



December 3, 2013

Mr. Eric Olson, Chair
North Pacific Fishery Management Council
605 W. Fourth Avenue, Suite 306
Anchorage, AK 99501-2252

Dr. James Balsiger, Regional Administrator
NOAA Fisheries, Alaska Region
709 West Ninth Street
Juneau, AK 99802-1668

RE: Agenda Item C-4, Grenadier Management

Dear Mr. Olson, Dr. Balsiger, and Council members:

The National Marine Fisheries Service (NMFS) and North Pacific Fishery Management Council (NPFMC) must take action to manage the harvest and bycatch of the deep-sea grenadiers (family *Macrouridae*). The discard of tens of millions of pounds of grenadiers each year in the groundfish fisheries in Alaska is a shameful waste. We commend you for moving forward with an effort to include grenadiers in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Groundfish Fishery Management Plans (FMP) and urge you to pick **Alternative 3** from the EA/RIR/IRFA, which would include the grenadier complex “in the fishery” of the BSAI and GOA FMPs.¹

The law explicitly requires NMFS to prevent overfishing by implementing conservation and management measures for fisheries. *See, e.g.*, 16 U.S.C. §§ 1801(a)(6) & 1851(a)(1). There is no exception to this rule for grenadiers, and the catch of grenadiers clearly requires active management. Annual discards of up to 46 million pounds (21,000 mt) of grenadiers occurred in the groundfish fisheries between 1997-2010.² In some years the bycatch of grenadiers exceeds the total harvest of sablefish and Greenland turbot. This bycatch currently is unregulated, and management is long overdue.

The Council should recommend, and NMFS implement, all management measures necessary to conserve and manage grenadiers. Given the substantial bycatch, potential for personal use and sale, and the possibility of overfishing, Annual Catch Limits, Optimum Yield calculations, and Essential Fish Habitat designations are necessary. Further, some grenadier catch, although likely a small amount, has been bought, processed, and sold.² Grenadiers clearly satisfy the guidelines” established by NMFS pursuant to National Standard 1 for management “in the fishery.” *See* 74 Fed. Reg. 3178, 3204-05 (Jan. 16, 2009) (stating that non-target species would be “in the fishery” if they “are retained for sale or personal use” or “either determined to be subject to overfishing, approaching overfished, or overfished, or could become so”).

¹ NMFS, Environmental Assessment/ Regulatory Impact Review/ Initial Regulatory Flexibility Analysis For Amendment 100 to the Fishery and Management Plan for Groundfish of the Bering Sea and Aleutian Islands, and Amendment 91 to the Fishery and Management Plan for Groundfish of the Gulf of Alaska: Management of Grenadiers (Family Macrouridae) EA/RIR/IRFA for Proposed Amendments to the Fishery Management Plans for Groundfish of the Bering Sea and Aleutian Islands Management Area and Gulf of Alaska Inclusion of Grenadiers (Family Macrouridae) In the Fishery Management Plans for Groundfish of the Bering Sea and Aleutian Islands and Gulf of Alaska, Initial Review Draft (November 27, 2013).

While at least seven species of grenadiers live in the deep waters off Alaska, three species: giant grenadier (*Albatrossia pectoralis*), Pacific grenadier (*Coryphaenoides acrolepis*) and popeye grenadier (*Coryphaenoides cinereus*) are caught in significant amounts by the groundfish fisheries. The bulk of the grenadier bycatch is comprised of giant grenadiers,² which are at least “moderately” vulnerable to overfishing.³ Giant grenadiers are long lived and late to mature, which makes them particularly susceptible to overfishing. In addition, the groundfish fisheries disproportionately catch female fish; nearly all giant grenadier bycatch is comprised of females.⁴ In the North Atlantic, two species of grenadiers, the roundnose grenadier *Coryphaenoides rupestris*, and the onion-eye grenadier, *Macrourus berglax* have declined severely as a result of both directed fisheries and bycatch, enough that the species could qualify as endangered.⁵

We should also remember that yesterday’s “trash fish” may be tomorrow’s market superstar. Arrowtooth flounder and skates, considered “trash” not too long ago, now support valuable targeted fisheries. Pacific grenadier caught off California are marketed as “Pacific Roughy” and “Black Snapper” and have been described as “mild, flaky, and delicious.”⁶ While giant grenadier have a high water content, treatment in a brine results in a firmer fillet product.⁷ Giant grenadier livers and roe have also been suggested as a valuable food source due to the high vitamin and fat content.⁸ Collagen extracted from the skins of the related New Zealand hoki (*Macruronus novaezelandiae*) are being used in the manufacture of carbon nano-fibers for an array of products.⁹ There is ample evidence that the grenadier resource in Alaska may become more desirable to fishery entrepreneurs.

