11. Assessment of the other flatfish stock complex in the Bering Sea and Aleutian Islands

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Executive Summary

Summary of Changes in Assessment Inputs

Changes in the Input Data

1) The 2015 catch was updated, and catch through 15 October, 2016 was included in the assessment.

2) The 2016 Eastern Bering Sea shelf survey, 2016 Aleutian Islands Survey, and 2016 Eastern Bering Sea slope survey biomass estimates for other flatfish species are included in the assessment.

Changes in the Assessment Methodology

There was no change to the assessment methodology.

Summary of Results

A summary of the 2017 recommended ABCs and OFLs (in bold) relative to the 2016 recommendations for Other flatfish in the Bering Sea/Aleutian Islands (BSAI) is as follows:

Quantity	As estimated or *specified last* year for: 2016	2017	As estimated or *recommended this* year for: 2017	2018
M (natural mortality rate) for rex sole	0.17	0.17	0.17	0.17
M (natural mortality rate) for Dover sole	0.085	0.085	0.085	0.085
M (natural mortality rate) for all others	0.15	0.15	0.15	0.15
Tier	5	5	5	5
RE Model Combined Biomass (t)	112,104	112,104	**113,450**	113,450
F_{OFL} (*F=M)* for rex sole	0.17	0.17	0.17	0.17
F_{OFL} (*F=M)* for Dover sole	0.085	0.085	0.085	0.085
F_{OFL} (*F=M)* for all other species	0.15	0.15	0.15	0.15
$maxF_{ABC}$ for rex sole	0.128	0.128	0.128	0.128
$maxF_{ABC}$ for Dover sole	0.064	0.064	0.064	0.064
$maxF_{ABC}$ for all other species	0.113	0.113	0.113	0.113
F_{ABC} for rex sole	0.128	0.128	0.128	0.13
F_{ABC} for Dover sole	0.064	0.064	0.064	0.064
F_{ABC} for all other species	0.113	0.113	0.113	0.113
OFL (t)	17,414	17,414	**17,591**	**17,591**
maxABC (t)	13,061	13,061	**13,193**	**13,193**
ABC (t)	13,061	13,061	**13,193**	**13,193**

Status	As determined *last* year for: 2014	2015	As determined *this* year for: 2015	2016
Overfishing	n/a	n/a	n/a	n/a

Responses to SSC and Plan Team Comments to Assessments in General

"The SSC reminds groundfish and crab stock assessment authors to follow their respective guidelines for SAFE preparation."

This document has been reviewed for consistency with the 2016 SAFE guidelines for Tier 5 stocks.

"The SSC requests that stock assessment authors bookmark their assessment documents and commends those that have already adopted this practice."

The requested bookmarks will be added to the final version of this document before distribution.

Responses to SSC and Plan Team Comments Specific to this Assessment

None pertaining to this assessment.

Introduction

The Bering Sea/Aleutian Islands "other flatfish" group have typically included those flatfish besides northern rock sole, yellowfin sole, arrowtooth flounder, Kamchatka flounder and Greenland turbot. Flathead sole (*Hippoglossoides elassodon*) were part of the other flatfish complex until they were removed in 1995, and Alaska plaice was removed from the complex in 2002, as sufficient biological data exists for these species to construct age-structured population models. In contrast, survey biomass estimates are the principal data source used to assess the remaining other flatfish. Although over a dozen species of flatfish are found in the BSAI area, the other flatfish biomass consists primarily of starry flounder, rex sole, and Dover sole. A full list of the species in the other flatfish complex is shown in Table 11.1. Different areas and depths in the BSAI have different species compositions within the other flatfish complex (Figure 11.1). Starry flounder, longhead dab, butter sole, and Sakhalin sole occur primarily on the on the shallower continental shelf. Dover sole and deep sea sole are found at greater depth, and English sole and Dover sole are more abundant in the AI than in the EBS. Rex sole is common on the EBS shelf, the slope, and in the AI. At present, no evidence of stock structure is evident for these species in the Bering Sea/Aleutian Islands region, although no formal genetic or tagging study has been conducted on these species in this region.

Fishery

The miscellaneous species of the other flatfish species category are listed in Table 11.1, and their catches from 1995-2016 are shown in Table 11.2 (with historical ABC and TAC). These species are not pursued as fishery targets but are captured in fisheries for other flatfish species and Pacific cod. Catch from 1995-2003 were obtained from the NMFS Regional Office "blend" data, and the catch for some species are reported by species and in an aggregate flatfish group. The catch estimates for these years were produced by applying the proportional catch, by species, from fishery observer data to the estimated total catch for the aggregate other flatfish group, and adding this total to the catch that was reported by species. In the current catch accounting system (in use since 2003), catches of other flatfish are reported only in an aggregate group, and the catch estimates for these years were produced by applying the proportional

catch, by species, from fishery observer data to the estimated total catch of the aggregate group. In recent years, starry flounder (*Platichthys stellatus*) and rex sole (*Glyptocephalus zachirus*) account for most of the harvest of other flatfish, contributing 94% of the harvest of other flatfish in 2015 and 2016 (Figure 1). The 2016 catch of 2,679 t through mid-October is well below (18%) the ABC.

Other flatfish fisheries are grouped with Alaska plaice, rock sole, and flathead sole in a single prohibited species group (PSC) classification, with seasonal and total annual allowances of prohibited bycatch applied to the group. In past years, this group of fisheries was closed due to the bycatch of halibut but since the implementation of Amendment 80 in 2008 there have been no closures.

