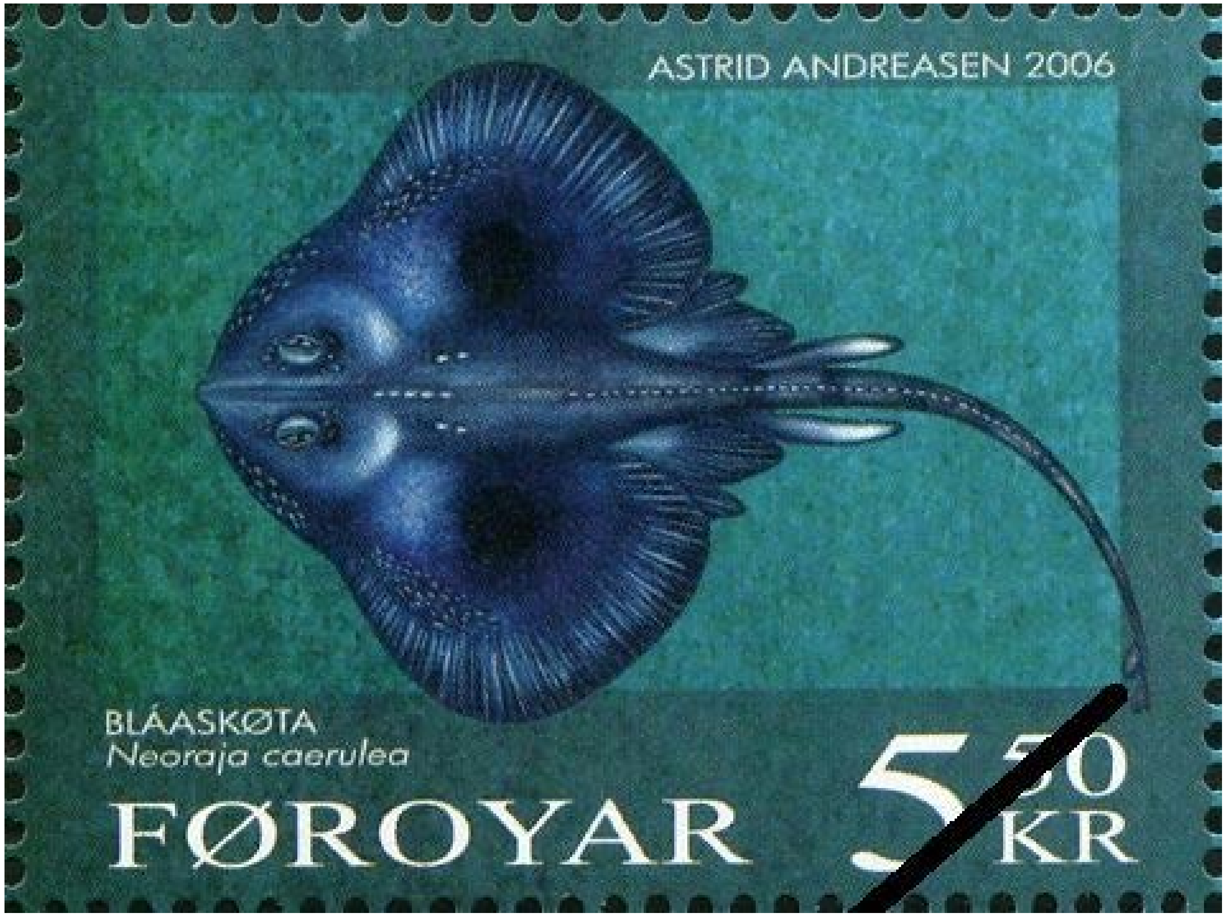
BSAI skate complex



Olav A. Ormseth
Alaska Fisheries Science Center
NPFMC Groundfish Plan Team meeting, November 2018

overview

1) responses to Plan Team & SSC comments
2) skate complex overview & status
3) spatial distribution: Alaska & big skate
4) incidental catches of skates
5) Alaska skate assessment
6) other skates assessment
7) harvest recommendations
8) alternative BMSY proxies for Alaska skate?

responses to comments

SSC 2016: "Re-evaluate the use of trawl survey data to apportion longline. The assessment uses trawl survey species composition to apportion Alaska skate from other skates caught in the longline fishery. Trawl species composition from a survey maybe quite different from species composition in the longline fishery. Speciation in the observer data has improved since the Ormseth and Matta (2007) paper referenced in the assessment. The author should compare the observer data from the longline fishery to the trawl survey catch to evaluate this assumption."

PT 2017: "The Team recommends that the author work with FMA and AKRO staff to investigate species composition."

PT 2017: "The Team requests that the author examine exploitation rates by species for the complex, in particular the endemic species in the Aleutian Islands (leopard and butterfly skates)."

Response: The assessment now uses observer data to estimate species composition of all BSAI skate catches, and the new estimates are used in the Alaska skate model and to estimate exploitation rates for all BSAI skate species.

responses to comments

PT 2018: "The Team recommends that, although this method appears to be a major improvement, the issue of how species composition may be affected by depth should be examined before the method is adopted. This could be addressed by a simple look at the observer data to see if depth-related differences in species composition exist. The November assessment should therefore include an examination of skate stratification by depth in the observer data."

SSC 2018: "The SSC agrees with the Team and recommends that, although this method appears to be an improvement, further investigation of how species composition is affected by depth should be examined before the method is adopted."

Response: Species composition of skates is highly stratified by depth, as described at length in the introductory section. Depth information is available for the observer data, but not for catch data from the CAS. The new method relies on identical stratification in both the observer and CAS datasets, so depth cannot be used as a stratum. NMFS statistical areas are largely depth-stratified and therefore serve as a reasonable proxy for depth. The majority (> 90%) of skate catches occur in the catcher-processor (CP) sector, which has 100% observer coverage. As a result area-specific species composition from the observer data is consistently matched with are-specific catch estimates. In addition because there are species composition data from every haul there is actually no need for stratification beyond harvest sector and gear type, although the CP data were stratified by area to provide the highest spatial resolution.

responses to comments

Response continued: In the catcher vessel (CV) sector, because observer coverage is partial there is often a mismatch between area availability of species composition versus catch data (i.e. there is often catch data for an area with no corresponding species composition data). In the original analysis this problem was solved by not using area stratification and accepting a certain amount of error in the result (see Appendix 2). After discussions at the September Plan Team meeting, this decision was revisited and a solution was found by creating larger geographical strata for both datasets by aggregating statistical areas. Aggregations were based on similarity in depth and correspondence with observed skate distributions. This allowed complete matching between the datasets with a couple of minor exceptions. The result is improved, albeit only slightly different, estimates of skate species composition.

responses to comments

PT 2016: "Investigate appropriate Bmsy proxies for skates and relate the values to current harvest recommendations, for example, most elasmobranchs have Bmsy >= B50%, less productive species have been documented to have Bmsy=B79%. The BSAI skate species are likely between these two extremes."

Response: Alternative reference points for Alaska skate were explored using "proj". Results were not included in this report but will be presented to the Plan Team in November for discussion.

PT 2016: "Examine the utility of including IPHC and AFSC longline survey indices in both Model 14.2 and the random effects model for the Tier 5 species."

Response: Data from these surveys are limited to the EBS slope and Aleutian Islands, and depths greater than 200 m. In addition, species composition in the AFSC longline survey is only available starting in 2009 and Bering, Aleutian, and Alaska skate (3 of the most important species) are still reported in aggregate. Due to these limitations the surveys were not considered to be useful for inclusion in either the Stock Synthesis or RE modeling efforts. However, data from the AFSC longline survey has been included in the Tier 5 assessment section to provide additional information regarding trends in skate abundance.

responses to comments

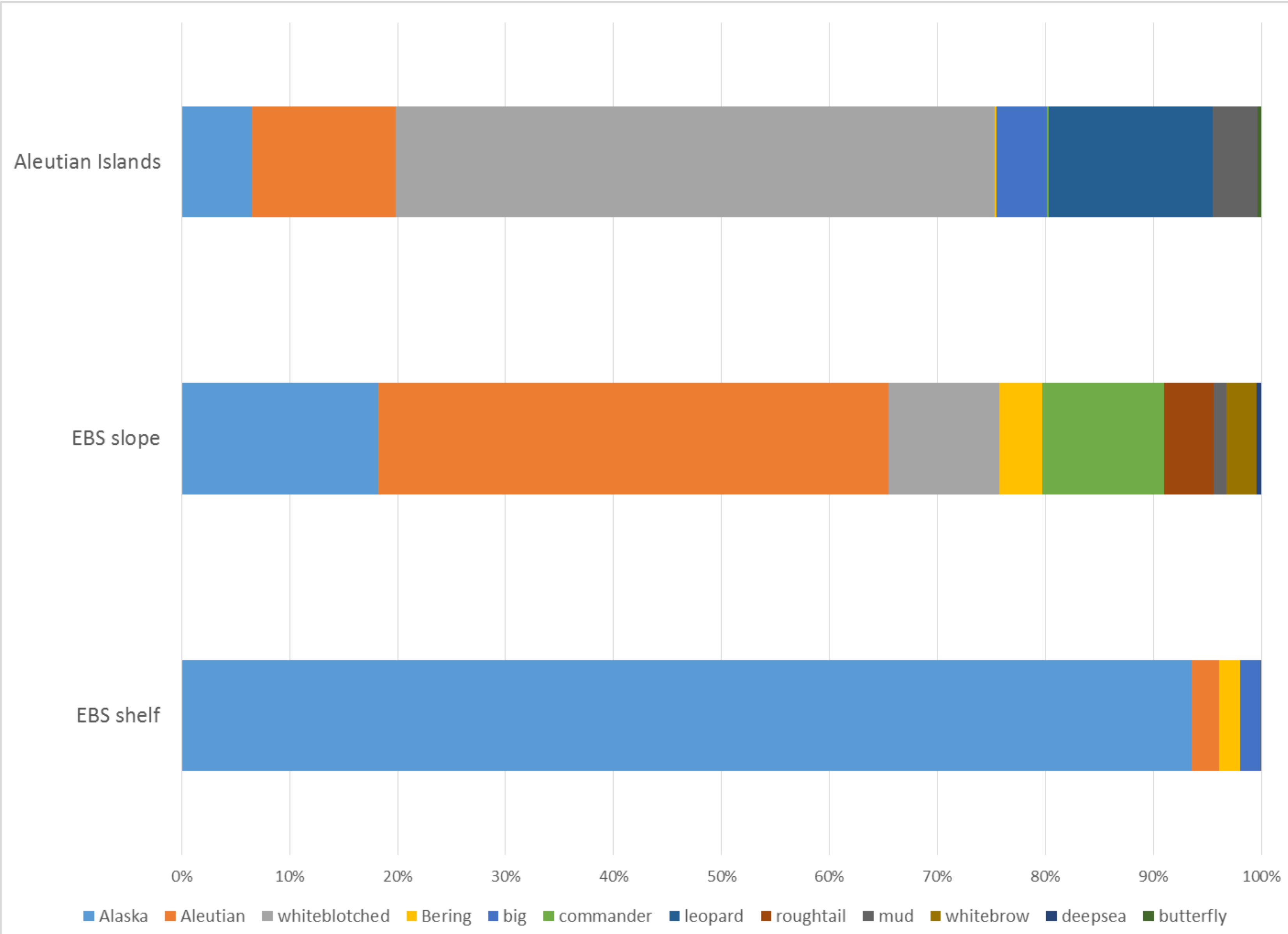
PT 2016: "Expand on appendix 2 of the SAFE document by reconciling more explicitly the differences between the results of the 2013 and 2014 assessments with respect to the substantial decreases in FOFL and 2015 spawning biomass and the substantial increase in 2015 OFL."

Response: This analysis was not completed in time for inclusion in this report.

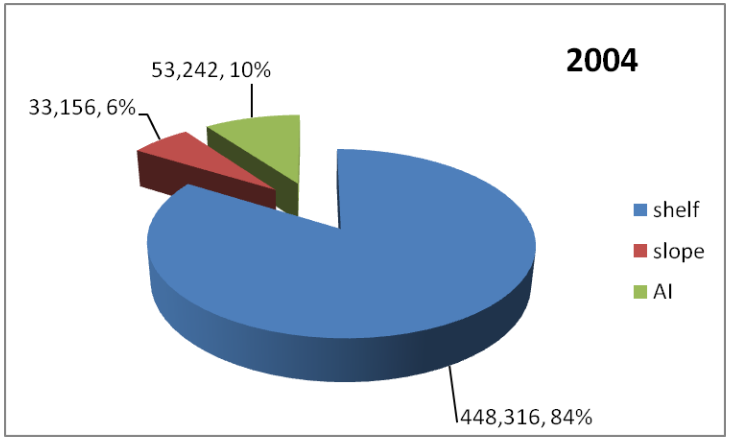
SSC 2016: "The assessment should incorporate relevant information pertaining to the relationship between water temperature and recruitment. Development time for some skate species is influenced by water temperature (i.e., warmer water results in shorter development periods). This may functionally affect recruitment trends and variability."

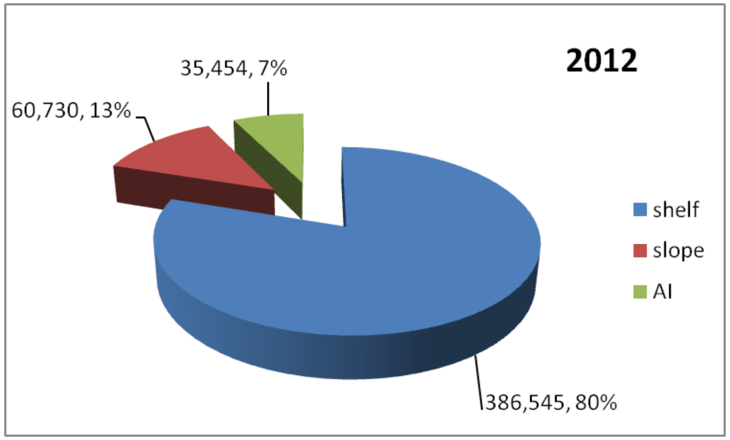
Response: Previous versions of this report have discussed this issue, particularly in regard to embryo development time and the potential for temperature-driven changes in development time to influence apparent year-class size (i.e. embryos deposited in different years may, as a result of different growth rates, emerge from eggcases at the same time). At this time however there is no realistic way to incorporate this possible effect into the Alaska skate assessment model. In addition, recruitment in the model is not linked to spawning biomass (i.e. it considers only deviations from an average level of recruitment).

