Summary of 14 2019 groundfish assessments by stock with catch projections from the PDT

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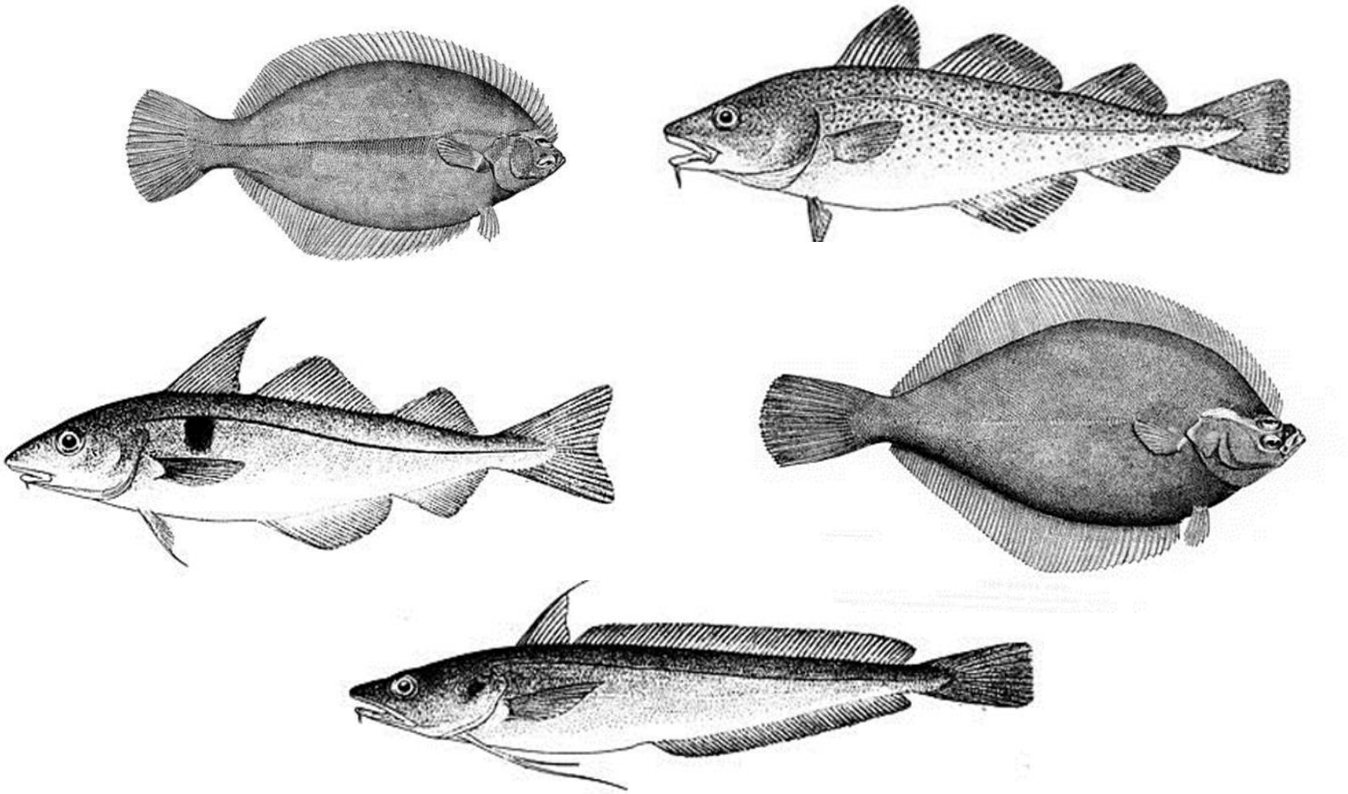
SSC Meeting
October 17-18 2019

Individual Stock Presentation
14 Groundfish Stocks



14 Groundfish Stocks

PN 1. Southern New England/Mid-Atlantic Yellowtail Flounder

ME 2. Cape Cod/Gulf of Maine Yellowtail Flounder

PN 3. Georges Bank Winter Flounder

PN 4. American Plaice

ME 5. Southern New England/Mid-Atlantic Windowpane Flounder*

PN 6. Gulf of Maine/Georges Bank Windowpane Flounder

ME 7. Atlantic Halibut*

PN 8. Georges Bank Cod*

PN 9. Gulf of Maine Cod

ME 10. Georges Bank Haddock

ME 11. Gulf of Maine Haddock

PN 12. Witch Flounder*

PN 13. Pollock

ME 14. White Hake

** Level 1 stocks*

Overview

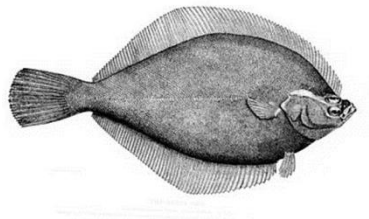
- Introduction summary table and PDT memo (does not include all sources of uncertainty or all reviewer comments).
- Status table (short report 2nd table)
- Biomass (mt) and F or exploitation plots (short report).
- PDT catch performance plots and tables for individual stocks.
- OFL and ABC tables at 75%F_{MSY} and lowest 75%F_{MSY} catch (2018-2020) held constant.

Individual Stock Details: Catch Plots and Tables (Catch History, OFLs, ABCs, Projections)

- CY 2005- CY 2018 total catch
- Historical FY OFLs & ABCs (2010-2020)
- PDT CY 2019 catch assumption
- F_{MSY} and 75%F_{MSY} projected catch 2020-2022
- Assessment overfishing history:

  "Yes" , "No", "unknown" ability to calculate whether overfishing was occurring in terminal year of assessment

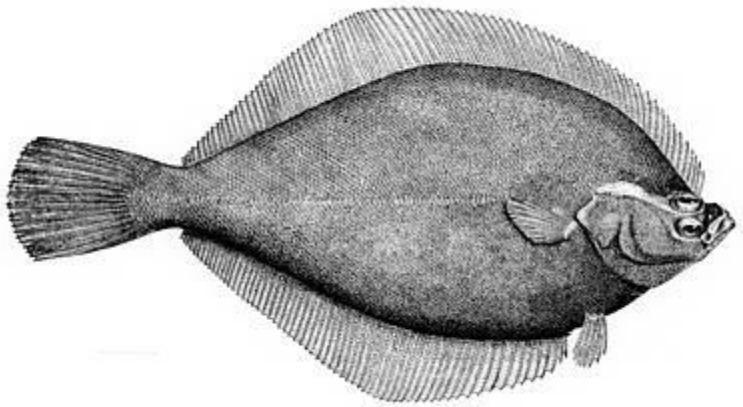
Southern New England/Mid-Atlantic Yellowtail Flounder



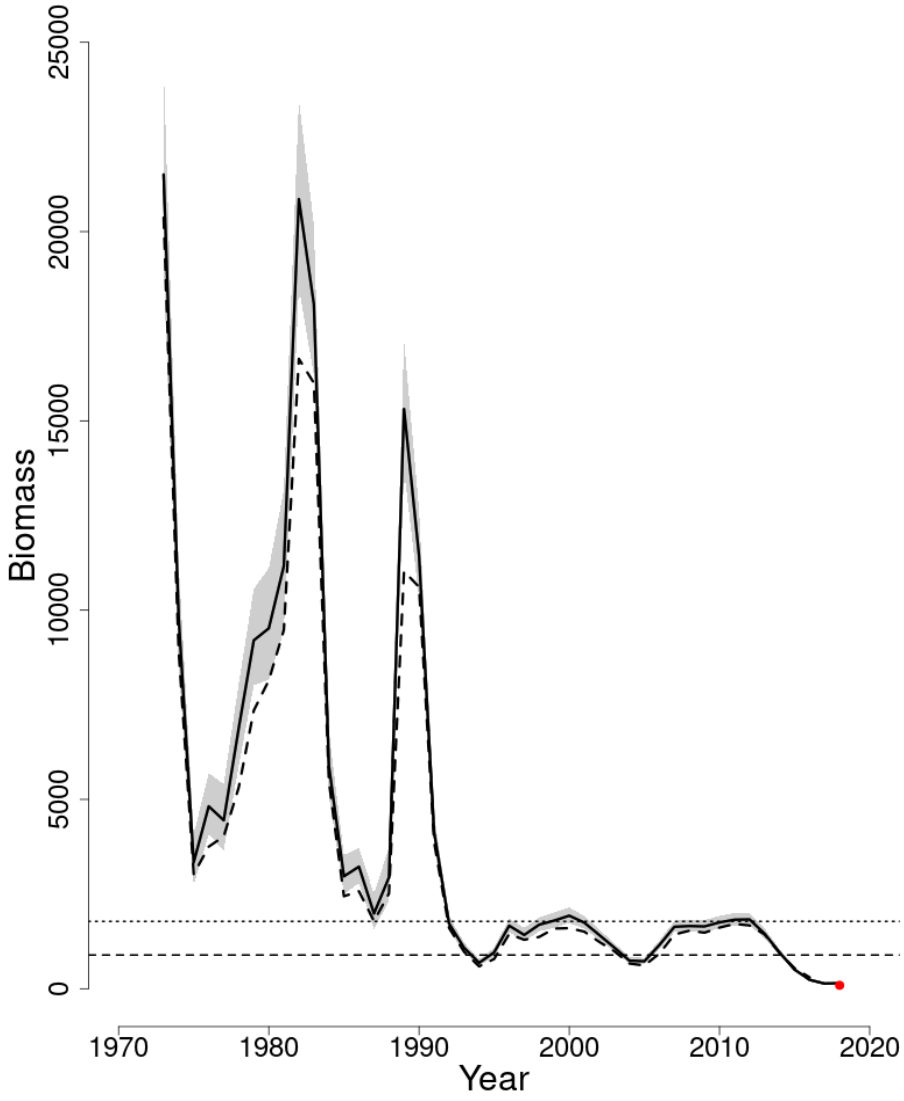
MODEL	ASAP (Level 2)
STOCK STATUS	Overfished & Overfishing is not occurring
REBUILDING	2029 (70%F_{MSY} Frebuild)
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Major retrospective pattern, recent low recruitment
REVIEWER COMMENTS	Recruitment continues to be at record lows and estimates of the current stock are 20% of what they were in the mid-1990s when it was considered to be collapsed. Trying to conduct a survey or an analytical assessment for a stock in this depleted state is challenging. Catchability is a source of uncertainty.

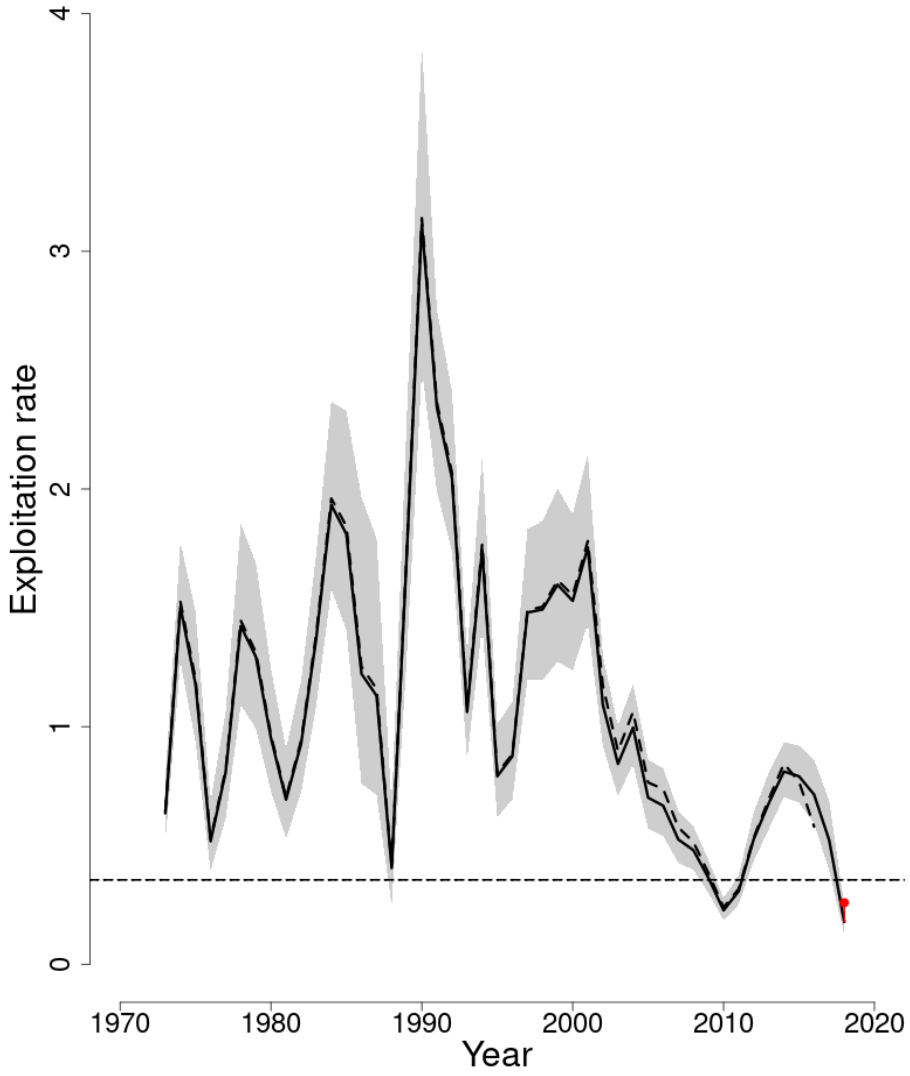
Southern New England/Mid-Atlantic Yellowtail Flounder

	2017	2019
F_{MSY} *proxy*	0.347	0.355
SSB_{MSY} (mt)	1,986	1,779 (993 - 2,725)
MSY (mt)	547	492 (277 - 749)
Median recruitment (age 1) (000s)	7,242	6,562
Overfishing	Yes	No
Overfished	Yes	Yes

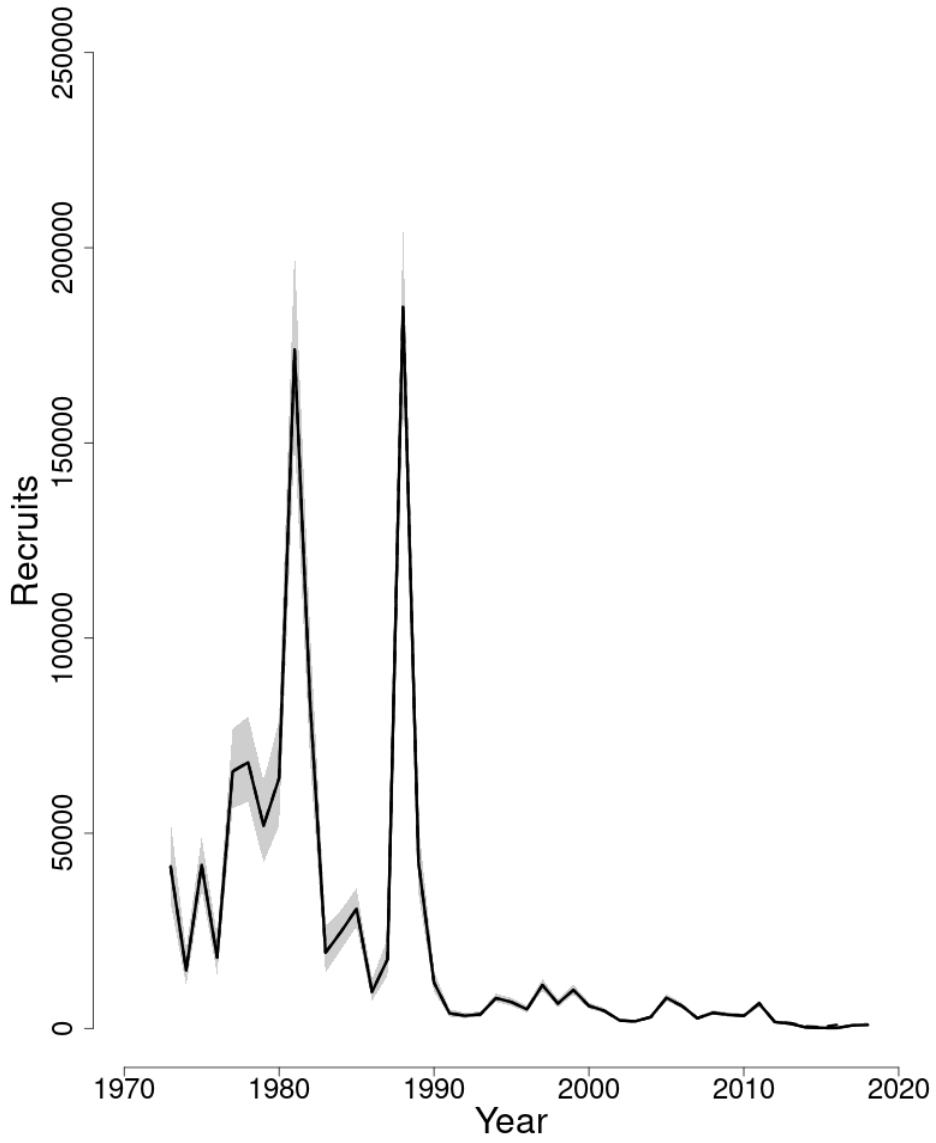


Southern New England/Mid-Atlantic Yellowtail Flounder

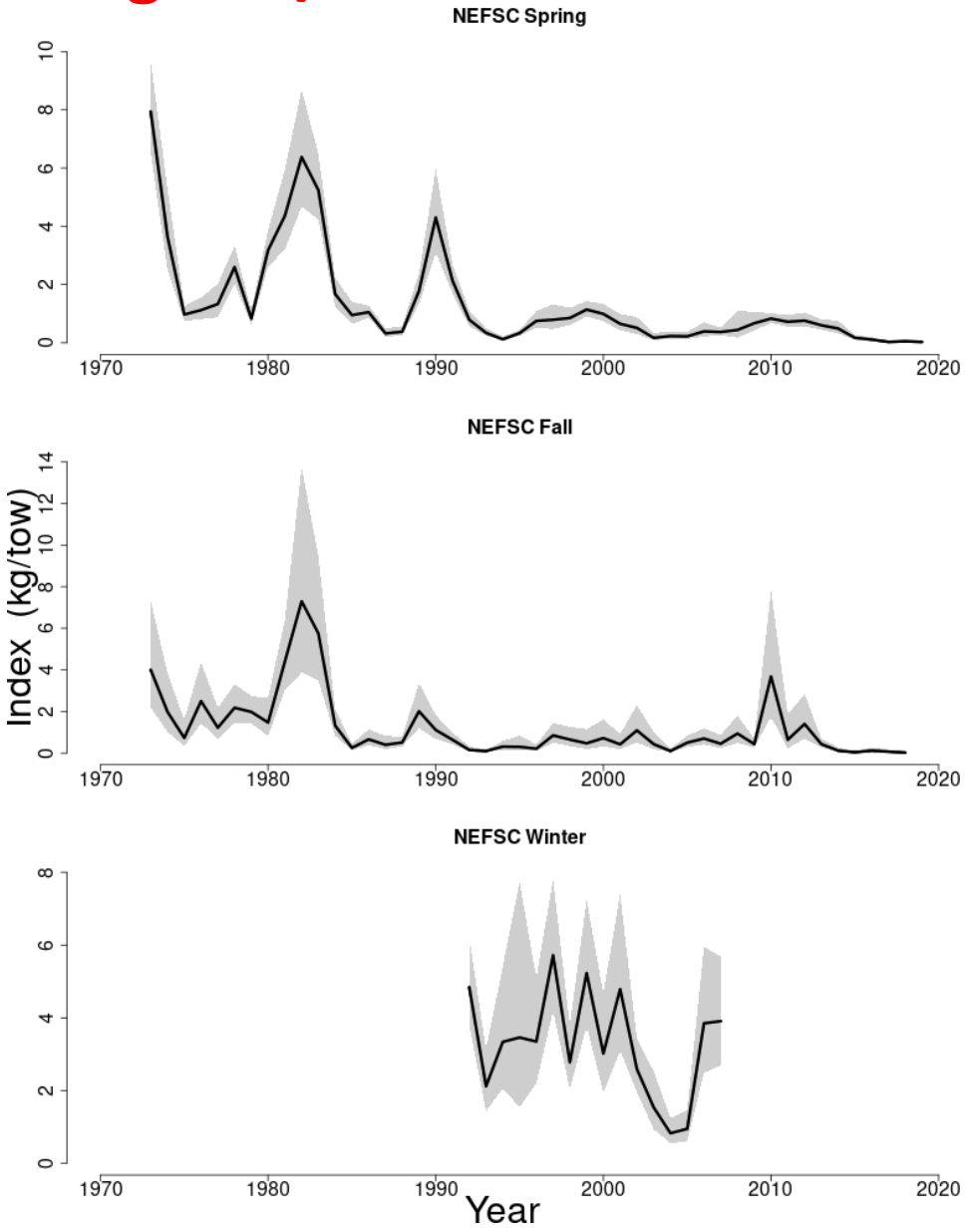




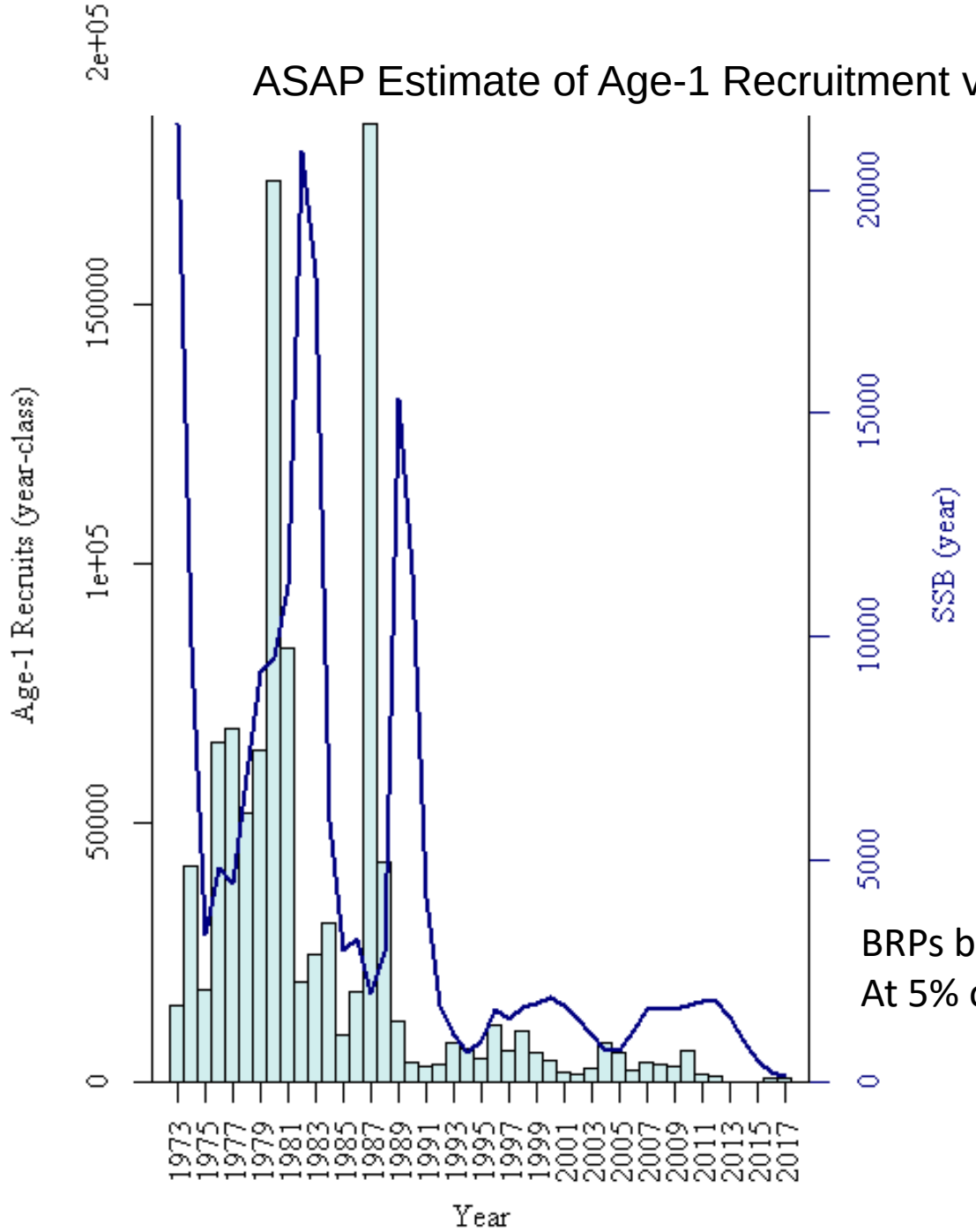
Southern New England/Mid-Atlantic Yellowtail Flounder

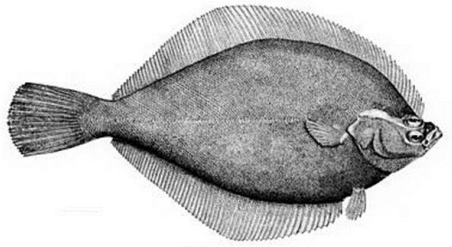


Southern New England/Mid-Atlantic Yellowtail Flounder



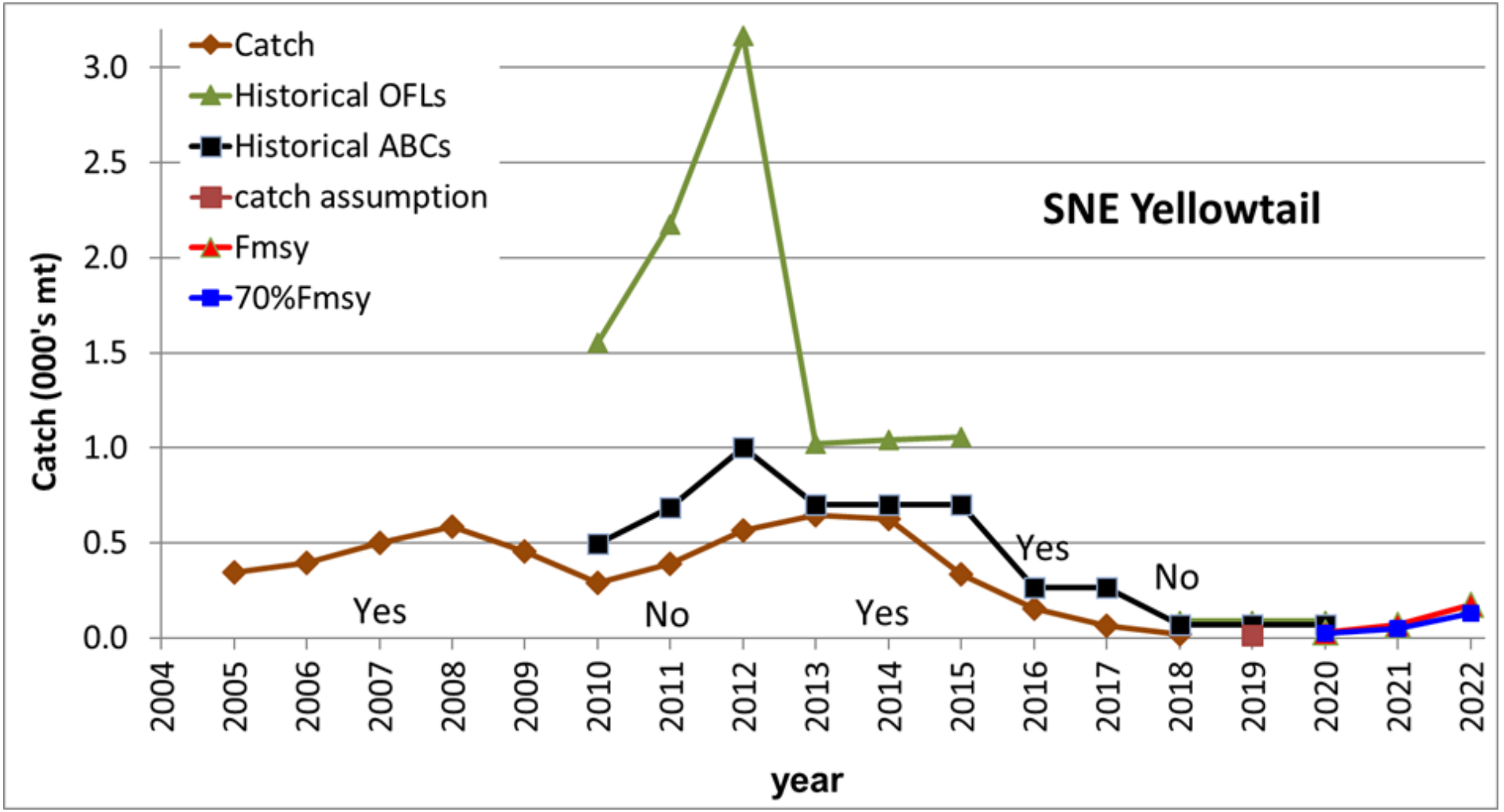
ASAP Estimate of Age-1 Recruitment vs SSB



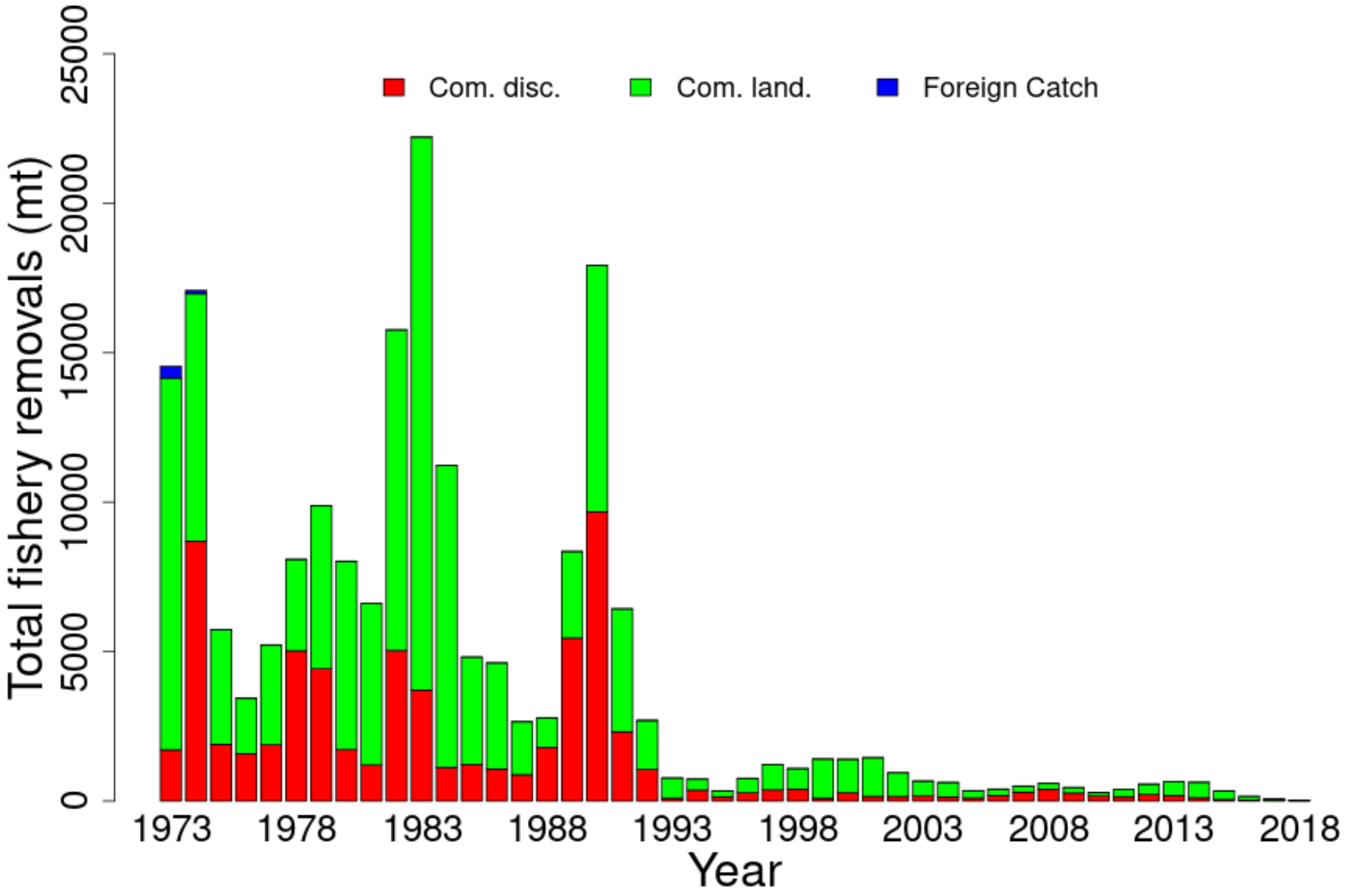


BRPs based on yc 1990-2017
At 5% of the low B_{MSY} target

Southern New England/Mid-Atlantic Yellowtail Flounder



Southern New England/Mid-Atlantic Yellowtail Flounder



Southern New England/Mid-Atlantic Yellowtail Flounder

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$70\%F_{MSY}$
2010	291	1,553	493			
2011	388	2,174	687			
2012	563	3,166	1,003			
2013	646	1,021	700			
2014	625	1,042	700			
2015	337	1,056	700			
2016	152	undefined	267			
2017	64	undefined	267			
2018	19	undefined	68			
2019		undefined	68	16		
2020		undefined	68		31	22
2021					69	51
2022					173	128

Southern New England/Mid-Atlantic Yellowtail Flounder

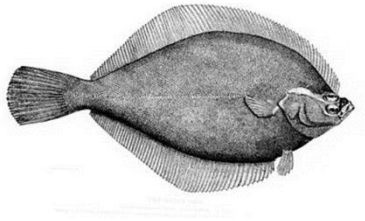
75%Fmsy Projection

year	OFL	ABC	F	SSB
2020	31	22	0.25	114
2021	71	51	0.25	418
2022	178	128	0.25	914

First Year Constant Projection

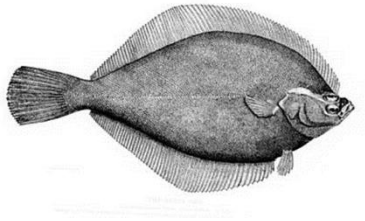
year	OFL	ABC	F	SSB
2020	31	22	0.25	114
2021	71	22	0.10	428
2022	184	22	0.04	982

Cape Cod/Gulf of Maine Yellowtail



MODEL	VPA (Level 2)
STOCK STATUS	not Overfished & Overfishing is not occurring
REBUILDING	on schedule within projections (2023)
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Retrospective pattern, survey residuals patterns, age-length keys from NEFSC surveys to age MENH surveys, survey catchability.
REVIEWER COMMENTS	Major diagnostic problems (major retrospective pattern, apparent problems with estimates of scale, residual patterns). VPA biomass estimates are getting closer to the Bigelow swept-area biomass time series in the most recent 2 years. The retrospective pattern is also improving.

