Options for Setting Red Hake OFL with Different Applications of Plan B Smooth

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Scientific and Statistical Committee
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New England Fishery Management Council

Small-mesh multispecies Specifications Package

Presentations today

- Context
  - Specifications process
  - Management background
- Northern silver hake and southern whiting (Alade)
  - Management track assessment
  - OFL and ABC recommendations
- Red hake stocks (Chute)
  - Research track assessment
  - Management track assessment
- Red hake OFL options (Applegate)
- ABC and estimating scientific uncertainty (Alade)

Specifications Package
Adjustments for 2021-2023

- NEFSC prepares management track assessment using previously approved methods Sep 2020
- GARFO prepares report on ACL accounting and fishery performance: Oct 2020
- Whiting PDT prepares Draft SAFE Report and recommends specifications: Nov 2020

Specifications Package
Adjustments for 2021-2023

- SSC review and approval of ABC recommendations
  - Nov 12
- Committee and advisors identify management adjustment options'
  - Nov 16
- Council approval of proposed management adjustments
  - Dec 2020

Specifications Package
Adjustments for 2021-2023

- Staff and PDT prepares draft specifications document
- Council approves final measures and specifications document
  - Jan 2021
- Adjustments become effective
  - May 1, 2021

Current measures

Table 4. Mesh size dependent possession limits

Codend Mesh Size	Silver and offshore hake, combined, possession limit	Northern red hake	Southern Red Hake
Smaller than 2.5”	3,500 lb	3,000 lb/1500 lb	5,000 lb
Larger than 2.5”, but smaller than 3.0”	7,500 lb	3,000 lb/1500 lb	5,000 lb
Equal to or greater than 3.0”	30,000 lb (40,000 lb in Southern Area)	3,000 l/1500 lb b	5,000 lb

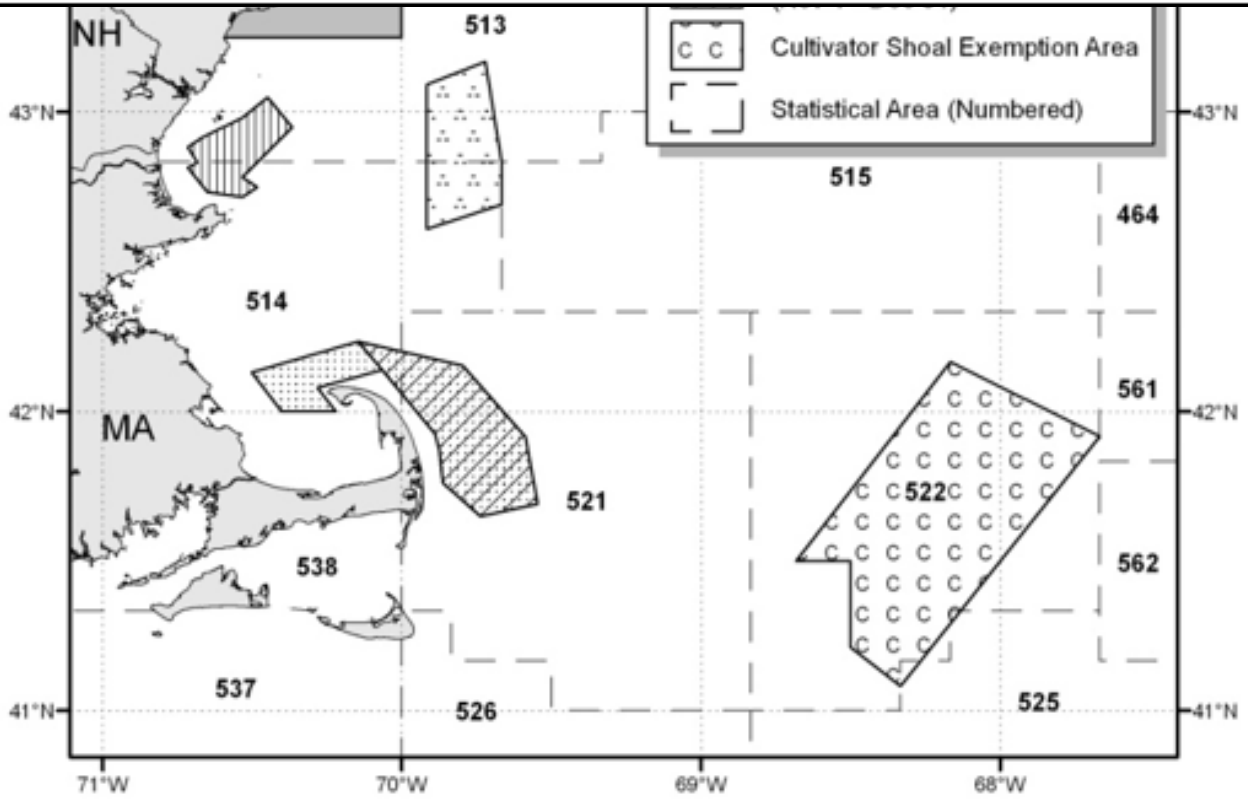
Map 1. Small-mesh exemption areas in the Gulf of Maine and Georges Bank

