

# Gulf of Alaska SAFE report

Report of the  
Gulf of Alaska Groundfish  
Plan Team meeting  
Nov 17<sup>th</sup>-21<sup>st</sup>, 2014

## GOA Plan Team Members

James Ianelli (chair)	AFSC/REFM
James Armstrong	NPFMC
Kristen Green	ADFG
Mark Stichert	ADFG
Jan Rumble	ADFG
Ian Stewart	IPHC
Leslie Slater	USFWS (joint)
Nancy Friday	AFSC/NMML
Mike Dalton	AFSC/REFM
Chris Lunsford	AFSC/ABL
Jon Heifetz	AFSC/ABL
Sandra Lowe	AFSC/REFM
Paul Spencer	AFSC/REFM
Craig Faunce	AFSC/FMA
Obren Davis	AKRO



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# Overview

Biennial cycle—**modified "off"** year for GOA

12 stocks in Tier 3

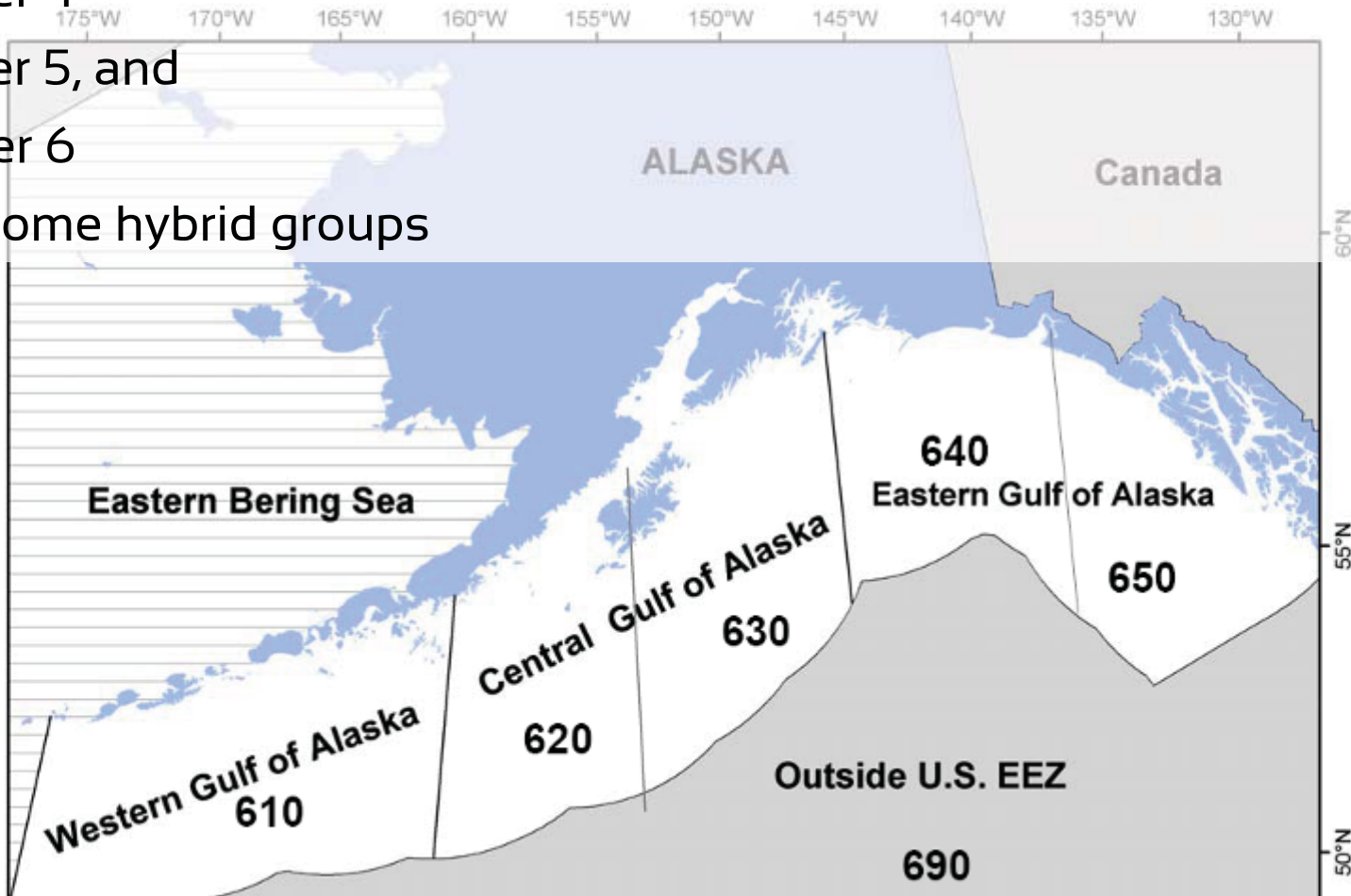
(mostly above  $B_{40\%}$ )

2 in Tier 4

7 in Tier 5, and

5 in Tier 6

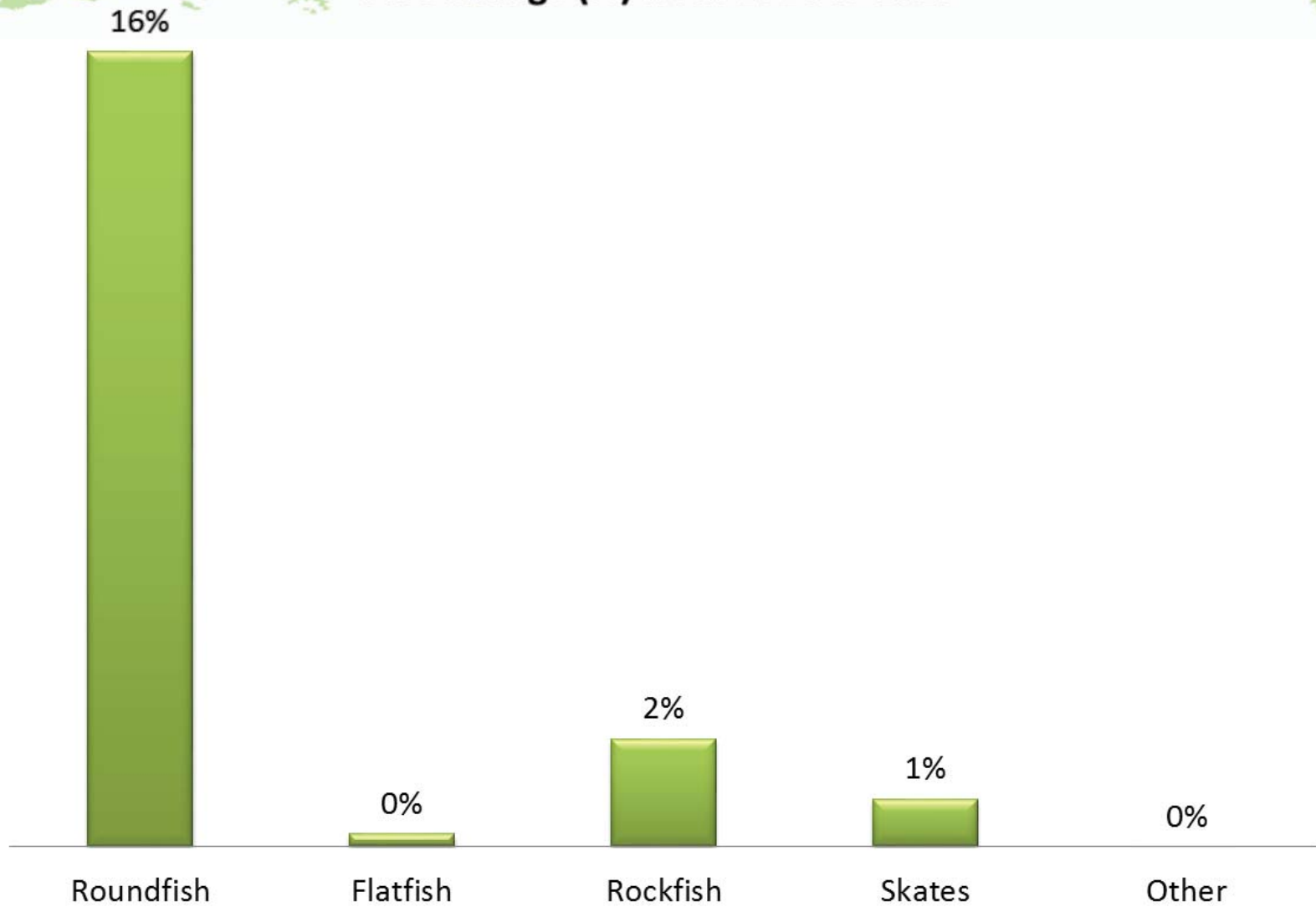
Note some hybrid groups



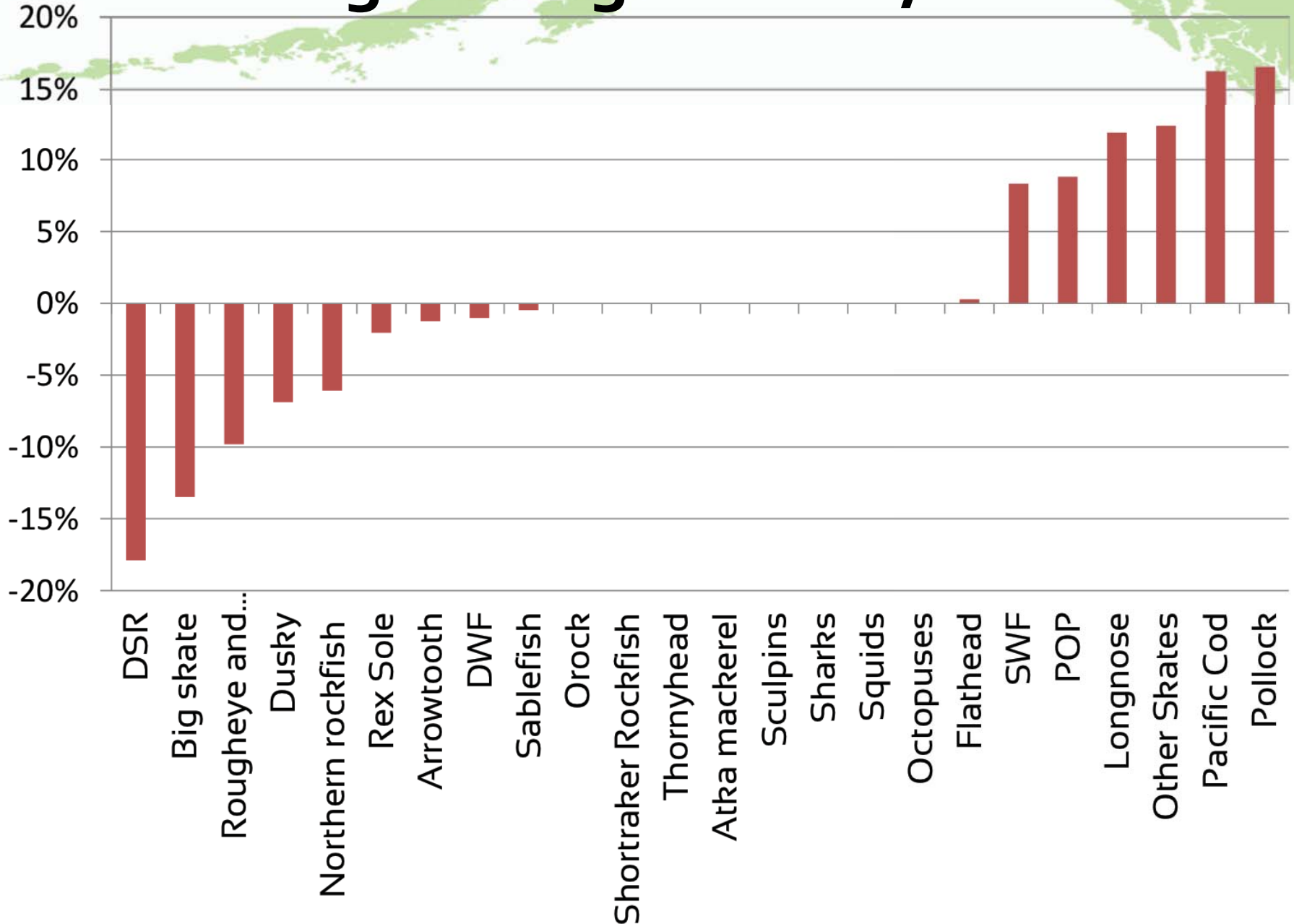
# GULF OF ALASKA GROUND FISH ASSESSMENTS