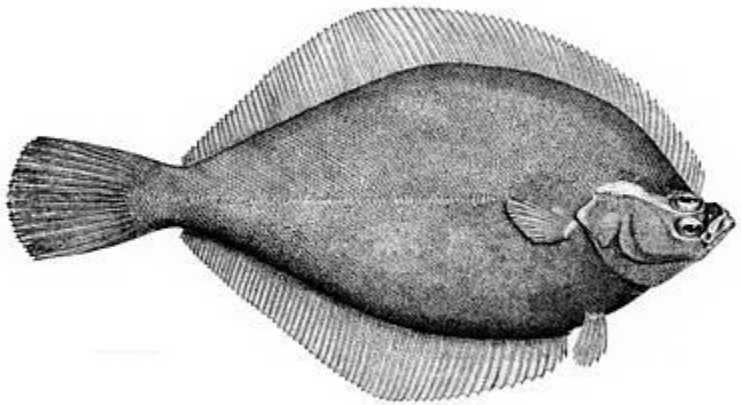
Cape Cod/Gulf of Maine Yellowtail



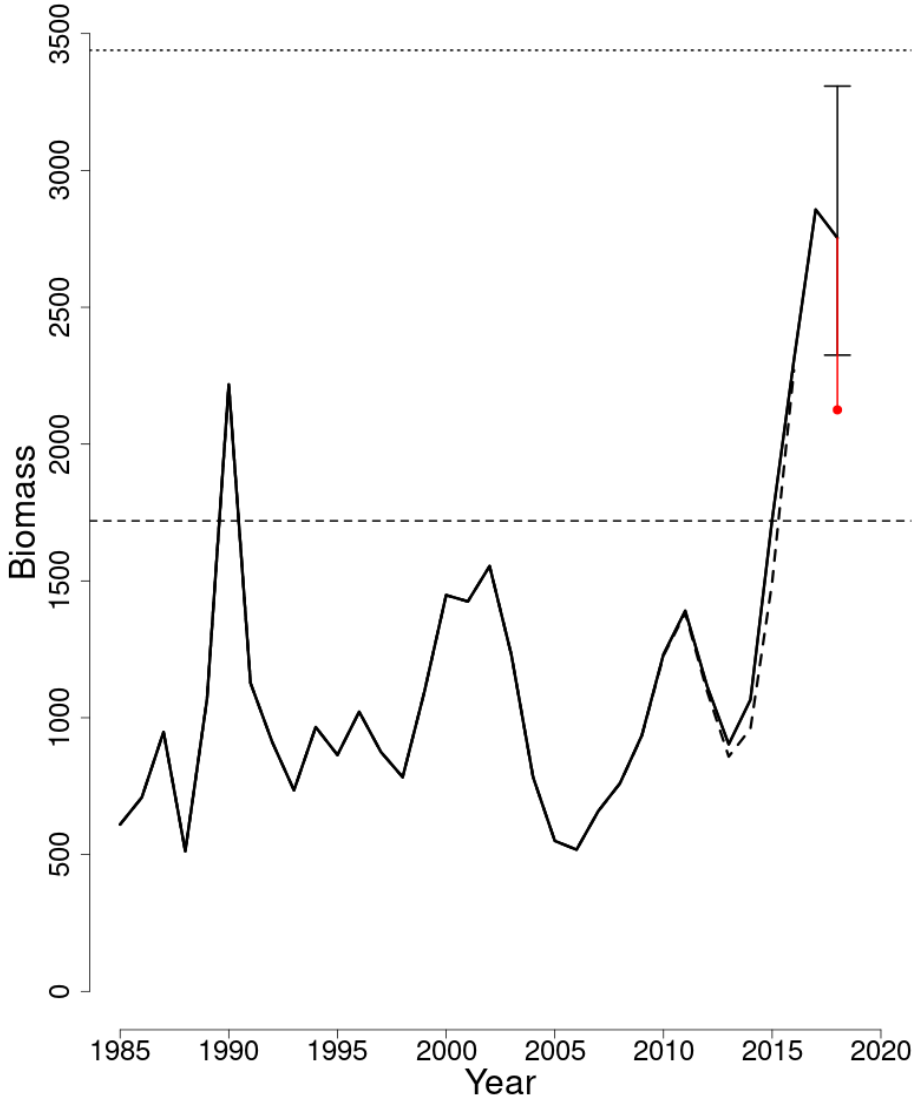
Changes	Removal of hindcast recruitment estimates due to increasing poor relationship between VPA estimates of age-1 and NEFSC age-1 fall survey used in deriving hindcast recruitment values.

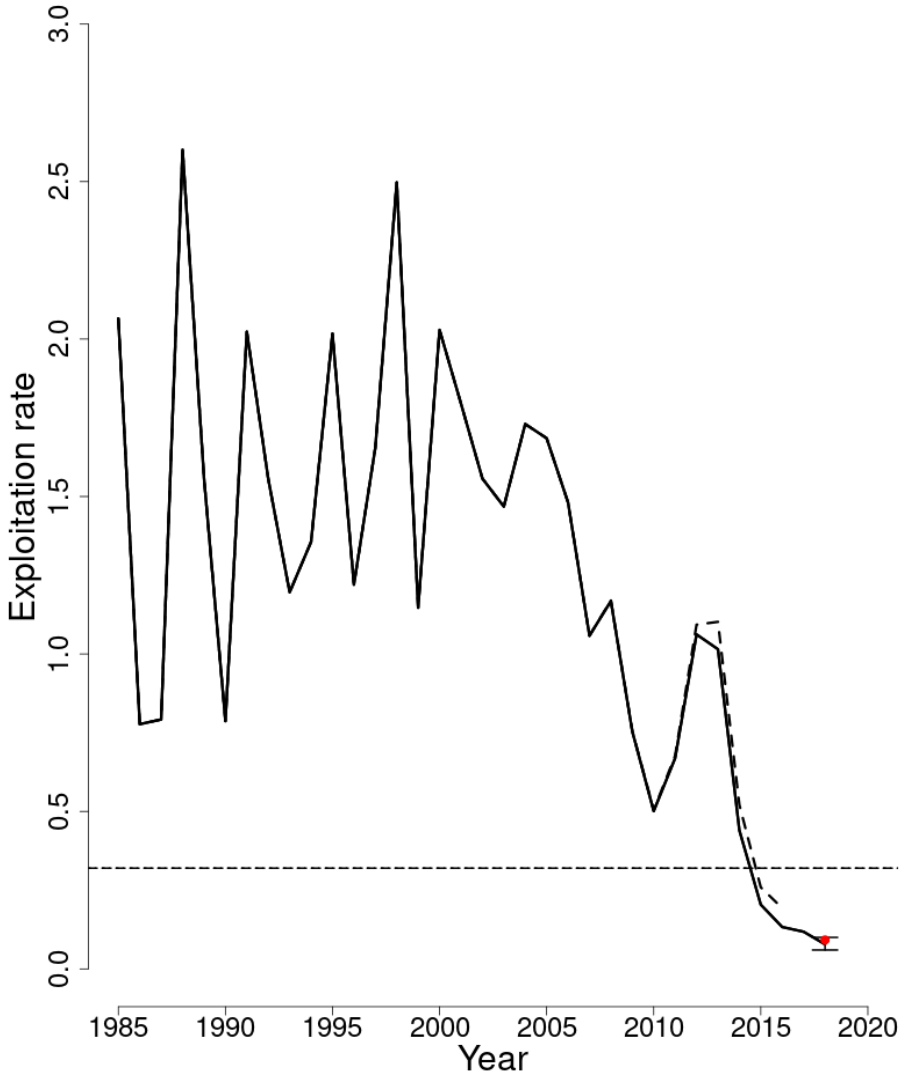
Cape Cod/Gulf of Maine Yellowtail

	2017	2019
F_{MSY} *proxy*	0.273	0.32
SSB_{MSY} (mt)	4,640	3,439 (2,593 - 4,794)
MSY (mt)	1,154	1,138 (860 - 1,582)
Median recruits (age 1) (000s)	6,186	5,781
Overfishing	Yes	No
Overfished	Yes	No

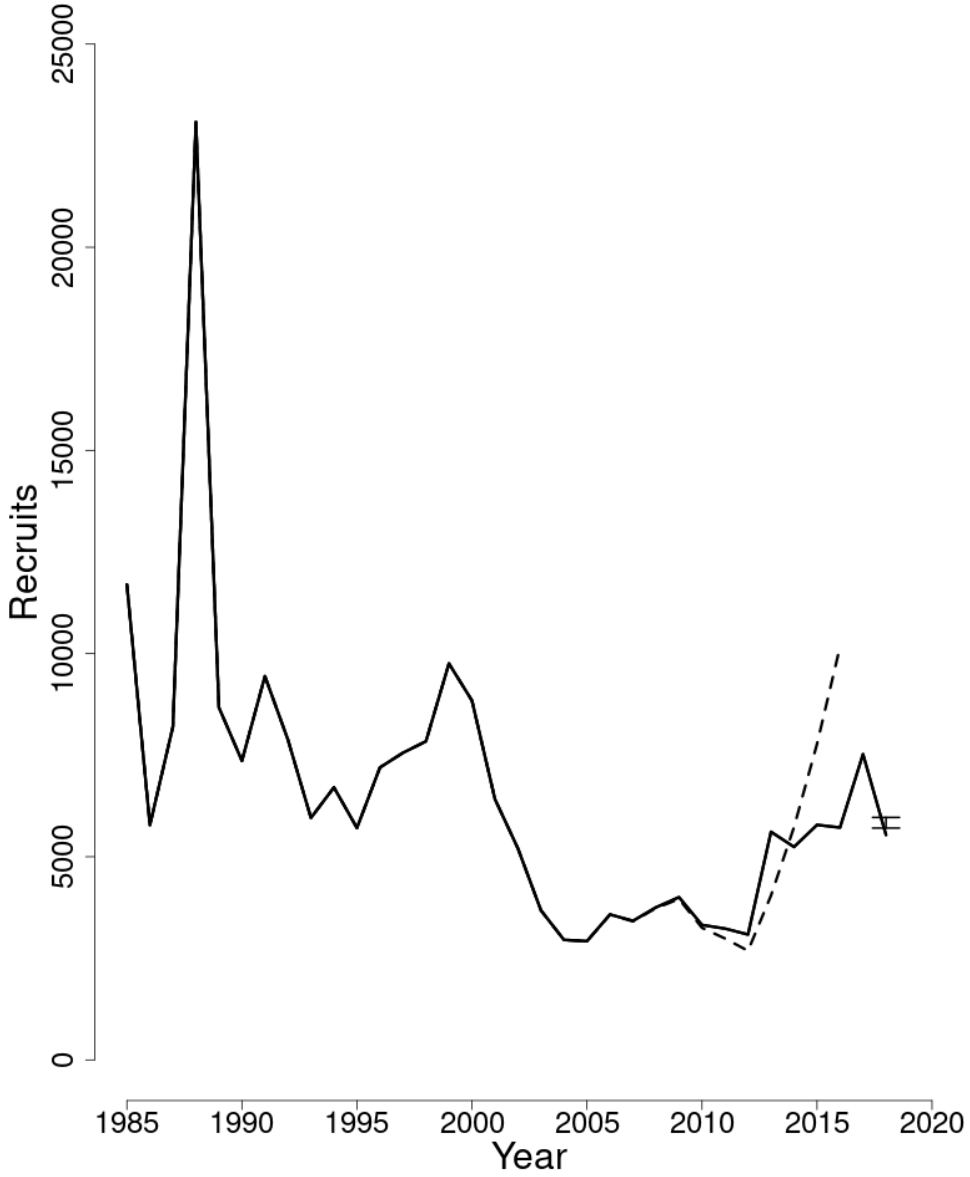


Cape Cod/Gulf of Maine Yellowtail

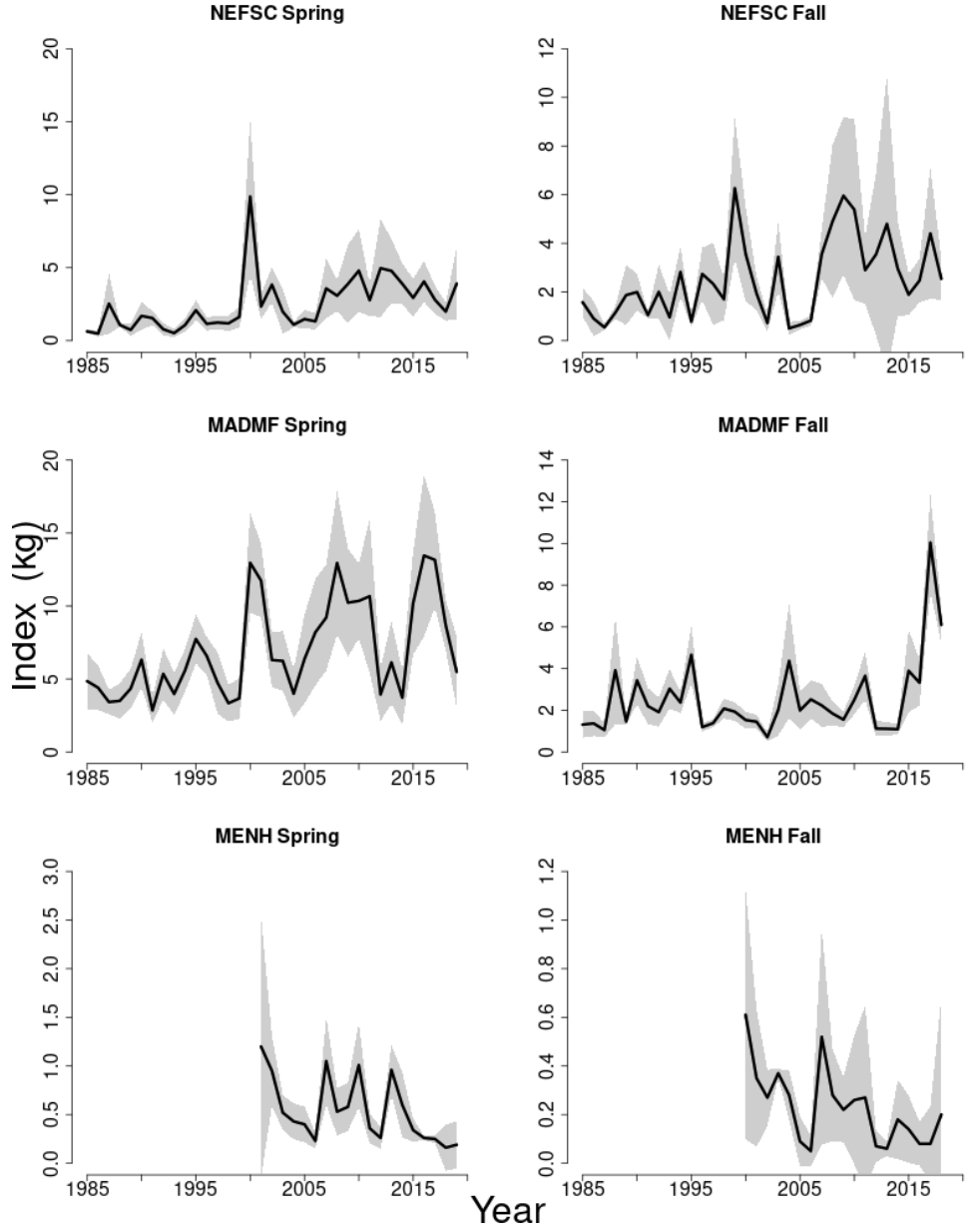




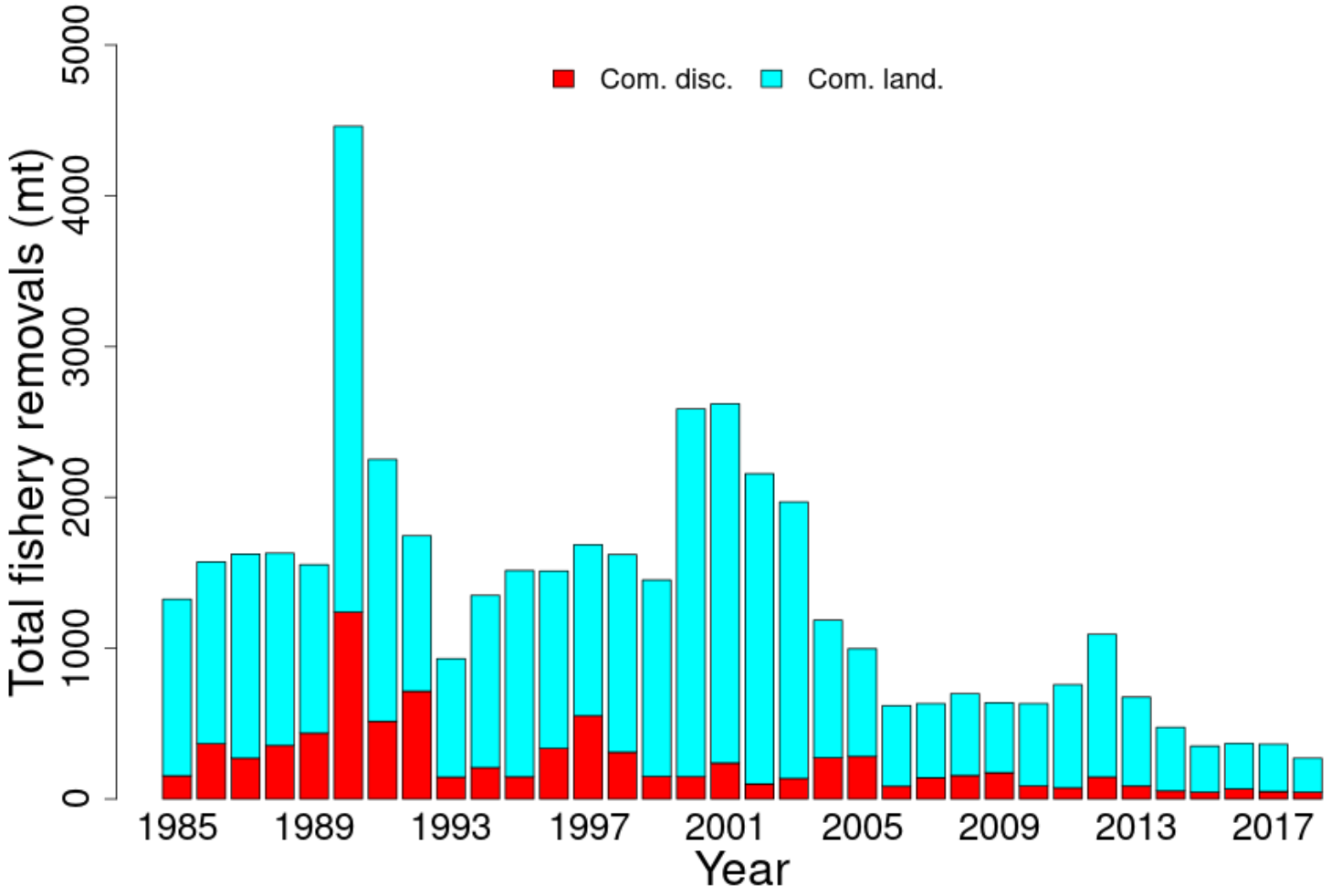
Cape Cod/Gulf of Maine Yellowtail



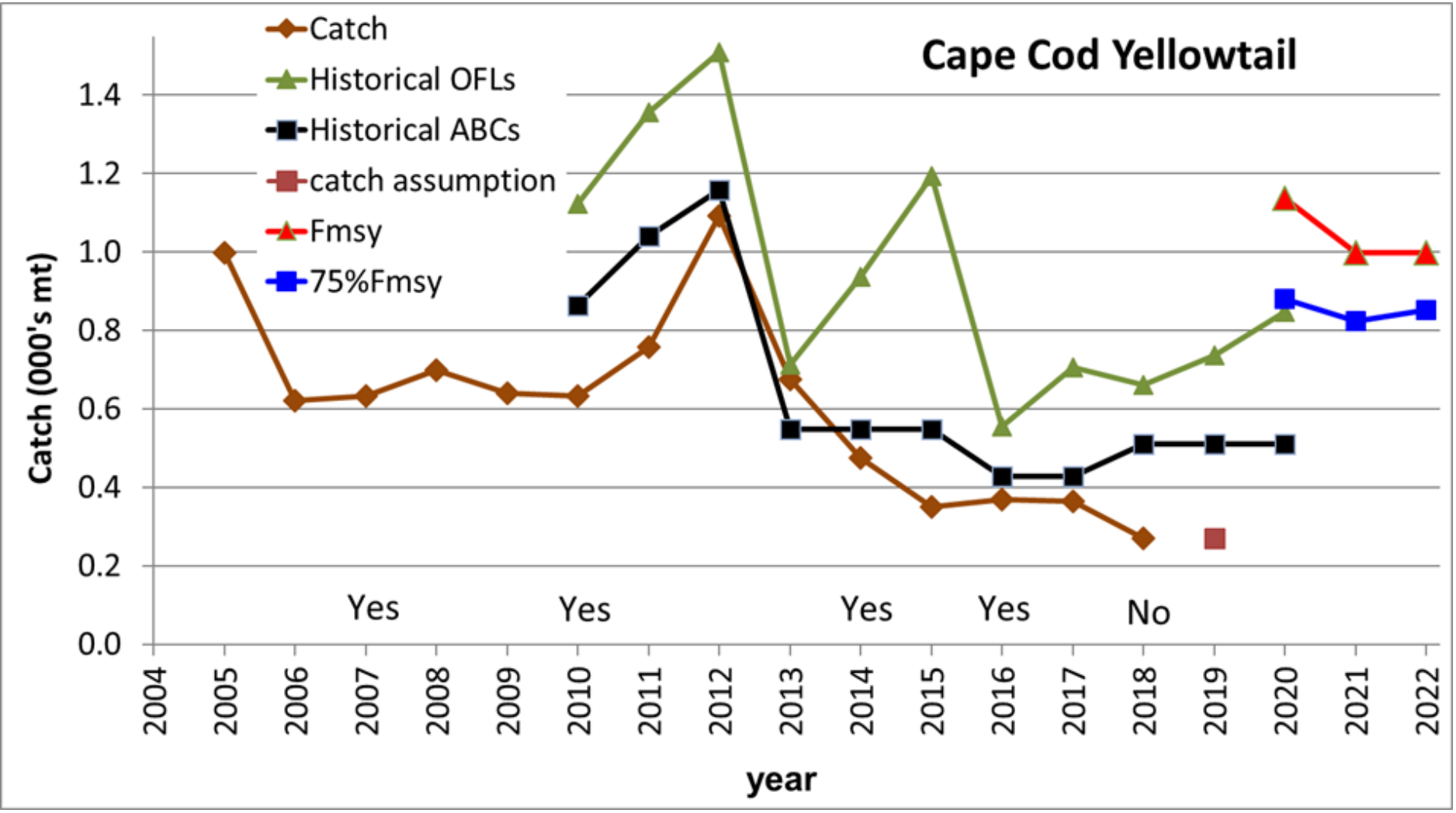
Cape Cod/Gulf of Maine Yellowtail



Cape Cod/Gulf of Maine Yellowtail



Cape Cod/Gulf of Maine Yellowtail



Cape Cod/Gulf of Maine Yellowtail

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$
2010	633	1,124	863			
2011	758	1,355	1,041			
2012	1,092	1,508	1,159			
2013	676	713	548			
2014	475	936	548			
2015	351	1,194	548			
2016	368	555	427			
2017	365	707	427			
2018	271	662	511			
2019		736	511	271		
2020		848	511		1,136	881
2021					997	823
2022					999	852

Cape Cod/Gulf of Maine Yellowtail

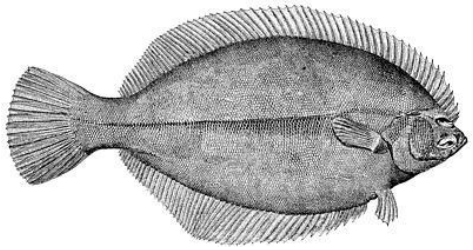
$75\%F_{MSY}$ Projection

year	OFL	ABC	F	SSB
2020	1,136	881	0.24	3,577
2021	1,061	823	0.24	3,318
2022	1,103	852	0.24	3,461

$75\%F_{MSY}$ Middle Year Constant Projection

year	OFL	ABC	F	SSB
2020	1,136	823	0.22	3,602
2021	1,076	823	0.24	3,373
2022	1,116	823	0.23	3,529

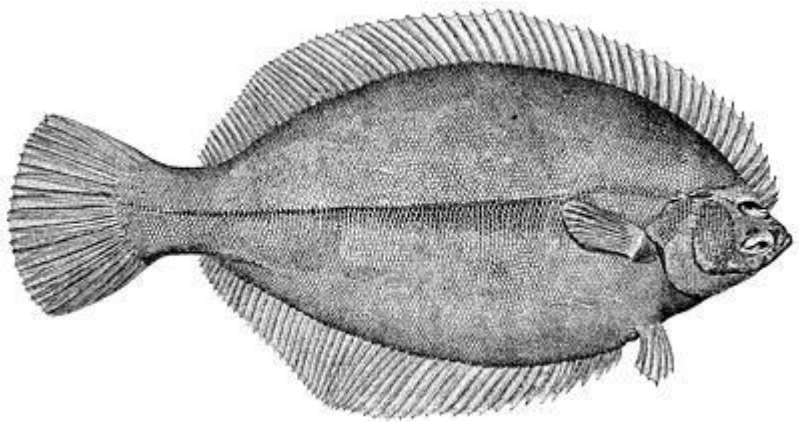
Georges Bank Winter Flounder



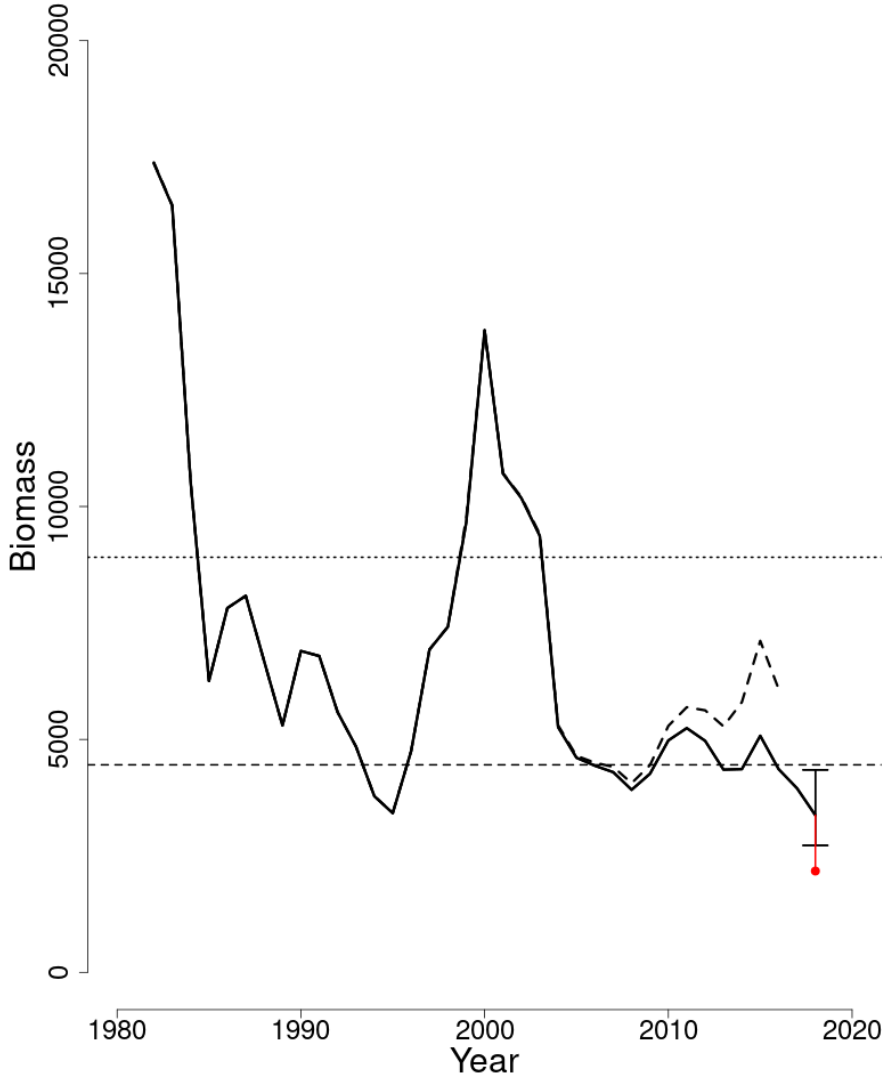
MODEL	VPA (Level 2)
STOCK STATUS	overfished & overfishing is not occurring
REBUILDING	2029 (70%F_{MSY} Frebuild)
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Natural mortality, catch uncertainties, lack of discards from Canadian trawl fishery, lack of age data from DFO spring survey, stock recruit residual pattern
REVIEWER COMMENTS	Concerns about the reference point definitions based on fixed steepness in S-R relationship resulting in an overly optimistic recruitment assumptions in projections. Stock-recruitment relationship for Georges Bank winter flounder has deteriorated (residual pattern). F40% sensitivity BRP.

