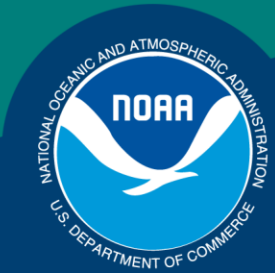


Science, Service, Stewardship



Bering Sea and Aleutian Islands Other Rockfish

Ingrid Spies

November 16, 2018

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What are Bering Sea and Aleutian Islands “Other Rockfish”?

All species of *Sebastes* and *Sebastolobus*,
EXCEPT:

Pacific ocean perch (POP, *Sebastes alutus*), northern rockfish (*Sebastes polyspinis*), rougheye rockfish (*S. aleutianus*),

blackspotted rockfish (*S. melanostictus*),
and shortraker rockfish (*S. borealis*)

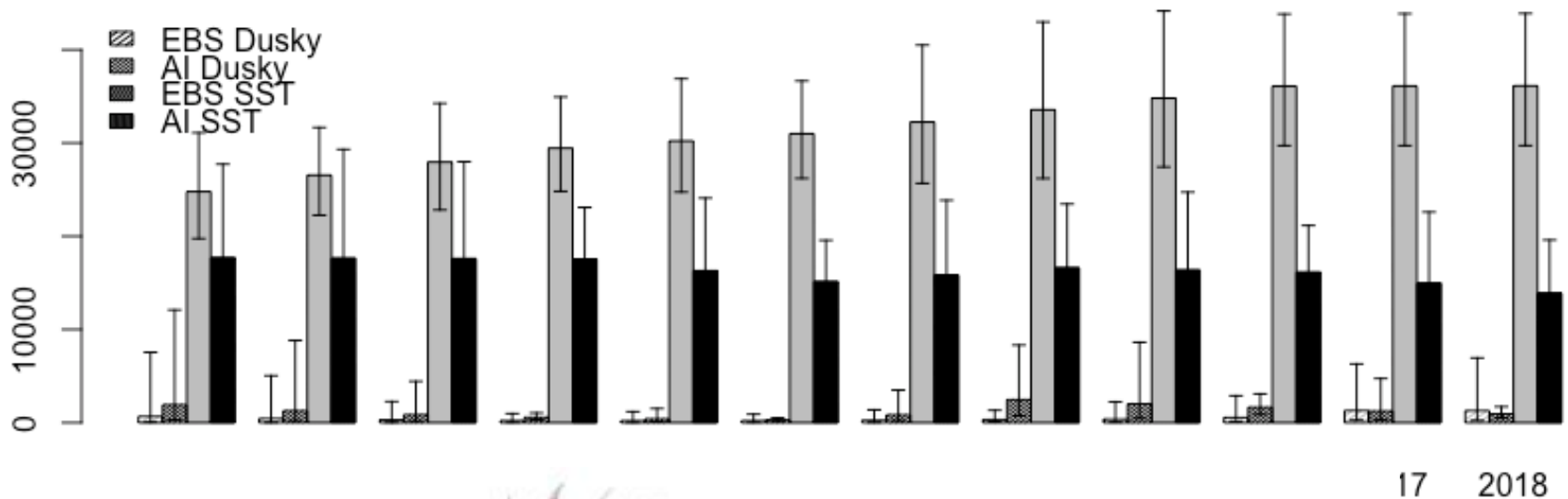
What are Bering Sea and Aleutian Islands “Other Rockfish”?

Most abundant:

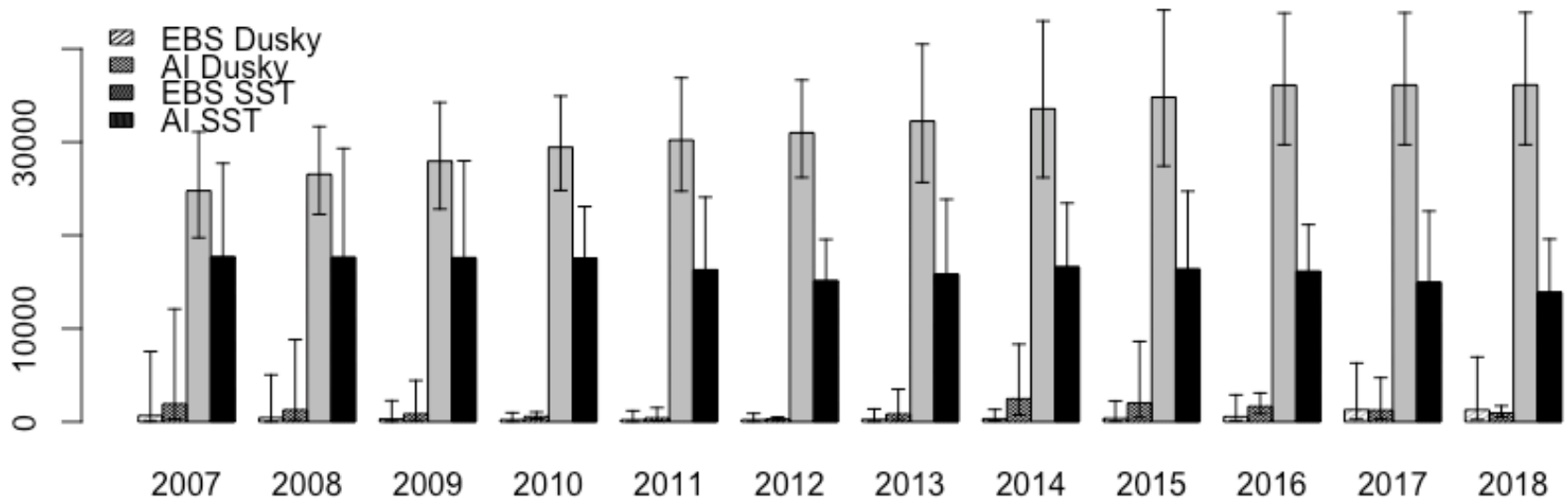
- shortspine thornyhead; *Sebastolobus alascanus*,
- dusky rockfish; *Sebastes variabilis*,
- harlequin rockfish; *Sebastes variegatus*,
- redbanded rockfish; *Sebastes babcocki*,
- redstriped rockfish; *Sebastes proriger*,
- yelloweye rockfish; *Sebastes ruberrimus*, and
- sharpchin rockfish; *Sebastes zacentrus*

24 species, including unidentified.

This species complex is dominated by shortspine thornyhead.



Dusky rockfish is the second most abundant species in the complex



Changes in the input data

- Catch data have been revised and updated through October 17, 2018.
- Biomass and variance estimates from the 2016 and 2018 Aleutian Islands (AI) trawl survey and the 2016 Eastern Bering Sea slope survey were added to the model input data.

Current assessment methodology

Natural mortality estimate (M) for SST = 0.03

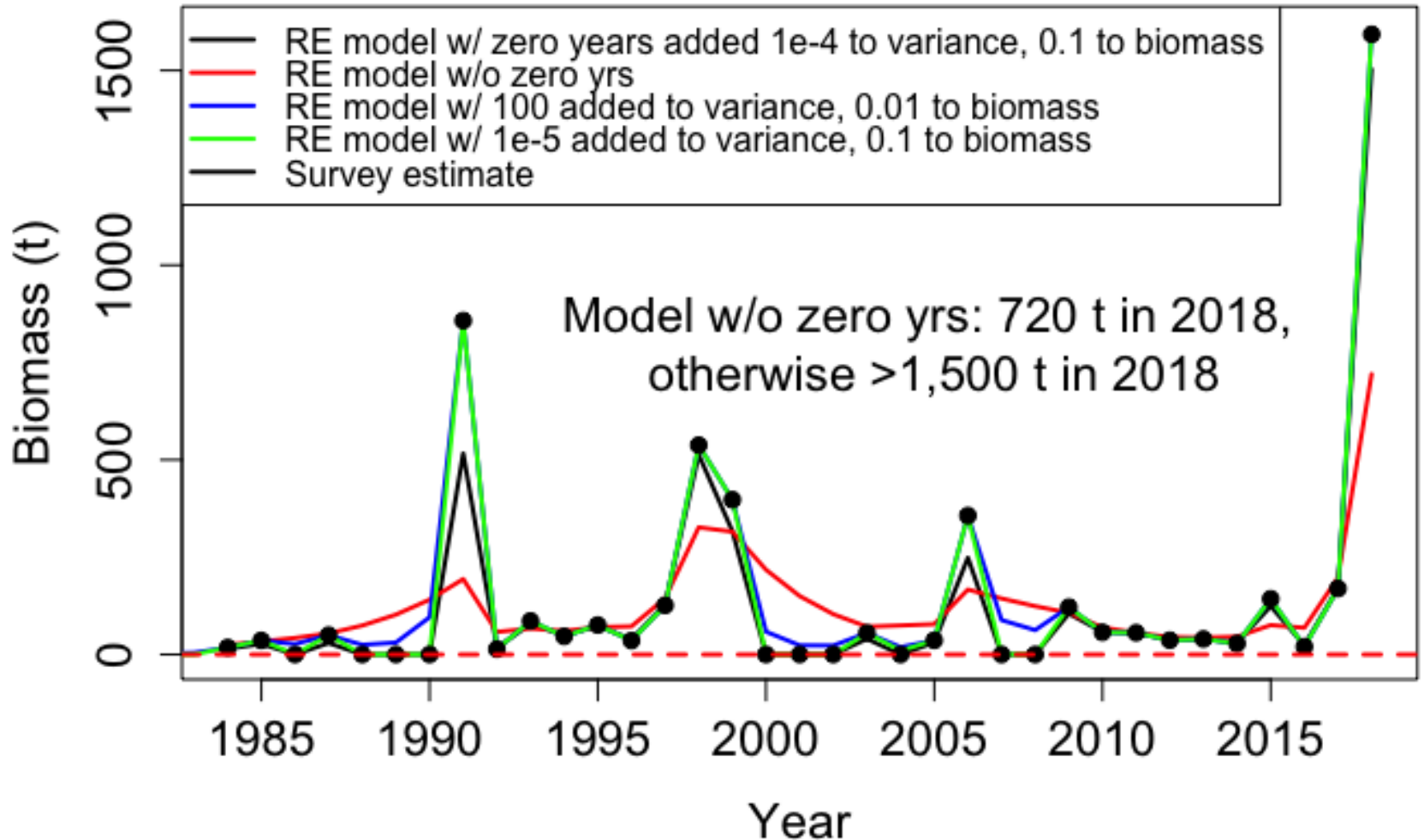
Natural mortality estimate (M) for non-SST=0.09

Biomass estimates for Other Rockfish were obtained using the random effects model.

Overfishing limit (OFL) = $M \times \text{Biomass}$.

Acceptable Biological Catch (ABC) = $0.75 \times \text{OFL}$.

Some issues fitting non-SST in the EBS survey data. 12 nonobservation data points



SST reference points

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2018	2019	2019	2020
M (natural mortality rate)	0.03	0.03	0.03	0.03
Tier	5	5	5	5
Biomass (t)	52,761	52,761	50,057	50,057
F_{OFL}	0.03	0.03	0.03	0.03
$maxF_{ABC}$	0.0225	0.0225	0.0225	0.0225
F_{ABC}	0.0225	0.0225	0.0225	0.0225
OFL (t)	1,583	1,583	1,502	1,502
maxABC (t)	1,187	1,187	1,126	1,126
ABC (t)	1,187	1,187	1,126	1,126
AI ABC (t)	398	398	417	417
EBS ABC (t)	789	789	813	813
Status	As determined <i>last</i> year for:		As determined <i>this</i> year for:	
	2016	2017	2017	2018
Overfishing	No	n/a	No	n/a

NonSST reference points

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2018	2019	2019	2020
M (natural mortality rate)*	0.09	0.09	0.09	0.09
Tier	5	5	5	5
Biomass (t)	2,592	2,592	3,233	3,233
F_{OFL}	0.09	0.09	0.09	0.09
$maxF_{ABC}$	0.0675	0.0675	0.0675	0.0675
F_{ABC}	0.0675	0.0675	0.0675	0.0675
OFL (t)	233	233	291	291
maxABC (t)	175	175	218	218
ABC (t)	175	175	218	218
AI ABC (t)	173	173	64	64
EBS ABC (t)	1	1	130	130
Status	As determined <i>last</i> year for:		As determined <i>this</i> year for:	
	2016	2017	2017	2018
Overfishing	No	n/a	No	n/a

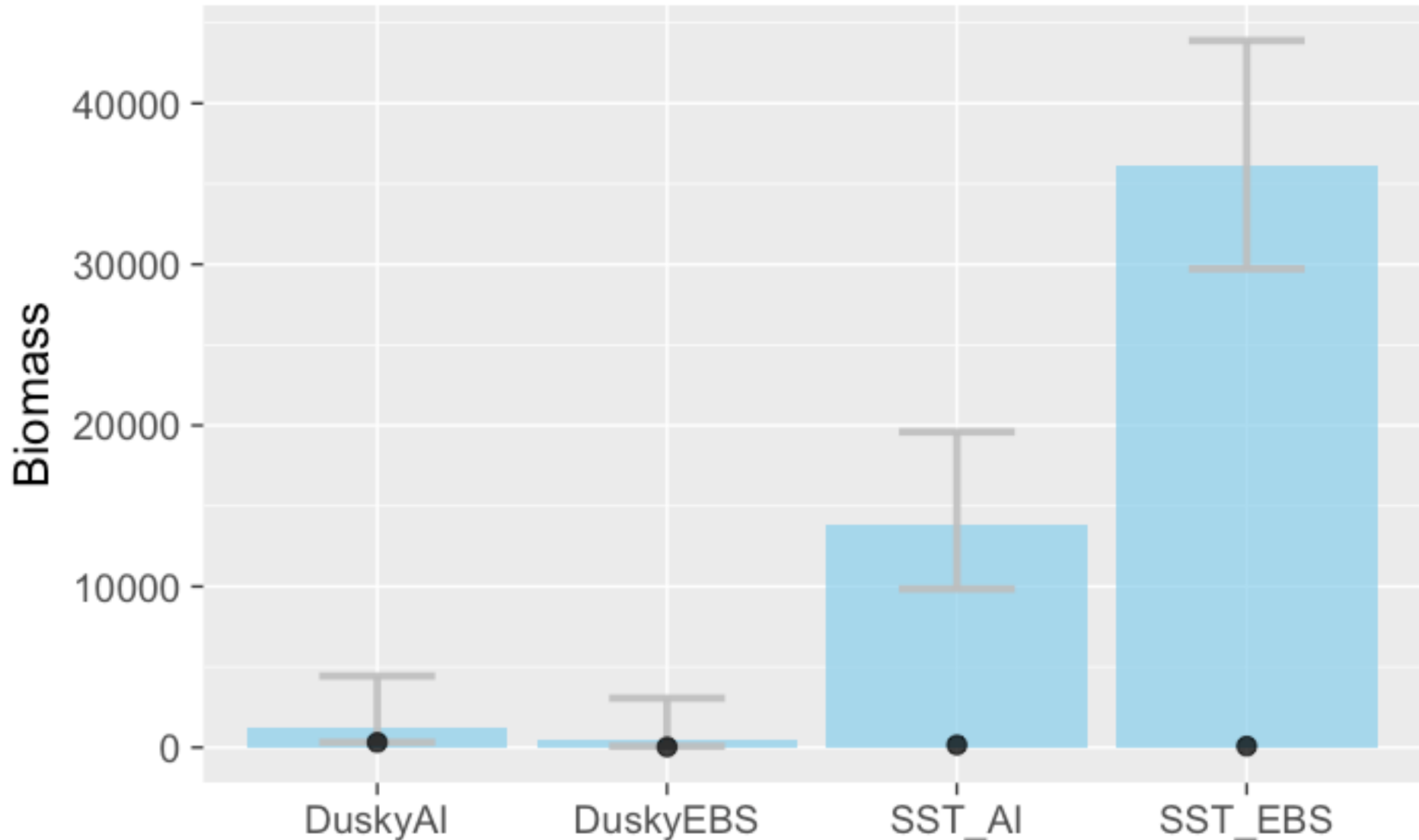
Summary for the entire Other Rockfish complex (SST and non-SST combined)

