18. Assessment of the big and longnose skate stocks and the other skate stock complex in the Gulf of Alaska

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Executive Summary

The Gulf of Alaska (GOA) skate complex is managed as three units. Big skates (*Beringraja binoculata*) and longnose skates (*Raja rhina*) each have separate harvest specifications, with acceptable biological catches (ABCs) specified for each GOA regulatory area (western, central, and eastern). A single gulfwide overfishing level (OFL) is specified for each stock. All remaining skate species are managed as an "Other Skates" complex with gulfwide harvest specifications. All GOA skates are managed under Tier 5, where OFL and ABC are based on survey biomass estimates and natural mortality rate.

Gulf of Alaska skates are assessed on a biennial schedule, with full assessments due in odd years to coincide with the availability of new trawl survey data. In even years an executive summary is prepared with updated catch data. The full assessment from 2015 is available on the web (Ormseth 2015, http://www.afsc.noaa.gov/REFM/Docs/2015/GOAskate.pdf).

Summary of Changes in Assessment Inputs

1) Catch data for all GOA skates has been updated through October 16, 2016.

Summary of Results

1) Catches of big skates in the central GOA regulatory area (CGOA) increased in 2016, reversing a trend of reduced catches in 2014 and 2015 relative to 2013 and earlier years (Tables 2-3 and Figure 1). The reduced catches in 2014 and 2015 were associated with early (February) prohibitions on big skate retention in those years; in contrast, in 2016 retention was permitted but was limited by a 5% maximum retention allowance (MRA). The reduced MRA was intended to reduce the incentive for targeting of big skates and diminish the probability that the ABC would be exceeded. Despite a prohibition on big skate retention in the CGOA that was issued on September 27, 2016, at the time of this assessment the catch had exceeded the ABC by a small amount and it is unclear the degree to which the final 2016 catch will be over ABC.

2) The catch of longnose skates in 2016 was similar to previous years (Tables 2-3). Similar to 2015 the catch in the western GOA regulatory area (WGOA) exceeded the ABC and retention of longnose skates in the WGOA was prohibited beginning April 25, 2016.

3) The retention rate of big skates in 2016 increased relative to 2014 and 2015, but was still lower than in 2013 and previous years (Table 4). Retention of longnose skate was lower in 2016 relative to previous years, but the retention of other skates was higher than in any year since 2007 (Table 4).

Following are the harvest recommendation summary tables for GOA skate stocks. W, C, and E indicate the western, central, and eastern GOA regulatory areas, respectively. Big and longnose skates have area-specific ABCs and gulfwide OFLs; the other skate complex has a gulfwide ABC and OFL.

big skate (*Beringraja binoculata*)					
		As estimated or *specified last* year for		As estimated or *recommended this* year for:	
Quantity		*2016*	*2017*	**2017**	2018
M (natural mortality)		*0.1*	*0.1*	**0.1**	0.1
Specified/recommended Tier		*5*	*5*	**5**	5
Biomass (t)	W	*12,112*	*12,112*	**12,112**	12,112
	C	*24,666*	*24,666*	**24,666**	24,666
	E	*14,079*	*14,079*	**14,079**	14,079
	GOA-wide	*50,857*	*50,857*	**50,857**	50,857
F_{OFL} (F=M)		*0.1*	*0.1*	**0.1**	0.1
maximum F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
OFL (t)	GOA-wide	*5,086*	*5,086*	**5,086**	5,086
ABC (t; equal to maximum ABC)	W	*908*	*908*	**908**	908
	C	*1,850*	*1,850*	**1,850**	1,850
	E	*1,056*	*1,056*	**1,056**	1,056
Status		As determined *last* year for:		As determined *this* year for:	
		2014	2015	**2015**	2016
Overfishing?		*no*	*n/a*	**no**	n/a
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)					