Data

Fishery

Data from the fishery includes blend estimates of total catch for the combined "other flatfish" species from the Alaska Regional Office and species catch data from observer sampling to apportion the total catch to individual species. The catch time series for "other flatfish", along with ABC and TACs, is listed in Table 11.2. This table also includes estimated catch by species, based on the species composition of observer samples. Throughout its history, the total catch of other flatfish in the BSAI has been only a fraction of the ABC for the complex. In 2016, approximately 34% of the BSAI "other flatfish" catch was retained.

Survey

Bottom trawl surveys are conducted annually on the eastern Bering Sea shelf and provide most of the available information on other flatfish, including estimates of absolute abundance (biomass) and population length compositions. The Aleutian Islands and Bering Sea slope surveys also capture some of the deeper dwelling species of this complex, although at a much reduced number. The biomass of the other flatfish complex on the eastern Bering Sea shelf was relatively stable from 1983-1995, averaging 54,274 t, and then increased from 1996 to 2003, averaging 84,137 t (Table 11.3, Fig. 11.2a). Since 2003, the biomass estimates have been higher, over 100,000 t in most years. The shelf survey biomass was particularly high in 2006-07 and in 2014, but the 2015 biomass estimate was low and the 2016 estimate was average. The 2016 shelf, slope, and Aleutian Islands surveys combined had an estimated biomass of 123,000 t for the complex. The increases and then decrease from the past five years are primarily due to fluctuating biomass estimates for starry flounder on the Eastern Bering Sea shelf.

Individual species biomass estimates for the shelf, slope, and AI surveys are shown in Table 11.4. Time series trends for species in on the EBS shelf are shown in Fig 11.3. Notable for 2015 and 2016 is the decline in the amount of longhead dab and rex sole on the Bering Sea shelf relative to estimated biomass ten years ago, but the highest estimate ever for Sakhalin sole. Dover and rex sole both show much greater abundance in the AI in 2006-2016 than in previous surveys. Butter sole and starry flounder both show decreased abundance during this period, and were both absent from the AI surveys in 2014-2016. Catches of other flatfish on the EBS slope have been stable since 2002. Coefficients of variation on survey biomass estimates are generally 15-25% for the most abundant species in each survey, but are much higher for the rarer species.

Several species in this management category are relatively rare on the EBS shelf, including Dover sole, Sakhalin sole, and English sole, and it is useful to identify whether the EBS represents the edge of the distribution for these species. The distribution of English sole has been identified as Baja California to Unimak Island, and the distribution of Dover sole has been identified as from Baja California to the

Bering Sea (Hart 1973). Thus, the eastern Bering Sea can be considered the periphery of the range for these species. They are much more abundant in the Gulf of Alaska. For example, the abundance of Dover sole in the 1984-2011 GOA surveys has fluctuated between 63,000 t and 99,000 t, the abundance of butter sole has ranged between 17,000 t and 31,000 t, and the abundance of English sole has varied between 3,000 t and 18,600 t (Turnock *et al*. 2011). Dover sole and English sole were most common in the eastern portion of the GOA, consistent with their reported distribution along the west coast of North America. In the case of Sakhalin sole, which prefer colder water and are caught at the northern extent of the survey, their perceived abundance from survey biomass estimates may be related to annual mean bottom water temperature, as they tended to be more abundant in colder years during the 1980s and 1990s. The recent trend from trawl surveys estimates Sakhalin sole at low abundance, however, sampling of the northern Bering Sea in 2010 indicated that their primary distribution is located to the north of the standard survey area.

At the request of the SSC, the 2015 stock assessment for the other flatfish complex included an analysis of temperature effects on the variance of trawl survey biomass estimates. Hypothesis testing failed to detect any significant relationship between bottom temperature anomalies and the *CV* of survey biomass estimates for rex sole, longhead dab, starry flounder, or butter sole. Only for Sakhalin sole was survey *CV* significantly related to bottom temperatures. Sakhalin sole are typically present in larger numbers in the northern part of the shelf survey area during colder years.

Exploitation rates based on the RE model estimates of biomass for the most abundant species in the other flatfish complex are generally low, between 1.5 and 3.5% (Table 11.5). Exploitations rates for both rex sole and Dover sole have declined since the early 2000s, while rates for starry flounder have remained steady. The estimated exploitation rates for butter sole are higher, due to very low and variable survey biomass estimates. In 2008 the butter sole catch exceeded the trawl survey biomass estimate. However the biomass estimates for butter sole have large sampling variances, with coefficients of variation ranging from 0.6 to 0.85 in recent EBS trawl surveys. Butter sole exploitation rates have been estimated as high as 0.43, but the actual amount of butter sole caught is general less than 200 t (Table 11.2).

Analytic Approach

Model Structure

As Tier 5 constituents, no stock assessment modeling is conducted for the BSAI Other Flatfish.

Modeling Approach

Due to the lack of biological information for other flatfish, assessments for this complex have all used a biomass-based approach based on trawl survey data to calculate ABCs. In past years, averages of survey biomass estimates was used. In 2014, following the recommendations by the Survey Averaging Plan Team and the SSC, methodology for calculating exploitable biomass was changed to the use of a random effects model (RE). This model is used to smooth the time series of trawl survey data, and the most recent biomass predicted by the model is used as the best estimate of exploitable biomass. Other flatfish in the BSAI are managed under Tier 5, where OFL = M * exploitable biomass, where M represents natural mortality, and F_{ABC} is estimated by 0.75 * M. The acceptable biological catch (ABC) is obtained by multiplying F_{ABC} by the estimated biomass, ABC $\leq$ 0.75 * M * biomass. M is assumed to vary by species as discussed further in the following section.