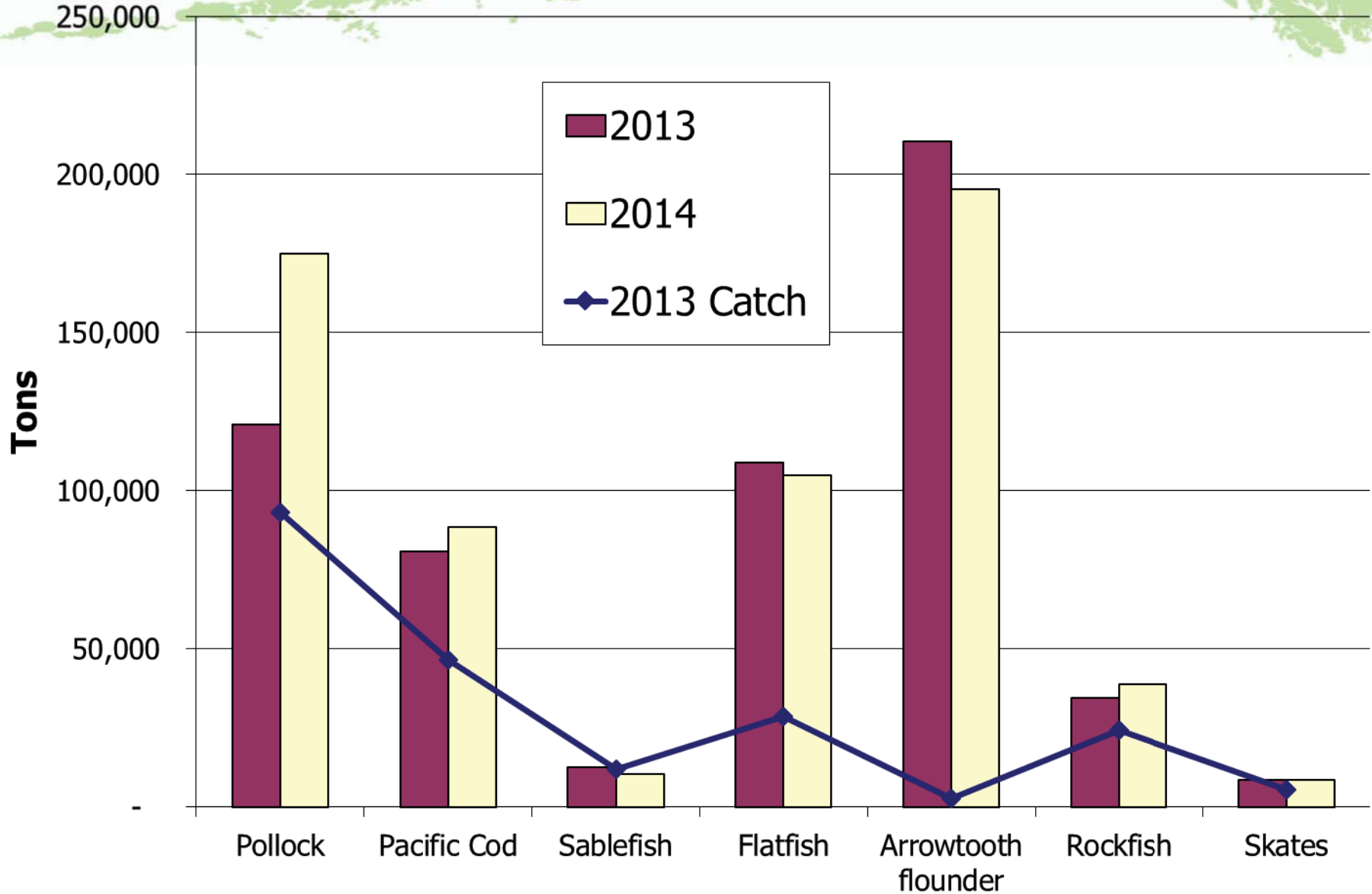
## ABC change (%) from 2014 to 2015



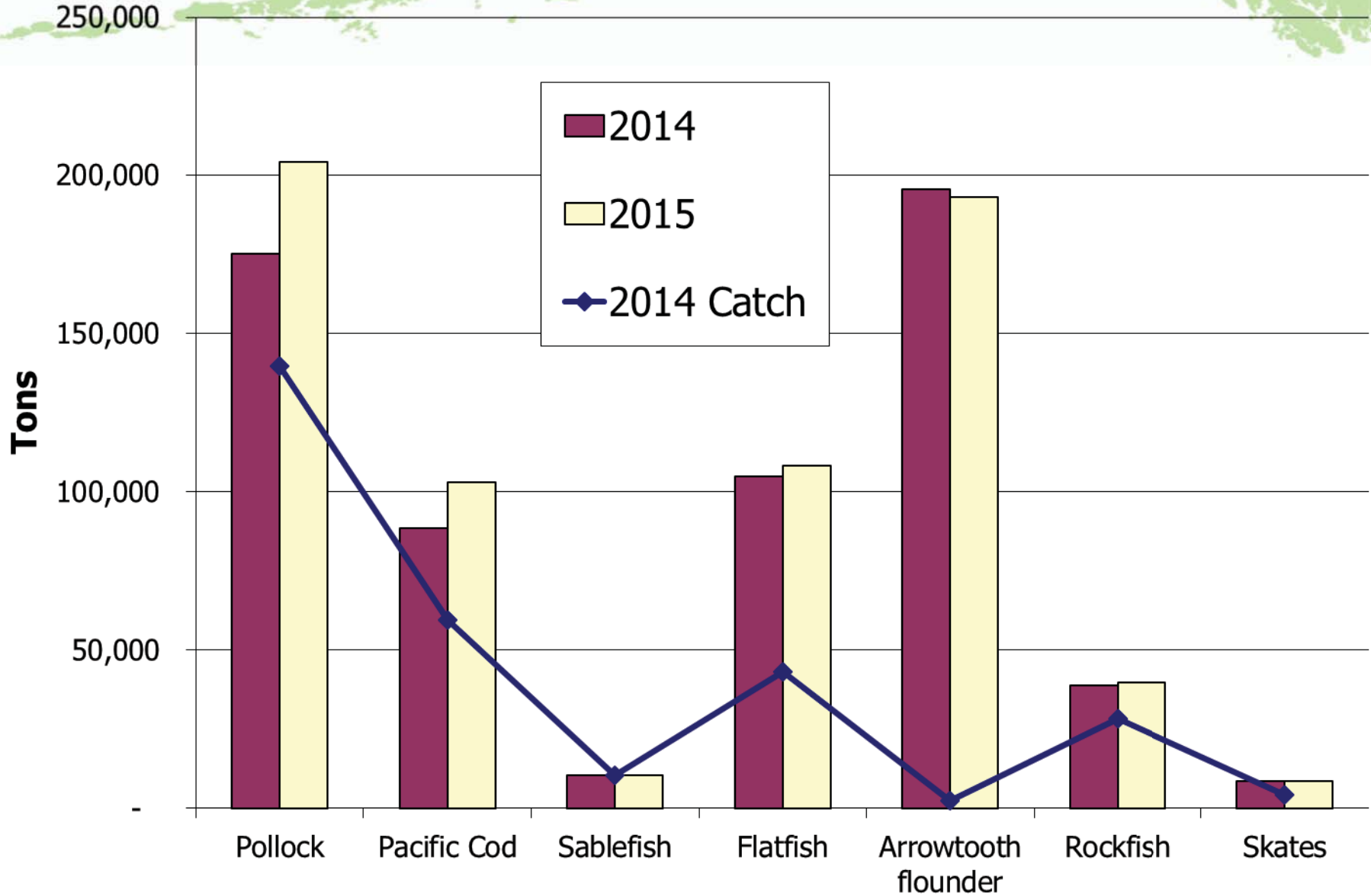
# Percentage change in ABC, 2014-2015



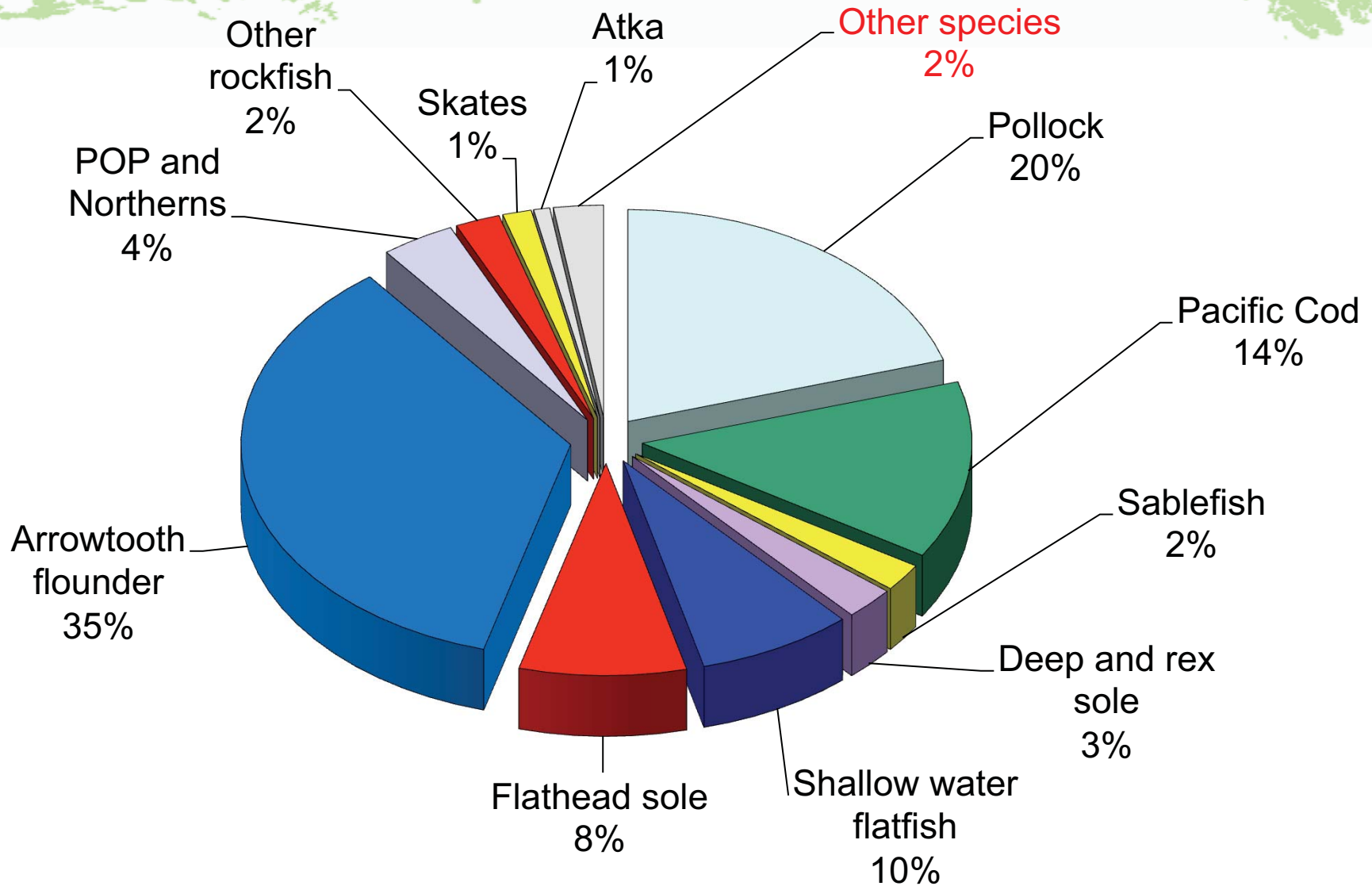
# GOA Catch and ABC levels



# GOA Catch and ABC levels

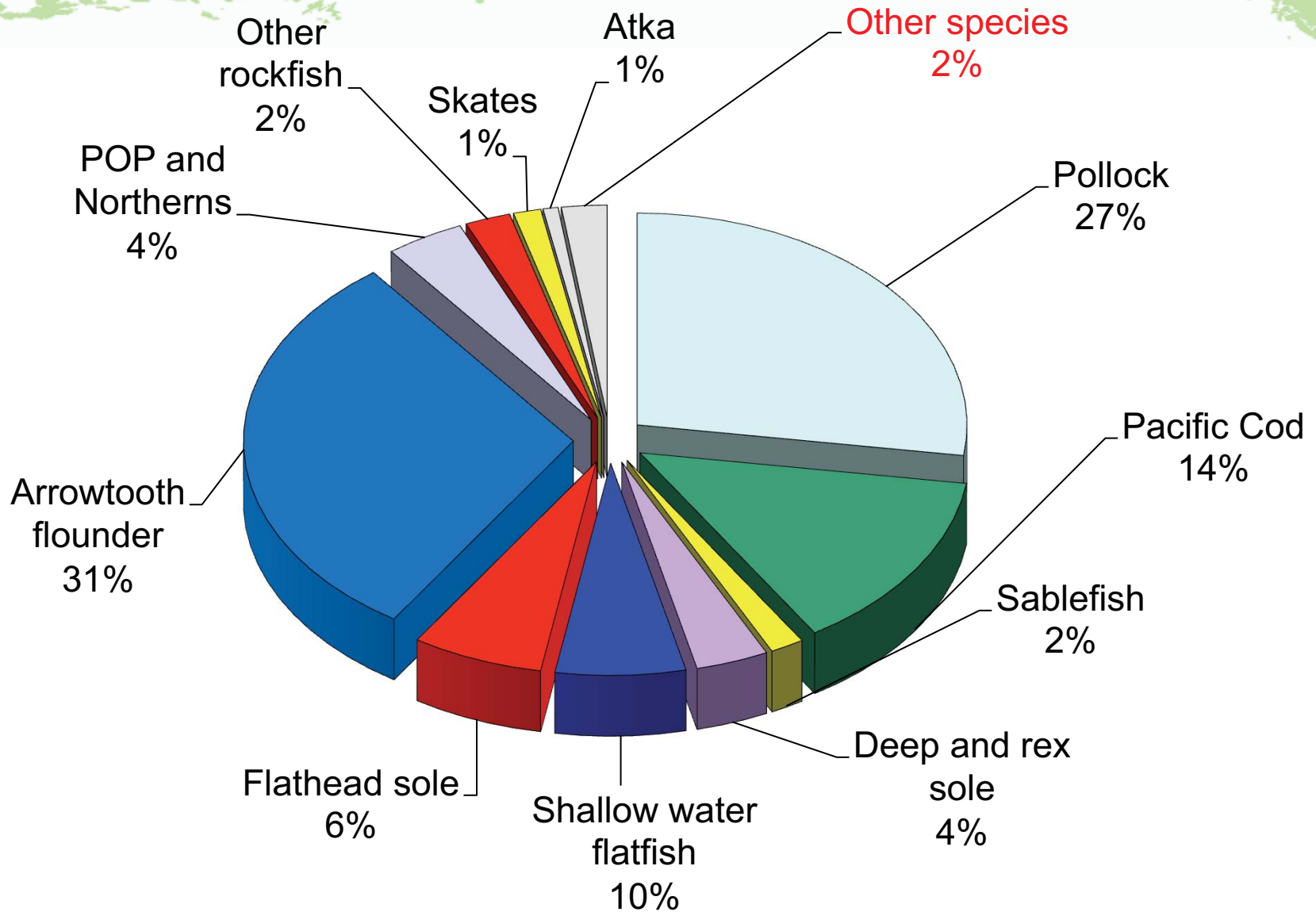


# GOA 2013 ABC's: 595,920 t

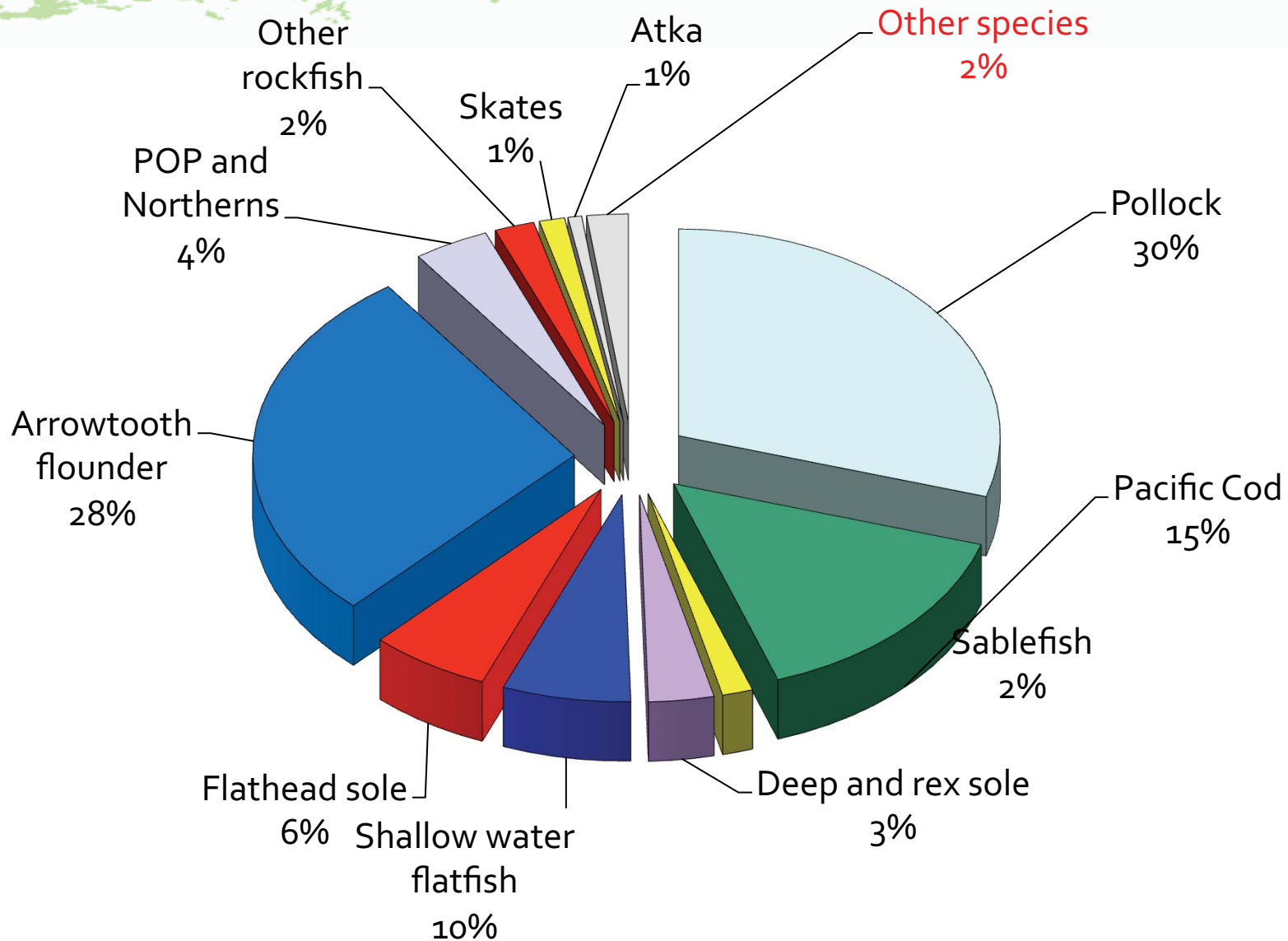




# GOA 2014 ABC's: 640,675 t



# GOA 2015 ABC's: 685,597 t



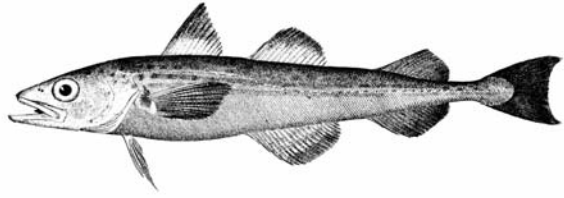
# ABC / TAC

Team recommendations where  
ABC < maximum permissible:

	<b>% of Max Permissible</b>
<b>Pollock</b>	<b>86%</b>
<b>Pacific cod</b>	<b>88%</b>
<b>Demersal shelf rockfish</b>	<b>77%</b>

# Species overviews

1. 2014 ABC/Catch and recommended changes
2. Highlights
  - ♦ New data
  - ♦ Analytic approach (changes)
3. Stock status and trend
4. ABC/OFL
  - ♦ Tier history and recommendations
  - ♦ 2014, 2015 maxABC; recommended ABC



# ABC

Species	2014	ABC		Change	
	Catch	2014	2015		
Pollock	139,753	174,976	203,934	up 28,958	(17%)
Pacific Cod	59,633	88,500	102,850	up 14,350	(16%)
Sablefish	10,375	10,572	10,522	down 50	(0%)
Flatfish	43,270	104,849	108,038	up 3,189	(3%)
Arrowtooth flounder	2,497	195,358	192,921	down 2,437	(1%)
Rockfish	28,267	38,880	39,711	up 831	(2%)
Atka mackerel	981	4,700	4,700	same	(0%)
Skates	4,356	8,627	8,708	up 81	(1%)
Other Species	3,412	14,213	14,213	same	(0%)
<b>Total</b>	<b>292,544</b>	<b>640,675</b>	<b>685,597</b>	<b>up 44,922</b>	<b>(7%)</b>

# New Data-GOA pollock

Fishery:

Shelikof EIT survey:

NMFS Summer trawl :

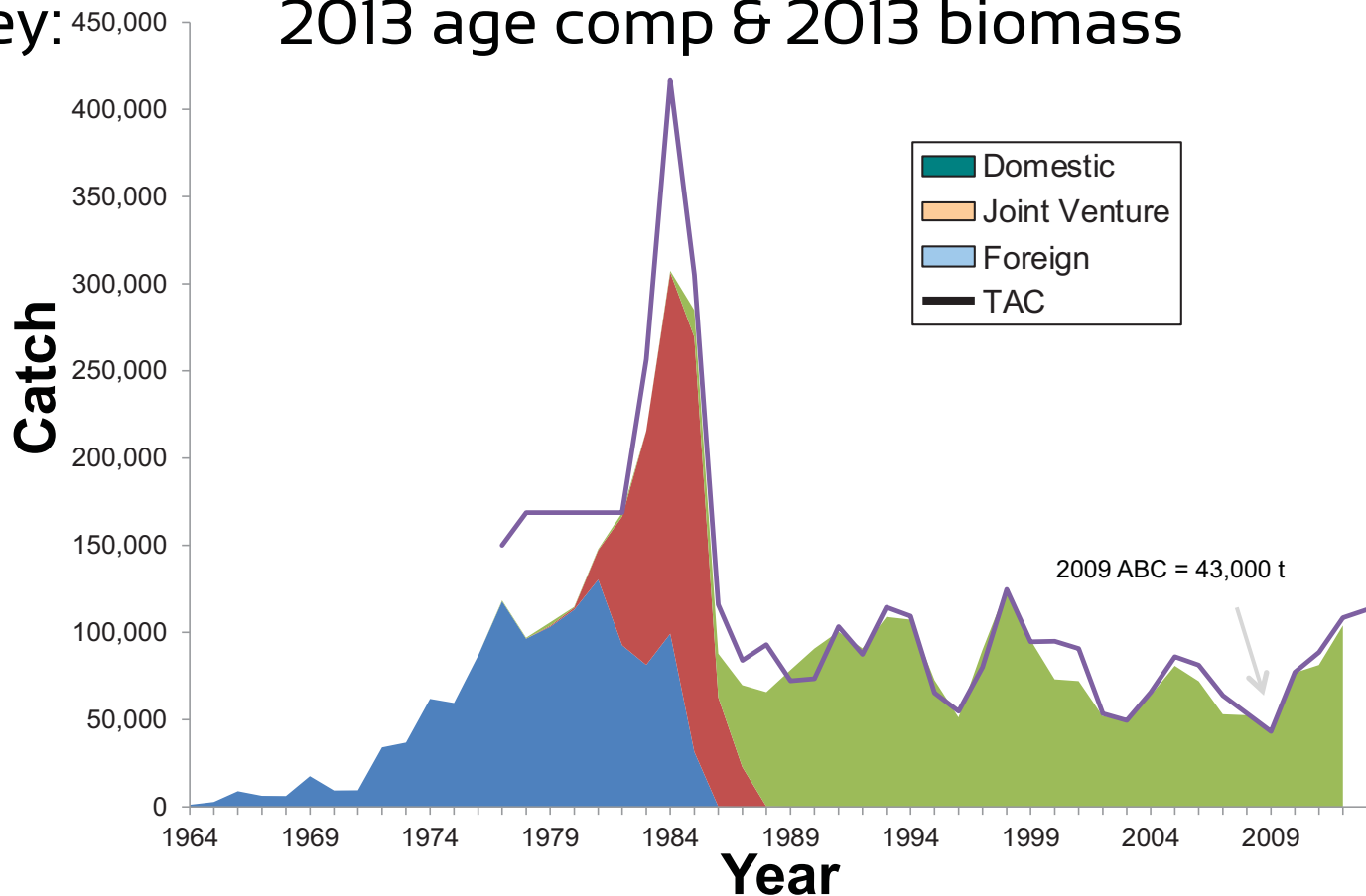
ADFG trawl survey:

2013 total catch and catch at age

2014 winter biomass and age comp

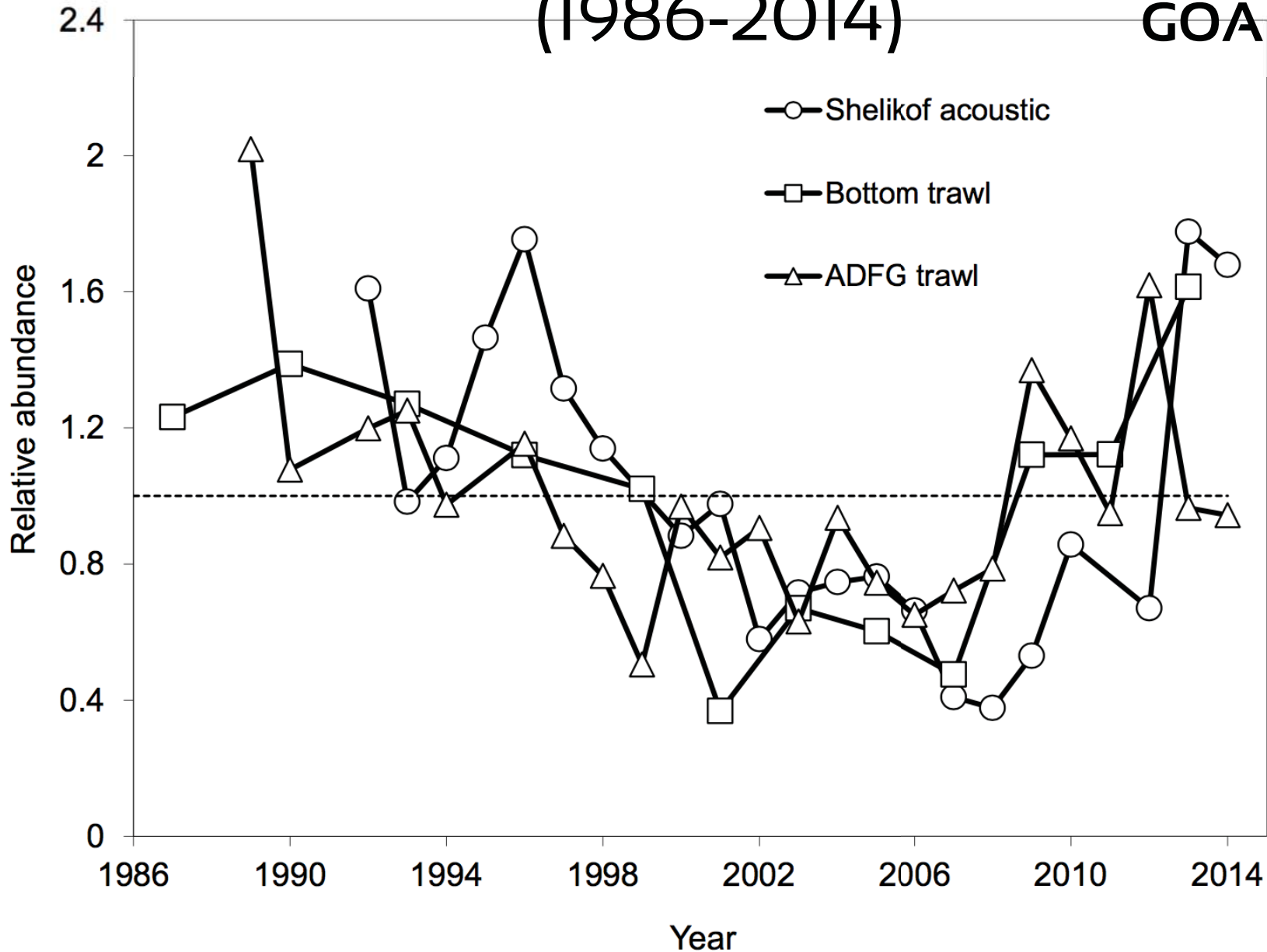
2014 biomass & length comps

2013 age comp & 2013 biomass

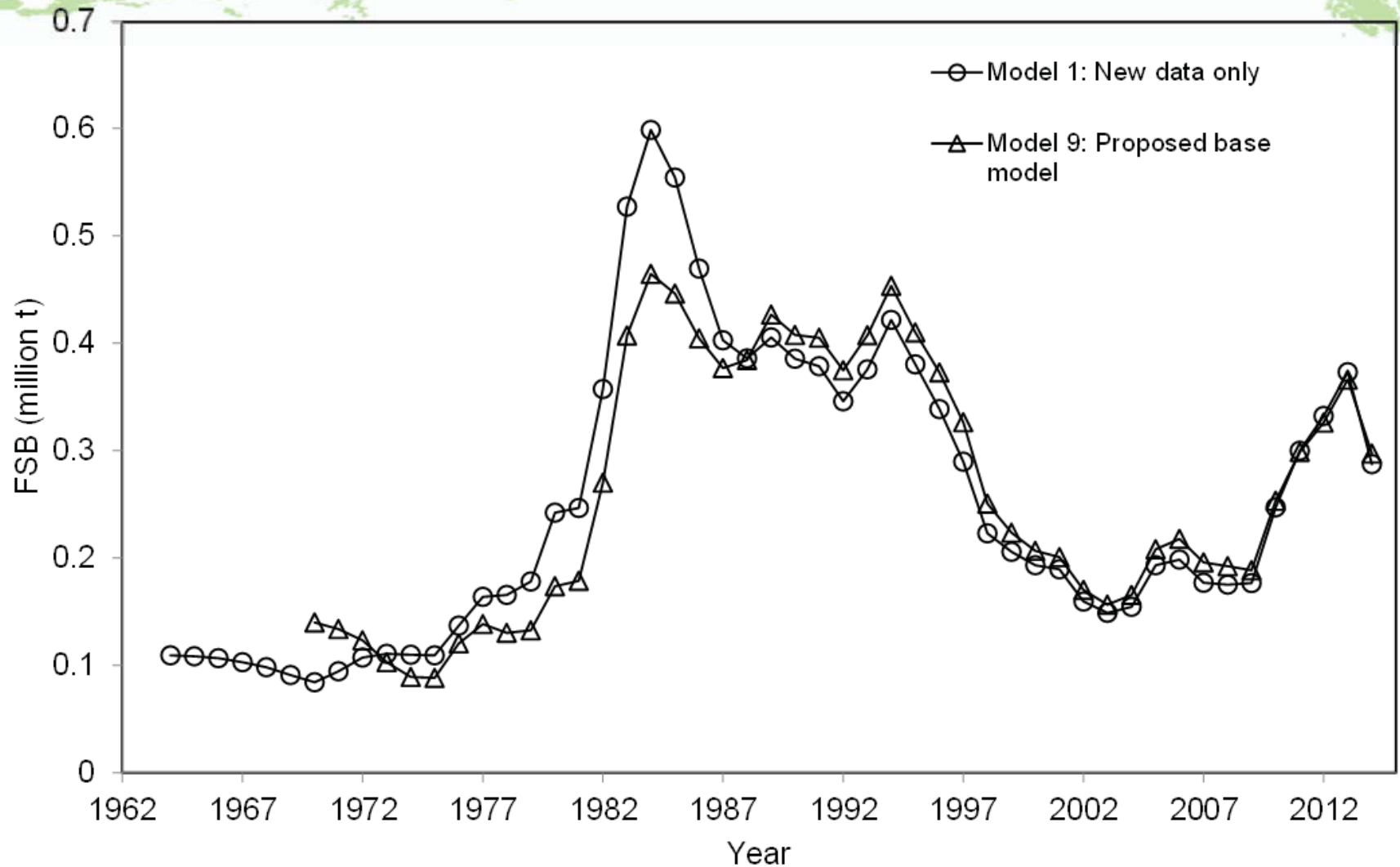


# Relative trends in abundance indices (1986-2014)

GOA pollock



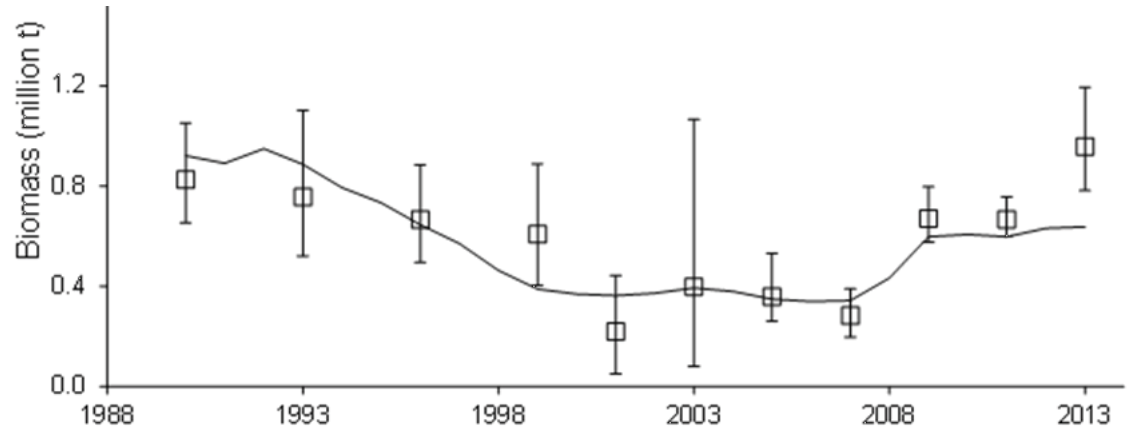
# Alternative GOA pollock models



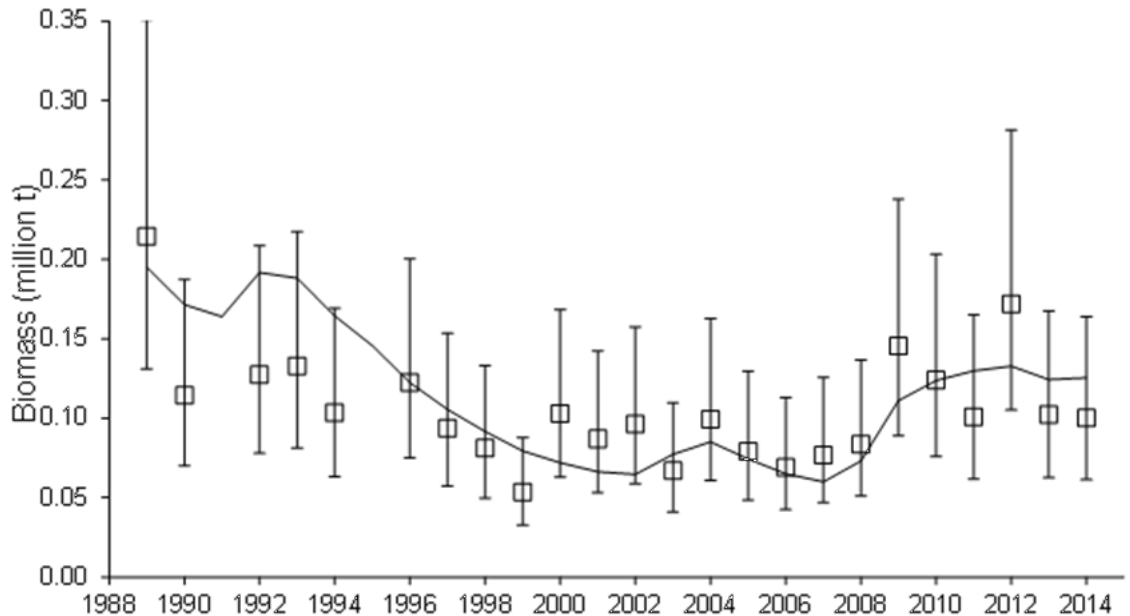


## GOA pollock

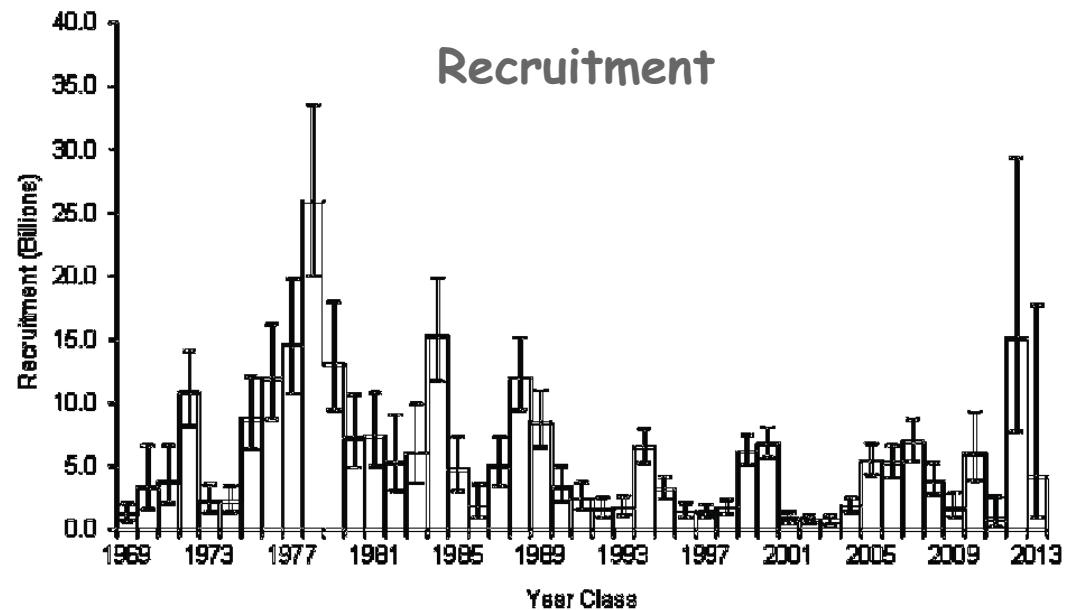
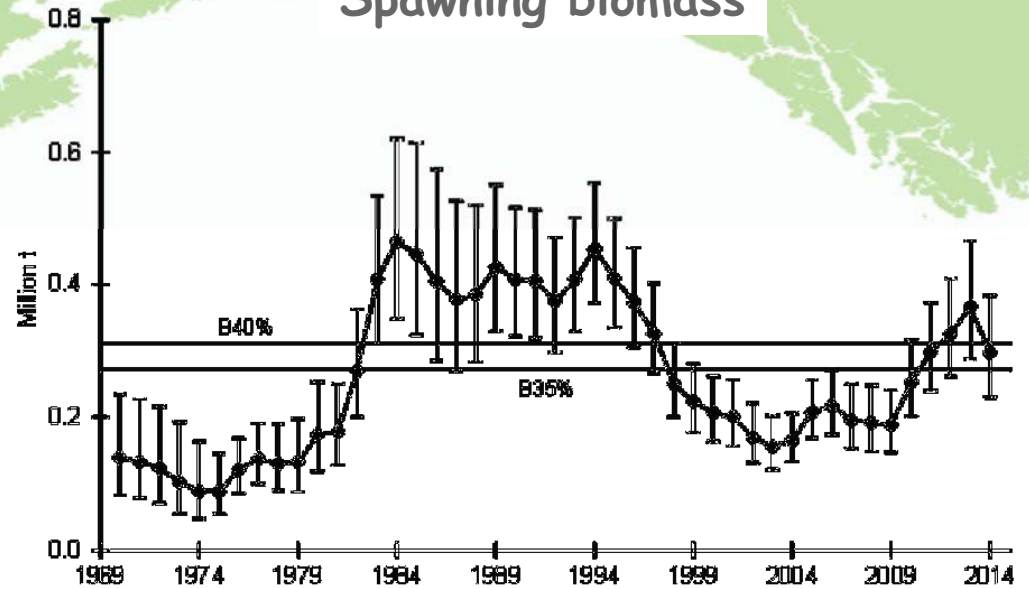
Fit to NMFS  
bottom  
trawl  
survey



