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 2014 catch (total and discarded) was updated, and catch through 25 October, 2014 were included in the assessment.

2) The 2014 Eastern Bering Sea shelf survey and Aleutian Islands survey biomass estimates and standard errors of other flatfish species are included in the assessment.

Changes in the Assessment Methodology

1) ABC biomass was computed by a random effects model.

Summary of Results

A summary of the 2014 recommended ABCs and OFLs (in bold) relative to the 2012 recommendations for Other flatfish in the Bering Sea/Aleutian Islands (BSAI) is as follows:

Quantity	As estimated or *specified last* year for: 2014	2015	As estimated or *recommended this* year for: 2015	2016
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
Survey Biomass (t)	107,500	107,500	**143,000**	143,000
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	0.13	0.13	0.13	0.13
$maxF_{ABC}$ 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	0.13	0.13	0.13	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)	16,700	16,700	**17,700**	17,700
maxABC (t)	12,400	12,400	**13,250**	13,250
ABC (t)	12,400	12,400	**13,250**	13,250

Status	As determined *last* year for: 2012	2013	As determined *this* year for: 2013	2014
Overfishing	n/a	n/a	n/a	n/a

Responses to SSC and Plan Team Comments to Assessments in General

There were no comments relative to the other flatfish assessment.

Responses to SSC and Plan Team Comments Specific to this Assessment

As requested last year, the SSC requests the reporting of biomass estimates with confidence intervals to help judge trends versus uncertainty. The SSC also looks forward to a future application of a random effects model to these other flatfish data. The authors should consider the merits of applying a random effects model to the aggregate or component species data. The SSC continues to maintain interest in tracking biomass trends of individual species to the extent practical. To the extent possible, the assessment authors are requested to consider the potential effects of temperature on the variance in survey catches of other flatfish.

Figures are provided of survey estimates with confidence intervals for the 5 primary species of the complex. The random effects model was used to calculate ABC biomass for 2015. No work was done on the incorporation of temperature on survey catchability of these species during this assessment cycle.

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, longhead dab, Dover sole and butter sole. A full list of the species in the other flatfish complex is shown in Table 11.1. 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 1995-2014 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 97% of the harvest of other flatfish in 2013. The 2014 catch of 4,385 t through late-October is well below the ABC of 13,300 t.

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.

Survey

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. 11.1). Since 2003, the biomass estimates have been at a higher level, averaging 125,800 t. The 2014 shelf and Aleutian Islands (slope survey not conducted in 2014) surveys combined estimate of 143,000 t is at the highest level of the past 7 years and third highest overall for the time-series. The estimated increases from the past five years are primarily due to the higher estimates of starry flounder on the Eastern Bering Sea shelf. In years when an AI survey was not conducted, such as 2013, total BSAI biomass was calculated by fitting a linear trend to the observed Aleutian Islands survey data (1991-2012 for this assessment), and then adding the predicted AI biomass estimate to the observed EBS estimate. For this assessment, the linear model estimates were not used to calculate the 2014 biomass since an Aleutian Islands survey was conducted. Individual species biomass estimates for the EBS and AI areas from 1997-2013 are shown in Table 11.4. Notable for 2013 and 2014 is the marked decline in the amount of rex sole on the Bering Sea shelf relative to estimated biomass ten years ago, but the second largest biomass of starry flounder ever observed. Estimates of total BSAI biomass (Table 11.5) were then used to compute species-specific exploitation rates (catch/biomass).

Exploitation rates for starry flounder and rex sole have been low, not exceeding 0.05 from 1997 to 2014 (Table 11.5). The exploitation rates for butter sole have been higher, exceeding 0.14 in 1997, 2000, 2001, and 2003-2009 and 2011-2012 and 2014. In 2008 the butter sole catch exceeded the trawl survey biomass estimate. However these biomass estimates calculated for butter sole have large sampling variances, with coefficients of variation ranging from 0.44 to 0.86 in recent EBS trawl surveys dating back to 1999. The 2013 exploitation rate was only 0.02, as only 29 t are estimated to have been caught through the end of October, but was higher again in 2014 with an exploitation rate of 0.43.