Parameter Estimates

Natural mortality values for rex and Dover sole are available from age-structured assessments in the Gulf of Alaska SAFE document (Turnock *et al*. 2005; Stockhausen *et al*. 2005), and those published values are used for rex and Dover sole in this stock assessment. For the remaining flatfish species, where less information is available, an assumption of $M = 0.15$ appears reasonable given the range of values shown above. For the case of starry flounder where estimates are available from a west coast stock assessment (Ralston 2005), the high estimates of M (male = 0.45, female = 0.3) are not used here due to the uncertainty of the estimates and the large spatial difference between the two management areas.

The natural mortality rates used in age-structured BSAI flatfish assessments can be used as guidance and are presented below:

Species	Natural mortality rate used for stock assessment
BSAI yellowfin sole	0.12
BSAI northern rock sole	0.15
BSAI flathead sole	0.20
BSAI Alaska plaice	0.13
GOA rex sole	0.17
GOA Dover sole	0.085

Results

Harvest Recommendations

Other flatfish are assessed under Tier 5 of Amendment 56 to the BSAI groundfish management plan, and thus have harvest recommendations which are directly calculated from estimates of biomass and natural mortality. The estimates of F_{abc} and F_{ofl} under Tier 5 are 0.75 x M and M, respectively, and the ABC and OFL levels are the product of the fishing mortality rate and the current biomass estimate.

Starting in 2014 the methodology for calculating ABC for the other flatfish complex changed to using a random effects model, recommended for all Tier 5 stocks managed by the North Pacific Fisheries Management Council. For the BSAI "other flatfish" complex, the model uses as input the time-series of biomass point-estimates from each survey and their associated standard errors, and the biomass and variances are summed to calculate an overall biomass time series for the BSAI (Fig. 11.4). The RE model is run separately for each survey, and predicts biomass in the years where there are missing survey values. The estimated biomass value in the terminal year of the random effects time series is used for ABC biomass. Because of differences in estimates of M, model runs were made separately for rex sole, Dover sole, and all other species combined (excluding rex sole and Dover sole). The terminal RE biomass for Rex sole was 35,005 t, for Dover sole 1,935 t, and for all other species (primarily starry flounder) 8,607 t.

Applying the F_{abc} and F_{ofl} levels listed below to the random effects model estimates of ABC biomass for each group results in overall ABC and OFL levels of 16,395 and 21,860 t, respectively, for the 2017 fishery.

Results from Random Effects Model

Species	Fabc	Fofl	B (REm)	**ABC**	**OFL**
Rex sole	0.128	0.17	35,005	4,463	5,951
Dover sole	0.064	0.085	1,935	123	164
All others	0.113	0.15	76,510	8,607	11,476
Total Other Flatfish			113,450	13,193	17,591

Literature Cited

Hart, J.L. 1973. Pacific fishes of Canada. Fisheries Research Board of Canada, Bulletin 180, Ottawa. 740 pp.

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Stockhausen, W.T., B. J. Turnock, A. T. A'mar, M. E. Wilkins and M. H. Martin. 2005. Gulf of Alaska Dover Sole. In Stock Assessment and Fishery Evaluation Document for Groundfish Resources in the Gulf of Alaska Region as Projected for 2002. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska 99510.

Turnock, B.J., T.K. Wilderbuer, and E.S. Brown. 2011. Gulf of Alaska flatfish. In Stock Assessment and Fishery Evaluation Document for Groundfish Resources in the Gulf of Alaska Region as Projecte for 2012. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska 99510.

Tables

Table 11.1. Flatfish species of the Bering Sea/Aleutian Islands "other flatfish" management complex.

Common Name	Scientific Name
Arctic flounder	*Liopsetta glacialis*
butter sole	*Isopsetta isolepis*
curlfin sole	*Pleuronectes decurrens*
deepsea sole	*Embassichths bathybius*
Dover sole	*Microstomus pacificus*
English sole	*Parophrys vetulus*
longhead dab	*Limanda proboscidea*
Pacific sanddab	*Citharichthys sordidus*
petrale sole	*Eopsetta jordani*
rex sole	*Glyptocephalus zachirus*
roughscale sole	*Clidodoerma asperrimum*
sand sole	*Psettichthys melanostictus*
slender sole	*Lyopsetta exilis*
starry flounder	*Platichthys stellatus*
Sakhalin sole	*Limanda sakhalinensis*

Table 11.2. Harvest (t) of other flatfish from 1995-2016. 2016 catch is through October 15, 2016.