Fit to ADFG  
survey



# GOA pollock model results



# State GHL considerations

**NEW** this year (presentation only):

Prince William Sound GHL subtracted from W/C GOA **after**  
ABC presented (similar to Pacific cod);

Still set to 2.5% of W/C ABC:

$$\text{GHL} = 0.025 \times 191,309 = \mathbf{4,783 \text{ t}}$$

# GOA pollock ABC considerations

- ◆ Harvest rate below maximum permissible  $F_{ABC}$

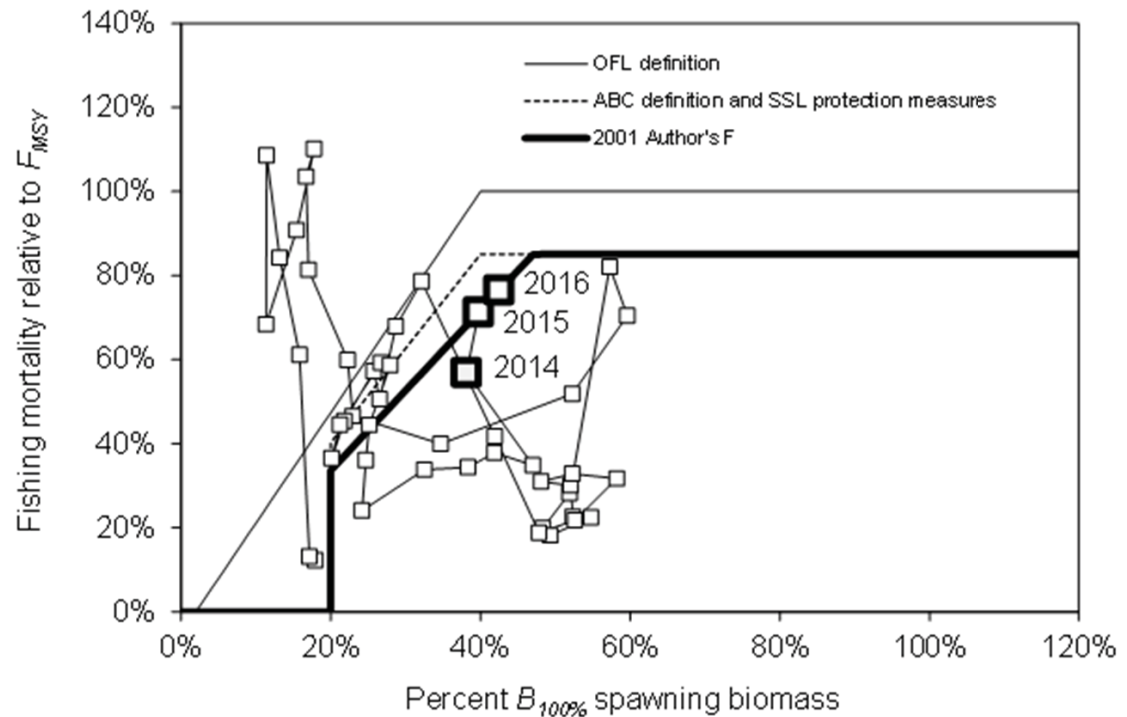
Pollock	Biomass*	OFL**	ABC**
2015	1,884,000	273,378	203,934
2016		337,900	263,449

\*Model estimated W/C/WYAK age 3+ biomass

\*\*Gulfwide

Tier 3b

2015 SSB 39.7% of  $B_{100\%}$



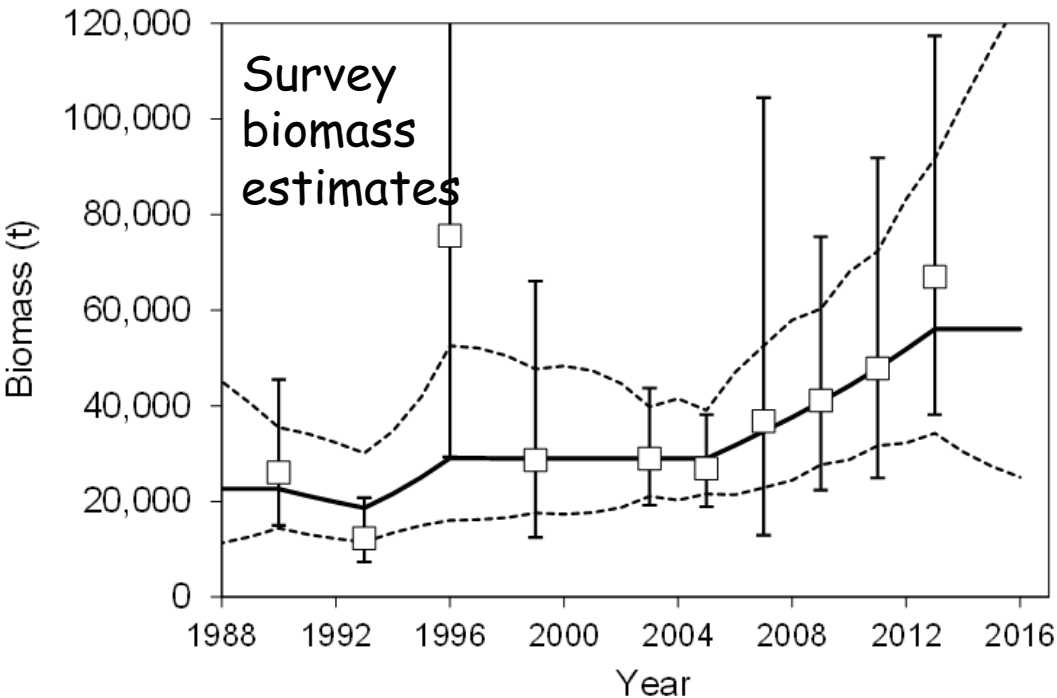
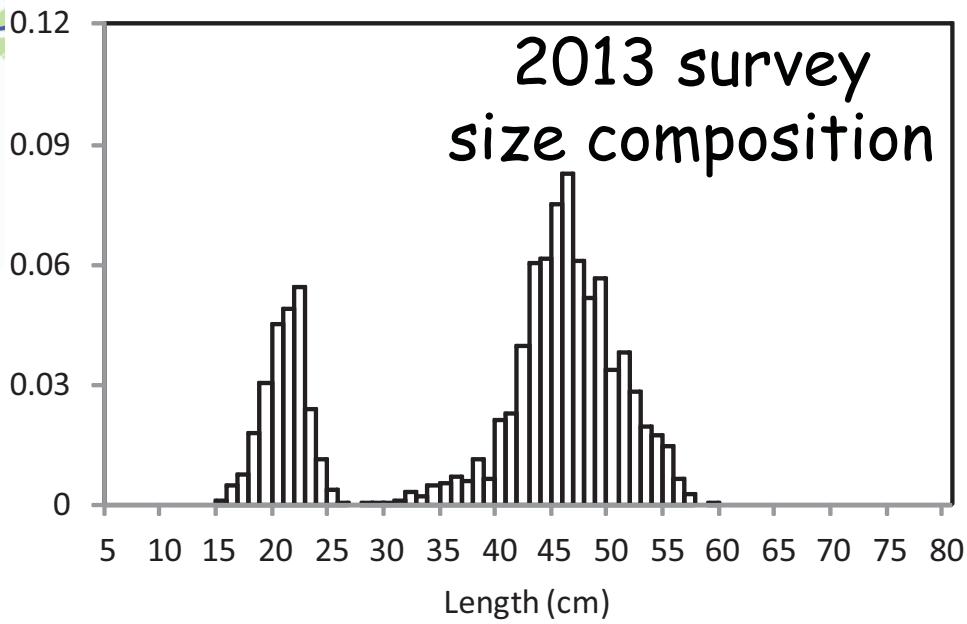
# EGOA pollock (Tier 5)

GULF C

EGOA  
Pollock

	Biomass	OFL	ABC
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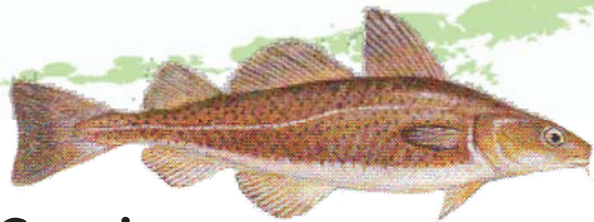
2015	56,111	16,833	12,625
2016		16,833	12,625



Random effects  
model used

## ABC Summary

## Pacific cod

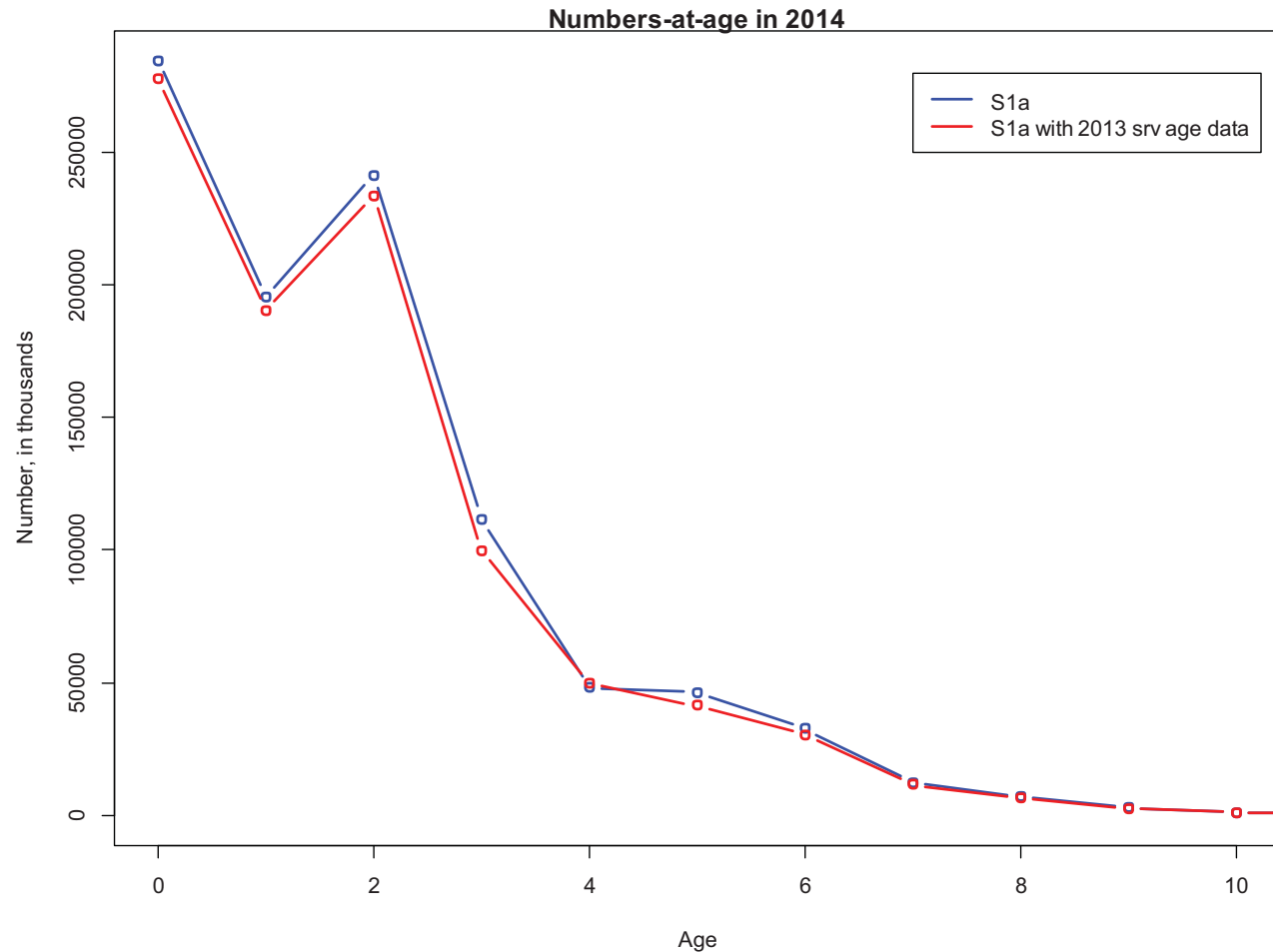


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# GOA Pacific cod

## Team discussion

- ◆ Influence of recent survey data addition
- ◆ Large increase in ABC
- ◆ Chose to allow gradual increase

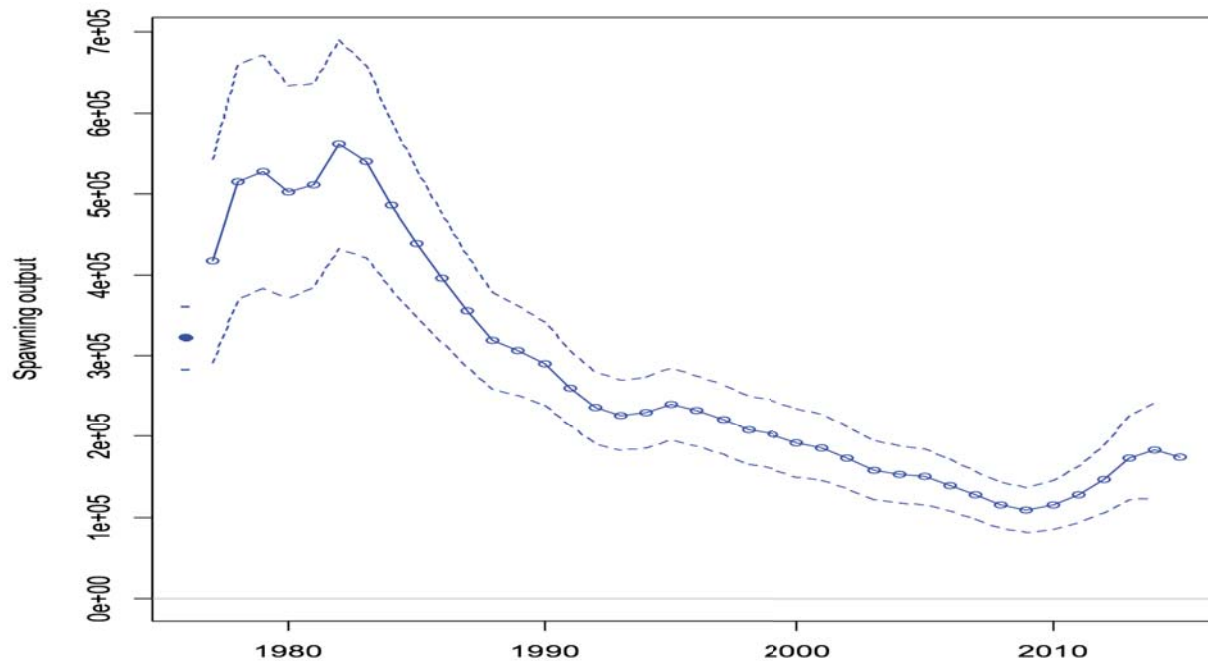


## GOA Pacific cod

Tier 3a

- ◆ SSB for 2015 at 49% of  $B_{100\%}$

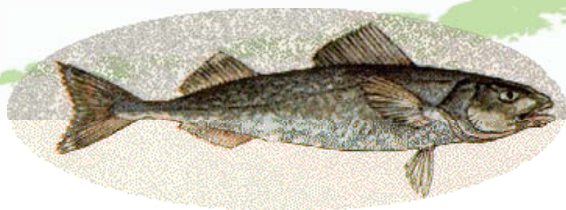
Pacific cod	Biomass	OFL	ABC
2015	583,800	140,300	102,850
2016		133,100	102,850





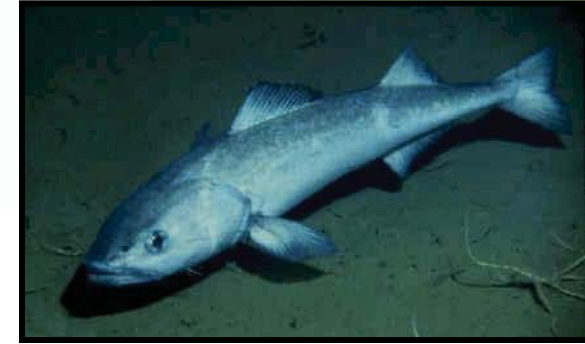
# ABC Summary

## Sablefish



Species	2014 Catch	ABC		Change	
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# 2014 sablefish assessment overview



## Model

No change

## Data updates

Catch: updated 2006-2013, and new catch for 2014

## Abundance:

2014 Longline survey

2013 Longline and trawl fisheries

## Ages:

2013 Longline survey

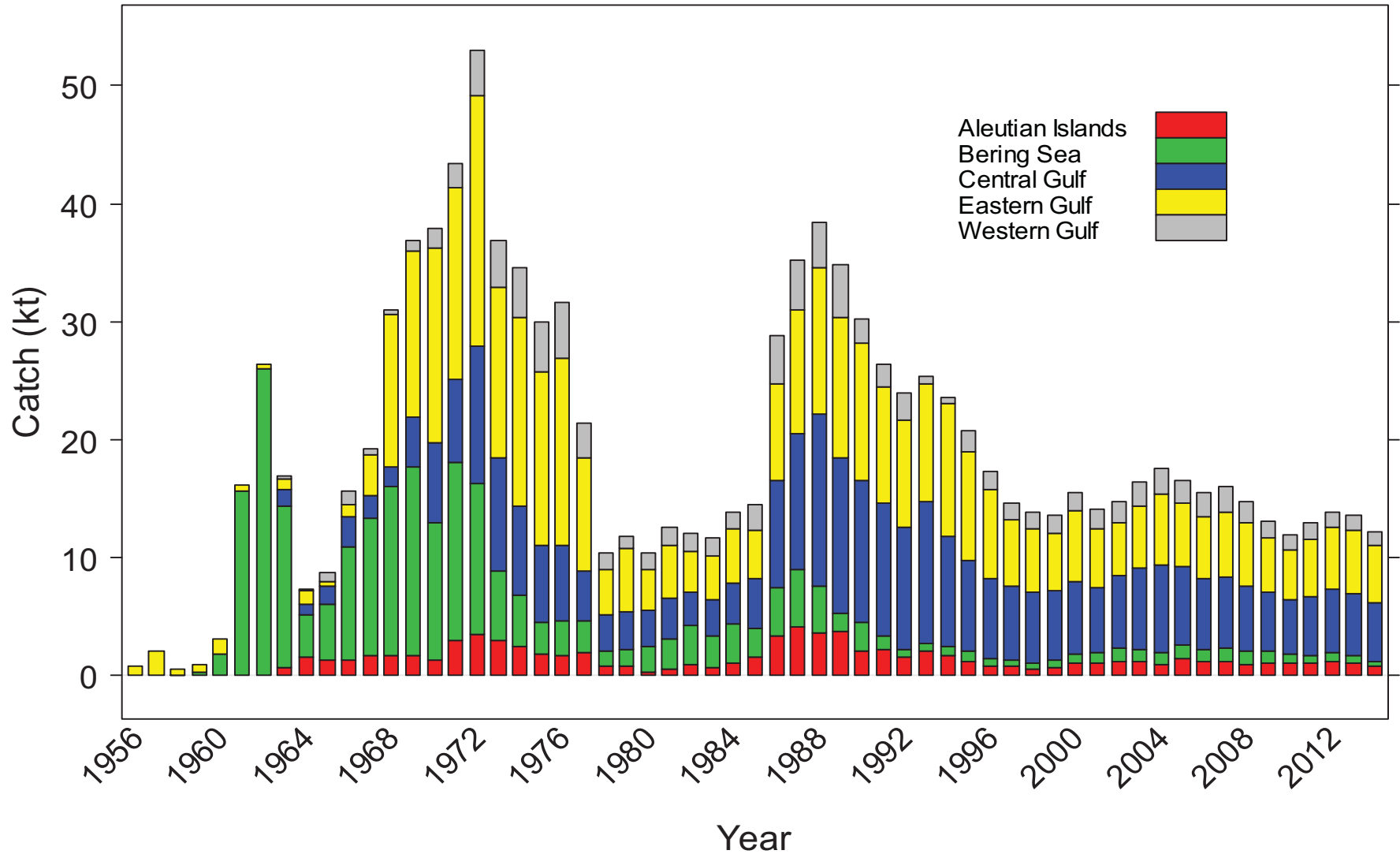
2013 Longline fishery

## Lengths:

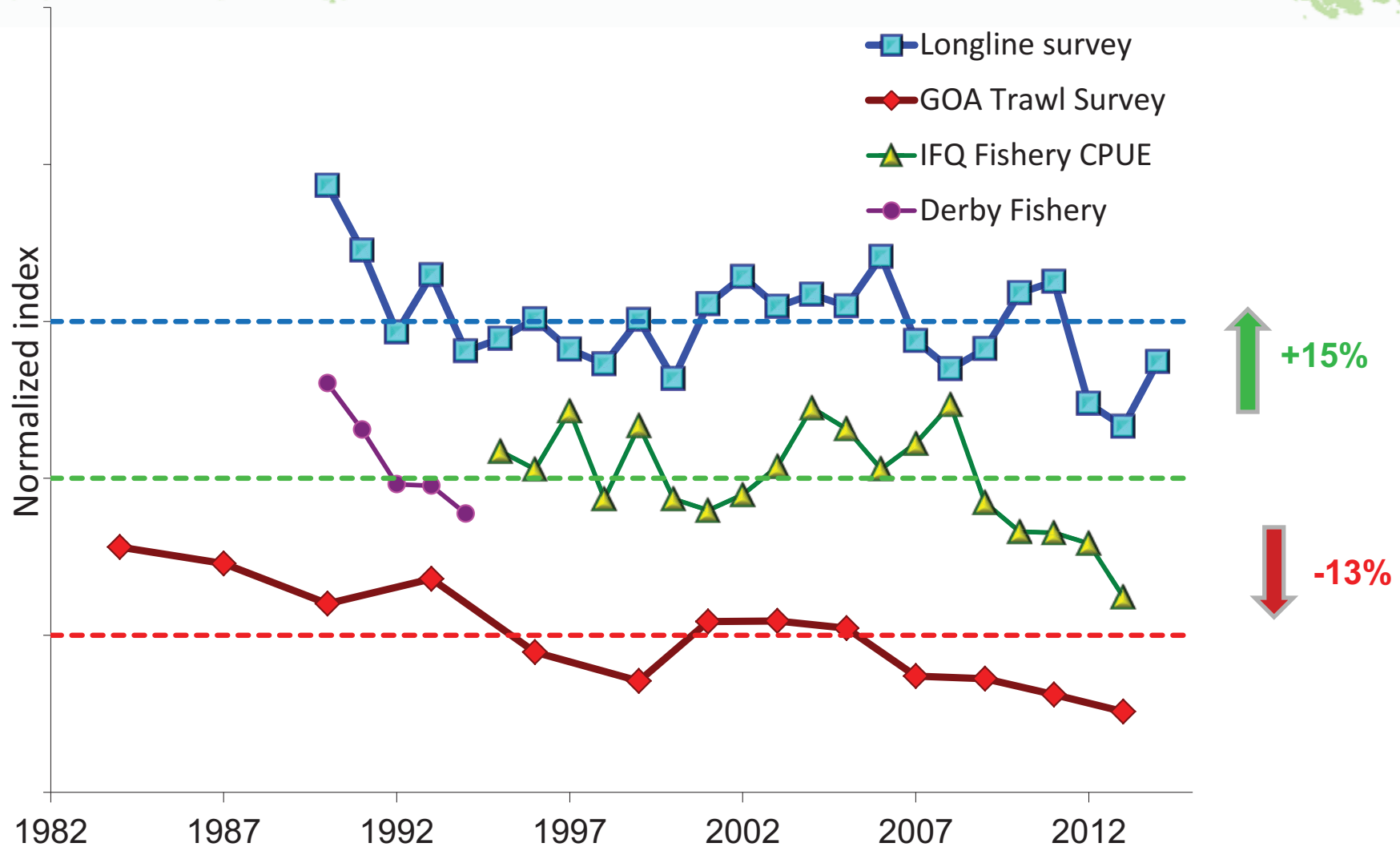
2014 Longline survey

2013 Longline and trawl fisheries

# Sablefish Catch by Area

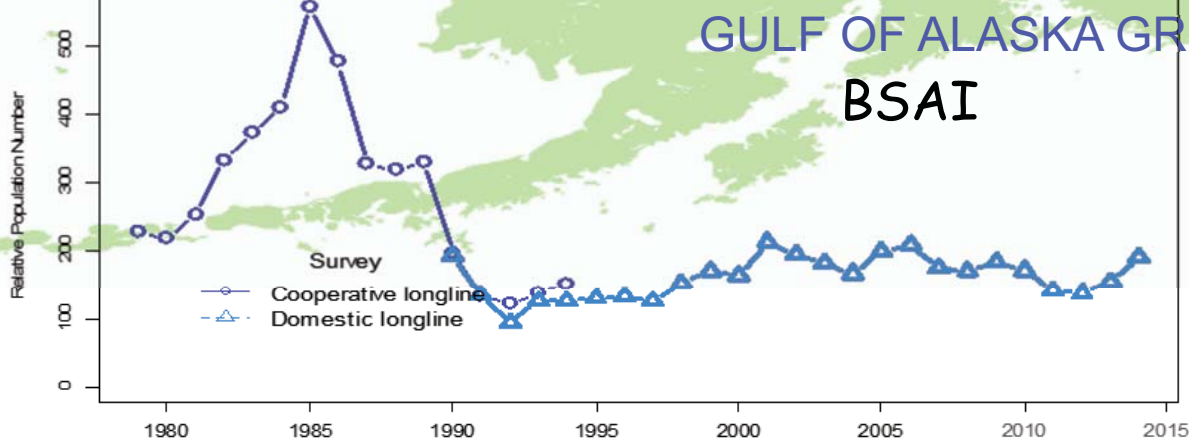


# Sablefish abundance indices

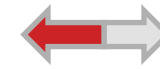
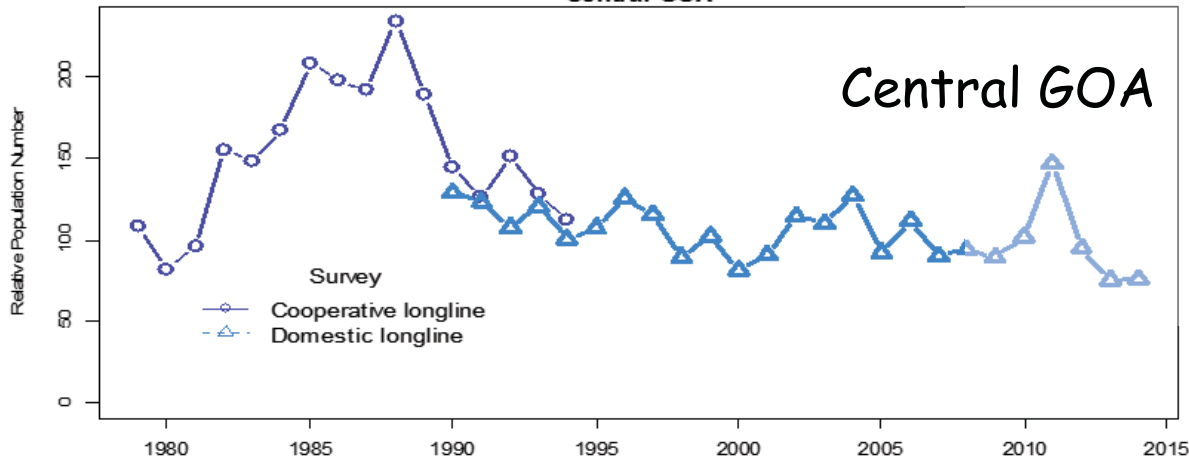