Closer inspection of the butter sole biomass variability suggests that occasional high exploitation rates may be an artifact of survey sampling. The 2003 and 2008 biomass estimates of butter sole were 429 t and 541 t, respectively, unusually low relative to biomass estimates from the past 20 years. These estimates are less than one-fourth the 2002 estimate of 2,382 t, and result in an estimated exploitation rate of nearly 70% in 2003 and 1.14 in 2008. However, butter sole were only captured in four hauls in the 2003 EBS trawl survey and in six hauls in the 2008 survey, causing a large coefficient of variation of 0.61 for the estimated biomass. Thus, it is likely that the population of butter sole is larger than that indicated from the survey, and the comparison of survey biomass to harvest should be interpreted accordingly. Biomass estimates since 2003 have been much higher, and variable. The 2012 biomass estimate of 619 t for butter sole was fairly low relative to the time-series since 1991 (4th lowest) and had a high CV (0.62).

The timing of the butter sole fishery catches do not overlap with survey sampling and came primarily from waters less than 50 m in January and February, a depth and time not covered by the trawl survey. Butter sole are mostly caught by non-pelagic trawl catcher-processors in the rock sole and Pacific cod target fisheries in areas 509 and 516. The center of abundance for butter sole in Alaska is in the Gulf of Alaska whereas the survey and fishery catches on the north side of the Alaska Peninsula represent butter sole captured at the periphery of their distribution, where they are relatively rare.

Several other 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 (Fig. 11.2). The northern Bering Sea biomass estimate of Sakhalin sole is 2,180 t compared to the 152 t average for the past 5 years estimated for the standard survey area.

Analytic Approach

Model Structure

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

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 and 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 biomass estimate.

The biomass used to calculate the next year's ABC and OFL has, up to this year, used the sum of the current year point estimates of biomass from each survey for all individual species. This year the ABC methodology has 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 attendant standard errors where the biomass and variances are summed over each species in the complex to calculate an annual ABC biomass (Fig. 11.3). The estimated biomass value in the terminal year of the random effects time series is used for ABC biomass. Runs were made separately for rex sole, Dover sole, and all other species combined (not rex sole and Dover sole).

Given the F_{abc} and F_{ofl} levels listed below and the model estimate of ABC biomass at 125,231 t, the resulting ABC and OFL levels are 14,400 and 19,200 t.

Random Effects Model

	F_{ABC}	F_{OFL}	ABC	OFL
Rex sole	0.13	0.17	3,469	4,626
Dover sole	0.064	0.085	121	162
Others	0.1125	0.15	9,656	12,875
Total Other flatfish			**13,247**	**17,663**

Survey biomass point-estimate of current year method

	F_{ABC}	F_{OFL}	ABC	OFL
Rex sole	0.13	0.17	3,331	4,442
Dover sole	0.064	0.085	105	140
Others	0.1125	0.15	12,959	17,278
Total Other flatfish			**16,395**	**21,860**

Ecosystem Considerations

Data Gaps and Research Priorities

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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	*Pleuronectes sakhalinensis*

Table 11.2. Harvest (t) of other flatfish from 1995-2014. 2014 catch is through October 25, 2013.

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	3,336	769	219	20	10	0	0	0	4,385	13,300	3,500

Table 11.3. Estimated biomass (t) of other flatfish from the eastern Bering Sea (EBS) and Aleutian Islands (AI) AFSC trawl surveys. Species included are Dover sole, longhead dab, rex sole, Sakhalin sole, starry flounder, and butter sole. A linear regression between EBS and AI survey abundance was used to predict AI abundance in years in which an AI survey did not occur.

