

5. Assessment of the Deepwater Flatfish Stock Complex in the Gulf of Alaska

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Executive Summary

Introduction

The Gulf of Alaska deepwater flatfish complex is assessed every four years and was last assessed in 2023. In year three of the four-year cycle, we present an executive summary to recommend harvest levels for the next two years. Please refer to the 2023 full stock assessment report for further information regarding the assessment model (McGilliard and Ferriss, 2023, available online at https://apps-afsc.fisheries.noaa.gov/Plan_Team/2023/GOAdeepflat.pdf). A full stock assessment document with updated assessment and projection model results will be presented in 2027. The deepwater flatfish complex consists of Dover sole, Greenland turbot, deepsea sole, and Kamchatka flounder.

Dover sole is assessed using an age-structured model and Tier 3 determination. Thus, the single species projection model was run using parameter values from the accepted 2023 Dover sole assessment model (McGilliard and Ferriss, 2023), together with updated catch information for 2023-2025, to predict stock status for Dover sole in 2026 and 2027 and to make ABC recommendations for those years. Projections are conducted using numbers-at-age for Dover sole from age 3-59+ and historical recruitment of age 3 individuals from 1978-2023 to calculate OFL's and ABC's.

Greenland turbot, Kamchatka flounder, and deepsea sole fall under Tier 6. ABC's and OFL's for these Tier 6 species are based on historical catch levels. The ABC and OFL for Greenland turbot and deepsea sole are based on the average catch over the years 1978-1995, and therefore these quantities are not updated. An exception occurred in 2023 when the historical average catch from 1978-1995 that defines the Tier 6 OFL for GOA Greenland turbot was updated to reflect the most recent reliable estimates of historical catch for this species from the Alaska Regional Office's Catch Accounting System.

The catch time series for Kamchatka flounder dates back to 2011, when it was separated from arrowtooth flounder in catch accounting and arrowtooth flounder was removed from the deepwater flatfish complex. In 2019, Kamchatka flounder was assigned a species-level OFL of 69 t based on the maximum historical catch as part of the deepwater flatfish complex. The Kamchatka flounder ABC and OFL are also not updated. ABC's and OFL's for the individual species in the deepwater flatfish complex are determined only as an intermediate step for the purpose of calculating complex-level OFL's and ABC's.

Summary of Results

As in McGilliard and Ferriss (2023), the species-level ABC is 37 t for Greenland turbot and the OFL is 49 t for both 2026 and 2027. The species-level ABC for Kamchatka flounder is 69 t and the OFL is 52 t. The species-level ABC for deepsea sole is 4 t and the OFL is 6 t for both 2026 and 2027. The species-level ABC for Dover sole is 6,743 t in 2026 and 6,604 t in 2027 and the OFL is 7,994 t in 2026 and 7,830 t in 2027.

Based on the updated projection model results, the recommended complex-level ABC's for 2026 and 2027 are 6,836 t and 6,697 t, and the OFL's are 8,118 t and 7,954 t. The new ABC recommendation and OFL for 2026 are similar to that developed in 2024. The principal reference values are shown in the following table:

Species	Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
		2025	2026	2026	2027
Dover sole	<i>M</i> (natural mortality rate)	0.129(f), 0.128(m)	0.129(f), 0.128(m)	0.129(f), 0.128(m)	0.129(f), 0.128(m)
	Tier	3a	3a	3a	3a
	Projected total (3+) biomass (t)	84,026	81,999	82,048	80,044
	Projected Female spawning biomass (t)	24,399	23,960	23,964	23,616
	<i>B</i> _{100%}	15,968	15,968	15,968	15,968
	<i>B</i> _{40%}	6,387	6,387	6,387	6,387
	<i>B</i> _{35%}	5,589	5,589	5,589	5,589
	<i>F</i> _{OFL}	0.15	0.15	0.15	0.15
	<i>maxF</i> _{ABC}	0.12	0.12	0.12	0.12
	<i>F</i> _{ABC}	0.12	0.12	0.12	0.12
	OFL (t)	8,139	7,990	7,994	7,830
	maxABC (t)	6,865	6,739	6,743	6,604
	ABC (t)	6,865	6,739	6,743	6,604
Greenland turbot	Tier	6	6	6	6
	OFL (t)	49	49	49	49
	maxABC (t)	37	37	37	37
	ABC (t)	37	37	37	37
Kamchatka flounder	Tier	6	6	6	6
	OFL (t)	69	69	69	69
	maxABC (t)	52	52	52	52
	ABC (t)	52	52	52	52
Deepsea sole	Tier	6	6	6	6
	OFL (t)	6	6	6	6
	maxABC (t)	4	4	4	4
	ABC (t)	4	4	4	4
Deepwater Flatfish Complex	OFL (t)	8,263	8,114	8,118	7,954
	maxABC (t)	6,958	6,832	6,836	6,697
	ABC (t)	6,958	6,832	6,836	6,697
	Status	As determined <i>last year</i> for:		As determined <i>this year</i> for:	