# GULF OF ALASKA GROUND FISH ASSESSMENTS

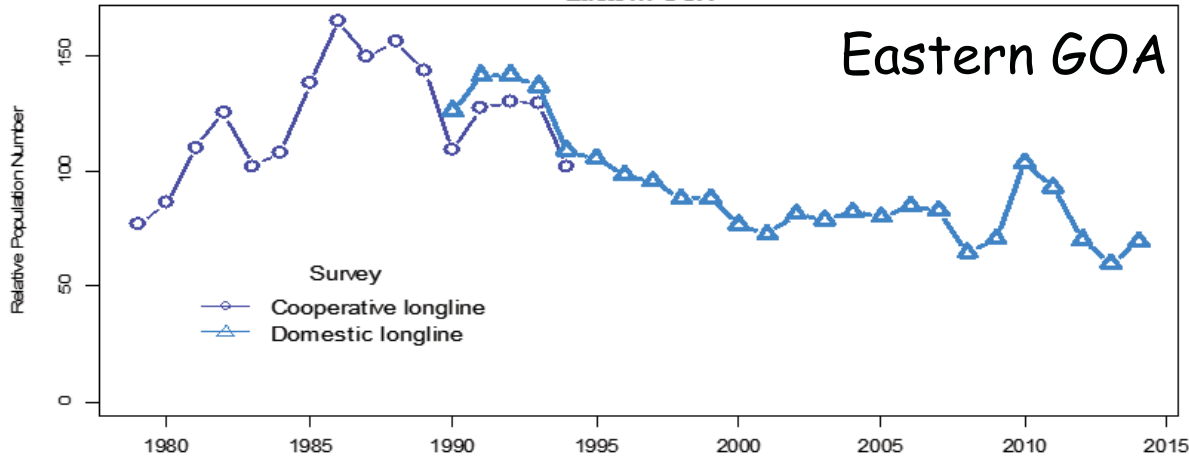
## BSAI



## Central GOA

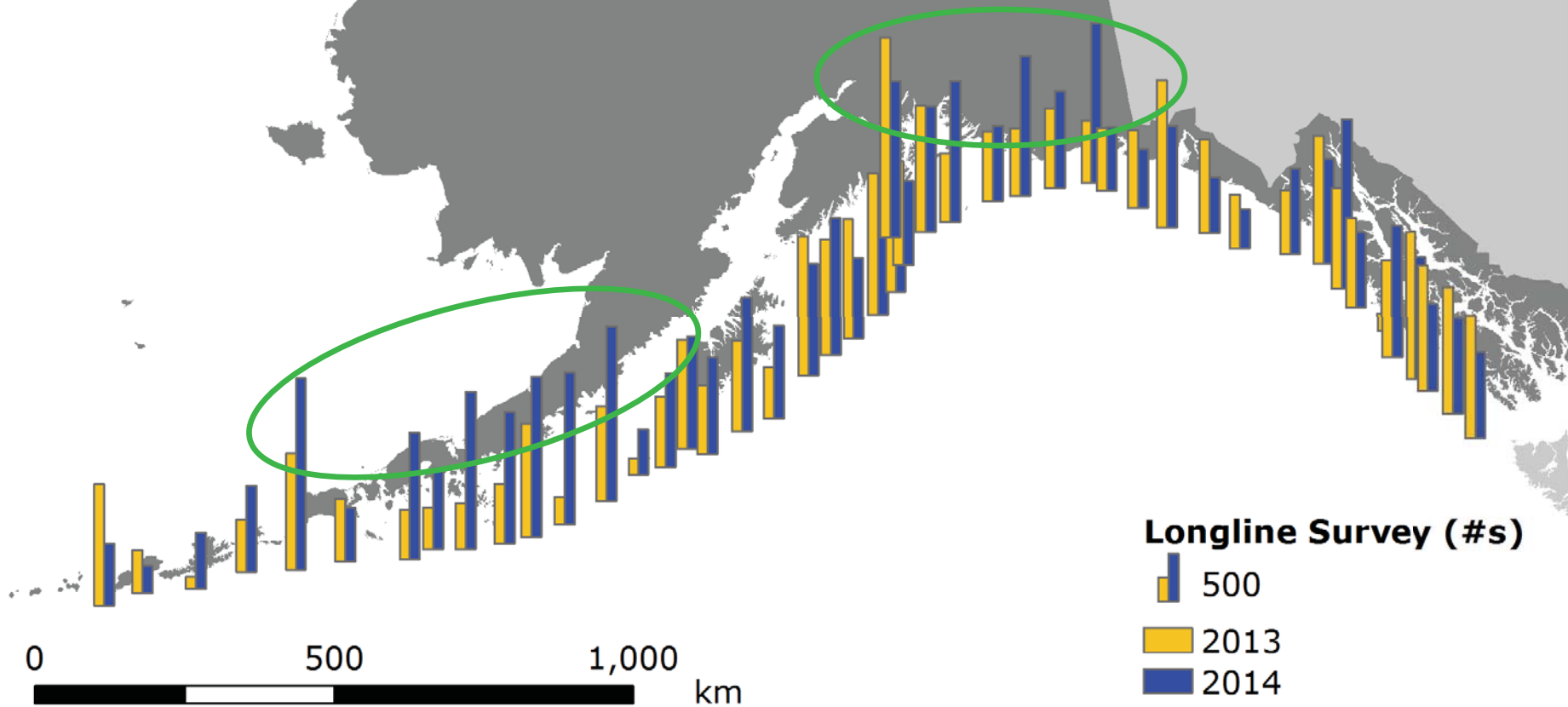


## Eastern GOA

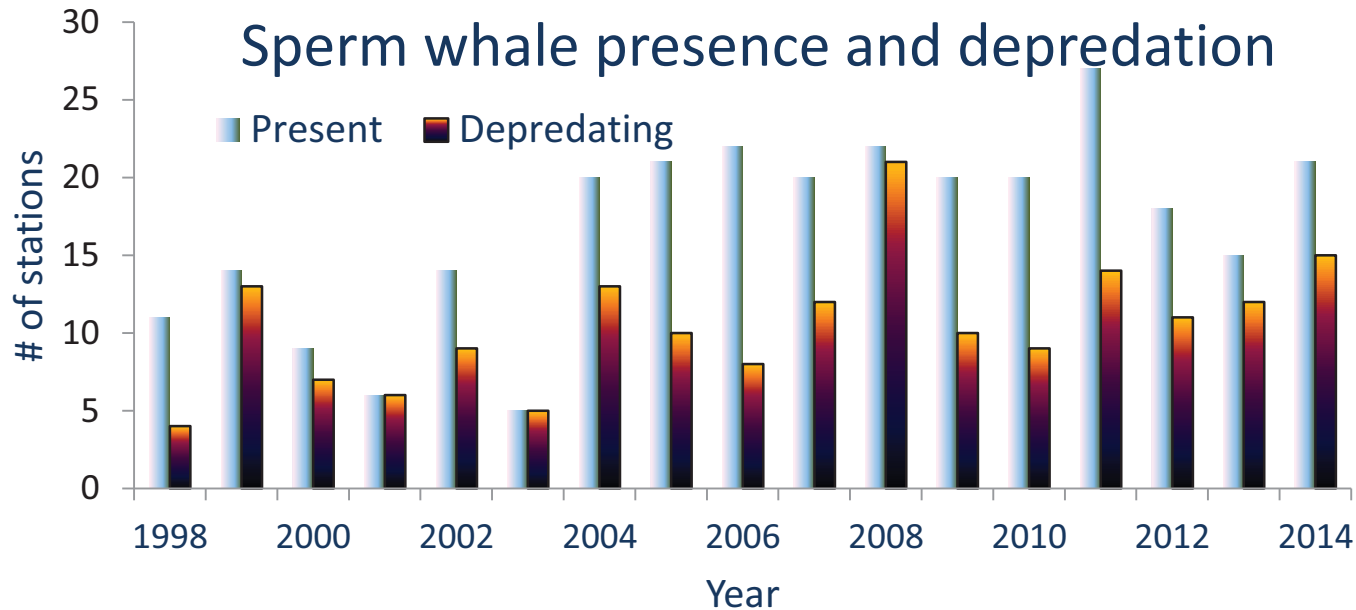
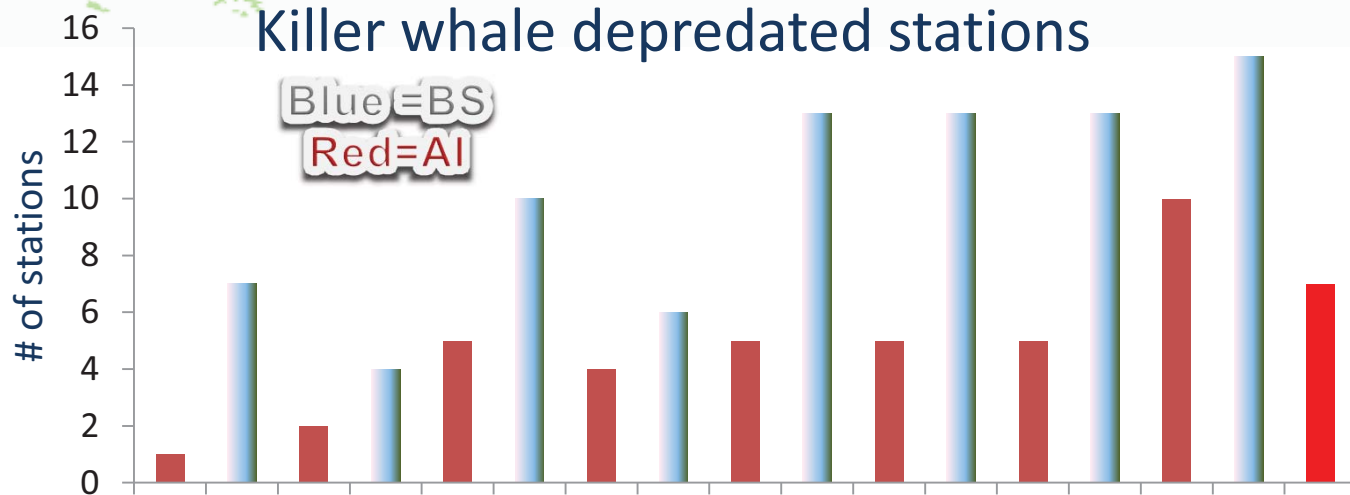


Sablefish  
longline  
survey  
RPN  
by  
area...

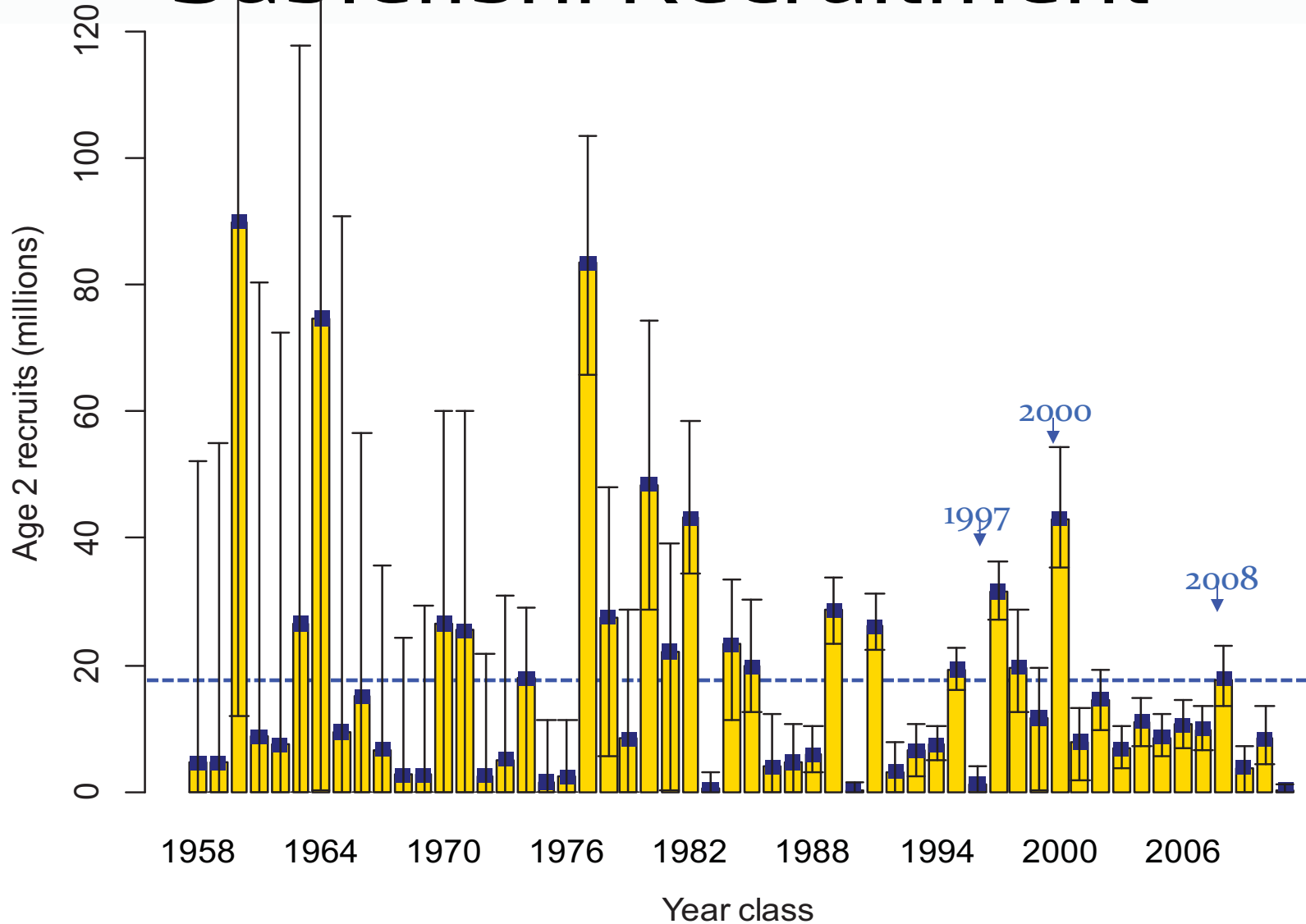
# Gulf of Alaska longline survey Sablefish 2013 and 2014



# Longline survey whale depredation

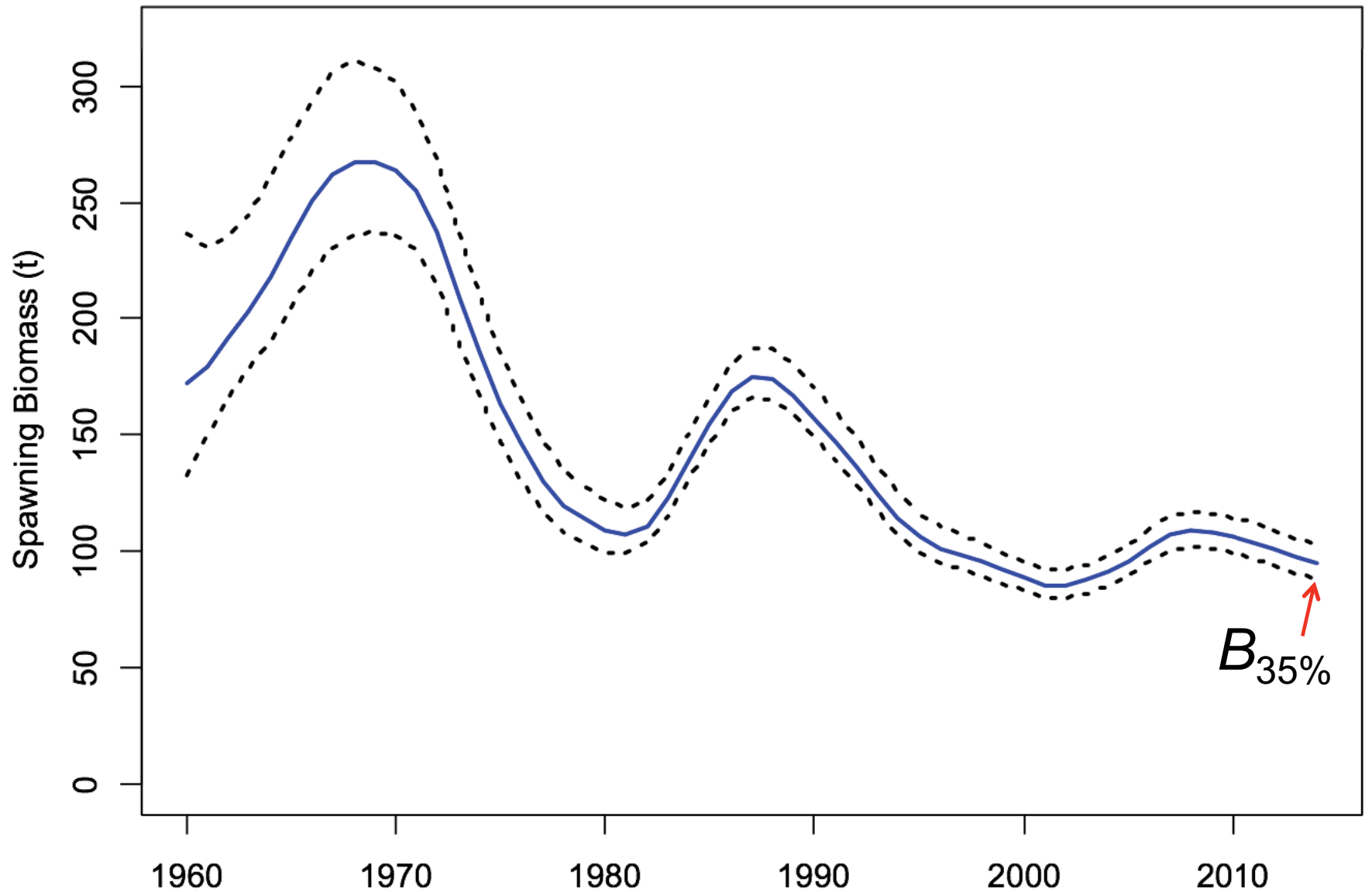


# Sablefish: Recruitment





# Sablefish



# Sablefish ABC/OFL

2015 spawning biomass @ 35% of  $B_{100\%}$

Gulf-wide ABC 2015: 13,657 t

*(vs. 12,400 t projected)*

GOA specific:

Sablefish	Biomass	OFL	ABC
2015	130,000	12,425	10,522
2016		11,293	9,558

# Sablefish

## Apportionment

### 2013 recap

- Goal 1: Take in to account actual changes in the distribution of the population
  - ♦ Solution 1: Use most recent survey and fishery CPUE distribution
- Goal 2: Reduce interannual variability in area ABCs
  - ♦ Solution 2: Use 5 year exponential average

# Sablefish apportionment

- Two options presented last year, Team went with Author's recommendation (greater stability)

Area	2014 ABC	Standard apportionment for 2015 ABC	Recommended fixed apportionment for 2015 ABC*	Difference from 2014
Total	13,722	13,657	<b>13,657</b>	-0.5%
Bering Sea	1,339	2,210	<b>1,333</b>	-0.5%
Aleutians	1,811	1,840	<b>1,802</b>	-0.5%
Gulf of Alaska (subtotal)	10,572	9,607	<b>10,522</b>	-0.5%
Western	1,480	1,445	<b>1,473</b>	-0.5%
Central	4,681	3,975	<b>4,658</b>	-0.5%
W. Yakutat**	1,574	1,428	<b>1,567</b>	-0.5%
E. Yak. / Southeast**	2,837	2,759	<b>2,823</b>	-0.5%

# Sablefish apportionment recommendation

- Interim measure to smooth out ABC variability
- Apportionment for sablefish less biological
- PhD project with UAF on spatial model to evaluate apportionment strategies to:
  - ♦ Maximize spawning biomass
  - ♦ Minimize volatility
  - ♦ Consider economic yield
- Guidance on apportionment research in September 2016

# Flatfish ABC Summary



Species	2014 Catch	ABC		Change	
		2014	2015		
Pollock	139,753	174,976	203,934	up 28,958	(17%)
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# Flatfish ABC's