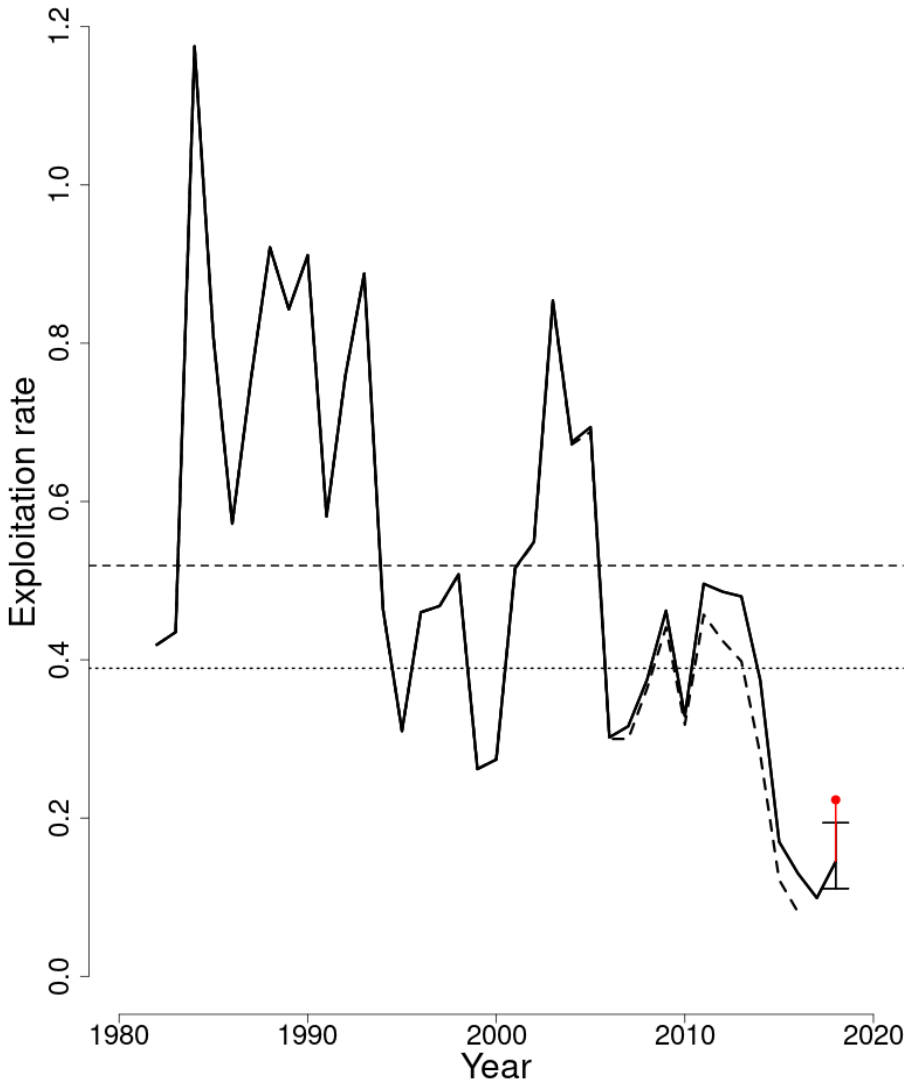
Georges Bank Winter Flounder

	2017	2019
F_{MSY}	0.522	0.519
SSB_{MSY} (mt)	7,600	8,910 (4,196 - 21,143)
MSY (mt)	3,500	4,260 (2,049 - 9,632)
Median recruits (age 1) (000s)	9,164	8,608
Overfishing	No	No
Overfished	No	Yes

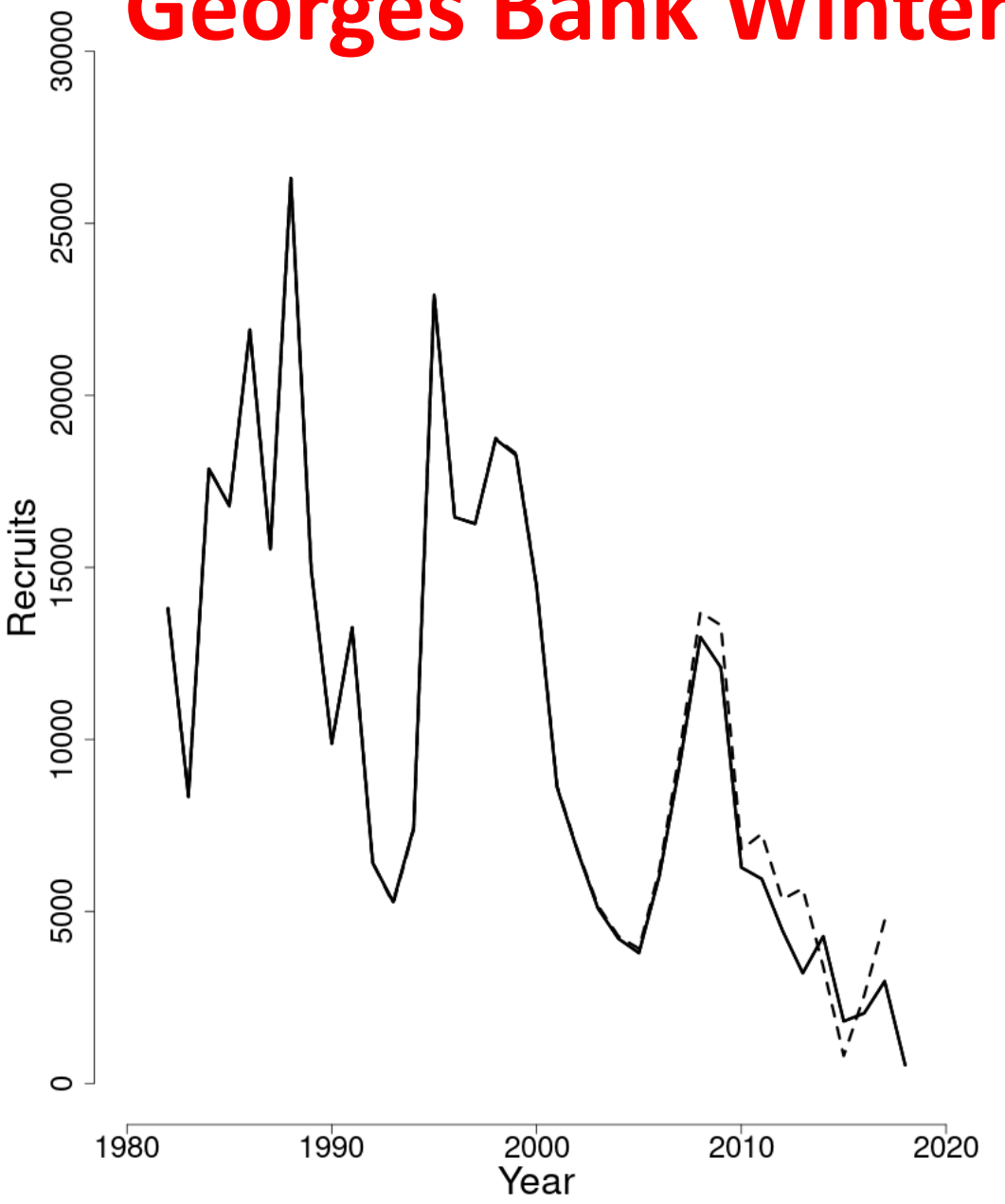


Georges Bank Winter Flounder

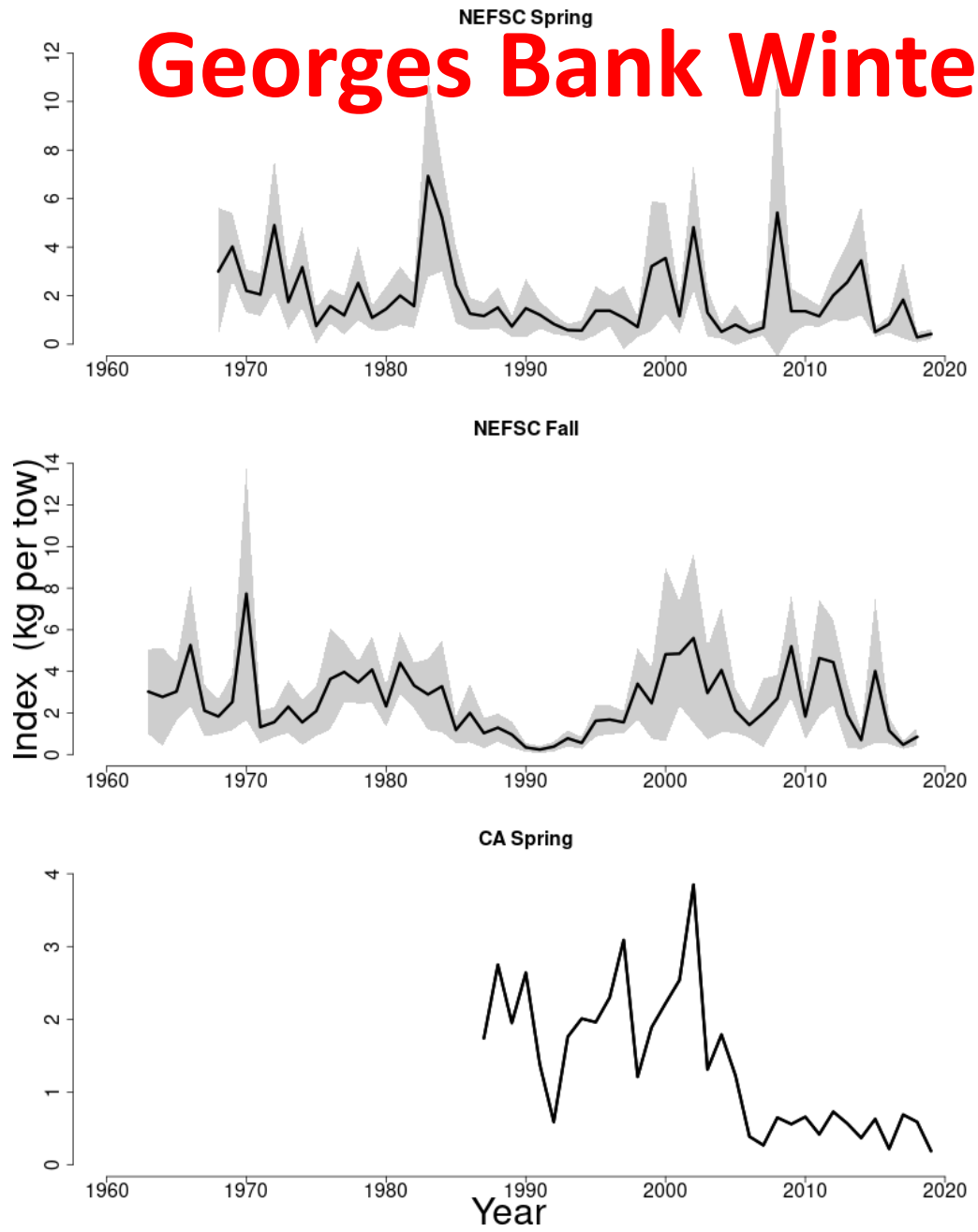




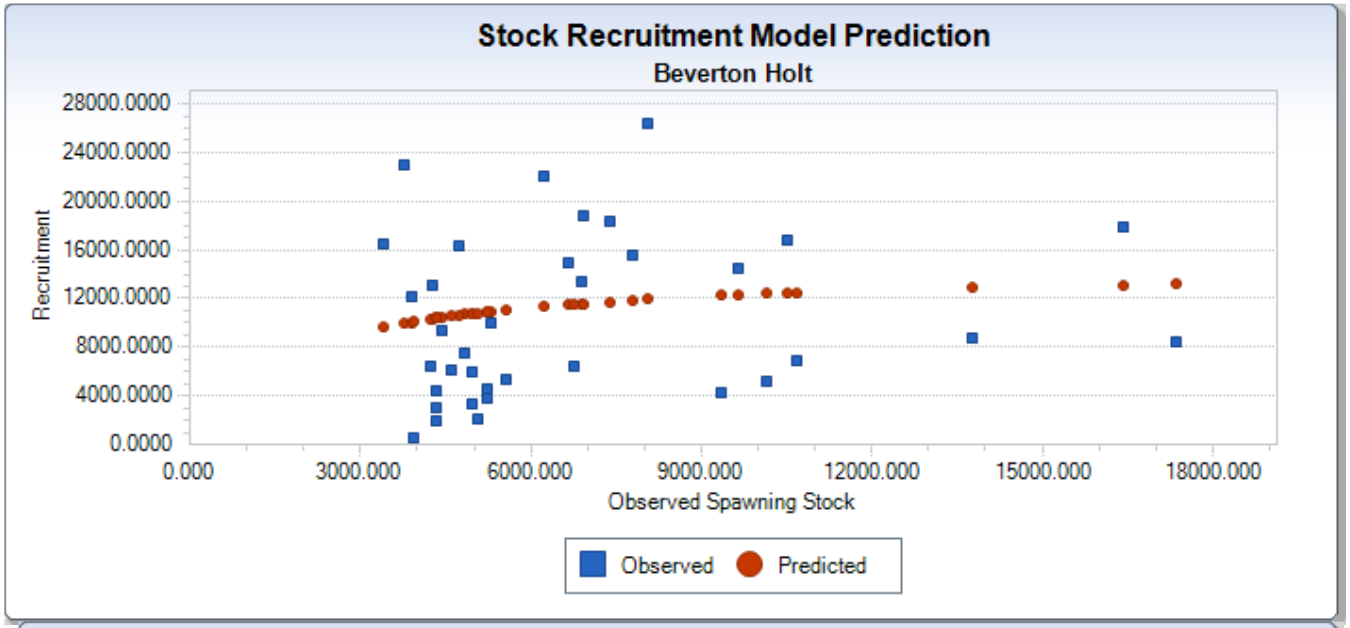
Georges Bank Winter Flounder



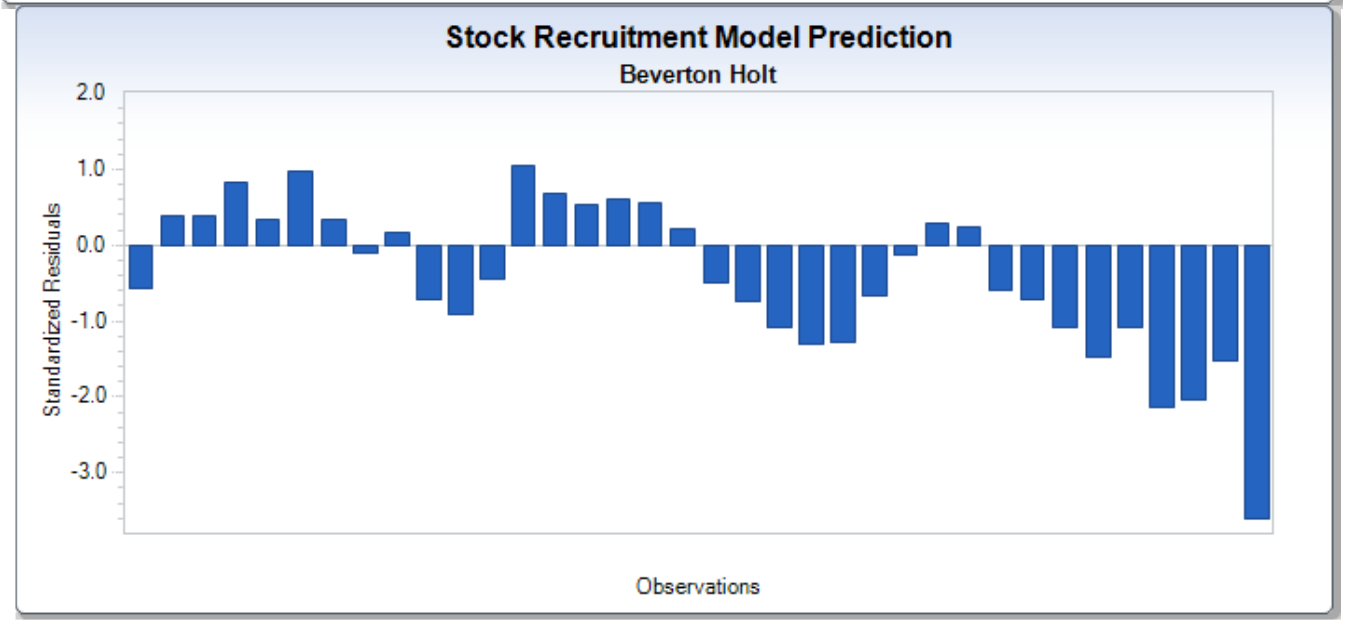
Georges Bank Winter Flounder



FMSY Estimation (Beverton-Holt S-R Model)

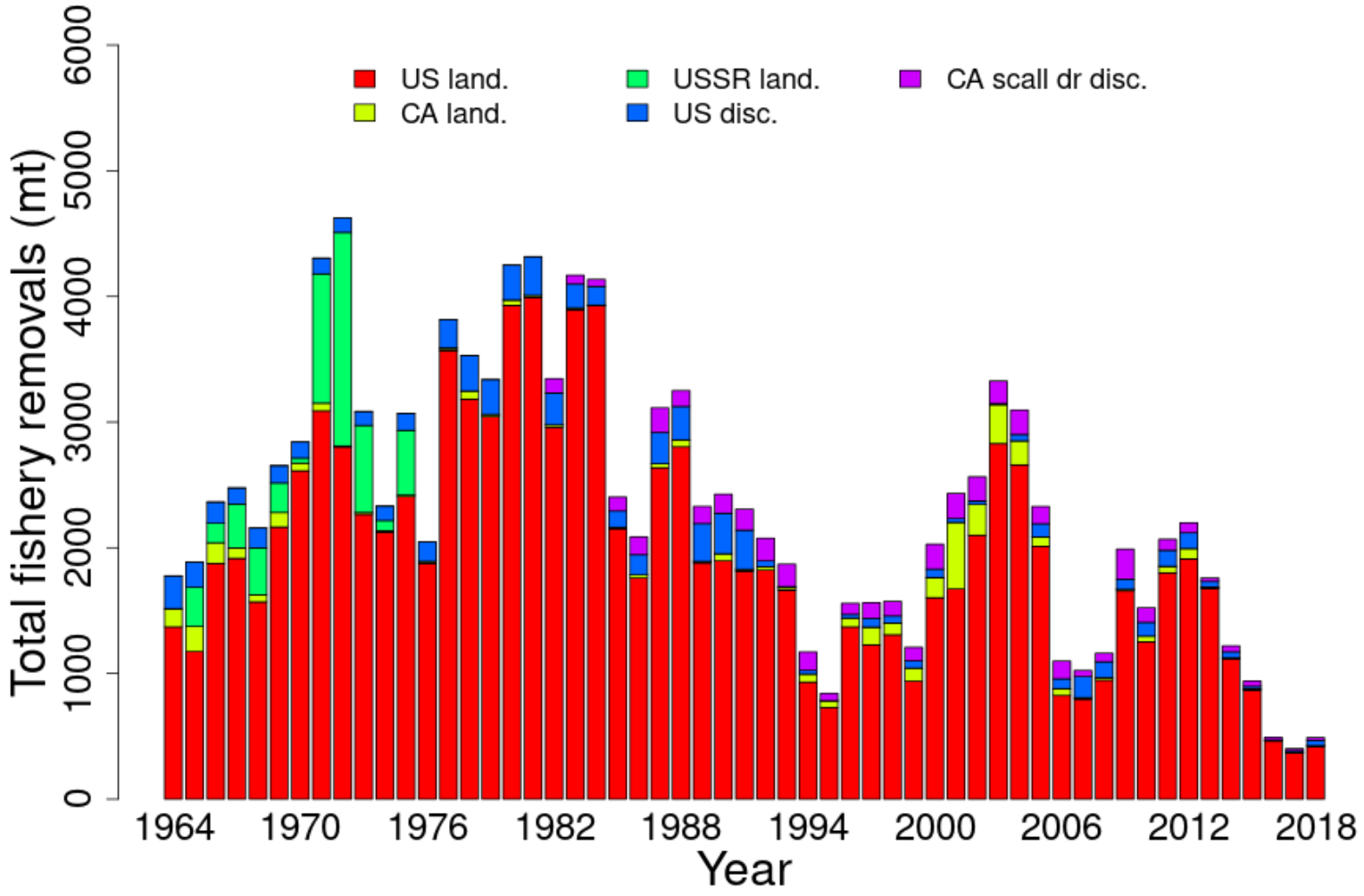


Steepness remained inestimable, so prior set to 0.78 as in previous assessments

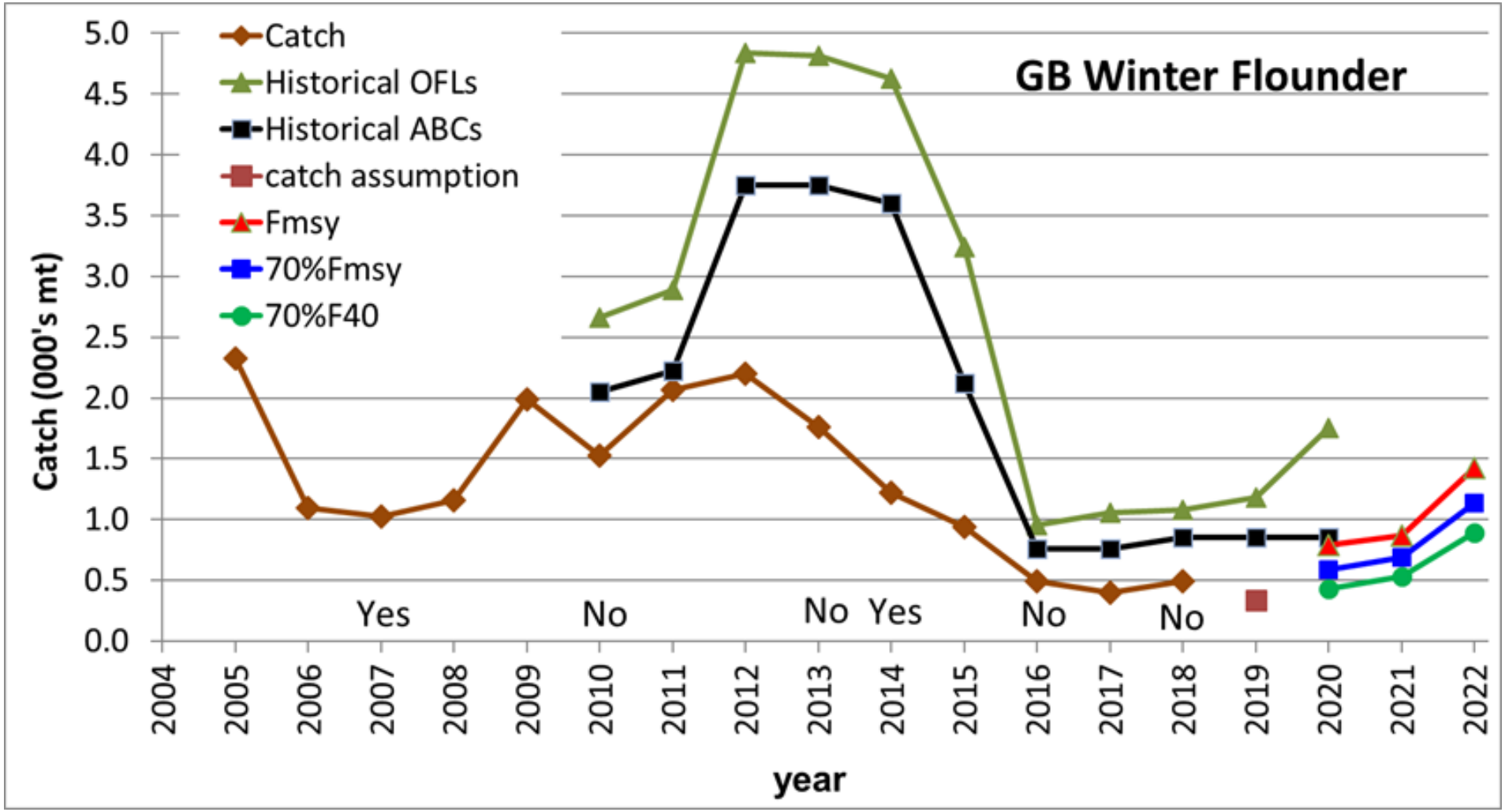


Negative residuals at the end of the time series.

Georges Bank Winter Flounder



Georges Bank Winter Flounder



Georges Bank Winter Flounder

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$70\%F_{MSY}$	$70\%F_{40}$
2010	1,523	2,660	2,052				
2011	2,069	2,886	2,224				
2012	2,199	4,839	3,753				
2013	1,761	4,819	3,750				
2014	1,219	4,626	3,598				
2015	940	3,242	2,124				
2016	492	957	755				
2017	402	1,056	755				
2018	490	1,083	855				
2019		1,182	855	334			
2020		1,756	855		790	587	433
2021					868	687	532
2022					1,422	1,138	890

Georges Bank Winter Flounder

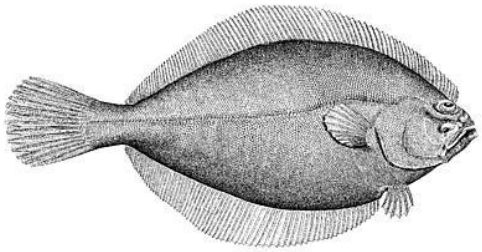
$75\%F_{MSY}$ Projection

year	OFL	ABC	F	SSB
2020	790	587	0.37	1,675
2021	944	687	0.37	1,798
2022	1,556	1,138	0.37	3,273

$75\%F_{MSY}$ First Year Constant Projection

year	OFL	ABC	F	SSB
2020	790	587	0.37	1,674
2021	944	587	0.302	1,828
2022	1,590	587	0.172	3,482

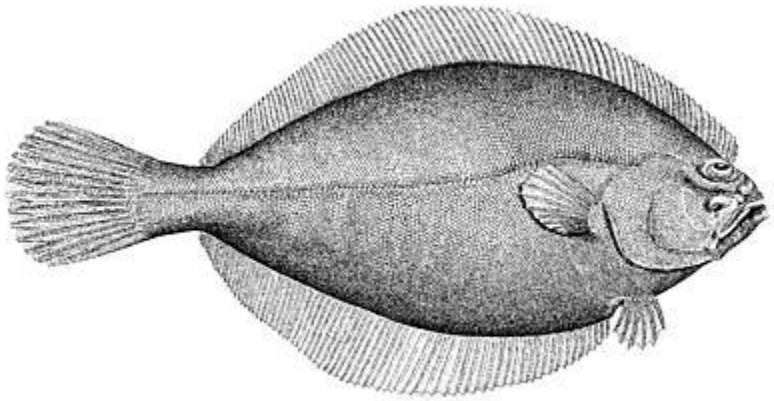
American Plaice



MODEL	VPA (Level 2)
STOCK STATUS	Not Overfished & Overfishing is not occurring
REBUILDING	Rebuilt (end date 2024)
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Evidence of growth differences between fish on Georges Bank and Gulf of Maine.
REVIEWER COMMENTS And Changes	The retrospective pattern remains a source of uncertainty. MDMF survey was excluded from the 2019 assessment due to concerns that the declining trends may reflect a movement of the stock offshore instead of decline in the population itself. Exclusion of the MA DMF survey resulted in higher biomass estimates that are more consistent with those from the area-swept survey estimates.

American Plaice

	2017	2019
F_{MSY} *proxy*	0.216	0.258
SSB_{MSY} (mt)	13,503	15,293 (11,706 - 20,432)
MSY (mt)	2,942	3,301 (2,531 - 4,386)
Median recruits (age 1) (000s)	21,969	22,414
Overfishing	No	No
Overfished	No	No



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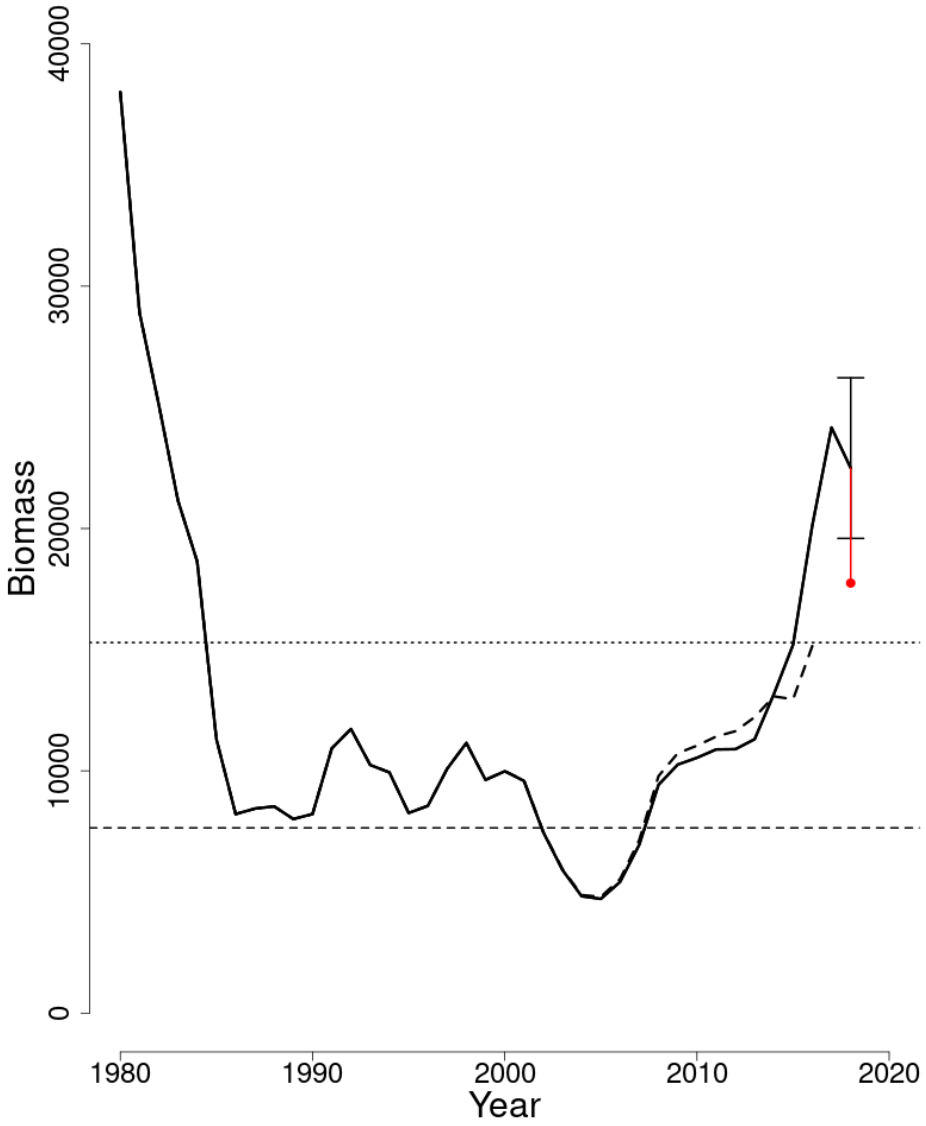
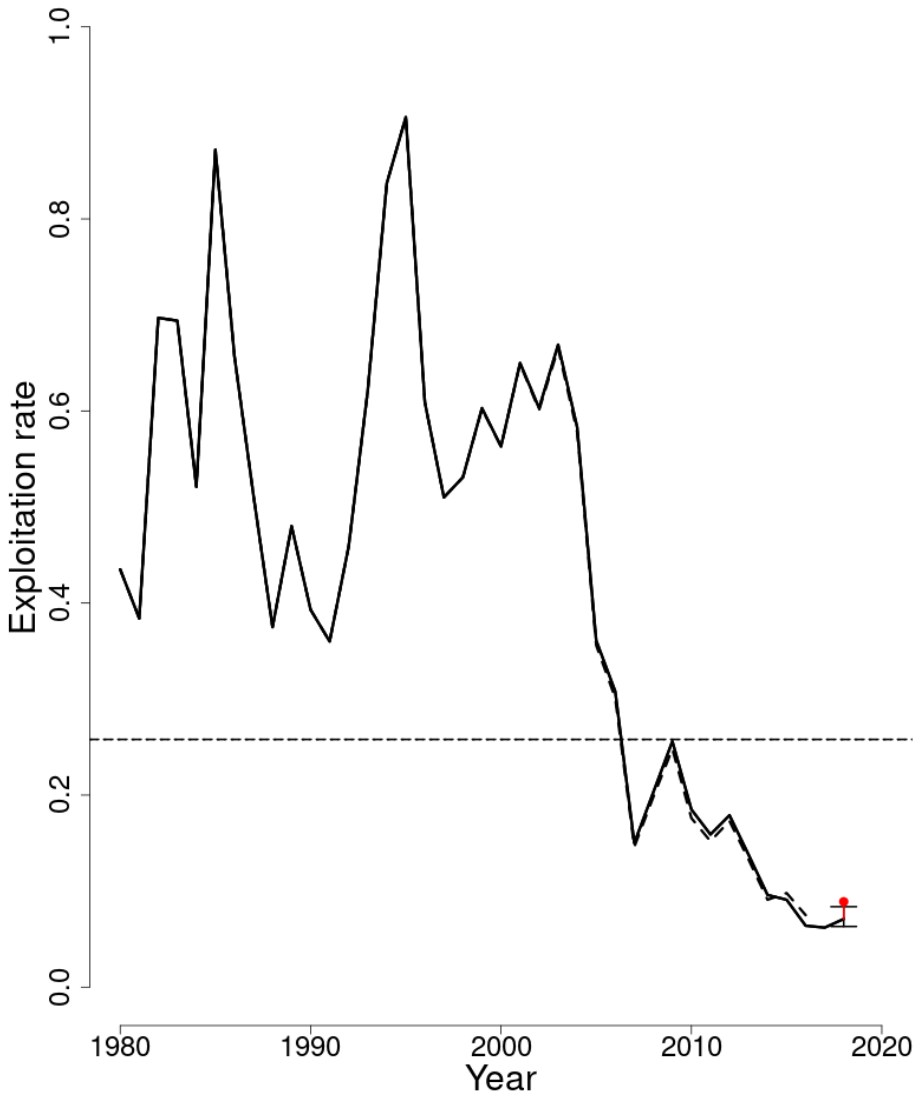
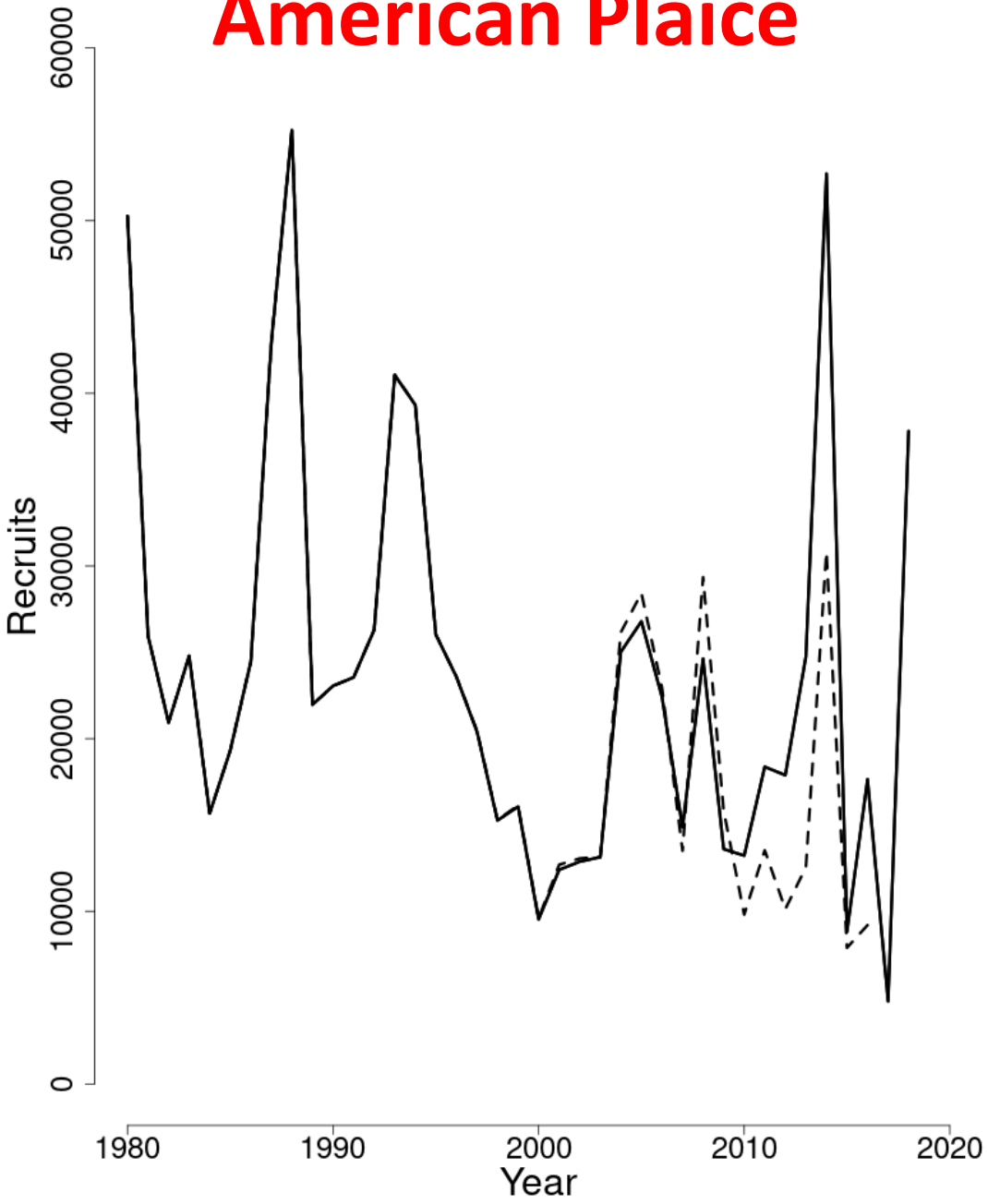




