complex in the Gulf of Alaska. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/.

Ormseth, O. 2016b. Assessment of the squid stock complex in the Bering Sea and Aleutian Islands. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/

Ormseth, O. 2016c Assessment of forage fish complex in the Gulf of Alaska. In, NPFMC. 2016. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/.

Ormseth, O. 2015a Assessment of the squid stock complex in the Gulf of Alaska. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/.

Ormseth, O. 2015b. Assessment of the squid stock complex in the Bering Sea and Aleutian Islands. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources

of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/

Ormseth, O. 2015c. Assessment of the forage fish complex in the Bering Sea and Aleutian Islands. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/

Ormseth, O. 2012. Assessment of the squid stock complex in the Bering Sea and Aleutian Islands. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/

Ormseth, O. 2011. Assessment of the squid stock complex in the Gulf of Alaska. In, NPFMC. 2015. Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage, Alaska. Available at: http://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/.

Osako, M., and M. Murata. 1983. Stock assessment of cephalopod resources in the Northwestern Pacific. In Advances in assessment of world cephalopod resources (J.F. Caddy, ed.), p. 55-144. FAO Fish. Tech. Pap. 231.

Roper, C.F.E., M.J. Sweeney, and C.E. Nauen. 1984. FAO Species Catalogue Vol. 3, Cephalopods of the world. FAO Fisheries Synopsis No. 125, Vol 3.

Sinclair, E.H., A.A. Balanov, T. Kubodera, V.I. Radchenko and Y.A. Fedorets. 1999. Distribution and ecology of mesopelagic fishes and cephalopods. Pages 485-508 in Dynamics of the Bering Sea (T.R. Loughlin and K Ohtani, eds.), Alaska Sea Grant College Program AK-SG-99-03, University of Alaska Fairbanks, 838 pp.

Tojo N, GH Kruse, FC Funk. 2007. Migration dynamics of Pacific herring (*Clupea pallasii*) and response to spring environmental variability in the southeastern Bering Sea. Deep Sea Research Part II 54:2832-2848

Undercurrent News. 2014. Peru's giant squid landings recover from sharp drop, but prices still high.

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