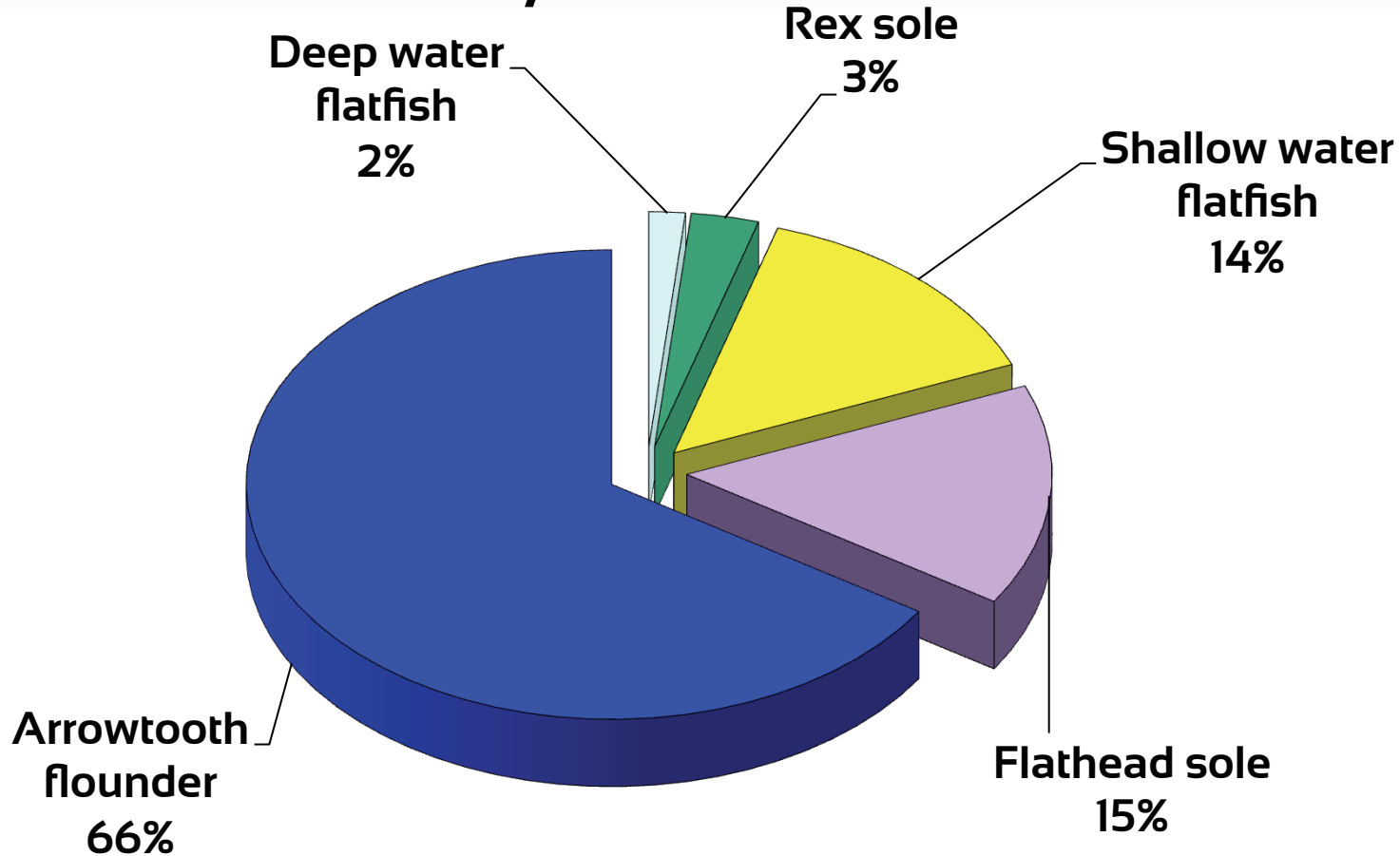
Stock	2014	2015	Change
Shallow water	40,805	44,205	up 3,400(8%)
Rex sole	9,341	9,150	down 191(2%)
Deep water	13,472	13,334	down 138(1%)
Flathead sole	41,231	41,349	up 118(0%)
Arrowtooth	195,358	192,921	down 2,437(1%)
Subtotal	300,207	300,959	up 752(0%)

Deep-water ABC from Dover assessment Tier 3 + others Tier 6

Shallow water flats: N and S rock sole Tier 3, others Tier 5

# Flatfish 2013 ABC's

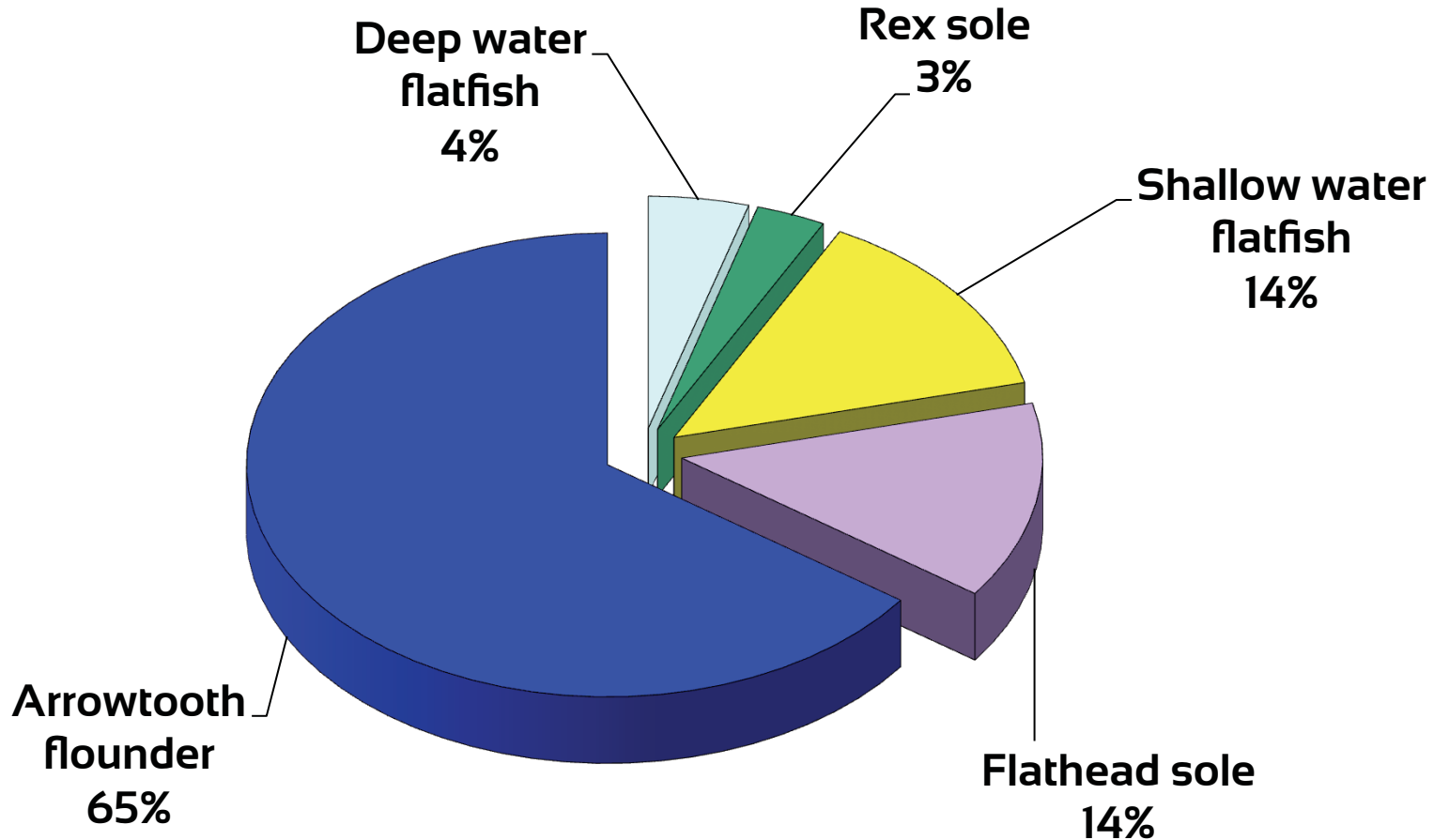
319,359 t combined





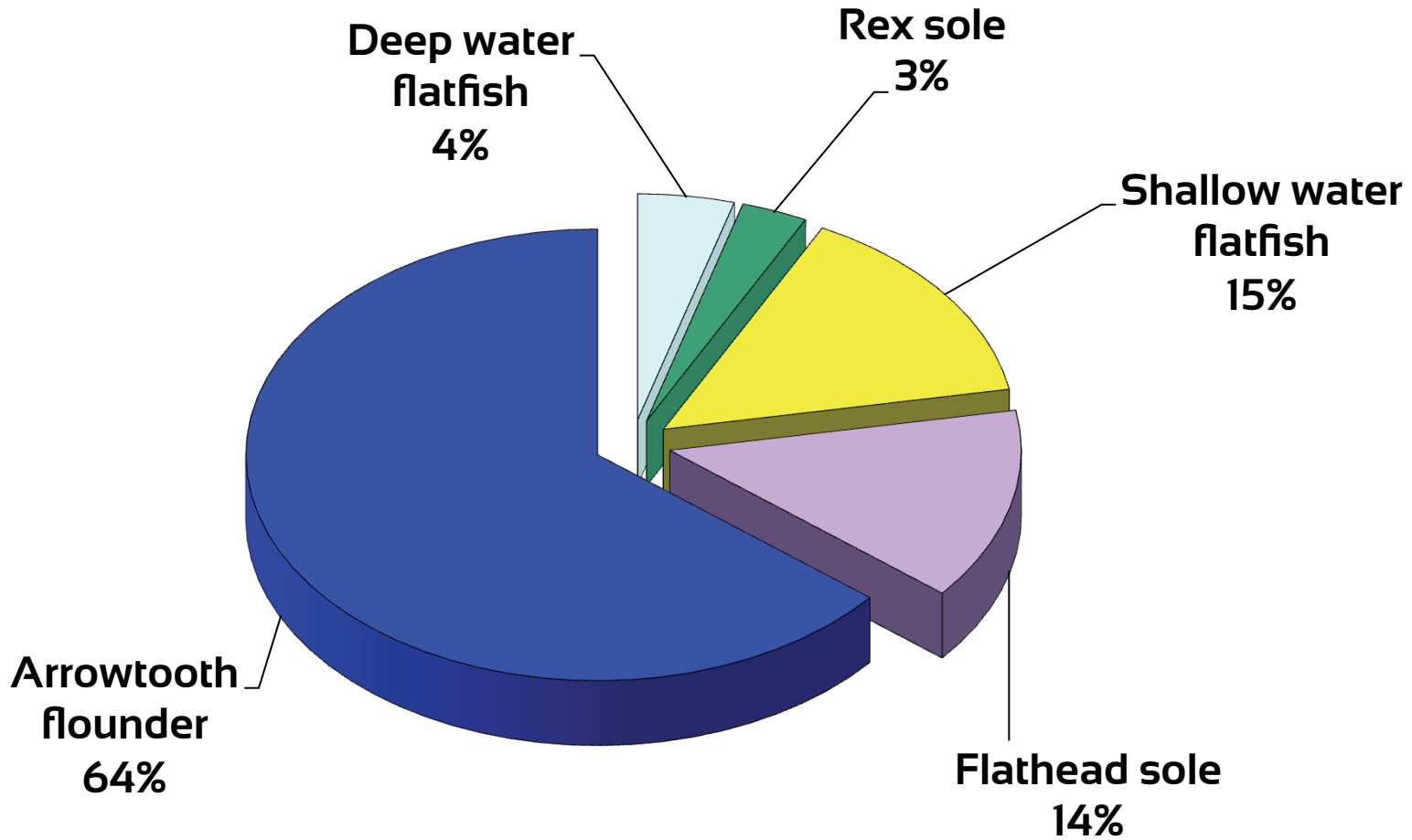
# Flatfish 2014 ABC's

300,207 t combined



# Flatfish 2015 ABC's

300,959 t combined



# General comments on flatfish assessments

- Lightly exploited
- Model developments:
  - ◆ N & S rock sole model
    - Continued development
  - ◆ Dover and flathead sole models done in full in 2013:
    - Stock Synthesis modeling platform (SS3) application
    - Several changes in data inputs and model configuration
  - ◆ Rex sole assessment
    - Same Tier 5 approach using model estimated adult biomass

# Flatfish ABC's

Stock	2014	2015	Change
Shallow water	40,805	44,205	up 3,400(8%)
Rex sole	9,341	9,150	down 191(2%)
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Shallow water flats: N and S rock sole Tier 3, others Tier 5

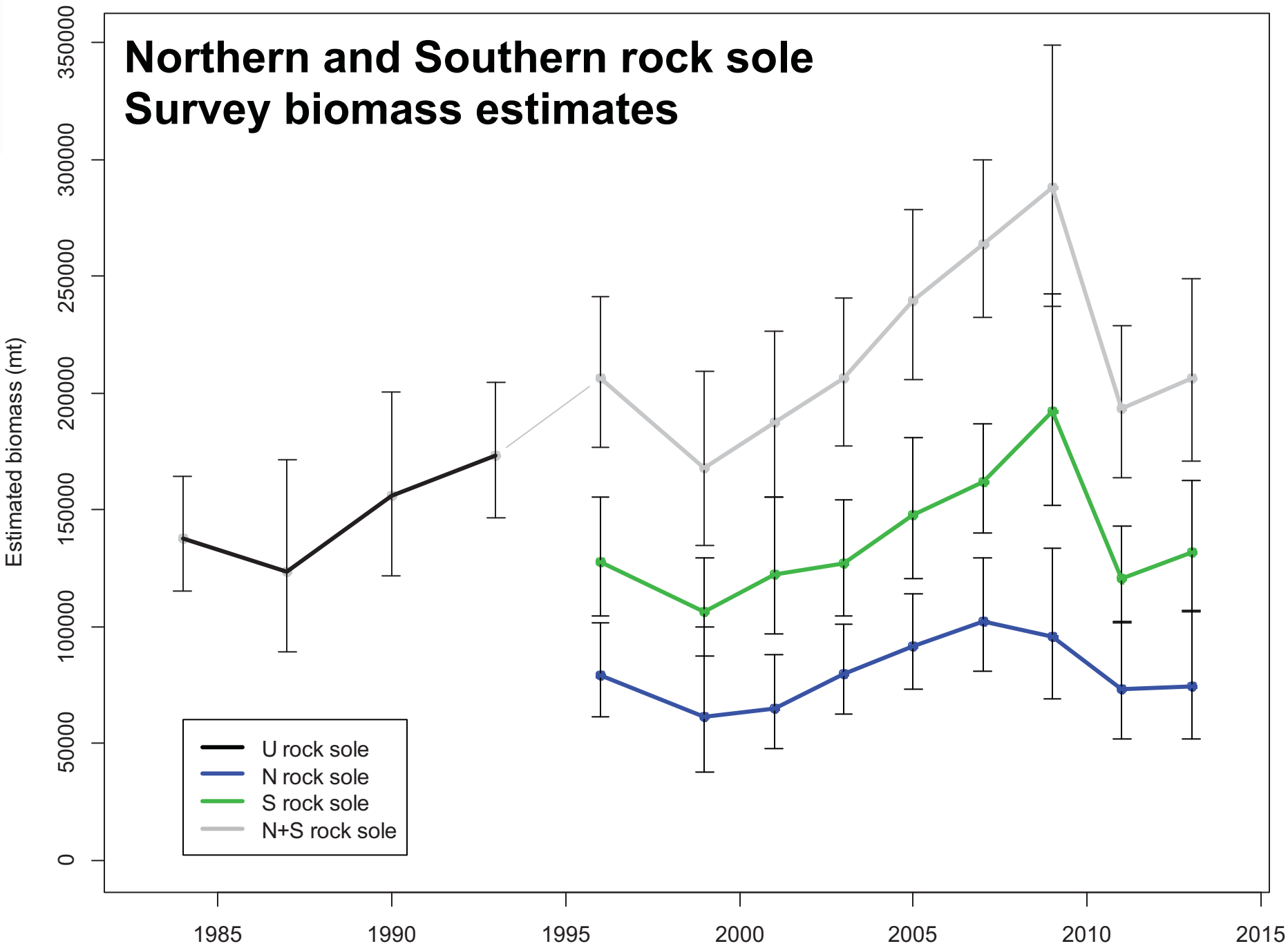
# 4. Shallow water flatfish

Rock sole species increased, others mainly decreased relative to 2011 survey estimates:

<b>Survey biomass estimates (t)</b>	<b>2011</b>	<b>2013</b>
Northern rock sole	72,875	74,586
Southern rock sole	120,573	131,441
Yellowfin sole	46,576	23,016
Butter sole	19,695	8,122
Starry flounder	39,757	30,028
English sole	16,720	18,121
Sand sole	755	703
Alaska plaice	12,266	8,044
<b>Total</b>	<b>329,217</b>	<b>294,061</b>

# Northern and Southern rock sole

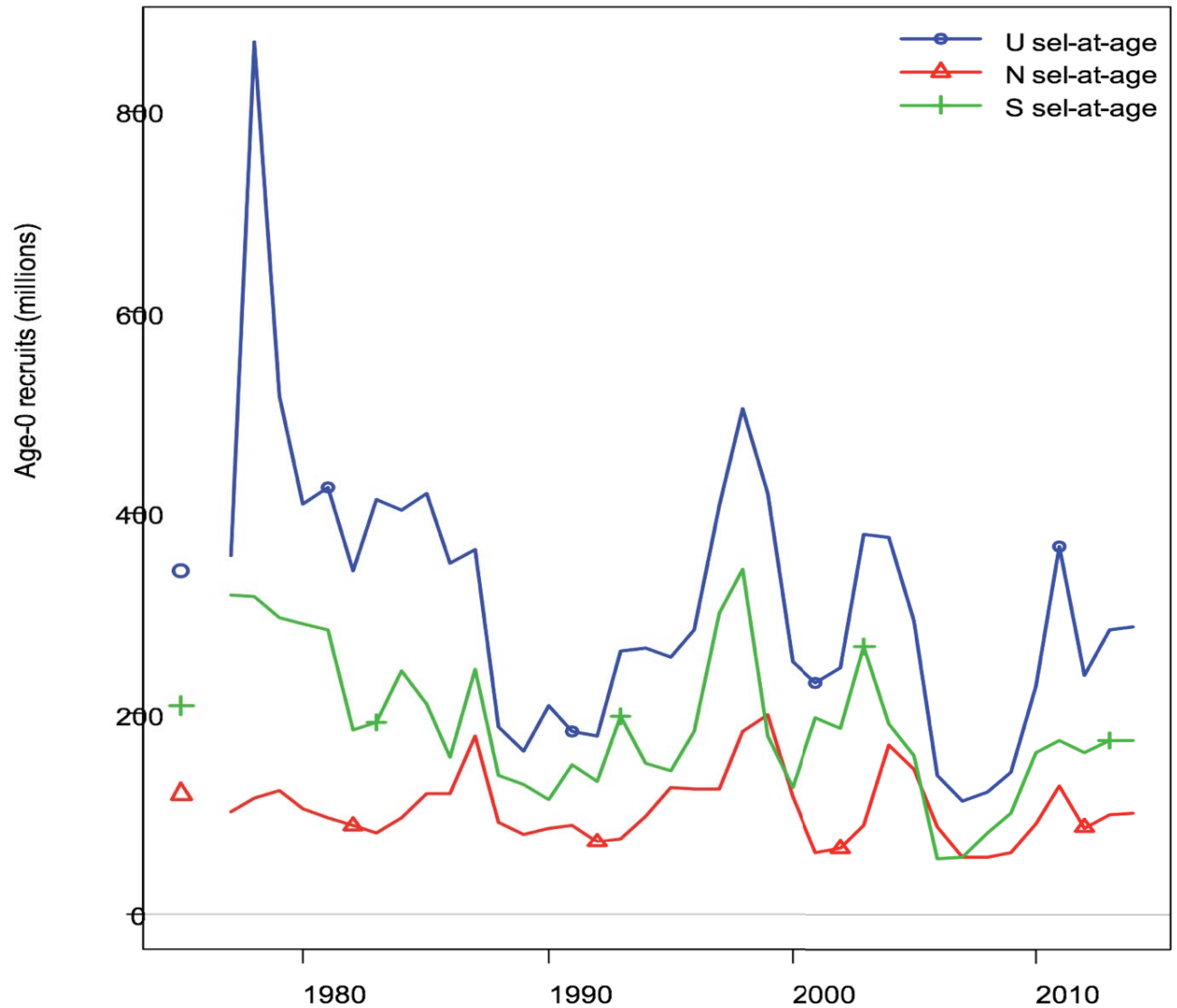
## Survey biomass estimates



# GOA N and S rock sole Model

- 2012 model was used for 2013
  - ♦ 2013 executive summary with updated projection
  - ♦ Two species two sex mixed fishery statistical catch-at-age model
- Stock synthesis version presented last year and in September 2014
  - ♦ Used this year

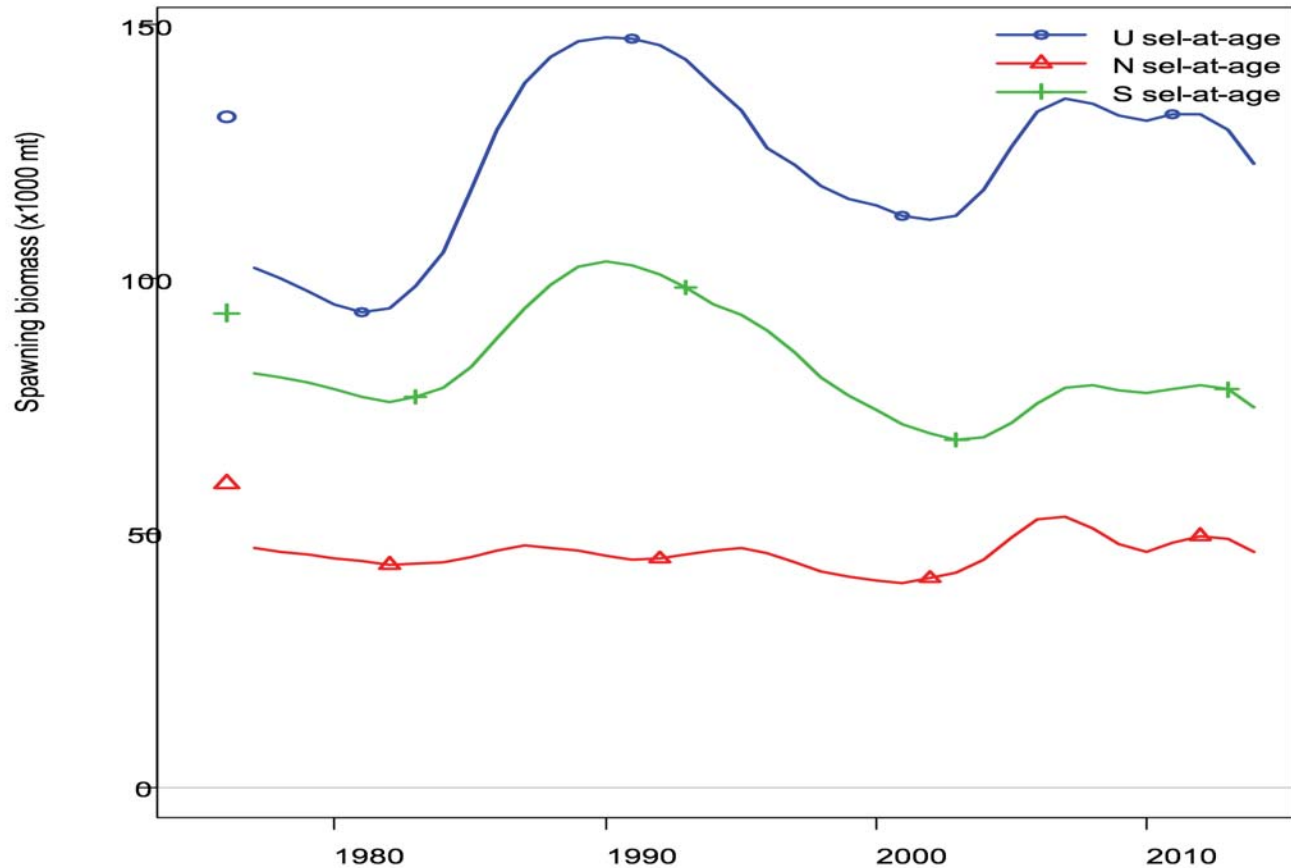
# GOA Rock sole recruitment





# 4. Shallow water flatfish summary

	Biomass	OFL	ABC
2015	287,534	54,207	44,205
2016		48,407	39,205



# Flatfish ABC's

Stock	2014	2015	Change
Shallow water	40,805	44,205	up 3,400(8%)
Rex sole	9,341	9,150	down 191(2%)
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Deep-water ABC from Dover assessment Tier 3 + others Tier 6

# Deepwater flatfish

Dover sole  
Deepsea sole  
Greenland turbot

Deepwater  
flatfish

Biomass

OFL

ABC

2015

182,160

15,993

13,334

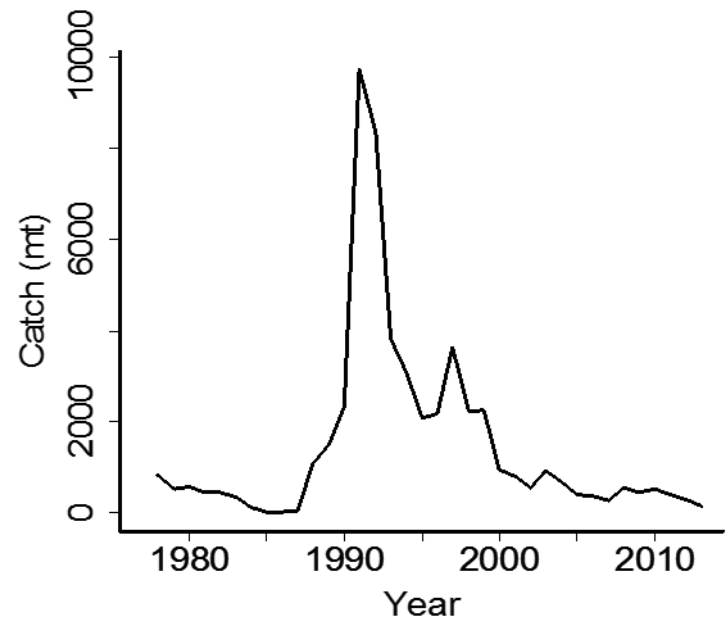
2016

15,803

13,177



Dover sole  
catch



# Flatfish ABC's

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# 6. GOA Rex Sole

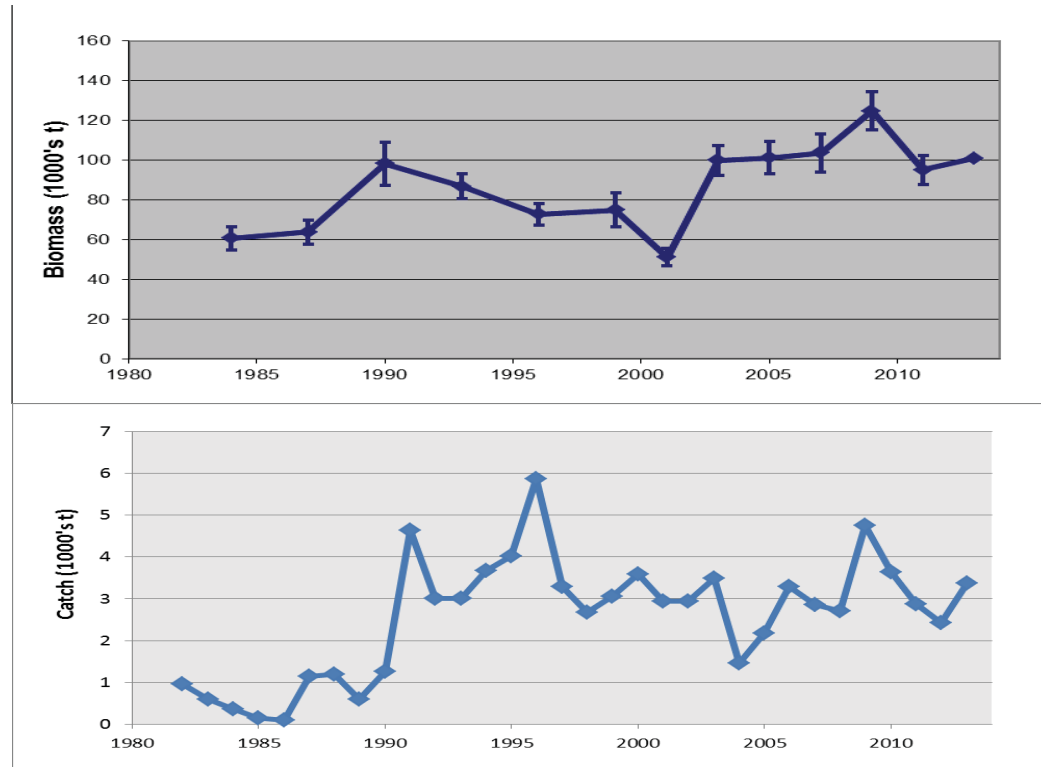
Age-structured model (since 2004),  $M=0.17$