American Plaice



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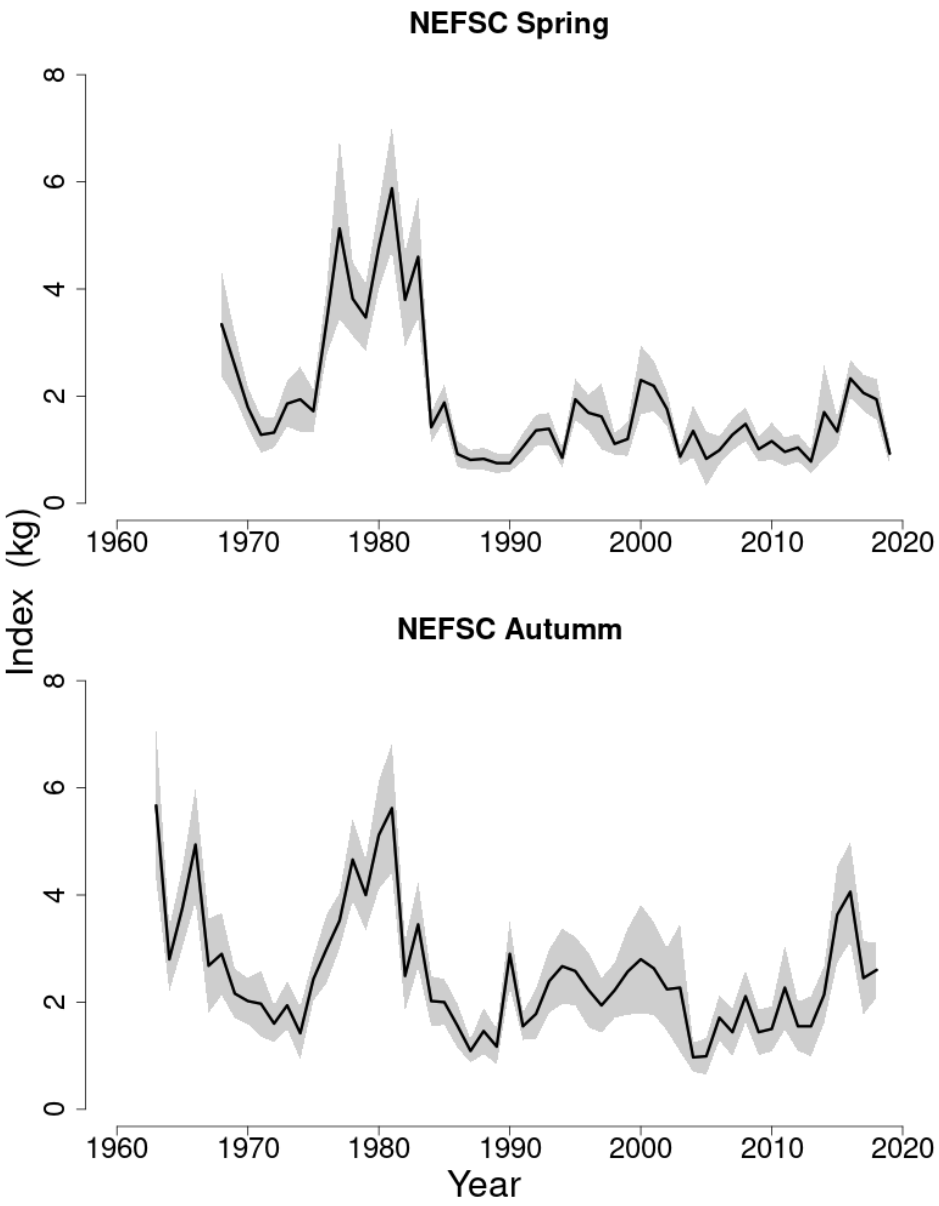

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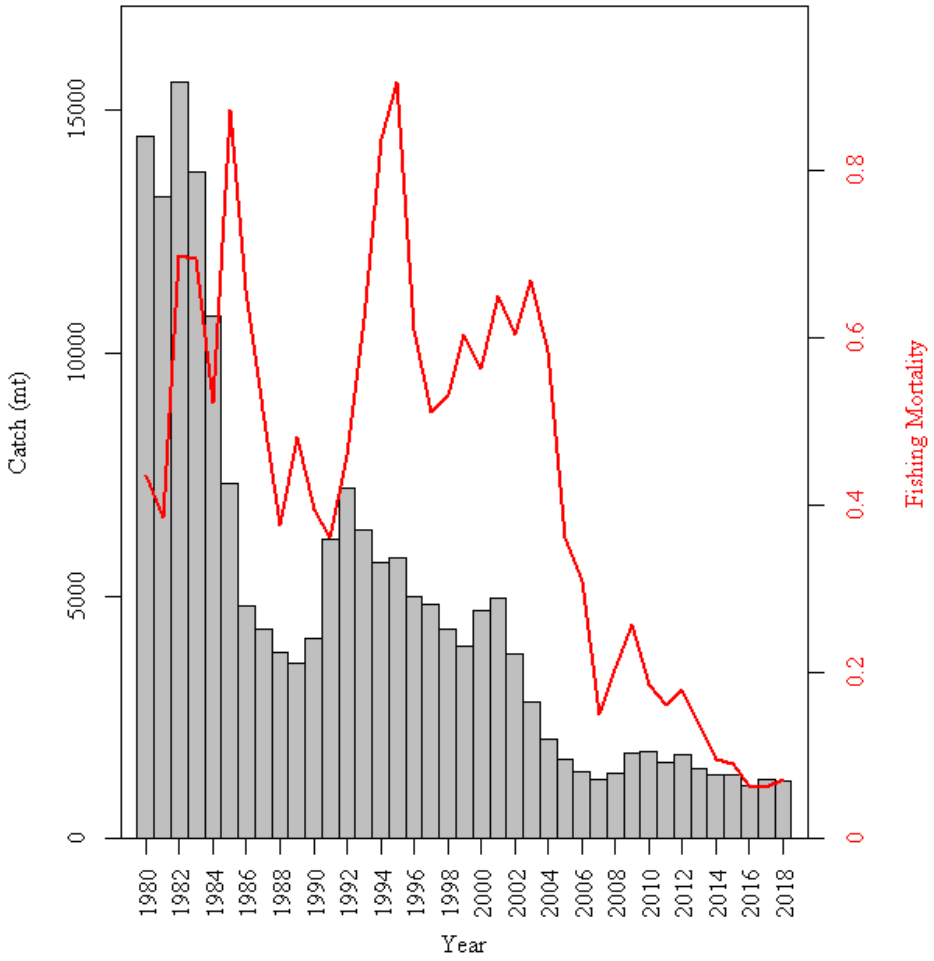
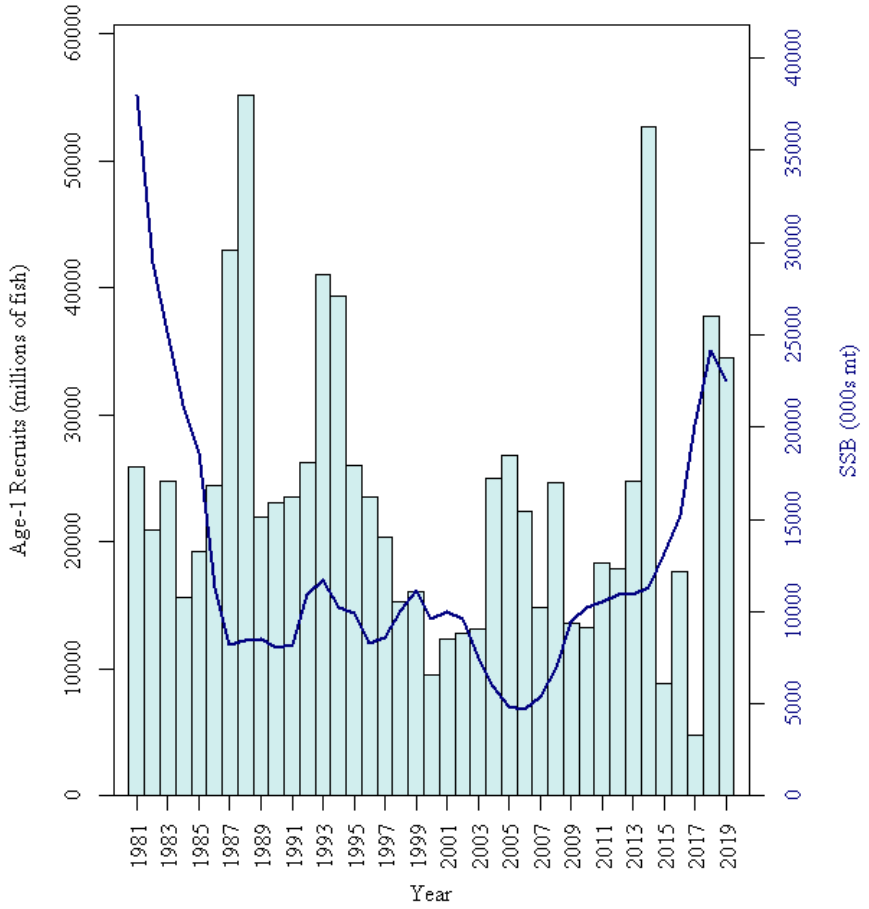


Age-1 Recruitment vs. SSB



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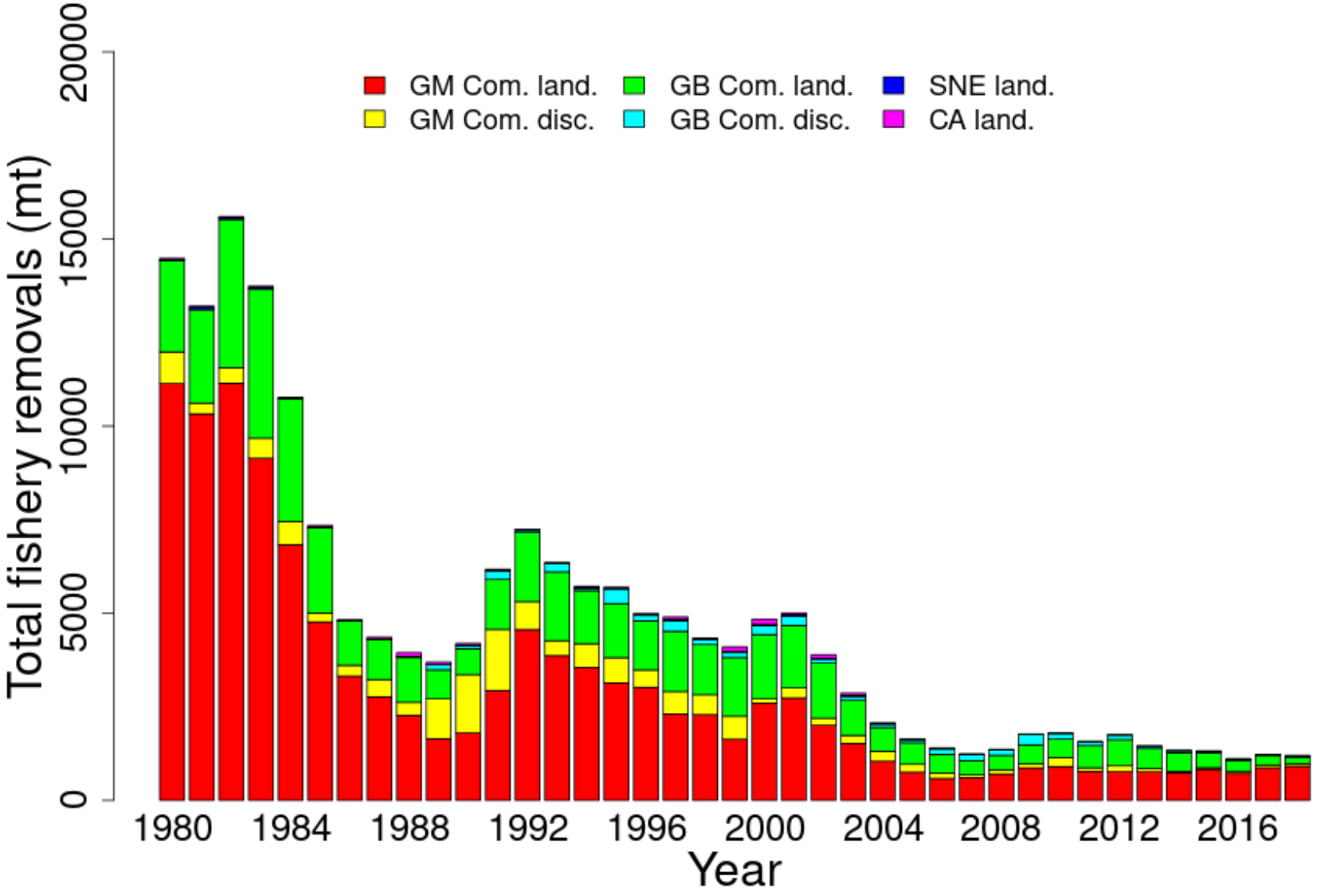
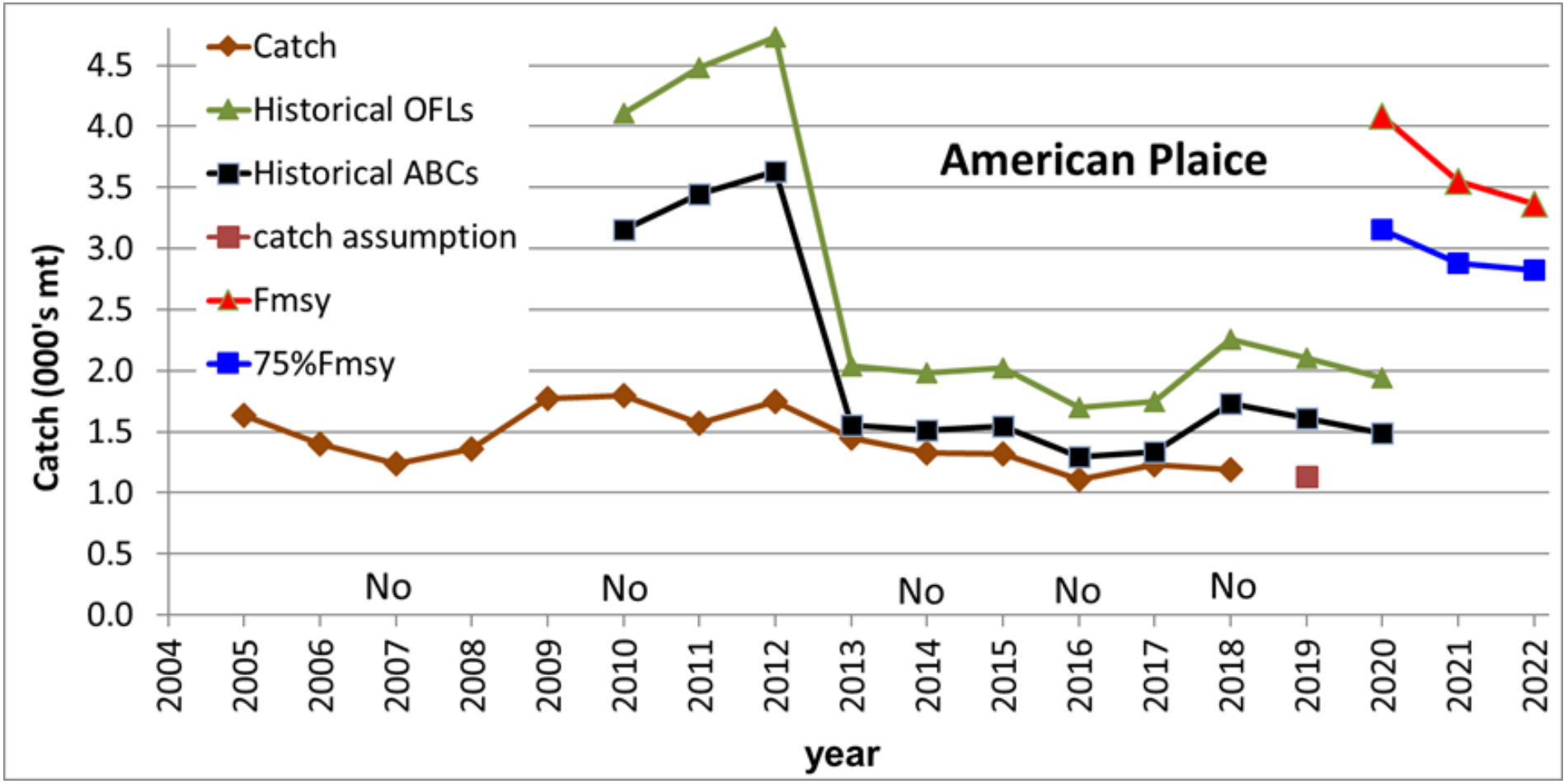


American Plaice



American Plaice

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	75%F_{MSY}
2010	1,795	4,110	3,156			
2011	1,569	4,483	3,444			
2012	1,747	4,727	3,632			
2013	1,449	2,035	1,557			
2014	1,328	1,981	1,515			
2015	1,316	2,021	1,544			
2016	1,108	1,695	1,297			
2017	1,226	1,748	1,336			
2018	1,192	2,260	1,732			
2019		2,099	1,609	1,131		
2020		1,945	1,492		4,084	3,155
2021					3,547	2,881
2022					3,367	2,825

American Plaice

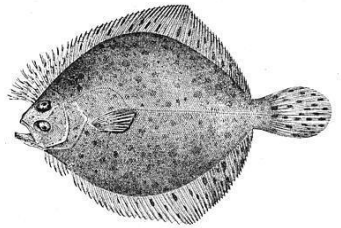
$75\%F_{MSY}$ Projection

year	OFL	ABC	F	SSB
2020	4,084	3,155	0.19	18,020
2021	3,740	2,881	0.19	16,875
2022	3,687	2,825	0.19	16,911

$75\%F_{MSY}$ Last Year Constant Projection

year	OFL	ABC	F	SSB
2020	4,084	2,825	0.17	18,101
2021	3,806	2,825	0.19	17,202
2022	3,753	2,825	0.19	17,267

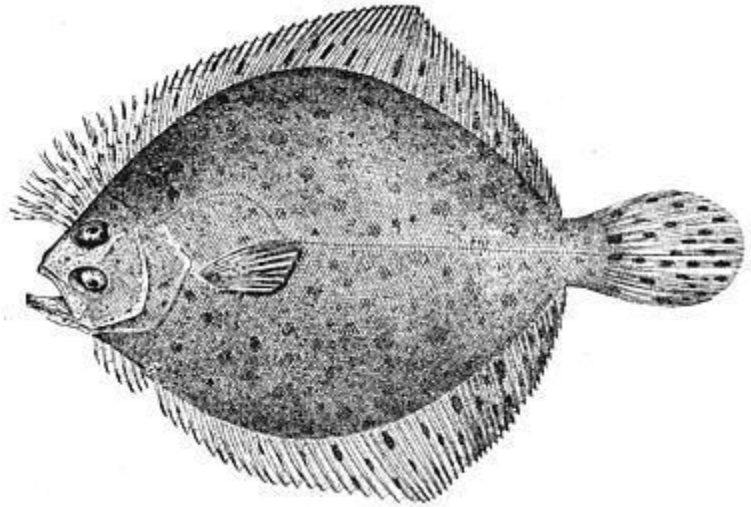
Southern Windowpane



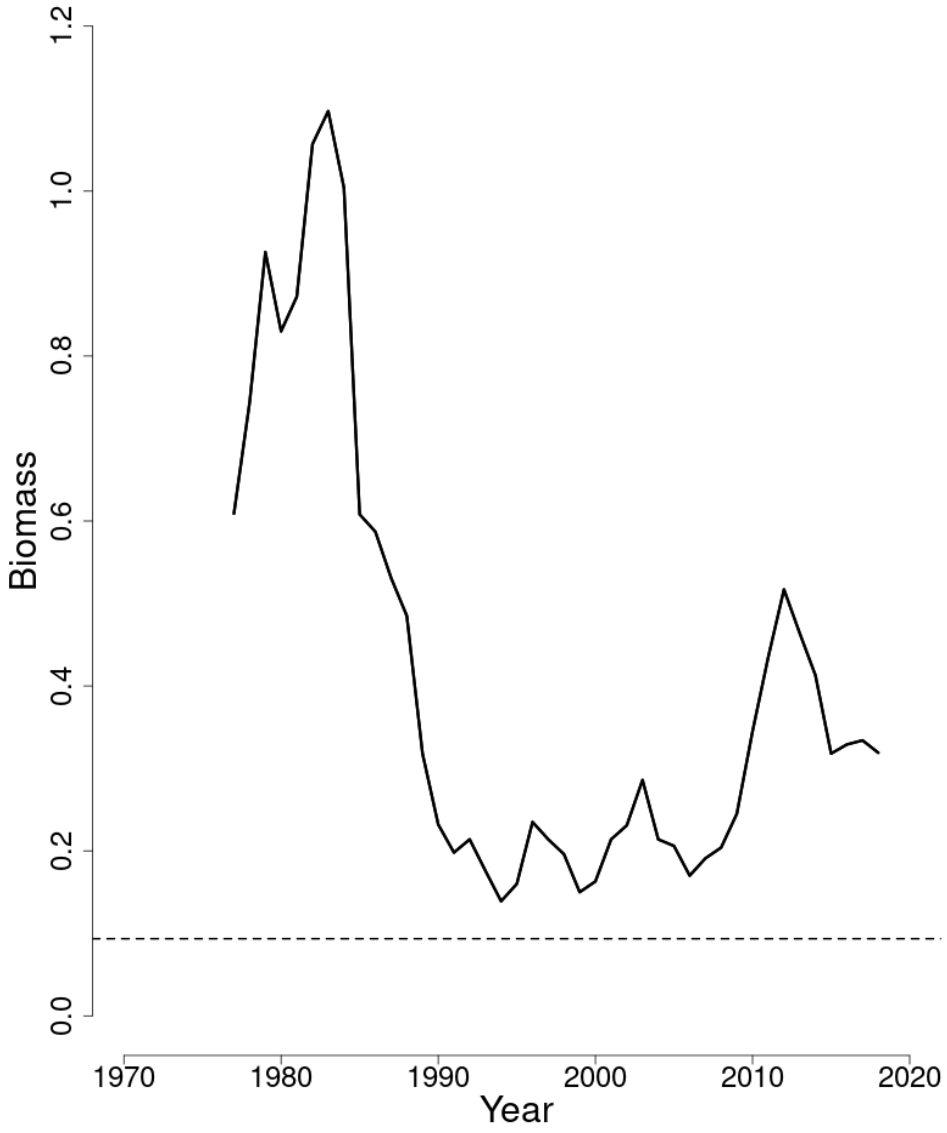
MODEL	AIM (Level 1)
STOCK STATUS	Not Overfished & Overfishing is not occurring
REBUILDING	Rebuilt
RETROSPECTIVE ADJUSTMENT	NA
UNCERTAINTIES	Data limited assessment, no possession since 2010 (catch is all discards) value was imputed for 2017 (from 2016 and 2018).
ASSESSMET COMMENTS	There is a significant relationship between the catch and the index [(ln(relative F) and ln(replacement ratio)]. Survey length frequencies indicate ongoing new recruits to the stock.
Changes	Updated discard time series using SBRM, general category scallop fleet discards added (5-8% total discards).

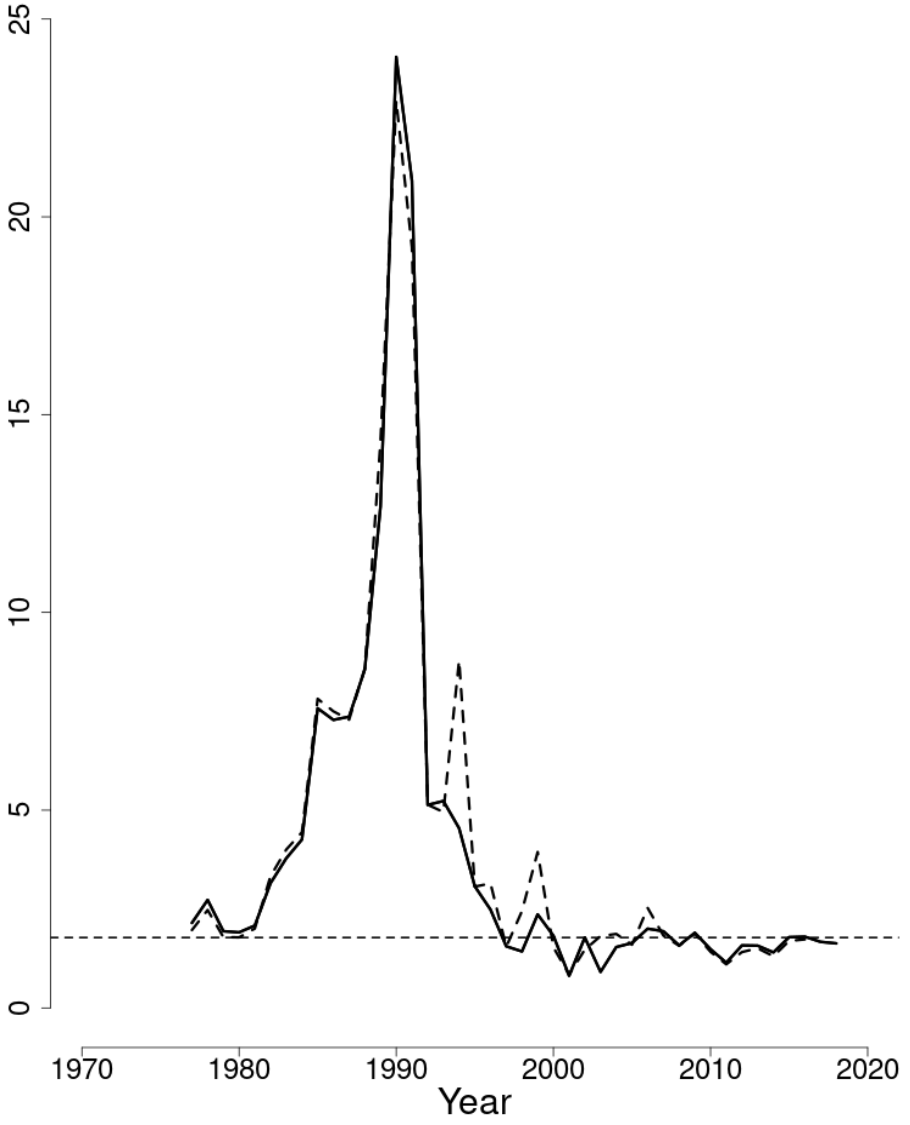
Southern Windowpane

	2017	2019
F_{MSY} *proxy*	1.918	1.780 (1.046 - 2.191)
B_{MSY} *proxy* (kg/tow)	0.261	0.187
MSY proxy (mt)	500	333
Overfishing	No	No
Overfished	No	No