Table 3. Northern area exemption program seasons

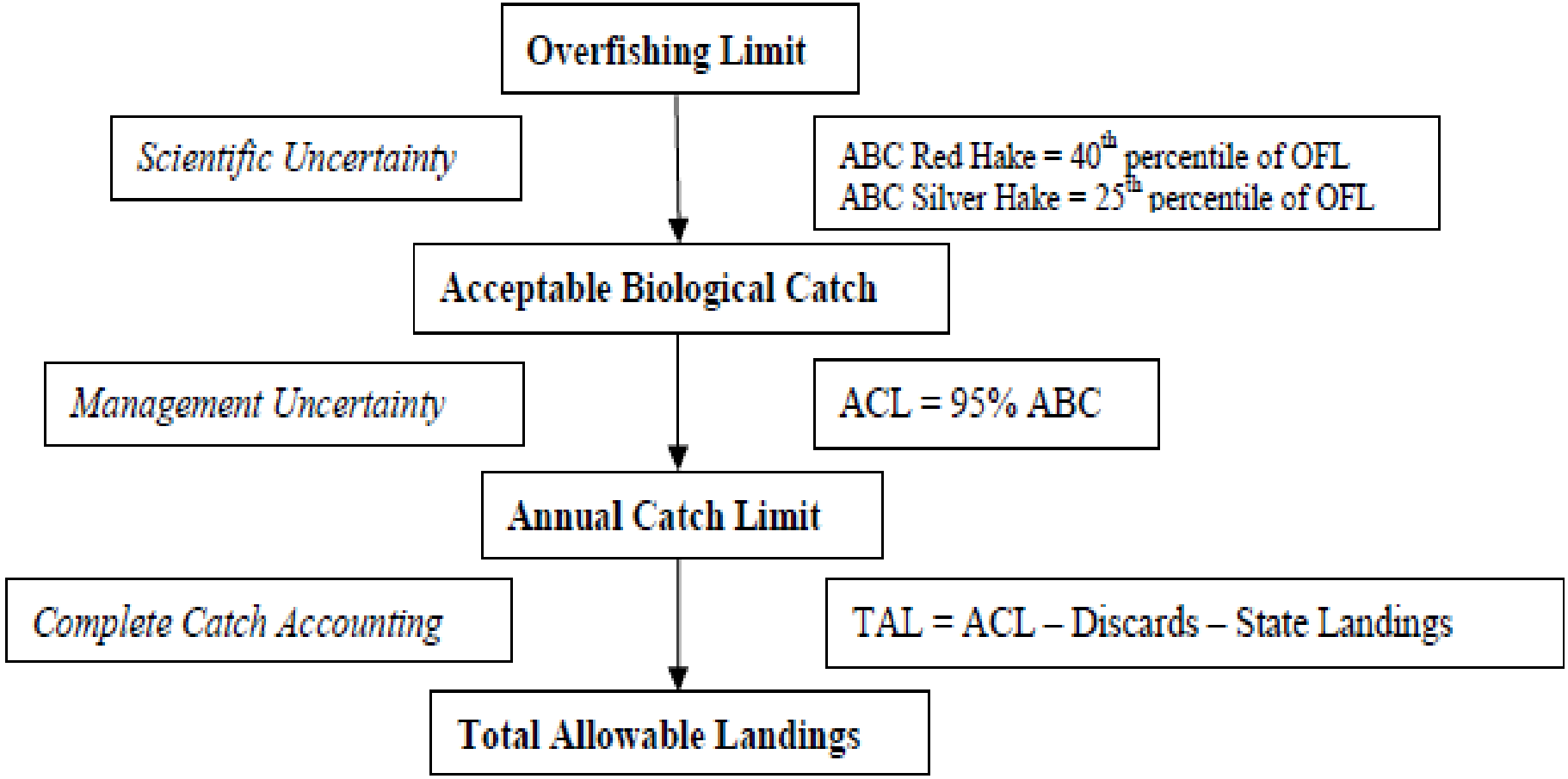
	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Cultivator		June 15 – October 31										
GOM* Grate			July 1 – November 30									
Small I				July 15 – November 15								
Small II	– June 30								January 1 –			
Cape Cod RFT†					Sept 1 – Nov 20							
					September 1 – December 31							