	Area		
Year	EBS	AI	total
1982	117,763		129,518
1983	66,131	2,700	68,831
1984	59,647		64,956
1985	34,572		37,101
1986	39,517	6,100	45,617
1987	49,764		53,977
1988	44,559		48,195
1989	49,663		53,865
1990	47,126		51,047
1991	72,453	2,144	74,597
1992	53,954		58,632
1993	44,500		48,130
1994	54,368	5,464	59,832
1995	37,891		40,788
1996	60,376		65,766
1997	71,545	7,580	79,125
1998	74,672		81,648
1999	68,557		74,855
2000	70,866	8,149	79,015
2001	78,930		86,378
2002	98,218	8,801	107,019
2003	90,552		99,289
2004	128,740	14,980	143,720
2005	43,970		120,900
2006	132,925	16,367	149,292
2007	133,502		149,507
2008	104,608		121,494
2009	103,575		121,342
2010	114,253	13,076	127,329
2011	94,217		111,060
2012	98,515	15,685	114,200
2013	89,995		107,481
2014	129,025	13,936	142,961

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

Eastern Bering Sea Shelf survey

Year	Dover Sole	Rex Sole	longhead dab	Sakhalin sole	starry flounder	butter sole	slender sole	sand sole
1982	--	5,994 (0.16)	103,806 (0.16)	--	7,781 (0.32)	182 (0.82)	--	--
1983	--	7,272 (0.18)	51,386 (0.38)	--	7,436 (0.25)	37 (0.45)	--	1,559(0.94)
1984	--	13,058 (0.28)	35,308 (0.16)	137 (0.43)	8,913 (0.36)	2,231 (0.64)	--	--
1985	10 (1.04)	10,751 (0.20)	9,107 (0.13)	102 (0.37)	12,181 (0.24)	2,421 (0.83)	--	--
1986	15 (1.00)	12,886 (0.22)	10,889 (0.14)	274 (0.48)	9,112 (0.33)	6,341 (0.58)	--	--
1987	81 (0.91)	12,931 (0.19)	11,897 (0.19)	110 (0.58)	22,702 (0.63)	2,043 (0.38)	--	--
1988	38 (0.59)	15,445 (0.15)	16,710 (0.19)	1,061 (0.40)	9,222 (0.30)	2,083 (0.47)	--	1,128(1.0)
1989	--	12,939 (0.15)	13,086 (0.16)	129 (0.57)	22,205 (0.35)	1,304 (0.54)	--	--
1990	47 (0.58)	11,857 (0.21)	18,601 (0.15)	587 (0.36)	15,048 (0.26)	986 (0.60)	--	--
1991	55 (0.70)	16,014 (0.28)	18,680 (0.14)	345 (0.68)	34,303 (0.23)	3,056 (0.50)	--	--
1992	137 (0.58)	14,001 (0.24)	10,827 (0.17)	212 (0.48)	27,544 (0.22)	1,233 (0.70)	--	--
1993	37 (0.75)	14,567 (0.32)	11,690 (0.21)	179 (0.31)	16,510 (0.22)	1,517 (0.75)	--	--
1994	73 (0.72)	15,943 (0.38)	18,533 (0.26)	506 (0.52)	18,218 (0.22)	1,095 (0.97)	--	--
1995	--	10,420 (0.28)	8,402 (0.15)	214 (0.27)	17,652 (0.29)	1,203 (0.54)	--	--
1996	--	10,532 (0.40)	8,567 (0.20)	185 (0.56)	40,409 (0.45)	683 (0.53)	--	--
1997	--	8,233 (0.27)	18,003 (0.21)	1,407 (0.84)	41,018 (0.21)	2,884 (0.43)	--	--
1998	41 (0.44)	7,588 (0.22)	14,737 (0.19)	770 (0.86)	49,605 (0.30)	1,942 (0.38)	--	--
1999	16 (0.65)	8,020 (0.28)	12,087 (0.21)	907 (0.63)	43,375 (0.25)	4,152 (0.62)	--	--
2000	11 (1.02)	9,348 (0.19)	13,511 (0.30)	473 (0.43)	45,810 (0.19)	1,713 (0.56)	--	--
2001	16 (0.84)	21,660 (0.23)	12,764 (0.26)	117 (0.32)	43,026 (0.25)	796 (0.50)	--	--
2002	7 (0.80)	26,053 (0.20)	9,740 (0.22)	173 (0.90)	59,877 (0.23)	2,254 (0.64)	--	--
2003	350 (0.66)	28,023 (0.15)	8,827(0.22)	280 (0.75)	52,893 (0.17)	179 (0.61)	3	
2004	31(0.51)	28,762 (0.19)	11,290 (0.23)	1,118 (0.98)	86,698 (0.38)	841 (0.86)	--	--
2005	157(0.19)	23,171(0.19)	11,556 (0.21)	961(0.97)	71,673(0.26)	958(0.81)	--	--
2006	90(0.53)	21,515(0.28)	13,204(0.25)	125(0.58)	96,900(0.37)	1,091(0.53)	--	--
2007	73(0.53)	17,025(0.25)	16,733(0.24)	30(0.34)	98,623(0.17)	1,018(0.44)	--	--
2008	364(0.90)	18,788(0.31)	10,884(0.22)	77(0.36)	74,077(0.21)	418(0.44)	--	--
2009	469(0.95)	18,142(0.39)	5,011(0.23)	55(0.44)	79,366(0.19)	532(0.60)	--	--
2010	201(0.54)	20,320(0.32)	11,557(0.47)	78(0.49)	80,351(0.25)	1,746(0.82)	--	--
2011	4,08(0.96)	18,525(0.32)	10,348(0.59)	513(0.72)	63,986(0.23)	437(0.69)	--	--
2012	1,921(0.7)	39,695(0.25)	9,065(0.23)	37(0.29)	62,837(0.27)	619(0.62)	--	--
2013	27(1)	9,767(0.18)	5,448(0.45)	625(0.87)	58,942(0.2)	1,306(0.69)	--	--
2014	620 (1)	13,276 (0.32)	3,129 (0.45)	584 (0.79)	110,907 (0.35)	510 (0.65)	--	--