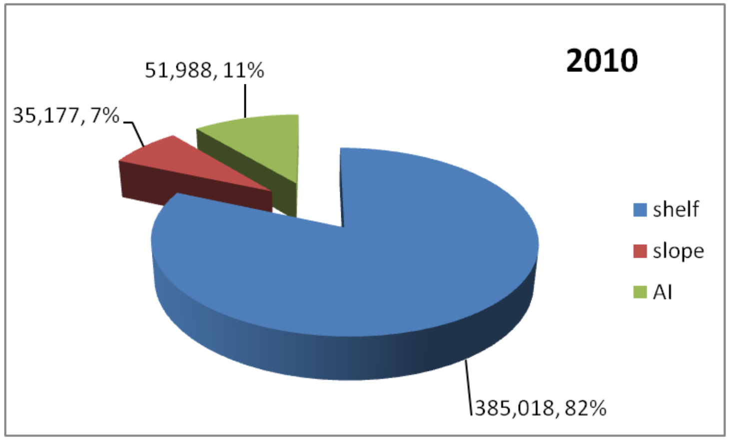
BSAI species composition

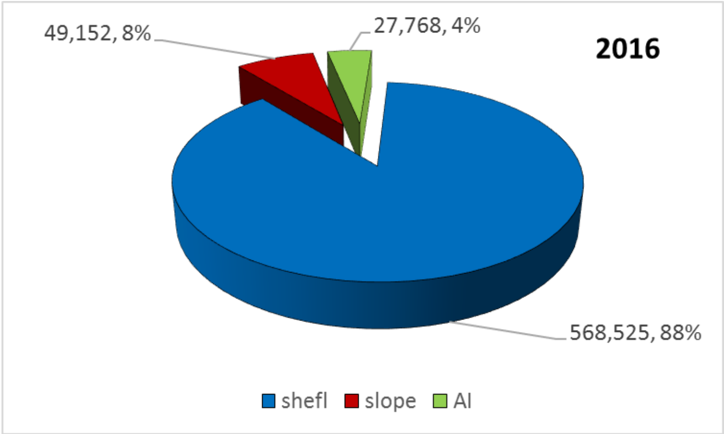


BSAI biomass distribution

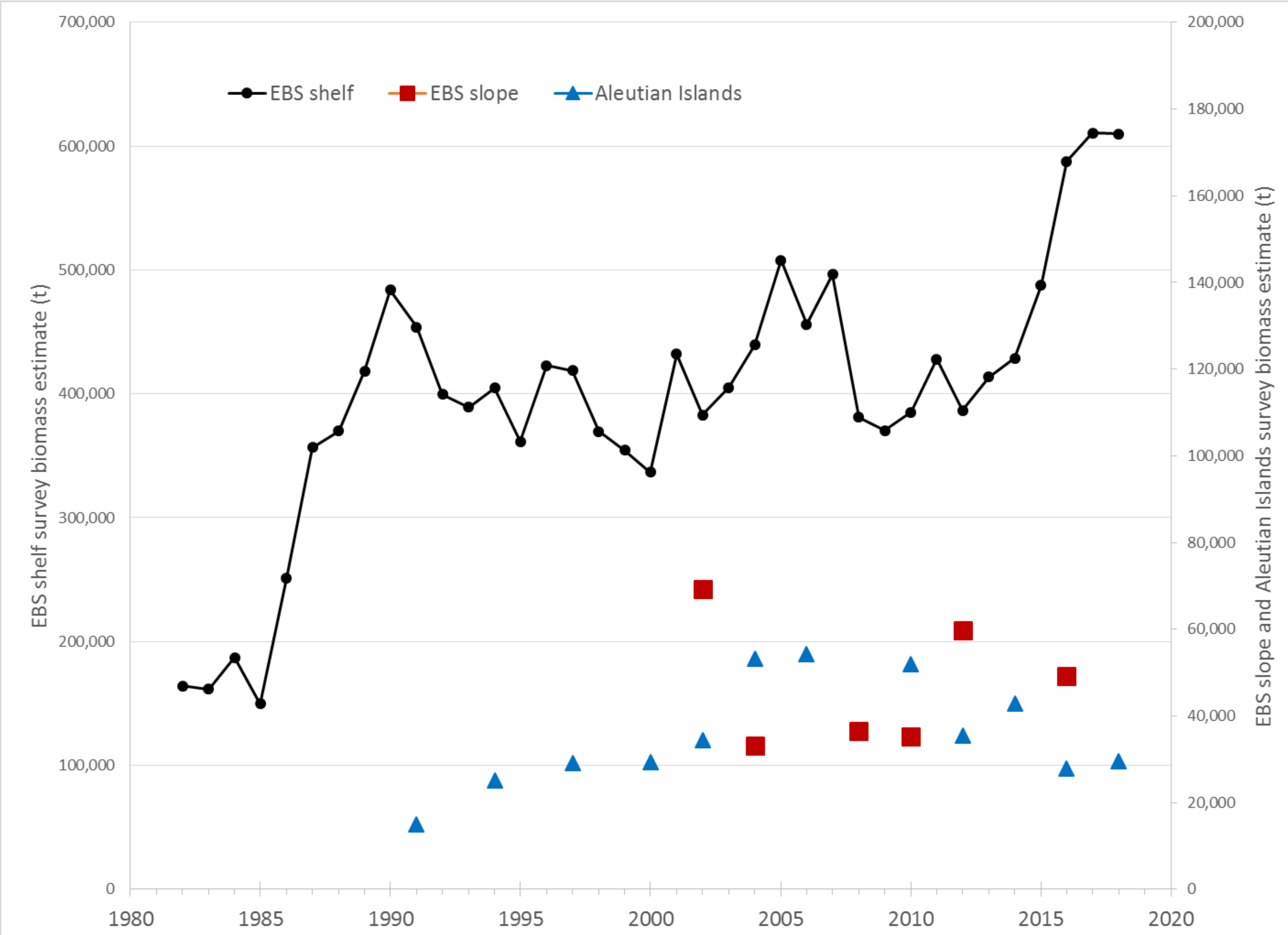






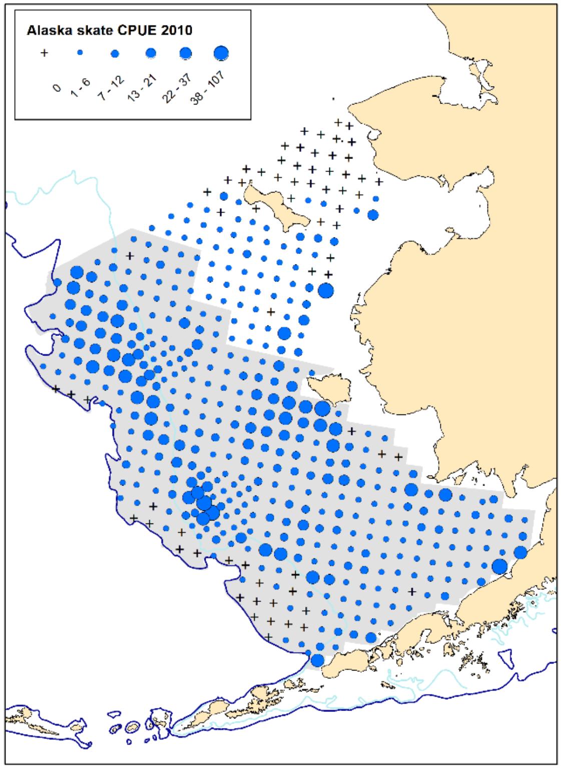


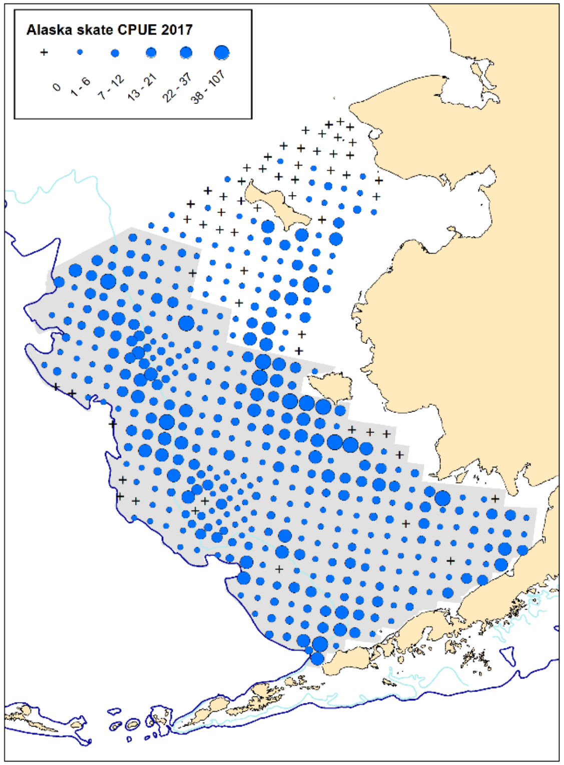
skate complex biomass – trawl surveys

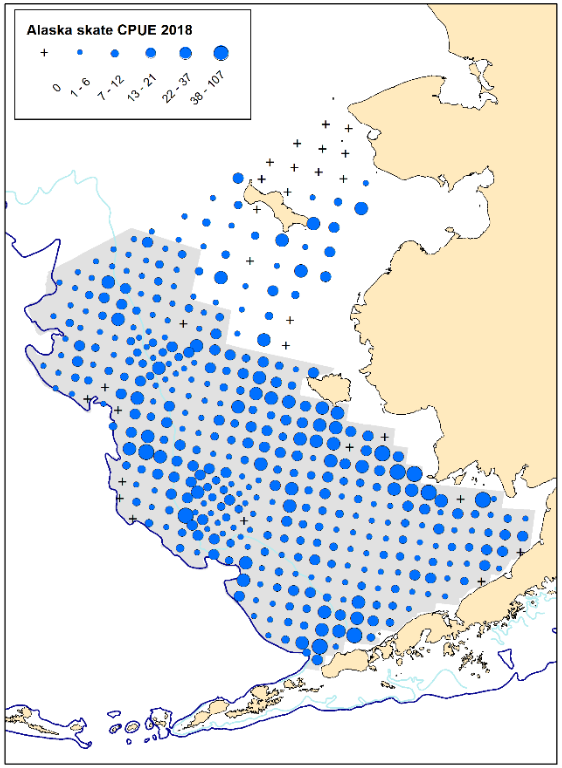


skate complex abundance – AFSC longline survey

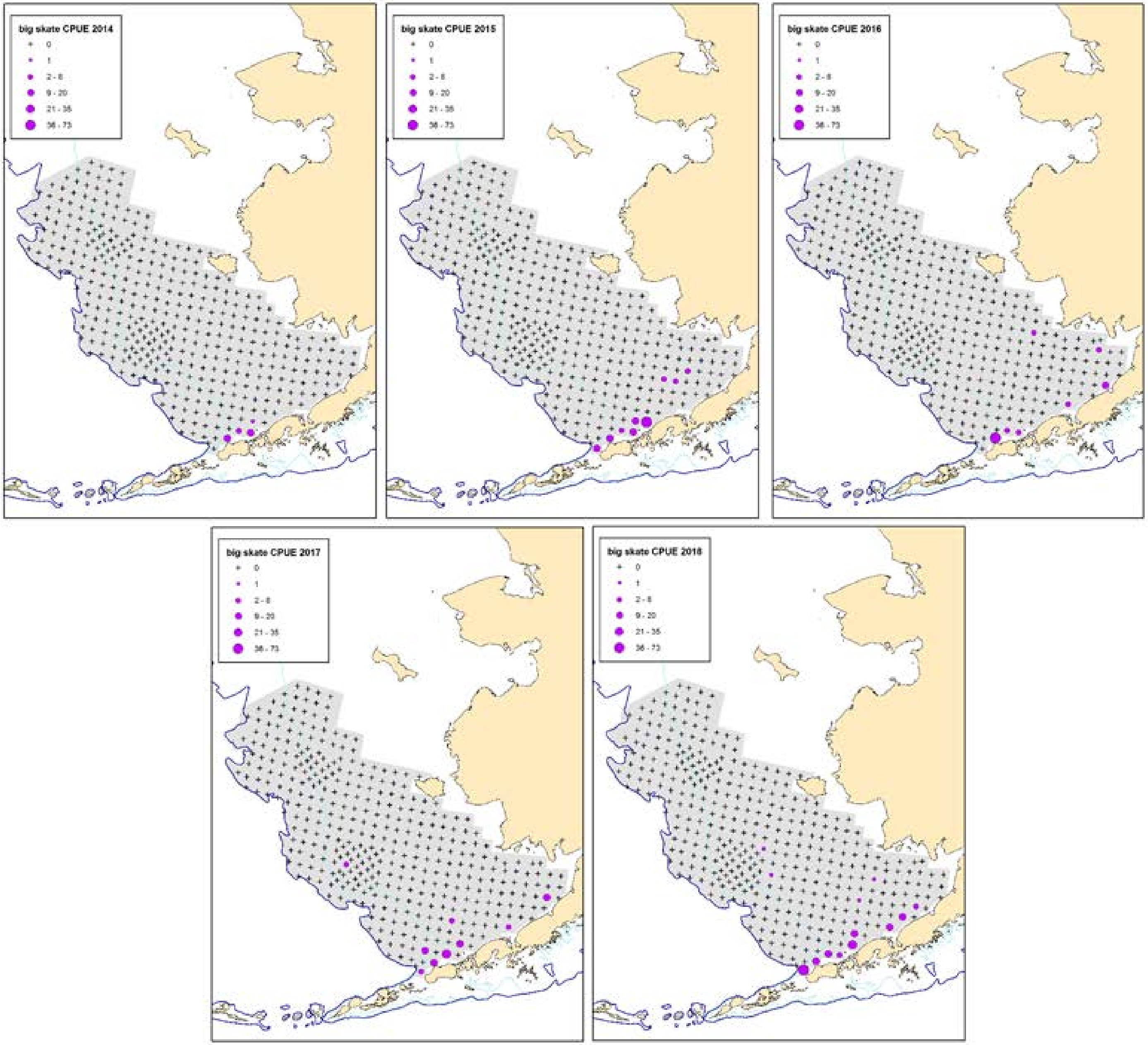
Alaska skate EBS/NBS distribution



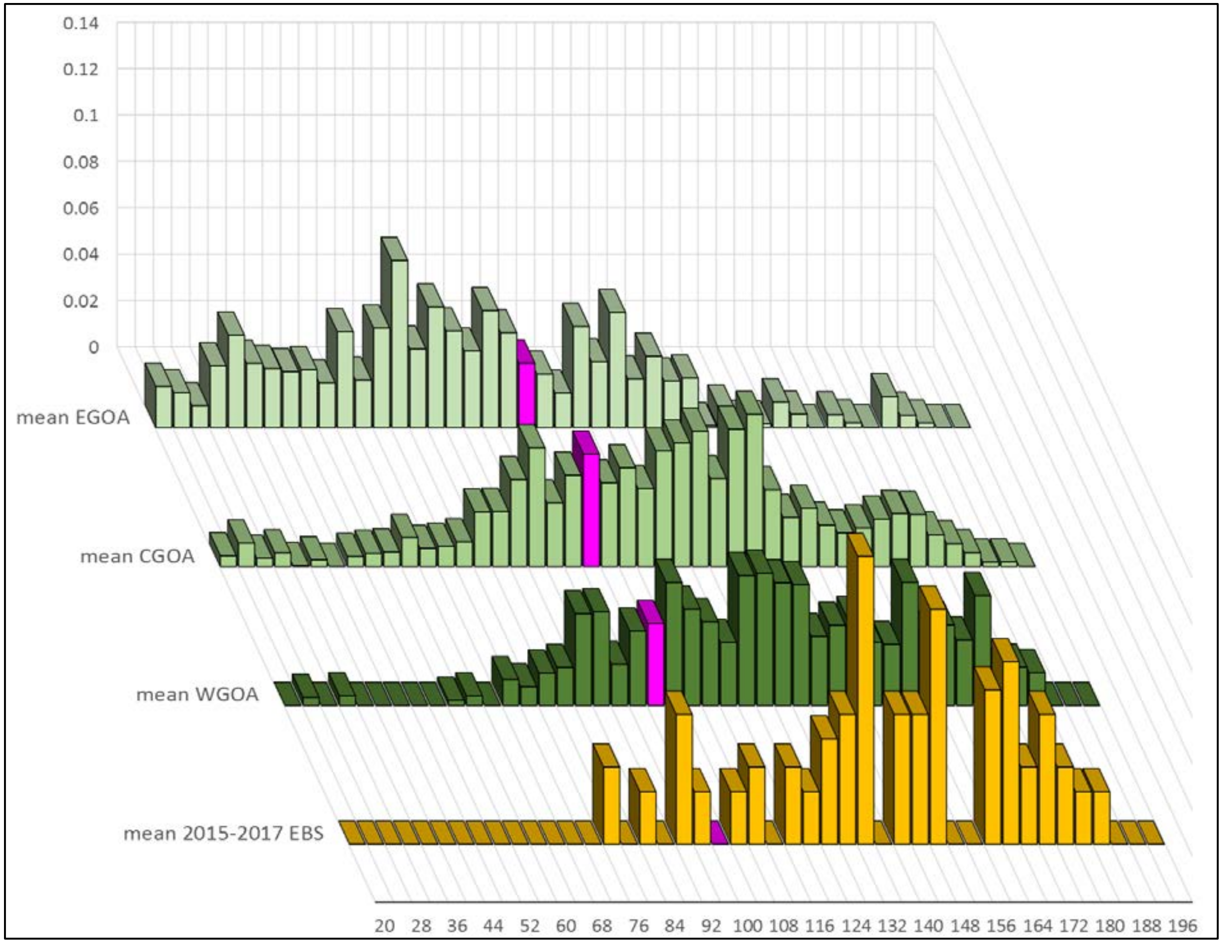




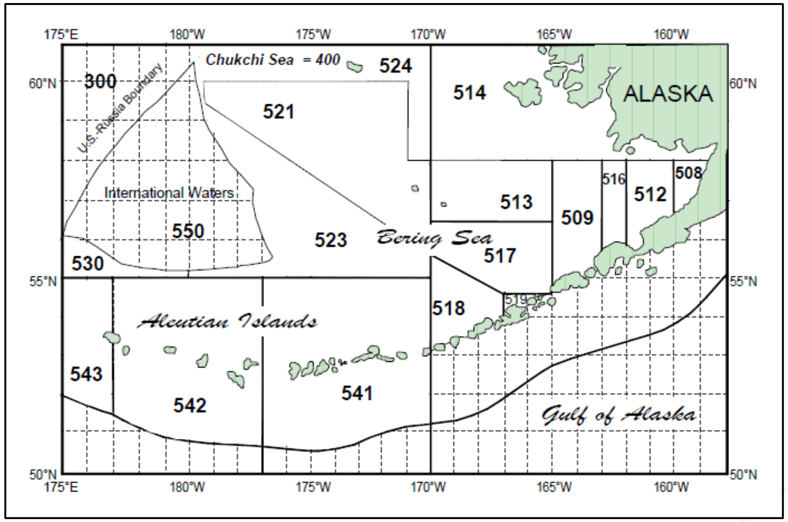