In 2005 adopted Tier 5 approach with model est. adult biomass

Maturity much younger than selectivity - unreliable  $F_{40\%}$ ,  $F_{50\%}$

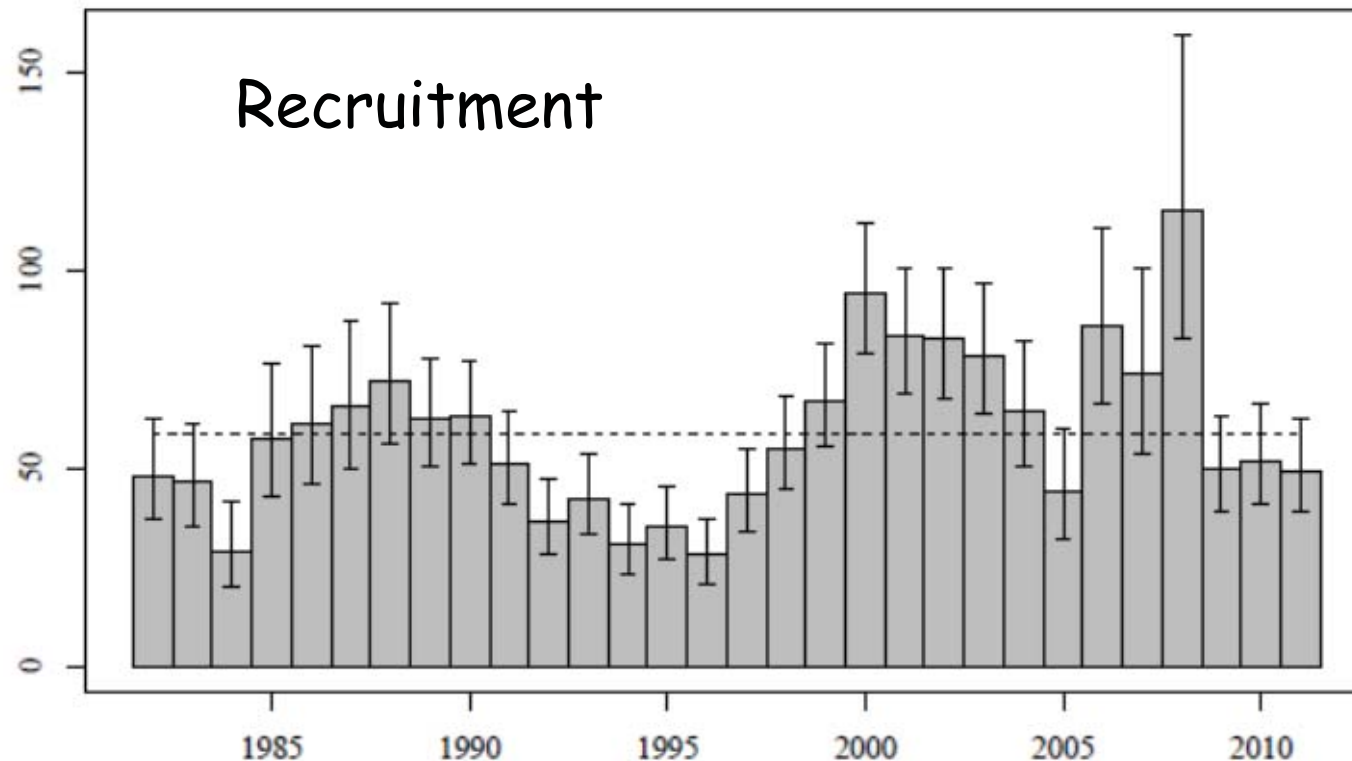


2014 an  
executive  
summary



# 6. Rex sole ABC/OFL

Rex sole	Biomass	OFL	ABC
2015	82,972	11,957	9,150
2016		11,733	8,979



**Tier 5**  
(model based)  
Key issue:  
Selectivity  
estimate  
unreliable, hence  
 $F_{40\%}$  also  
unreliable

# Flatfish ABC's

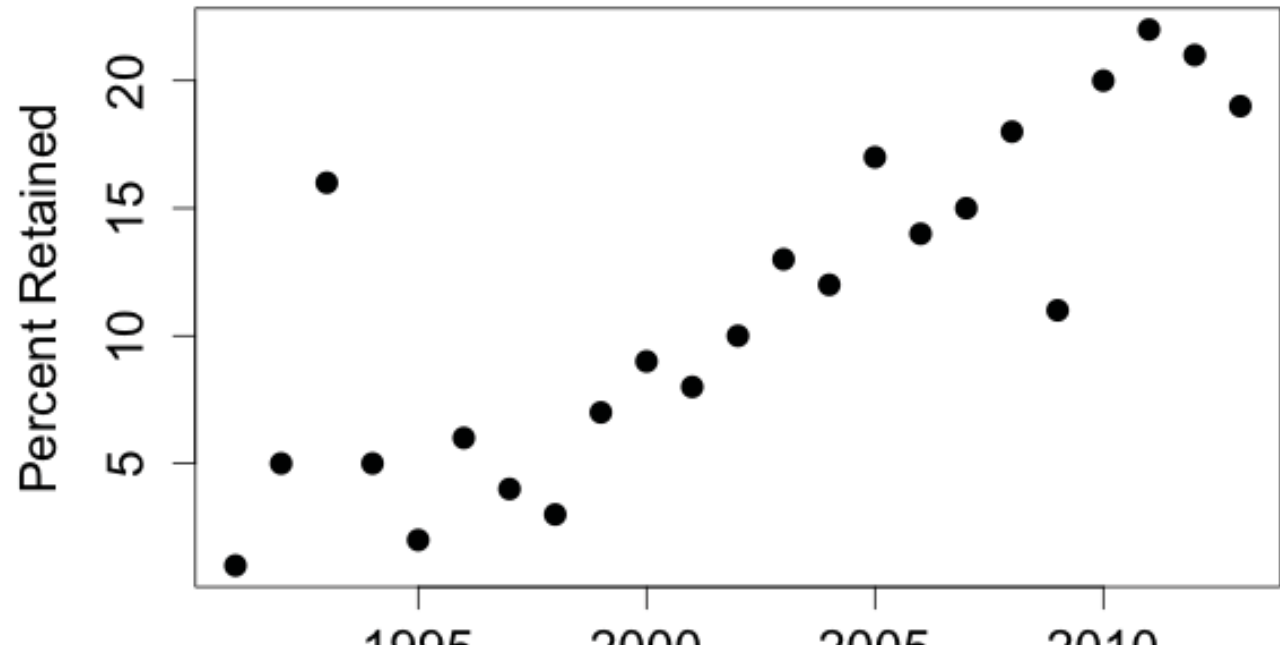
Stock	2014	2015	Change
Shallow water	40,805	44,205	up 3,400(8%)
Rex sole	9,341	9,150	down 191(2%)
Deep water	13,472	13,334	down 138(1%)
Flathead sole	41,231	41,349	up 118(0%)
Arrowtooth	195,358	192,921	down 2,437(1%)
Subtotal	300,207	300,959	up 752(0%)

# 7. GOA Arrowtooth flounder

Based on age/sex structured model

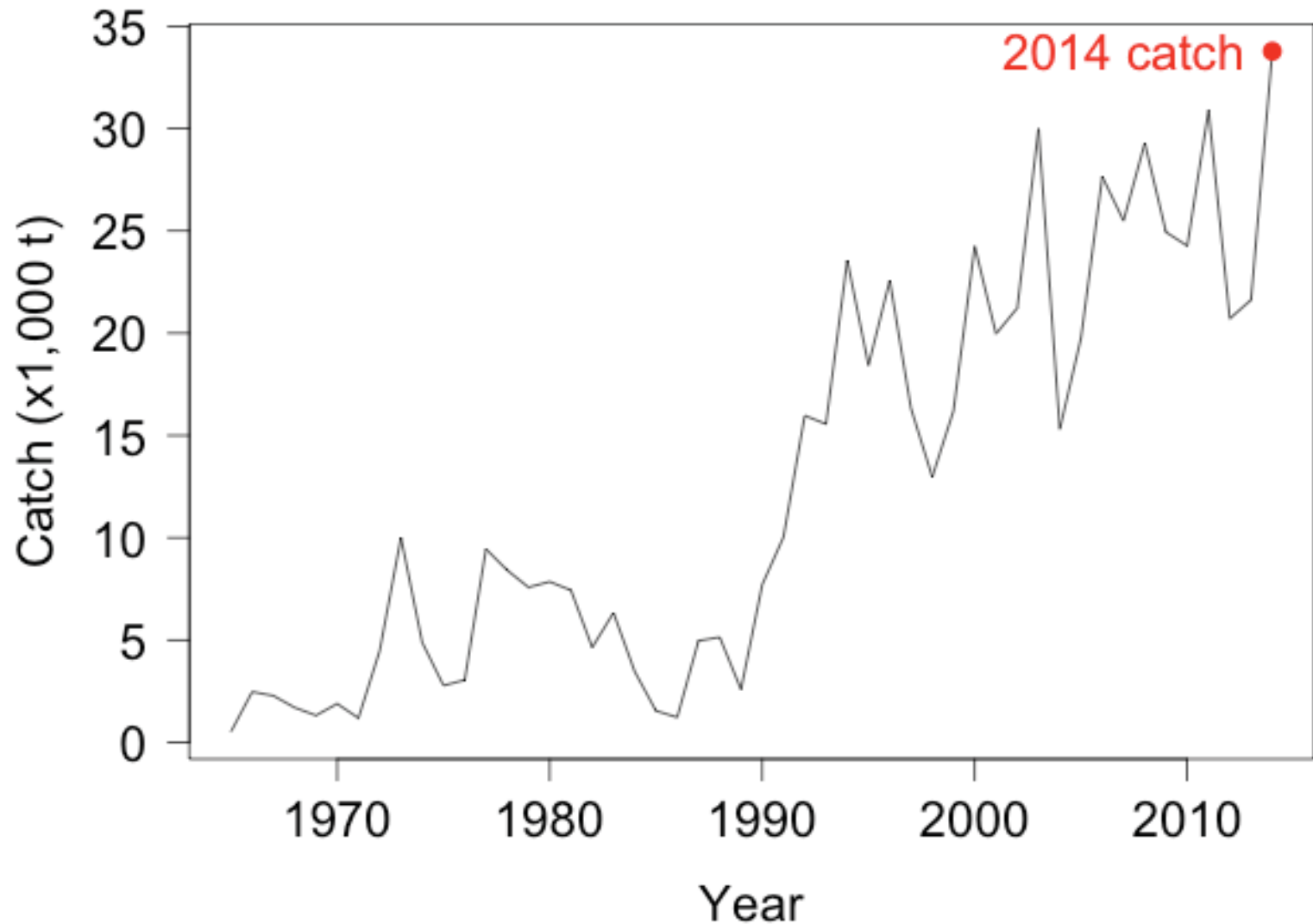
Executive summary

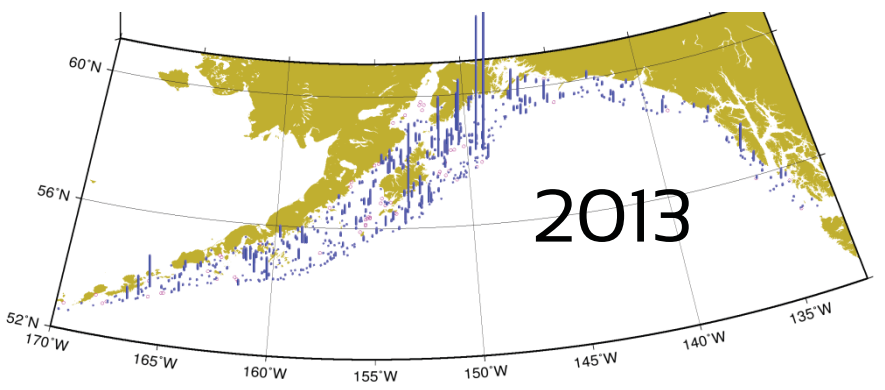
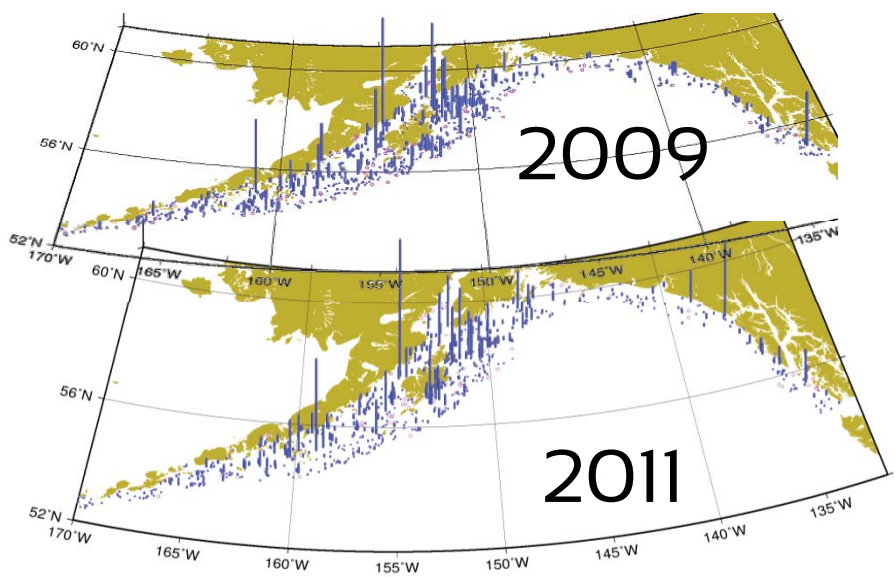
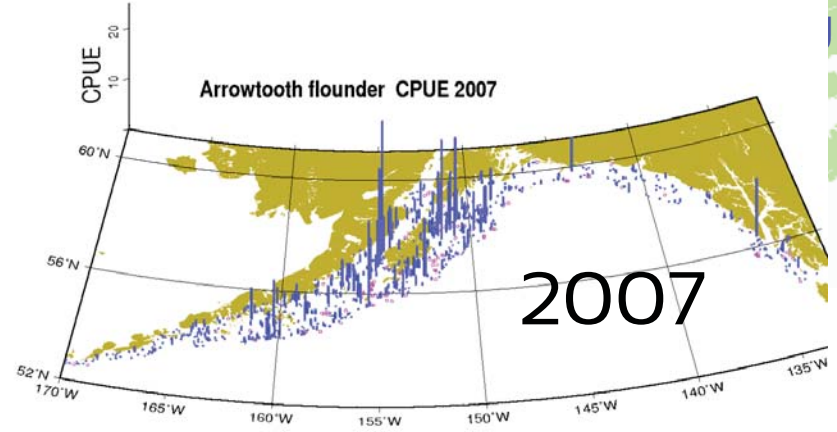
- ◆ Updated catch and projections





# GOA Arrowtooth catch



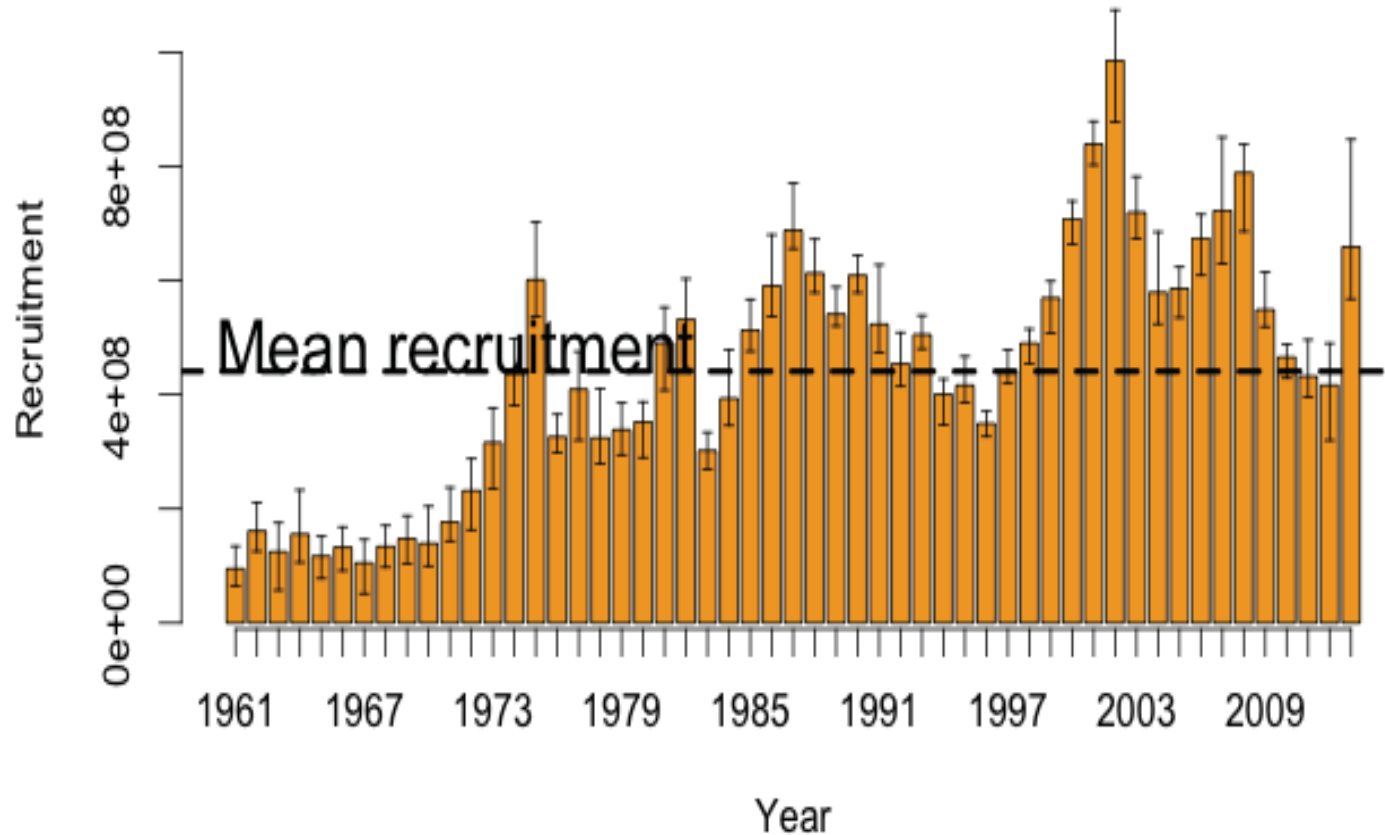


# GOA Arrowtooth flounder survey CPUE

# GOA Arrowtooth flounder ABC/OFL

Tier 3a  
2015 ABC down  
slightly

Year	Biomass	OFL	ABC
2015	1,957,970	226,390	192,921
2016		217,522	185,352



# Flatfish ABC's

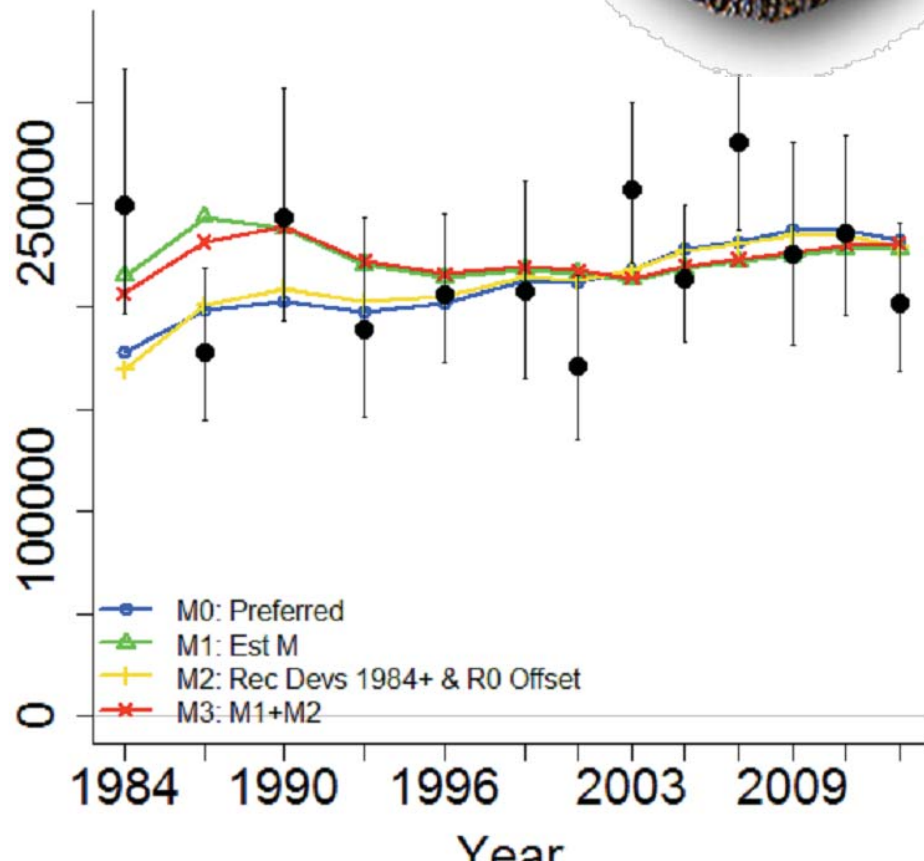
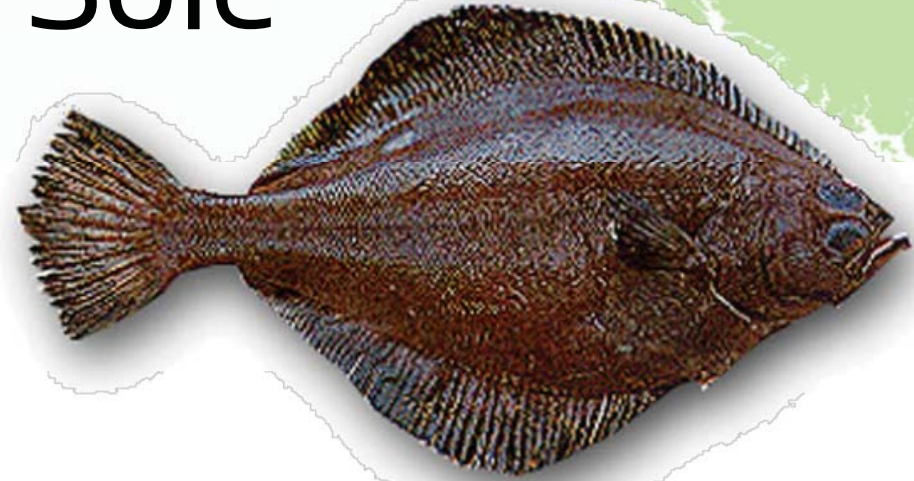
Stock	2014	2015	Change
Shallow water	40,805	44,205	up 3,400(8%)
Rex sole	9,341	9,150	down 191(2%)
Deep water	13,472	13,334	down 138(1%)
Flathead sole	41,231	41,349	up 118(0%)
Arrowtooth	195,358	192,921	down 2,437(1%)
Subtotal	300,207	300,959	up 752(0%)