*GOM = Gulf of Maine

†RFT = Raised Footrope Trawl



Small-mesh Multispecies ACL Framework

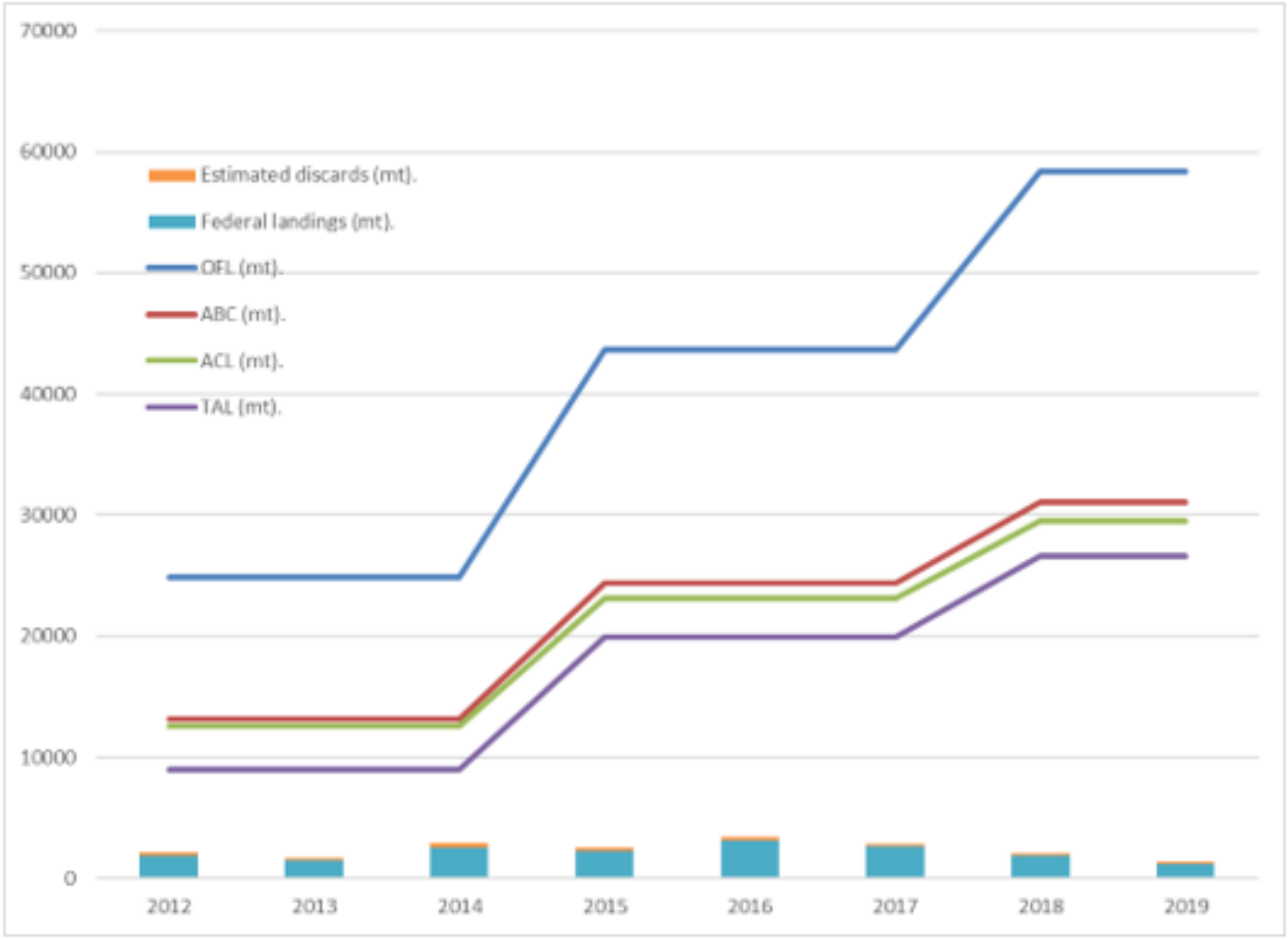


2018-2019 specifications

Fishing year	2019					
Row Labels	**OFL (mt).**	**ABC (mt).**	**ACL (mt).**	**TAL (mt).**	**TAL trigger (mt).**	**TAL trigger (%)**
Northern silver hake	58,350	31,030	29,475	26,604	23,944	90%
Southern whiting	37,110	20,170	19,162	15,043	13,539	90%
Northern red hake	807	720	684	273	104	38%
Southern red hake	1,120	1,060	1,007	305	274	90%