movement of big skate into SEBS

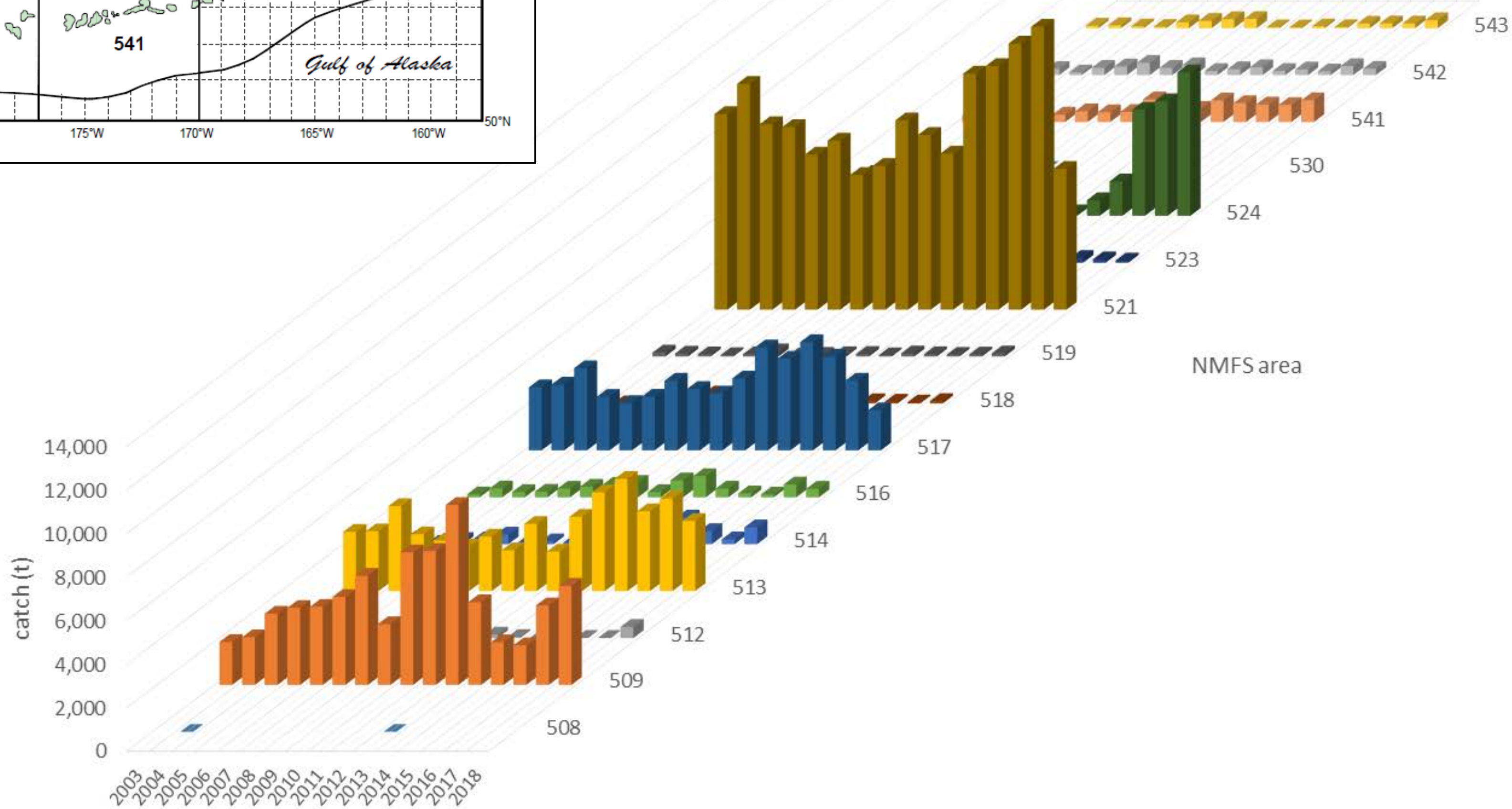


movement of big skate into SEBS

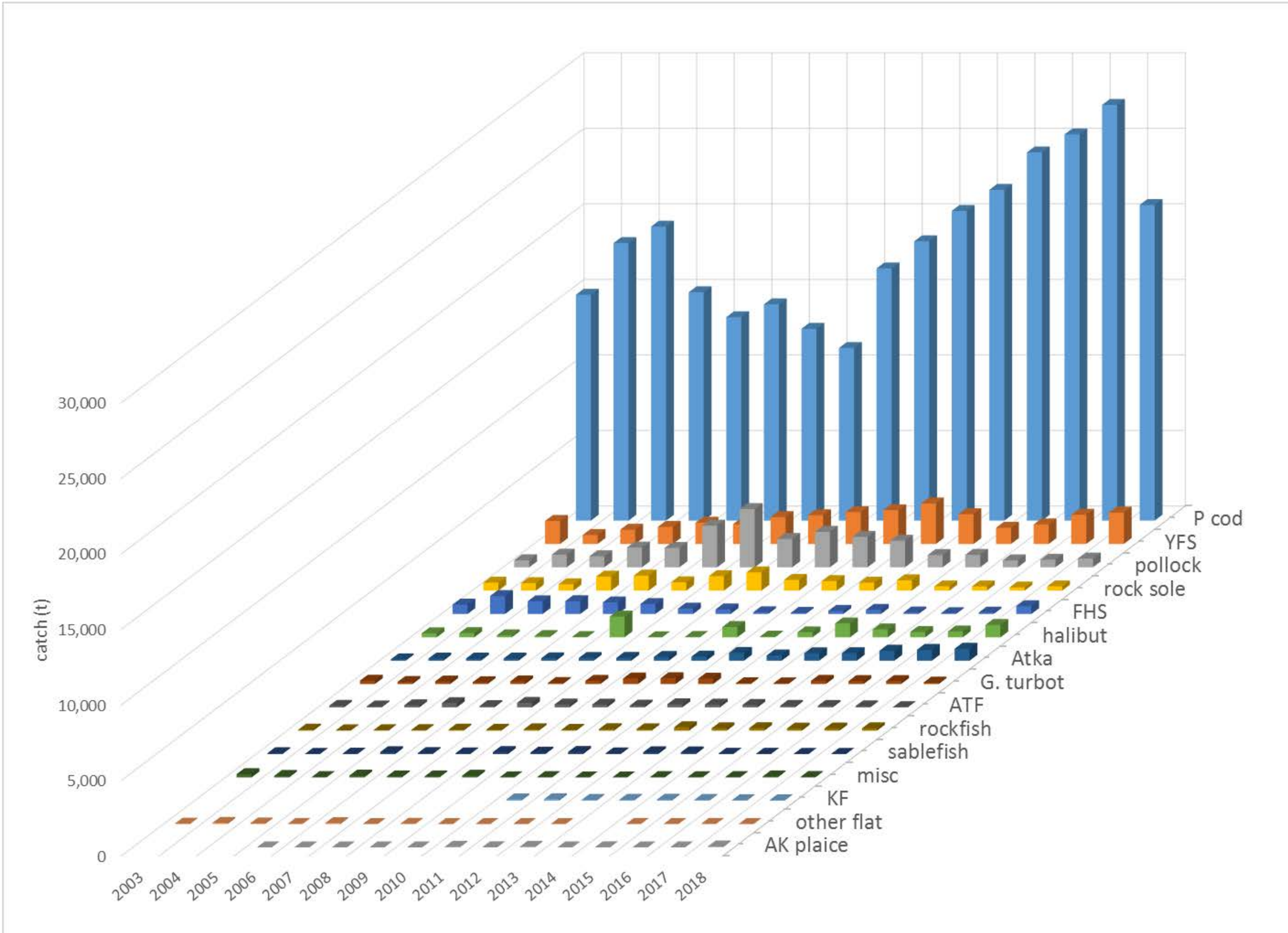


BSAI skate catch - by area

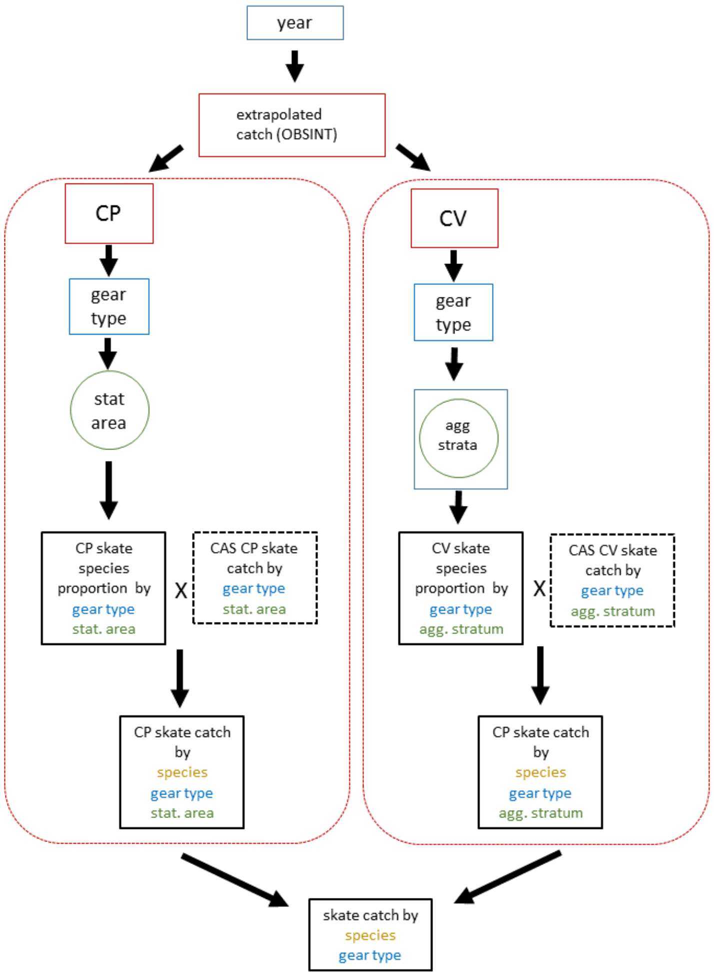


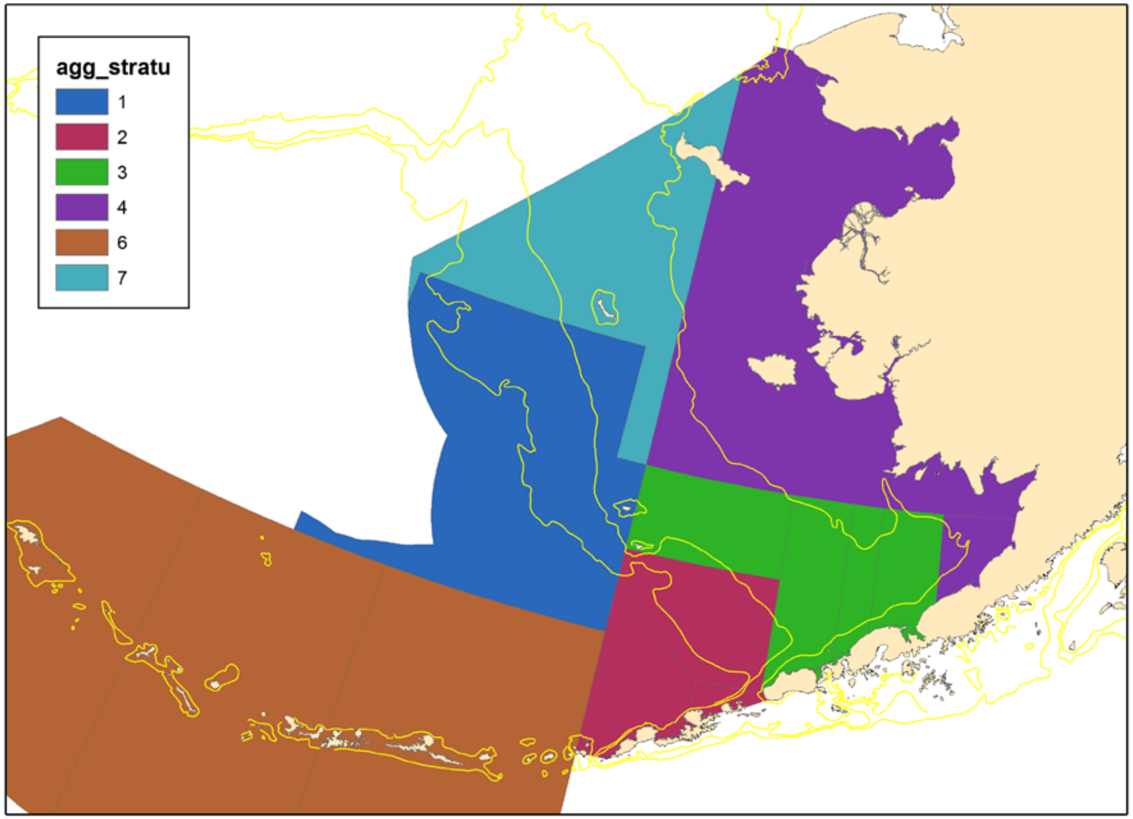


BSAI skate catch - by target fishery



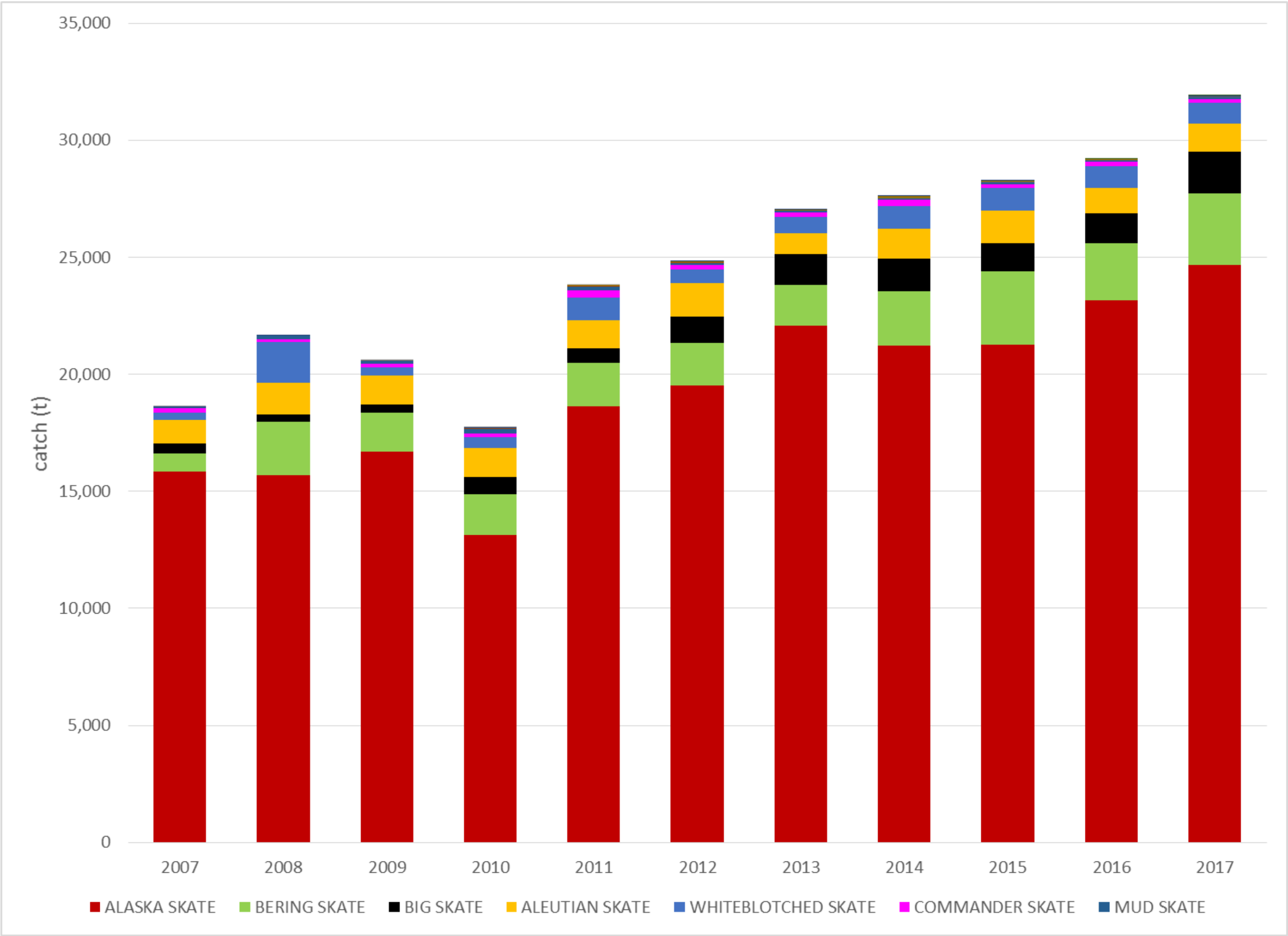
revised skate composition analysis

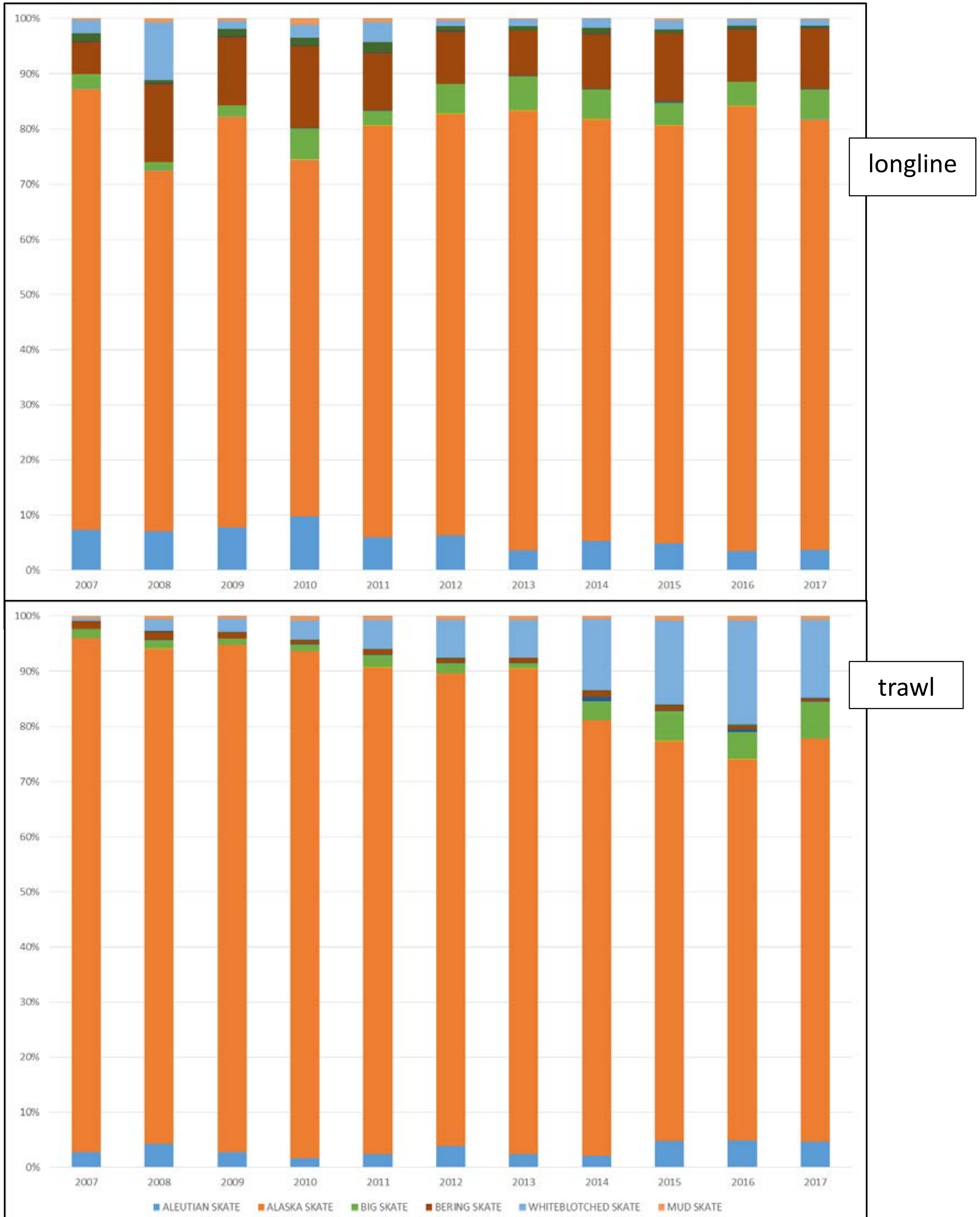




- CP has 100% coverage, CV partial
- CV catch 4.3% of total, 2013-2017
- aggregated strata used for CV