Year	Starry Founder	Rex Sole	Butter Sole	Longhead Dab	Dover Sole	English Sole	Deep Sea Sole	Sakhalin Sole	Total	ABC	TAC
1995	398	673	157	7	59	26	4	0	1,324	117,000	19,540
1996	1,171	1,148	218	175	6	0	0	30	2,748	102,000	35,000
1997	1,043	687	448	211	53	0	29	6	2,490	97,500	50,750
1998	402	998	229	93	41	0	0	0	1,765	164,000	89,434
1999	725	998	230	56	81	27	0	0	2,117	154,000	154,000
2000	1,151	1,069	458	277	66	4	0	0	3,027	117,000	83,813
2001	755	869	244	62	70	4	6	0	2,028	122,000	28,000
2002	1,075	1,192	222	107	34	0	1	0	2,631	18,100	3,000
2003	887	1,399	296	125	39	2	0	0	2,749	16,000	3,000
2004	2,062	1,858	514	146	82	6	0	0	4,669	13,500	3,000
2005	2,069	2,001	487	25	16	1	0	0	4,599	21,400	3,500
2006	1,663	1,266	261	33	10	0	0	0	3,233	18,100	3,500
2007	4,356	812	579	87	4	2	<1	<1	5,840	21,400	10,000
2008	1,978	968	618	47	10	2	<1	<1	3,623	21,600	21,600
2009	806	1,143	198	7	7	2	0	<1	2,163	17,400	17,400
2010	1,506	510	162	9	5	<1	<1	<1	2,194	17,300	17,300
2011	2,168	860	107	18	10	13	0	<1	3,176	14,500	3,000
2012	2,205	866	191	9	15	5	0	0	3,292	12,700	3,200
2013	906	579	30	15	6	0	0	<1	1,536	13,300	3,500
2014	3,341	770	219	20	10	0	0	0	4,391	13,300	3,500
2015	1,523	746	113	28	6	<1	0	0	2,415	13,250	3,620
2016	1,602	883	152	39	3	0	0	<1	2,679	13,061	2,500

Table 11.3. Estimated biomass (t) of other flatfish from the eastern Bering Sea (EBS) shelf, slope, and Aleutian Islands (AI) AFSC trawl surveys.

	Area			
Year	EBS shelf	EBS slope	Aleutians	Combined
1987	49753			
1988	44695			
1989	49440			
1990	47097			
1991	72478		2144	
1992	53937			
1993	44350			
1994	54350		5466	
1995	37790			
1996	60101			
1997	71393		7580	
1998	74581			
1999	70473			
2000	70727		8149	
2001	78920			
2002	98172	8284	8801	115257
2003	89407			
2004	129146	12986	14980	157112
2005	108426			
2006	150480		16440	
2007	133503			
2008	104604	11556		
2009	103573			
2010	114261	10834	13076	139367
2011	94217			
2012	85826	13380	15685	115392
2013	76115			
2014	129024		13936	
2015	69515			
2016	97291	12200	13672	123164

Table 11.4 --Estimated biomass (t) and coefficient of variation (shaded) for the miscellaneous species of the "other flatfish" management complex in the AFSC Bering Sea shelf, slope, and Aleutian Islands surveys.

Eastern Bering Sea Shelf survey

YEAR	butter sole		Dover sole		longhead dab		rex sole		Sakhalin sole		starry flounder	
1990	986	0.60	47	0.60	18,649	0.15	11,857	0.21	526	0.35	15,033	0.26
1991	3,055	0.50	55	0.71	18,671	0.14	16,052	0.28	342	0.68	34,303	0.23
1992	1,233	0.70	137	0.58	10,827	0.17	14,001	0.24	194	0.47	27,544	0.22
1993	1,516	0.75	36	0.74	11,717	0.21	14,405	0.33	166	0.30	16,510	0.22
1994	1,095	0.97	73	0.72	18,533	0.26	15,945	0.38	487	0.52	18,218	0.22
1995	1,203	0.54	-		8,404	0.15	10,330	0.28	200	0.27	17,652	0.29
1996	683	0.53	-		8,568	0.20	10,275	0.40	165	0.55	40,409	0.45
1997	2,884	0.43	-		18,003	0.21	8,254	0.27	1,233	0.84	41,018	0.21
1998	1,942	0.38	41	0.45	14,735	0.19	7,588	0.22	674	0.86	49,602	0.30
1999	4,152	0.62	16	0.66	12,087	0.21	8,046	0.27	796	0.62	45,376	0.23
2000	1,728	0.56	10	1.00	13,514	0.30	9,180	0.19	430	0.44	45,865	0.19
2001	802	0.50	16	0.83	12,920	0.26	21,664	0.23	106	0.32	43,412	0.24
2002	2,255	0.63	7	0.79	9,791	0.22	26,006	0.20	151	0.89	59,962	0.23
2003	175	0.60	145	0.41	8,824	0.22	27,464	0.15	251	0.73	52,549	0.17
2004	833	0.85	31	0.51	11,450	0.23	28,787	0.19	973	0.98	87,073	0.37
2005	958	0.81	157	0.59	11,556	0.21	23,242	0.19	839	0.97	71,673	0.26
2006	1,186	0.67	90	0.52	15,258	0.25	21,562	0.28	115	0.55	112,268	0.38
2007	1,019	0.43	73	0.52	16,733	0.24	17,026	0.24	29	0.34	98,624	0.17
2008	419	0.62	364	0.90	10,884	0.22	18,788	0.31	73	0.35	74,077	0.21
2009	532	0.60	469	0.95	5,012	0.23	18,142	0.29	53	0.45	79,366	0.19
2010	1,747	0.82	201	0.54	11,559	0.47	20,320	0.32	72	0.47	80,362	0.25
2011	437	0.69	408	0.96	10,349	0.59	18,525	0.32	513	0.72	63,986	0.23
2012	486	0.67	68	1.00	9,066	0.36	12,811	0.25	376	0.83	62,629	0.16
2013	1,306	0.69	27	1.00	5,448	0.45	9,767	0.18	625	0.87	58,942	0.20
2014	510	0.65	620	1.00	3,128	0.45	13,276	0.32	584	0.79	110,907	0.35
2015	342	0.74	5	1.00	1,647	0.50	9,496	0.19	1,835	0.75	56,190	0.29
2016	281	0.67	12	0.93	1,580	0.39	11,112	0.24	2,057	0.33	82,249	0.36

Table 11.4. Continued. Estimated biomass (t) and coefficient of variation (shaded) for the miscellaneous species of the "other flatfish" management complex in the Aleutian Islands surveys.