longnose skate (*Raja rhina*)					
		As estimated or *specified last* year for		As estimated or *recommended this* year for:	
Quantity		*2016*	*2017*	**2017**	2018
M (natural mortality)		*0.1*	*0.1*	**0.1**	0.1
Specified/recommended Tier		*5*	*5*	**5**	5
Biomass (t)	W	*808*	*808*	**808**	808
	C	*33,503*	*33,503*	**33,503**	33,503
	E	*8,426*	*8,426*	**8,426**	8,426
	GOA-wide	*42,737*	*42,737*	**42,737**	42,737
F_{OFL} (*F=M*)		*0.1*	*0.1*	**0.1**	0.1
maximum F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
OFL (t)	GOA-wide	*4,274*	*4,274*	**4,274**	4,274
ABC (t; equal to maximum ABC)	W	*61*	*61*	**61**	61
	C	*2,513*	*2,513*	**2,513**	2,513
	E	*632*	*632*	**632**	632
		As determined *last* year for:		As determined *this* year for:	
Status		2014	2015	**2015**	2016
Overfishing?		*no*	*n/a*	**no**	n/a
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)					

other skates (*Bathyraja* sp.)					
		As estimated or *specified last* year for		As estimated or *recommended this* year for:	
Quantity		*2016*	*2017*	**2017**	2018
M (natural mortality)		*0.1*	*0.1*	**0.1**	0.1
Specified/recommended Tier		*5*	*5*	**5**	5
Biomass (t)	GOA-wide	*25,580*	*25,580*	**25,580**	25,580
F_{OFL} (*F=M*)		*0.1*	*0.1*	**0.1**	0.1
maximum F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
F_{ABC}		*0.075*	*0.075*	**0.075**	0.075
OFL (t)	GOA-wide	*2,558*	*2,558*	**2,558**	2,558
ABC (t; equal to maximum ABC)	GOA-wide	*1,919*	*1,919*	**1,919**	1,919
		As determined last year for:		As determined *this* year for:	
Status		2014	2015	**2015**	2016
Overfishing?		*no*	*n/a*	**no**	n/a
(for Tier 5 stocks, data are not available to determine whether the stock is in an overfished condition)					

Responses to SSC and Plan Team Comments on Assessments in General

There were no relevant general comments from either the SSC or Pan Team.

Responses to SSC and Plan Team Comments Specific to this Assessment

From the November 2015 GOA Plan Team minutes:
The Team recommended considering the following suggestions for future assessments:
1. Exploring shared process error among areas in RE estimates of biomass,
2. Examining a more thorough accounting of skate catches in the directed halibut fishery,
3. Including IPHC survey for regional CPUE and apportionment
4. Given skate association with depth strata, consider analyzing skate abundance as a function of habitat.

> *Response*: These suggestions will be considered in the next full assessment that will be conducted in 2017.

From the November 2015 GOA Plan Team minutes:
The Team recommended that the random effects model be used to estimate the gulf-wide ABC by species or species aggregate. Also, the Team recommended that the apportionment be determined by the individual area random effects biomass estimates.

> *Response*: The recommended approaches were used for harvest recommendations in the 2015 full assessment and are carried forward in the 2016 assessment.

From the December 2015 SSC report:
The SSC reiterates its request that the author investigate whether there is information to support that skates in areas 649 and 659 are part of the GOA population and, if so, how to estimate skate biomass in these areas.

> *Response*: Area 649 & 659 catches will be explored in the next full assessment that will be conducted in 2017.

Tables

Table 1. Gulfwide bottom trawl survey biomass estimates (t) for the three managed skate groups in the GOA, 1984-2015. CV = coefficient of variation. Bottom row of table contains the 2015 biomass estimate from a random-effects timeseries model; this value is used for recommending harvest levels under Tier 5.

	big skate		**longnose skate**		**other skate**		**total skate biomass**
	biomass (t)	CV	biomass (t)	CV	biomass (t)	CV	
1984	27,540	0.22	9,002	0.38	4,647	0.16	41,189
1987	28,093	0.16	6,631	0.36	3,339	0.21	38,063
1990	22,316	0.25	11,995	0.22	13,936	0.25	48,248
1993	39,708	0.18	17,803	0.12	6,191	0.14	63,702
1996	43,064	0.18	26,226	0.14	11,912	0.17	81,201
1999	54,650	0.15	39,333	0.14	18,946	0.11	112,929
2001	39,082	0.19	23,275	0.16	12,857	0.16	75,214
2003	55,397	0.16	39,603	0.09	21,775	0.11	116,775
2005	39,320	0.16	41,370	0.08	29,998	0.11	110,688
2007	39,630	0.19	34,470	0.11	32,289	0.11	106,388
2009	44,349	0.16	36,652	0.09	27,399	0.12	108,401
2011	67,883	0.37	33,911	0.11	21,389	0.10	123,183
2013	38,234	0.26	44,484	0.11	30,705	0.11	113,423
2015	58,006	0.17	41,833	0.09	25,182	0.11	125,020
RE estimate	**50,857**		**42,737**		**25,580**		