BSAI skate catch – species composition

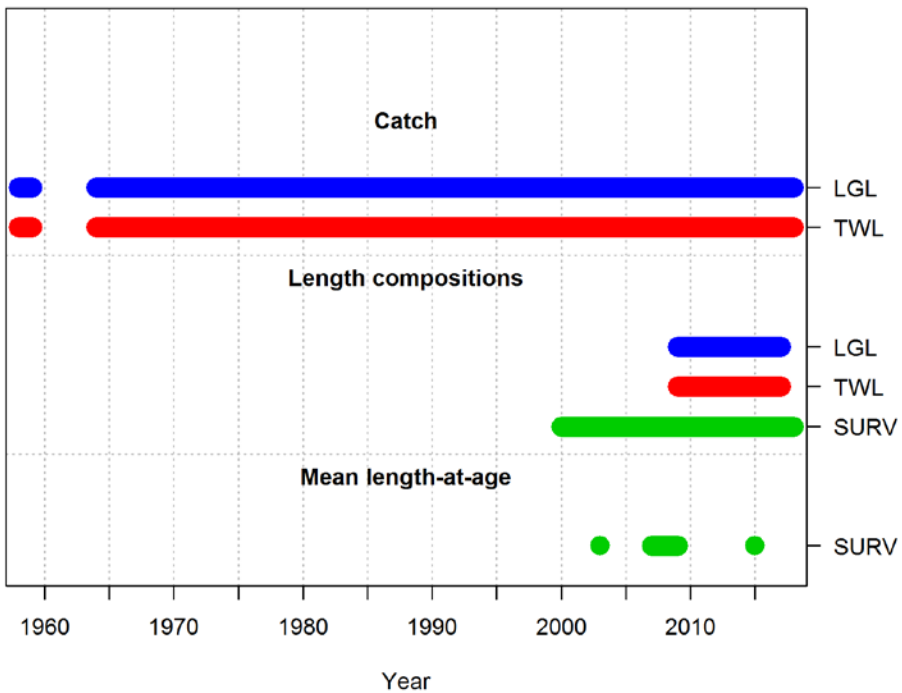




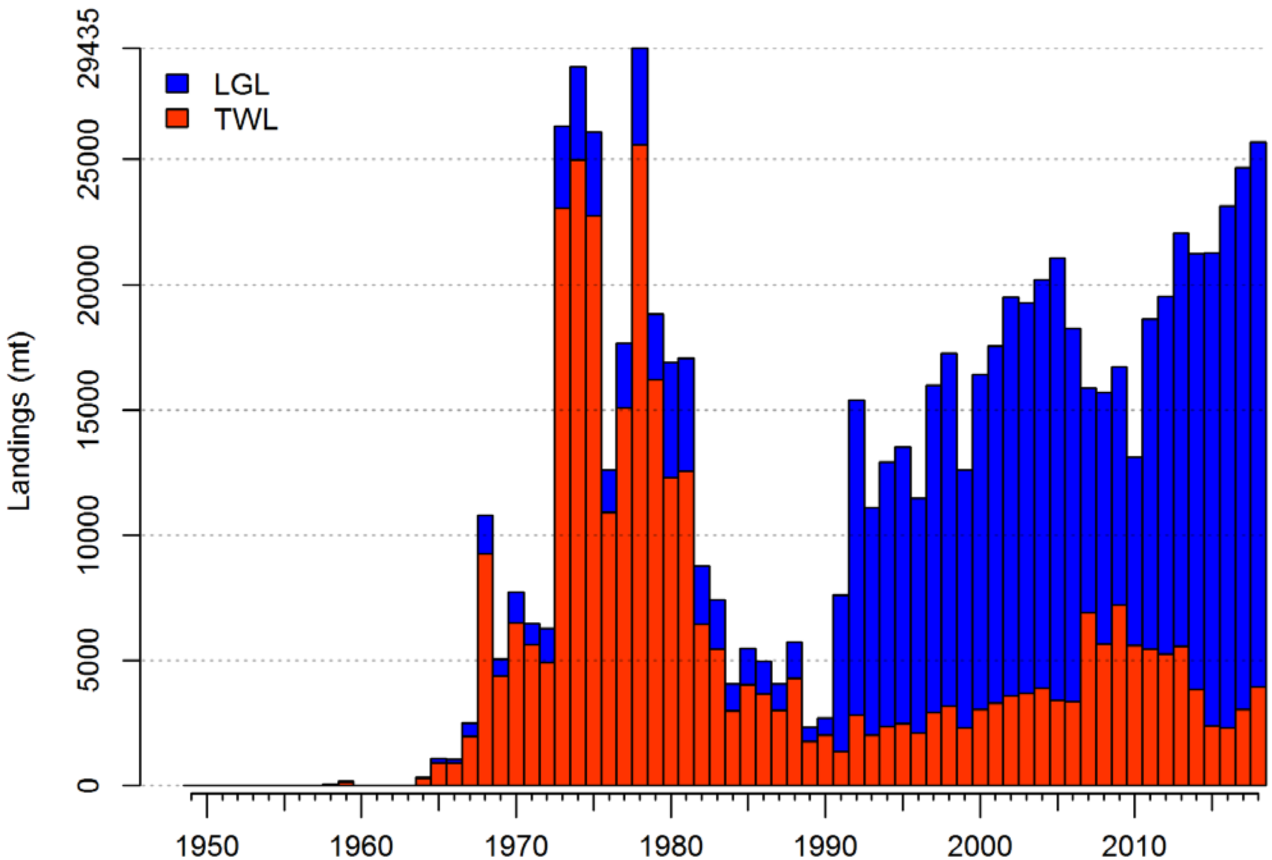
<u>BSAI skate catch</u>
species composition

Alaska skate assessment

- same model as in 2016 (14.2), no alternative models
- uses Stock Synthesis 3.23
- begins in 1950; most data begin 1999
- devs from average recruitment (*h* fixed at 1)
- fixed par: *M*, L/W, $L_{50\%}$, σR, *q*
- double-normal selectivity
- no age comps; age-length 2003, 2007-2009, 2015



Alaska skate assessment - catch



- 2 fisheries (longline & trawl)
- 1954-1996: derived from “Other Species” catch
- 1997-2006: skate-specific catch, survey species composition
- 2007-2018: skate-specific catch, observer species composition

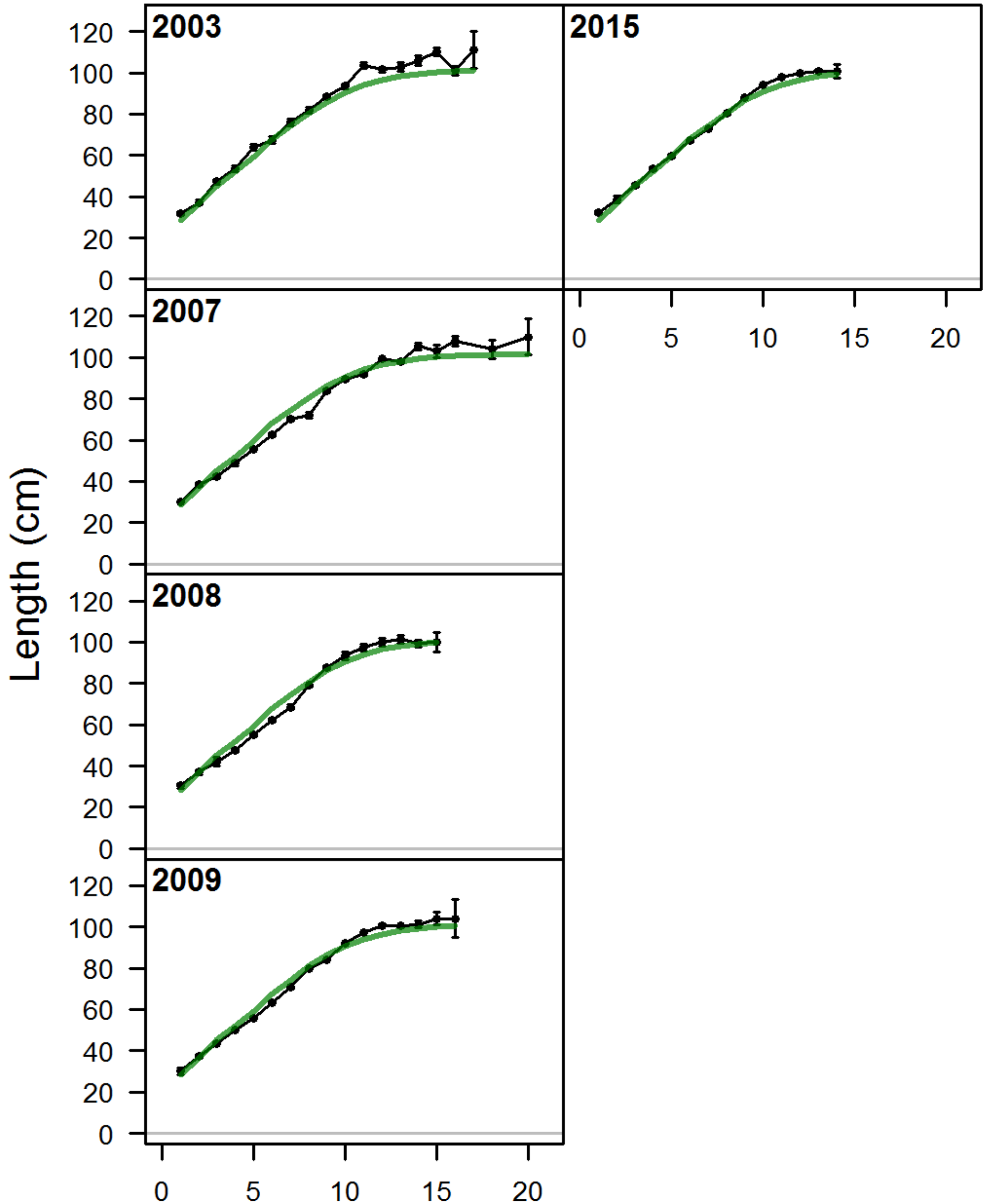
AK skate assessment

- results very similar to 2016 run
- fits not quite as good, mainly due to worse survey fit
- model estimates dome-shaped selectivity for survey and both fleets

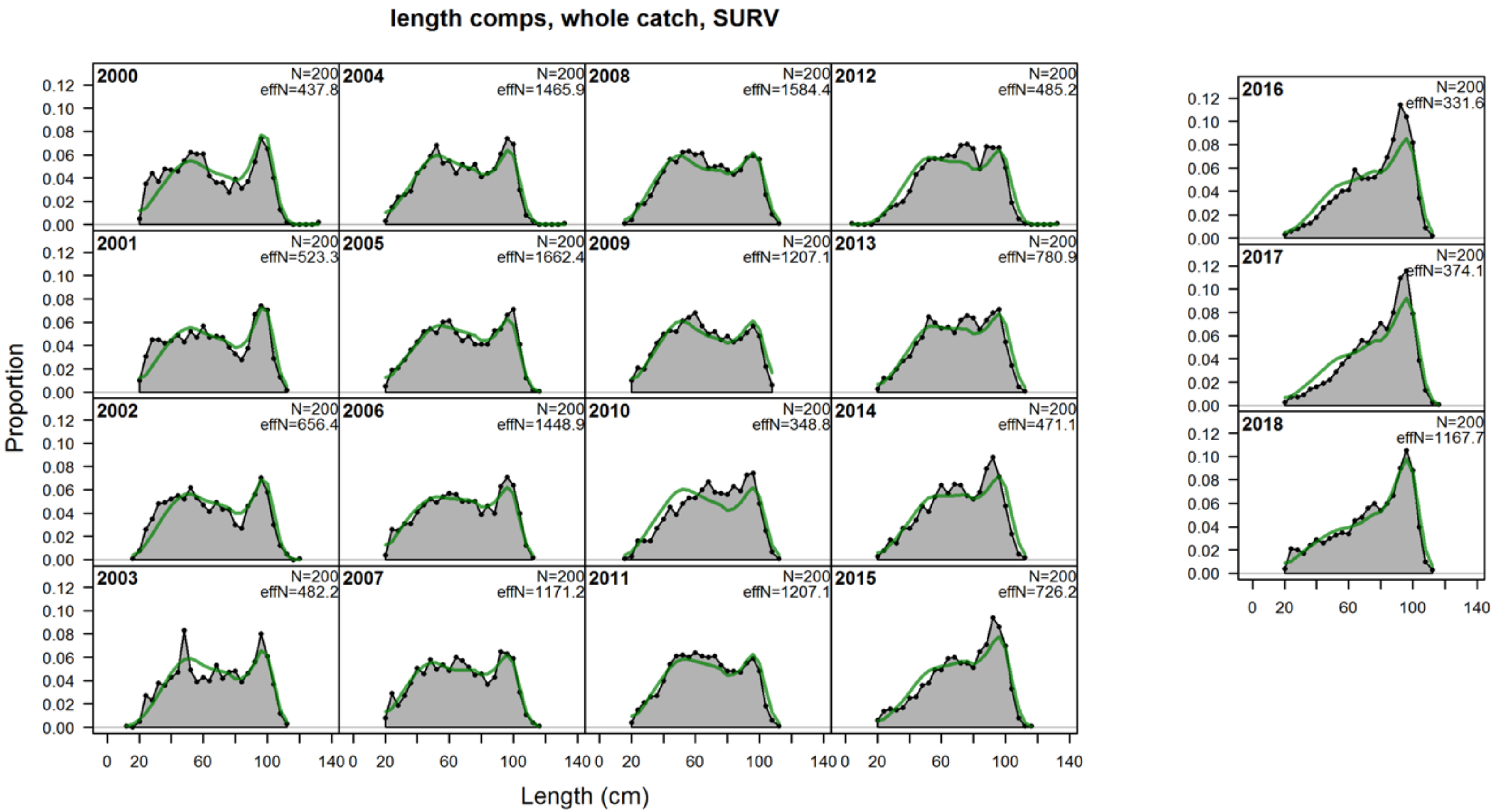
model number	*14.2*	14.2
Description	*2016 run*	**2018 run**
likelihood components		
survey	*-13.9165*	-7.56
length comps	*100.518*	117.81
LAA	*156.543*	158.94
recruitment	*-41.0821*	-42.35
total	*202.087*	226.86
# of parameters estimated	*91*	94
ln (Rzero)	*10.12*	10.11
CV	*0.004*	0.037
unfished spawning biomass_	*334,622*	331,810
CV	*0.043*	0.040
unfished recruitment	*24,738*	24,585
CV	*0.040*	0.037
RMSE_survey	*0.141*	0.147
% within survey CI	*70.6%*	63.9%
correlation obs-pred	*0.764*	0.761
mean longline input N	*77.3*	77.8
mean longline eff N	*1000.4*	884.2
mean longline effN/N	*12.94*	11.54
mean trawl input N	*54.7*	53.8
mean trawl eff N	*705.4*	896.9
mean trawl effN/N	*12.89*	17.00
mean survey input N	*200.0*	200.0
mean survey eff N	*887.6*	870.1
mean survey effN/N	*4.44*	4.35
mean LAA N	*223.8*	223.8
mean LAA eff N	*2976.2*	3035.3
mean LAA eff N/N	*13.30*	14.32