# 8. GOA Flathead Sole

## Age-structured model

2013 development of  
stock synthesis  
Application

## Executive summary

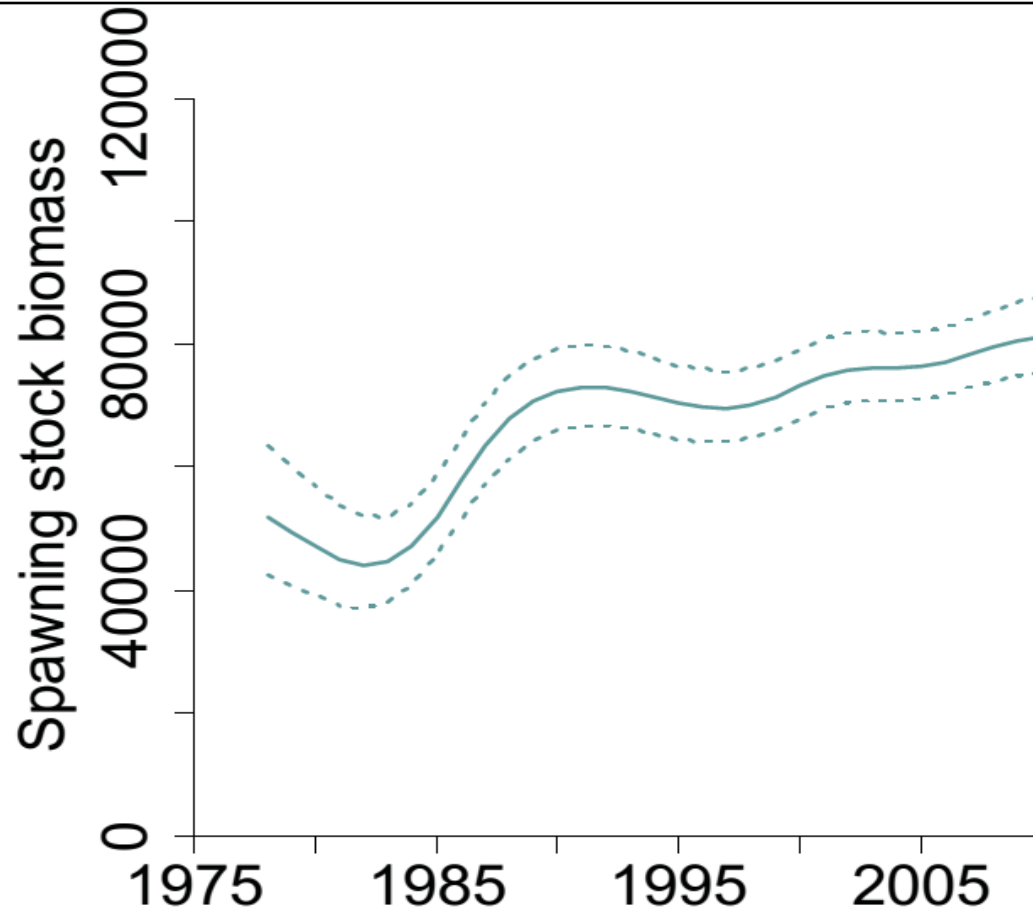


# GOA Flathead sole ABC/OFL

	Biomass	OFL	ABC
2015	254,602	50,792	41,349
2016		50,818	41,378

Tier 3a

Executive  
summary

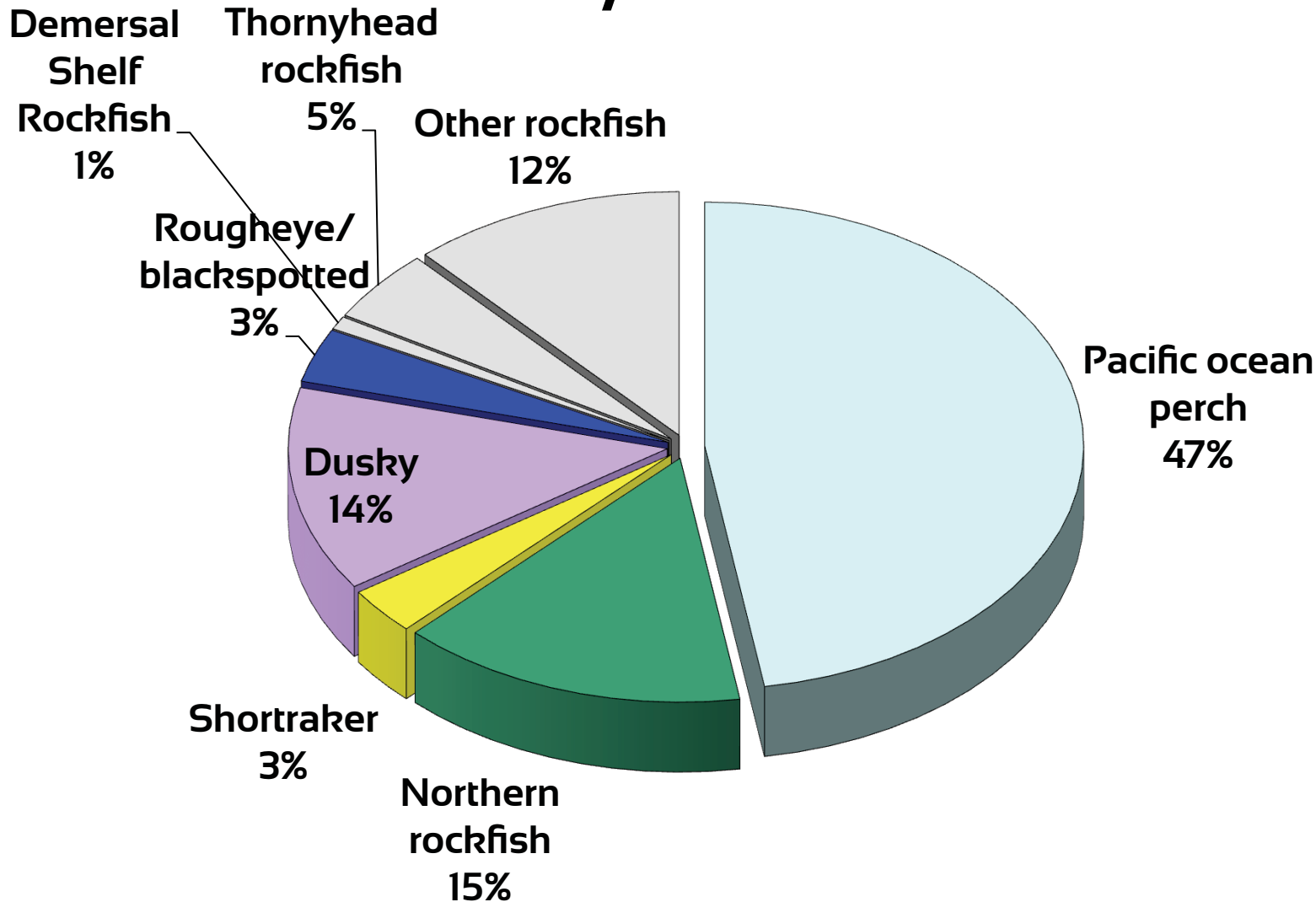


## GOA Rockfish

Species	2014	ABC		
	Catch	2014	2015	Change
Pollock	139,753	174,976	203,934	up 28,958 (17%)
Pacific Cod	59,633	88,500	102,850	up 14,350 (16%)
Sablefish	10,375	10,572	10,522	down 50 (0%)
Flatfish	43,270	104,849	108,038	up 3,189 (3%)
Arrowtooth flounder	2,497	195,358	192,921	down 2,437 (1%)
Rockfish	28,267	38,880	39,711	up 831 (2%)
Atka mackerel	981	4,700	4,700	same (0%)
Skates	4,356	8,627	8,708	up 81 (1%)
Other Species	3,412	14,213	14,213	same (0%)
Total	292,544	640,675	685,597	up 44,922 (7%)

# Slope Rockfish 2013 ABC's

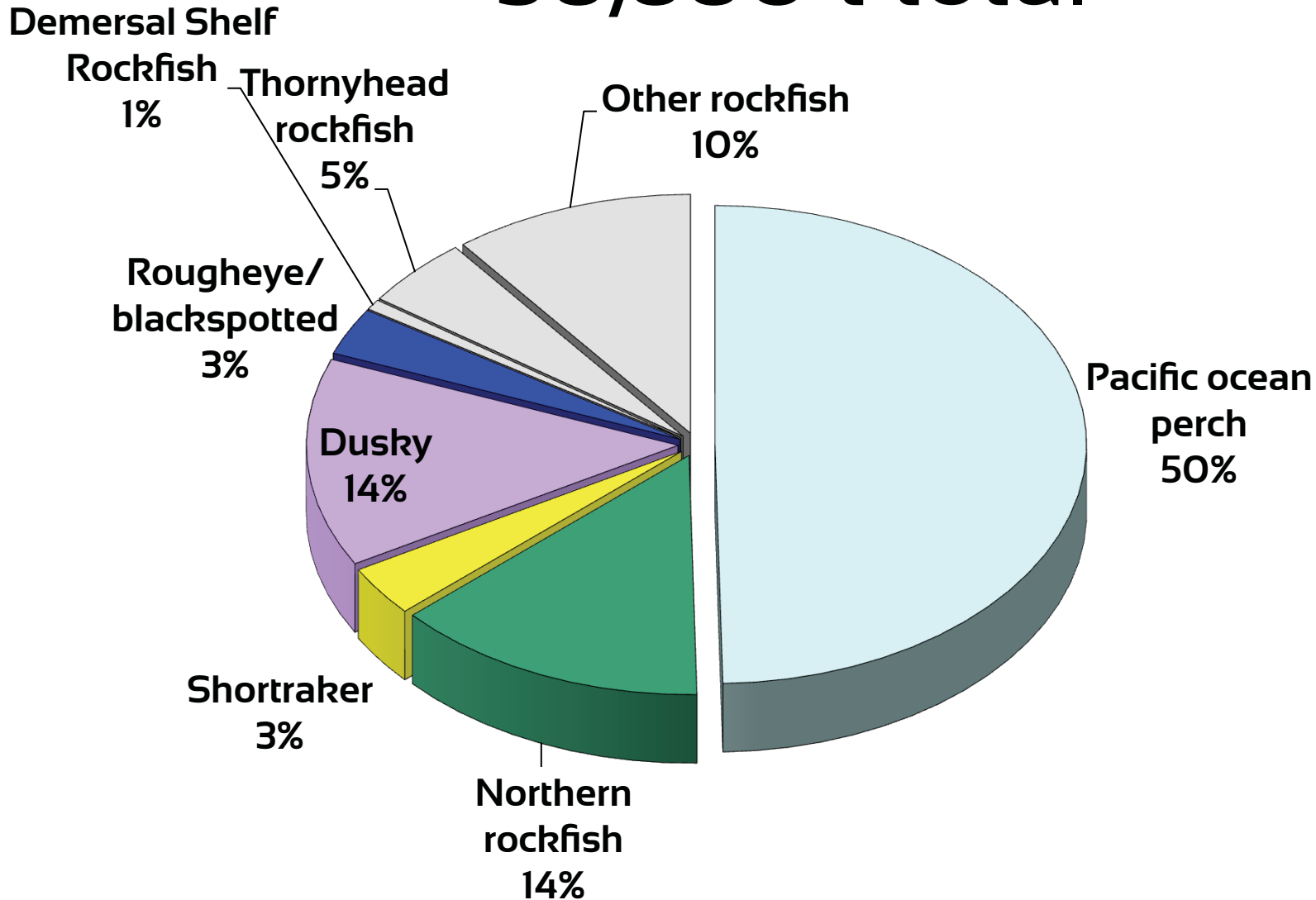
34,568 t total





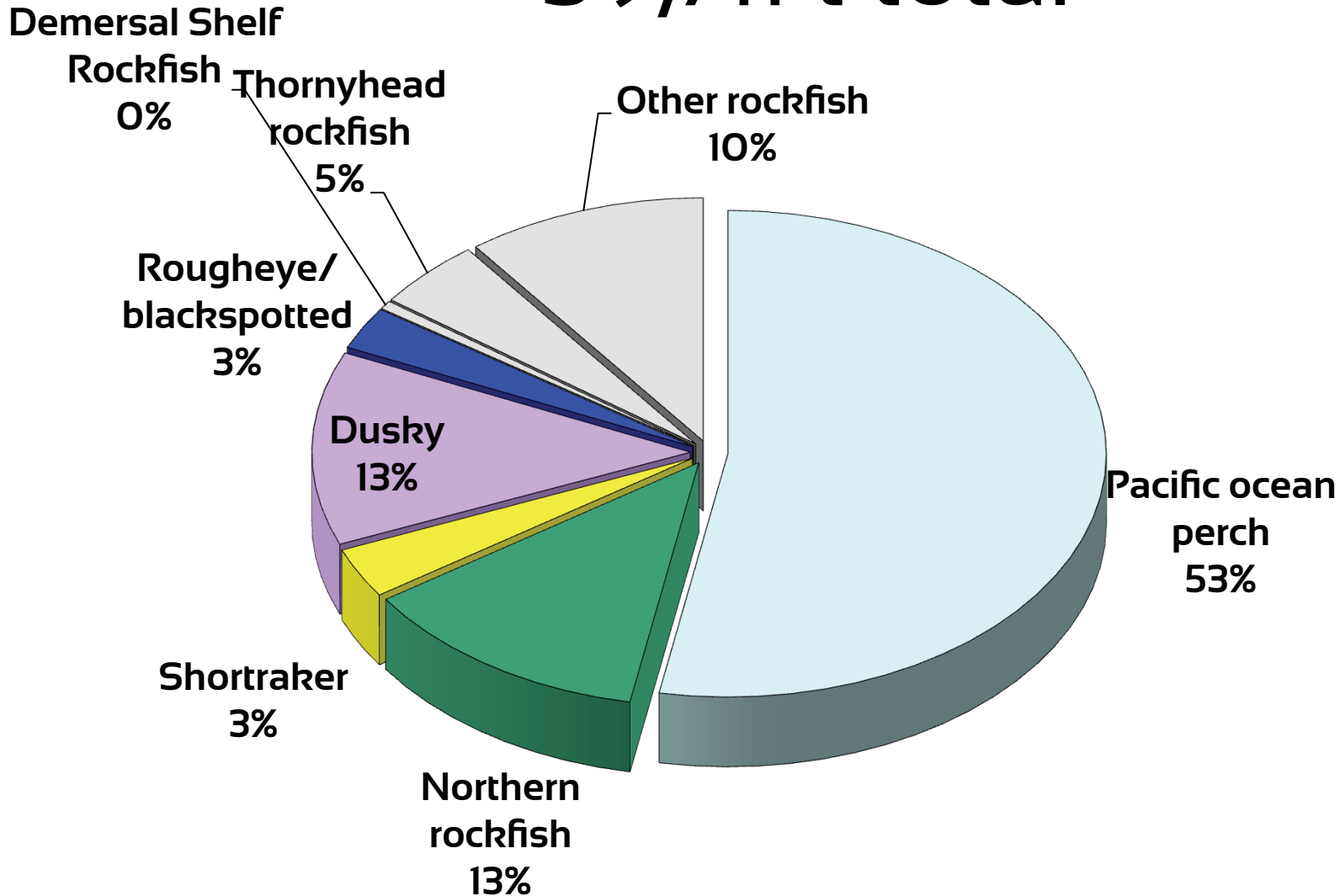
# Rockfish 2014 ABC's

## 38,880 t total



# Rockfish 2015 ABC's

## 39,711 t total



# GOA Rockfish overview

## 2013

- ♦ Modified full assessments for POP, northern and dusky rockfish
- ♦ Executive summaries for shortraker, roughey and blackspotted, thornyheads, other rockfish, and demersal shelf rockfish

## 2014

- ♦ Full assessments for POP and roughey/black spotted; others executive summary

# Rockfish assessments

## Projection model assessments

- ♦ Northern Rockfish Tier 3
- ♦ Dusky Rockfish Tier 3

## Rollover assessments

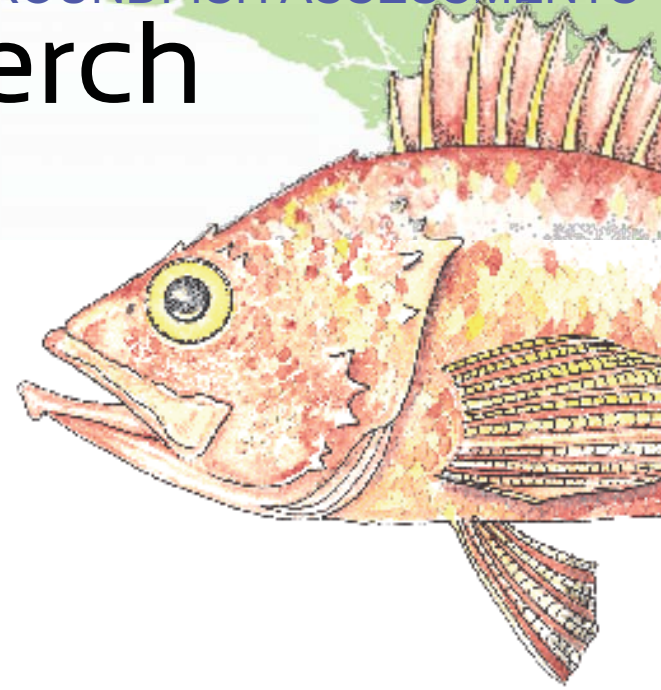
- ♦ Shortraker Rockfish Tier 5
- ♦ Thornyheads Tier 5
- ♦ Other Rockfish (25 species) Tier 4 and 5

# POP ABC Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703(9%)
northern rockfish	5,322	4,999	down 323(6%)
Shortraker Rockfish	1,323	1,323	same(0%)
Dusky	5,486	5,109	down 377(7%)
Rougheyeye and Blackspotted Rockfish	1,244	1,122	same(0%)
Demersal shelf rockfish	274	225	same(0%)
Thornyhead	1,841	1,841	same(0%)
Other rock	4,081	4,080	down 1(0%)
Sub Total	38,880	39,711	up 831(2%)

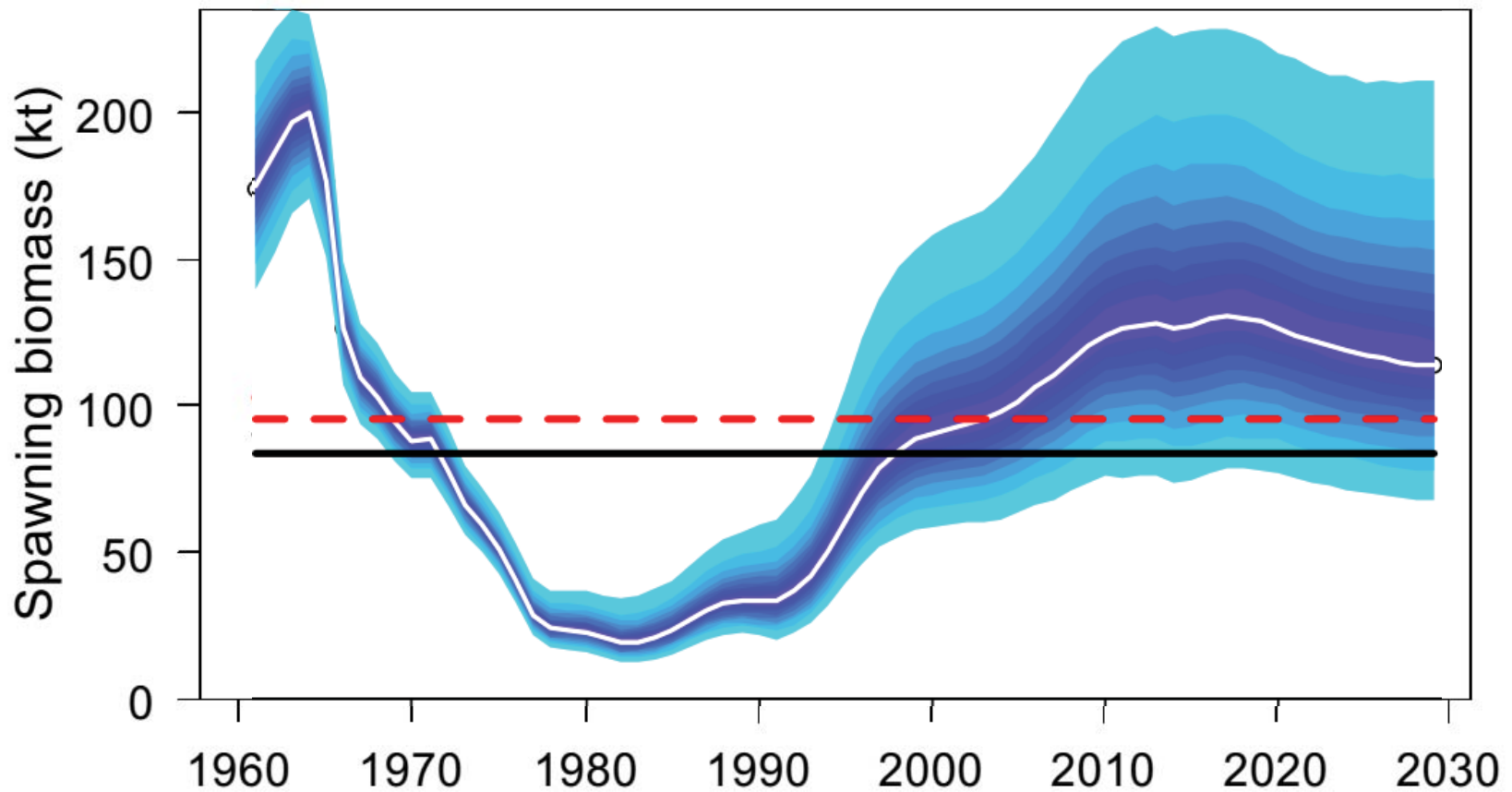
# 9. GOA Pacific ocean perch

- Features
  - ◆ Survey length composition analysis
  - ◆ New maturity
  - ◆ New growth
  - ◆ Random effects apportionment
- Tier 3a



# GOA Pacific ocean perch

Pacific ocean perch	Biomass	OFL	ABC
2015	416,140	24,360	21,012
2016		24,849	21,436



# GOA POP Area apportionment (tons)

	<b>Western</b>	<b>Central</b>	<b>WYAK</b>	<b>SEO</b>	<b>Total</b>
2015 ABC	2,302	15,873	2,014	823	21,012
2016 ABC	2,358	16,184	2,055	839	21,436
	<b>Western</b>	<b>Central</b>	<b>WYAK</b>	<b>SEO</b>	<b>Total</b>
2015 OFL		<b>23,406</b>		954	24,360
2016 OFL		<b>23,876</b>		973	24,849



# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703(9%)
northern rockfish	5,322	4,999	down 323(6%)
Shortraker Rockfish	1,323	1,323	same(0%)
Dusky	5,486	5,109	down 377(7%)
Rougeye and Blackspotted Rockfish	1,244	1,122	same(0%)
Demersal shelf rockfish	274	225	same(0%)
Thornyhead	1,841	1,841	same(0%)
Other rock	4,081	4,080	down 1(0%)
Sub Total	38,880	39,711	up 831(2%)

# Northern rockfish

## Tier 3a species

- ◆ Only update catches in the projection model
- ◆ Updated 2013 and estimated 2014-2016 catches

## Catch Update:

- ◆ Timing of WGOA fishery changed: catch estimate for 2014 changed accordingly

# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703 (9%)
northern rockfish	5,322	4,999	down 323 (6%)
Shortraker Rockfish	1,323	1,323	same (0%)
Dusky	5,486	5,109	down 377 (7%)
Rougheye and Blackspotted Rockfish	1,244	1,122	same (0%)
Demersal shelf rockfish	274	225	same (0%)
Thornyhead	1,841	1,841	same (0%)
Other rock	4,081	4,080	down 1 (0%)
Sub Total	38,880	39,711	up 831 (2%)

# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703 (9%)
northern rockfish	5,322	4,999	down 323 (6%)
Shortraker Rockfish	1,323	1,323	same (0%)
Dusky	5,486	5,109	down 377 (7%)
Rougheye and Blackspotted Rockfish	1,244	1,122	same (0%)
Demersal shelf rockfish	274	225	same (0%)
Thornyhead	1,841	1,841	same (0%)
Other rock	4,081	4,080	down 1 (0%)
Sub Total	38,880	39,711	up 831 (2%)

# 12. Dusky rockfish summary

Dusky rockfish

Biomass

OFL

ABC

2015

66,629

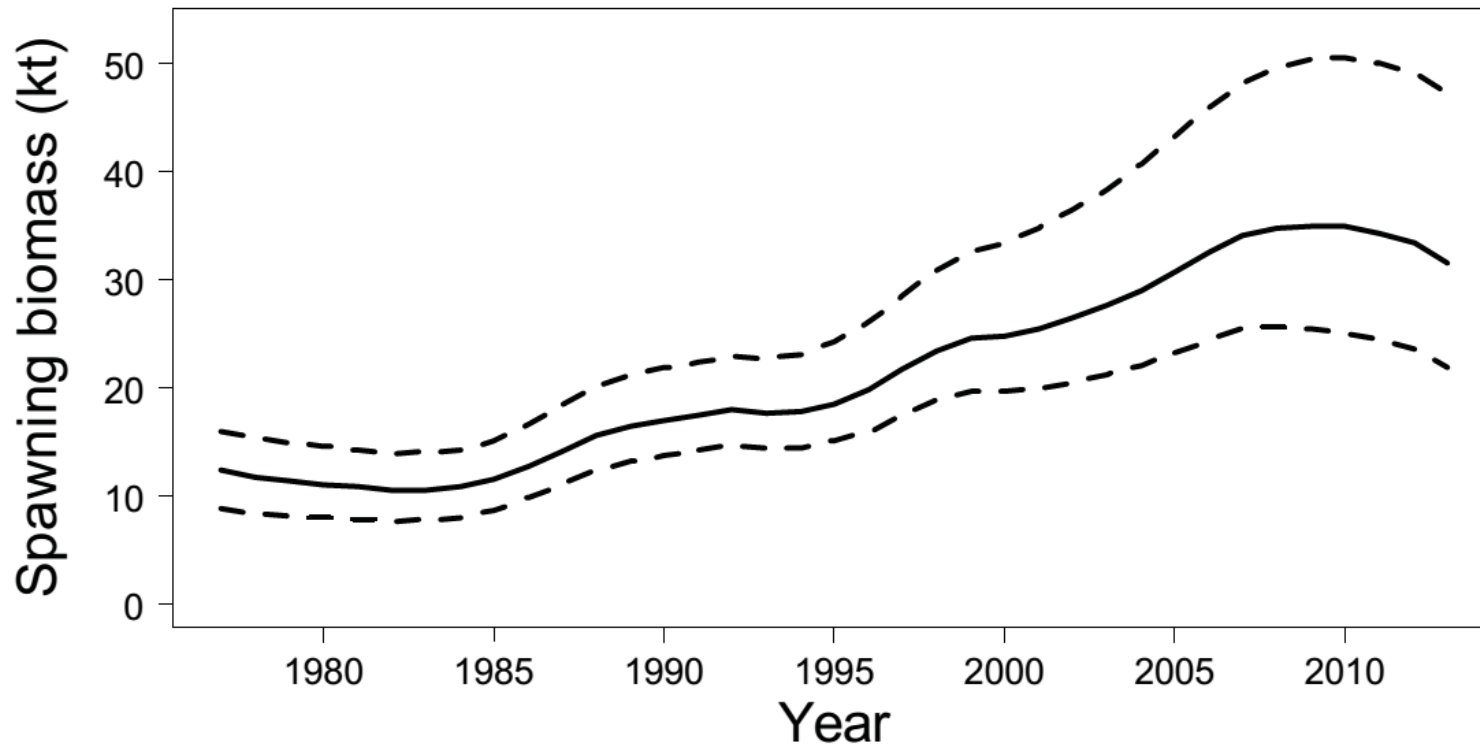
6,246

5,109

2016

5,759

4,711



Dusky  
rockfish

# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703 (9%)
northern rockfish	5,322	4,999	down 323 (6%)
Shortraker Rockfish	1,323	1,323	same (0%)
Dusky	5,486	5,109	down 377 (7%)
Rougheye and Blackspotted Rockfish	1,244	1,122	same (0%)
Demersal shelf rockfish	274	225	same (0%)
Thornyhead	1,841	1,841	same (0%)
Other rock	4,081	4,080	down 1 (0%)
Sub Total	38,880	39,711	up 831 (2%)