For ease of management, we support managing grenadiers as a stock complex with biological reference points for giant grenadier serving as a proxy for the grenadier complex. Future amendments to describe and designate Essential Fish Habitat for the grenadier complex could also take the same approach.

The Council will have an opportunity to consider grenadier management during each Annual Groundfish Harvest Specifications process. An appropriate grenadier TAC will provide an incentive to reduce grenadier bycatch and make better use of bycatch that cannot be avoided. Setting a grenadier TAC below current bycatch levels may reduce the economic impact to other

² Clausen, D.M., and C.J. Rodgeveiler. 2010. Assessment of Grenadier Stocks in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. NPFMC Gulf of Alaska, Bering Sea, and Aleutian Islands SAFE.

³ Ormseth, O. A. and P. D. Spencer. 2009. Alaska Groundfish Vulnerability Analysis in the Gulf of Alaska, Eastern Bering Sea and Aleutian Islands. In Stock assessment and fishery evaluation. report for the groundfish resources of the Gulf of Alaska, and Bering Sea/Aleutian Islands.

⁴ Clausen, D.M., and C.J. Rodgeveiler. 2010. Assessment of Grenadier Stocks in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. NPFMC Gulf of Alaska, Bering Sea, and Aleutian Islands SAFE.

⁵ Devine, J. A., K. D. Baker, and R. L. Haedrich. 2006. Deep-sea fishes qualify as endangered. Nature 439: p. 29.

⁶ <http://brainfoodblog.wordpress.com/tag/pacific-roughy/>.

⁷ Crapo, C., B. Himelbloom, R. Pfutzenreuter, and C. Lee. 1999b. Texture modification processes for giant grenadier (*Albatrossia pectoralis*) fillets. Journal of Aquatic Food Product Technology 8(4): 27- 41.

⁸ Novikov, N. P. 1970. Biology of *Chalinura pectoralis* in the North Pacific. In Soviet fisheries investigations in the Northeast Pacific, Part V, P. A. Moiseev (ed.), p. 304-331.

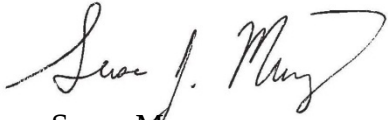
⁹ http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11156645.

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fisheries and induce changes in behavior or gear modifications in the fisheries where grenadier bycatch is a problem.

We urge NMFS and the NPFMC to chose **Alternative 3** to address grenadier bycatch and better manage Alaska's groundfish fisheries.

Sincerely,

A handwritten signature in black ink, appearing to read "Susan J. Murray". The signature is fluid and cursive, with a large, sweeping "M" at the end.

Susan Murray,
Deputy Vice President, Pacific
Oceana



Marine Conservation Alliance
promoting sustainable fisheries to feed the world



December 3, 2013

Mr. Eric Olson, Chairman
North Pacific Fishery Management Council
605 West 4th, Suite 306
Anchorage, Alaska 99501-2252

RE: Agenda Item C-4. Initial Review of Grenadier Management

Dear Chairman Olson,

Thank you for the opportunity to comment on Agenda item C-4, Initial Review of Grenadier Management. On behalf of the Freezer Longline Coalition, the Fishing Vessel Owners Association, the Marine Conservation Alliance, and the Petersburg Vessel Owners Association, we submit these comments and accompanying analysis. We appreciate the efforts of Council and NMFS staff in assembling the draft Environmental Assessment and for bringing very important research forward regarding grenadier stock status in the Gulf of Alaska, the Bering Sea, and the Aleutian Islands.

In this letter we have provided a summary of our recommendations and supporting rationale, along with a more detailed piece of analysis which explores existing policy guidance and the available science. We hope you find our comments to be useful and constructive.

Our recommendation is that the Council place Giant grenadier in both the BSAI and GOA Groundfish FMPs and classify them as "Ecosystem Component" (EC) species, the purpose of which would be to serve as a monitoring function. Classification as EC species would mean they would not be placed on the TAC sheet. We do not recommend placing Popeye or Pacific Grenadier in either the BSAI or GOA Groundfish FMP at this time as these stocks are largely outside the reach of existing fisheries.