AK skate model fits –

length at age

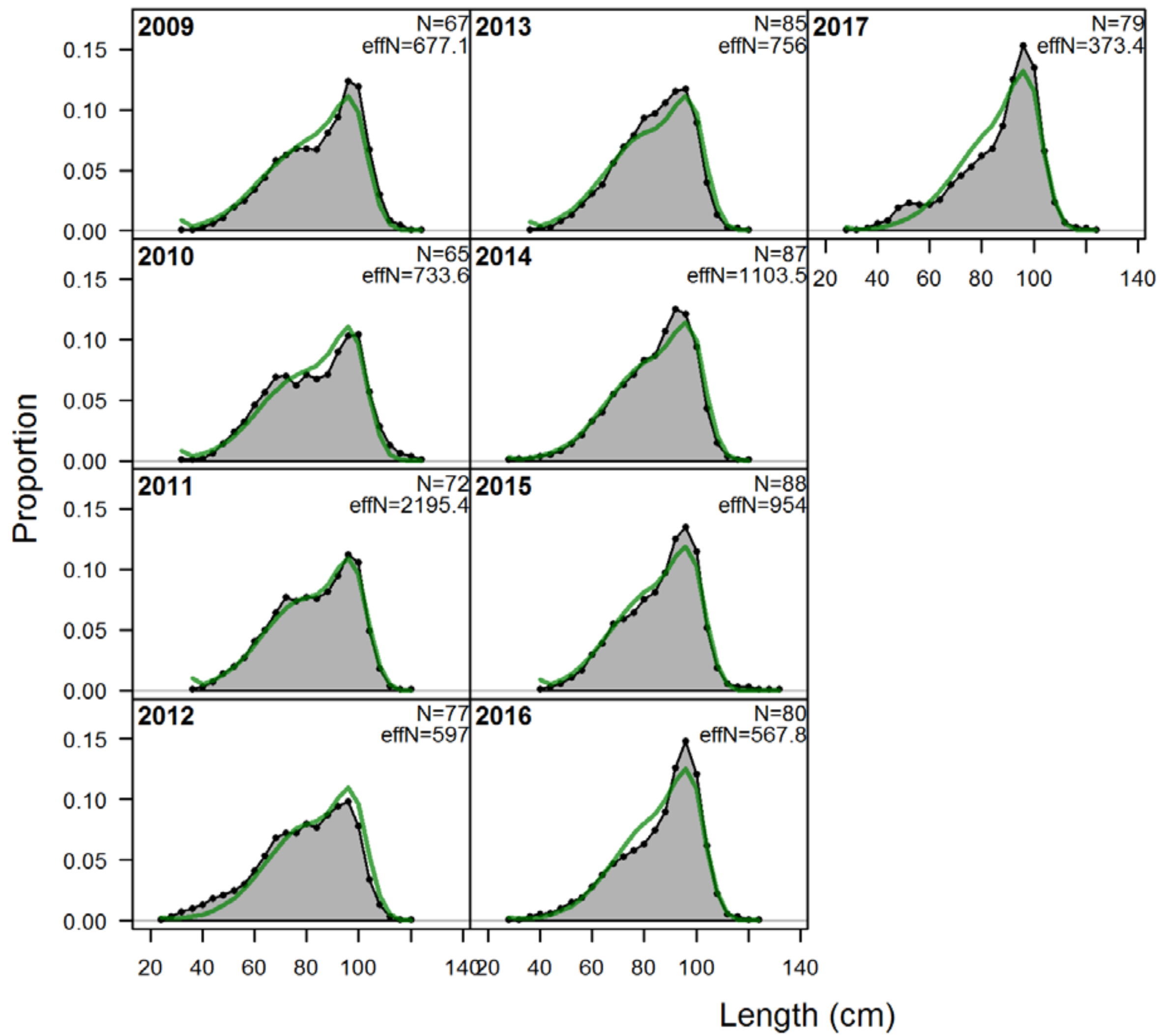


AK skate model fits – survey length comp

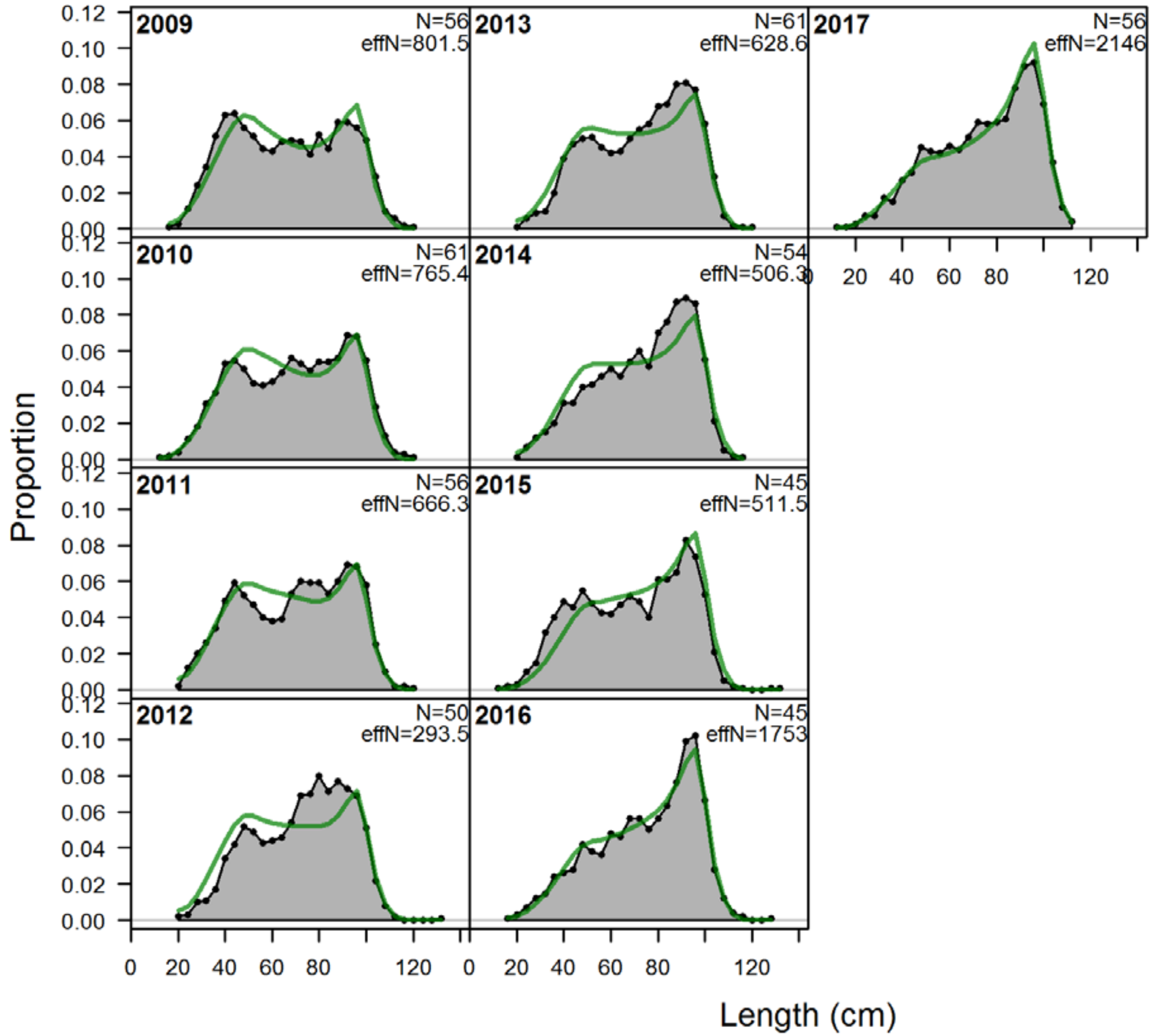


- model has trouble fitting largest mode…except in 2018

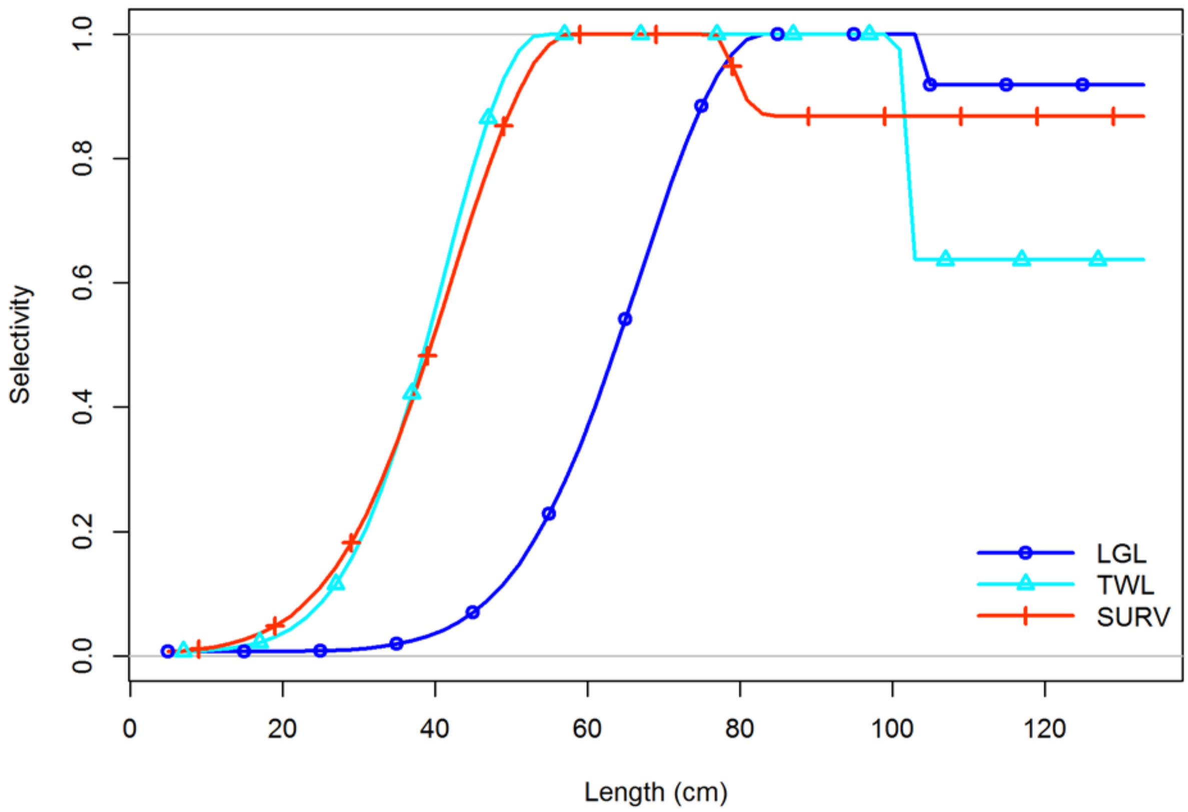
AK skate model fits – LL length comp



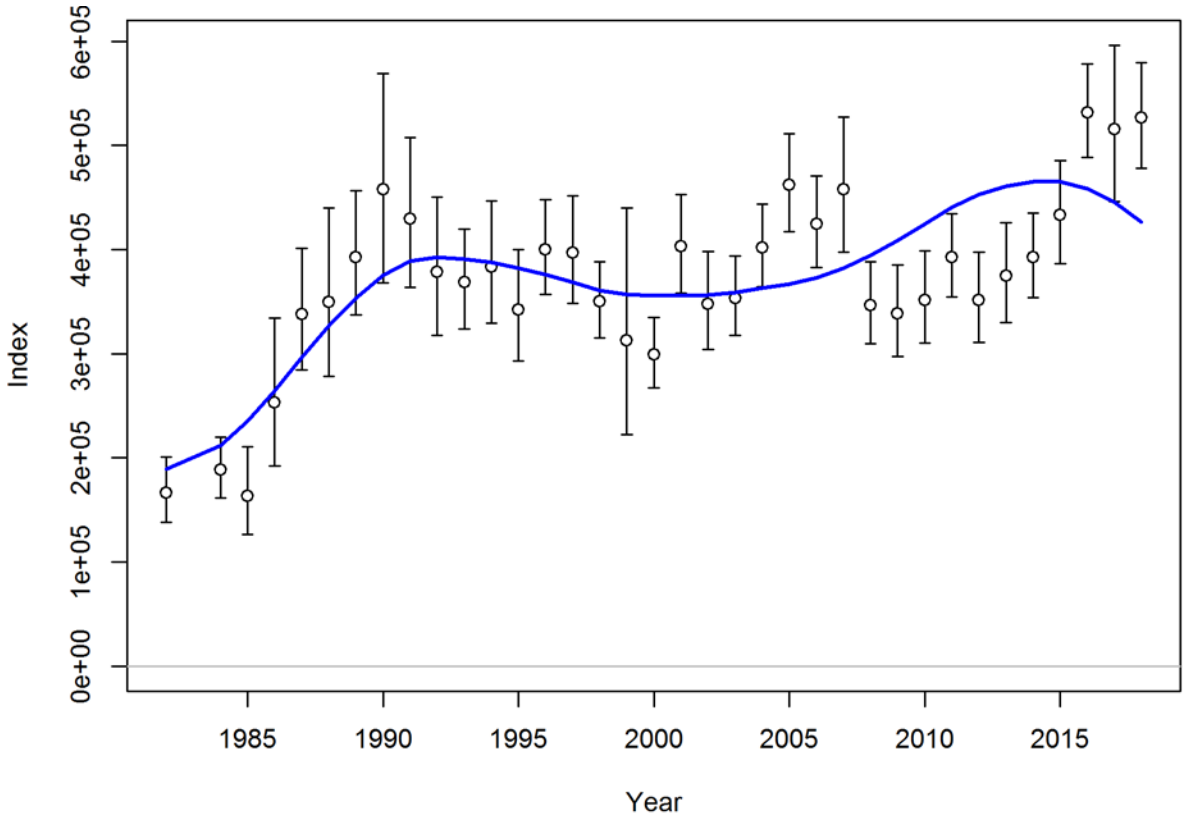
AK skate model fits – trawl length comp