Table 2. Time series of ABC, OFL and catch (t) for skates, beginning in 2005 when the current management approach for skates was adopted. For big and longnose skates, ABC and catch are divided by GOA regulatory area (**W**estern, **C**entral, **E**astern). Red-shaded cells indicate years/areas where the catch exceeded the ABC. All data are from the Alaska Regional Office.

year	species/ group	ABC				OFL	estimated skate catch			
		W	C	E	GOA		W	C	E	GOA
2005	big	727	2,463	809		5,332	26	811	65	902
	longnose	66	1,972	780		3,757	37	993	162	1,192
	other				1,327	1,769	163	506	42	711
2006	big	695	2,250	599		4,726	72	1,272	344	1,688
	longnose	65	1,969	861		3,860	57	682	219	958
	other				1,617	2,156	354	988	51	1,393
2007	big	695	2,250	599		4,726	69	1,518	8	1,595
	longnose	65	1,969	861		3,860	76	978	342	1,396
	other				1,617	2,156	479	690	88	1,257
2008	big	632	2,065	633		4,439	132	1,241	45	1,418
	longnose	78	2,041	768		3,849	34	965	113	1,112
	other				2,104	2,806	252	1,053	69	1,374
2009	big	632	2,065	633		4,439	79	1,903	100	2,082
	longnose	78	2,041	768		3,849	**79**	1,096	244	1,419
	other				2,104	2,806	343	1,092	113	1,548
2010	big	598	2,049	681		4,438	148	2,220	149	2,517
	longnose	81	2,009	762		3,803	105	846	131	1,082
	other				2,093	2,791	421	986	83	1,490
2011	big	598	2,049	681		4,438	110	2,111	90	2,311
	longnose	81	2,009	762		3,803	71	892	68	1,031
	other				2,093	2,791	313	977	59	1,349
2012	big	469	1,793	1,505		5,023	65	1,902	38	2,006
	longnose	70	1,879	676		3,500	39	793	93	925
	other				2,030	2,706	256	843	104	1,203
2013	big	469	1,793	1,505		5,023	121	2,319	79	2,519
	longnose	70	1,879	676		3,500	90	1,254	429	1,773
	other				2,030	2,706	218	1,486	174	1,878
2014	big	589	1,532	1,641		5,016	157	1,412	103	1,672
	longnose	107	1,935	834		3,835	59	1,158	355	1,572
	other				1,989	2,652	305	1,370	240	1,915
2015	big	589	1,532	1,641		5,016	233	1,224	58	1,515
	longnose	107	1,935	834		3,835	138	1,176	357	1,672
	other				1,989	2,652	571	1,035	175	1,782
2016*	big	908	1,850	1,056		6,200	126	1,921	41	2,088
	longnose	61	2,513	632		4,274	107	773	331	1,211
	other				1,919	2,558	288	959	146	1,393

* 2016 catch data are incomplete; retrieved October 16, 2016.

Table 3a. Catches (t) of **big skates** in the GOA by target fishery, 2005-2016. Data are from the Alaska Regional Office Catch Accounting System. The 2016 data are incomplete; retrieved October 16, 2016. Target fisheries are arranged separately in each table according to the 2016 estimated catch, in descending order.

	big skate											
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	***2016***
Halibut	36	566	11	34	163	42	142	35	420	413	338	*738*
Pacific Cod	222	417	536	584	552	928	921	735	611	840	771	*596*
Arrowtooth Flounder	225	163	299	219	433	484	817	677	949	190	237	*569*
Pollock	2	23	38	22	34	47	93	48	228	171	63	*99*
Shallow Water Flatfish	251	350	608	413	535	700	190	288	140	26	72	*66*
Flathead Sole	21	30	23	66	53	112	31	57	15	0	2	*6*
Rockfish	19	4	0	4	4	14	8	13	2	4	7	*4*
Sablefish	23	8	6	5	6	12	2	3	8	3	6	*4*
Rex Sole - GOA	49	99	74	70	264	172	106	149	145	25	19	*4*
Atka Mackerel	0	0	0	0	0	0	0	0	0	0	0	*1*
Other Species	56	27	0	2	38	5	1	0	1	0	0	*1*
Deep Water Flatfish	0	0	0	0	0	1	1	0	0	0	0	*0*
total	**903**	**1,688**	**1,594**	**1,418**	**2,082**	**2,517**	**2,312**	**2,006**	**2,519**	**1,671**	**1,515**	***2,088***