Aleutian Islands survey

Year	English sole		Dover sole		rex sole		starry flounder		butter sole	
1986	67.4	0.70	95	0.31	3,977	0.20	41	0.85	50.2	0.50
1991	47.1	0.80	224	0.40	1,774	0.18	142	0.85	85.6	0.73
1994	83.0	0.81	438	0.41	4,321	0.15	134	0.69	504.9	0.98
1997	12.4	0.72	374	0.35	6,394	0.16	459	0.90	345.8	0.98
2000	94.7	0.97	630	0.38	6,658	0.18	590	0.71	309.7	0.99
2002	46.5	0.94	576	0.28	7,398	0.15	671	0.72	126.8	0.83
2004	34.5	1.00	868	0.28	13,708	0.18	123	0.73	235.2	0.93
2006	24.7	0.85	2,157	0.57	14,234	0.19	17	1.00	12.8	1.00
2010	154.6	0.67	2,874	0.43	9,722	0.14	126	0.83	180.1	0.69
2012	26.0	0.74	1,214	0.24	14,102	0.24	209	0.60	133.8	1.00
2014	58.4	0.69	1,025	0.31	12,853	0.13	0		0.0	
2016	66.4	0.69	1,459	0.36	12,146	0.12	0		0.2	1.12

Bering Sea slope survey

Survey Year	Dover sole		deep sea sole		rex sole	
2002	96.8	0.30	101.0	0.34	8,085	0.13
2004	140.6	0.17	406.5	0.27	12,439	0.11
2008	330.0	0.25	485.9	0.29	11,556	0.13
2010	463.2	0.20	767.0	0.36	10,834	0.12
2012	701.8	0.36	397.4	0.27	13,380	0.13
2016	594.1	0.49	402.6	0.25	12,200	0.14

Table 11.5. Random Effects model estimated biomass (t), harvest amount (t), and exploitation rates (catch/biomass) of rex sole, starry flounder and butter sole from 2002 to 2016.

	Rex sole			Starry flounder			Dover sole		
Year	Biomass	Catch	Exp. Rate	Biomass	Catch	Exp. Rate	Biomass	Catch	Exp. Rate
2002	40,704	1,192	2.9%	59,962	1,075	1.8%	755	34	4.5%
2003	46,245	1,399	3.0%	52,549	887	1.7%	1,025	39	3.8%
2004	49,586	1,858	3.7%	87,073	2,062	2.4%	1,074	82	7.6%
2005	47,490	2,001	4.2%	71,673	2,069	2.9%	1,441	16	1.1%
2006	45,875	1,266	2.8%	112,268	1,663	1.5%	1,678	10	0.6%
2007	42,899	812	1.9%	98,624	4,356	4.4%	1,810	4	0.2%
2008	41,695	968	2.3%	74,077	1,978	2.7%	2,259	10	0.4%
2009	40,421	1,143	2.8%	79,366	806	1.0%	2,538	7	0.3%
2010	39,134	510	1.3%	80,362	1,506	1.9%	2,477	5	0.2%
2011	38,899	860	2.2%	63,986	2,168	3.4%	2,447	10	0.4%
2012	37,986	866	2.3%	62,629	2,205	3.5%	1,962	15	0.8%
2013	35,991	579	1.6%	58,942	906	1.5%	1,851	6	0.3%
2014	36,020	770	2.1%	110,907	3,341	3.0%	2,291	10	0.4%
2015	34,960	746	2.1%	56,190	1,523	2.7%	1,843	6	0.3%
2016	35,005	883	2.5%	82,249	1,602	1.9%	1,935	3	0.2%