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

Year	Dover Sole	Rex Sole	longhead dab	Sakhalin sole	starry flounder	butter sole	English sole
1991	174 (0.45)	1,694 (0.18)	--	--	142 (0.85)	86 (0.73)	47 (0.80)
1994	438 (0.41)	4,306 (0.15)	--	--	134 (0.69)	505 (0.98)	83 (0.81)
1997	386 (0.34)	6,378 (0.16)	--	--	459 (0.90)	346 (0.98)	12 (0.72)
2000	630 (0.38)	6,526 (0.18)	--	--	590 (0.71)	310 (0.99)	95 (0.97)
2002	575 (0.28)	7,381 (0.15)	--	--	671 (0.72)	127 (0.83)	47 (0.94)
2004	870 (0.28)	13,717 (0.18)	--	--	123 (0.72)	235 (0.93)	35 (1.00)
2006	2,155 (0.57)	14,230 (0.19)			17 (0.97)	13(0.98)	25 (0.84)
2010	2,853 (0.43)	9,762 (0.14)	--	--	127 (0.14)	180 (0.69)	15 4(0.67)
2012	1,214 (0.24)	14,102(0.24)	--	--	209 (0.6)	134 (0.1)	26 (0.73)
2014	1,025 (0.31)	12,853 (0.13)	--	--	0	0	58 (0.69)

Table 11.5. Estimated biomass (t), harvest amount (t), and exploitation rates of rex sole, starry flounder and butter sole from 1997 to 2014.