Policy guidance relevant to the placement of stocks within an FMP essentially guides us toward a two-part question. The first question to ask is, "which stocks are in need of conservation and management?" The second question – if a stock is believed to be in need of conservation and management – is how to classify those stocks within an FMP. The National Standard 1 Guidelines provides two classifications of species within an FMP: 1) "in the fishery", and 2) "Ecosystem Component" species. The basic difference between the two is that stocks classified as "in the fishery" are targeted, or otherwise may need an

Annual Catch Limit to prevent overfishing of the stock. An “Ecosystem Component” classification is one which allows a Council to manage a species for ecological reasons. These types of stocks are not at risk of experiencing overfishing (and therefore Annual Catch Limit specifications are not necessary), but placement of these species in an FMP may be desirable for ecosystem-related reasons.

Available information shows that grenadier catch levels are a small fraction of the OFL in both the GOA and BSAI management areas. In the GOA, catch levels have averaged around 14% of the OFL, while in the BSAI catch levels have averaged around 6% of the OFL. In addition, abundance estimates indicate a healthy and stable stock status. From an ecological perspective, Giant grenadier are estimated to be the most abundant stock across a large area of the continental slope, meaning they likely play an important ecological role in areas of the GOA and BSAI.

Future catch levels of grenadier are likely to remain stable and perhaps even decrease for reasons outlined in the attached analysis. Giant grenadier marketing efforts have been met with repeated failure and there is nothing on the horizon indicating that Giant grenadier can be processed in a way that is palatable and sold in a manner that is economically viable.

Because grenadier catch levels are a small fraction of the OFL and catch levels are unlikely to increase at any point in the near future, classifying grenadiers as “in the fishery” would be inappropriate. There is simply nothing gained in a conservation sense by doing so, but there are likely to be negative economic implications (especially in the BSAI) and negative management implications due to increased management complexity. Classifying them as “in the fishery” would require that they be placed on the TAC sheet. In the BSAI this would cause clear economic harm due to the presence of the 2 million ton cap and the need to reduce catches of target species in order to make room for accounting of grenadier catches.

Classifying Giant grenadiers as “ecosystem component” species may make some sense due to their apparently important ecological role on the continental slope. While this role is not well understood, and the ecological effect of fishery removals of Giant grenadier is also not well understood, an EC classification would assist in monitoring efforts which could help advance this understanding.

The attached analysis provides further detail and justification for our recommendations. We look forward to discussing this matter in more detail at the December 2013 Council meeting.

Sincerely,

Robert Alverson



Executive Director, Fishing Vessel Owners
Association

Brian Lynch



Executive Director, Petersburg Vessel Owners
Association

Merrick Burden



Executive Director, Marine Conservation Alliance

Chad See



Executive Director, Freezer Longline Coalition

Introduction

In this analysis we have combined available scientific information with existing policy guidance to derive a recommendation regarding the management of three species of grenadier in the Gulf of Alaska and Bering Sea/Aleutian Islands management areas. We find that the most appropriate approach is to place Giant grenadier in both the BSAI and GOA Groundfish FMPs and classify them as “Ecosystem Component” species. We envision this classification as primarily serving a monitoring role in order to advance scientific objectives. Even though we make this recommendation, we believe that it would be reasonable for one to conclude that grenadiers be left out of the Groundfish FMPs entirely because it is not clear that conservation and management measures are necessary given the size of the OFL, the abundance of grenadiers, and the unlikely event of Giant grenadier markets developing in the foreseeable future.

In this analysis we have summarized relevant portions of existing policy guidance. To a large extent, the most appropriate pieces of policy guidance are found in the Magnuson-Stevens Act and the existing National Standard 1 Guidelines. We then summarize the relevant scientific information regarding fishery removals, stock status and trends, overfishing levels, and ecological information. This information is complimented with information regarding past efforts at selling Giant grenadier, the future potential for developing grenadier markets, and the possibility of future targeting activity.

A review of the grenadier stock assessment will lead one to conclude that A) the population of Giant grenadiers is healthy and stable, and may have been increasing over the past couple of decades, B) catch of Giant grenadiers has been far below the estimated OFL, and C) Giant grenadiers are an abundant species on the slope and are situated toward the top of the food chain. Available information on Pacific and Popeye grenadier indicates that these species are not encountered by active fisheries to any appreciable degree – both Pacific and Popeye grenadier are generally found beyond the depths at which fisheries operate. Furthermore, Popeye grenadier are too small to be caught by existing longline gear.