Table 3b. Catches (t) of **longnose skates** in the GOA by target fishery, 2005-2016. Data are from the Alaska Regional Office Catch Accounting System. The 2016 data are incomplete; retrieved October 16, 2016. Target fisheries are arranged separately in each table according to the 2016 estimated catch, in descending order.

	longnose skate											
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	***2016***
Pacific Cod	139	165	305	359	339	408	334	307	348	415	613	*432*
Halibut	103	186	400	105	421	106	191	114	704	421	503	*328*
Arrowtooth Flounder	373	135	165	212	152	166	238	181	218	303	250	*202*
Sablefish	105	298	277	126	81	109	69	121	321	159	122	*149*
Rockfish	20	21	17	12	17	12	25	23	23	26	33	*39*
Pollock	5	13	27	24	35	10	35	9	25	180	87	*37*
Shallow Water Flatfish	278	97	168	227	239	172	78	65	70	36	26	*13*
Flathead Sole	11	11	13	11	24	30	17	60	8	11	10	*6*
Rex Sole	19	29	24	36	82	52	44	45	54	23	21	*4*
Atka Mackerel	0	0	0	0	0	0	0	0	1	0	0	*1*
Other Species	137	2	0	0	30	16	0	0	1	0	7	*0*
Deep Water Flatfish	1	0	0	0	0	1	0	0	0	0	0	*0*
total	**1,192**	**957**	**1,396**	**1,112**	**1,419**	**1,082**	**1,032**	**925**	**1,773**	**1,573**	**1,672**	***1,211***

Table 3c. Catches (t) of **other skates** in the GOA by target fishery, 2005-2016. Data are from the Alaska Regional Office Catch Accounting System. The 2016 data are incomplete; retrieved October 16, 2016. Target fisheries are arranged separately in each table according to the 2016 estimated catch, in descending order.

other skate complex												
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	***2016***
Pacific Cod	175	980	527	945	887	1,058	776	686	805	935	1,076	*789*
Halibut	47	74	109	32	256	37	142	100	682	534	290	*233*
Arrowtooth Flounder	194	64	123	88	99	133	242	174	63	163	118	*192*
Sablefish	122	124	262	144	89	133	117	148	200	169	177	*141*
Rockfish	59	49	20	10	13	28	15	20	18	45	21	*17*
Shallow Water Flatfish	36	27	79	107	98	35	20	33	44	28	30	*16*
Pollock	1	5	9	6	3	7	2	6	24	17	18	*5*
Flathead Sole	38	12	20	5	13	19	13	17	8	1	8	*2*
Rex Sole	36	56	103	22	60	41	21	20	33	21	13	*0*
Atka Mackerel	0	0	0	0	0	0	2	0	0	0	0	*0*
Deep Water Flatfish	0	0	0	0	0	0	0	0	0	1	0	*0*
Other Species	2	3	4	16	30	0	0	0	0	0	30	*0*
total	**711**	**1,393**	**1,257**	**1,374**	**1,548**	**1,491**	**1,349**	**1,202**	**1,878**	**1,915**	**1,782**	***1,393***

Table 4. Retention rates of skates in GOA fisheries, 2007-2016. Data are from tables published by the Alaska Regional Office and available online at https://alaskafisheries.noaa.gov/fisheries-catch-landings. Retention rates in 2013-2016 were influenced by management actions; see footnotes.

	big skate	**longnose skate**	**other skates**
2007	46%	28%	27%
2008	70%	64%	17%
2009	76%	51%	18%
2010	72%	64%	15%
2011	81%	65%	19%
2012	93%	74%	13%
2013[1]	63%	36%	1%
2014[2]	26%	52%	5%
2015[3]	15%	52%	3%
*2016[4]**	*33%*	*32%*	*20%*

[1] On May 8, 2013 retention of big skate was prohibited in the CGOA.

[2] On February 5, 2014 retention of big skate was prohibited in the CGOA.

[3] On February 11, 2015 retention of big skate was prohibited in the CGOA.