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2018	2019	2019	2020
M (natural mortality rate)*	-	-	-	-
Tier	5	5	5	5
Biomass (t)	55,312	55,312	53,290	53,290
F_{OFL} *	-	-	-	-
$maxF_{ABC}$	-	-	-	-
F_{ABC}	-	-	-	-
OFL (t)	1,816	1,816	1,793	1,793
maxABC (t)	1,362	1,362	1,345	1,345
ABC (t)	1,362	1,362	1,345	1,345
AI ABC (t)	572	572	377	377
EBS ABC (t)	790	790	942	942
	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
Status	2016	2017	2017	2018
Overfishing	No	n/a	No	n/a

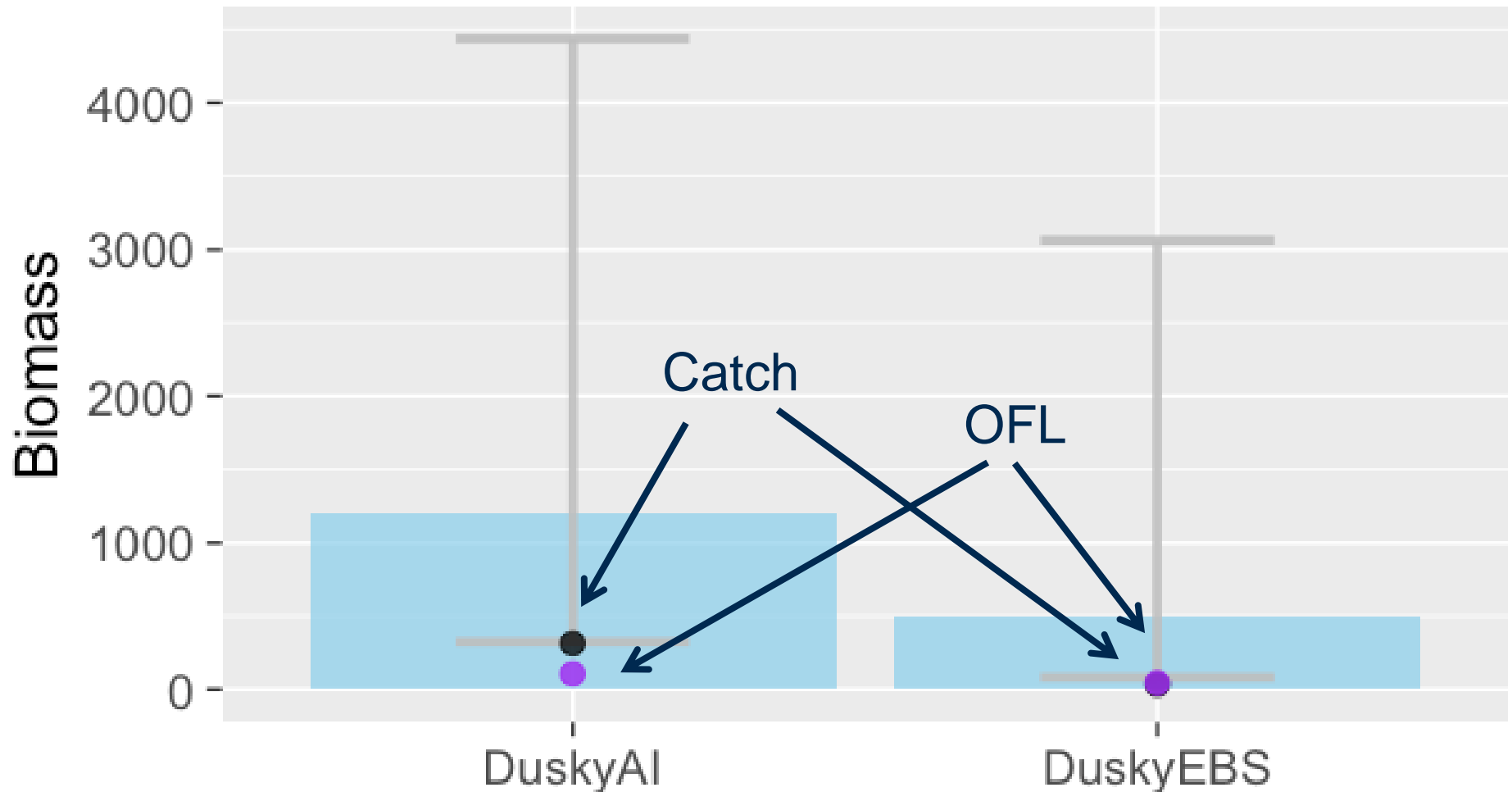
Summary

2018	SST	NonSST	Total Other Rockfish
<i>M</i>	0.03	0.09	-
Biomass	50,057	3,233	53,290
LCI	(59,475)	(6,665)	(63,024)
UCI	(42,130)	(1,568)	(45,059)
F_{OFL}	0.03	0.09	-
$\max F_{ABC}$	0.0225	0.0675	-
F_{ABC}	0.0225	0.0675	-
OFL	1,502	291	1,793
$\max ABC$	1,126	218	1,345
ABC	1,126	218	1,345
Aleutian Islands ABC	312	64	377
Eastern Bering Sea ABC	813	130	942

Dusky rockfish and shortspine thornyhead mean biomass 2007-2018, catch (black circles)



2007-2018 mean catch, overfishing limit (OFL), and biomass estimates for dusky rockfish in the Aleutian Islands and Eastern Bering Sea

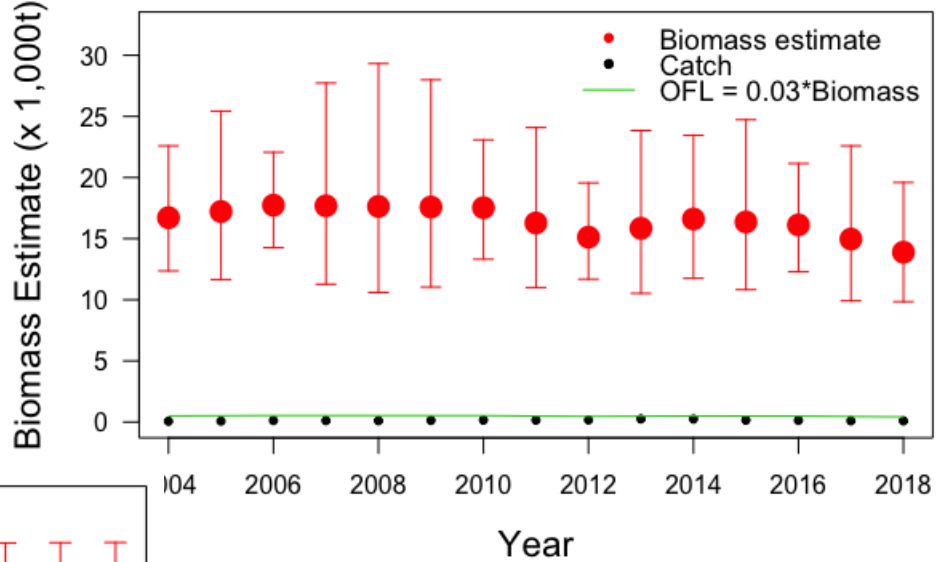


Average biomass estimate of dusky rockfish and shortpine thornyhead (SST) in the Aleutian Islands (AI) and Eastern Bering Sea (EBS) from 2004-2018

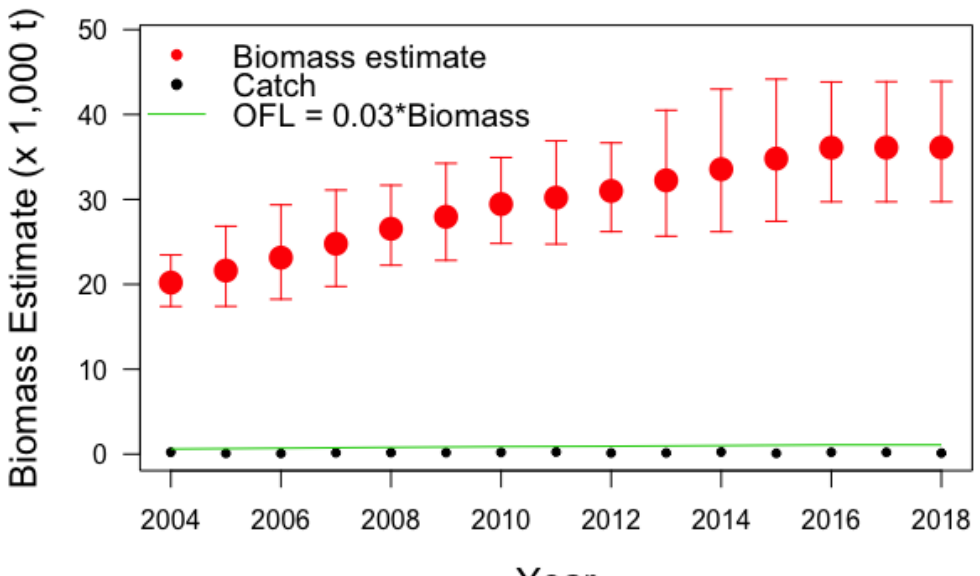
Species	Area	Biomass (t)	LCI	UCI	Catch (t)	OFL (t)
Dusky	AI	1,199	324	4,437	314	108
Dusky	EBS	507	84	3,063	33	46
SST	AI	13,890	9,846	19,595	157	1,250
SST	EBS	36,120	29,723	43,894	83	3,251

Catch and biomass for AI and EBS shortpine thornyhead

AI SST catch and biomass

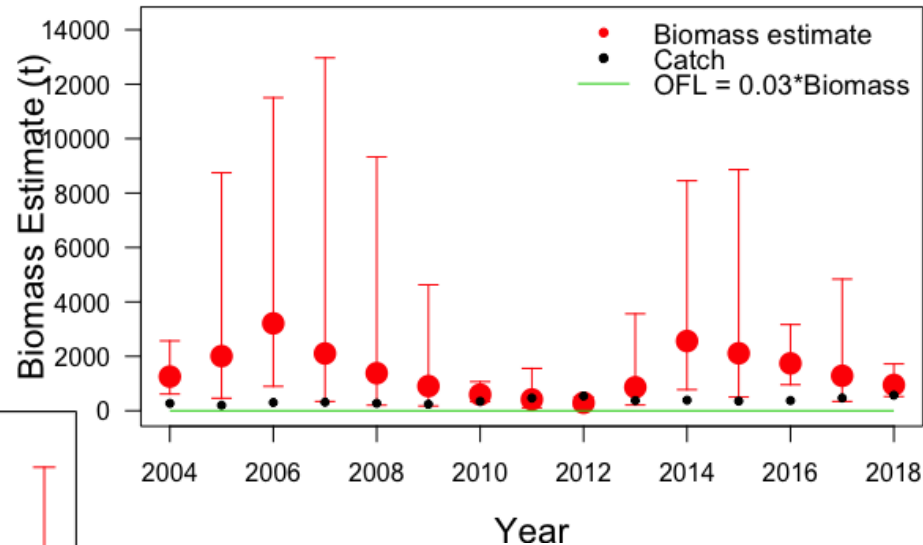


EBS SST catch and biomass

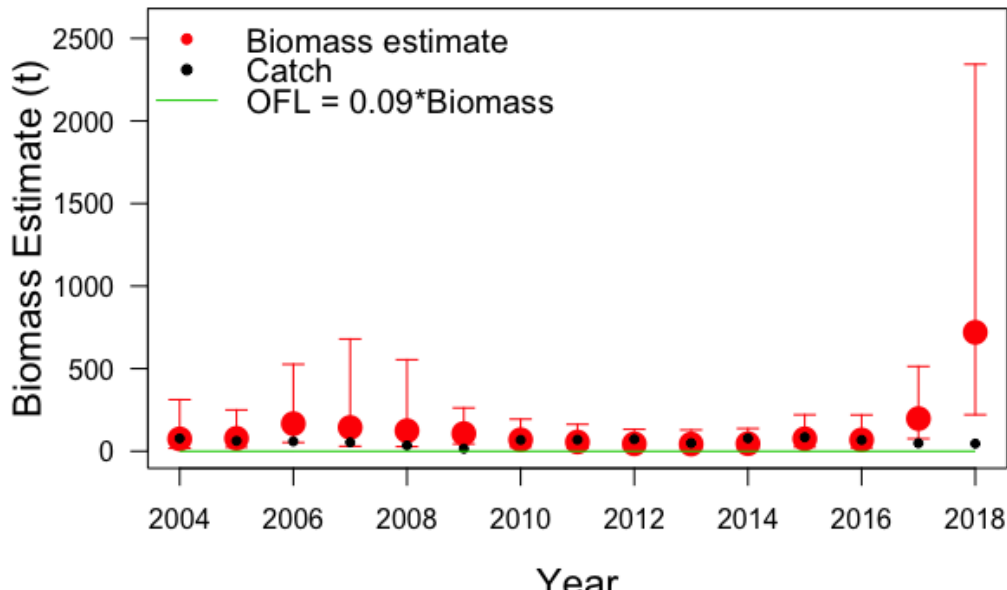


Catch and biomass for AI and EBS nonSST Other Rockfish (primarily dusky RF)