Figures

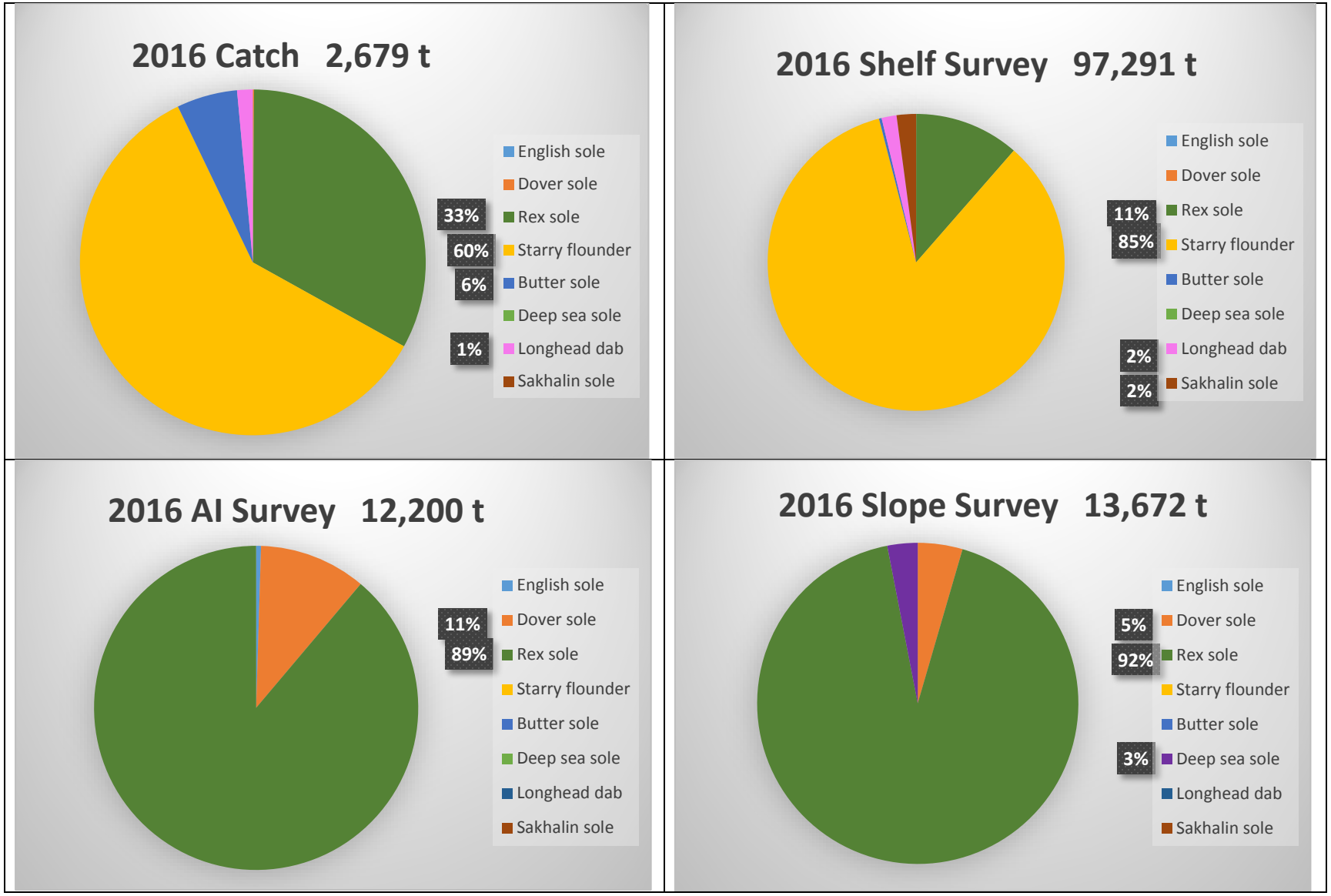


Figure 11.1. Species composition of most recent survey and fishery catch data for BSAI Other Flatfish: a) 2016 Observed fishery catch, b) 2016 EBS shelf survey, c) 2016 AI survey, d) 2016 EBS slope survey.