	Rex sole			Starry Flounder			Butter sole		
Year	Biomass (t)	Harvest (t)	Exp. Rate	Biomass (t)	Harvest (t)	Exp. Rate	Biomass (t)	Harvest (t)	Exp. Rate
1997	14,611	401	0.03	41,477	814	0.02	3,230	336	0.10
1998	14,250	569	0.04	49,950	242	0.00	2,210	157	0.07
1999	15,415	516	0.03	43,750	597	0.01	4,416	167	0.04
2000	15,874	569	0.04	46,400	770	0.02	2,023	266	0.13
2001	30,524	507	0.02	43,829	479	0.01	1,059	147	0.14
2002	33,411	1,227	0.04	60,633	1,023	0.02	2,382	187	0.08
2003	38,349	1,399	0.04	53,353	887	0.02	429	296	0.69
2004	42,479	1,858	0.04	86,821	2,062	0.02	1,076	514	0.48
2005	34,963	1,830	0.05	72,176	1,892	0.03	1,201	445	0.37
2006	35,745	1,266	0.04	96,917	1,663	0.02	1,104	261	0.24
2007	31,052	812	0.03	98,941	4,356	0.04	1,153	579	0.50
2008	33,613	961	0.03	74,397	1,964	0.03	541	614	1.14
2009	33,766	1,132	0.03	79,688	797	0.01	642	196	0.31
2010	30,082	491	0.02	80,478	1,148	0.02	1,926	156	0.08
2011	32,544	826	0.03	64,218	2,082	0.03	562	103	0.18
2012	39,695	866	0.02	62,837	2,205	0.04	619	191	0.31
2013	9,767	569	0.015	58,942	889	0.015	1,306	29	0.02
2014	26,129	769	0.03	111,116	3,366	0.03	510	219	0.43