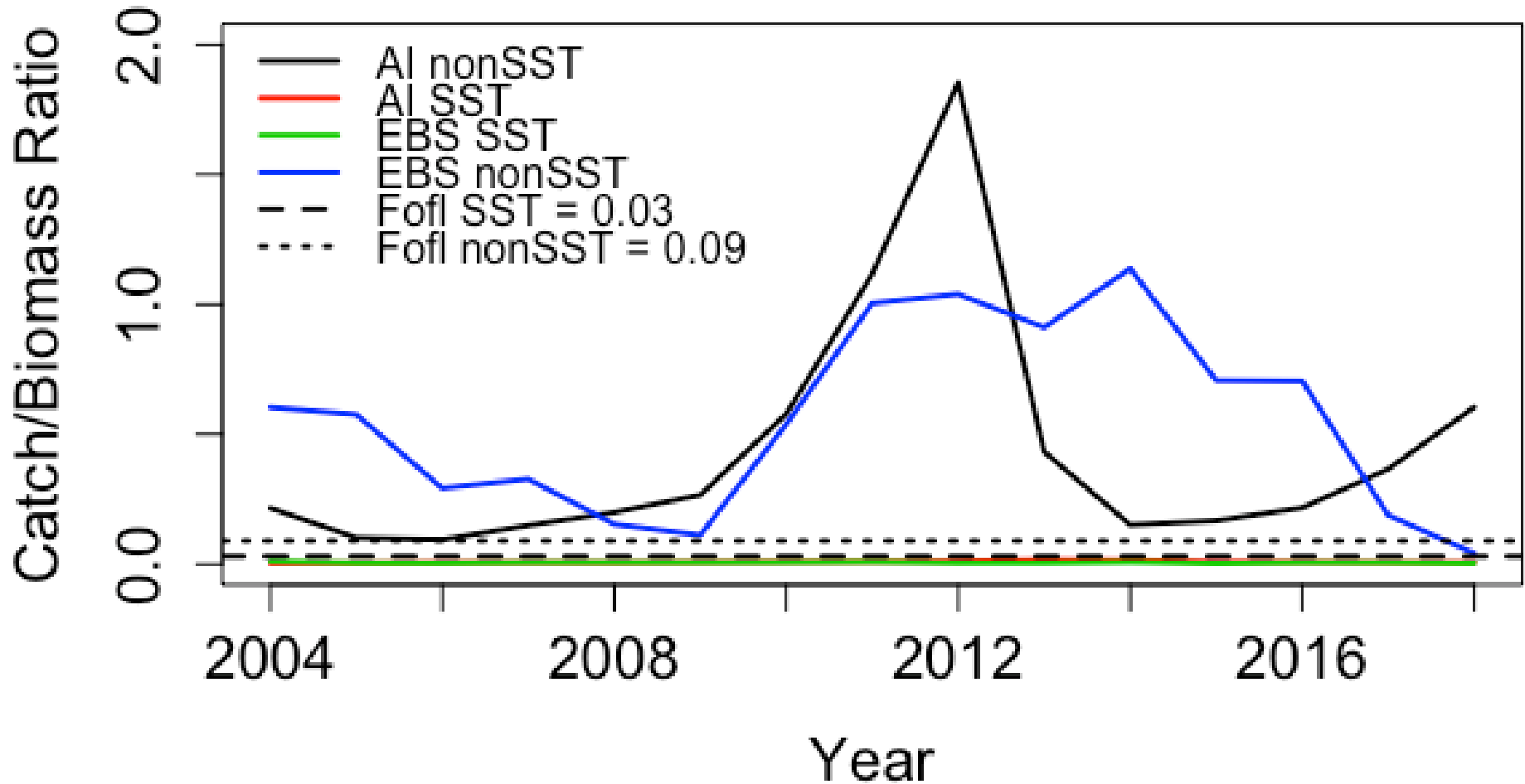
AI nonSST



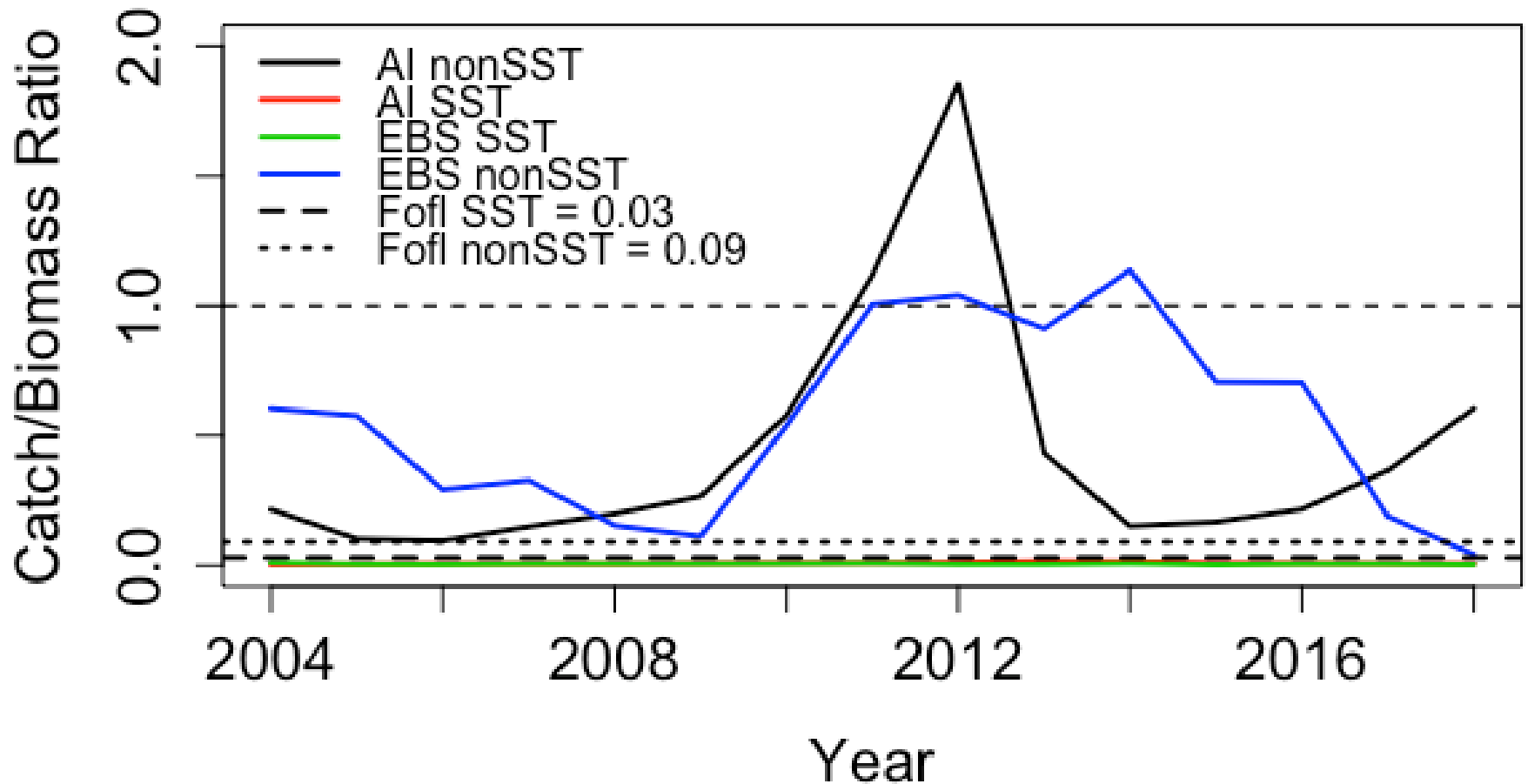
EBS nonSST



Catch/Biomass ratio for AI and EBS nonSST Other Rockfish (primarily dusky RF) $>F_{OFL}$.

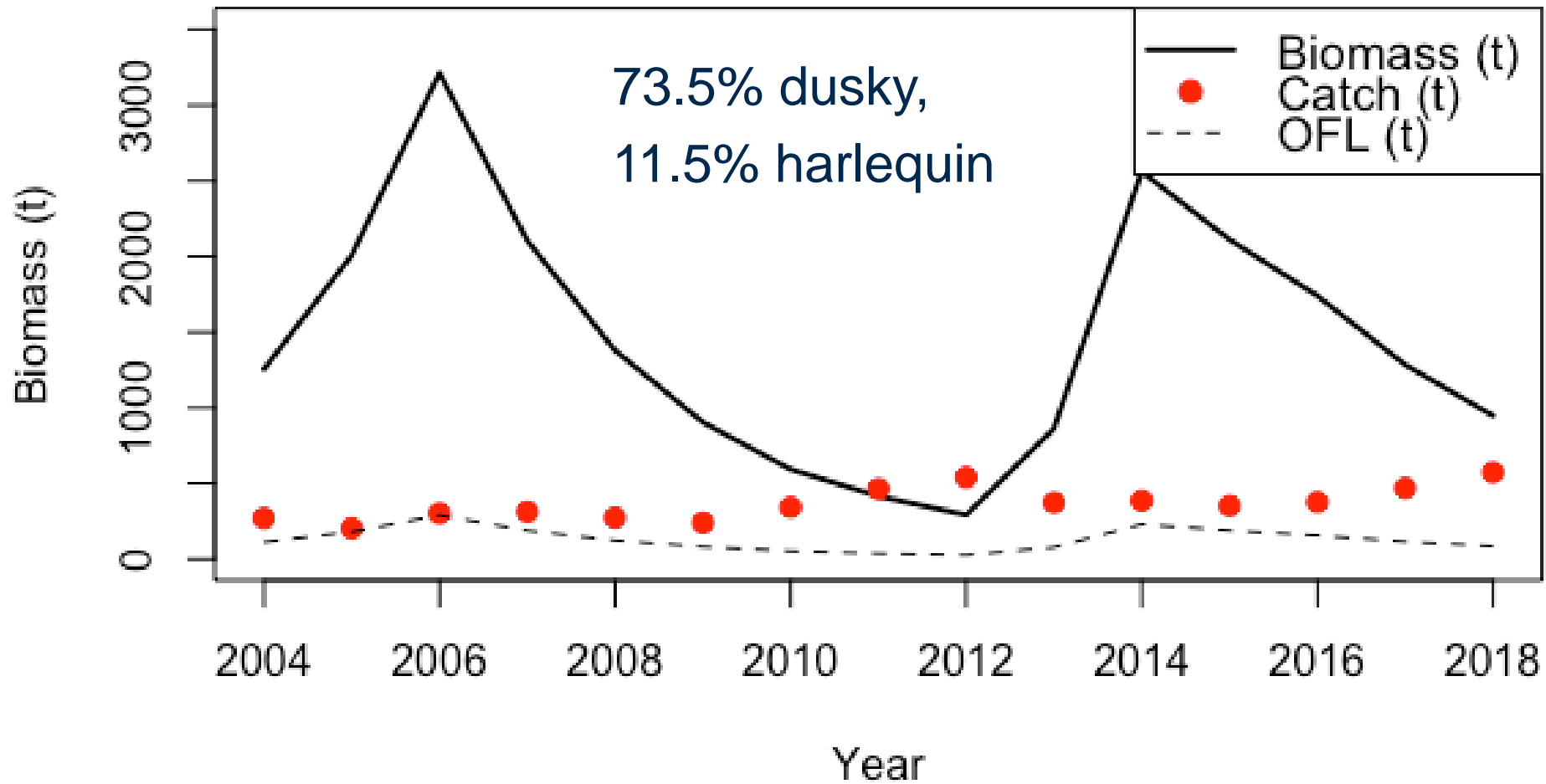


Catch/Biomass ratio for AI and EBS nonSST Other Rockfish (primarily dusky RF) $>F_{OFL}$.



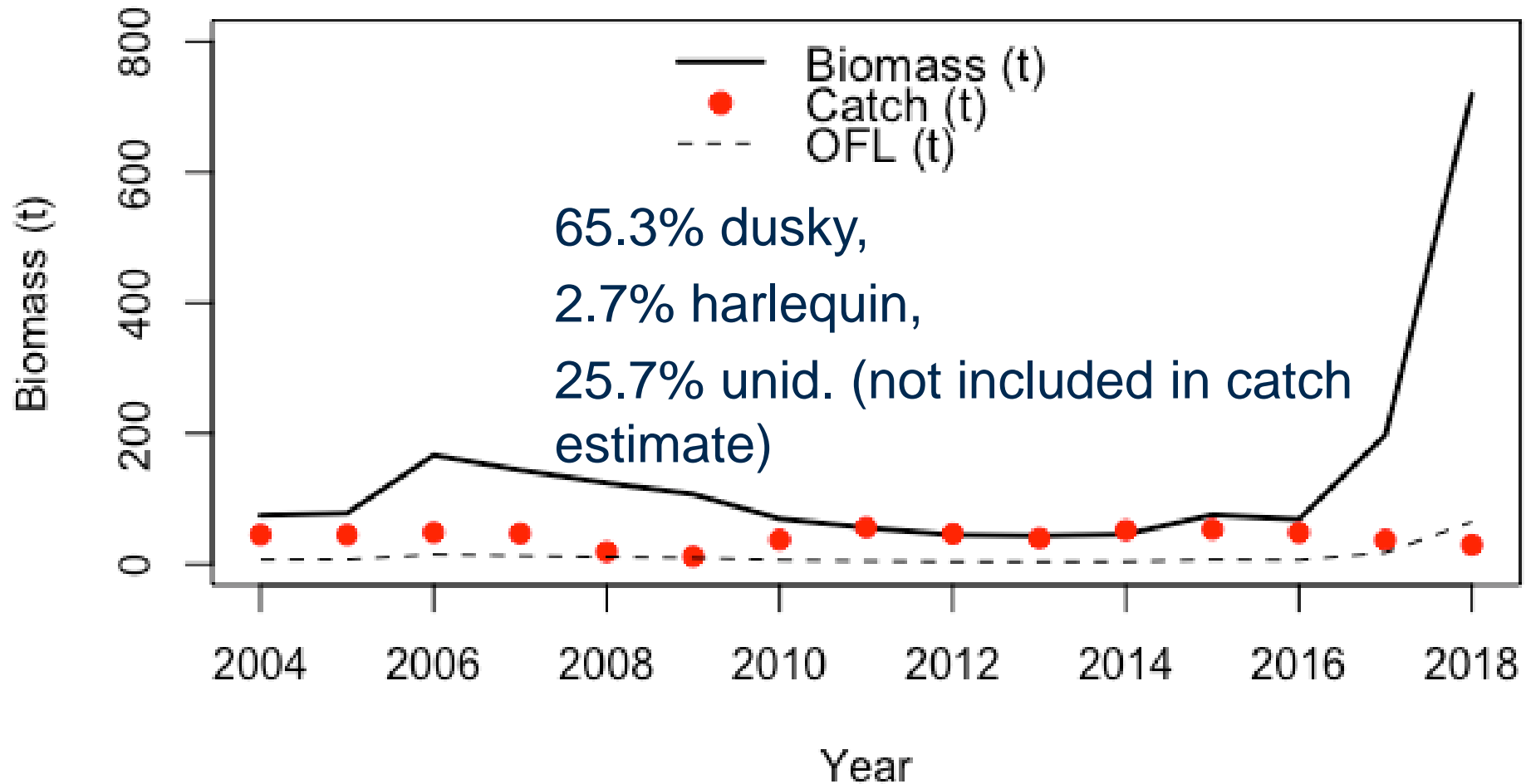
Aleutian Islands Other Rockfish

Catch, biomass, overfishing limit (OFL)