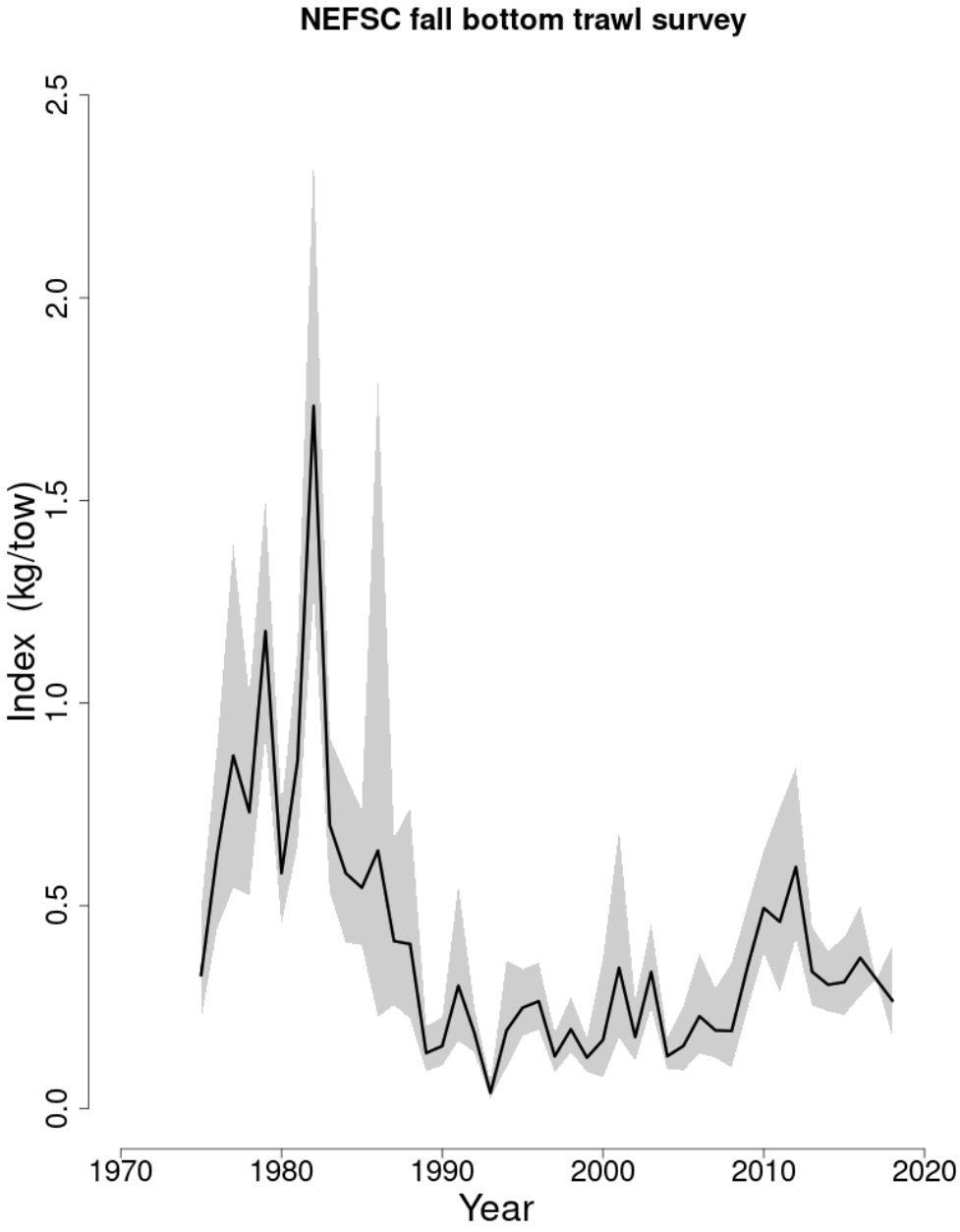


Southern Windowpane

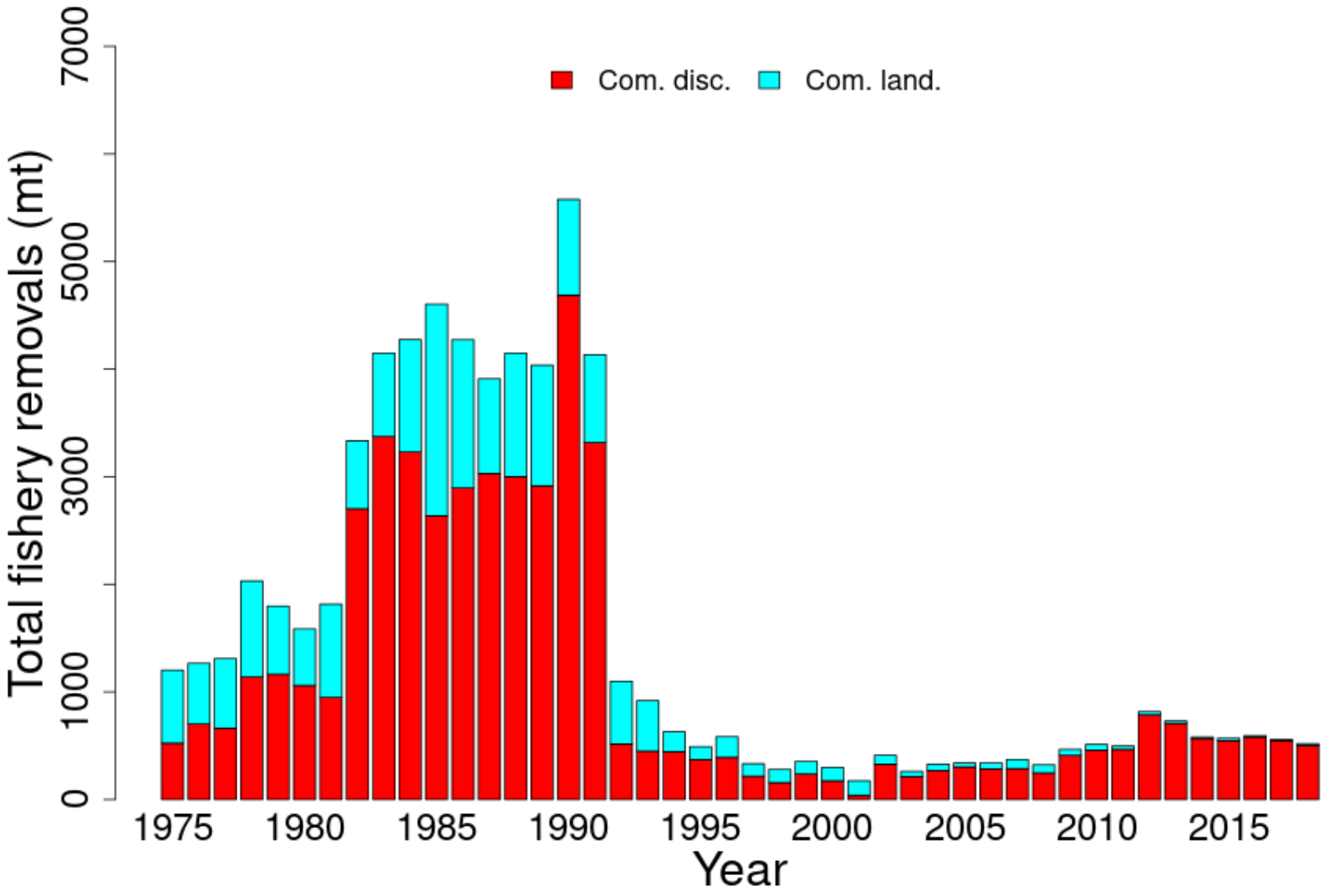




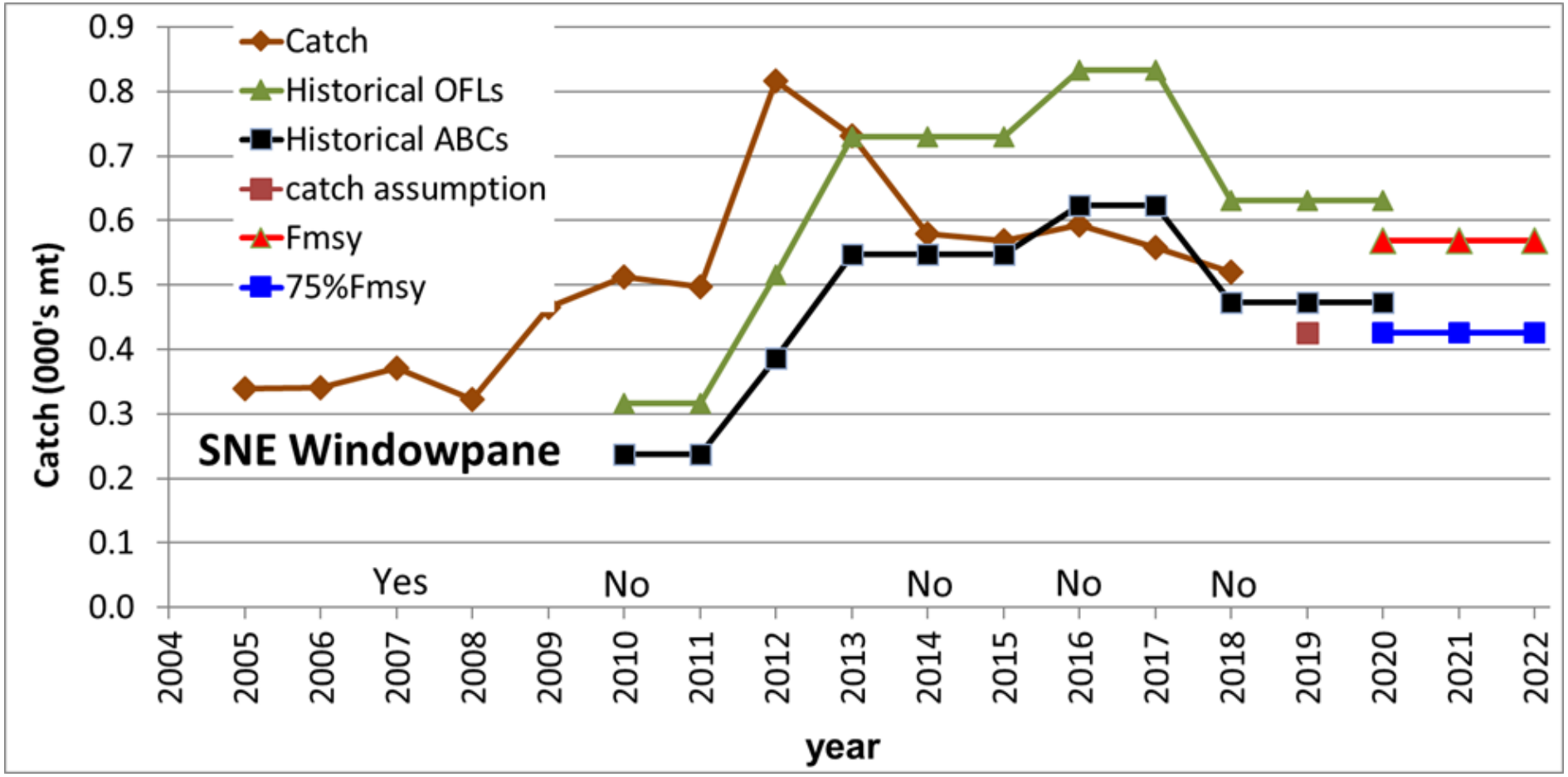
Southern Windowpane



Southern Windowpane



Southern Windowpane



Southern Windowpane

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$
2010	513	317	237			
2011	498	317	237			
2012	817	515	386			
2013	731	730	548			
2014	580	730	548			
2015	569	730	548			
2016	593	833	623			
2017	558	833	623			
2018	520	631	473			
2019		631	473	426		
2020		631	473		568	426
2021					568	426
2022					568	426

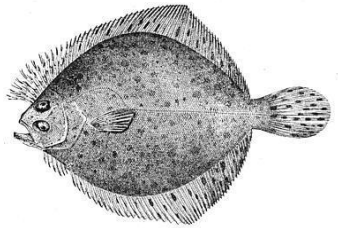
Southern Windowpane

OFL = F_{MSY} x kg/tow Constant

ABC = 75%F_{MSY} x kg/tow Constant

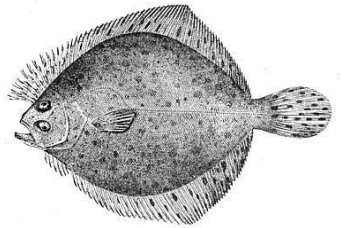
year	OFL	ABC
2020	568	426
2021	568	426
2022	568	426

Northern Windowpane

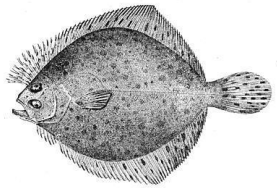


MODEL	AIM (Level 2)
STOCK STATUS	Overfished & Overfishing is not occurring
REBUILDING	2029 (70%F_{MSY} Frebuild, no projection)
RETROSPECTIVE ADJUSTMENT	NA
UNCERTAINTIES	Data limited assessment, Both catch and surveys have been decreasing in recent years, relationship between the catch and the index is worsening, no possession since 2010 - catch comprised of discards
REVIEWER COMMENTS	Did not accept the BRPs from the 2019 model due to update relationship of biomass replacement to relative F being uninformative, numerous negative residuals at the end of the time series, recent instability of FMSY estimates, declining trend in biomass despite low catches was captured by the empirical approach, stock should be re-considered at the 2020 research track workshop.

Northern Windowpane



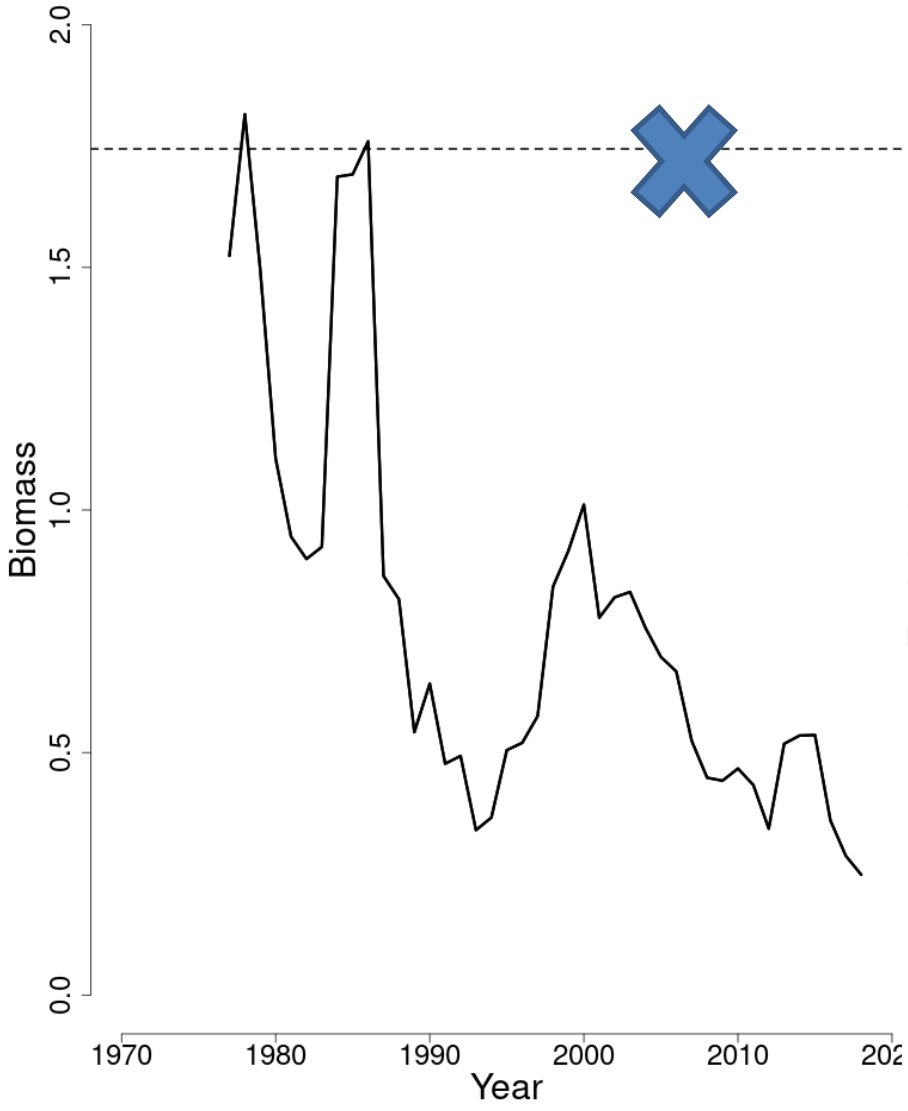
Changes	Updated discard time series, general category scallop fleet discards added.

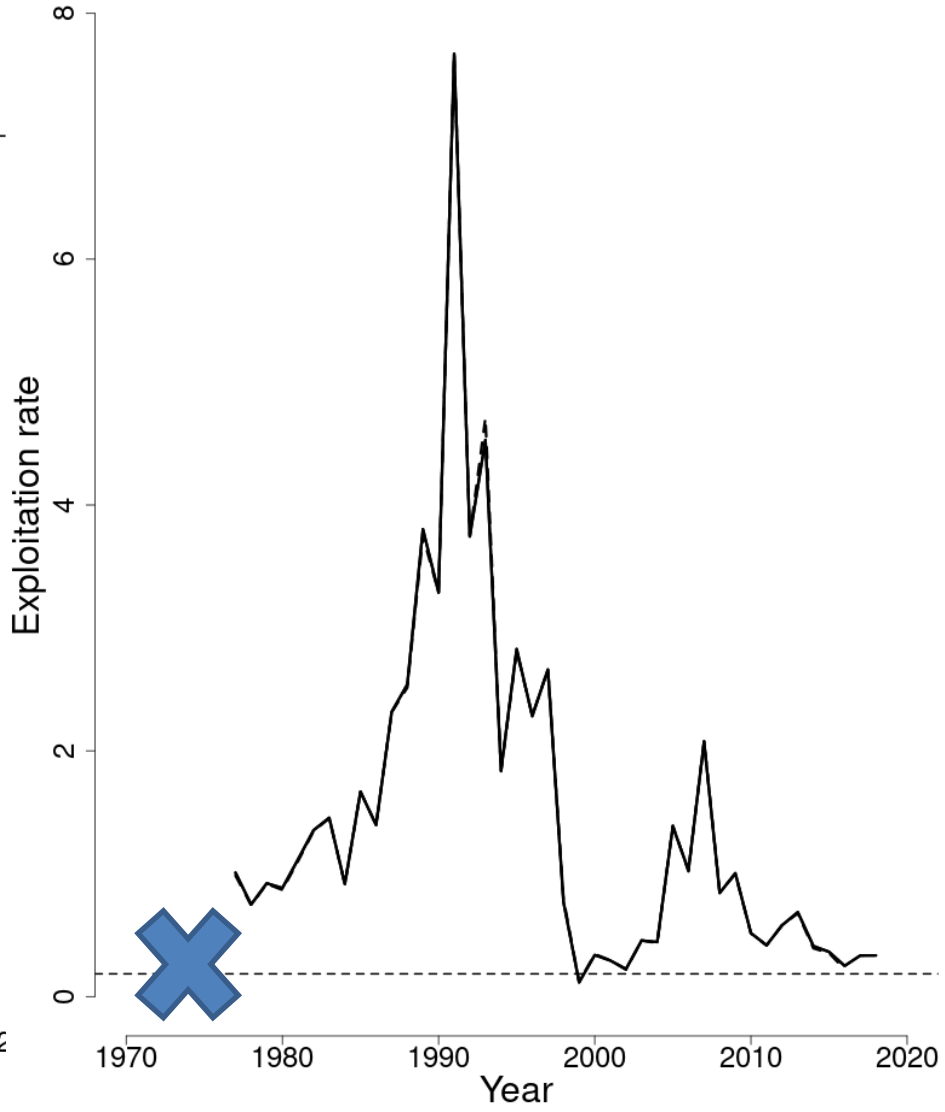


Northern Windowpane

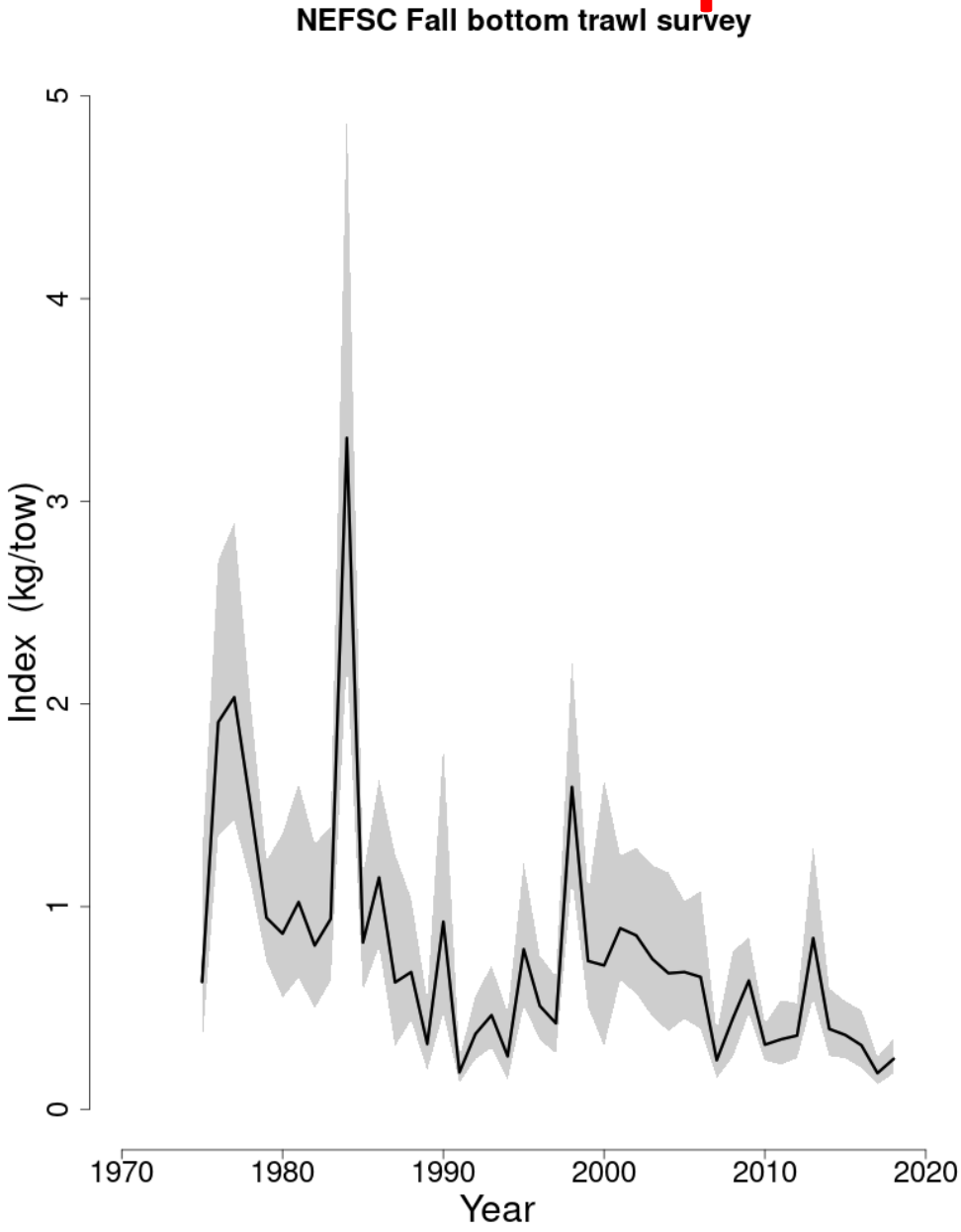
	2017	2019
F_{MSY} *proxy*	0.340	~~0.185 (0.0001 - 0.726)~~
B_{MSY} *proxy* (kg/tow)	2.060	~~3.489~~
MSY proxy (mt)	700	~~647~~
Overfishing	No	~~Yes~~
Overfished	Yes	Yes

Northern Windowpane

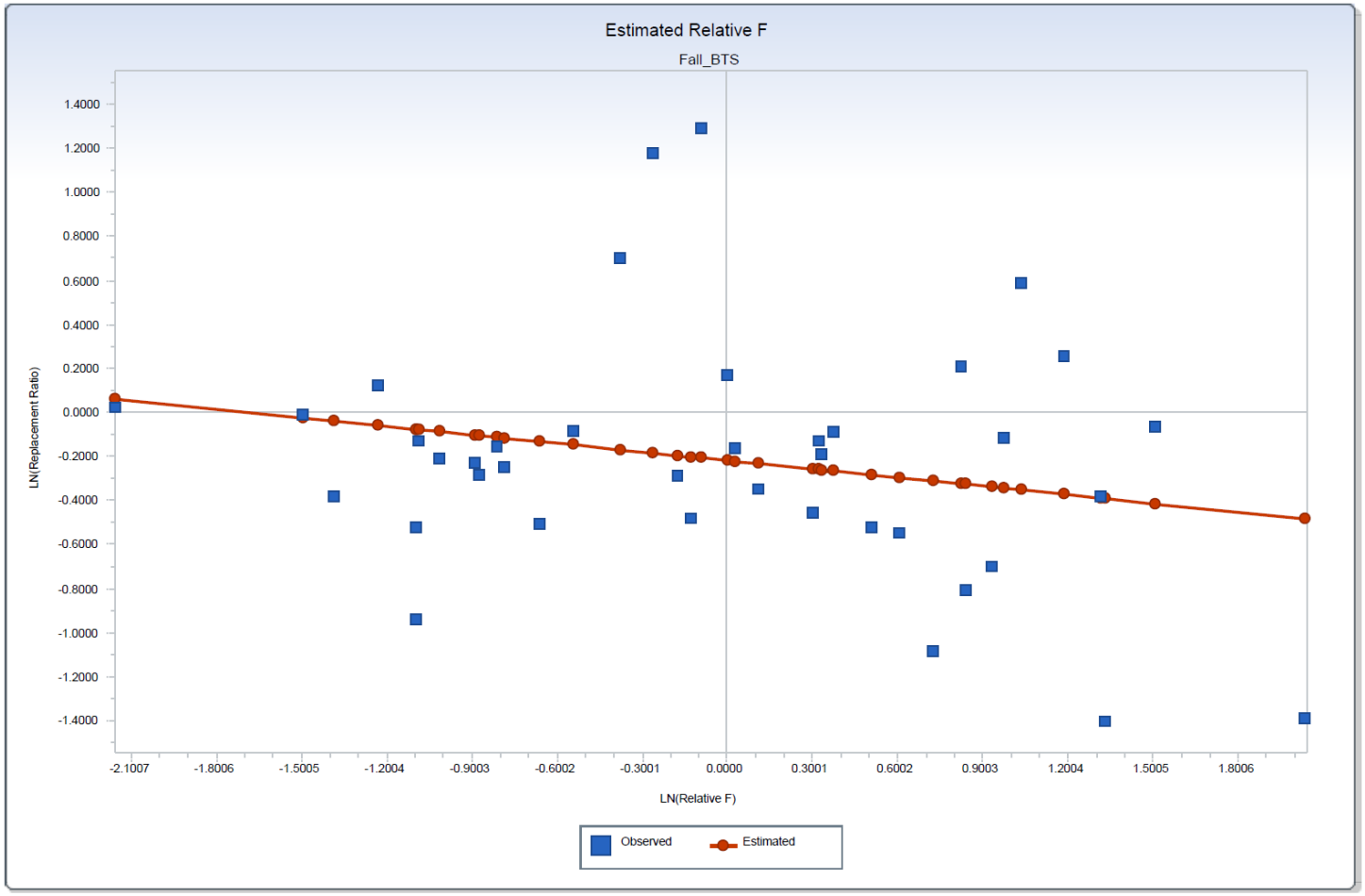




Northern Windowpane

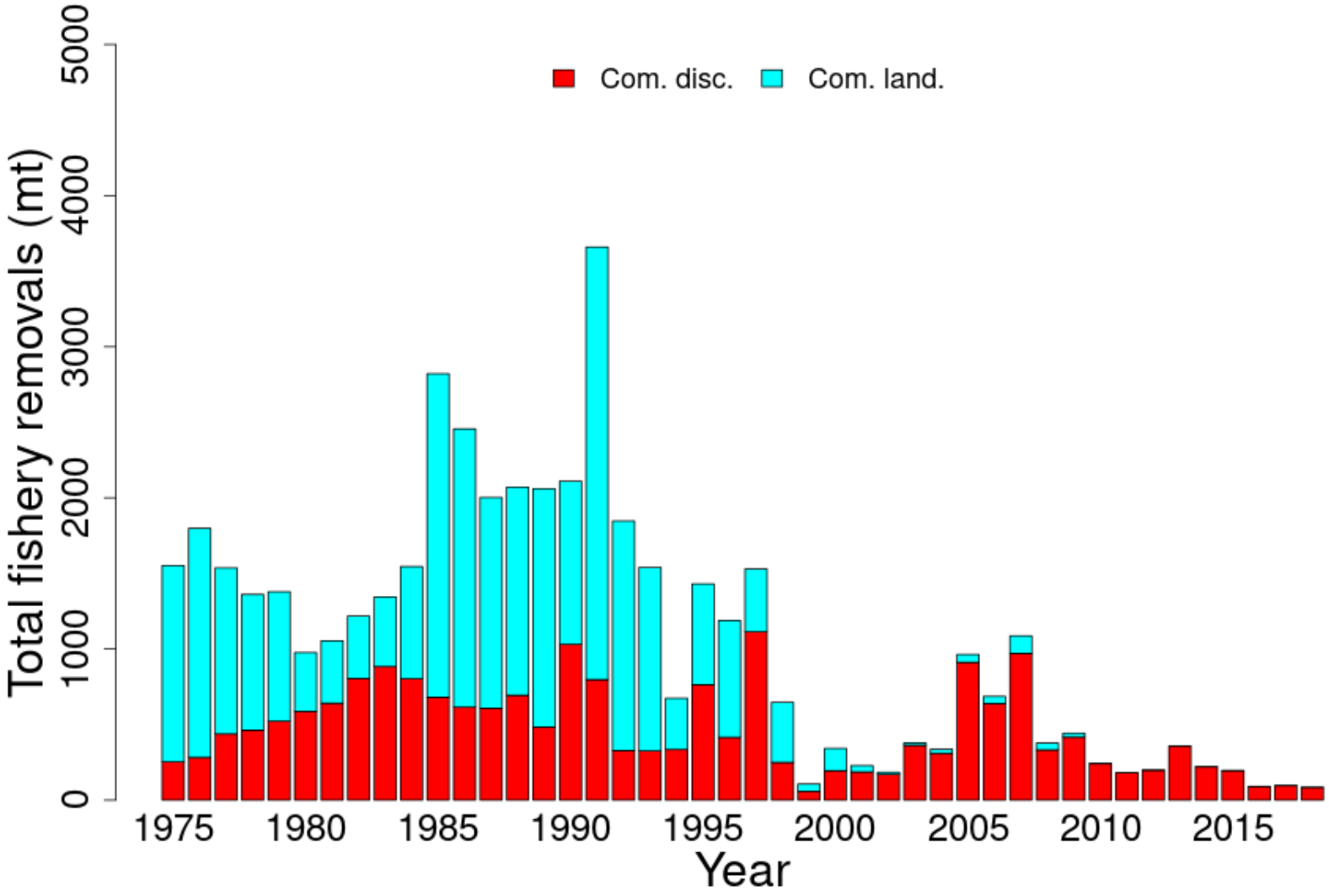


Northern Windowpane

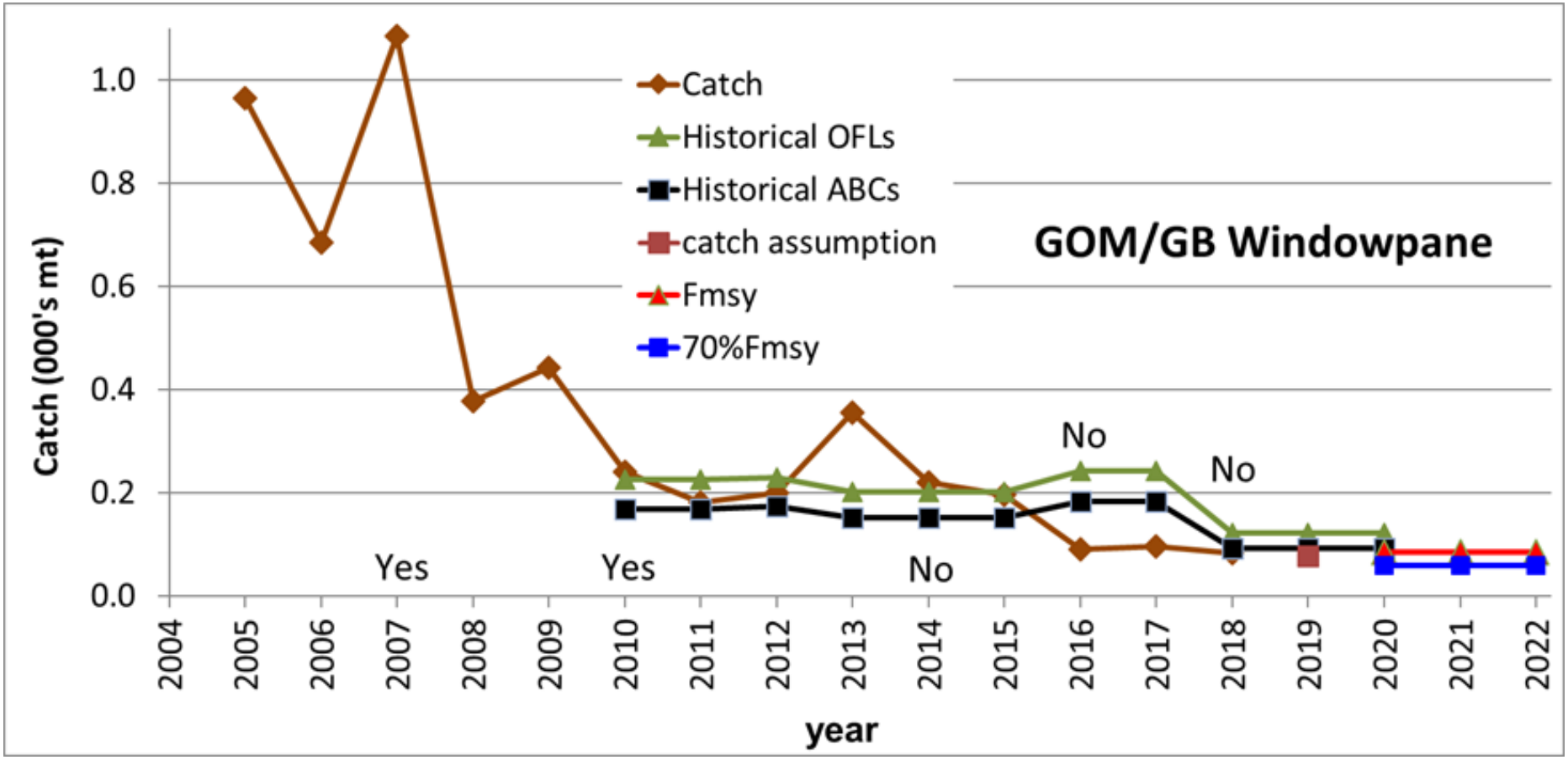


F_{msy} proxy occurs where the regression line crosses zero (replacement ratio = 1.0).