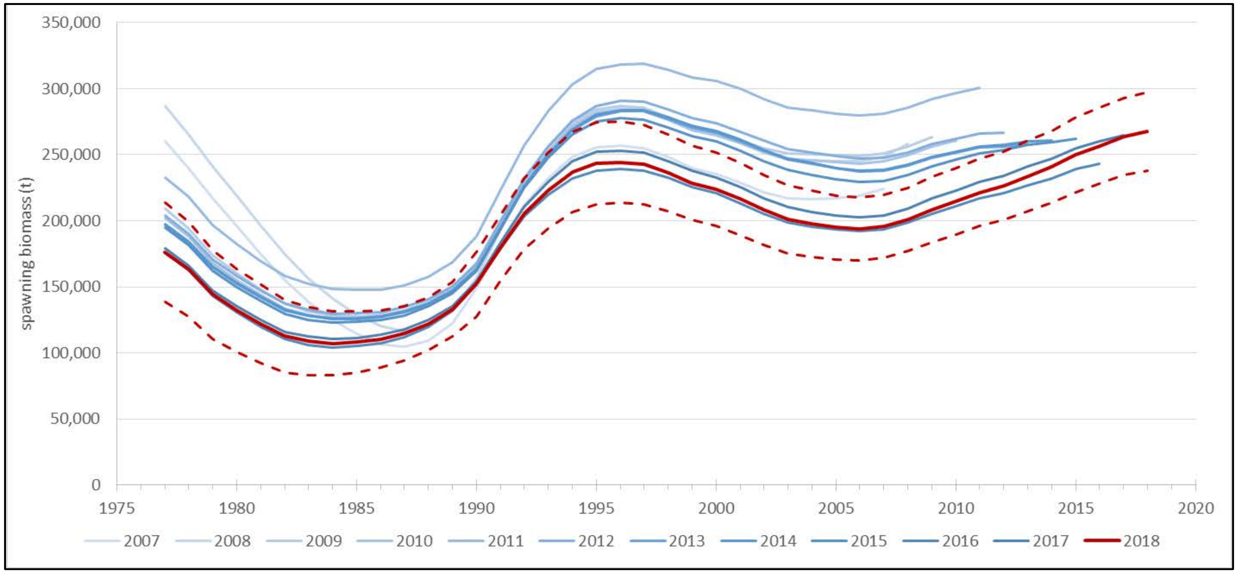
AK skate model - selectivity

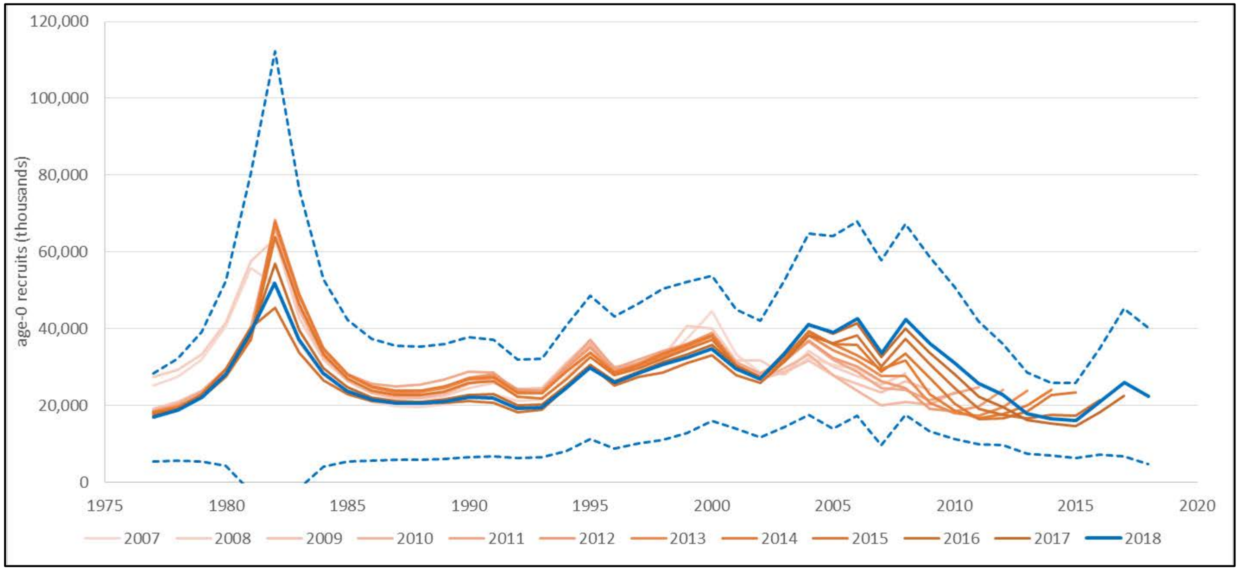


AK skate model fits – survey biomass



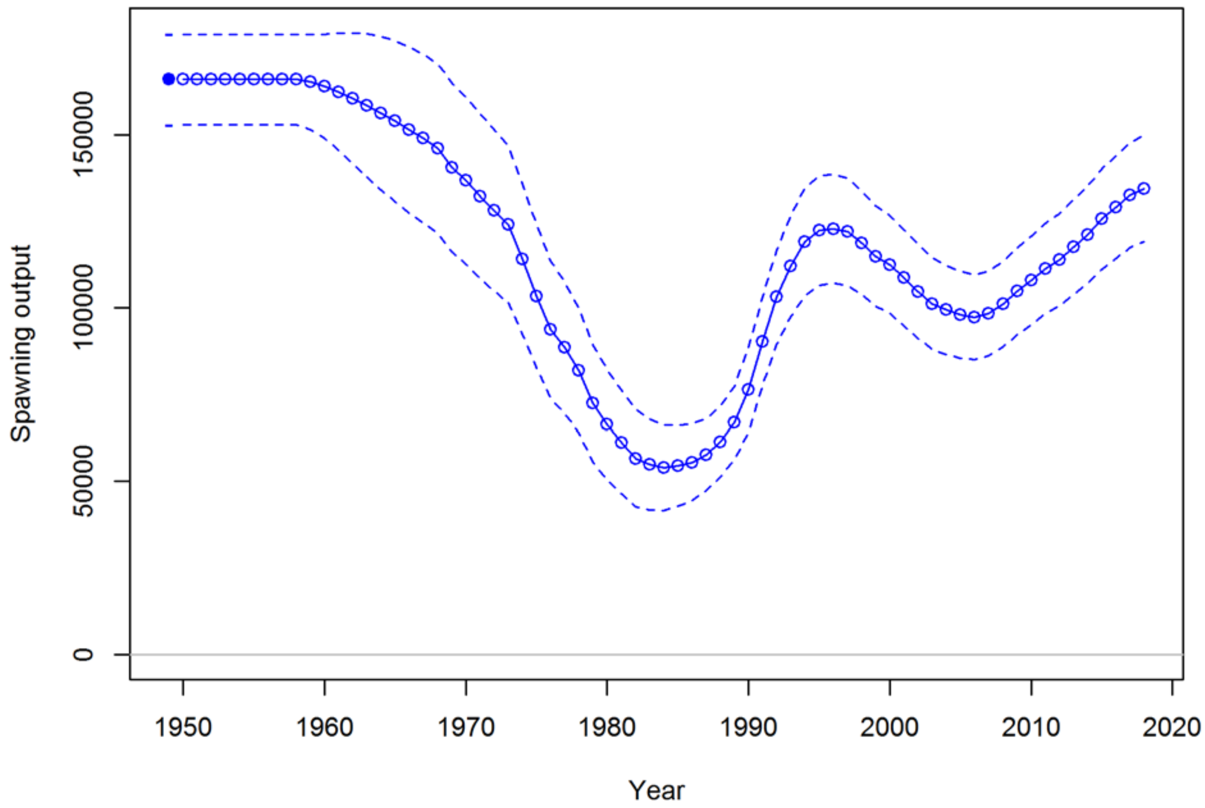
AK skate model retrospective analysis



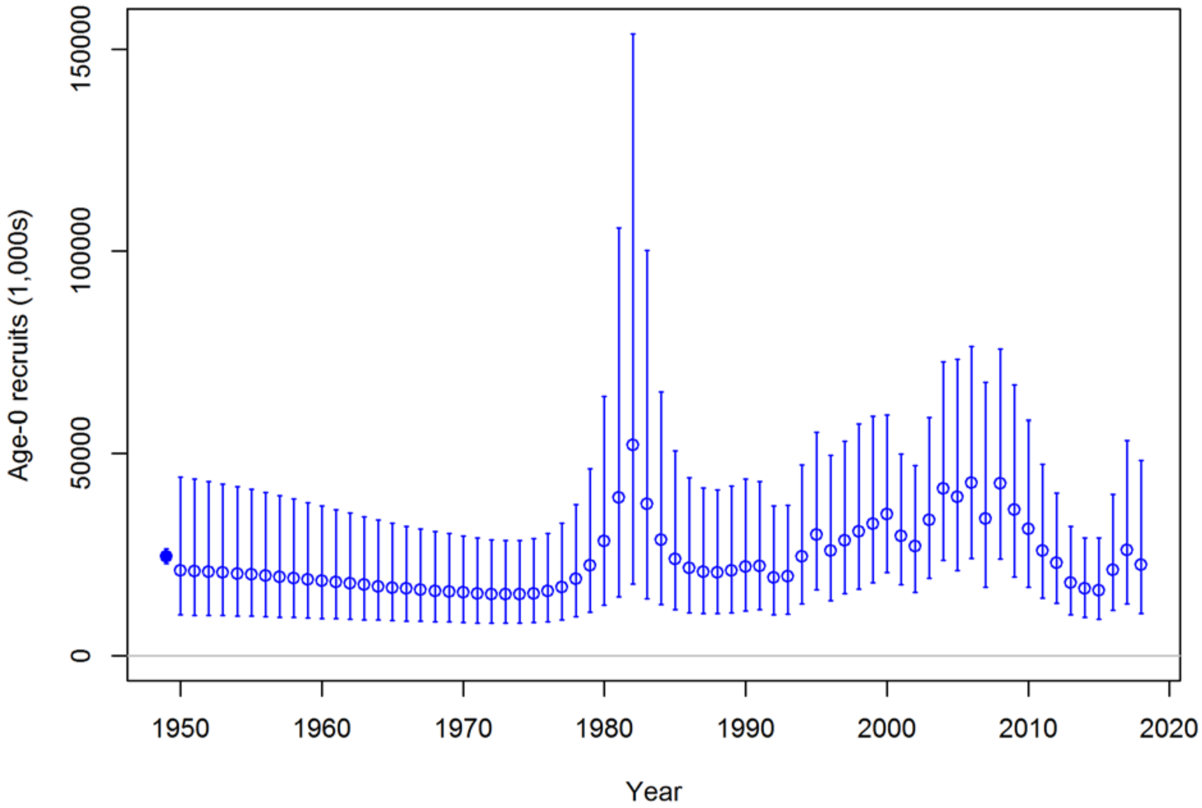


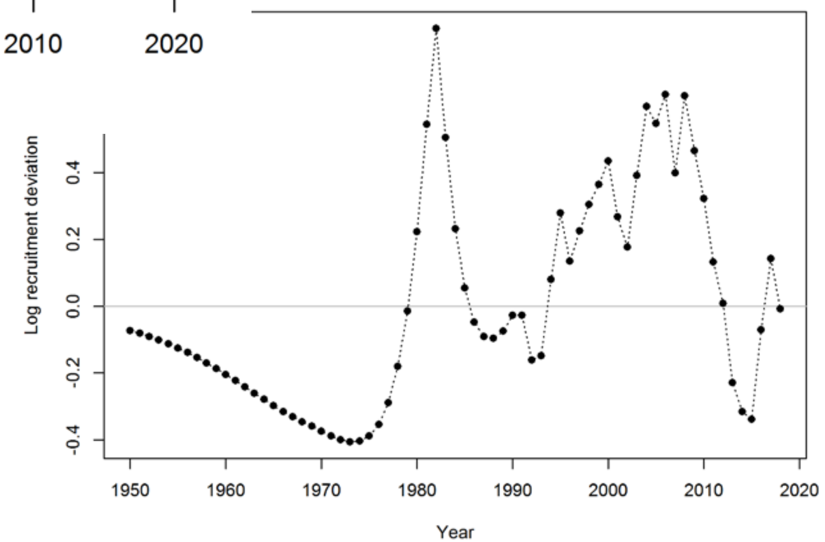
	ρ rev Mohn	ρ Woods Hole	RMSE
spawning biomass	0.148	0.197	0.176
recruitment	0.060	0.038	0.197