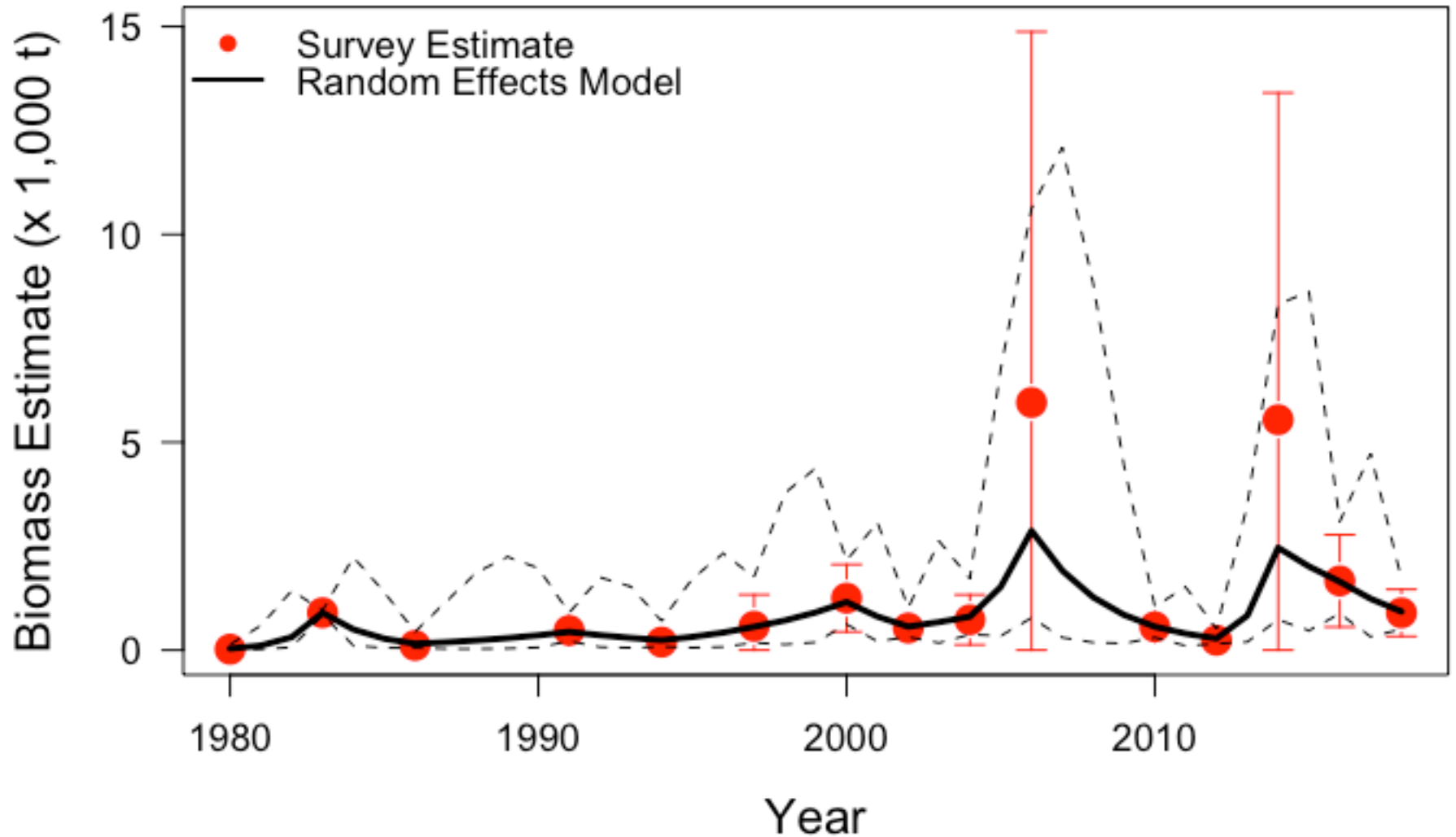


Eastern Bering Sea Other Rockfish

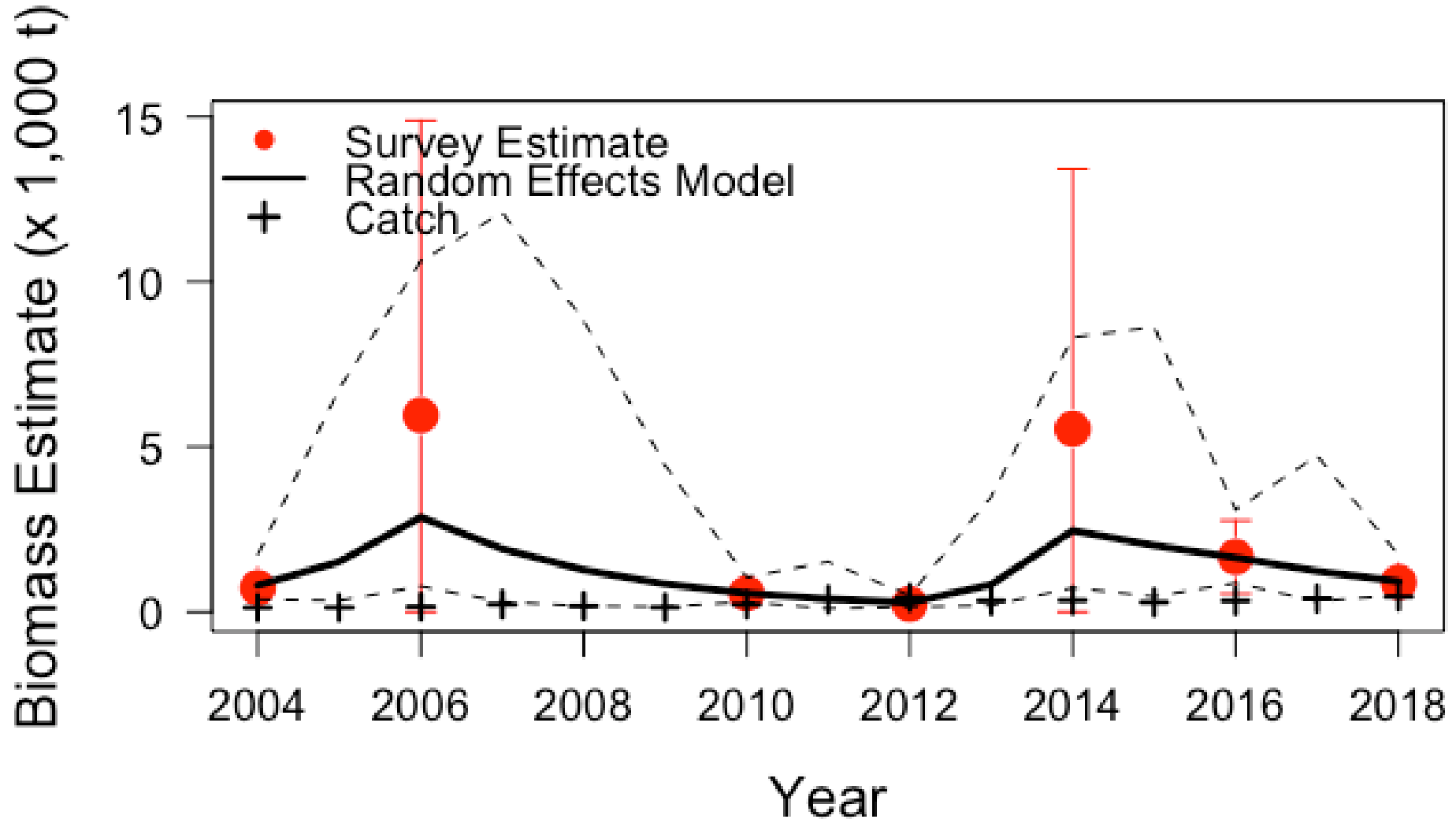
Catch, biomass, overfishing limit (OFL)



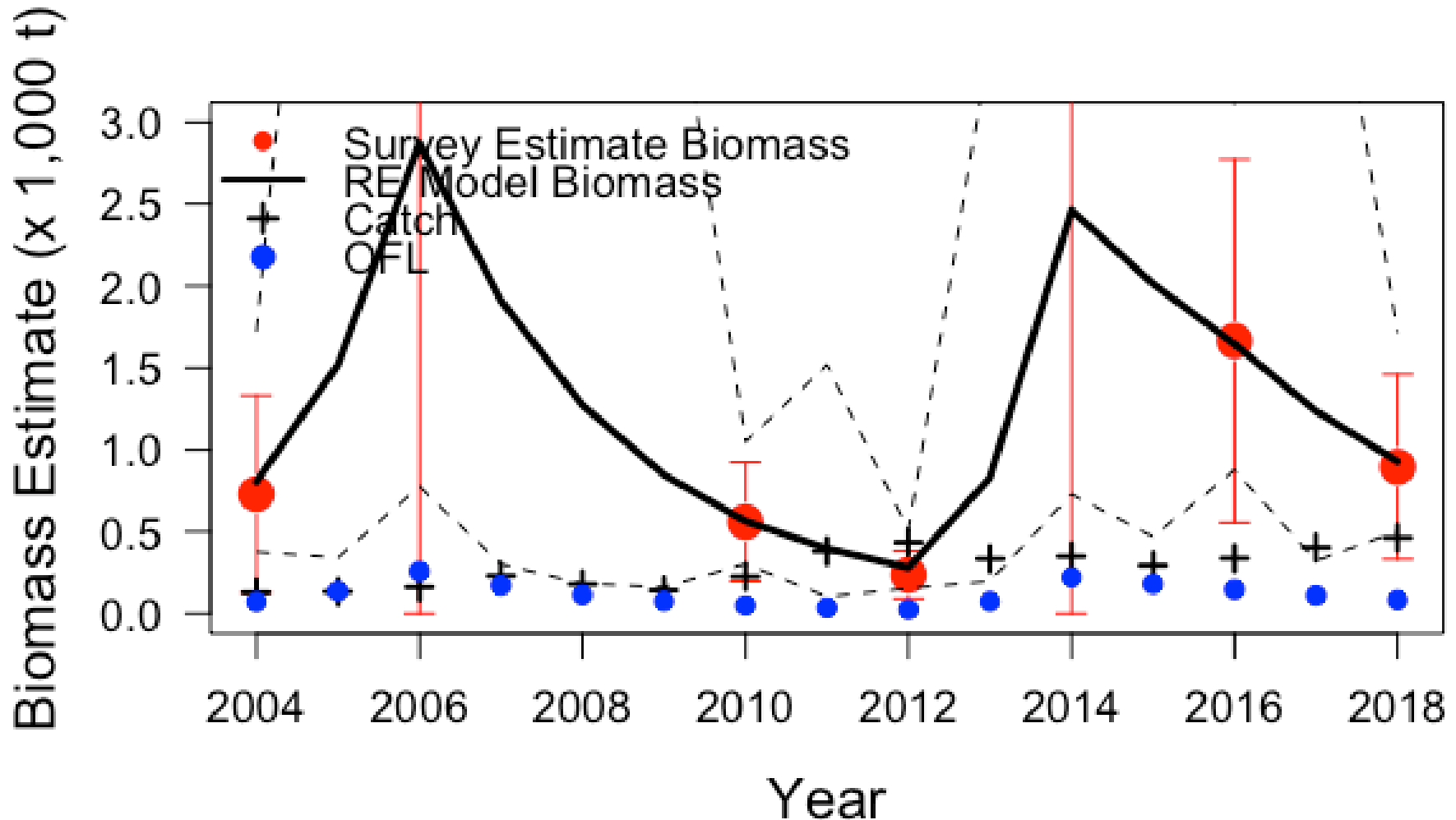
Aleutian Islands dusky random effects biomass estimate