Northern Windowpane



Northern Windowpane



Northern Windowpane

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	70%F_{MSY}
2010	241	225	169			
2011	181	225	169			
2012	199	230	173			
2013	356	202	151			
2014	220	202	151			
2015	195	202	151			
2016	90	243	182			
2017	96	243	182			
2018	83	122	92			
2019		122	92	77		
2020		122	92		84	59
2021					84	59
2022					84	59

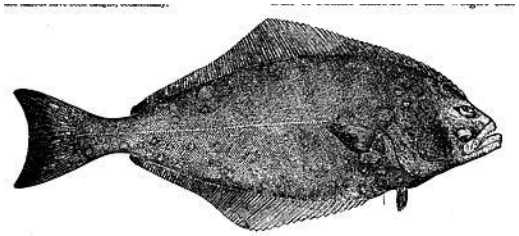
Northern Windowpane

OFL = F_{MSY} x kg/tow Constant

ABC = 70%F_{MSY} x kg/tow Constant

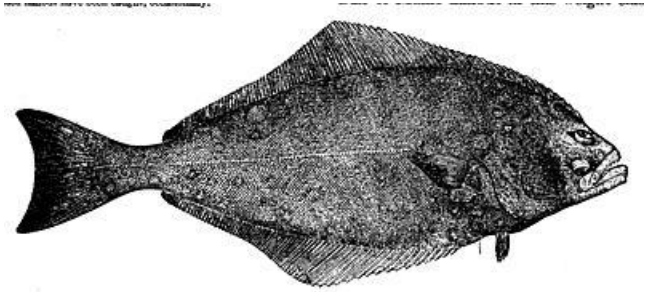
year	OFL	ABC
2020	84	59
2021	84	59
2022	84	59

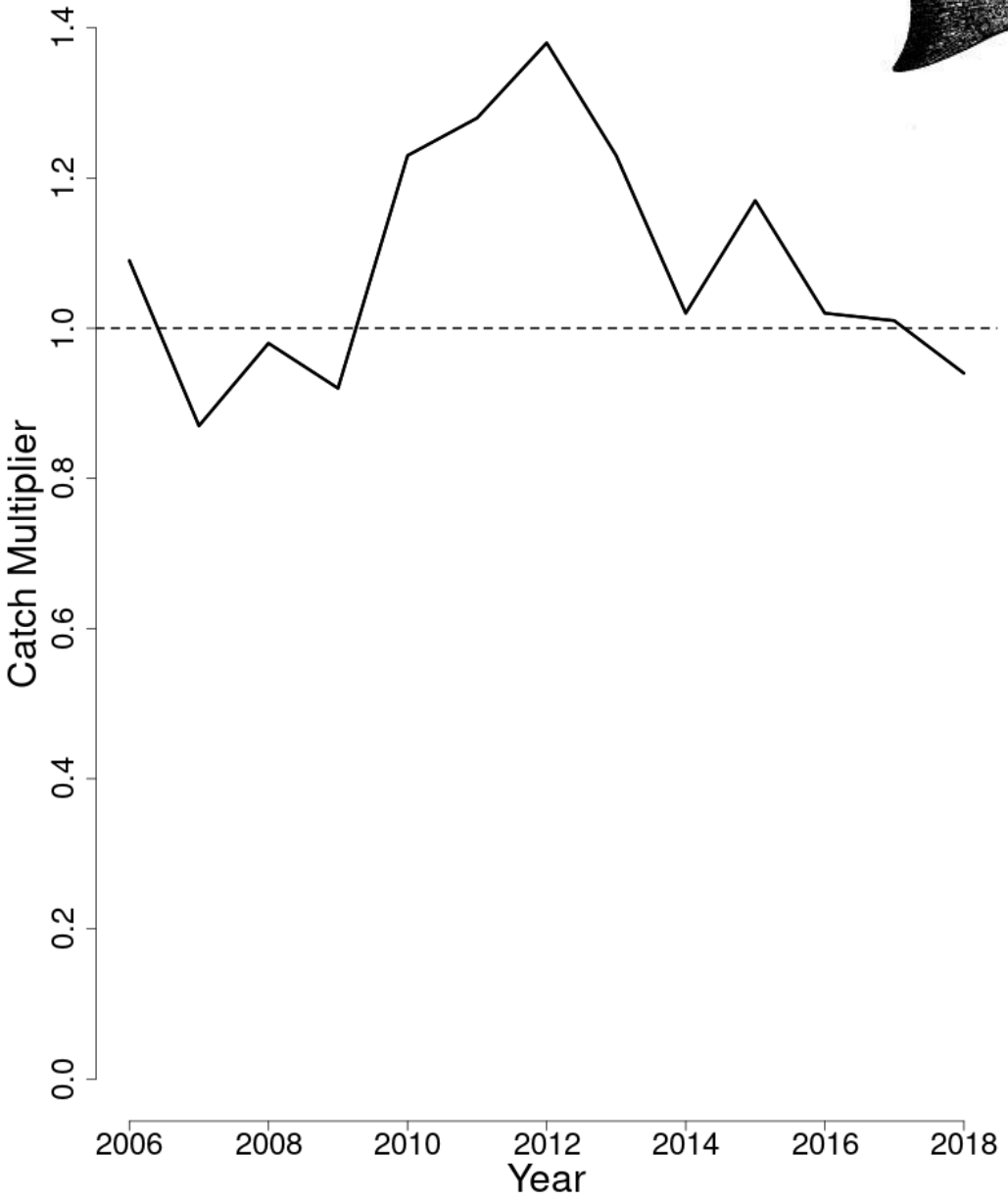
Halibut



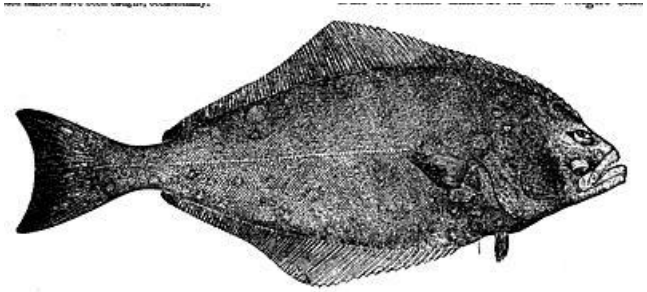
MODEL	FSD Method (Level 1)
STOCK STATUS	Overfished & Overfishing is unknown
REBUILDING	2056 (No Projection)
RETROSPECTIVE ADJUSTMENT	NA
UNCERTAINTIES	Data limited assessment, stock structure, Lack of BRPs, 2018 SSB and fully selected fishing mortality are unknown.
ASSESSMENT COMMENTS	Low catchability in NEFSC surveys, uncertainty associated time lags in using the catch advice for the out years (2020-2022) from FSD.

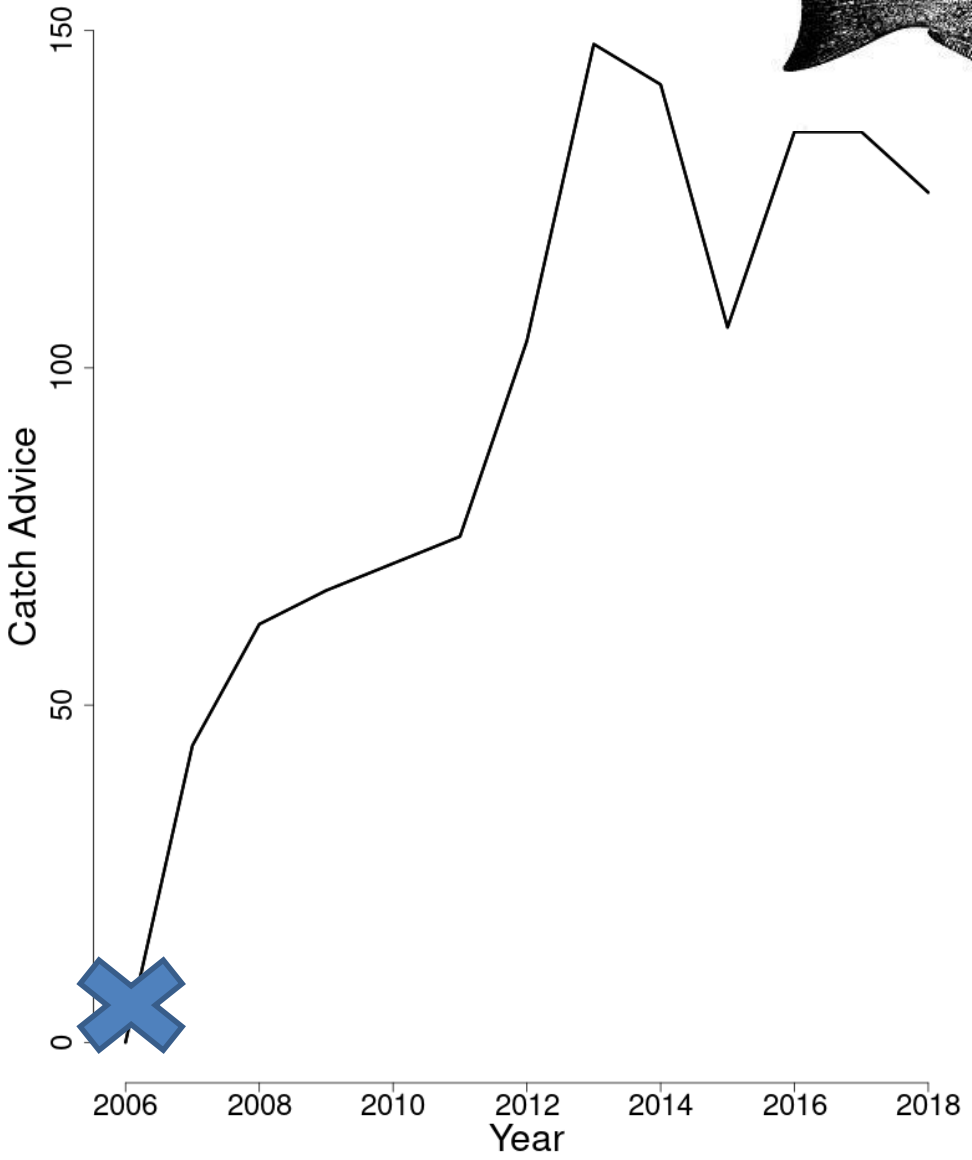
Halibut



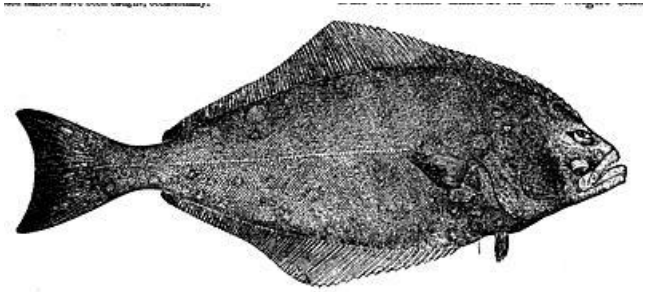

Catch Multiplier
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
2006
2008
2010
2012
2014
2016
2018
Year

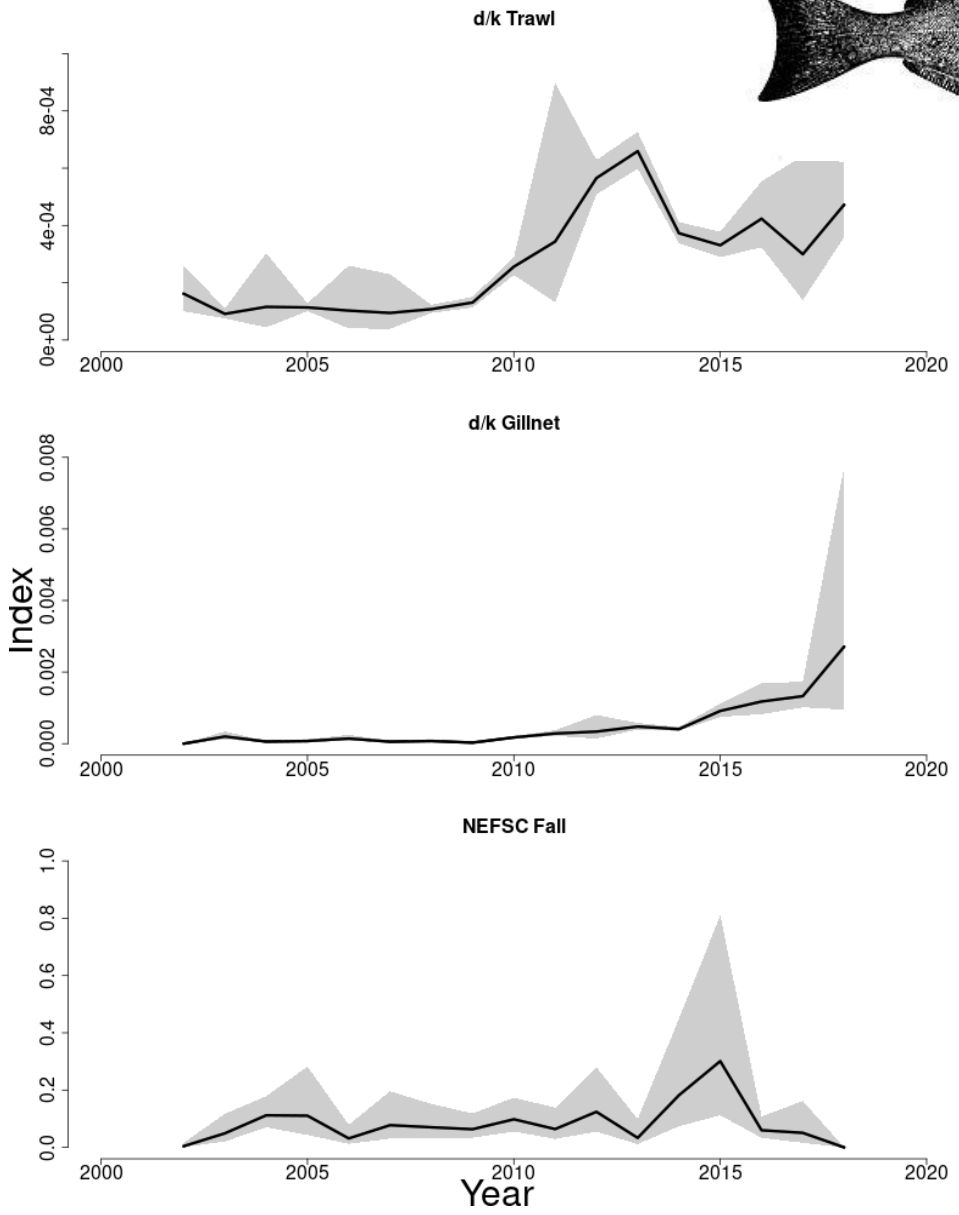
Halibut



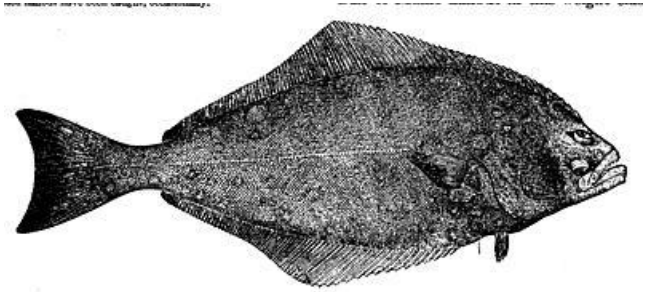

Catch Advice
0
50
100
150
2006
2008
2010
2012
2014
2016
2018
Year

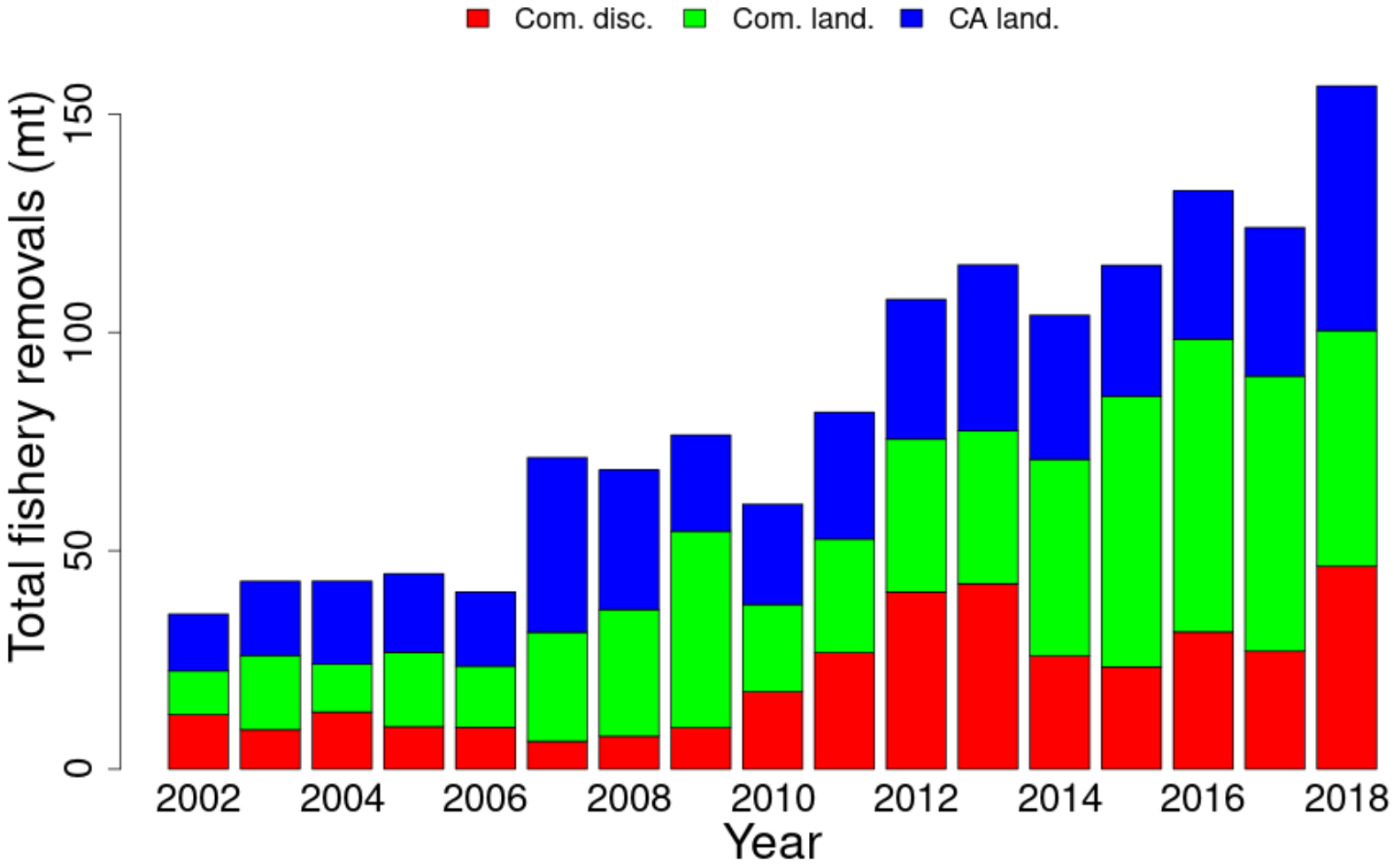
Halibut




d/k Trawl
0e+00
4e-04
8e-04
2000
2005
2010
2015
2020
d/k Gillnet
Index
0.000
0.002
0.004
0.006
0.008
2000
2005
2010
2015
2020
NEFSC Fall
0.0
0.2
0.4
0.6
0.8
1.0
2000
2005
2010
2015
2020
Year

Halibut

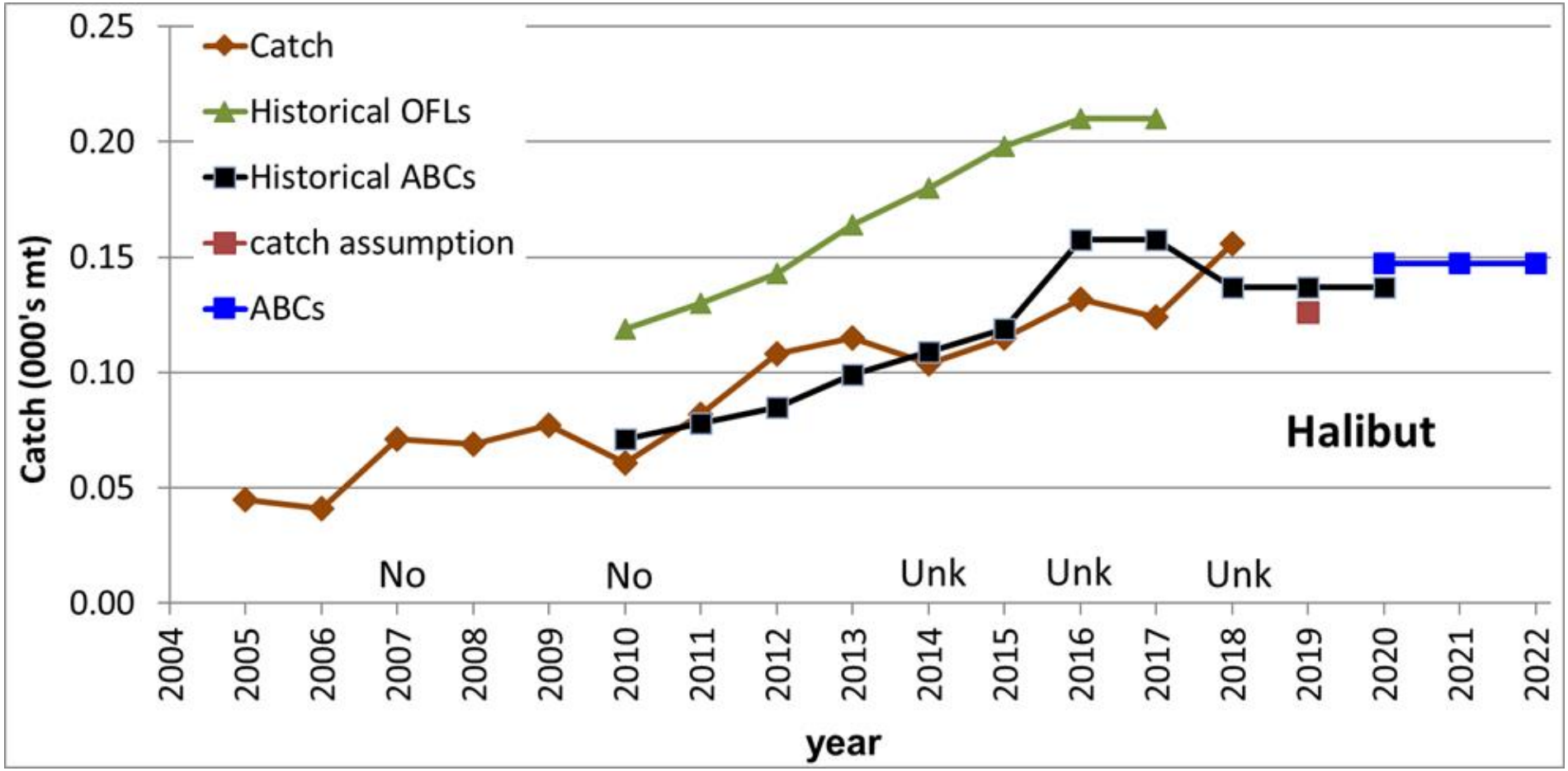



Com. disc.
Com. land.
CA land.
Total fishery removals (mt)
0
50
100
150
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year

Halibut

2018 catch (156.4 mt) X 0.94 = 147 mt

Halibut


0.25
0.20
0.15
0.10
0.05
0.00
Catch (000's mt)
Catch
Historical OFLs
Historical ABCs
catch assumption
ABCs
Halibut
No
No
Unk
Unk
Unk
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
year

Halibut

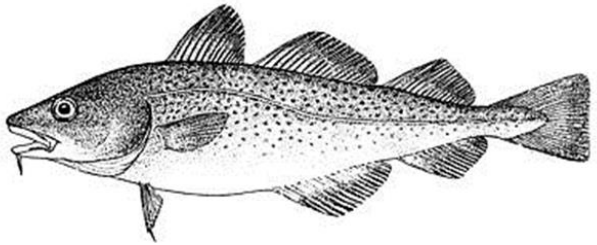
Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	ABC
2010	61	119	71			
2011	82	130	78			
2012	108	143	85			
2013	115	164	99			
2014	104	180	109			
2015	115	198	119			
2016	132	210	158			
2017	124	210	158			
2018	156	undefined	137			
2019		undefined	137	126		
2020		undefined	137		-	147
2021					-	147
2022					-	147

Halibut

Constant ABC

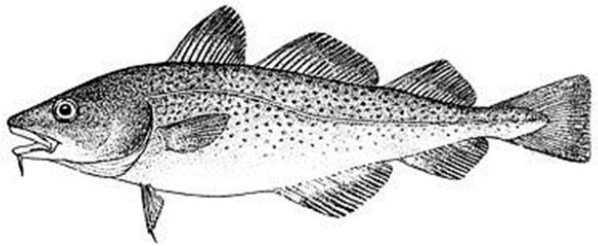
year	OFL	ABC
2020	unknown	147
2021	unknown	147
2022	unknown	147

Georges Bank Cod



MODEL	PlanBsmooth (Level 1)
STOCK STATUS	Overfished & Overfishing is Unknown
REBUILDING	2026 (no projection)
RETROSPECTIVE ADJUSTMENT	NA
UNCERTAINTIES	No analytical assessment, unstable catch advice from empirical approach
ASSESSMENT COMMENTS	Cause of the retrospective pattern that led to the analytical assessment of this stock not being accepted at the 2015 operational review.

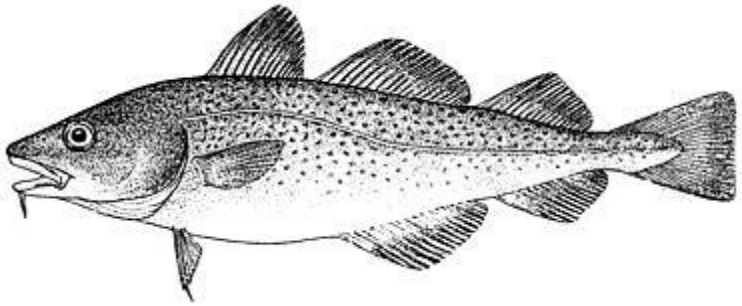
Georges Bank Cod



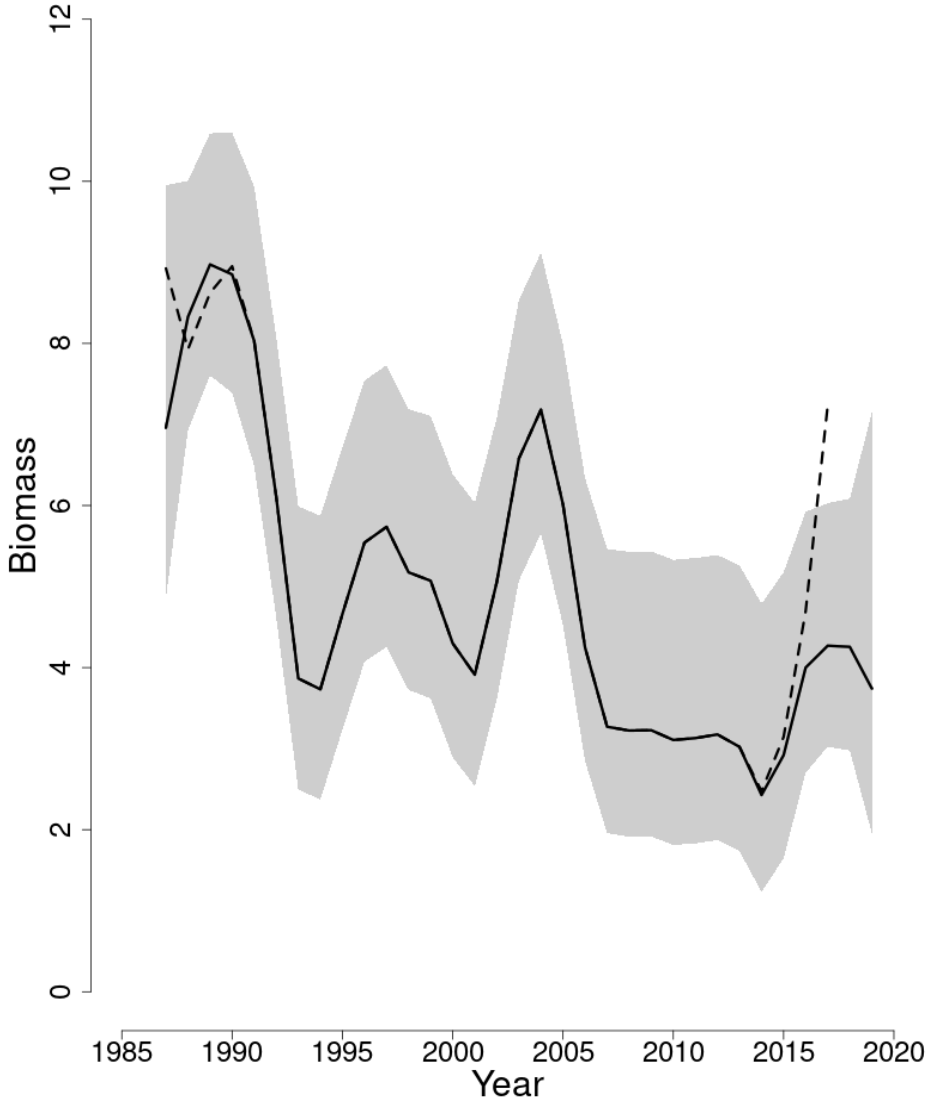
CHANGES	New MRIP time series is incorporated in the model.

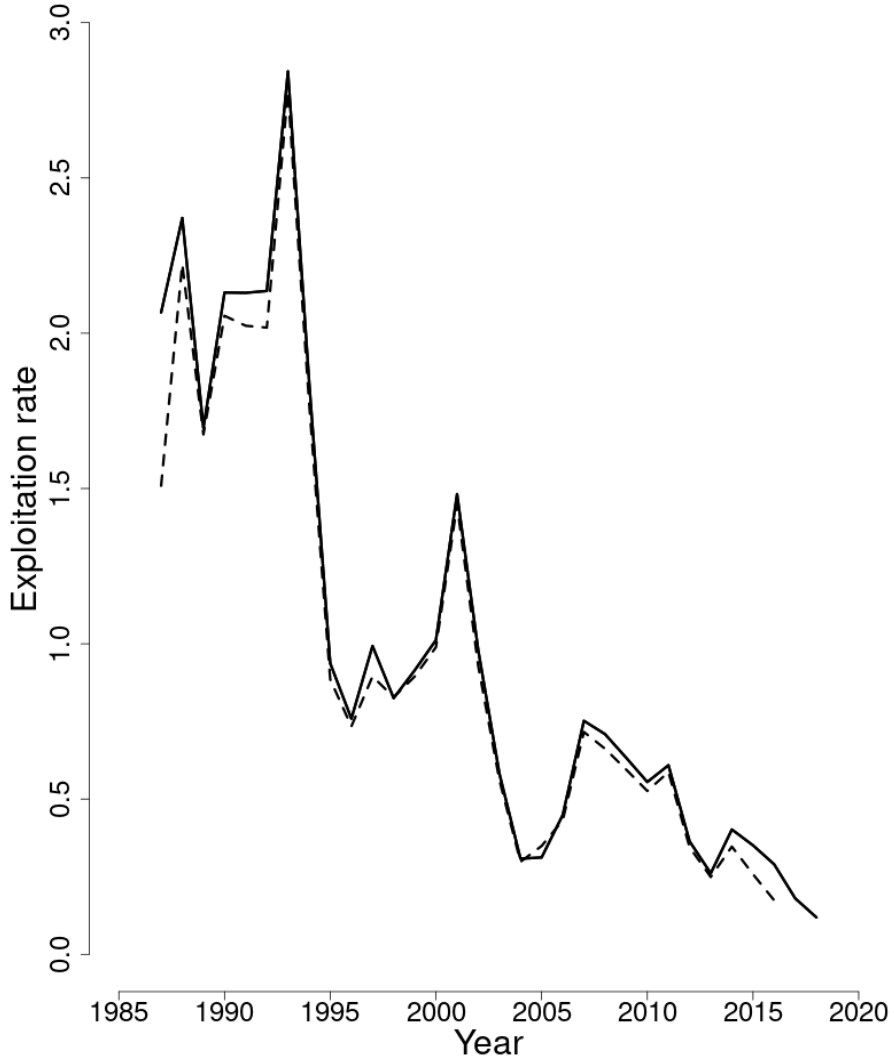
Georges Bank Cod

	2017	2019
F_{MSY} *proxy*	NA	NA
SSB_{MSY} (kg/tow)	NA	NA
MSY (mt)	NA	NA
Overfishing	Unknown	Unknown
Overfished	Yes	Yes