AKSK model results – spawning biomass

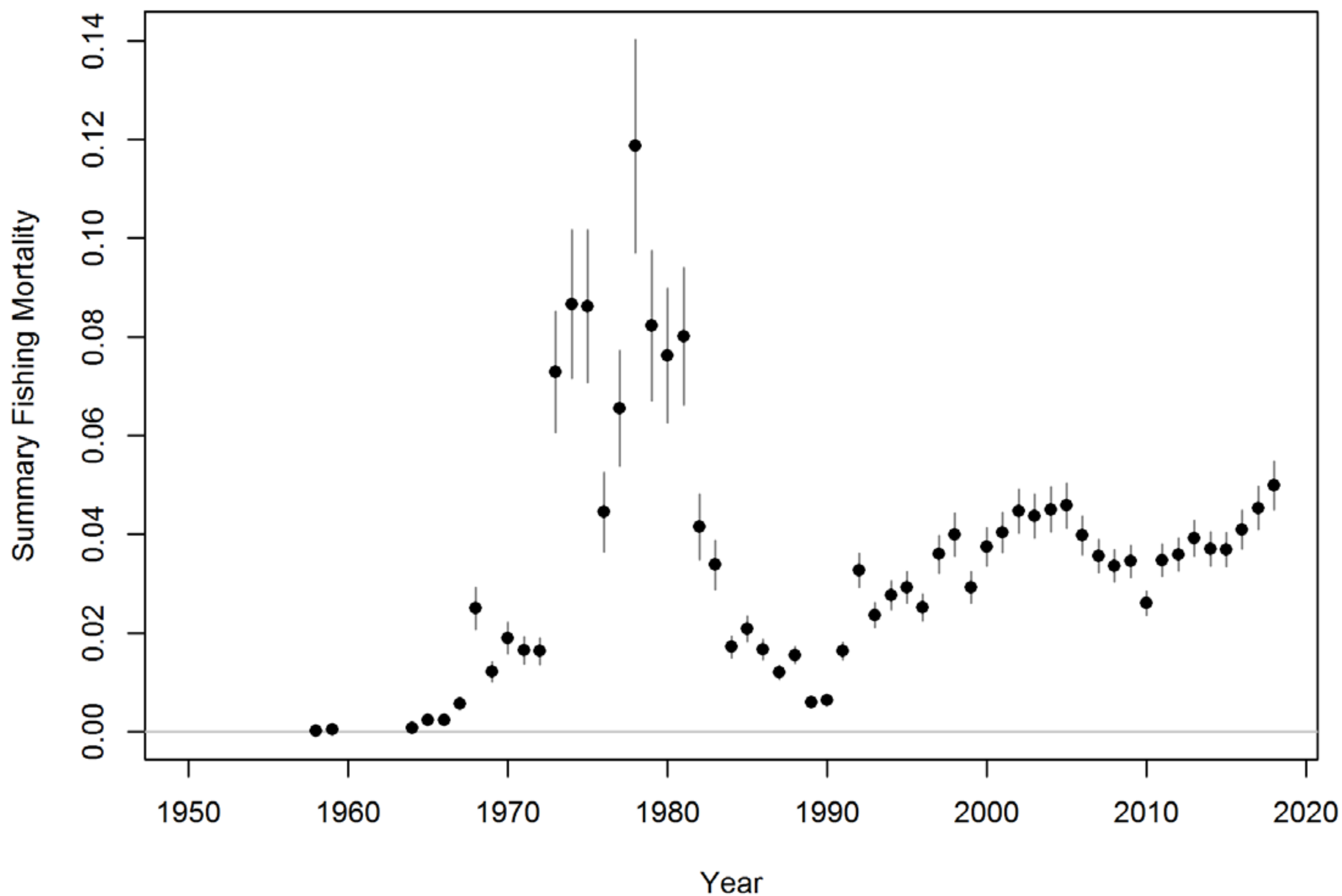


AKSK model results - recruitment

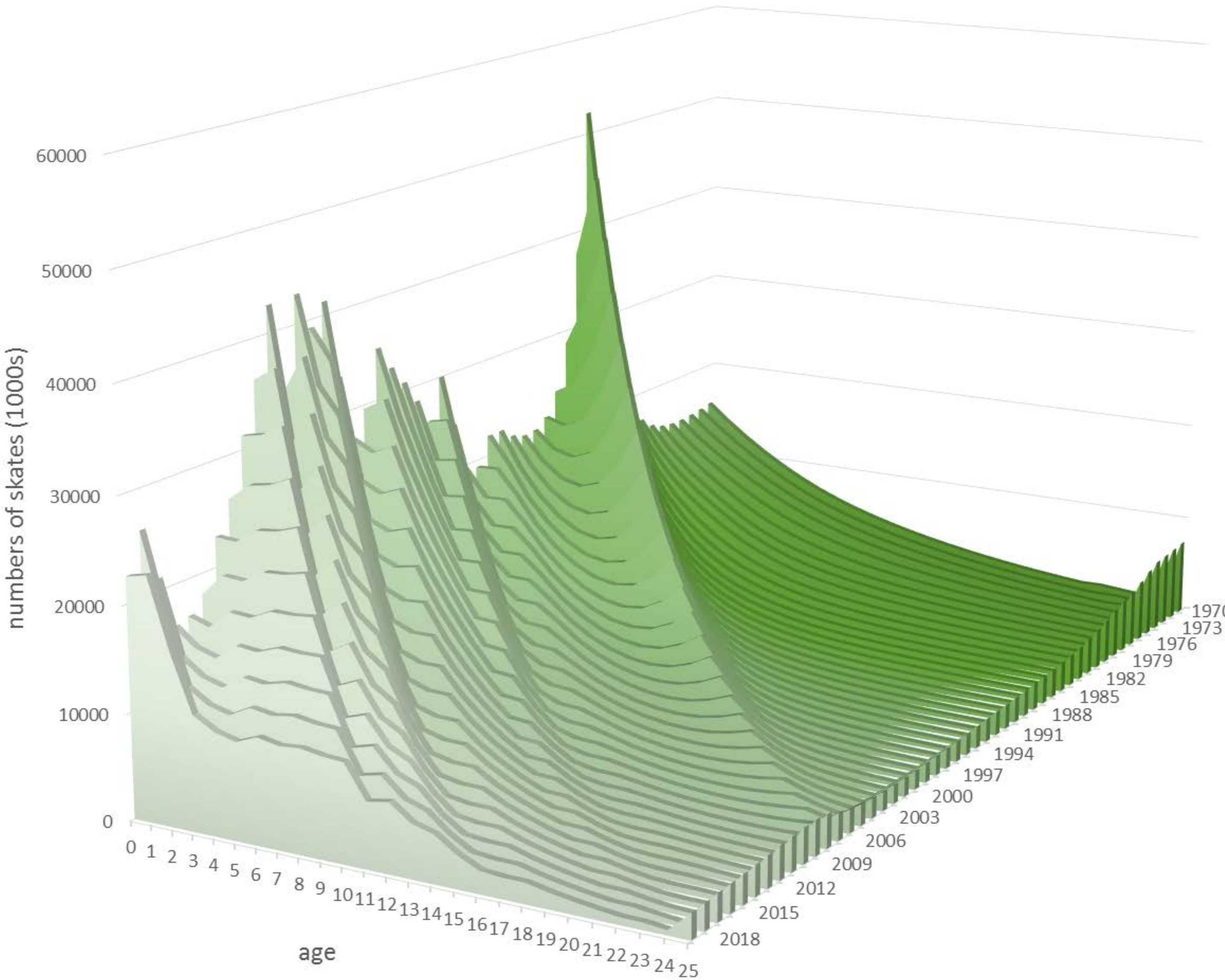




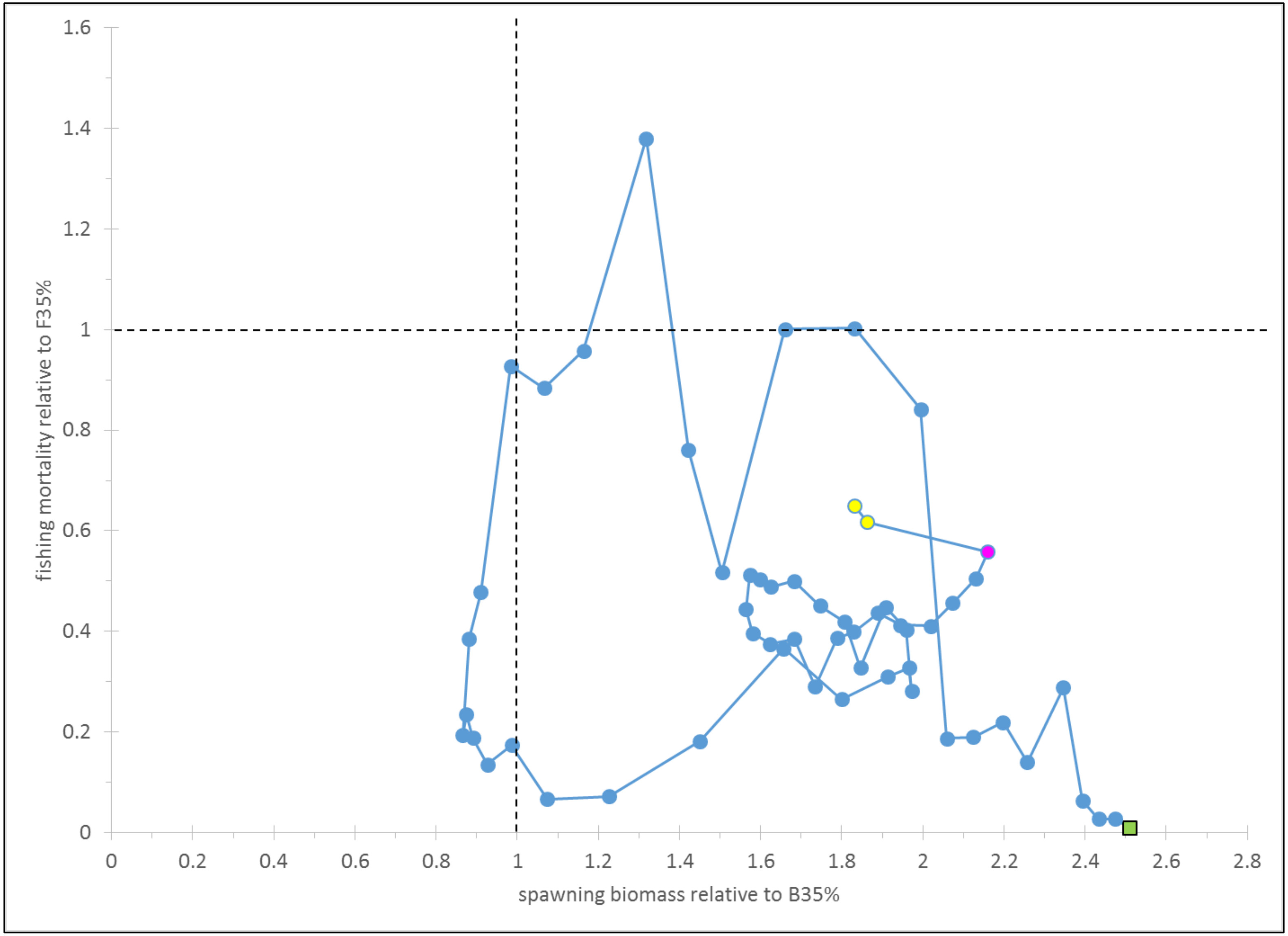
AKSK model results – fishing mortality



AKSK model results – numbers at age



AKSK model results – phase plane



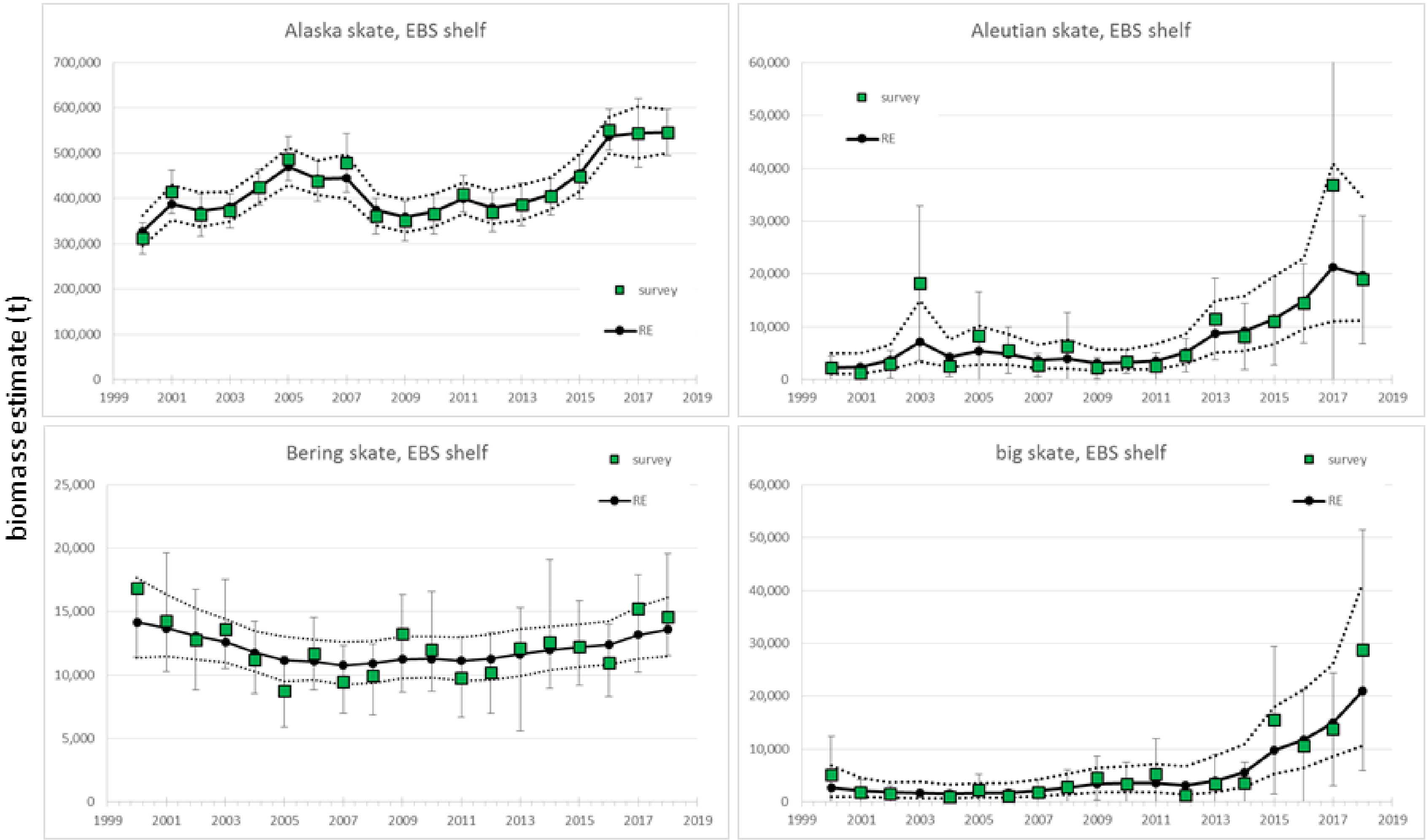
AK skate – harvest recs

Quantity	As estimated or specified *last* year for: 2018	2019	As estimated or recommended *this* year for: 2019*	2020*
M (natural mortality rate)	0.13	0.13	0.13	0.13
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	506,921	487,035	504,551	481,653
Female spawning biomass (t)				
Projected	110,180	110,159	115,957	114,010
$B_{100\%}$	180,556	180,556	177,761	177,761
$B_{40\%}$	72,222	72,222	71,105	71,105
$B_{35\%}$	63,195	63,195	62,217	62,217
F_{OFL}	0.092	0.092	0.094	0.094
$maxF_{ABC}$	0.079	0.079	0.081	0.081
F_{ABC}	0.079	0.079	0.081	0.081
OFL (t)	39,162	37,365	39,173	36,965
maxABC (t)	33,731	32,183	33,730	31,829
ABC (t)	33,731	32,183	33,730	31,829
Status	**As determined last year for: 2016**	**2017**	**As determined *this* year for: 2017**	**2018**
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

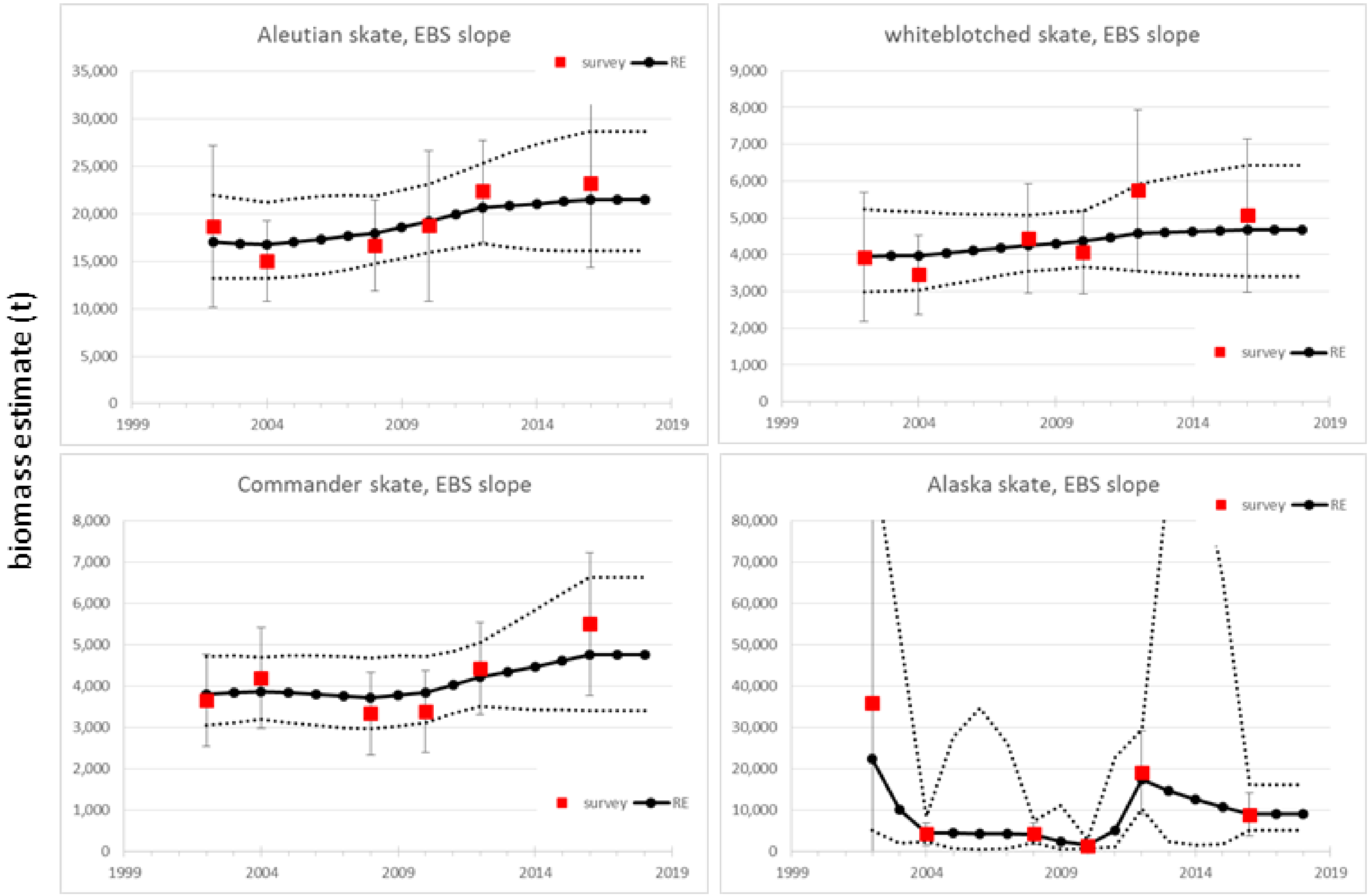
“other skates” assessment

- change in RE methodology
- old: aggregate single “other skate” model run for each survey
- new: separate run for each species in each survey
- uncommon species run in aggregate as “minor species” group
- individual results aggregated to get biomass estimate for complex
- Alaska/leopard skate survey biomass “corrected” for species ID issues
- analysis of abundance trends & exploitation rates