		2023	2024	2024	2025
	Overfishing	no	n/a	no	n/a
	Overfished	n/a	no	n/a	no
	Approaching overfished	n/a	no	n/a	no

*Projections are based on realized catches for Dover sole of 60 t and 77 t for 2023 and 2024, respectively. Estimated catches of 68.8 t were used in place of maximum ABC for 2025. The 2025 estimated catches were calculated by dividing the current realized catches for January to August for 2025 by the long-term mean proportion of fish caught in January-August. Estimated catches of 83 t were used in place of maximum permissible ABC for 2026-2028, which was the average catch over 2020-2024.

Area Apportionment

Area apportionment for ABC of deepwater flatfish is currently based on the proportion of survey biomass of Greenland turbot, Kamchatka flounder, and deepsea sole found within each management area from 2001-2021 and estimates of 2023 and 2024 survey biomass for Dover sole in each management area based on results from a random effects model (REMA; Sullivan et al. 2022; <https://github.com/afsc-assessments/rema>). An ABC exists only at the level of the complex (deepwater flatfish) and not for each species individually. The ABC by area for the deepwater flatfish complex is then the sum of the species-specific portions of the ABC.

The random effects model is used to fill in depth and area gaps in the Dover sole survey biomass by area and to calculate an area- and depth-specific estimate of current survey biomass as of the most recent full stock assessment (McGilliard and Ferriss 2023). These estimates are summed over depths and the resulting relative biomass in each management area is used as the basis for apportionment of the Dover sole portion of the deepwater complex. This method of conducting area apportionment for deepwater flatfish was recommended by the GOA Plan Team in 2016 and was presented in the 2016 SAFE (McGilliard 2016; <https://apps-afsc.fisheries.noaa.gov/REFM/Docs/2016/GOAdeepflat.pdf>). The method was chosen because it accounts for time and area gaps in the survey for Dover sole, which comprises nearly all of the deepwater flatfish catch and moves to deeper waters ontogenetically, and explicitly accounts for differences in the spatial distributions of the component species. For instance, Greenland turbot are found exclusively in the Western region by the survey.

Survey Biomass and Catch-to-Biomass Ratios

The survey biomass of Dover sole increased from 2023 from 48,251 t to 64,169 t (Table 5.2). The catch-to-biomass ratio for Dover sole remains very low (Figure 5.1).

Species	Year	Western	Central	West Yakutat	Southeast	ABC
		2.6260%	37.5485%	26.6279%	33.1976%	100.0%
Dover Sole	2026	177	2,532	1,796	2,238	6,743
	2027	173	2,480	1,759	2,192	6,604
		100.0%	0.0%	0.0%	0.0%	100.0%
Greenland Turbot	2026	37	0	0	0	37
	2027	37	0	0	0	37
		32.1%	67.9%			100.0%
Kamchatka Flounder	2026	17	35	0	0	52
	2027	17	35	0	0	52
		0.0%	74.9%	11.2%	13.9%	100.0%
Deepsea Sole	2026	0	3	0	1	4
	2027	0	3	0	1	4
Deepwater Flatfish	2026	231	2,570	1,796	2,239	6,836
	2027	227	2,518	1,759	2,193	6,697

Literature Cited

- McGilliard, C.R. and Ferriss, B. 2023. 5. Gulf of Alaska Deepwater Flatfish. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510.
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- Sullivan, J., C. Monnahan, P. Hulson, J. Ianelli, J. Thorson, and A. Havron. 2022a. REMA: a consensus version of the random effects model for ABC apportionment and Tier 4/5 assessments. Plan Team Report, Joint Groundfish Plan Teams, North Pacific Fishery Management Council. 605 W 4th Ave, Suite 306 Anchorage, AK 99501. [Available through the Oct 2022 Joint GPT e-Agenda.](#)