[4] The following management actions related to skates in the GOA occurred during 2016:

- the maximum retention allowance (gulfwide for all species) was set at 5% on January 27, 2016
- retention of longnose skates in the WGOA was prohibited on April 25, 2016
- retention of big skates in the CGOA was prohibited on September 27, 2016

* 2016 data are incomplete; retrieved October 21, 2016

Figures

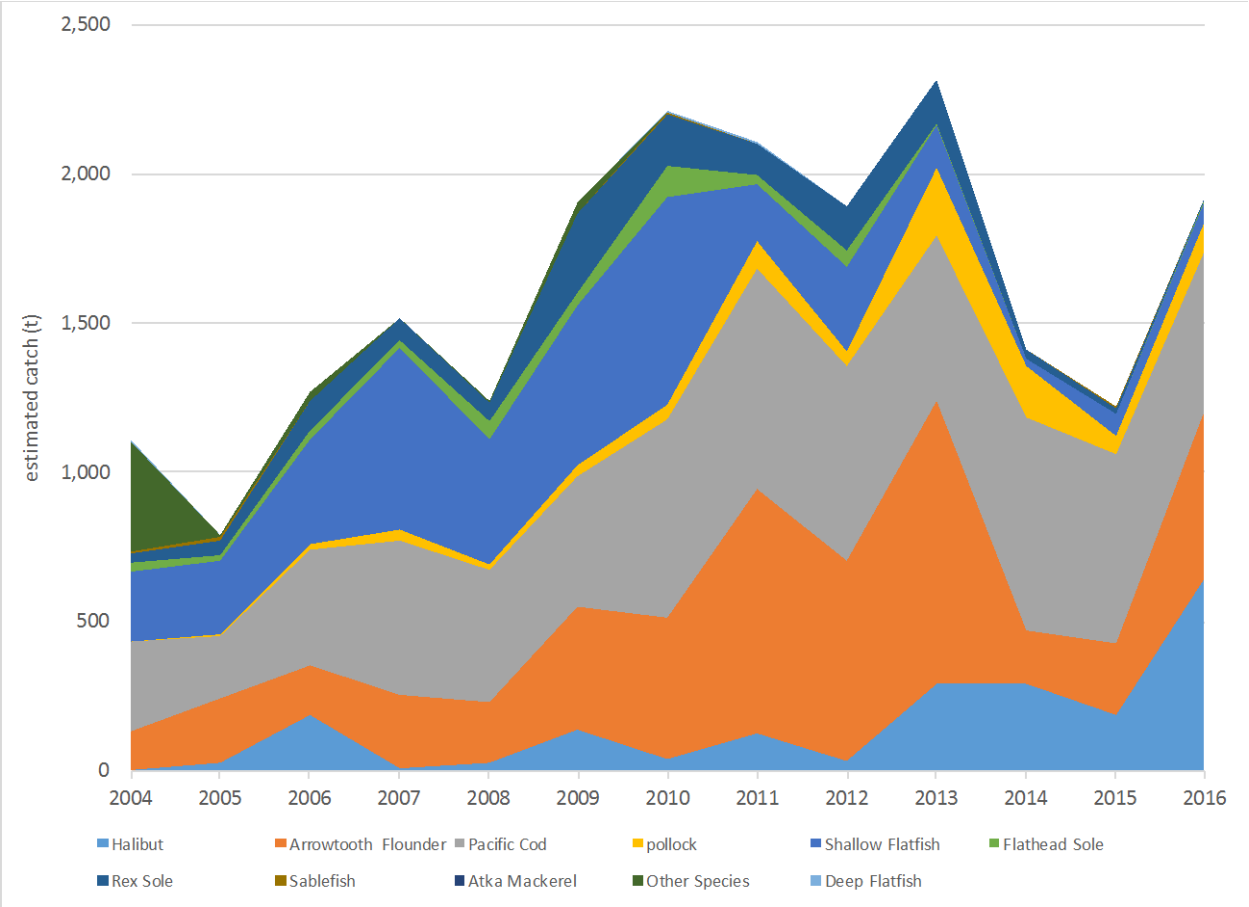

Figure 1. Incidental catch of big skates in the Central Gulf of Alaska regulatory area, 2004-2016, by target fishery. Data are from the NMFS Alaska Regional Office. **2016 data are incomplete; retrieved October 16, 2016.**

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