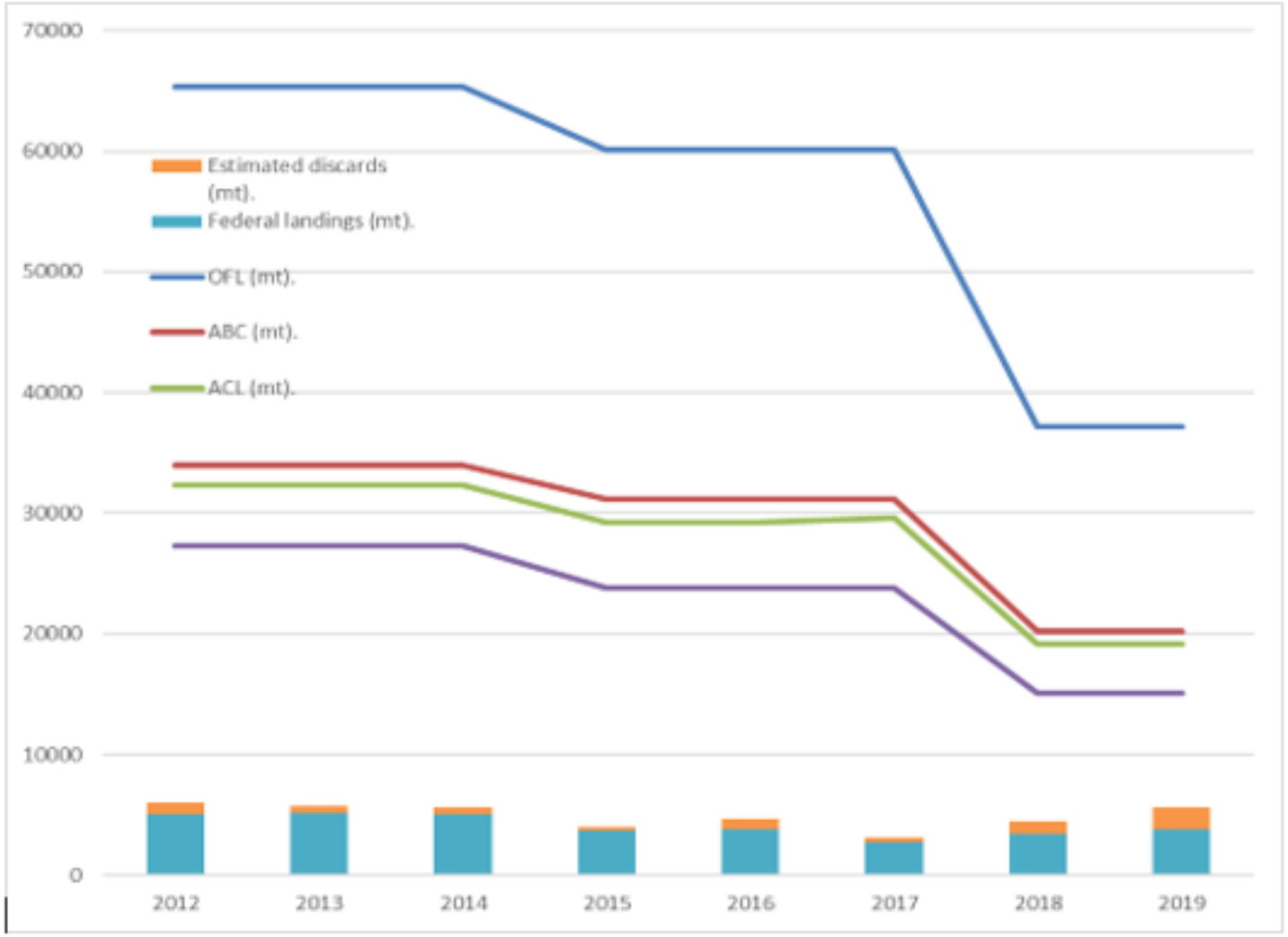
Northern silver hake

Figure 1. Specifications and catch by fishing year: **Northern silver hake.**



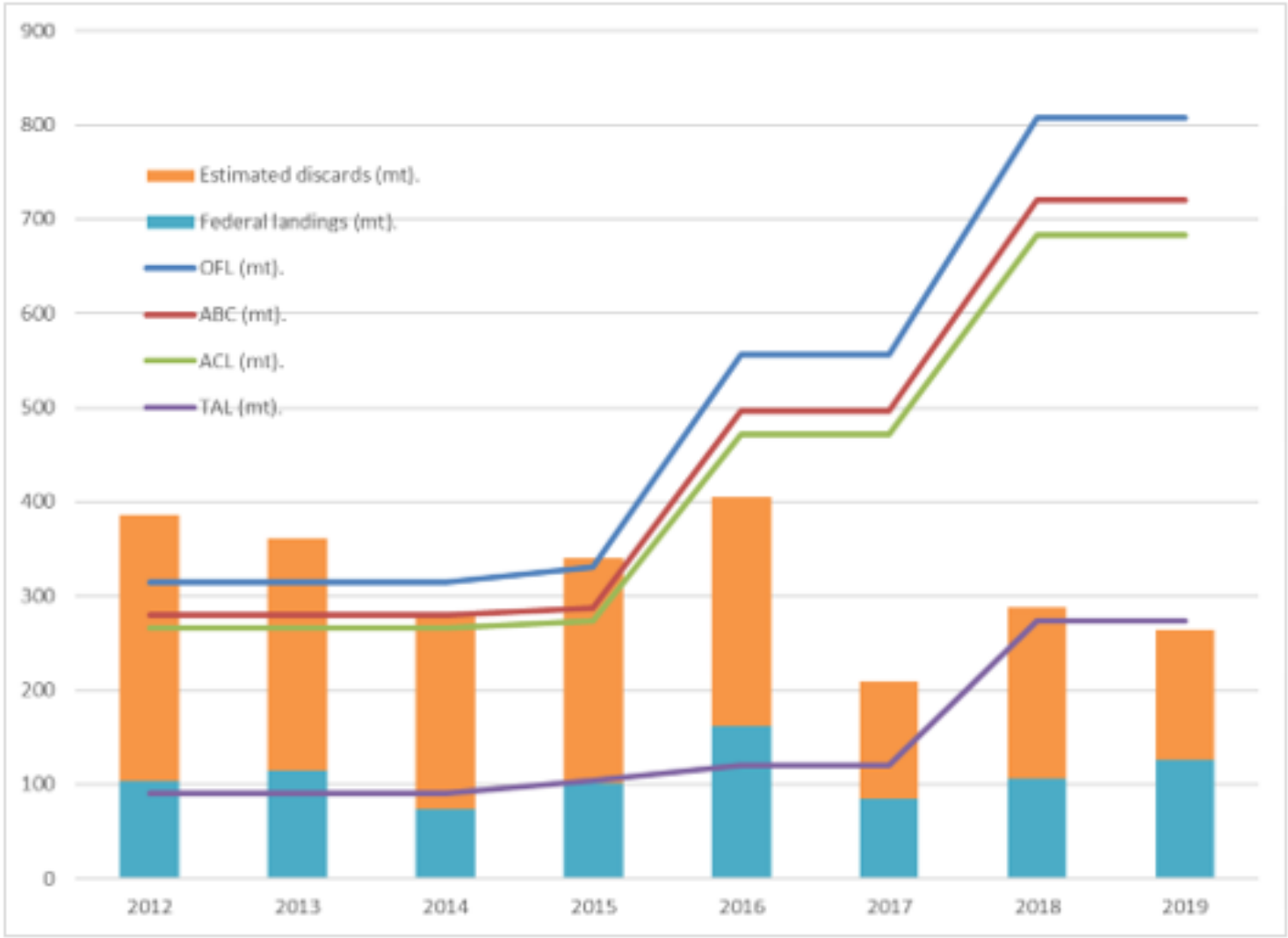
Southern whiting

Figure 2. Specifications and catch by fishing year: **Southern silver hake.**



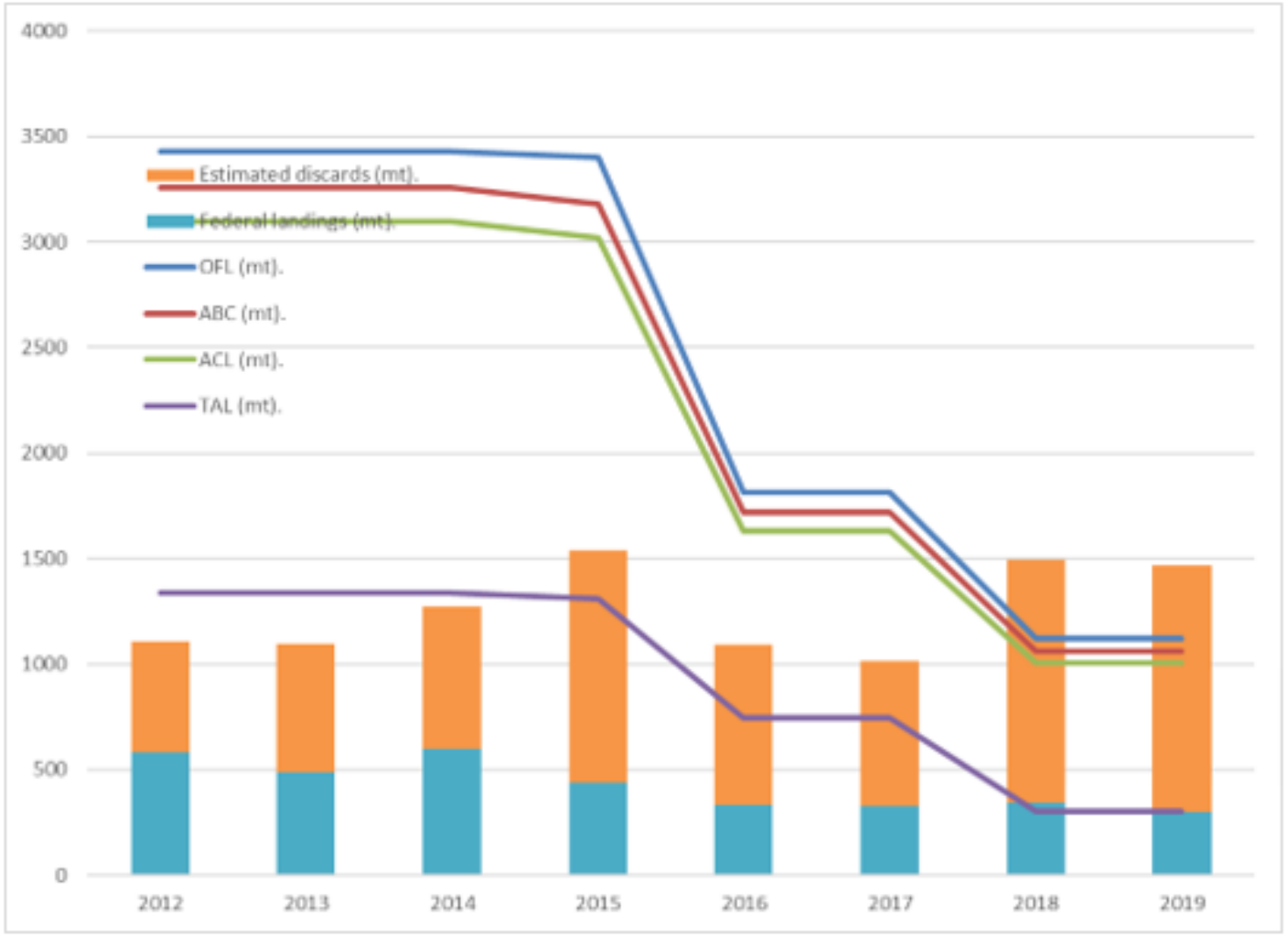
Northern red hake

Figure 3. Specifications and catch by fishing year: **Northern red hake.**



Southern red hake

Figure 4. Specifications and catch by fishing year: **Southern red hake**.



Draft SAFE Report
Fishery Performance Report

- Document Chapters
  - Executive summary
  - Summary of ABC specifications
    - PDT recommendations
    - SSC approval
    - Stock structure and sampling issues
  - Advisory Panel discussion

Draft SAFE Report
Fishery Performance Report

- Document Chapters
  - Fishery performance
    - ABC accounting for FY 2019
    - Permit trends
    - Revenue and ports