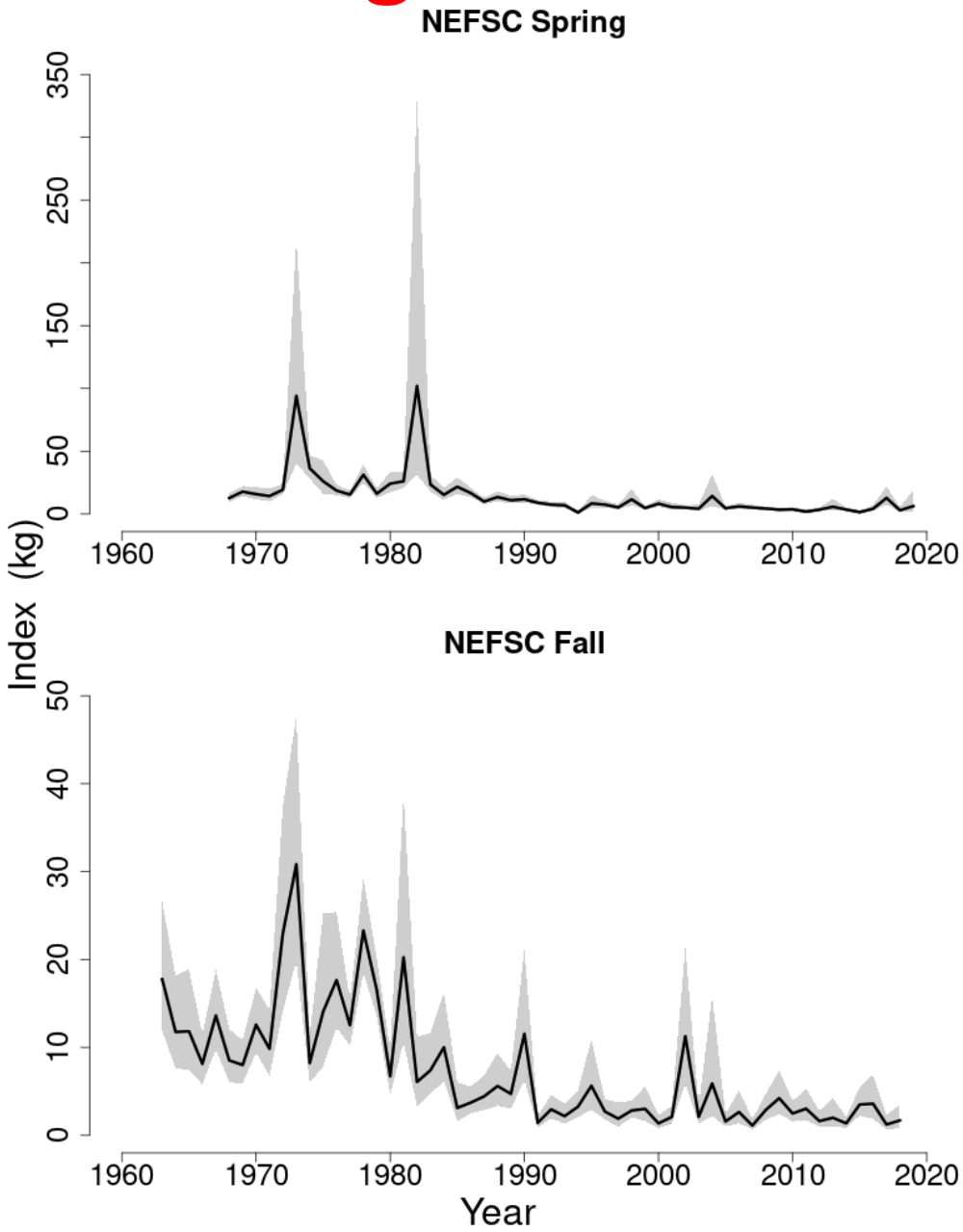


Georges Bank Cod



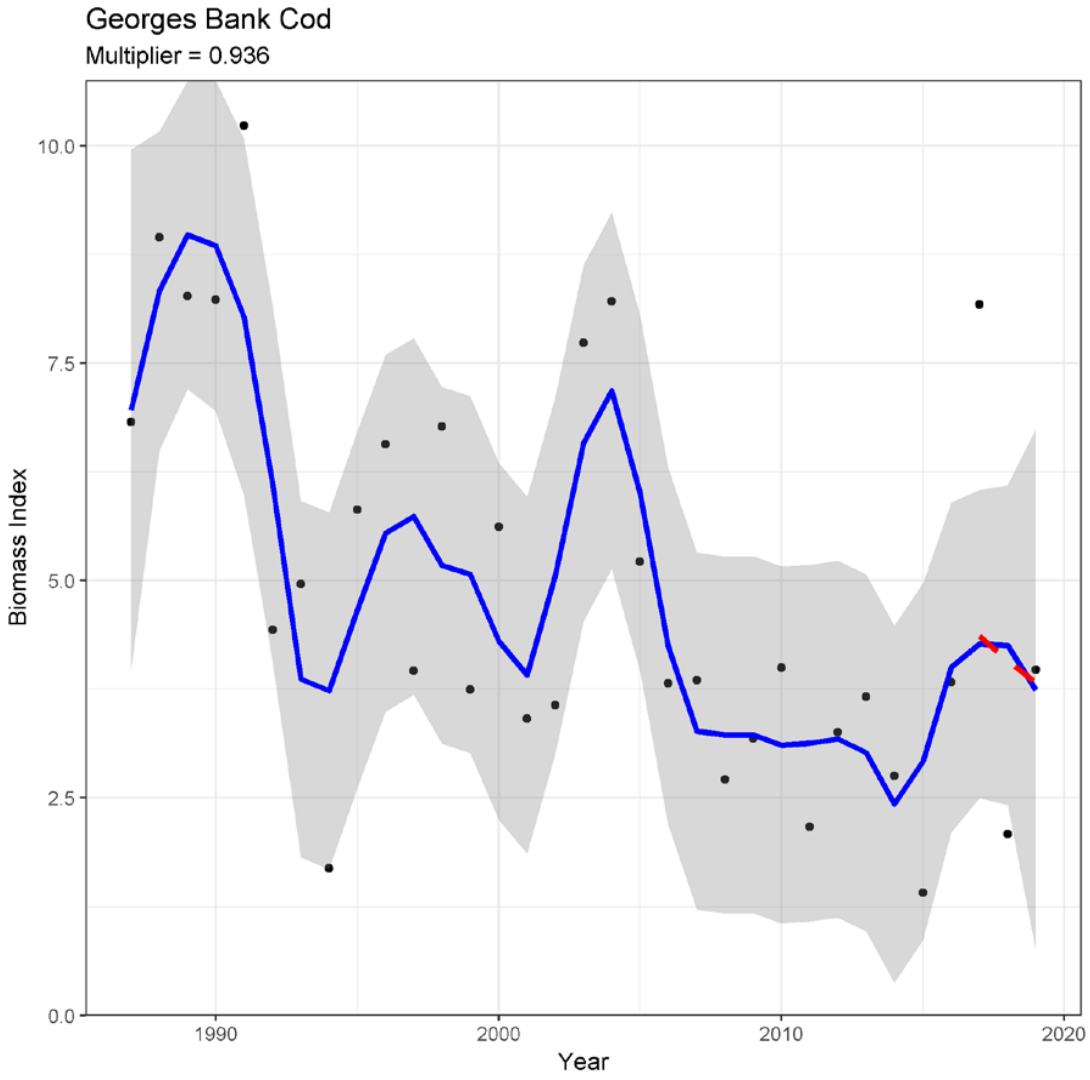


Georges Bank Cod

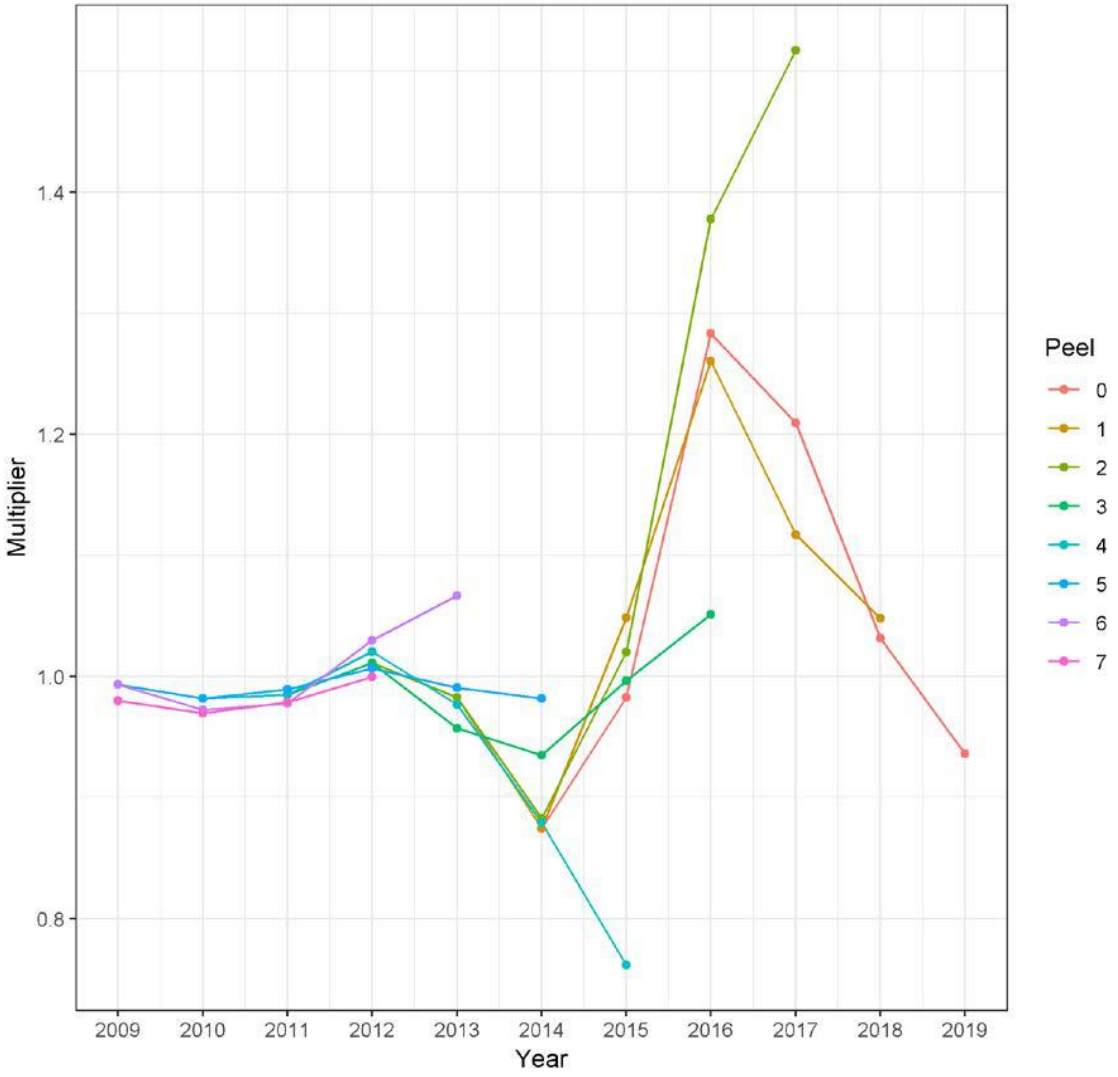


GB Cod PlanBsmooth Applied

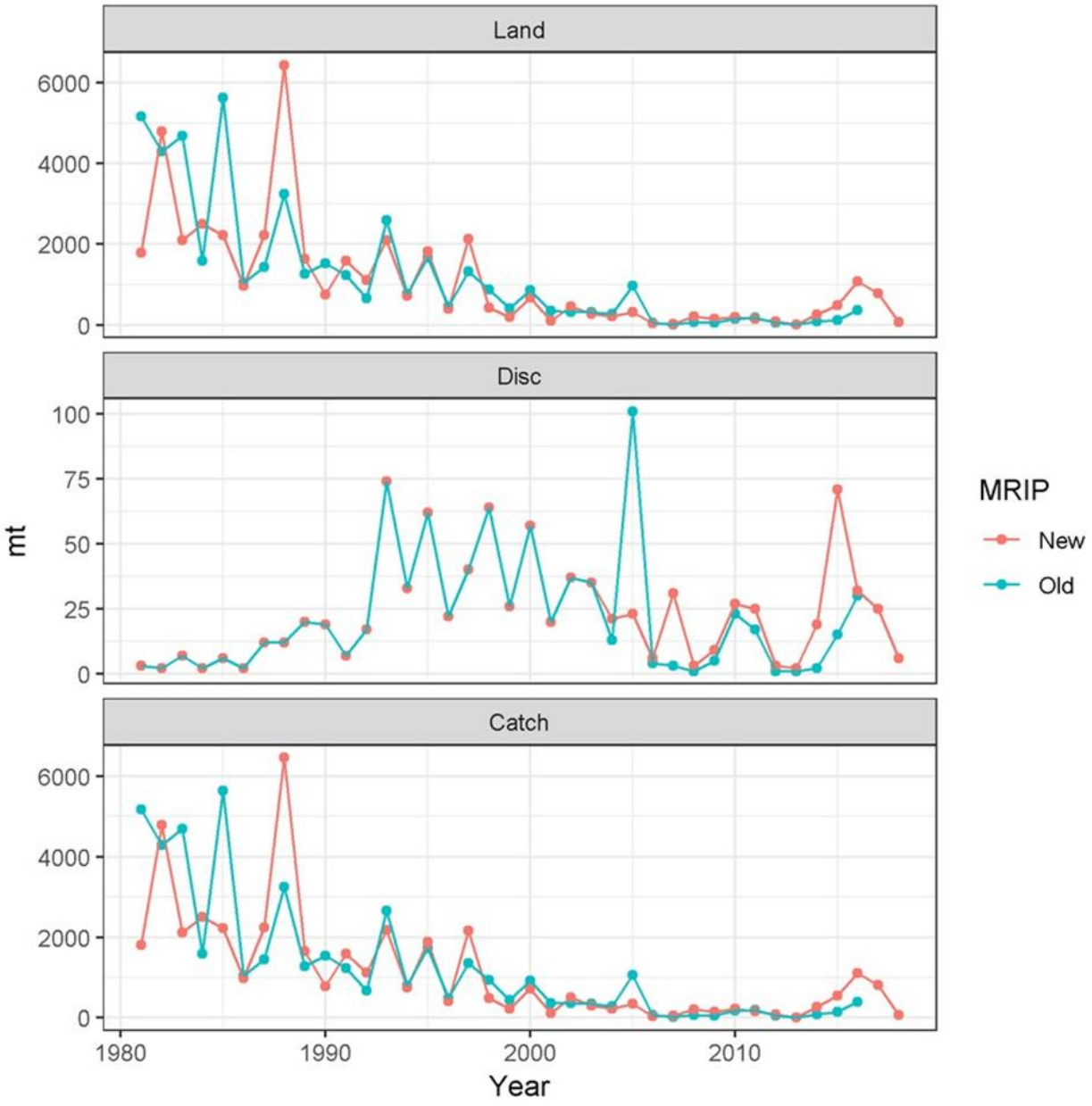
- Black dots = average survey biomass
- Blue line = loess smooth
- Grey area = 95% confidence interval for loess smooth
- Red dashed line = retransformed log-linear fit to recent 3 years of smoothed data



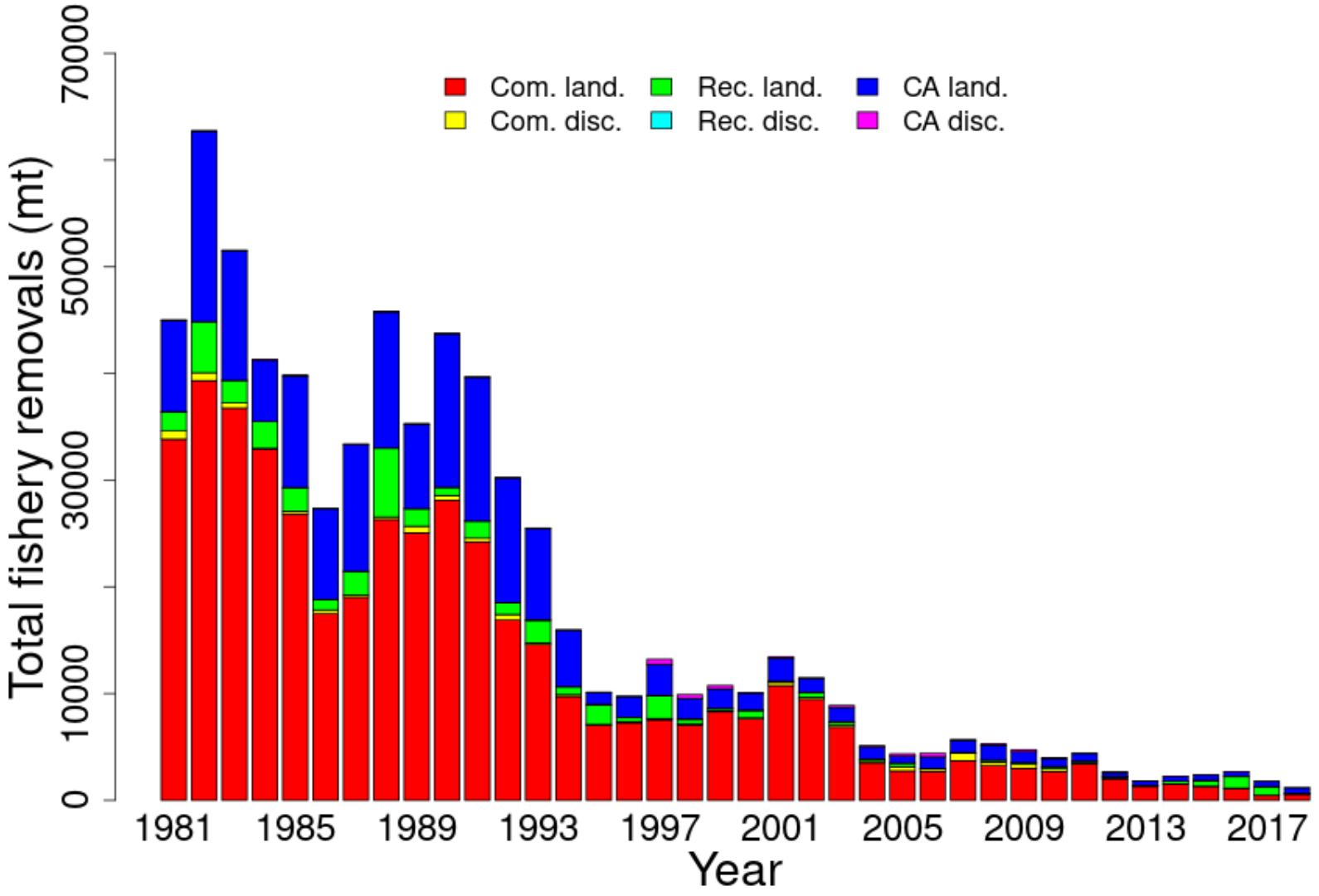
Retrospective analysis of the multiplier estimated in PlanBsmooth.



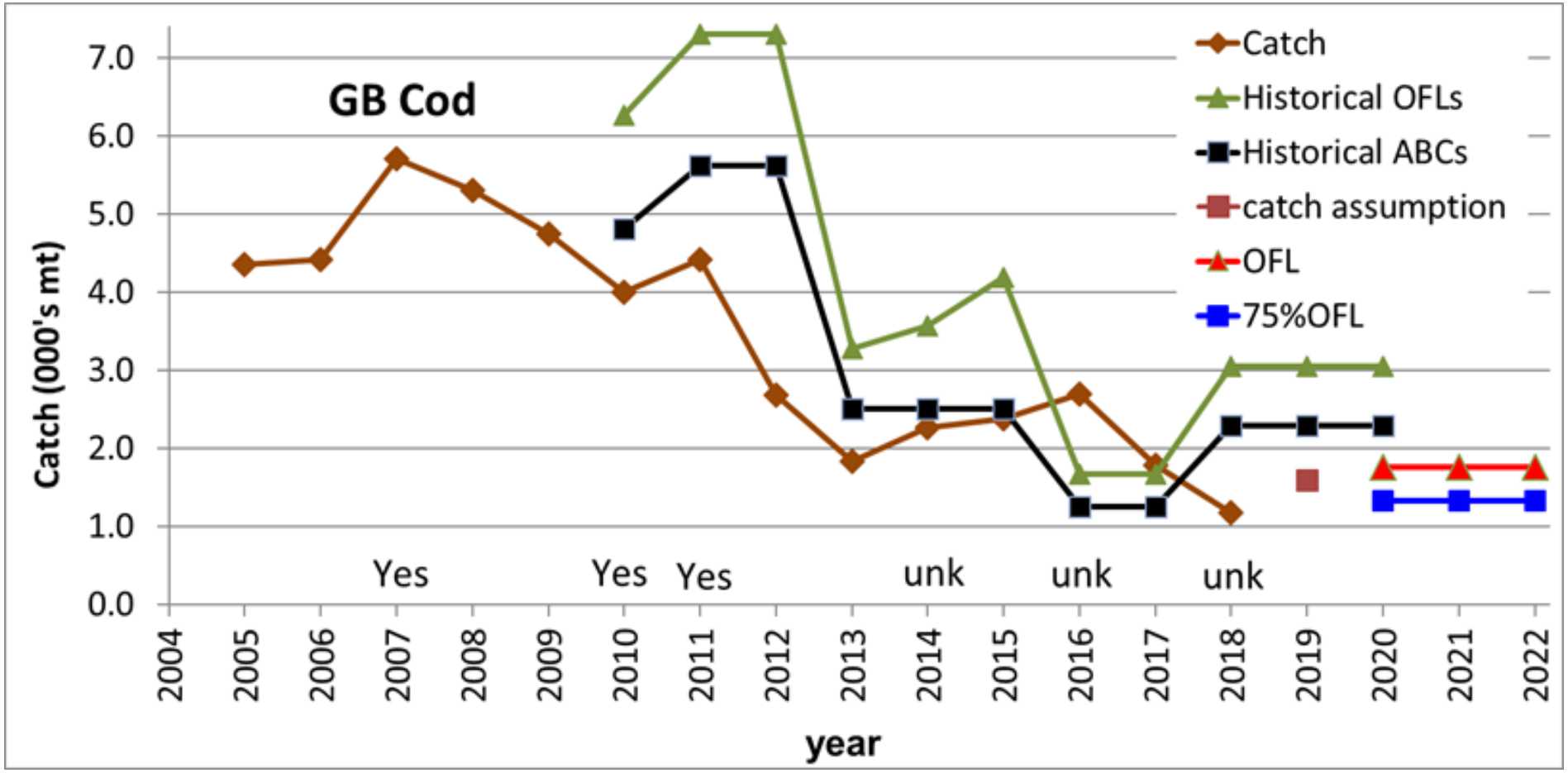
Georges Bank Cod



Georges Bank Cod



Georges Bank Cod



Georges Bank Cod

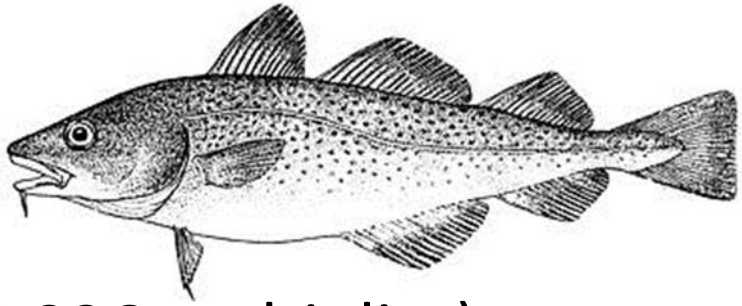
PlanBsmooth

Year	Catch (mt)	New MRIP Catch (mt)	
2014	2,081	2,267	
2015	1,962	2,380	
2016	1,982	2,690	2,690
2017			1,782
2018			1,176
average	2,008	2,446	1,883
multiplier	1.517	1.517	0.936
OFL	3,047	3,710	1,762

Georges Bank Cod

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$
2010	4,005	6,272	4,812			
2011	4,421	7,311	5,616			
2012	2,681	7,311	5,616			
2013	1,828	3,279	2,506			
2014	2,267	3,570	2,506			
2015	2,380	4,191	2,506			
2016	2,690	1,665	1,249			
2017	1,782	1,665	1,249			
2018	1,176	3,047	2,285			
2019		3,047	2,285	1,599		
2020		3,047	2,285		1,762	1,322
2021					1,762	1,322
2022					1,762	1,322

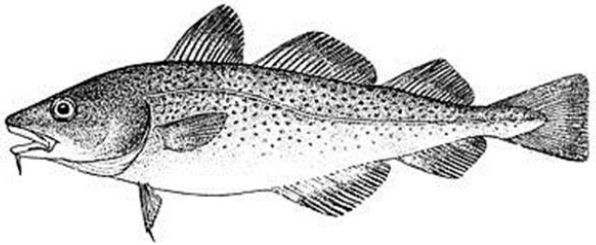
Georges Bank Cod



Recent survey trend (0.936 multiplier)
applied to 3 yr average catch.
Constant Three Years
OFL = 1,762 mt ABC = 75% of OFL

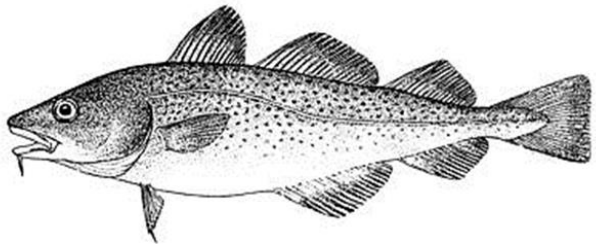
year	OFL	ABC
2020	1,762	1,322
2021	1,762	1,322
2022	1,762	1,322

Gulf of Maine Cod



MODEL	ASAP (Level 3)
STOCK STATUS	Overfished & Overfishing is occurring
REBUILDING	2024 (cannot rebuild when F=0)
RETROSPECTIVE ADJUSTMENT	No? (M=0.2 model has a retrospective pattern)
UNCERTAINTIES	Recent commercial landings may have been underestimated, low recent recruitment compromises rebuilding potential.
REVIEWER COMMENTS	An important source of uncertainty with this stock is the estimate of natural mortality. Other areas of uncertainty include the retrospective error in the M=0.2 model, stock structure, and the accuracy of fishery catch data.

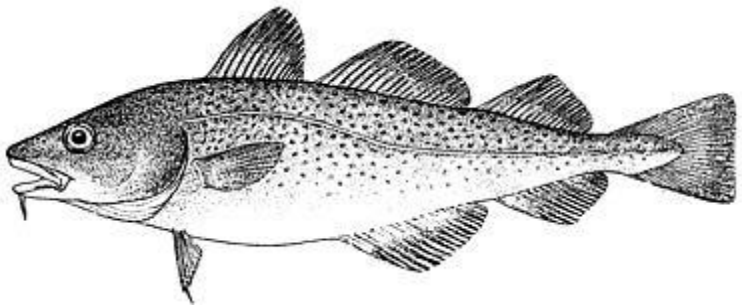
Gulf of Maine Cod



CHANGES	New MRIP time series is incorporated in the model.

Gulf of Maine Cod

	2017 M=0.2	2017 M-ramp	M=0.2	M-ramp
F_{MSY}	0.174	0.177	0.173	0.175
SSB_{MSY} (mt)	40,604 (27,631 - 58,553)	59,714 (44,732 - 77,611)	42,692 (27,916 - 62,785)	63,867 (46,144 - 84,098)
MSY (mt)	7,049 (4,699 - 10,380)	10,502 (7,734 - 13,822)	7,580 (4,853 - 11,366)	11,420 (8,149 - 15,268)
Median recruits age-1) (000s)	4,377 (1,161 - 14,434)	8,464 (2,353 - 15,934)	4,677 (1,064 - 16,392)	9,249 (2,129 - 18,031)
Overfishing	Yes	Yes	Yes	Yes
Overfished	Yes	Yes	Yes	Yes



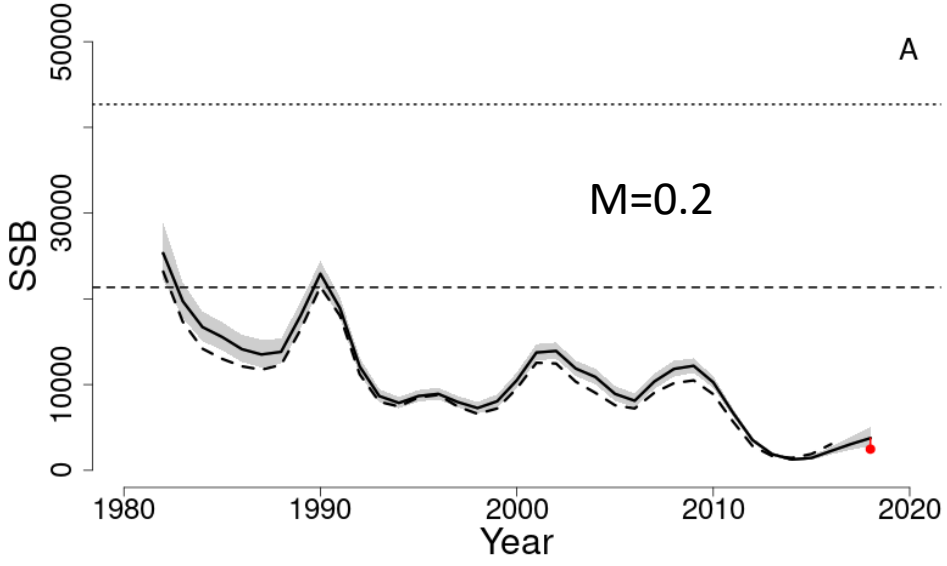
Gulf of Maine Cod

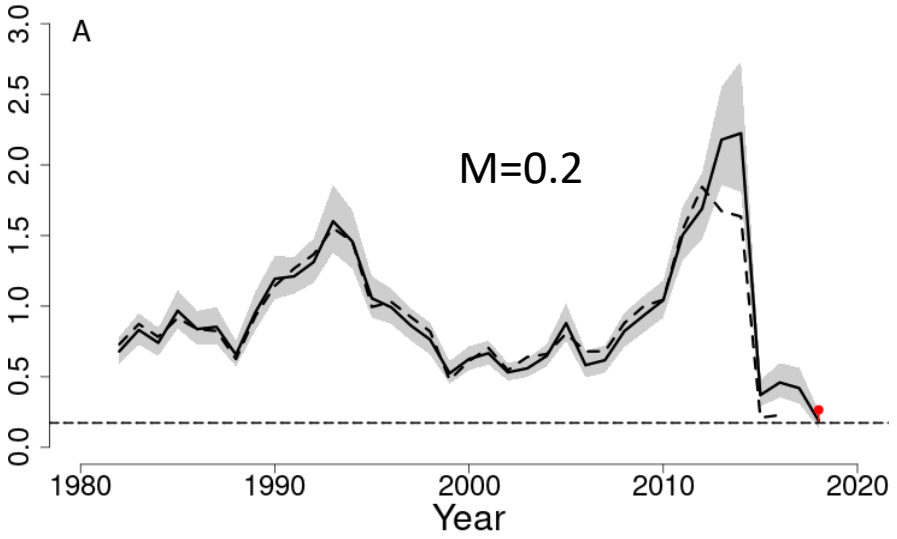
Harvest strategy	Year	Input	M=0.2 model					
			No retro adjustment			Retrospective adjustment		
			Catch (mt)	Spawning stock biomass (mt)	F_{full}	Catch (mt)	Spawning stock biomass (mt)	F_{full}
F_{MSY}	2018	Model result	753	3,752	0.188	753	3,752	0.188
	2019	Assumed catch	710	4,732	0.144	710	3,074	0.225
	2020	Projection	1,102	6,276	0.173	689	3,947	0.173
	2021	Projection	1,440	8,064	0.173	912	5,127	0.173
	2022	Projection	1,813	10,673	0.173	1.160	6,828	0.173
75% F_{MSY}	2018	Model result	753	3,752	0.188	753	3,752	0.188
	2019	Assumed catch	710	4,732	0.144	710	3,074	0.225
	2020	Projection	843	6,327	0.13	526	3,979	0.13
	2021	Projection	1.134	8,355	0.13	718	5,309	0.13
	2022	Projection	1,461	11,298	0.13	935	7,288	0.13

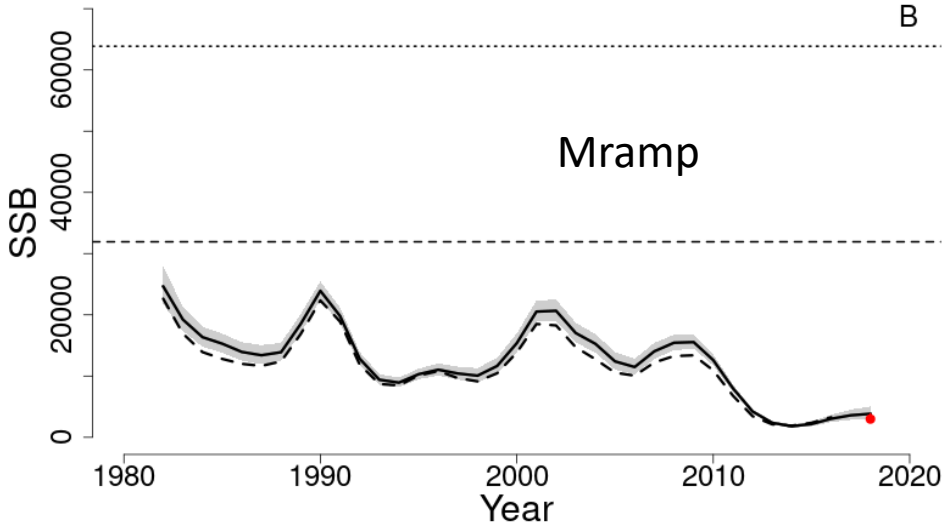
Gulf of Maine Cod

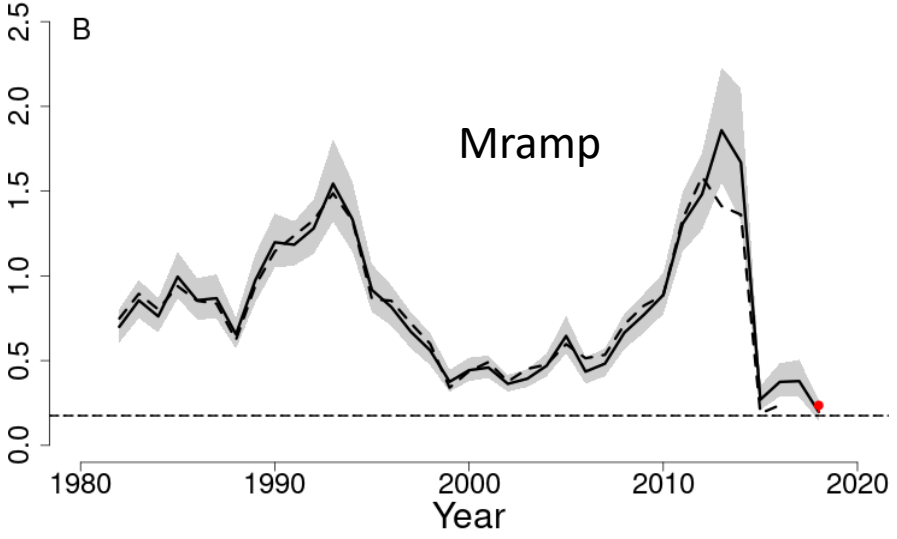
Harvest strategy	Year	Input	M-ramp model: M=0.2 (M decreases to 0.2) Catch (mt)	Spawning stock biomass (mt)	F_{full}	M=0.4 (M remains at 0.4) Catch (mt)	Spawning stock biomass (mt)	F_{full}
F_{MSY}	2018	Model result	753	3,838	0.198	753	3,838	0.198
	2019	Assumed catch	710	4,326	0.171	710	4,103	0.189
	2020	Projection	1,027	6,112	0.175	758	4,719	0.175
	2021	Projection	1,469	8,547	0.175	893	5,461	0.175
	2022	Projection	1,995	11,927	0.175	1,010	6,415	0.175
F_{MSY} 75%	2018	Model result	753	3,838	0.198	753	3,838	0.198
	2019	Assumed catch	710	4,326	0.166	710	4,103	0.183
	2020	Projection	782	6,159	0.131	577	4,756	0.131
	2021	Projection	1,150	8,822	0.131	698	5,637	0.131
	2022	Projection	1,596	12,548	0.131	807	6,738	0.131