Figures

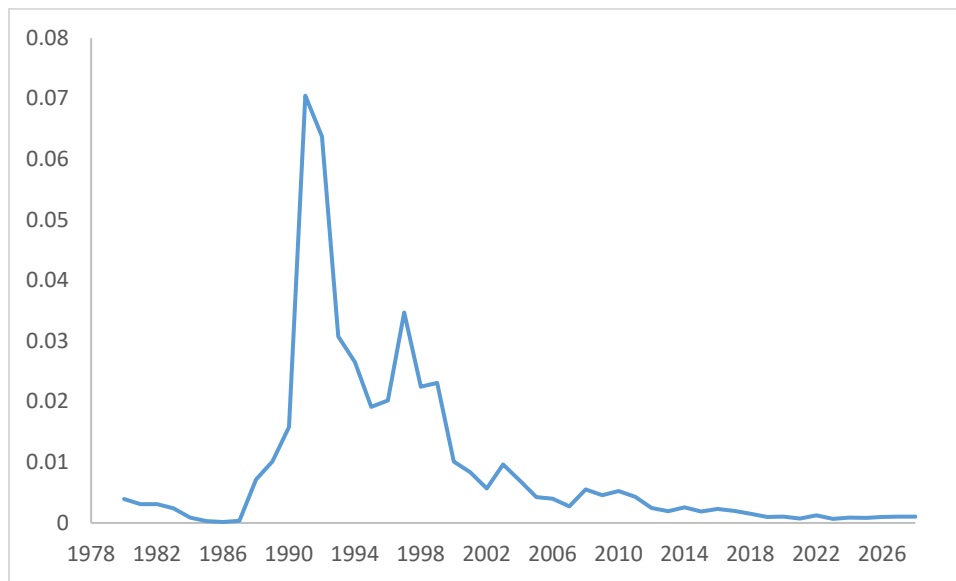


Figure 5.1. Ratio of Dover sole (and unidentified) catch to total age 3+ Dover sole (and unidentified) modeled biomass, including projected ABC and estimated catches through 2028: age 3+ total biomass for Dover sole and unidentified species catches together (catches of Dover sole in the assessment are assumed to be those recorded as Dover and unidentified deepwater flatfish). The two highest historical catches (1991-1992) are recorded as unidentified deepwater flatfish.

Tables

Table 5.1. Total catch of species in the deepwater flatfish complex as of September 5, 2025.

Year	Greenland turbot	Dover sole	Unidentified	Total
1978	51	827		878
1979	24	530		554
1980	57	570		627
1981	8	457		465
1982	23	457		480
1983	145	354		499
1984	18	132		150
1985	0	43		43
1986	0	23		23
1987	44	56		100
1988	256	1,087		1,343
1989	56	1,521		1,577
1990	0	2,348		2,348
1991			10,196	10,196
1992			8,497	8,497
1993	19	1,869	1,935	6,706
1994	3	2,538	536	3,078
1995	78	1,415	718	2,215
1996	5	1,485	701	2,195
1997	3	2,675	982	3,674
1998	10	2,110	166	2,289
1999	6	1,831	446	2,285
2000	5	811	165	985
2001	4	654	146	804
2002	4	410	145	560
2003	3	899	50	902
2004	1	646	40	647
2005	1	378	39	379
2006	10	326	69	336
2007	1	235	46	236
2008	4	517	53	521
2009	0	435	40	435
2010	0	550		550

Year	Greenland turbot	Dover sole	Kamchatka Flounder	Total
2011	3	451	14	468
2012	0	259	6	266
2013	15	207	17	240
2014	2	283	69	355
2015	25	195	36	255
2016	4	228	5	237
2017	7	189	67	263
2018	1	144	40	185
2019	7	90	13	111
2020	NA	96	11	107
2021	9	67	20	95
2022	3	114	13	130
2023	22	60	22	104
2024	8	77	8	93
2025	1	56	23	80

Table 5.2. GOA bottom trawl survey biomass and logspace standard error for Dover sole

Year	Biomass	Log Std. Err.
1990	96,336	0.13
1993	85,044	0.07
1996	78,635	0.07
1999	71,961	0.07
2001	32,387	0.12
2003	98,114	0.11
2005	80,465	0.09
2007	70,818	0.10
2009	75,810	0.08
2011	76,198	0.10
2013	79,364	0.22
2015	51,899	0.09
2017	57,248	0.17
2019	47,308	0.12
2021	43,003	0.11
2023	48,251	0.12
2025	64,169	0.18