    - Fishery dependence
    - Landings trends
    - Groundfish and red hake bycatch rates
  - Economic trends in the small-mesh multispecies fishery

Draft SAFE Report
Fishery Performance Report

- Document Chapters
  - Stock assessment results
    - Stock status
    - OFL and ABC specifications, scientific uncertainty
    - Risk analysis
  - Stock assessment data and methods (Appendix I)

Stock Assessments

- Update existing model with new data
- Northern (Level I) and Southern silver hake (Level II)
  - Survey data through Fall 2019 (2017 incomplete)
  - Catches through CY 2019
  - Not overfished; overfishing not occurring
- Northern and southern red hake (Level III)
  - Research track assessment
    - Stock structure
    - Survey trawl catch efficiency
  - Survey data through Spring 2019
  - Catches through CY 2019
  - Overfished status unknown; overfishing status unknown

Catches associate with OFL and ABC

- Estimate OFL, associated with Fmsy proxy
- Estimate scientific uncertainty profile
- Estimate ABCs at various levels of estimated scientific uncertainty and probabilities of overfishing
  - Silver hake: 25th percentile
    - Southern silver hake ABC adjusted to account for mixed catch of offshore hake
  - Red hake: 40th percentile

Catches associate with OFL and ABC

- Silver hake
  - Customary methods
  - Fall 2017 survey missing in southern management area
  - 4% southern management area adjustment to account for offshore hake
- Red hake
  - 'Plan B' not reviewed by the management track panel
  - Options developed by the Whiting PDT
  - Applications of the Plan B Smooth Approach
  - No specific PDT recommendation

Red hake OFL estimation

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Application of Plan B Smooth Approach

1. Create a new time series as average of NEFSC spring and fall bottom trawl surveys:
   $Y_t = \frac{SPR_{t+1}+FAL_t}{2}$ **Catch efficiency adjusted swept area biomass**
2. Create a LOESS smooth of the Y_t, using 33 years (1982-2014), with 0.3 span in LOESS:
   $Y_{t,smo} = LOESS[Y_t]$
3. Obtain smoothed predictions for 2012 to 2014:
   $\{Y_{2012,smo}, Y_{2013,smo}, Y_{2014,smo}\}$
4. Use a log linear regression to estimate slope over last 3 years of smoothed estimates (2012-2014):
   $Ln(Y_{t,smo}) = \alpha + \beta t$
5. Compute proportional change in recent average catch as:
   $R = e^{\beta}$
6. Compute recommended OFL for 2016 as function of average catch from 2012-2014:
   $C_{OFLproxy,2016} = R * \overline{C}_{2012-14}$

- Technicals: https://rdrr.io/github/cmlegault/PlanBsmooth/

Options

Table 1. Red Hake strategies for setting 2021-2023 catch specifications. These approaches would define an OFL and uncertainty in the Plan B estimates would be applied to derive ABC.