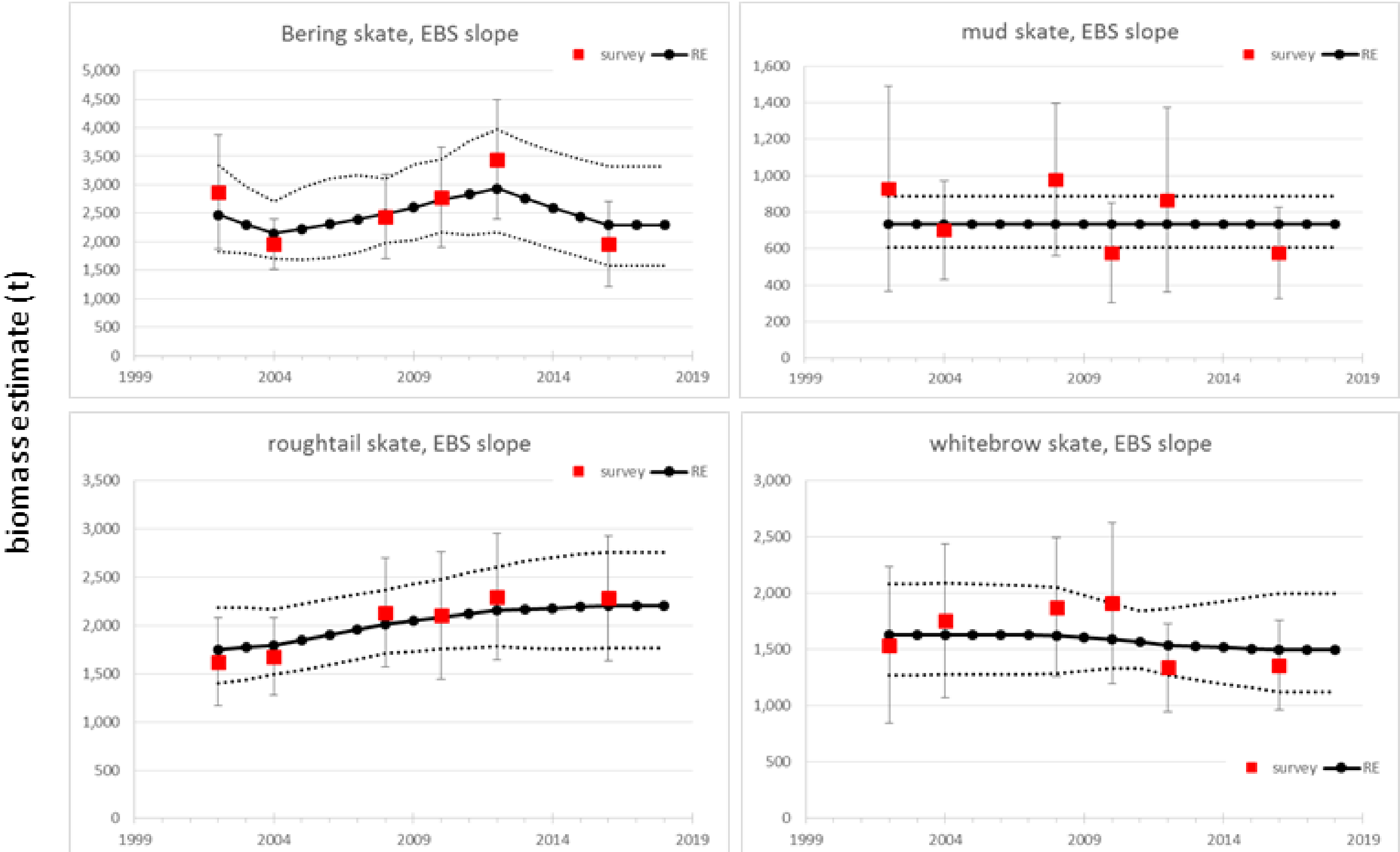
“other skate” biomass – EBS shelf



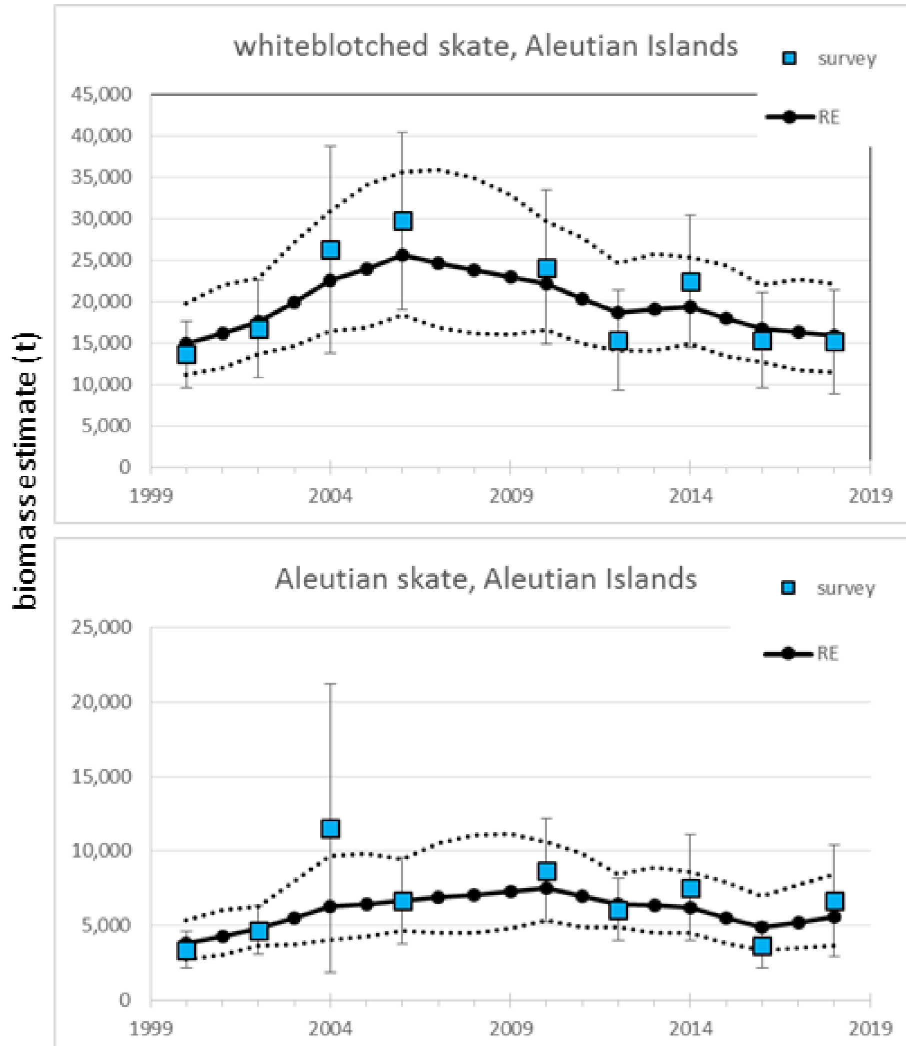
“other skate” biomass – EBS slope



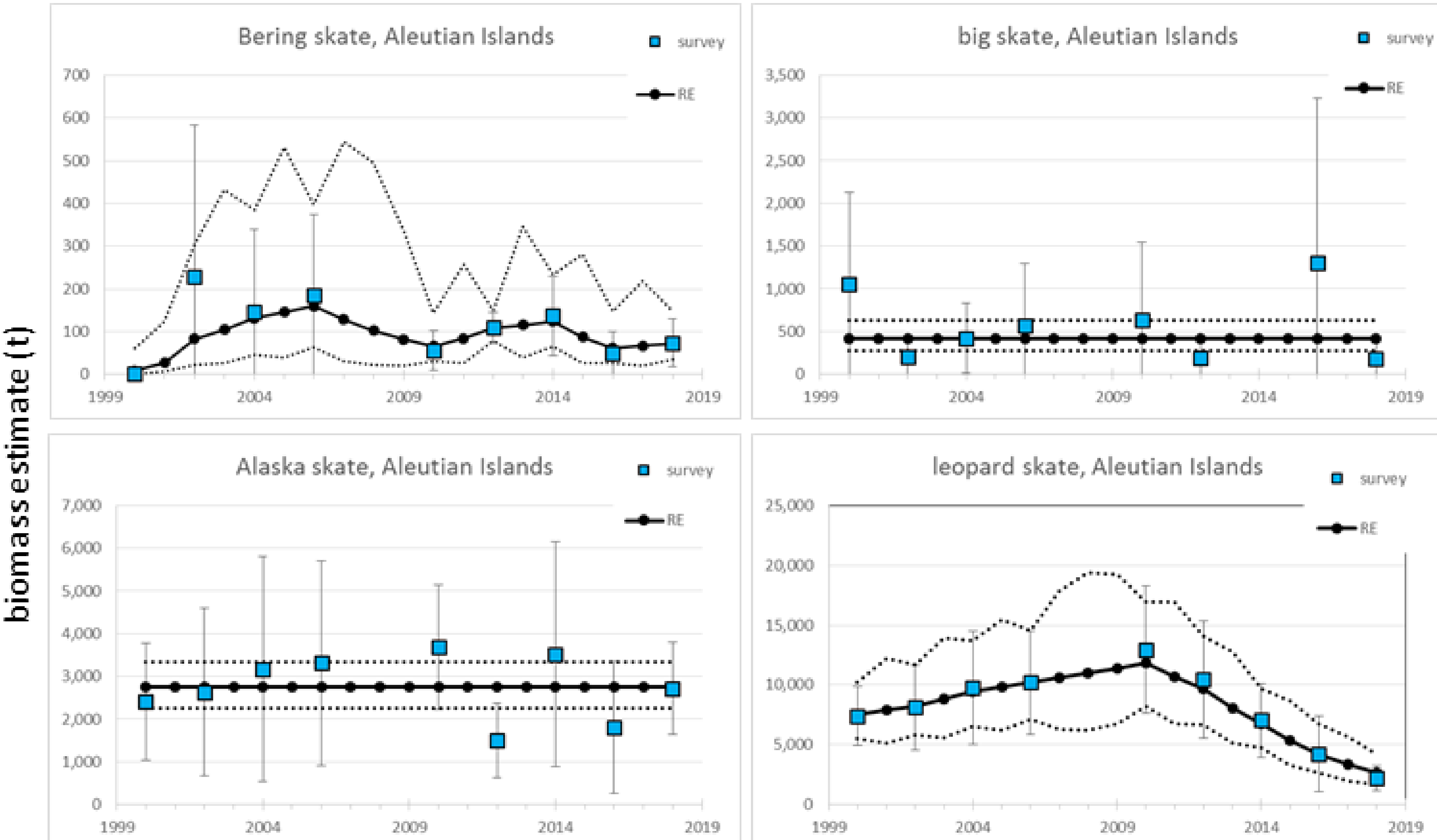
“other skate” biomass – EBS slope



“other skate” biomass – Aleutian Islands



“other skate” biomass – Aleutian Islands



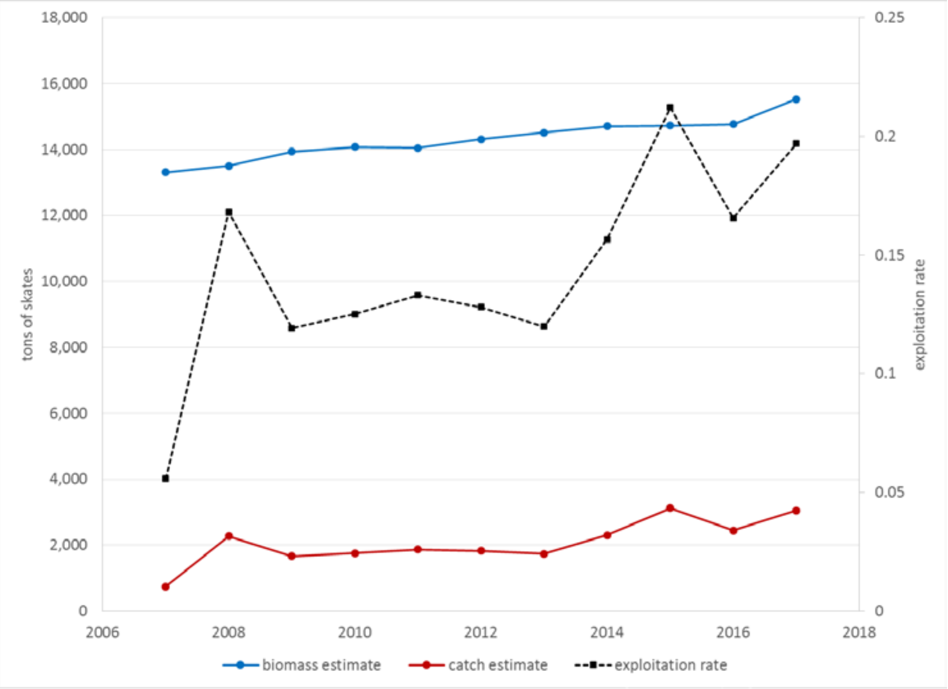
“other skate” exploitation rates

	2010	2012	2016
Alaska	0.035	0.050	0.041
Aleutian	0.040	0.043	0.026
Bering	**0.119**	**0.133**	**0.188**
big	**0.179**	**0.812**	**0.109**
butterfly	0.001	0.000	0.000
Commander	0.047	0.036	0.033
deepsea	0.000	0.000	0.001
longnose	0.000	**0.155**	0.000
mud	0.086	0.042	0.022
roughtail	0.009	0.004	0.002
whiteblotched	0.017	0.029	0.045
whitebrow	0.012	0.019	0.014

- for all species: used survey biomass estimates in 2010, 2012, 2016
- Bering & big skate > 0.1; further explored using RE output

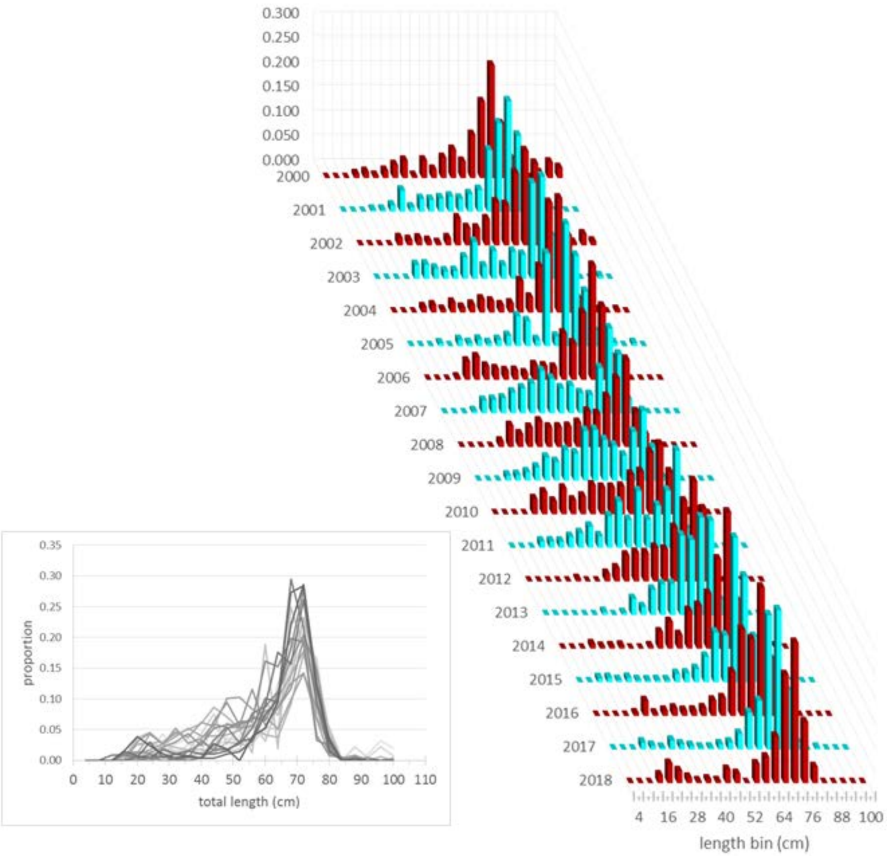
Bering skate exploitation rates

			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
		biomass	13,312	13,498	13,939	14,082	14,053	14,315	14,514	14,704	14,726	14,769	15,533
Bering	BSAI	catch	742	2,270	1,662	1,762	1,870	1,832	1,741	2,303	3,123	2,446	3,058
		exploitation rate	**0.056**	**0.168**	**0.119**	**0.125**	**0.133**	**0.128**	**0.120**	**0.157**	**0.212**	**0.166**	**0.197**

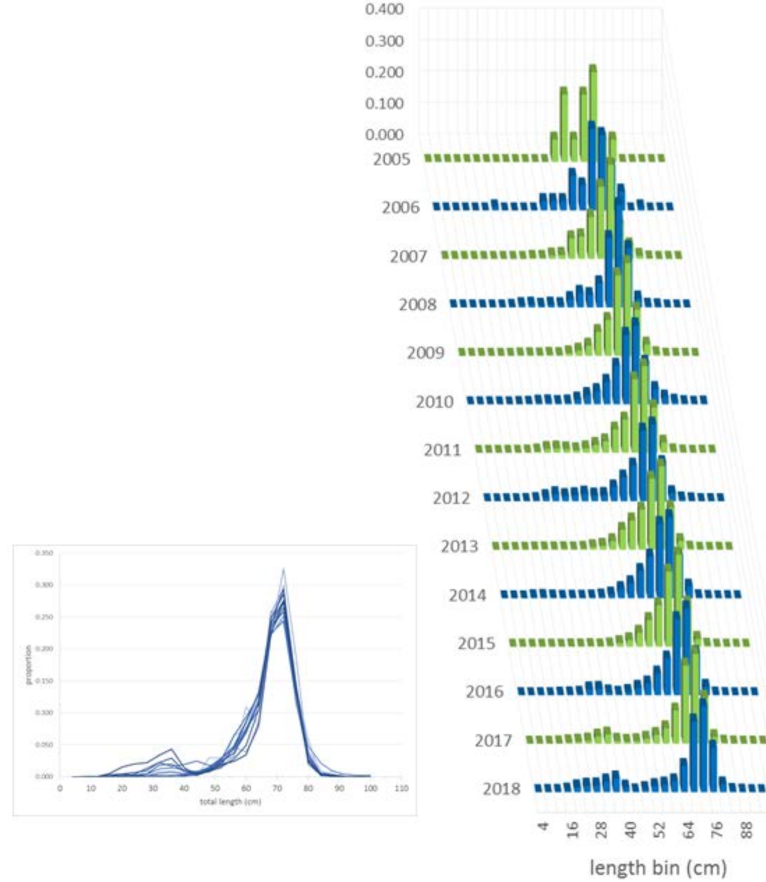


- rates generally higher than 0.1
- but:
  - biomass is increasing
  - new year class(es) coming in
  - *M* higher than 0.1?
  - retention rate lower than for other skate species

Bering skate length comps



survey



fishery

big skate exploitation rates

big	BSAI	biomass	2,493	3,124	3,837	3,890	3,957	3,472	4,438	5,949	10,153	12,105	15,346
		catch	422	316	348	729	612	1,102	1,331	1,396	1,210	1,307	1,776
		exploitation rate	**0.169**	**0.101**	**0.091**	**0.187**	**0.155**	**0.317**	**0.300**	**0.235**	**0.119**	**0.108**	**0.116**
big	GOA	biomass	41,449	42,080	42,921	44,893	47,669	45,684	44,091	44,683	45,680	41,448	37,975
		catch	1,594	1,418	2,082	2,517	2,312	2,006	2,520	1,671	1,519	2,100	1,510
		exploitation rate	**0.038**	**0.034**	**0.049**	**0.056**	**0.048**	**0.044**	**0.057**	**0.037**	**0.033**	**0.051**	**0.040**
big	BSAI + GOA	biomass	43,943	45,204	46,758	48,783	51,626	49,155	48,529	50,632	55,833	53,553	53,321
		catch	2,016	1,734	2,429	3,246	2,924	3,108	3,851	3,067	2,728	3,407	3,286
		exploitation rate	**0.046**	**0.038**	**0.052**	**0.067**	**0.057**	**0.063**	**0.079**	**0.061**	**0.049**	**0.064**	**0.062**

- EBS big skates likely part of GOA population
- combined BSAI+ GOA exploitation < 0.1

harvest recommendations

other skate harvest recommendations				
	As estimated or specified last year for:		As estimated or recommended this year for:	
Quantity	2018	2019	2019	2020
M (natural mortality rate)	0.1	0.1	0.1	0.1
Tier	5	5	5	5
Biomass (t)	100,130	100,130	119,787	119,787
F_{OFL}	0.10	0.10	0.10	0.10
$maxF_{ABC}$	0.075	0.075	0.075	0.075
F_{ABC}	0.075	0.075	0.075	0.075
OFL (t)	10,013	10,013	11,979	11,979
maxABC (t)	7,510	7,510	8,984	8,984
ABC (t)	7,510	7,510	8,984	8,984
	As determined *last* year for:		As determined *this* year for:	
Status	2015	2016	2016	2017
Overfishing	No	n/a	No	n/a

aggregate harvest recommendations for the BSAI complex				
	As estimated or specified *last* year for:		As estimated or recommended this year for:	
Quantity	2018	2019	2019	2020
OFL (t)	49,063	46,583	51,152	48,944
ABC (t)	41,144	39,008	42,714	40,813

alternative BMSY proxies for Alaska skate

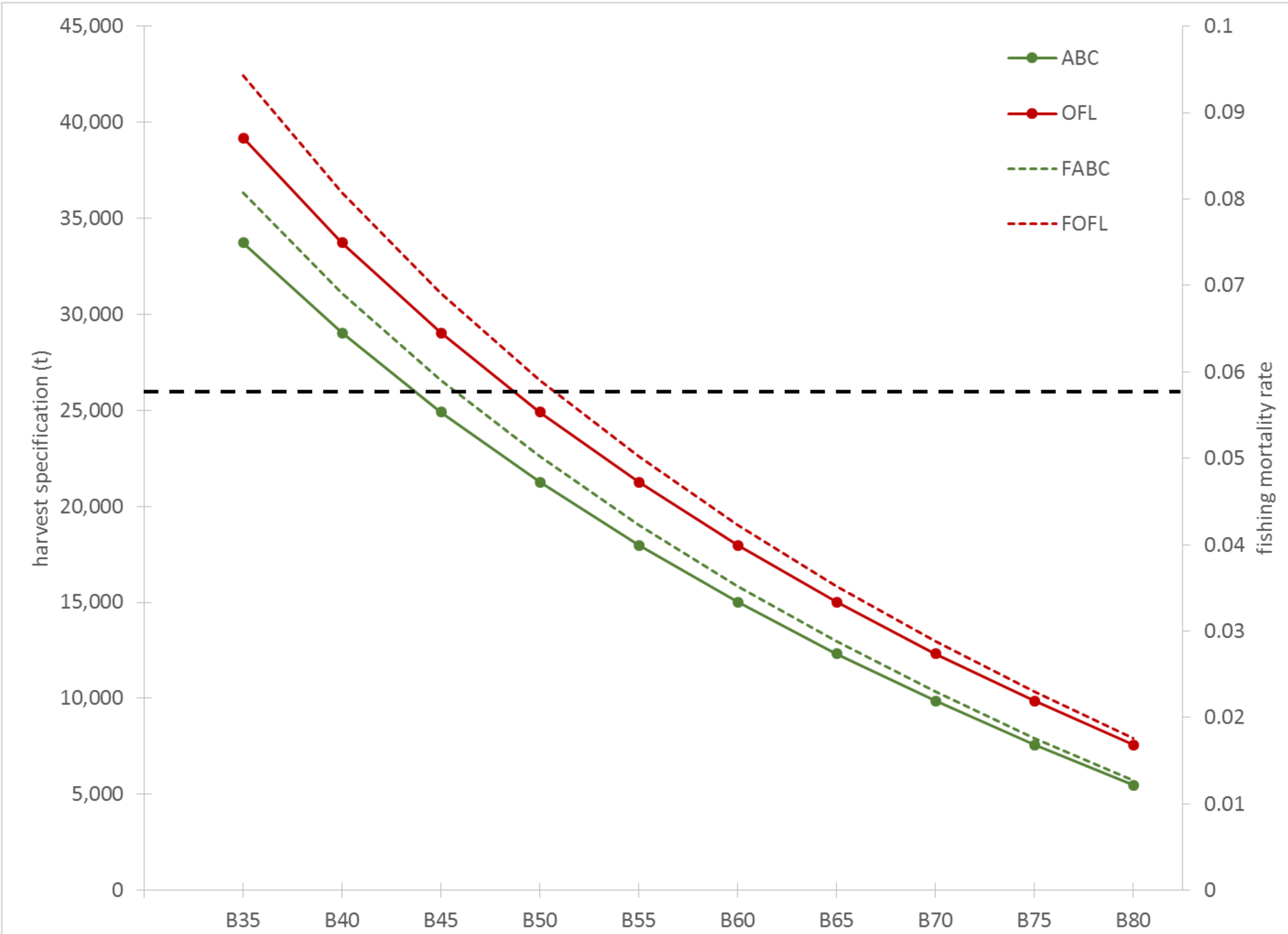
1) used ‘proj’ model

2) manipulated proxy levels for OFL and ABC, also future catch

3) ran model to get OFL, ABC, FOFL, FABC for different proxies
    - $B_{MSY} = B_{35\%} - B_{80\%}$ in 5% increments

4) analyzed biomass projections for three catch scenarios
    a) catch = max ABC except 2018-2020 (alt 2)
    b) constant *F*: *F* = average *F* 2014-2018 (alt 3)
    c) constant catch: catch in all years set at 2018 level

harvest specs for alternative BMSY proxies



BMSY proxy

biomass projections