Catch of grenadiers has remained far below the OFL for decades and there is nothing indicating that catch will approach the OFL in the future. Food science research indicates that Giant grenadier are an undesirable species to the human palate and prior attempts at selling Giant grenadier on the market have been met with failure. Therefore, the prospect of a Giant grenadier market developing with a corresponding target fishery appears remote at this time. Furthermore, classifying grenadiers as “in the fishery” within the Bering Sea would implicate the 2 million metric ton cap, resulting in negative economic impacts without a corresponding conservation benefit.

Available information simply does not support classification of grenadiers as “in the fishery” in either the BSAI or GOA management areas. Available information indicates that the debate is whether they should be left out of the FMP entirely, or classified as Ecosystem Component stocks in order to monitor these species. While we believe sound arguments exist for either outcome, we support classification of Giant grenadiers as Ecosystem Component stocks because of their abundance along the continental slope, the

fact that fishery removals are on the order of several thousand tons, and because monitoring of Giant grenadier will further scientific objectives.

Policy Guidance

The MSA provides helpful context when considering whether to place a stock within an FMP. In the broadest sense, the MSA states that a Council must develop a Fishery Management Plan “*for each fishery under its authority that requires conservation and management*”. The question therefore is what would constitute a conservation and management need?

The Final Rule implementing the National Standard 1 Guidelines provides helpful context in this regard. The guidelines describe factors which include, but are not necessarily limited to: A) whether targeting of a stock occurs, B) whether overfishing is a concern, C) whether an overfished status exists, and D) whether the species plays a role in the ecosystem which would justify conservation measures for reasons other than an overfishing or overfished standard.

If a Council determines that a stock should be placed within an FMP the National Standard 1 Guidelines outline two possible classifications for that stock. These classifications are 1) “in the fishery” and 2) “ecosystem component” stocks. We’ve summarized the difference between the two classifications below:

- In the fishery: This includes stocks that are A) target species, B) non-target stocks that are retained for sale or personal use, and C) non-target stocks for which there is an overfishing concern, or for which an overfished status may exist.
- Ecosystem component: This includes stocks which are not targeted and for which overfishing or overfished status is not a concern and which are generally not retained or sold. These stocks may play an important role in the ecosystem and conservation considerations for them may not be well defined by an overfishing or overfished standard¹.

¹ In developing the ecosystem component (EC) category, NMFS indicated that it was intending to encourage ecosystem approaches to management. The EC category provides guidance for Councils which may wish to manage a species for ecosystem reasons, yet may find that establishing ACLs for these stocks is unnecessary.

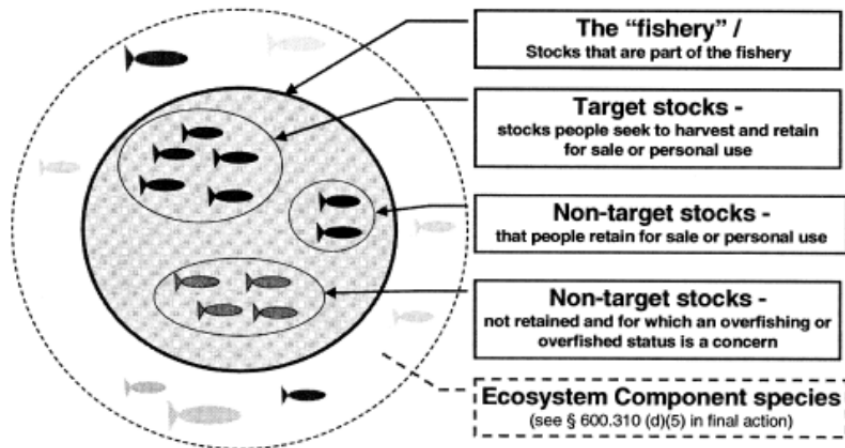


Figure 1 Description of FMP Categories (source: NS 1 Guidelines FR)

The classification system within the National Standard 1 Guidelines is helpful, however there is frequent confusion regarding the level of retention which would shift a species between an EC classification and an “in the fishery” classification. This confusion appears to exist – at least in part – because a species may be classified within the EC category even if some retention occurs. The question then is what level, or what type, of retention would shift a species from an EC classification to an “in the fishery” classification? In our view, the distinguishing factor ought to be one of intent. In other words, is retention the result of some incidental activity, or did a fishing vessel intend to fish in a way that would result in there being some retention of this non-target species? The bullets below outline some scenarios which we believe help to distinguish between the types of limited retention that may result in an EC classification versus an “in the fishery” classification:

- Some types of non-target species retention may change fishing behavior. Some types of non-target species retention can have an impact on fishing behavior, which can then lead to impacts which affect the Council’s desired management outcomes. In these cases, an “in the fishery” designation may be appropriate. A couple of examples are:
 - A non-target species could be retained because the total bundle of fish caught during a trip (target and non-target) collectively justifies fishing activity and the non-target stocks in this bundle are an important component that contributes to economically viable fishing activity.
 - A non-target stock could be retained as the result of “topping off” activity where an extra set is made, or tow duration is extended in time or space, to ‘top off’ with desirable species which are not the principle target. These types of scenarios mean that some retention of non-target species will have an impact on fishing behavior, and this may be of interest to the Council as it considers the management goals it has specified for the fishery.
- Some types of non-target species retention may be purely incidental to targeting activity. Other types of non-target species retention is purely incidental to target fishing activity. Retention in

this case would not influence fishing behavior, and management of non-target species would not tend to influence the Council's management goals (discards being an exception). In this type of scenario the overall fishery management goals the Council has specified for the fishery would tend to be unaffected. In this instance, an EC classification may be more appropriate².

Other factors that ought to be considered include the role of a species in the ecosystem and the level of catch that is occurring. In other words, we recommend that a two part question be asked—does the species play an important role in the ecosystem? If so, is catch large enough that fishing activity may be having an impact on the food-web via catch of this species? The factors that may lead one to conclude that there is an ecosystem-related reason for considering a species as an EC is not immediately clear from the guidelines, however we can imagine several reasons why classifying as an EC makes sense, which include but are not limited to:

- Prey species: A key prey species may be important to the status and productivity of other species in the marine food web
- Predator species: A key predator may be in a position of causing rippling effects through the food web if their abundance changes
- A large component of biomass: A species might not be a key predator or prey, but by its very abundance it constitutes an important piece of the marine food web

Grenadier Life History and its Role in the Slope Ecosystem

Grenadiers tend to be long-lived species that inhabit the relatively deep reaches of the continental slope. Of the three species being considered for placement in the GOA and BSAI groundfish FMPs, Giant grenadier are estimated to live up to 56 years³, Pacific grenadier are estimated to live up to 73 years⁴, and Popeye grenadier are estimated to live up to 10 years⁵.

Grenadiers are believed to make up a significant portion of the biomass on the slope. Giant grenadiers in particular are considered the dominant species (in terms of total biomass) at depths of 400 to 1,000 m and are therefore likely to play an important ecological role in this area. Pacific and Popeye grenadiers appear to be more abundant at depths that are deeper than those inhabited by Giant grenadier and also

² In the case of Giant grenadiers in the North Pacific, some exploratory activity has occurred in the past which would be considered target activity. We believe that periodic exploratory activity should be expected as part of fishing activity, and indeed we believe it should be encouraged in many instances, however periodic exploratory activity should not lead one to conclude that a species should be classified as "in the fishery". The type of target activity that should lead one to consider classifying a stock as "in the fishery" should be a sustained target activity that exists over time and is likely to continue in the future.

³ Burton, E.J., 1999. Radiometric age determination of the Giant grenadier (*Albatrossia pectoralis*) using 210Pb: 226Ra disequilibria. MS thesis, San Francisco State University

⁴ Andrews, A.H., G.M. Cailliet and K.H. Coale, 1999. Age and growth of the Pacific grenadier (*Coryphaenoides acrolepis*) with age estimate validation using an improved radiometric ageing technique. Can. J. Fish. Aquat. Sci. 56:1339-1350.

⁵ Fadeev, N.S., 2005. Guide to biology and fisheries of fishes of the North Pacific Ocean. Vladivostok, TINRO-Center. 366 p.

generally beyond the depths of fishing activity. Furthermore, Popeye grenadier appear too small to be caught by longline gear to any appreciable degree.

Grenadier Stock Status and Catch

Current grenadier biomass estimates suggest a robust and stable stock. In fact, available data tends to demonstrate an increasing trend in biomass, especially if the 1999 biomass estimate is included⁶.

