Appendix 1b: Gulf of Alaska Squids

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Executive summary
Gulf of Alaska (GOA) squids continue to be managed as part of the GOA Other Species group. The total allowable catch (TAC) for this group is set by the North Pacific Fishery Management Council (NPFMC) as ≤ 5% of the combined GOA target species TAC, so no assessment is required for GOA squids. However, the NPFMC is considering an amendment to separate the Other Species group into species groups. If this amendment is approved, under the requirements of the current data quality Tier system they could only be managed under the lowest information tiers, Tier 5 or Tier 6. The information in this assessment has been prepared for analysis purposes in the event that this amendment is approved. For 2007, the GOA Plan Team requested that we limit our assessment to a two-page summary.

Provisional harvest recommendations under Tiers 5 and 6

		Tier 5	Tier 5	Tier 6	Tier 6
time period used for avg. biomass or catch		1999-2007	2003-2007	1990-2005	1990-2006
average survey biomass (t)		6,390	7,737	N/A	N/A
option 1	ABC (t)	1,198	1,451	80	143
	OFL (t)	1,598	1,934	106	190
option 2	ABC (t)	2,263	2,740		
	OFL (t)	2,763	3,345		

Introduction
There are 18 squid species found in the mesopelagic regions of the Eastern Bering Sea (EBS), representing 7 families and 10 genera. Less is known about which squid species inhabit the GOA, but the species are likely to represent both EBS species and more temperate species in the family Loligo, which are regularly found on the U.S. West Coast and in British Columbia, Canada, especially in warmer years. Squid are distributed throughout the North Pacific, but are common in large schools in pelagic waters surrounding the outer continental shelf and slope. The spatial distribution of squids in the GOA is largely unknown. Relative to most groundfish, squids are highly productive, short-lived animals.

Squids are currently not targeted by commercial fisheries, and fishing mortality appears to be low relative to natural mortality. The majority of the squid catch in the GOA occurs in the pollock fisheries (Table 1) along the outer continental shelf. Species identification of squids in the commercial catch is poor, and is inconsistent in the surveys. The gear (bottom trawl) and sampling locations of the biennial GOA surveys are not optimized for catching squids, yet the coefficients of variation of squid biomass estimates from the survey are low. This suggests that the surveys provide a reliable minimum estimate of squid biomass. Squid biomass and catch fluctuate widely in the GOA (Table 1), as has been observed for squids elsewhere. The squid catch was extremely high in 2006, and the GOA survey biomass estimate in 2007 was much higher than in previous years (Table 1).

Analytical approach

Tier 5

The overfishing level (OFL) under Tier 5 is calculated as the F_{OFL} (based on the natural mortality rate M) multiplied by estimated biomass. We present two options for determining the appropriate F_{OFL} for squid:

Option 1: Under option 1, the standard Tier 5 methodology is adapted for species with high turnover rates and values of M approaching 1.0. Tier 5 criteria are modified based on previous experience with squid fisheries that suggests overfishing may occur at fishing rates of half to one quarter of M. As a proxy for a sustainable fishing mortality rate, we suggest that M = 1.00 is a reasonable value for the longer lived North Pacific squid found in the GOA, but we recommend using 25% of M to establish F_{OFL} and establishing F_{ABC} as 0.75 * adjusted M (i.e., 0.1875).

Option 2: For option 2, the methodology is adapted to account for the effect of harvesting and natural mortality on squid biomass throughout the year by including a decay function based on total mortality. Using this approach, we calculate the OFL as average survey biomass * F_{OFL} * (1-exp(-Z))/(Z), where Z = M+ F_{OFL}, M = 1.00 and F_{OFL} = M = 1.00. ABC is calculated using the same approach, but substituting F_{ABC} = 0.75 * M for F_{OFL}.

Average survey biomass: The biennial GOA bottom trawl surveys likely underestimate the biomass of squids in the GOA, but they provide fairly reliable estimates of minimum biomass. Populations of squids in the GOA appear to fluctuate widely from year to year, so we recommend using at least three surveys to calculate average survey biomass. The 2007 survey biomass estimate was much larger than in previous years. Therefore, we suggest two alternatives for estimating average biomass: 1) use only the last three surveys (2001-2007) or 2) reduce bias by using the last 5 surveys (1999-2007). Both options are presented here.

Tier 6

Under Tier 6, OFL is established as equal to the average historical annual catch from 1978-1995, and ABC is established as 0.75 * OFL. Tier 6 is problematic for squids because fishing pressure on squid appears to be low and average catch may not be a good indicator of productivity in a lightly fished population. In addition, squid catch has only been recorded since 1990. We suggest using recent data to supplement the short catch history and offer two alternative for estimation under Tier 6 depending on the inclusion of 2006 catch data, when the catches was much higher than in other years.

Table 1. Survey biomass and catch of squids in the GOA.

year	2003	2004	2005	2006	2007*
GOA squid survey biomass (t)	6,322		4,899		11,991
total GOA squid catch (t)	91	157	625	1,527	412
pollock fishery squid catch (t)	62	139	620	1,515	406
- as % of total squid catch	69%	89%	99%	99%	99%
total other species catch (t)	1,692	1,608	2,347	3,425	2,116
squid % of other species catch	5%	10%	27%	45%	19%
other species TAC (t)	11,260	12,592	13,871	13,856	4,500

* 2007 catch estimates as of October 5, 2007. All catch estimates are from the Catch Accounting System at the Alaska Regional Office. Other species catch does not include skates.