# 13. Rougheye/blackspotted rockfish

Full assessment; summary of changes

New catch, survey, age/size compositions

Update catch, survey age compositions

Update growth, weight@age, size@age, age error

Change from RPW to RPN for longline survey



# RE/BS Genetic Study

## Project during 2009 and 2013 trawl surveys

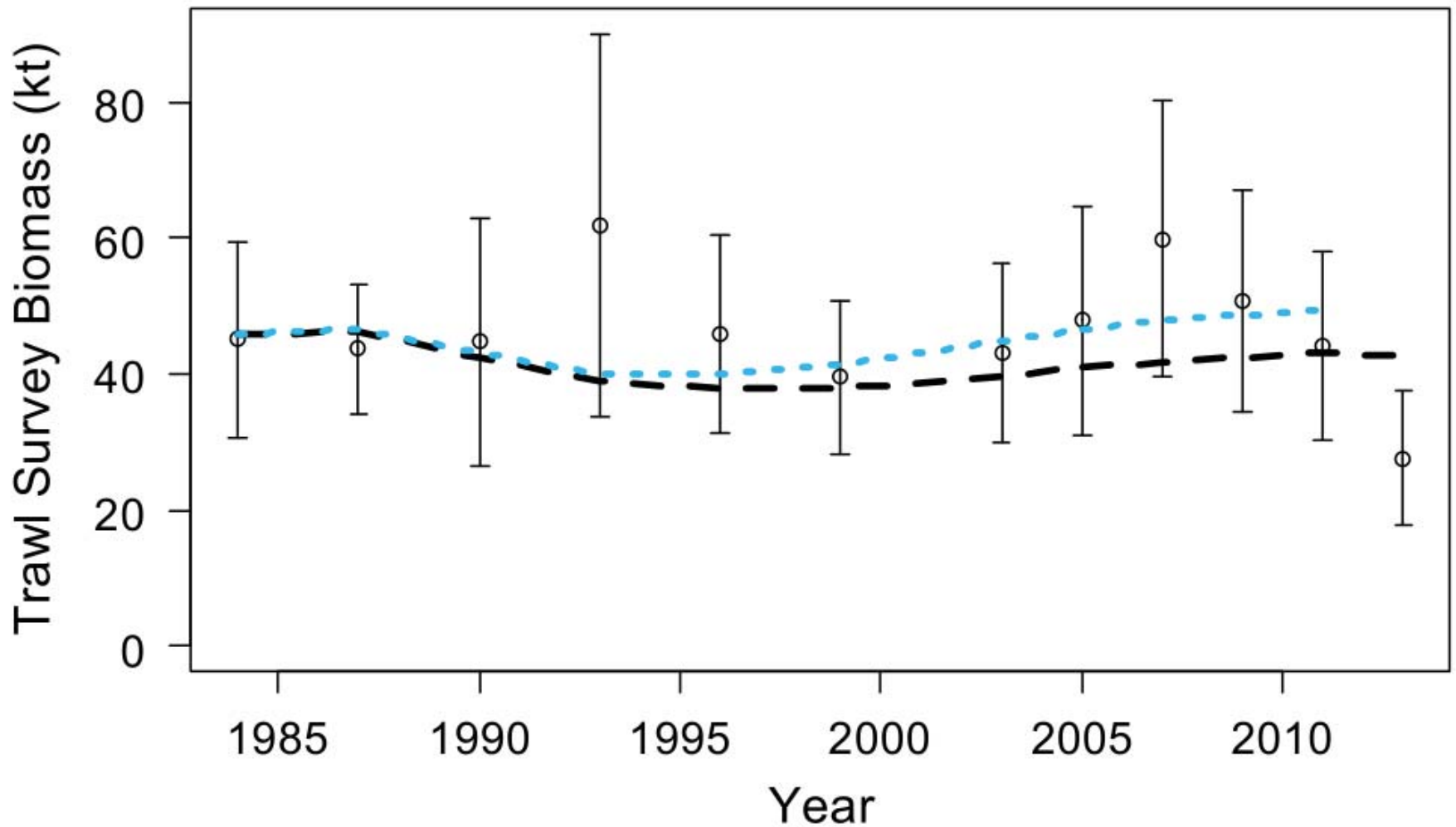
- ◆ Collected length, weight, muscle tissue or fin clip for most RE/BS samples for otoliths
- ◆ Goals to improve at-sea ID, adjust biomass estimates by species, examine species-specific growth

## Preliminary results

- ◆ Samples: 895 in 2009, 1,099 in 2013
- ◆ MisID: 23% in 2009, 13% in 2013 (previously 46%)
- ◆ Generally RE correctly ID in field, BS 31% incorrect
- ◆ Aged 2009: average RE = 15 years, BS = 20 years
- ◆ Growth 2009: RE grow faster with greater max size

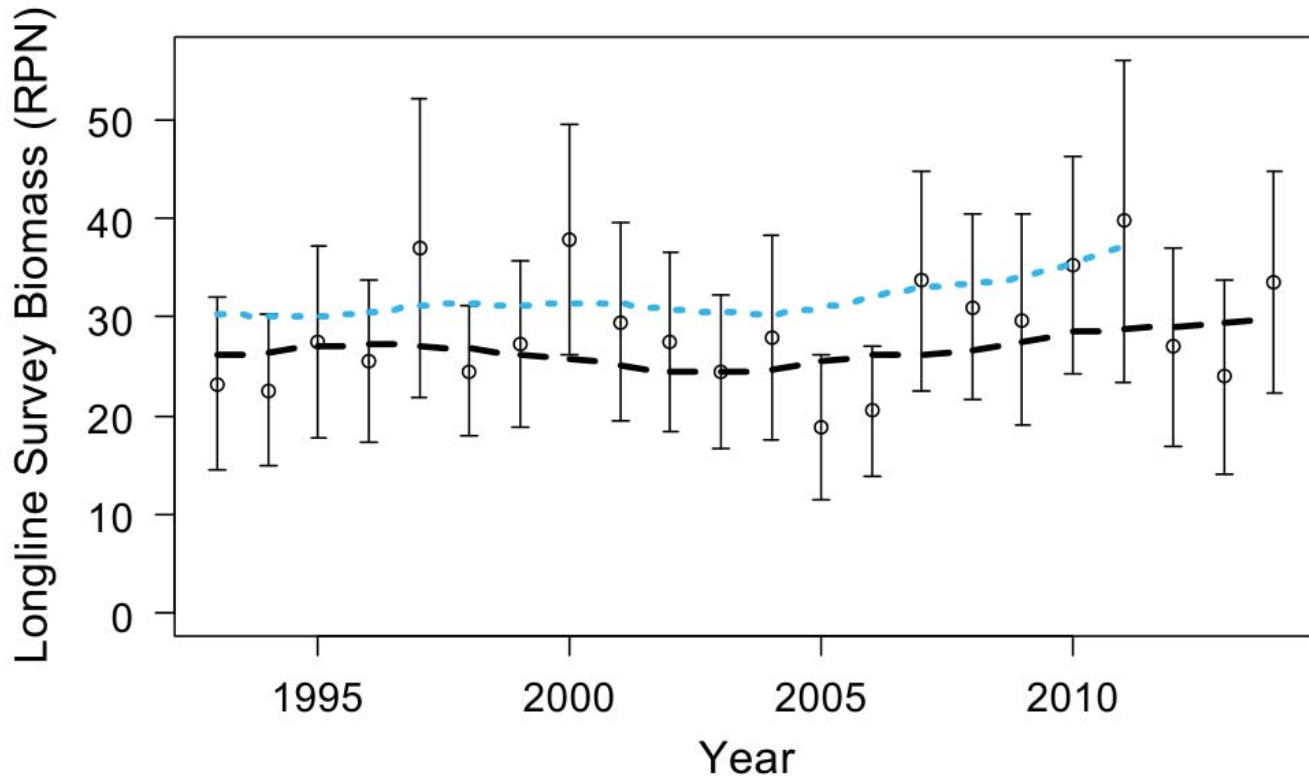


# RE/BS Trawl Survey Biomass



# 13. Rougheyeye/blackspotted rockfish summary

Rougheyeye-BS	Biomass	OFL	ABC
2015	36,584	1,345	1,122
2016		1,370	1,142

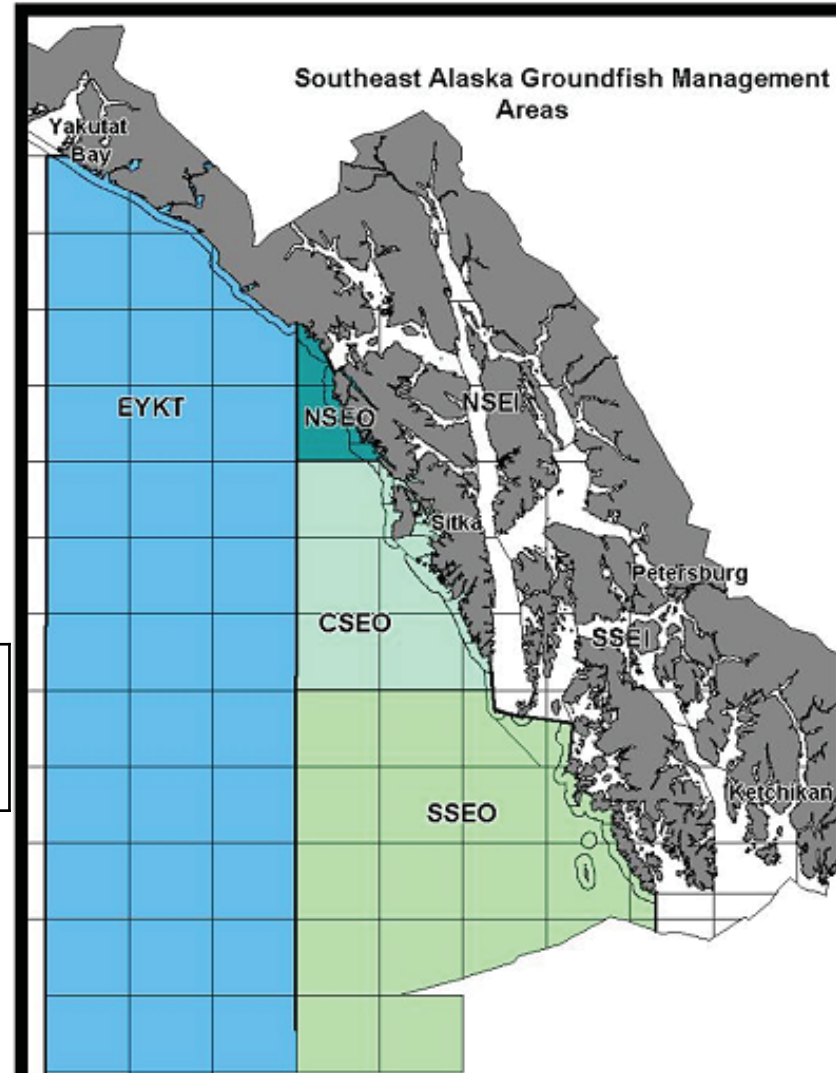


# 14. Demersal shelf rockfish

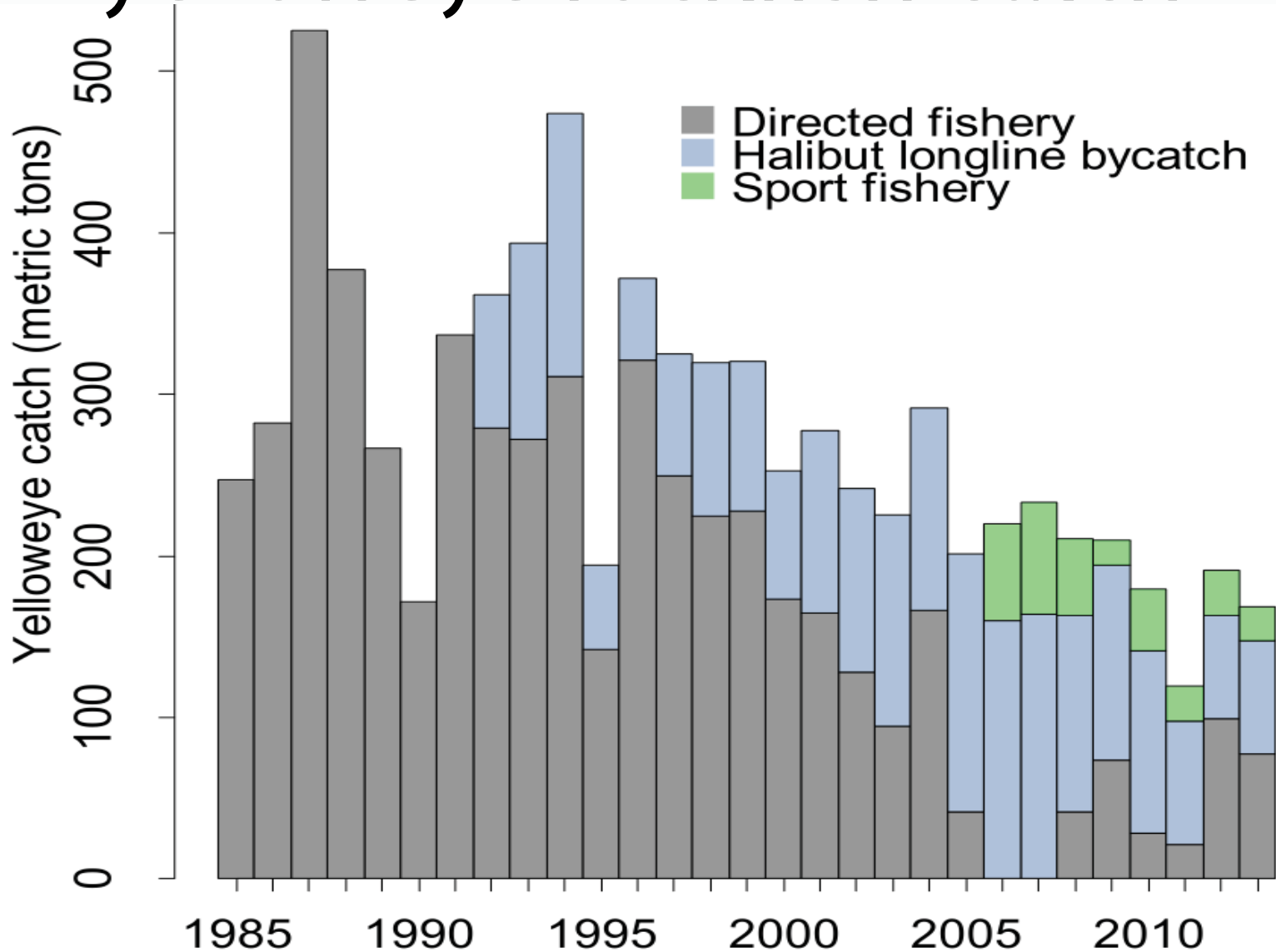


Demersal shelf  
rockfish

	Biomass	OFL	ABC
2015	10,933	361	225
2016		361	225

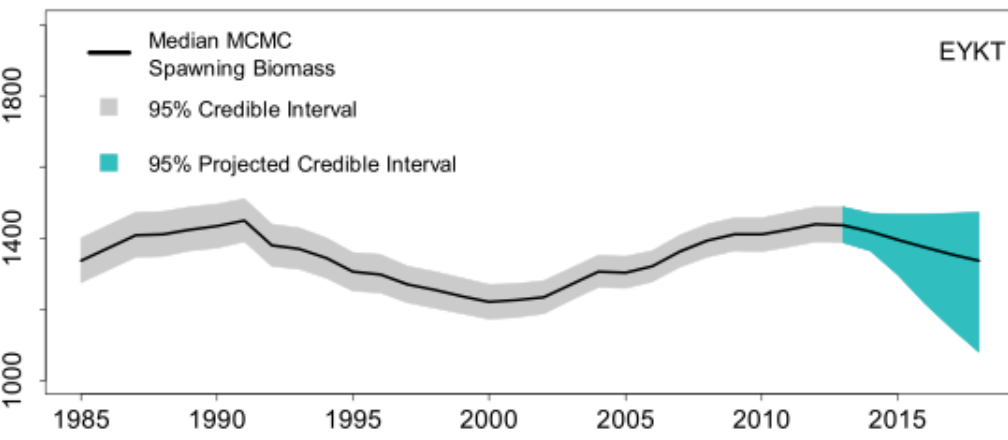
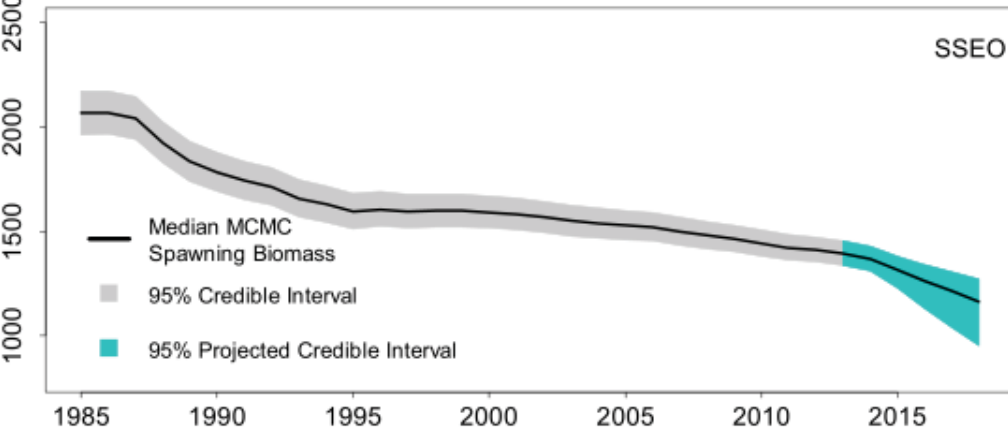
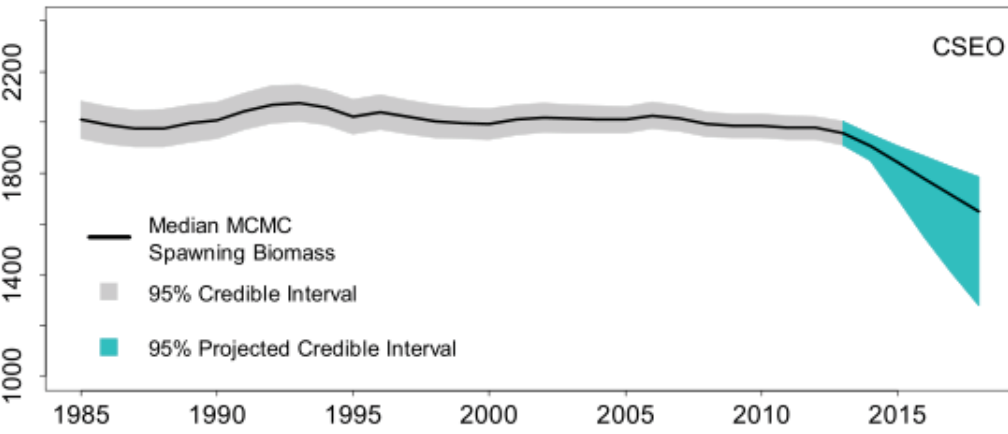


# Demersal shelf rockfish yelloweye rockfish catch



# Update on DSR ASA (age structured assessment)

Model discussed,  
recommend informal  
working group to continue  
making improvements



# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703 (9%)
northern rockfish	5,322	4,999	down 323 (6%)
Shortraker Rockfish	1,323	1,323	same (0%)
Dusky	5,486	5,109	down 377 (7%)
Rougheyeye and Blackspotted Rockfish	1,244	1,122	same (0%)
Demersal shelf rockfish	274	225	same (0%)
Thornyhead	1,841	1,841	same (0%)
Other rock	4,081	4,080	down 1 (0%)
Sub Total	38,880	39,711	up 831 (2%)

# 15. Shortspine thornyheads



Tier 5, executive summary

2013 trawl survey biomass up 11% from 2011

- Only depths less than 700 m sampled
- Biomass inflated to account for lack of sampling in deep strata (2011 methodology)

	Biomass	OFL	ABC
2015	81,816	2,454	1,841
2016		2,454	1,841

# Rockfish Summary

Species	2014	2015	Change
POP	19,309	21,012	up 1,703 (9%)
northern rockfish	5,322	4,999	down 323 (6%)
Shortraker Rockfish	1,323	1,323	same (0%)
Dusky	5,486	5,109	down 377 (7%)
Rougheye and Blackspotted Rockfish	1,244	1,122	same (0%)
Demersal shelf rockfish	274	225	same (0%)
Thornyhead	1,841	1,841	same (0%)
Other rock	4,081	4,080	down 1 (0%)
Sub Total	38,880	39,711	up 831 (2%)



# 16. Other rockfish

Included 2013 GOA bottom trawl survey estimates

(3-survey average)

Composition of complex reviewed in September

Complex sum of individual species ABC/OFLs:

Tier 4: Sharpchin rockfish

Tier 5: 24 species

# GOA Team recommendations

## Other rockfish

Other rockfish	Biomass	OFL	ABC
2015	83,383	5,347	4,079
2016		5,347	4,079

### SSC Requests from Oct 2014 meeting:

- ◆ Stock structure for yelloweye/DSR species coastwide
- ◆ Yelloweye/DSR model developments (coastwide and SE)
- ◆ Examine fishery catch and survey data in detail
- ◆ Model development assistance for recommendations for review at September 2015 PT meeting.

# ABCs for remaining GOA species



Species	2014	ABC		
	Catch	2014	2015	Change
Pollock	139,753	174,976	203,934	up 28,958 (17%)
Pacific Cod	59,633	88,500	102,850	up 14,350 (16%)
Sablefish	10,375	10,572	10,522	down 50 (0%)
Flatfish	43,270	104,849	108,038	up 3,189 (3%)
Arrowtooth flounder	2,497	195,358	192,921	down 2,437 (1%)
Rockfish	28,267	38,880	39,711	up 831 (2%)
Atka mackerel	981	4,700	4,700	same (0%)
Skates	4,356	8,627	8,708	up 81 (1%)
Other Species	3,412	14,213	14,213	same (0%)
<b>Total</b>	<b>292,544</b>	<b>640,675</b>	<b>685,597</b>	<b>up 44,922 (7%)</b>

# 18. GOA skates

<b>Species</b>	<b>2014 Catch</b>	<b>2014</b>	<b>2015</b>	<b>Change</b>
Big skate	1,379	3,762	3,255	down 507 (13%)
Longnose skate	1,418	2,876	3,218	up 342 (12%)
Other skate	1,559	1,989	2,235	up 246 (12%)
All skates	4,356	8,627	8,708	up 81 (1%)

# Skates ABC/OFL

## Tier 5

Age-structured model may be available for Big and/or longnose skates next year

Big skates		Biomass	OFL	ABC
	2015	43,398	4,340	3,255
	2016		4,340	3,255

Longnose skates				
	2015	42,911	4,291	3,218
	2016		4,291	3,218

Other Skates				
	2015	29,797	2,980	2,235
	2016		2,980	2,235

# 19. GOA sculpin

Yellow Irish lord (YIL), plain, great, and bigmouth sculpin



ABC 5,569 t and OFL 7,448 t same as last year

## 20. Sharks ABC and OFL

### Spiny Dogfish

- Linked to survey biomass

### Pacific sleeper, salmon and other/unidentified sharks

- Tier 6 average historical catch

OFL = 7,986 t

ABC = 5,989 t

## 21. Squid

	Biomass	OFL	ABC
2015	-	1,530	1,148
2016		1,530	1,148

## 22. Octopus

	Biomass	OFL	ABC
2015	3,791	2,009	1,507
2016		2,009	1,507



# Appendices

- **Ecosystem component species**
  - ◆ Grenadiers
    - Monitoring status, catches well below unofficial Tier 5 calculation
  
  - ◆ Forage fish