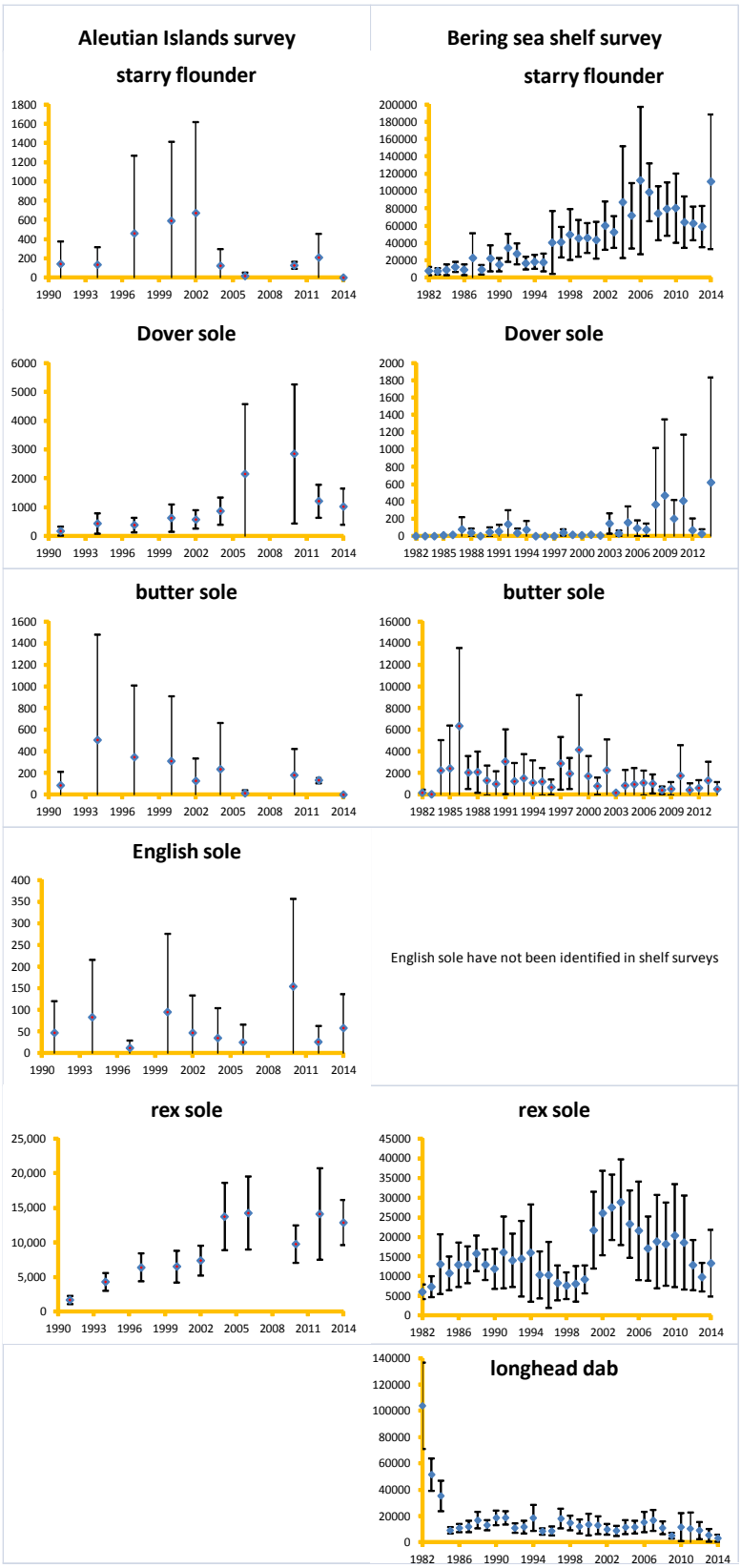

Figure 11.1. BSAI shelf survey and Aleutian Islands survey biomass estimates with 95% confidence intervals.

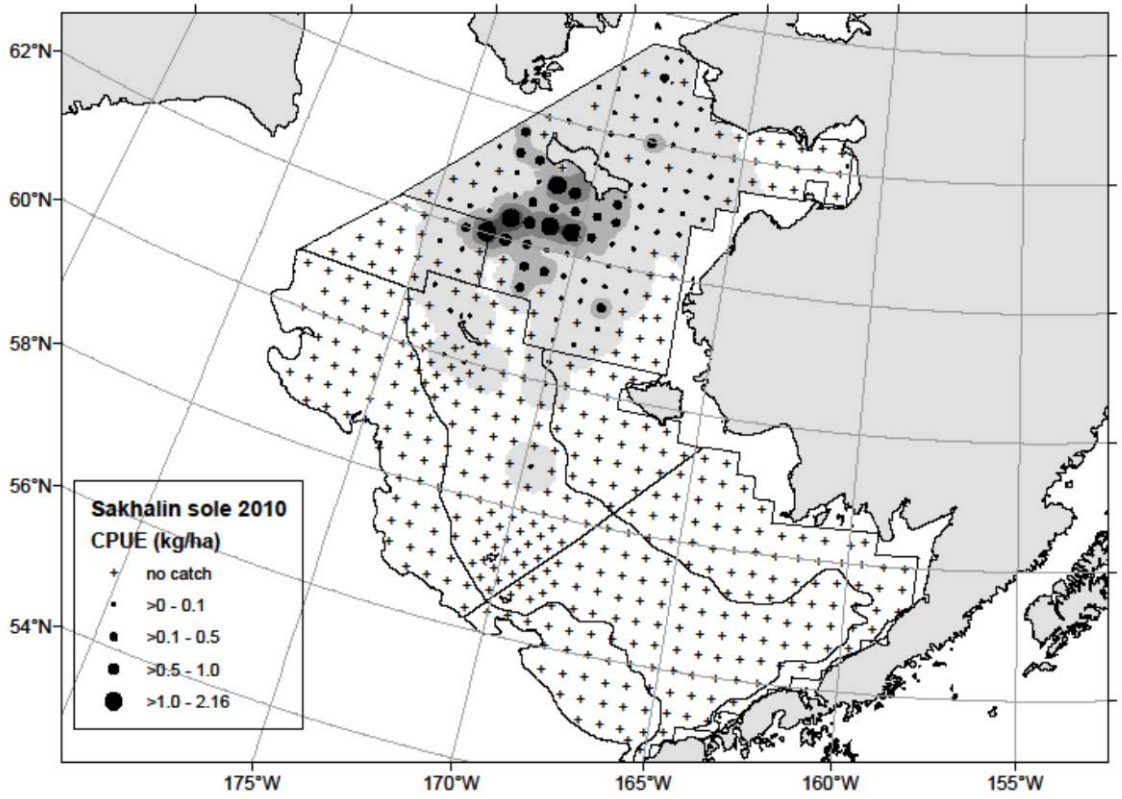

Figure 11-2. Distribution and relative abundance of Sakhalin sole from the AFSC sampling of the Bering Sea in the summer of 2010.