Furthermore, available information indicates that overfishing is not occurring and that the stock is not overfished – this being the case without any current measures for conservation and management. The table below summarizes information on the estimated “overfishing level” and the average catch over the 2006 – 2012 time period. On average, estimated catch has been around 6% of the OFL in the Bering Sea and roughly 14% of the OFL in the GOA.

Stock	OFL	'06-'12 average catch	Avg. catch as a % of OFL
GOA Grenadiers	46,635	6,367	13.7%
BSAI Grenadiers	89,878	5,607	6.2%

Note: while there is some uncertainty regarding current and future catch estimates due to recent the changes in the observer program, even a doubling of the catch estimate as a result of these new observer data would result in catch rates that are a small portion of the OFL

The Grenadier biomass estimates are likely biased low. All of the biomass estimates are derived from longline and trawl surveys conducted in both GOA and BSAI at depths shallower than 1,000 m and no adjustment or correction is made to include the portion of the population dwelling below this depth in the total biomass estimate. This means that the current biomass estimate should be considered a minimum estimate, and the impact of the current catch levels in both areas is likely less than is currently being assessed.

Indication that the stock is under-assessed is derived from information showing an increase in the male component in the samples at progressively increasing depth. Based on these data, it is reasonable to assume that some level of sexual disaggregation of the population is occurring and that a significant number of males may not be susceptible to capture in the surveys because they reside at depths below survey depths. Table 1-9 of the December 2012 GOA Grenadier Assessment (Gulf of Alaska and Bering Sea/Aleutian Islands SAFE) shows the male proportion in the survey samples increasing by at least 10% between the 200 m-300 m and 800 m-1,000 m depth strata for the 2006-2012 surveys. Assuming a true 50:50 male:female population sex ratio and not accounting for the male component at depths greater than 1,000 m, the GOA Grenadier biomass estimate could be underestimated by over 45% in GOA and 51% in BSAI. As the following table shows, even if the sex ratio is heavily weighted toward females (as is the case for some species of flatfish) the biomass estimate in the GOA could still be underestimated by 1.3% at 20% males to 27% at 40% males and 4% to 51% in the BSAI, respectively. This is further supported on page 702 of the 2012 Grenadier Assessment, *“In the longline survey sex distributions, there was a trend toward an increased number of males in progressively deeper strata, but even at the*

⁶ Table 1-4 of the December, 2012 GOA Grenadier Assessment, Gulf of Alaska and Bering Sea/Aleutian Islands SAFE

deepest stratum of 800-1,000 m, males were only 6-13% of the catch in the GOA, 7-31% in the eastern AI, and 5-8% in the EBS (Table 1-9). These results imply that much of the male population may reside in depths >1,000 that are not covered by the survey, at least during the summer period when the survey is occurring."

In the table below we have outlined some approximations of grenadier biomass, OFL, and ABC based on the current assessment and alternative assumptions regarding the true proportion of males in the grenadier population. As assumptions regarding the proportion of males in the population increases, the total estimate of grenadier biomass increases. This is because the majority of males (and also some females) appear to live at depths that are not surveyed.

Table 1 Biomass, OFL, and ABC Estimates Based on Several Possible Scenarios of Male Grenadier Abundance

GOA								
		% > Current Biomass			Avg % Males Observer	Avg. GOA Catch	Catch As	Catch As
	Biomass	Est.	OFL	ABC	'07-'12	'06-'12	% OFL	% ABC
<1,000m 2012-13	597,884		46,635	34,976	18.7%	6,367	13.7%	18.2%
Tot Biomass w/males=20%*	605,759	1.3%	47,249	35,437	20%**	6,367	13.5%	18.0%
Tot Biomass w/males=30%*	674,052	12.7%	52,576	39,432	30%**	6,367	12.1%	16.1%
Tot Biomass w/males=40%*	759,700	27.1%	59,257	44,442	40%**	6,367	10.7%	14.3%
Tot Biomass w/males=50%*	870,282	45.6%	67,882	50,912	50%**	6,367	9.4%	12.5%
BSAI								
		% > Current Biomass			Avg % Males Observer	Avg. BSAI Catch	Catch As	Catch As
	Biomass	Est.	OFL	ABC	'07-'12	'06-'12	% OFL	% ABC
<1,000m 2012-13	1,152,284		89,878	67,409	16.1%	5,607	6.2%	8.3%
Tot Biomass w/males=20%*	1,199,047	4.1%	93,526	70,144	20%**	5,607	6.0%	8.0%
Tot Biomass w/males=30%*	1,338,309	16.1%	104,388	78,291	30%**	5,607	5.4%	7.2%
Tot Biomass w/males=40%*	1,514,171	31.4%	118,105	88,579	40%**	5,607	4.7%	6.3%
Tot Biomass w/males=50%*	1,743,244	51.3%	135,973	101,980	50%**	5,607	4.1%	5.5%
*Tot. Biomass all depths								
**Assumed % Males In Tot. Pop.								