Plan B proportional change (2017-2019) applied to:	Justification	Issues
1. 2017-2019 actual estimated catch	Follows standard Plan B smooth approach application (yellowtail flounder)	Catch may not be representative of OFL, especially with fishing restrictions. May be driven by circumstances that affect the fishery or by actual catch that exceed the OFL.
2. Existing OFL from 2018-2020 specifications	Applies Plan B smooth approach to previous OFL, rather than actual catch	Uses OFL estimate from rejected AIM model application
3. 1981-2009 OFL forecast from Plan B smooth in that time period (previous estimate using the Plan B smooth approach)	Consistent with overfishing definition, but using Plan B method to evaluated OFL during the MSY proxy time period	Period may not be representative of contemporary stock productivity.
4. 2017-2019 OFL forecast from Plan B smooth in that time period (previous estimate using the Plan B smooth approach)	Follows Plan B smooth approach, using Plan B estimate for 2017-2019 as representative of MSY proxy, rather than actual catch.	May be sensitive to rapid changes in survey swept area biomass.
5. Fixed exploitation rate applied to SWAB 2017-2019 (TYMA).	Fishing mortality estimates are exceptionally low, particularly for the northern stock. Uses an F MSY proxy that is more consistent with life history	Catch limits may exceed availability of the stock due to regulations. Mean exploitation rates for time series were rejected by the MTA as the basis for catch advice.

Plan B Smooth Performance

Estimates
Northern red hake

Strategy	North		
		ABC	
	OFL (% ch)	P*40 (% ch)	Lower 90% CI
1 Catch	229 (-73%)	TBD	183 (-75%)
2 2018 specs	785 (-6%)	TBD	758 (+5%)
3 Plan B OFL	1,722 (+105%)	TBD	NA
4 2019 Plan B	2,328 (+177%)	TBD	???
5a (2% expl)	4,602 (+448%)	TBD	3,607 (+400%)
5b (4% expl)			
5c (6% expl)	13,873 (1544%)		10,904 (+1412%)
5d (8% expl)			
5e (10% expl)			
5f (12% expl)	27,615 (3187%)	TBD	21,807 (+2925%)

Estimates
Southern red hake

Strategy	South			
			ABC	
	OFL (% ch)	75% OFL (rebuild)	P*40 (% ch)	Lower 90% CI
1 Catch	1,919 (+67%)	1,440 (+43%)		731 (-15%)
2 2018 specs	1,460 (+27%)	1,095 (+9%)		1,443 (+67%)
3 Plan B OFL	3,181 (+177%)	2,386 (+137%)		NA
4 2019 Plan B	3,093 (+169%)	2,320 (+130%)		???
5a (2% expl)	1,294 (+13%)	971 (-4%)		409 (-53%)
5b (4% expl)	2,589 (+125%)	1,941 (+93%)		
5c (6% expl)	3,883 (+238%)	2,912 (+189%)		2,039 (+136%)
5d (8% expl)	5,177 (+350%)	3,883 (+286%)		
5e (10% expl)	6,471 (+463%)	4,854 (+382%)		
5f (12% expl)	7,766 (+575%)	5,824 (+478%)		4,201 (+367%)

Considerations
Southern red hake

Figure 8. Calculation of the age at which a female southern red hake produces 50% of lifetime egg production, a proxy for a mean generation time for a mating pair to replace itself with a mating pair in a subsequent generation.

Age	Maturity	Biomass	Adult survival	Fecundity (biomass multiplier)	Egg viability factor	Surviving recruits	Cumulative	Percent of total lifetime fecundity	Age @ 50%
(A)	(B)	(C)	(D)	(E)	(F)	(G)=B*C*D*E	(H)=∑G		
1	0.04	19.35	1.00	1.00	-	-	-	0	
2	0.75	26.78	0.67	1.00	0.20	2.69	2.69	0.06	
3	0.99	31.38	0.45	1.00	0.50	6.98	9.67	0.22	
4	1.00	34.13	0.30	1.05	0.80	8.63	18.31	0.42	
5	1.00	35.94	0.20	1.10	1.00	7.98	26.29	0.61	4.41
6	1.00	37.24	0.14	1.15	1.00	5.80	32.08	0.74	
7	1.00	40.06	0.09	1.20	1.00	4.36	36.44	0.85	
8	1.00	41.70	0.06	1.25	1.00	3.17	39.61	0.92	
9	1.00	39.00	0.04	1.30	1.00	2.07	41.68	0.97	
10	1.00	39.00	0.03	1.351	1.00	1.44	43.12	1.00	

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