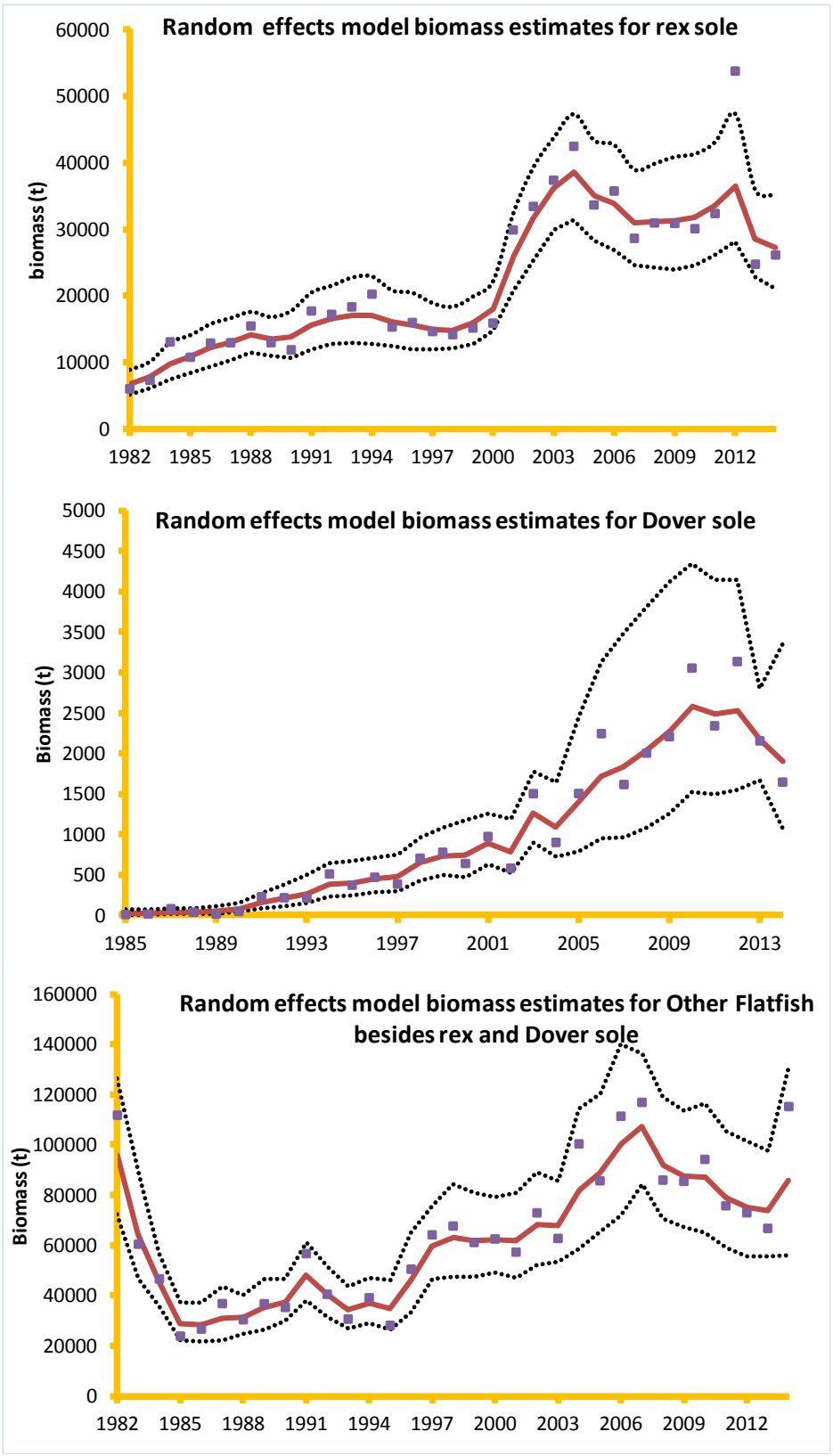

Figure 11.3. Random effects model results for BSAI Other Flatfish. Purple squares are the sum of survey biomasses.