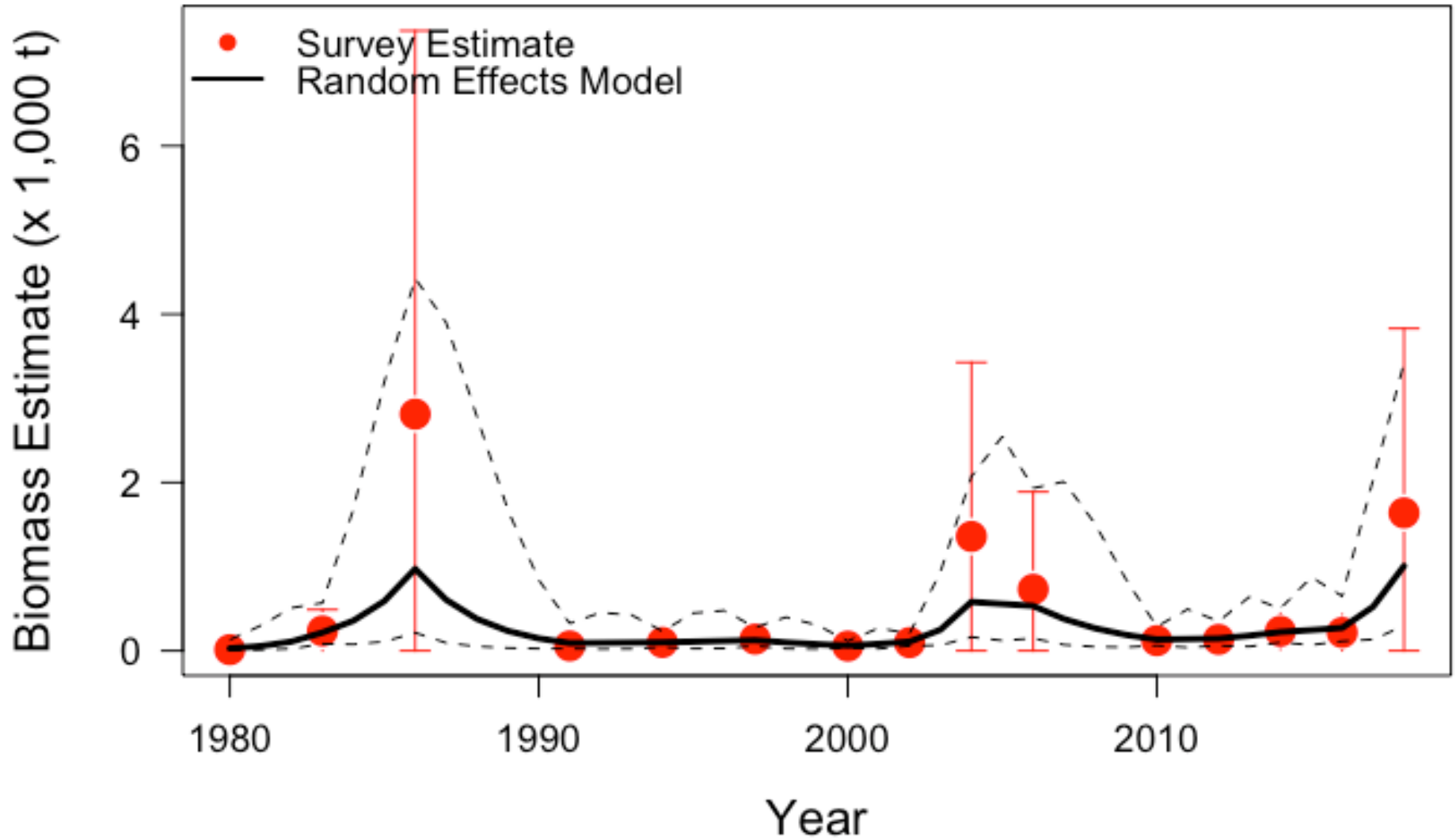
Aleutian Islands dusky rockfish catch & biomass