Naturally, one may be inclined to point out that current catch levels are likely to be comprised of females if females do tend to inhabit shallower depths than males. In some cases a high proportion of females in the catch may be cause for concern; however available data does not appear to indicate that there is reason for concern in this case. Catch levels are a small fraction of the total OFL and are so small that it seems unlikely that there is a possibility of overharvesting the female portion of the population. Secondly, if excessive harvest of females was occurring, we would expect to see some evidence in the available data: the proportion of males may begin to increase at shallower depths, the overall catch rate would be decreasing, the survey index of biomass in the shallower depths where females are found would be decreasing, or some combination thereof. None of those phenomena appears to be occurring.

Grenadier Catch Rates and their Correlation with Sablefish Efforts

Grenadier catch rates have remained low relative to the OFL for many years. The catch that does occur is correlated to a fairly high degree with the sablefish longline catches. In other words, inter-annual changes in grenadier catch can be explained – to a large degree – by changes in sablefish longline catch and effort. To demonstrate this point, we regressed grenadier catch on sablefish catch and discovered a high degree of explanatory power between the two in both management areas, as shown in the table below. This means that as sablefish catches increase, grenadier catches should be expected to increase and vice versa.

This information is useful as supporting empirical evidence showing that grenadier catch is incidental to other types of fishing activity and is not the result of targeting activity. Of course, sablefish catch doesn't explain all of the variation in the catch of grenadier. Other contributing forces are undoubtedly the relatively deep-water longline and trawl turbot fishery as well as variations in grenadier abundance, among others.

Table 2 Linear Correlation between Sablefish and Grenadier Catch in the GOA and BSAI (2003 to 2012)

	GOA Grenadier Catch	BSAI Grenadier Catch
GOA Sablefish Catch	0.74	
BSAI Sablefish Catch		0.72

Note: R square values were 0.62 for the GOA and 0.53 in the BSAI

Marketing Efforts

In a June 2012 NPFMC discussion paper addressing grenadier fisheries in the BSAI and GOA⁷, the authors comment that *“there may be potential for future development of a targeted fishery for Giant grenadier.”* They note that there have been *“experimental attempts to market the fish, and there has been food technology research to develop marketable products from this species.”* While true, efforts to market these species have largely been unsuccessful and there is little evidence to suggest that anyone is actively targeting or topping-off the species in either the BSAI or GOA for the purposes of sale or personal use.

One member company of the Freezer Longline Coalition that participates in the BSAI sablefish and turbot fisheries has sometimes opted to retain limited amounts of grenadier. The company sought to market H&G grenadier in domestic and international markets. However, despite their efforts, they have never succeeded in developing a viable market for the fish. They have had no sales of H&G grenadier for nearly two years, and have since stopped retaining even limited quantities of grenadier bycatch. Reasons the company cited for the lack of a market for the species included the poor taste and texture of the fish, and the difficulty of catching grenadier that were large enough in size to attract even some interest from potential buyers.

⁷ *Inclusion of Grenadiers in the Fishery Management Plans For the Bering Sea and Aleutian Islands and/or the Gulf of Alaska*, by Tom Pearson, Sustainable Fisheries, Alaska Region, NMFS; Dave Clausen, AFSC; Jane DiCosimo, NPFMC; June 2012

Research conducted on grenadier fisheries suggests that the company's experience with Giant grenadier is consistent with others fishing in Alaskan waters and elsewhere. The Monterey Bay Aquarium's Seafood Watch report on grenadier⁸ notes that "*Giant grenadier has been considered a valuable food species because of its presumed abundance and the high vitamin and fat content of its liver and eggs. Nevertheless, this species has not received favorable reviews for human consumption. When tested by a panel of judges, Giant grenadier received low scores for flakiness, chewiness, hardness, and fibrousness, and high scores only for moistness* (Matsui et al. 1990)." The report goes on to note that in the early years of the grenadier fishery Japanese fleets caught grenadier for use in surimi. However, while Pacific grenadier produced good surimi, Giant grenadier did not and soon other species replaced grenadier in the Japanese surimi market. Today, fish surimi production worldwide is predominantly derived from Alaskan pollock and other species, with little, if any production from grenadier species.⁹