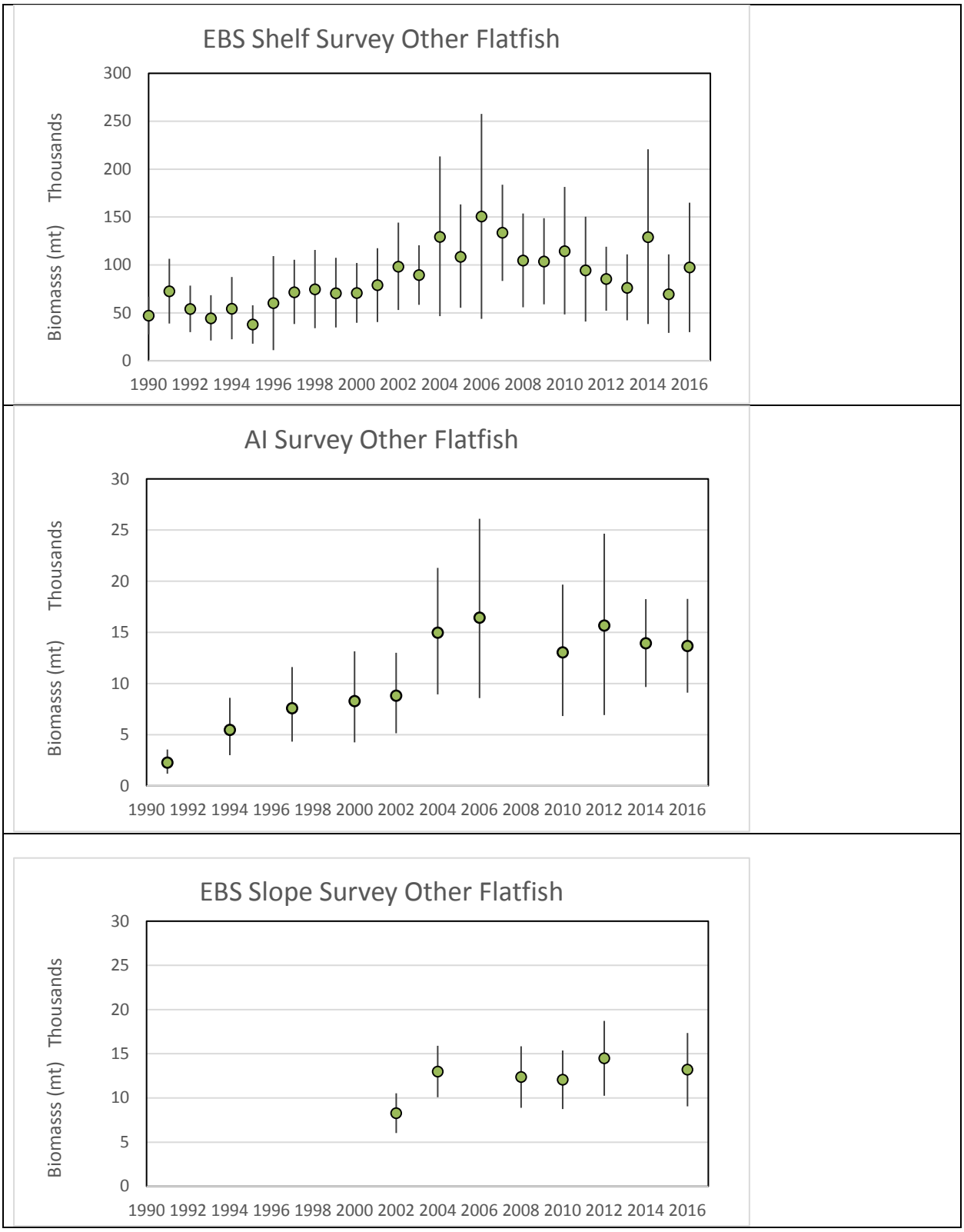
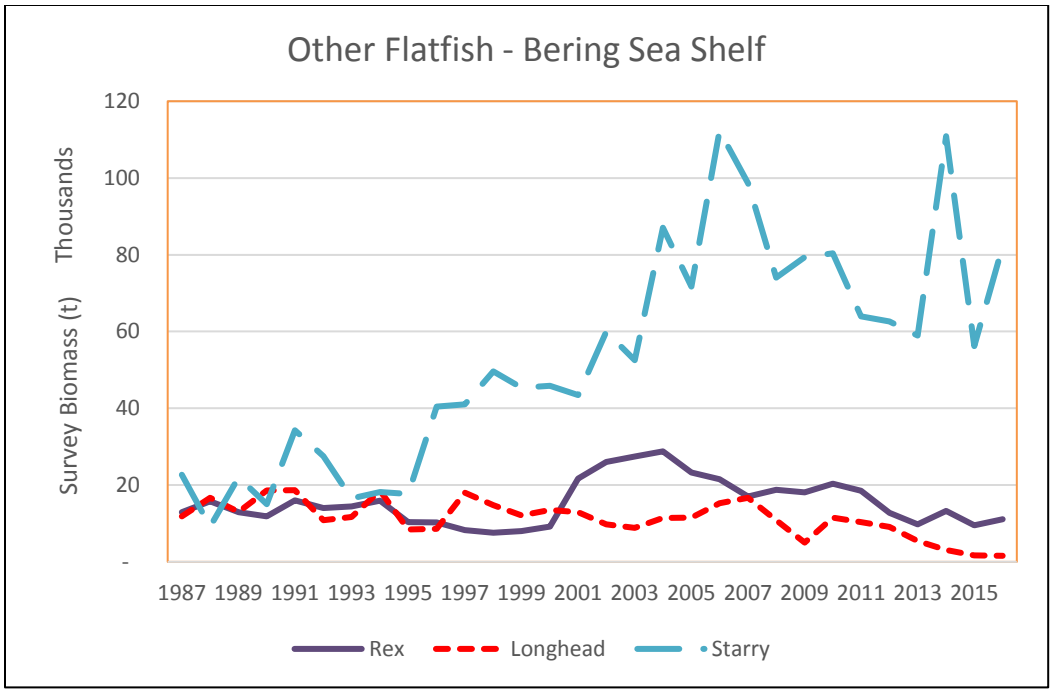


Figure 11.2. BSAI survey biomass estimates for Other Flatfish, with 95% confidence intervals: a) EBS shelf survey, b) AI survey, c) EBS slope survey. Note that the y-axis for the AI and slope surveys is an order of magnitude smaller than for the shelf survey.