Aleutian Islands dusky overfishing limit (OFL), catch & biomass

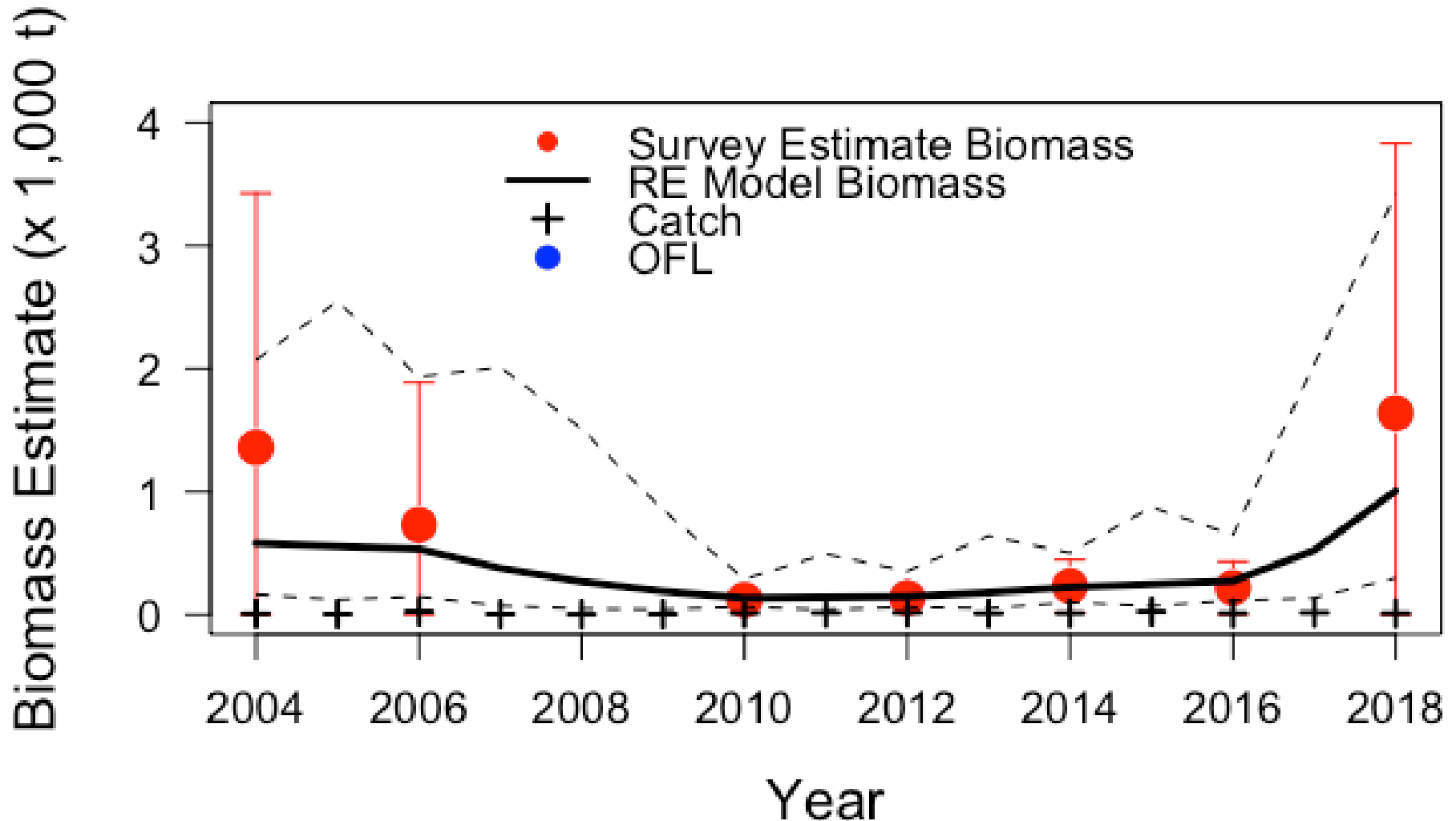


Southern Bering Sea dusky overfishing limit (OFL), catch & biomass



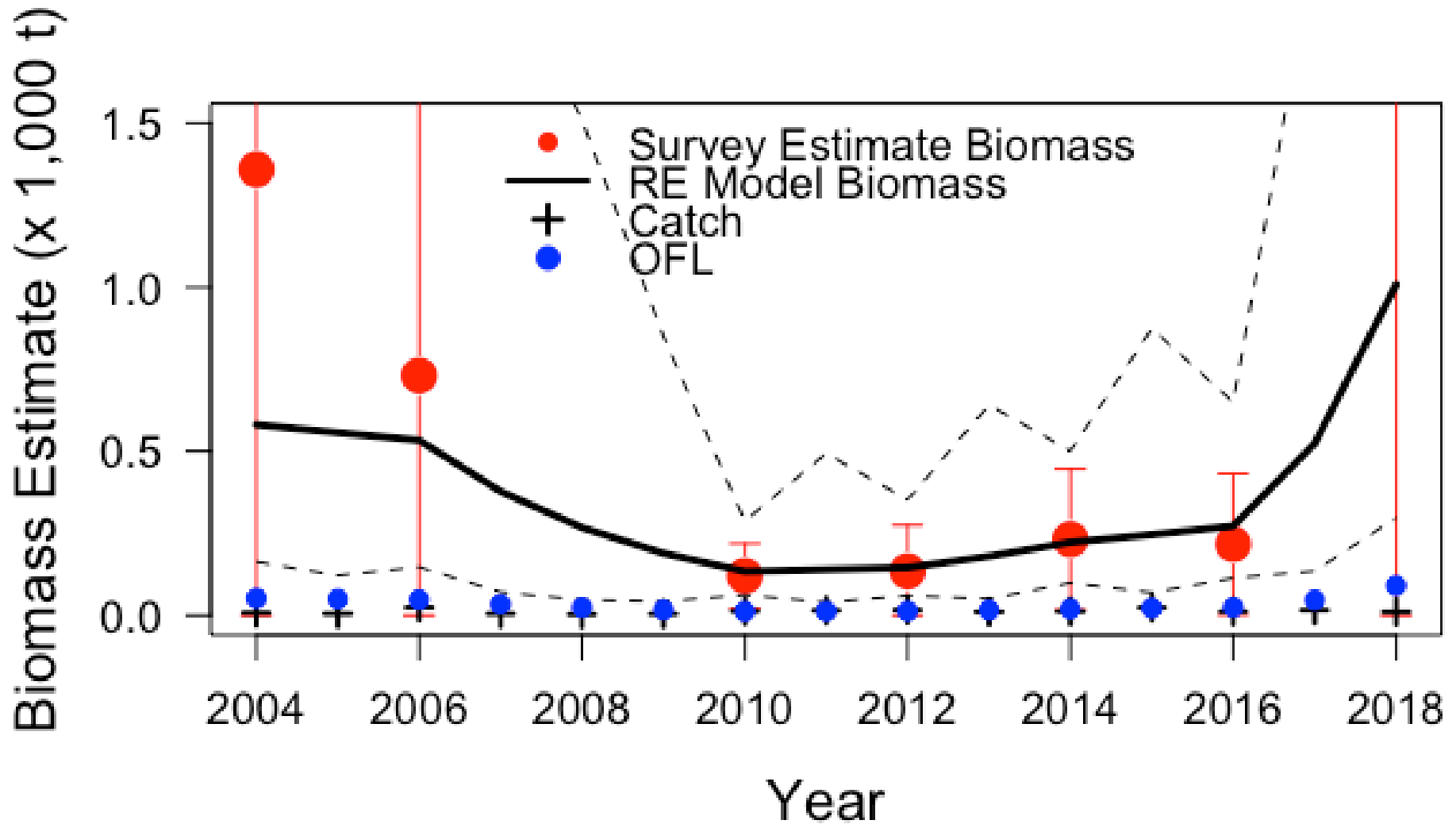
Southern Bering Sea Dusky Rockfish

Areas 517 and 518



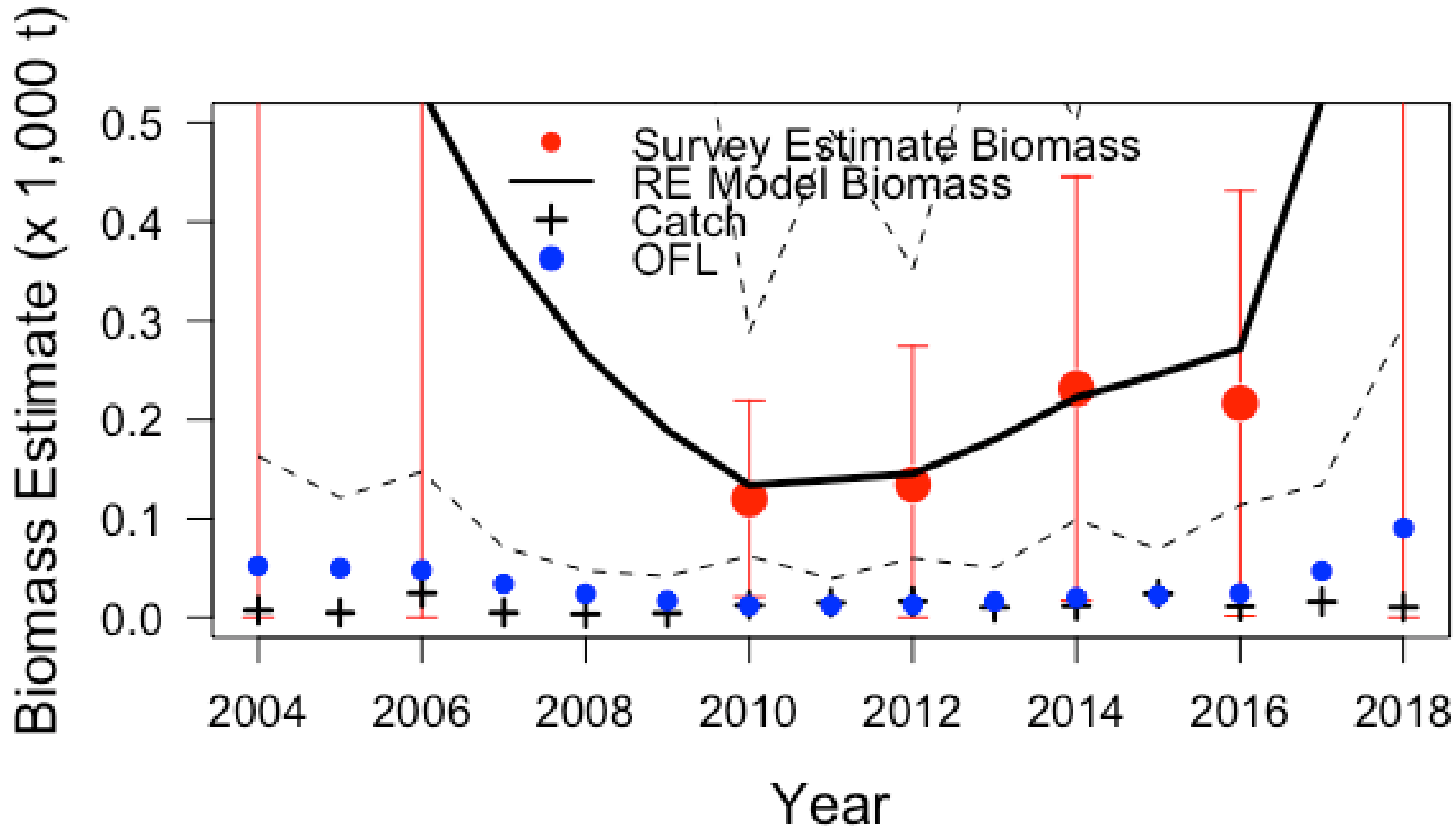
Southern Bering Sea Dusky Rockfish

Areas 517 and 518

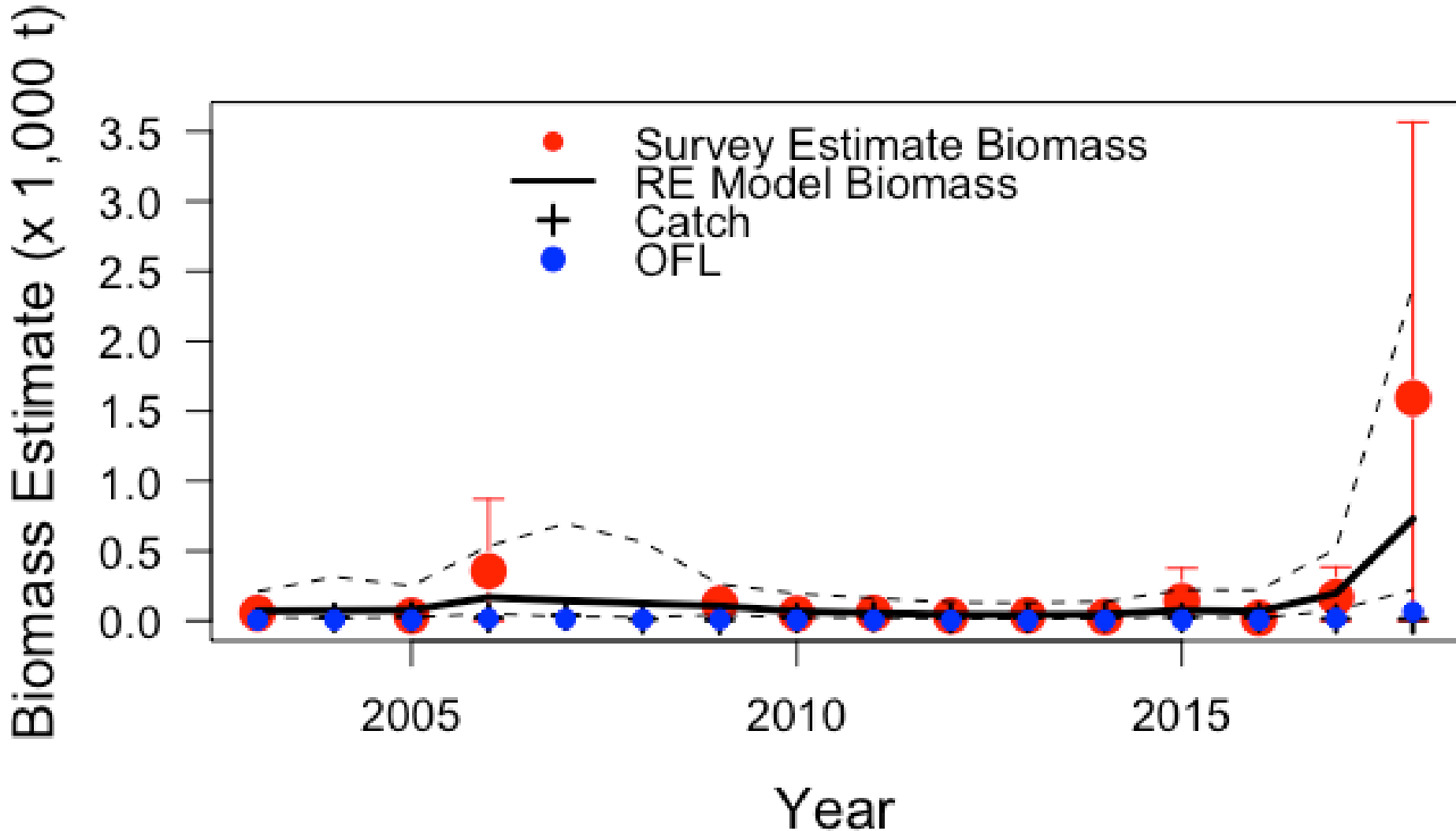


Southern Bering Sea Dusky Rockfish

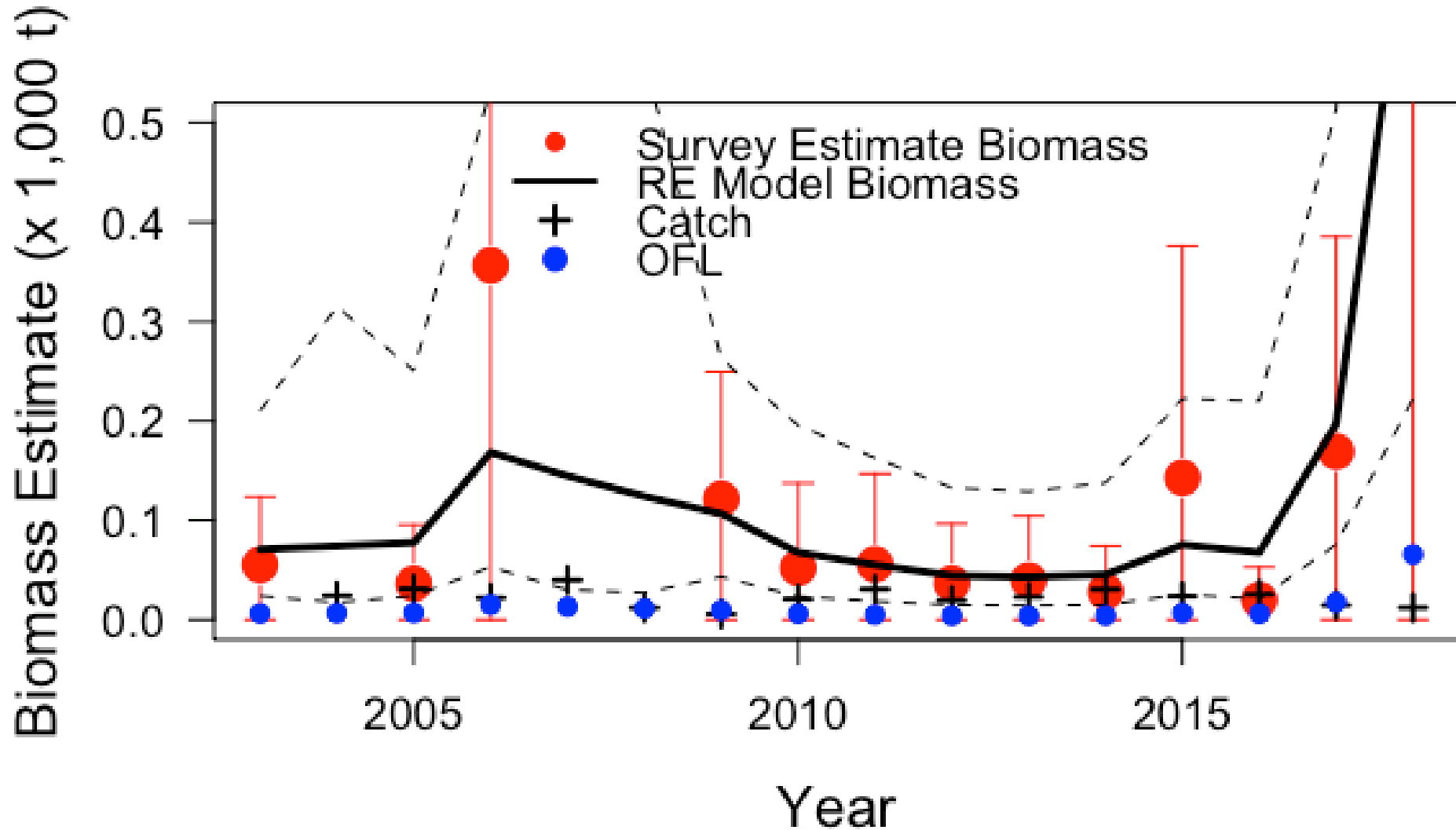
Areas 517 and 518



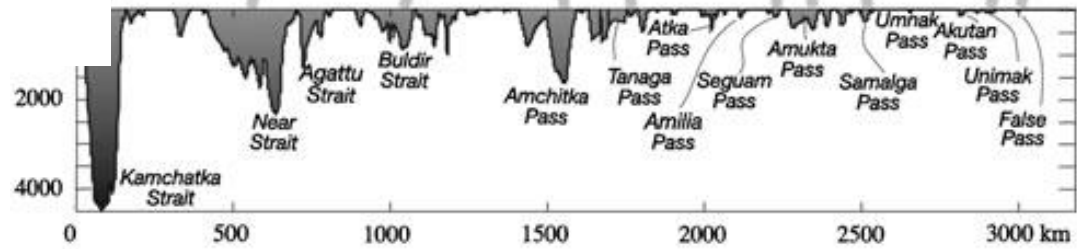
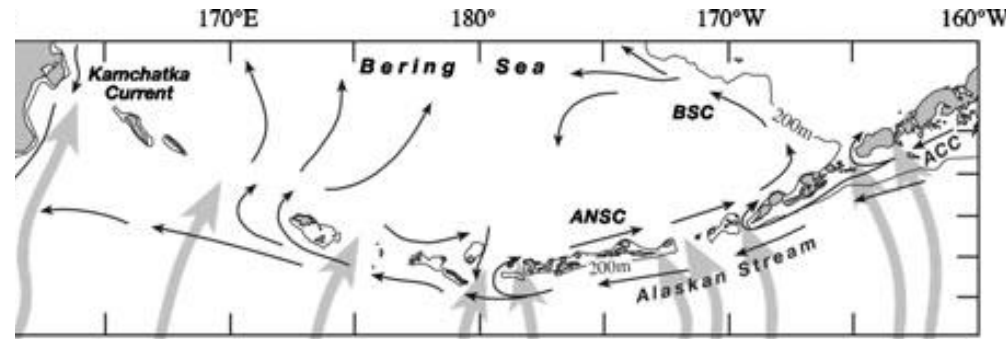
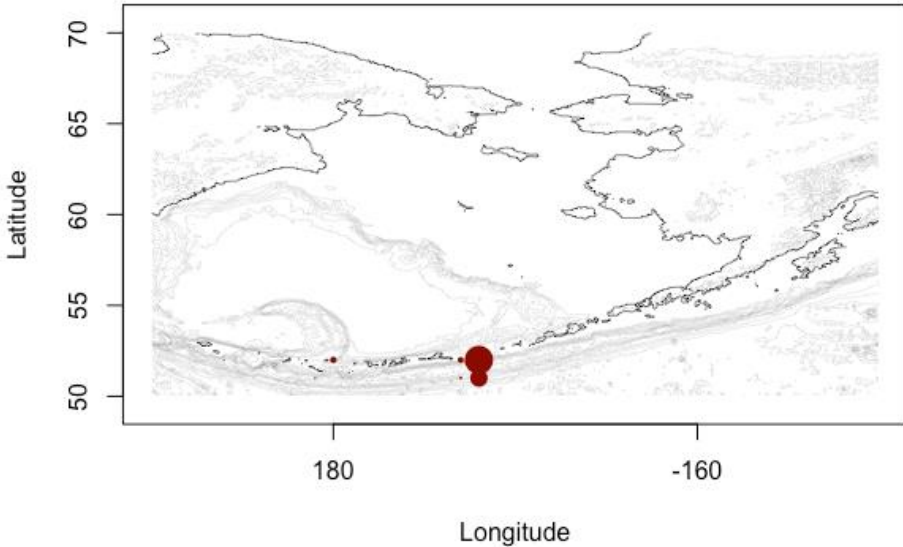
Eastern Bering Sea Dusky rockfish catch, overfishing limit (OFL), biomass



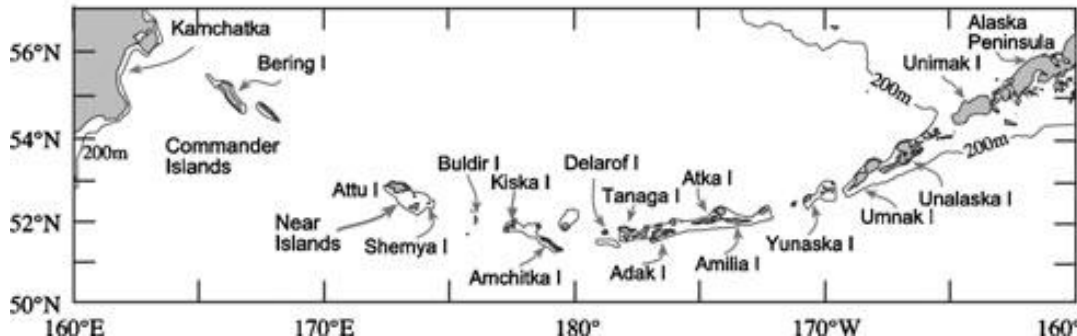
Eastern Bering Sea Dusky rockfish catch, overfishing limit (OFL), biomass



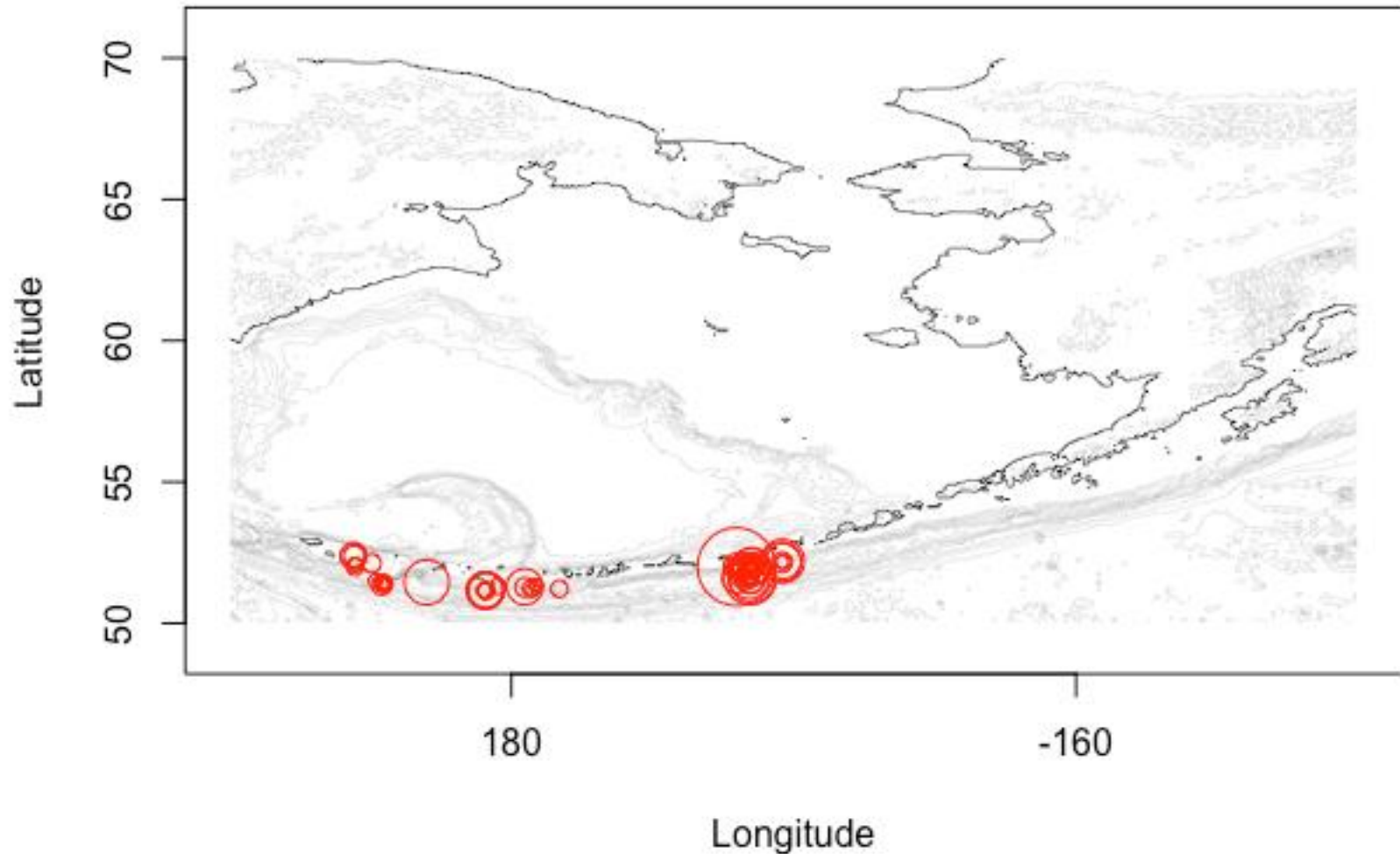
Dusky catch in the Aleutian Islands east of Amliia Island (2004-2018)



