Appendix 3 Grenadiers in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands

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Executive Summary

Grenadiers are presently considered "unspecified" by the NPFMC, which means they are not a part of the groundfish management plans for either the Gulf of Alaska (GOA) or the Bering Sea/Aleutian Islands (BSAI). Therefore, there are no limitations on catch or retention, no reporting requirements, and no official tracking of grenadier catch by management. However, a proposed joint management plan amendment for "other species" may change grenadiers to a specified status, in which case they would be included as managed groundfish species in the plans. In response to this possibility, an assessment of grenadiers in Alaska was prepared for the first time as an appendix to the 2006 SAFE report (Clausen 2006). For the 2007 SAFE report, it was decided that for many of the "other species" reports and also for unspecified fish such as grenadiers, a full assessment was not necessary, and that an Executive Summary would suffice.

Of the seven species of grenadiers known to occur in Alaska, the giant grenadier appears to be most abundant and also has the shallowest depth distribution on the continental slope. As a result, it is by far the most common grenadier caught in the commercial fishery and in fish surveys. Therefore, the grenadier assessment focuses on giant grenadier. Because of a lack of information on the population dynamics of giant grenadier, this species could be classified into either tier 5 or tier 6 in the NPFMC's definitions of overfishing level (OFL) and acceptable biological catch (ABC). However, a tier 5 approach was recommended in the 2006 assessment, and this approach was supported by the NPFMC Plan Teams and by the NPFMC Scientific and Statistical Committee.

Tier 5 assumes that a species has reliable estimates of biomass and natural mortality, and it states that $F_{OFL}=M$ and $F_{\mathrm{ABC}}\leq 0.75M$, where F is the fishing mortality rate and M is the natural mortality rate. Tier 5 computations were based on giant grenadier only and excluded the other grenadier species because virtually none of the other species are caught in the commercial fishery and relatively few are taken in fish surveys. Therefore, in the tier 5 determinations, giant grenadier are serving as a proxy for the entire grenadier group. Biomass estimates for giant grenadier in the eastern Bering Sea (EBS) and GOA were calculated based on the average of the two most recent deep-water (to 1,000-1,200 m) trawl surveys in each area. In the EBS, these were in 2002 and 2004, and the average was 546,453 mt; in the GOA, these were in 1999 and 2005 and the average was 488,627 mt. No trawl surveys in the Aleutian Islands (AI) have sampled depths >500 m since 1986, so an indirect method was used to determine biomass of giant grenadier in this region. According to biomass-weighted index values (relative population weights) in NMFS longline surveys, biomass of giant grenadier for the period 1996-2006 was 2.50 times higher in the AI than in the EBS. If this ratio is applied to the estimated biomass of 546,453 mt in the EBS, an indirect estimate of 1,363,858 mt can be computed for the AI. A natural mortality rate of 0.074 has been estimated for giant grenadier, but a more conservative rate may be more appropriate for a number of reasons: 1) the natural mortality rate of 0.074 is very uncertain and may be too high; 2) female giant grenadier are caught disproportionately in the fishery; and 3) deep-sea fish such as grenadiers appear to be especially vulnerable to overexploitation. Hence, an alternative, proxy value for M of 0.057, which corresponds to the M for Pacific grenadier, was recommended for use in the tier 5 computations for giant grenadier. Based on this value of M, and the estimated

biomass estimates for each region, OFLs and ABCs can be computed as follows (biomass, OFL, and ABC are in mt):

Area	Biomass	Natural mortality *M*	OFL Definition	OFL	ABC Definition	ABC
EBS	546,453	0.057	Biom x *M*	31,148	0.75 x OFL	23,361
AI	1,363,858	0.057	Biom x *M*	77,740	0.75 x OFL	58,305
GOA	488,627	0.057	Biom x *M*	27,852	0.75 x OFL	20,889
Total	2,398,938	0.057	Biom x *M*	136,739	0.75 x OFL	102,555

New Information in 2007

New information in 2007 for giant grenadier includes updated commercial catch estimates for 2003-2007, a new biomass estimate for the GOA based on the recently completed 2007 trawl survey in this area, the 2007 longline survey results for the GOA and EBS, and new age results for the GOA.

Updated catches

Although official catches for grenadiers are not available, unofficial catches have been estimated for the years since 1997. The updated sequence of catches (mt) is listed in the following table[1]:

	Eastern Bering Sea	Aleutian Islands	Gulf of Alaska	Total
1997	2,964	2,887	12,029	17,881
1998	5,011	1,578	14,683	21,272
1999	4,505	2,883	11,388	18,776
2000	4,067	3,254	11,610	18,931
2001	2,294	1,460	9,685	13,439
2002	1,891	2,807	10,479	15,177
2003	2,853	3,556	12,321	18,730
2004	2,225	1,123	11,964	15,311
2005	2,581	1,676	7,190	11,447
2006	2,068	2,222	8,291	12,581
2007	1,707	1,579	9,057	12,343
mean	2,924	2,275	10,791	15,990

The catch estimates for 2003-2005 in the EBS and AI are the same as in last year's assessment, but the catches for these years in the GOA have increased by a factor of about 10%. The catches for 2006 and 2007 have not been reported previously.

[1] New catches for 2003-2007 are based on data from National Marine Fisheries Service, Alaska Regional Office, Sustainable Fisheries Division, P.O. 21668, Juneau AK 99802. Updated as of Oct. 5, 2007.

New GOA biomass estimate

The biomass for giant grenadier in the 2007 GOA trawl survey was 487,987 mt. This value is nearly the same as the 488,627 mt biomass that was used in the 2006 assessment to compute OFL and ABC for the GOA. Thus, if the new value was included in the OFL and ABC computations, the resultant OFL and ABC values for the GOA would be very similar to those in the 2006 assessment which are listed above.

New longline survey abundance indices

The relative population weight (RPW; an index of relative biomass) for giant grenadier in the GOA was 1,404,684 in the 2007 NMFS longline survey. This is an increase of nearly 46% compared to the 2006 survey, and it is highest RPW for this area since 1997. However, the RPW in the EBS was 484,294, which is a decline of 37% compared to the last year the EBS was surveyed in 2005.

Age results for giant grenadier in the GOA

The AFSC REFM Division Age and Growth Program attempted to age giant grenadier for first time in 2006-2007, and results of this aging have recently become available. The age samples (otoliths) were collected during the 2004 and 2006 NMFS longline surveys in the GOA for an age of maturity study. A total of 357 fish were aged, and ages ranged from 14 to 58 years. The maximum age of 58 is very close to the maximum age of 56 that was reported for the only other age study of giant grenadiers. The aging procedure developed by the Age and Growth Program is considered experimental, and validation studies are needed to confirm the ages.

Reference

Clausen, D. M. 2006. Grenadiers 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 regions, Appendix F, p. 563-600. North Pacific Fishery Management Council, 605 W 4th Ave., Suite 306, Anchorage AK 99501.

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