Worldwide, several species identified as grenadiers are, or have been successfully harvested for commercial sale. However, it's important to point out that several of these species are vastly different in a biological sense from Giant grenadier (some of them are Merlucciidae while Giant grenadier are Macrouridae). Others have noticeably different qualities that make them more viable on the commercial market. Pacific grenadier has been marketed and sold on the West Coast, off of California (though landings there are small, totaling just over 14 tons in 2012 at \$0.10 per pound). Likewise, there is a strong commercial fishery in Australia and New Zealand for Blue grenadier, also known as hake. These species differ from Giant grenadier in that they are known to have a taste, color and texture that is much more appealing for human consumption than Giant grenadier. Other harvested species identified as grenadiers, but which are distinct from Giant grenadiers, include roundnose grenadier (North Atlantic), Patagonian grenadier (South America) and roughnose grenadier (North Atlantic), amongst others. At this point in time a future fishery for Giant grenadier should only be considered a hypothetical scenario, and one which would require technological advancements in order to create a product that is desirable to the human palate.

The Future

As we consider the future environment that will influence fishing activity in the North Pacific and impact the corresponding levels of grenadier catch, it is helpful to consider a few points:

- We believe it is unlikely that a market for Giant grenadier will develop in the foreseeable future. Such a development would require an innovation in food science technology to create a product that is appealing to the human palate. We are unaware of any imminent breakthroughs in such technology and therefore the prospect of a target fishery seems hypothetical at best.
- The Council is considering measures to deal with whale depredation issues in the GOA. Should the Council elect to allow pot gear usage in the GOA sablefish fishery, we should expect

⁸ *Seafood Watch Seafood Report: Grenadier, West Coast Region*; by Kelsey Abbott, on behalf of Monterey Bay Aquarium; updated March 17, 2006

⁹ Aside from Alaskan pollock, other species cited by Monterey Bay Aquarium as used in fish surimi include Atka mackerel, barracuda, blue whiting, cod, hoki, mackerel, Pacific whiting, sardine, striped mullet and threadfin bream. See http://www.montereybayaquarium.org/cr/SeafoodWatch/web/sfw_factsheet.aspx?fid=17

grenadier catch rates to decline there. Bering Sea observer data indicates that pot gear catches far fewer grenadier than longline gear.

Together, these issues indicate that the direction of grenadier catch levels in the GOA and BSAI should remain relatively stable, and perhaps even decline in the foreseeable future. As indicated previously, existing catch levels are a small fraction of the OFL. This provides additional rationale for not classifying grenadiers as “in the fishery”.

Concluding Remarks

When we combine the best available scientific information and policy guidance on the content of Fishery Management Plans, we believe that designating grenadiers as “in the fishery” would be inappropriate. It is not apparent that classifying them as such would result in any conservation outcome, but it would clearly have negative impacts, both economic and managerial.

Available information shows that grenadiers are not subject to overfishing and are not overfished; the biomass of grenadiers has generally been increasing over the past couple of decades; targeting of grenadiers does not currently take place and what limited retention has taken place is best described as “exploratory” in nature as companies explore market possibilities. To date these market exploration activities can only be considered a failure and the prospect of a Giant grenadier market developing in the near future is best described as a hypothetical scenario.

There may be reasons for placing grenadiers in the FMP so that their status and role in the ecosystem can be monitored more accurately than they are now. Information suggests that grenadiers play an important role in the slope ecosystem due to their abundance there and – to the naked eye – catch volumes could be large enough to warrant some monitoring of these effects, even though catch rates are far below the OFL.

For these reasons, and others listed above, we believe it would be reasonable to leave grenadiers outside both the BSAI and GOA groundfish FMPs entirely. However, we recommend that Giant grenadiers be placed in the GOA and BSAI Groundfish FMPs and classified as “Ecosystem Component” species due to their apparent ecological importance on the continental slope. We envision the purpose for classifying them in this way is to primarily serve as a monitoring function and would not lead to the establishment of Annual Catch Limits. We do not believe the information supports the placement of Pacific or Popeye grenadier within either FMP as the available information indicates these species are largely outside the reach of existing fishing activity.