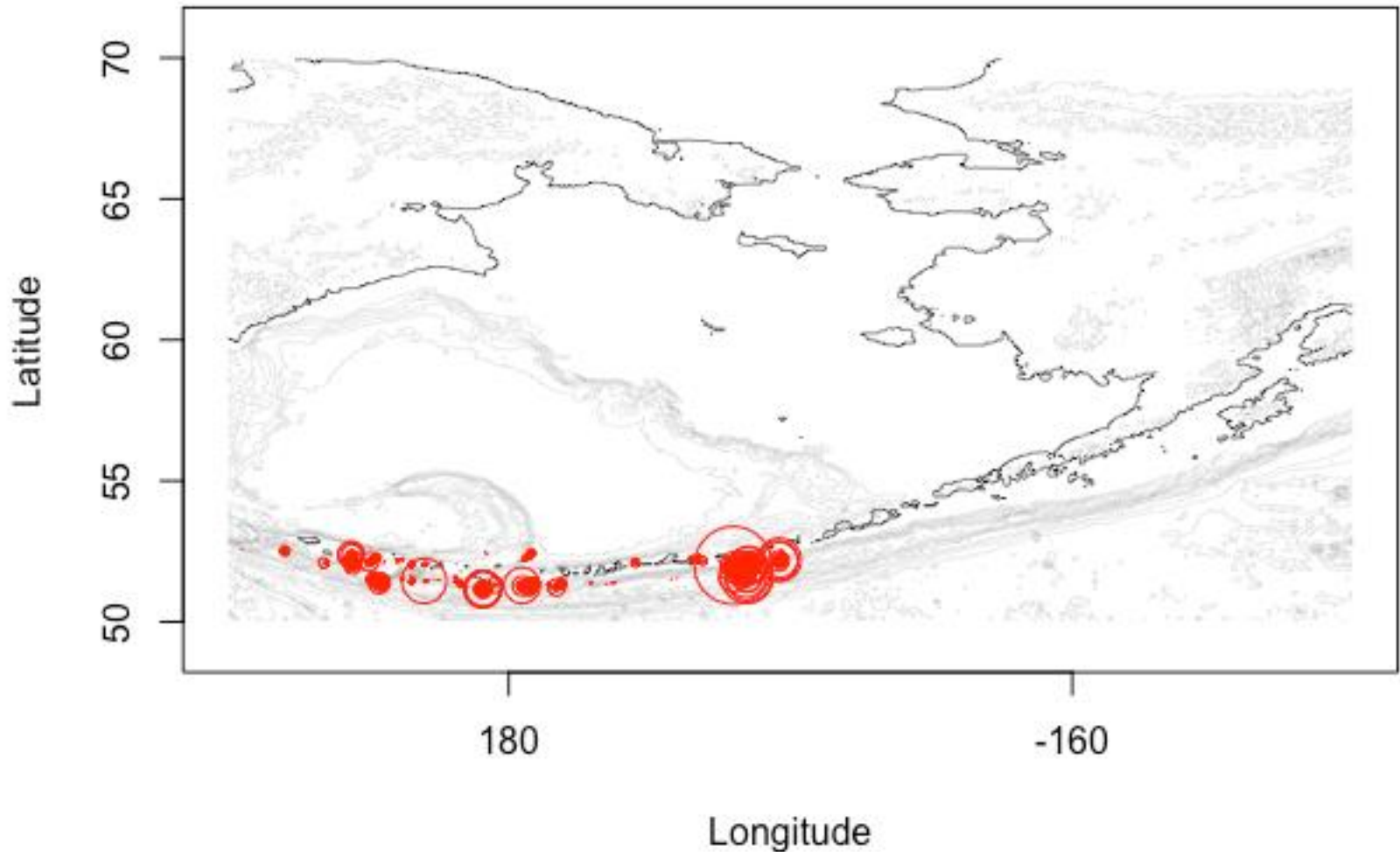
- 80% of dusky rockfish is caught in the Atka mackerel fishery.
- High potential for localized depletion.



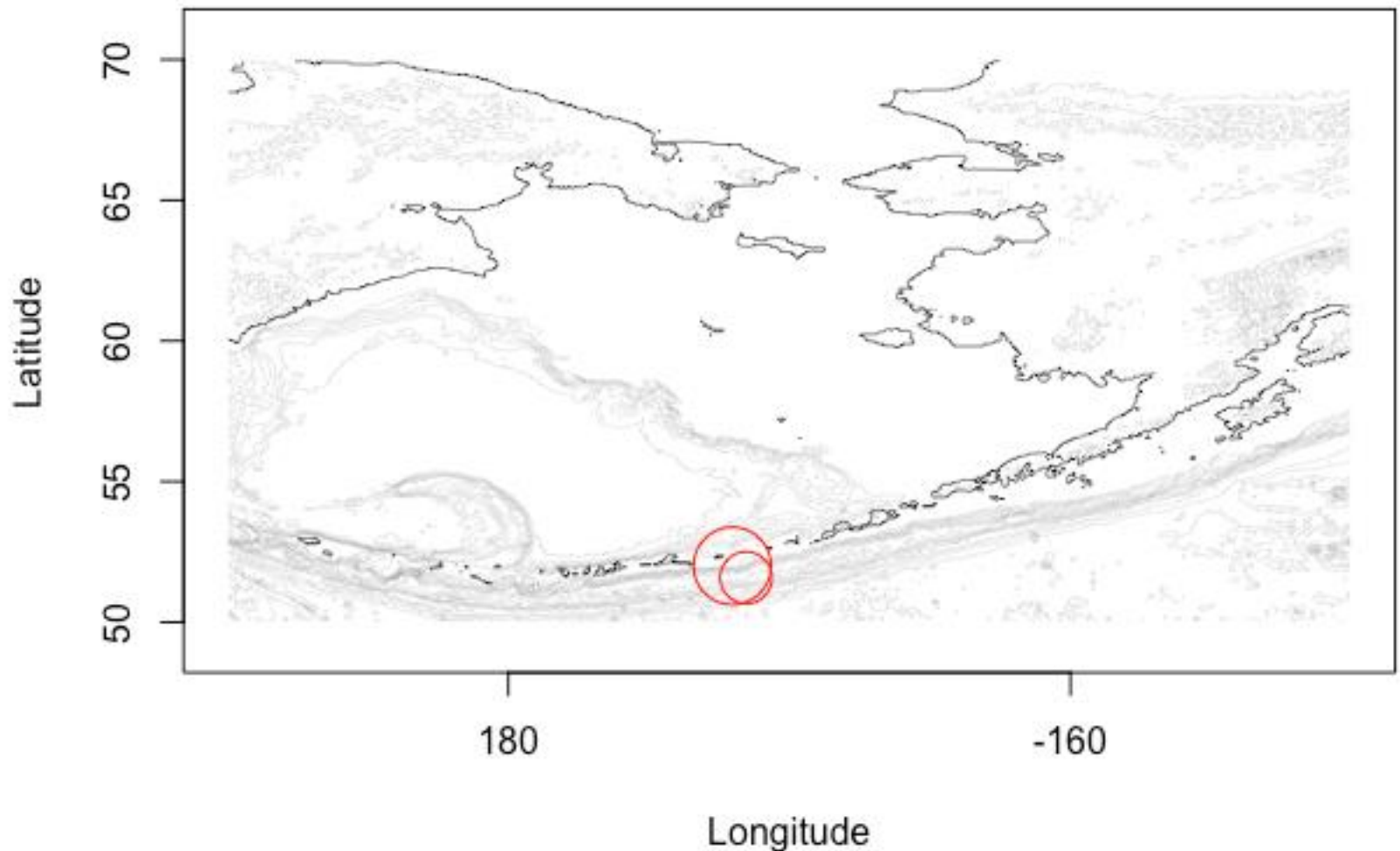
Dusky Rockfish catches >1,000kg 2004-2018

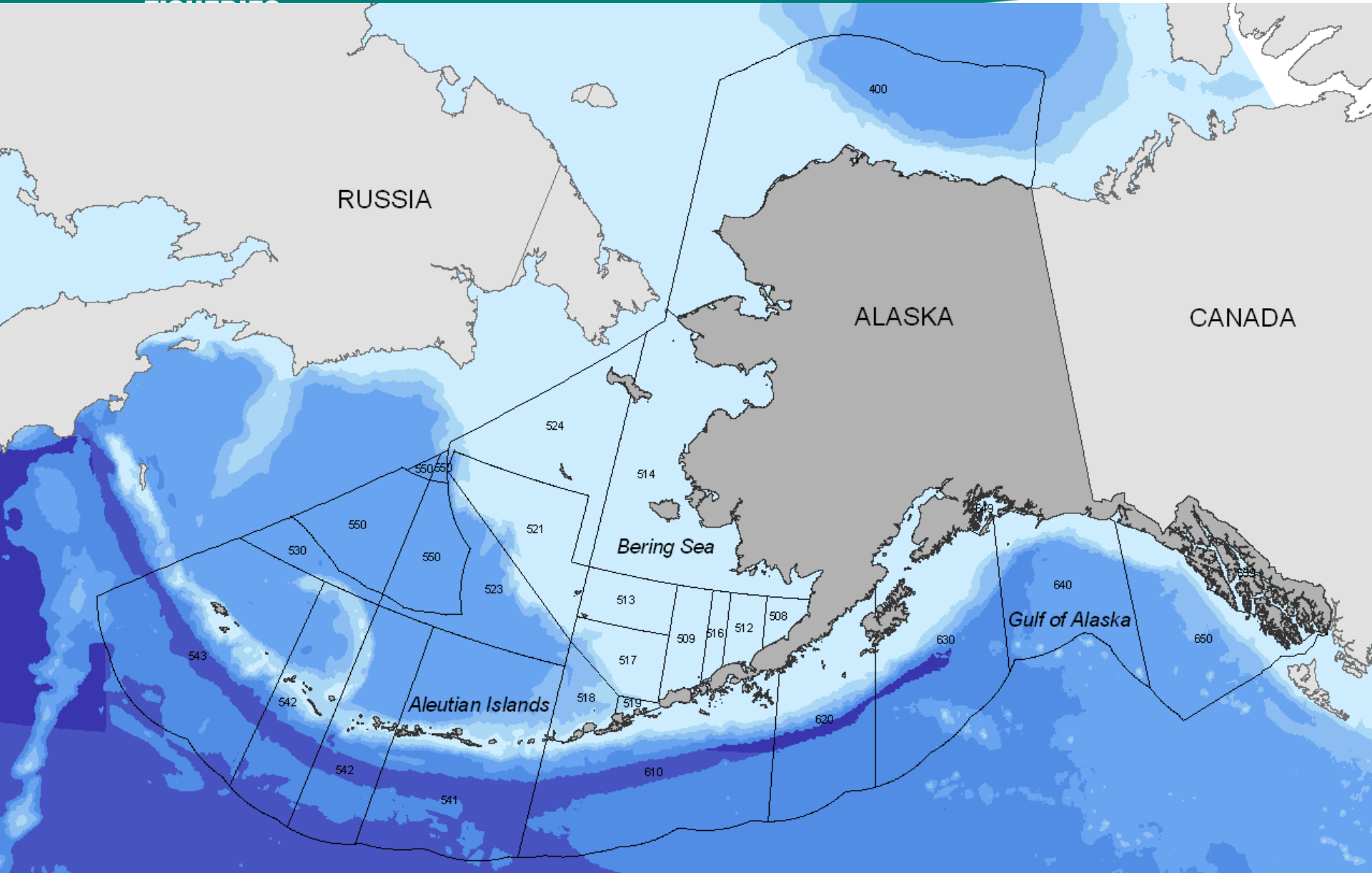


Dusky Rockfish all catch 2004-2018



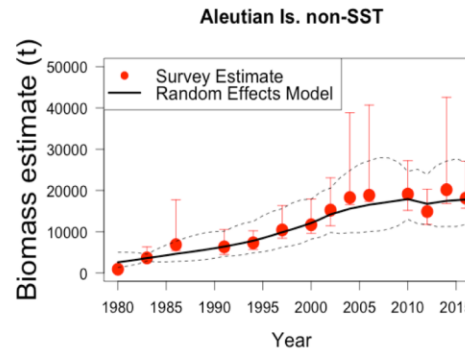
Two biggest dusky rockfish hauls: 6.9 t in 2011, 4.6 t in 2007



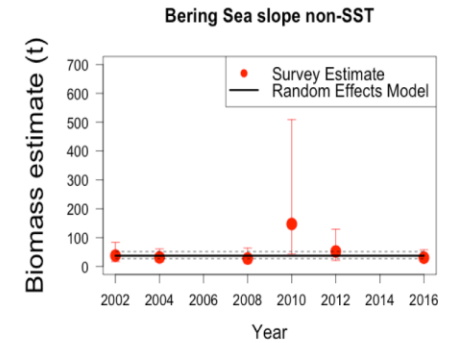


Survey biomass estimates

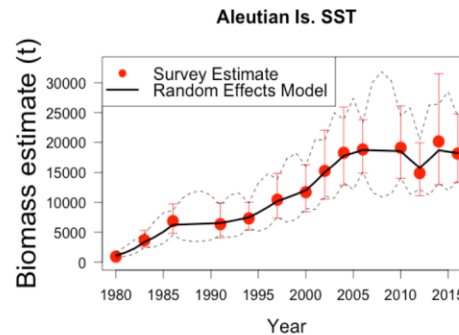
Aleutian Islands non-SST Other Rockfish



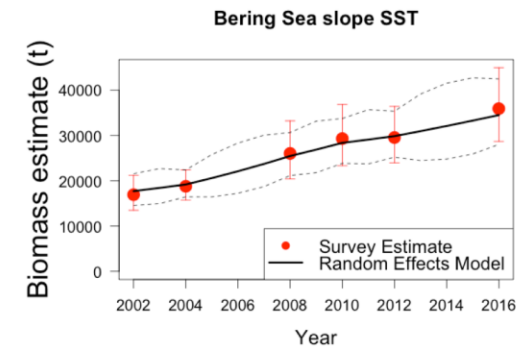
Bering Sea slope non-SST Other Rockfish



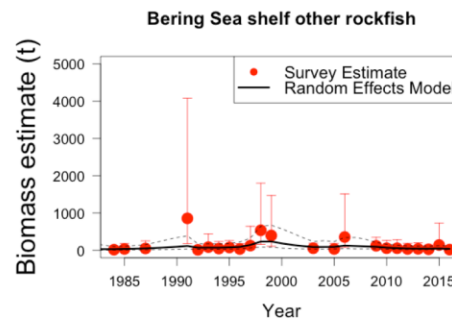
Aleutian Islands SST



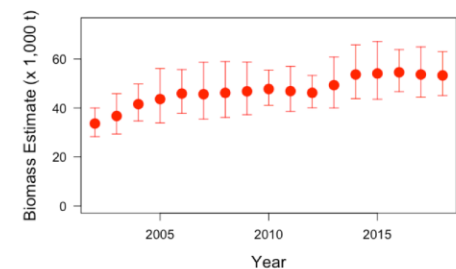
Bering Sea slope SST



Bering Sea shelf all Other Rockfish



Combined Random effect estimates of all Other Rockfish biomass (BSAI)



- Shortspine thornyhead increasing
- Other rockfish not increasing

Biomass of dusky rockfish estimated from NMFS survey data using the random effects model, catch, and overfishing limit (OFL, $0.09 \times$ biomass estimate).