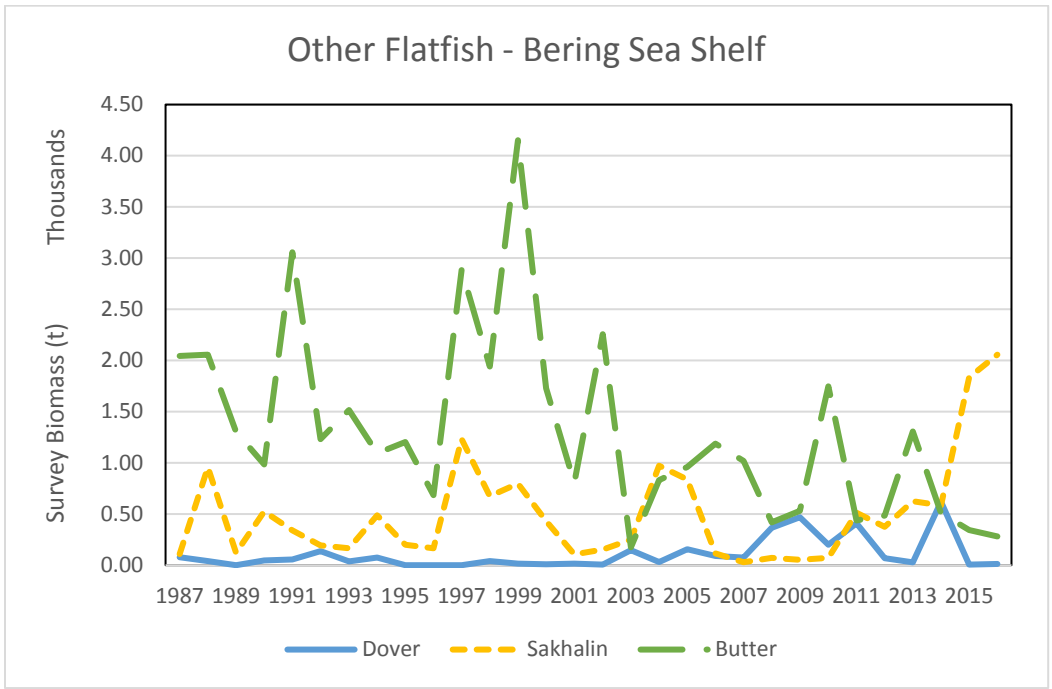


Figure 11.3. Biomass trends of Other Flatfish species from the EBS shelf survey.

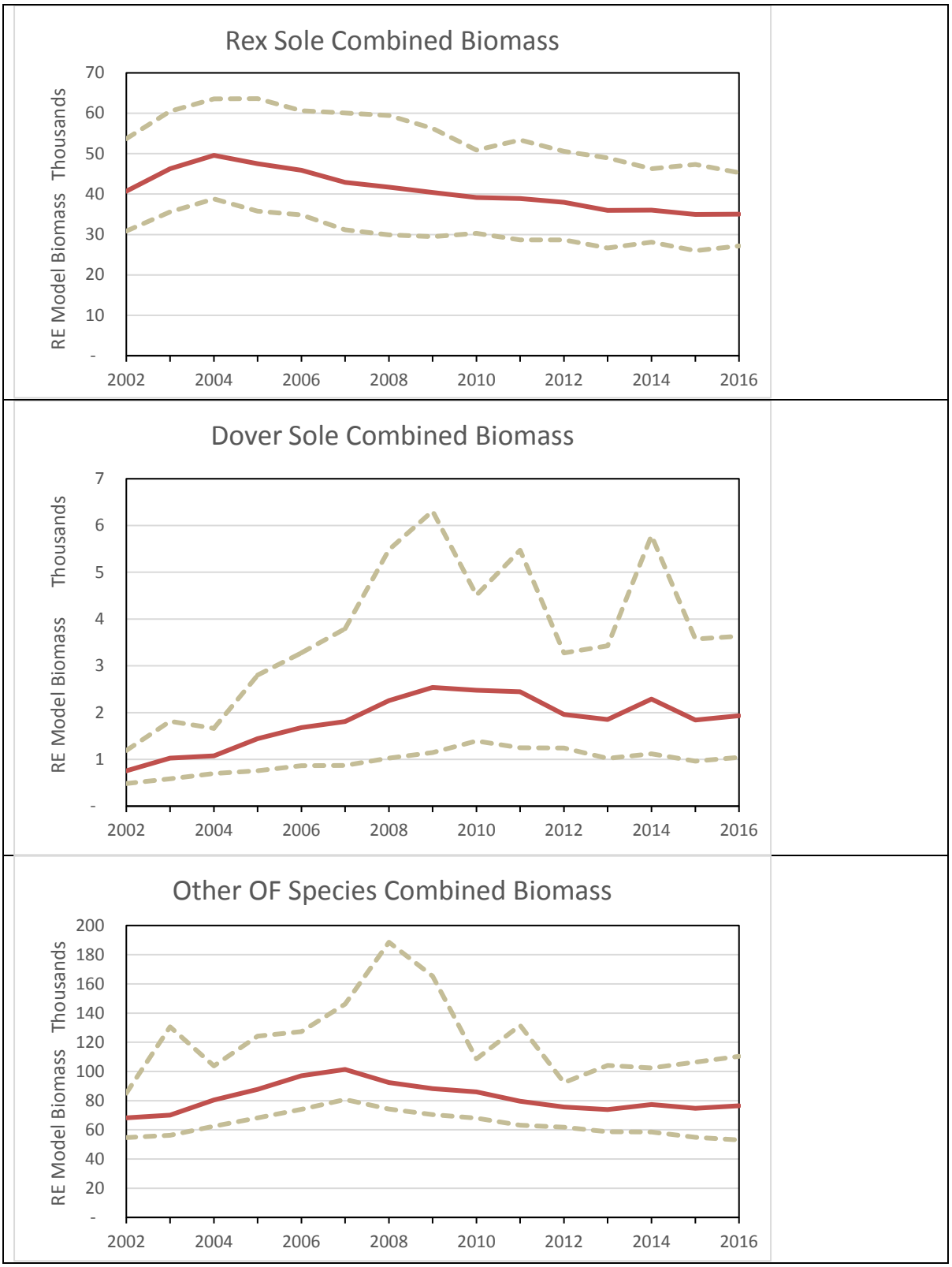


Figure 11.4. Combined random effects model results for BSAI Other Flatfish biomass (solid red line) and upper and lower 95% confidence intervals (dashed lines): a) Rex sole, b) Dover sole, c) All other species