Year	Eastern Bering Sea			Southern Bering Sea			Aleutian Islands		
	Biomass	Catch	OFL	Biomass	Catch	OFL	Biomass	Catch	OFL
2004	74	24	7	581	8	52	805	129	72
2005	78	31	7	556	5	50	1,520	134	137
2006	168	22	15	533	25	48	2,870	161	258
2007	145	40	13	377	5	34	1,911	232	172
2008	124	12	11	267	3	24	1,273	180	115
2009	107	6	10	189	4	17	847	142	76
2010	68	21	6	134	12	12	564	226	51
2011	55	31	5	139	15	13	397	381	36
2012	44	20	4	145	16	13	280	435	25
2013	43	23	4	180	10	16	830	334	75
2014	45	31	4	222	12	20	2,463	349	222
2015	75	24	7	246	24	22	2,013	294	181
2016	68	26	6	272	11	24	1,645	338	148
2017	197	15	18	523	16	47	1,236	404	111
2018	730	12	66	1,008	10	91	928	463	84

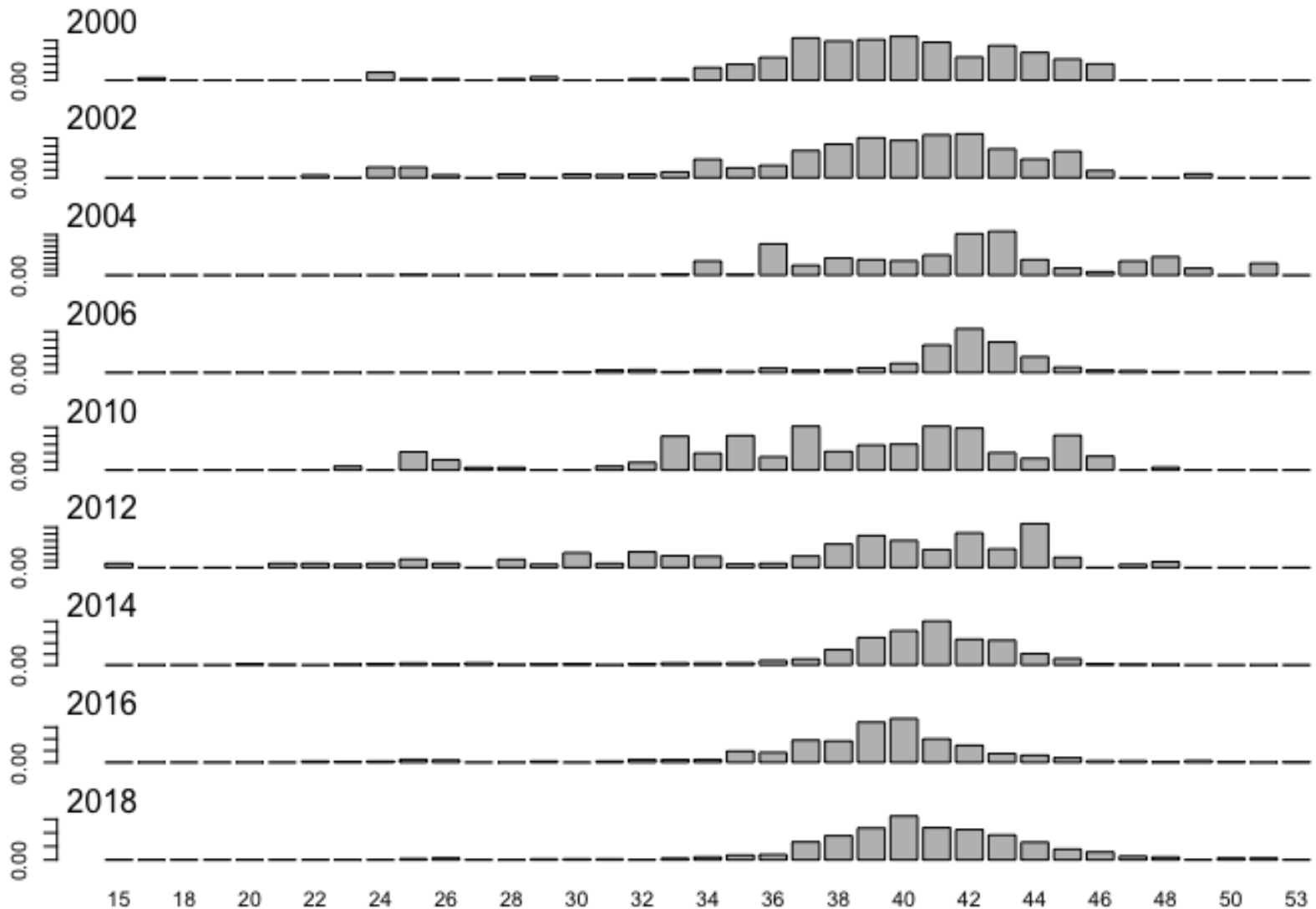
Yellow shading indicates years in which catch was equal to or higher than the OFL.

Aleutian Islands biomass of dusky rockfish estimated from NMFS survey data using the random effects model, catch, and overfishing limit

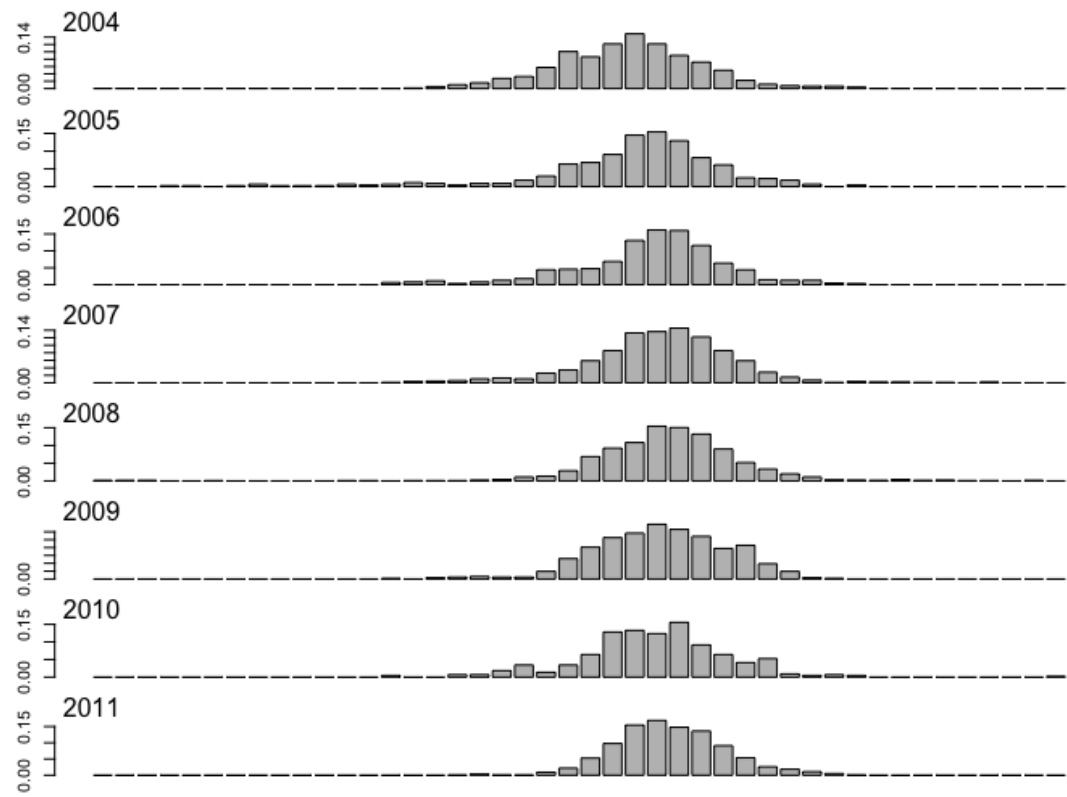
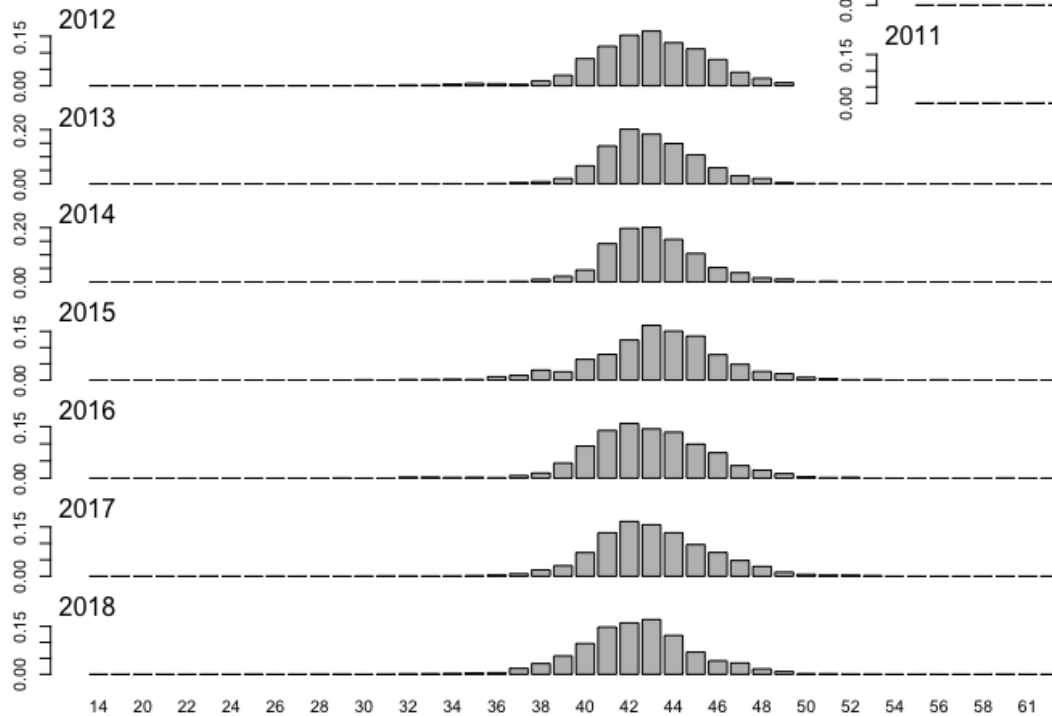
	WAI			CAI			EAI		
	Biomass	Catch	OFL	Biomass	Catch	OFL	Biomass	Catch	OFL
2004	132	13	12	499	84	45	104	33	9
2005	70	14	6	988	53	89	177	66	16
2006	37	9	3	1,954	50	176	300	102	27
2007	26	14	2	1,264	47	114	277	171	25
2008	18	13	2	818	57	74	256	111	23
2009	13	11	1	529	36	48	236	94	21
2010	9	19	1	342	40	31	218	167	20
2011	9	3	1	241	33	22	177	345	16
2012	8	2	1	170	30	15	144	403	13
2013	20	2	2	493	41	44	289	292	26
2014	50	1	4	1,431	25	129	579	324	52
2015	122	29	11	1,213	42	109	365	224	33
2016	300	19	27	1,029	38	93	230	280	21
2017	170	50	15	794	67	71	234	286	21
2018	96	54	9	612	112	55	237	298	21

Yellow shading indicates years in which catch was equal to or higher than the OFL.

Dusky lengths from AI survey



Dusky rockfish fishery data BSAI, 2004-2018



Magnuson Stevens National Standard One:

A “stock complex” is a tool to manage a group of stocks within a FMP.

Where practicable, the group of stocks should have a similar geographic distribution, life history characteristics, and vulnerabilities to fishing pressure such that the impact of management actions on the stocks is similar. The vulnerability of individual stocks should be considered when determining if a particular stock complex should be established or reorganized, or if a particular stock should be included in a complex.

Consider non-SST species -> Tier 6

Tier 5: reliable point estimates of B and natural mortality rate M.

Tier 6: Information available: reliable catch history from 1978-1995.

—OFL = average catch from 1978-1995, unless an alternative value is suggested by the SSC based on best available scientific information.

— $ABC \leq 0.75 \times OFL$.

—Tier 6 AI OFL: 118 t (ABC 88.5 t), Tier 6 EBS OFL: 66.3 t (49.7 t).

Species	Area	Biomass (t)	LCI	UCI	Catch (t)	OFL (t)
Dusky	AI	1,199	324	4,437	314	108
Dusky	EBS	507	84	3,063	33	46
SST	AI	13,890	9,846	19,595	157	1,250
SST	EBS	36,120	29,723	43,894	83	3,251

Conclusions

- Unreliable biomass point estimate of the non-SST component of the Other Rockfish Complex.
- Overfishing is occurring (past 15 years) in the non-SST component of the Other Rockfish Complex.
- Consider non-SST Other Rockfish -> Tier 6.