Gulf of Maine Cod

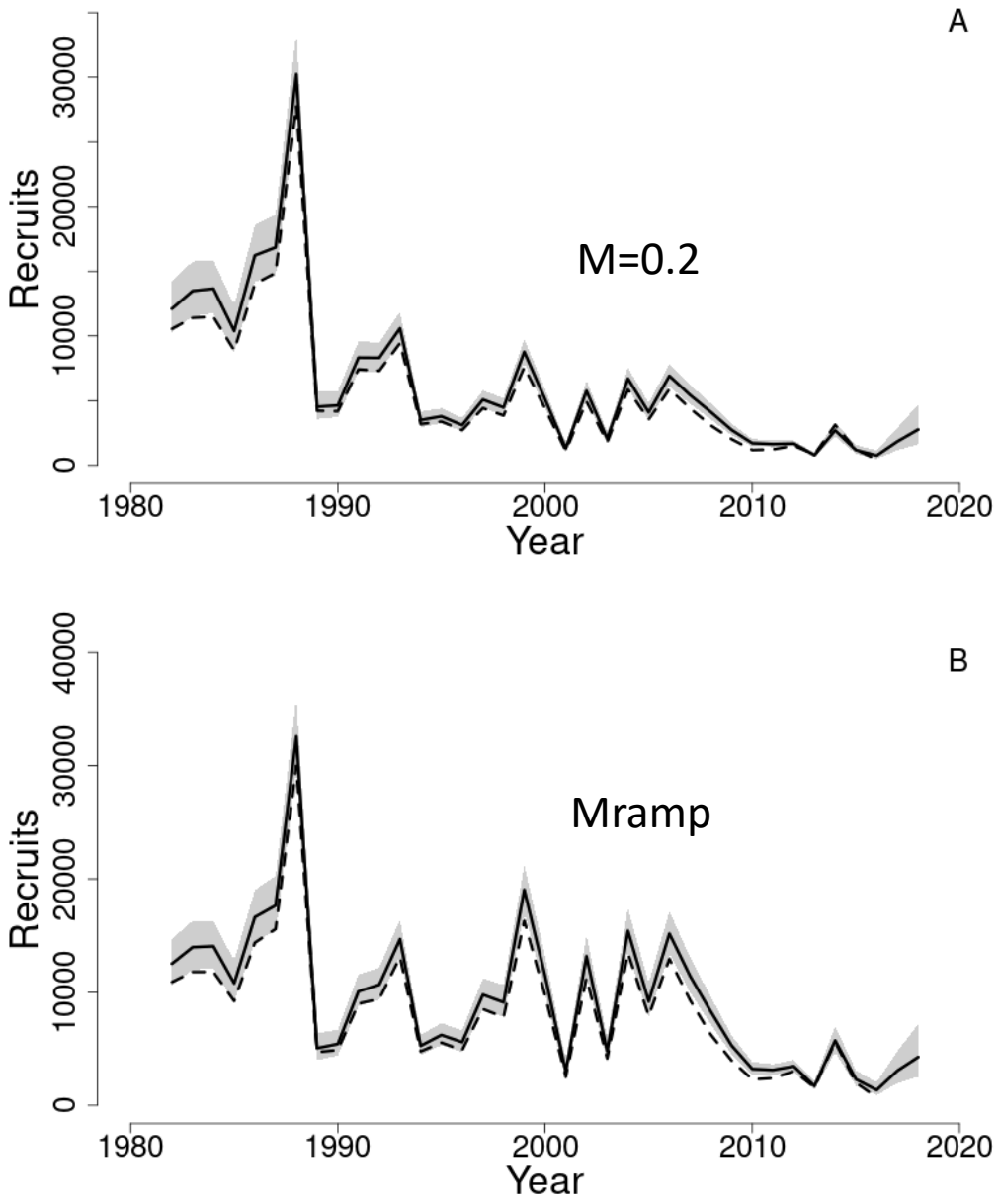




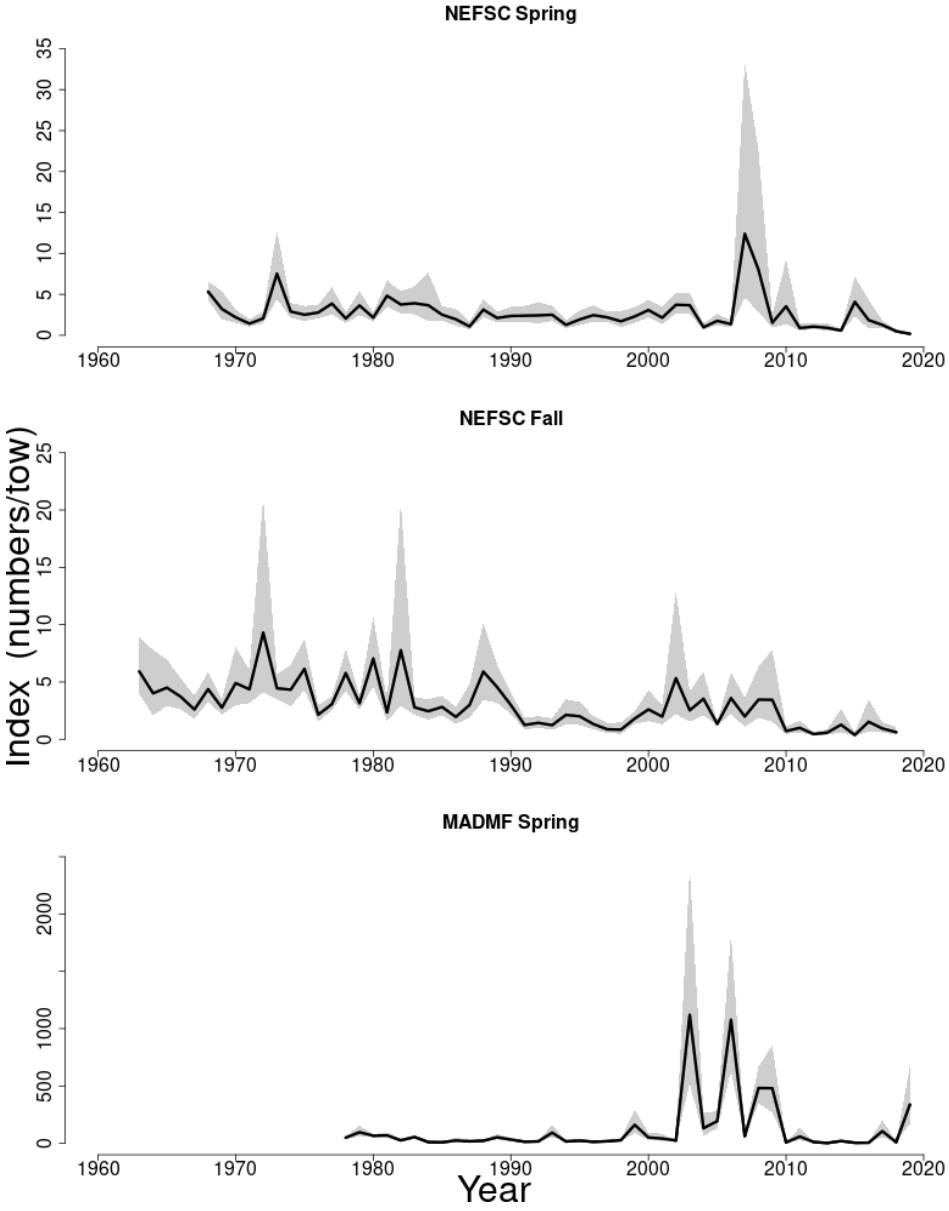




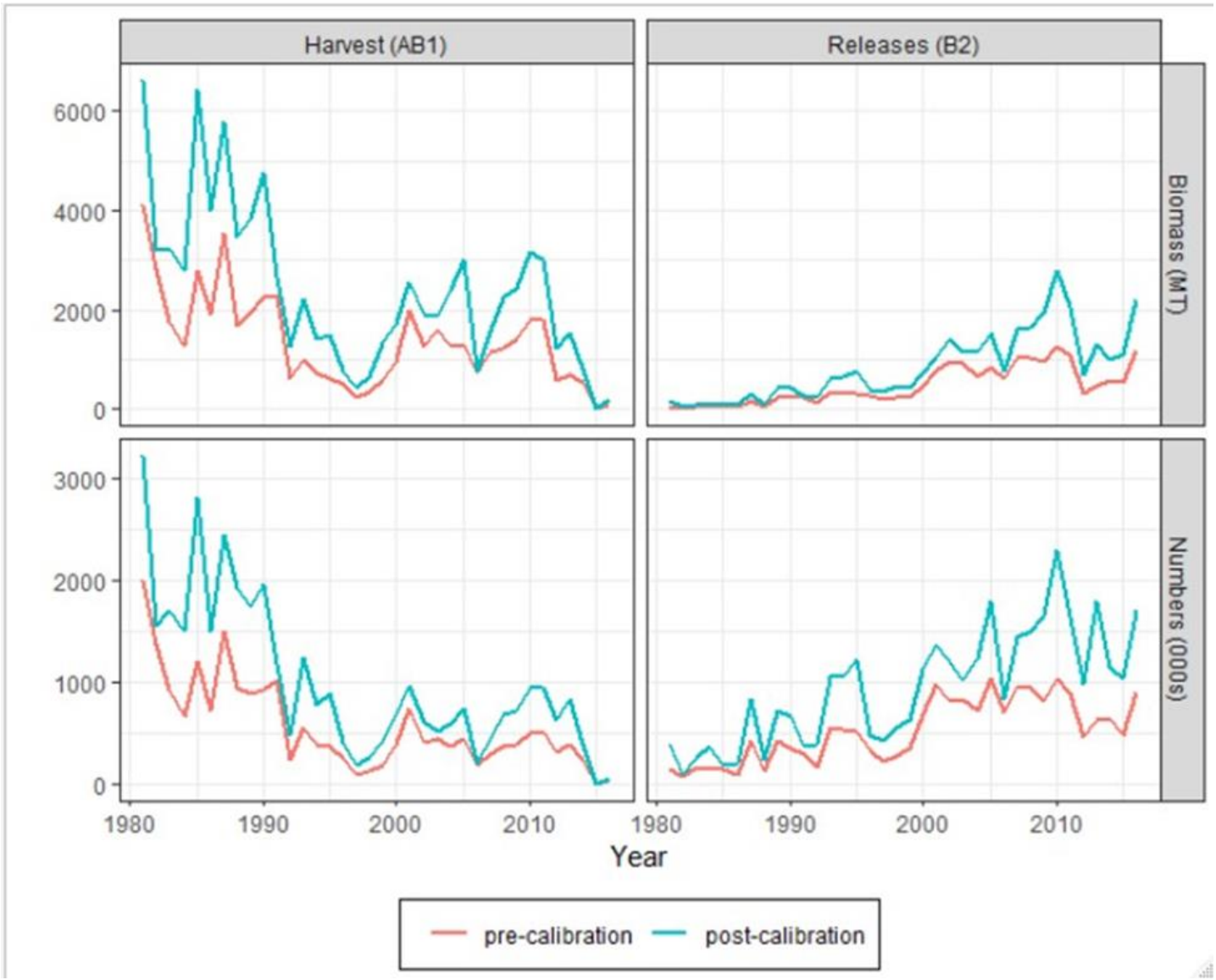
Gulf of Maine Cod



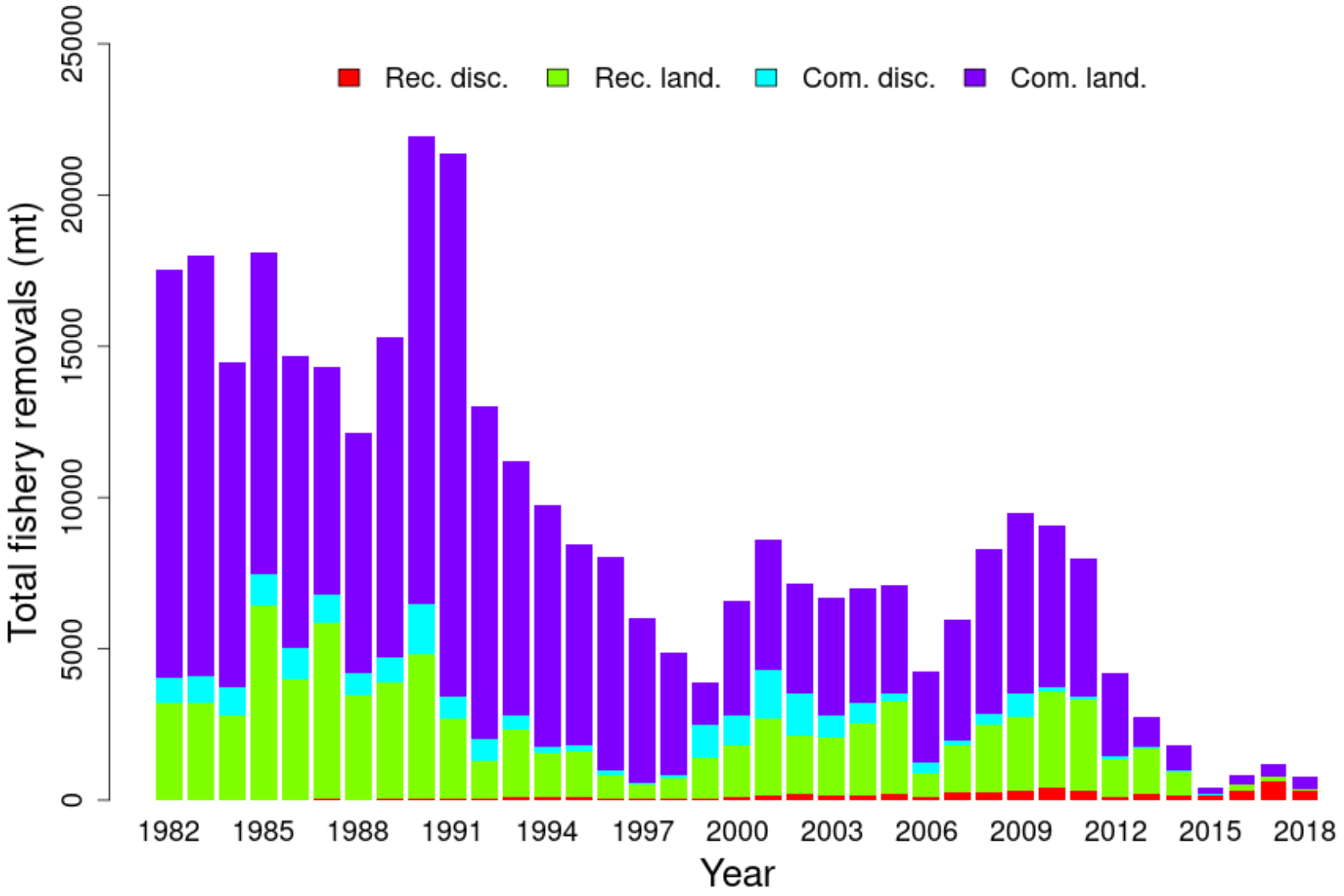
Gulf of Maine Cod



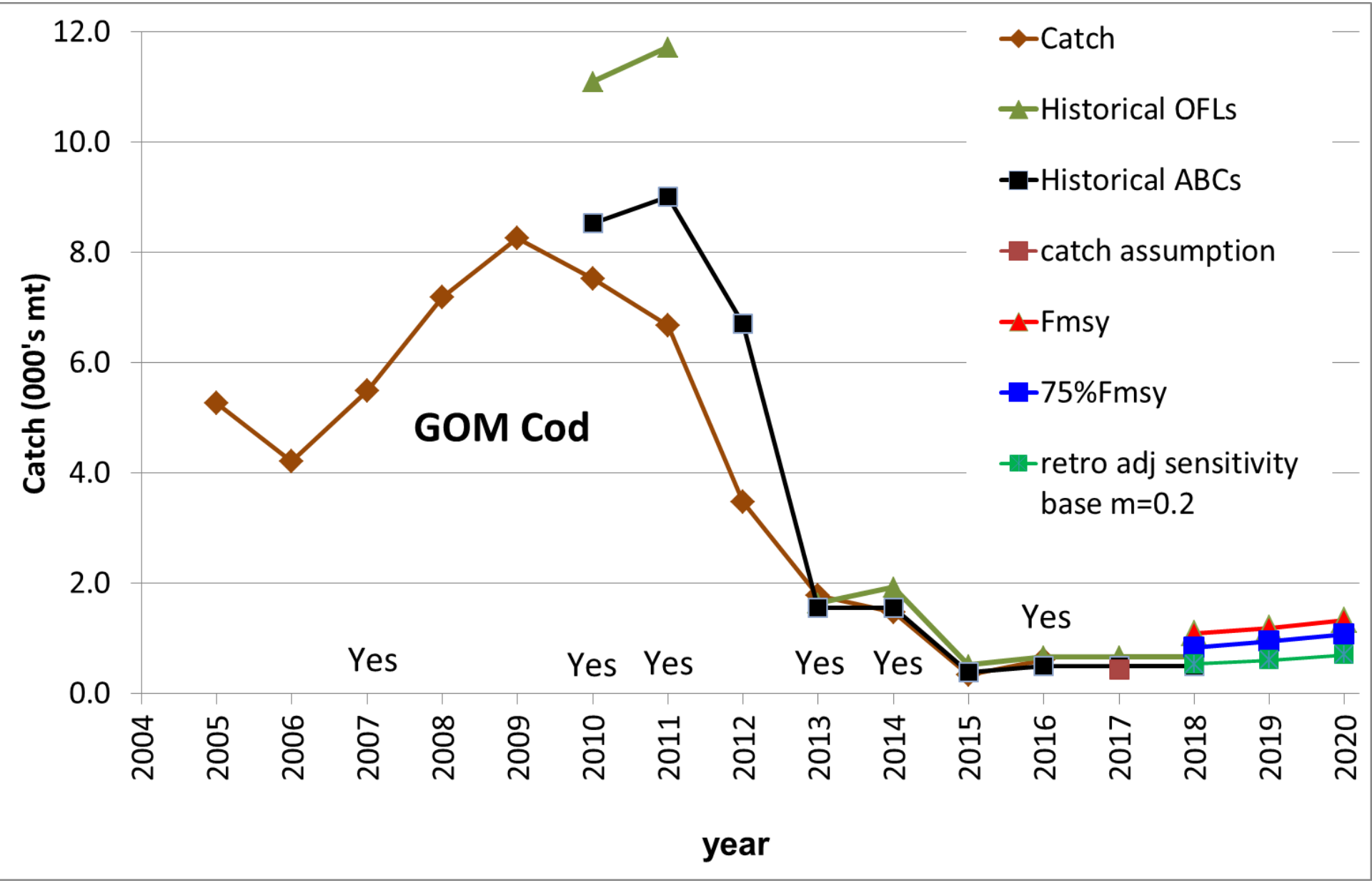
Gulf of Maine Cod



Gulf of Maine Cod



Gulf of Maine Cod



Gulf of Maine Cod

Option C: Basing ABC on bycatch estimate

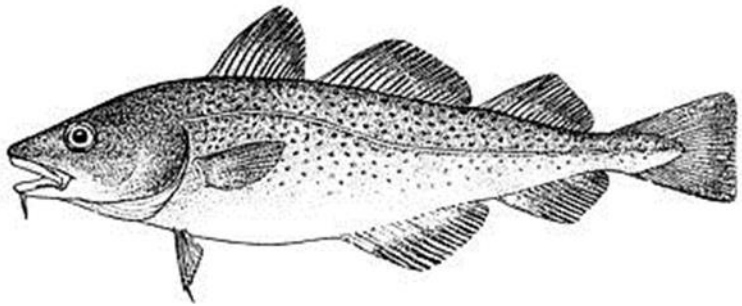
	FY2016 (mt)			FY2017 (mt)			FY2018 (mt)			
	Total Discards	Other landings	2016 Total	Total Discards	Other landings	2017 Total	Total Discards	Other landings	2018 Total	Average of totals
Total	347.8	5.7	353.5	635.6	22.7	658.3	335.8	3.7	339.5	450.4
Commercial	*13.8*	-	-	*25.6*	-	-	*9.8*	-	-	-
Recreational[1]	*334*	-	-	*610*	-	-	*326*	-	-	-

Gulf of Maine Cod

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	M=0.2 F_{MSY}	M=0.2 75%F_{MSY}	*M=0.2 Rho adj 75%F_{MSY}*	Mramp M=0.2 F_{MSY}	Mramp M=0.2 75%F_{MSY}	Mramp M=0.4 F_{MSY}	Mramp M=0.4 75%F_{MSY}
2010	9,100	11,089	8,530								
2011	8,007	11,715	9,012								
2012	4,204		6,700								
2013	2,723	1,635	1,550								
2014	1,806	1,917	1,550								
2015	420	514	386								
2016	850	667	500								
2017	1,171	667	500								
2018	753	938	703								
2019		938	703	710							
2020		938	703		1,102	843	526	*1,027*	*782*	758	577
2021					1,440	1,134	718	*1,469*	*1,150*	893	698
2022					1,813	1,461	935	*1,995*	*1,596*	1,010	807

Candidate ABCs from projections

Gulf of Maine Cod

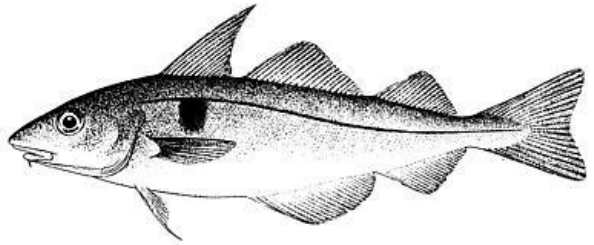


OFL = Average? ABC = Average?

Projections and/or Option C?

year	OFL	ABC
2020	?	?
2021	?	?
2022	?	?

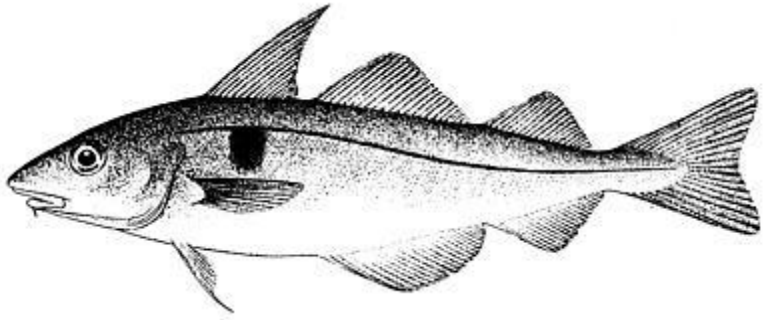
Georges Bank Haddock



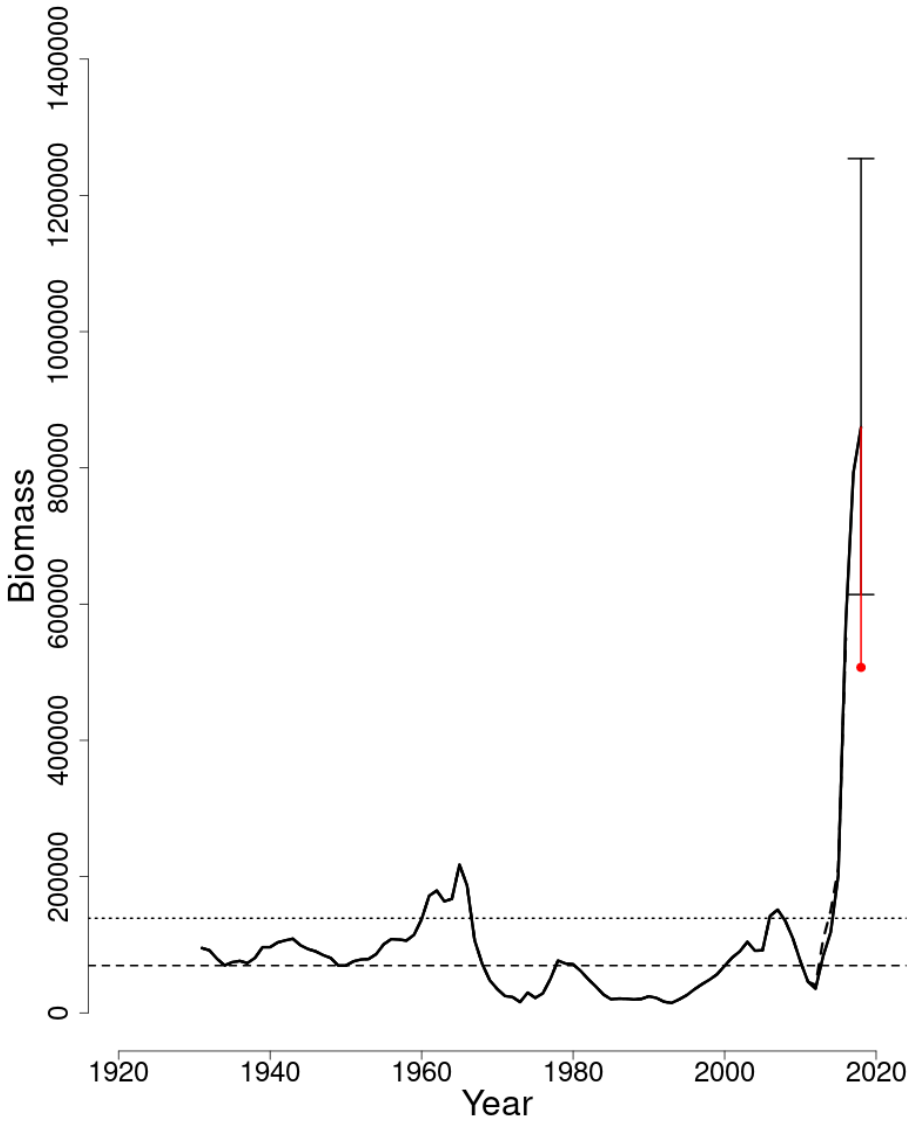
MODEL	VPA (Level 2)
STOCK STATUS	Not Overfished & Overfishing is not occurring
REBUILDING	Rebuilt
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Retrospective bias, uncertainty with 2013 year class estimate, slower growth with large year classes and selectivity implications
REVIEWER COMMENTS	The largest sources of uncertainty for this stock include the retrospective bias and assumptions in the projections about weights and selectivity at age. Short term projections make adjustments for year class effects. Stock structure assessment implications for the TRAC stock subset assessment verses the whole bank assessment.

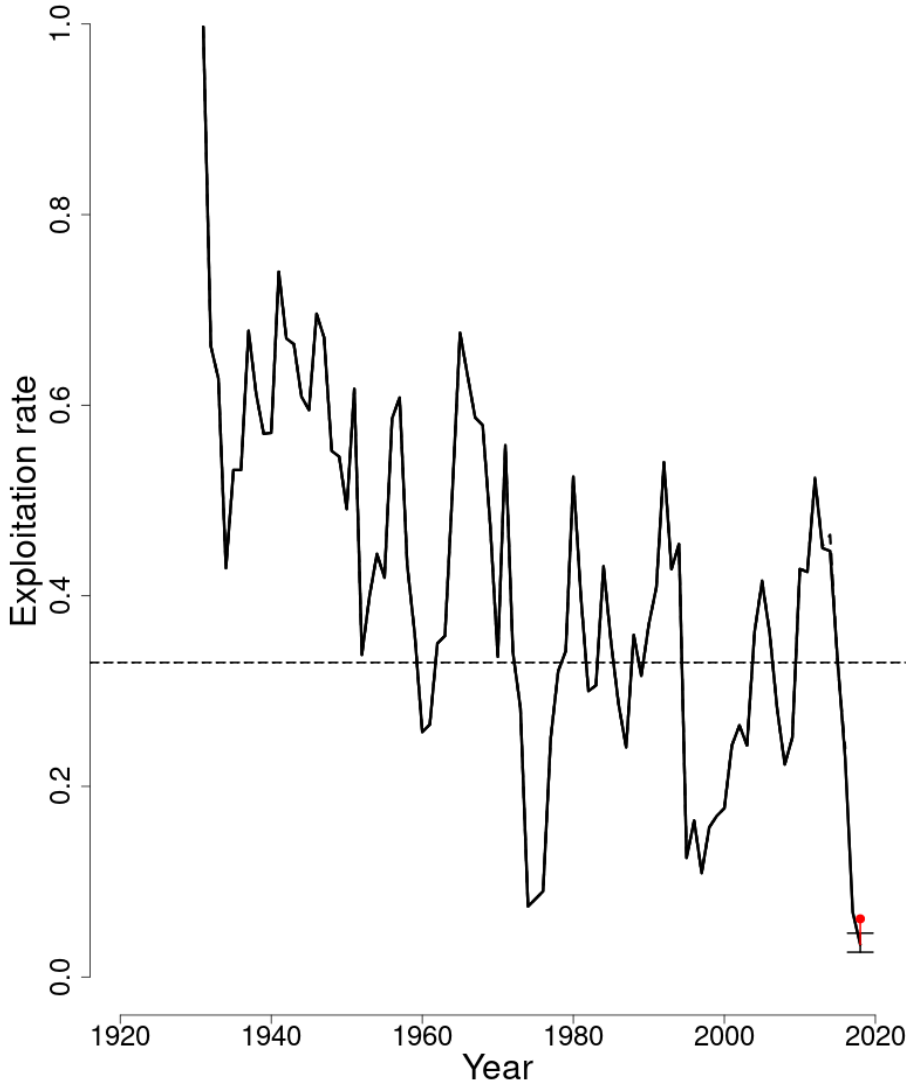
Georges Bank Haddock

	2017	2019
F_{MSY} *proxy*	0.41	0.33
SSB_{MSY} (mt)	104,312	138,924 (67,347 - 511,852)
MSY (mt)	24,400	30,489 (14,894 - 111,258)
Median recruits (age 1) (000s)	52,249	59,143 (2,780 - 394,017)
Overfishing	No	No
Overfished	No	No

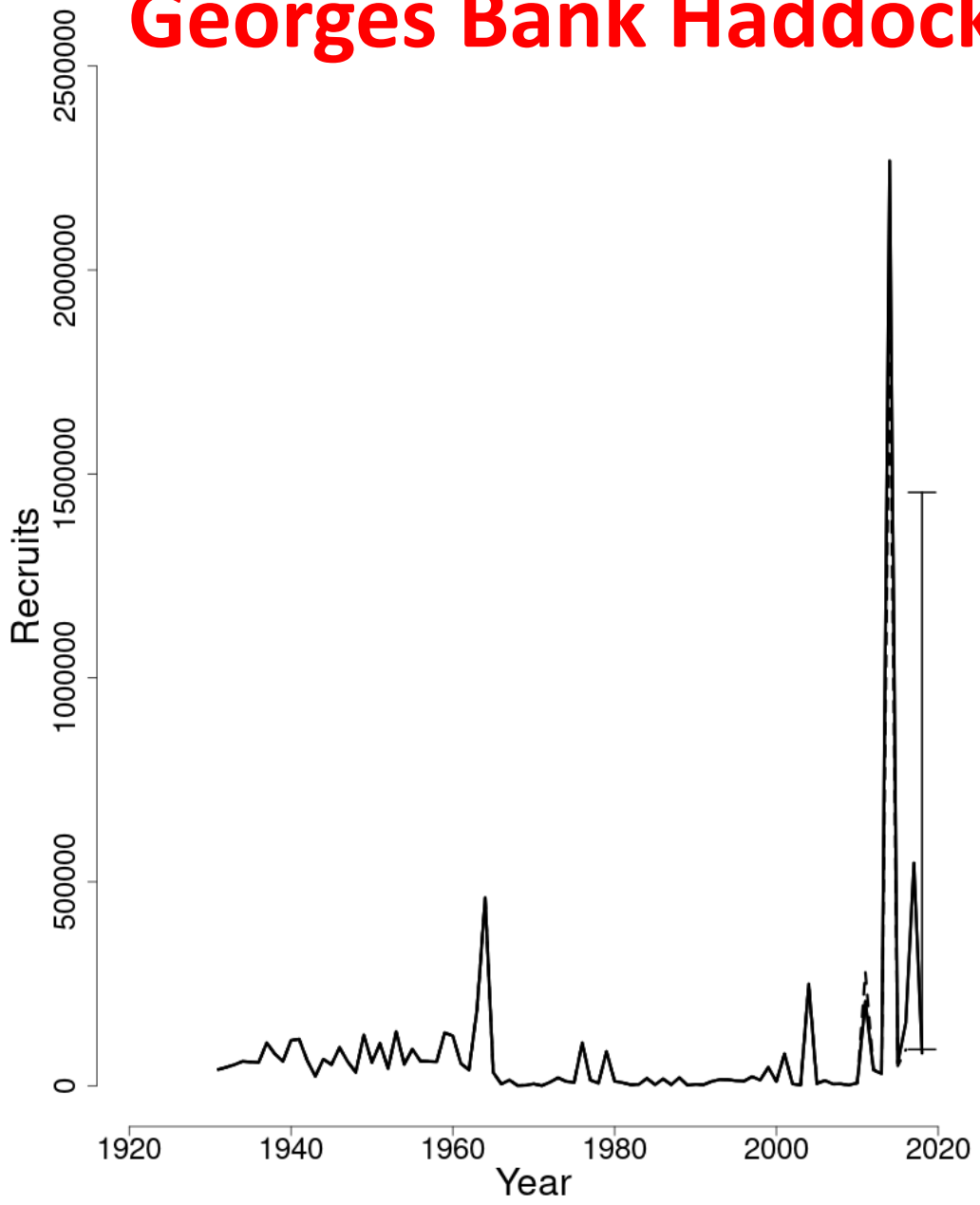


Georges Bank Haddock

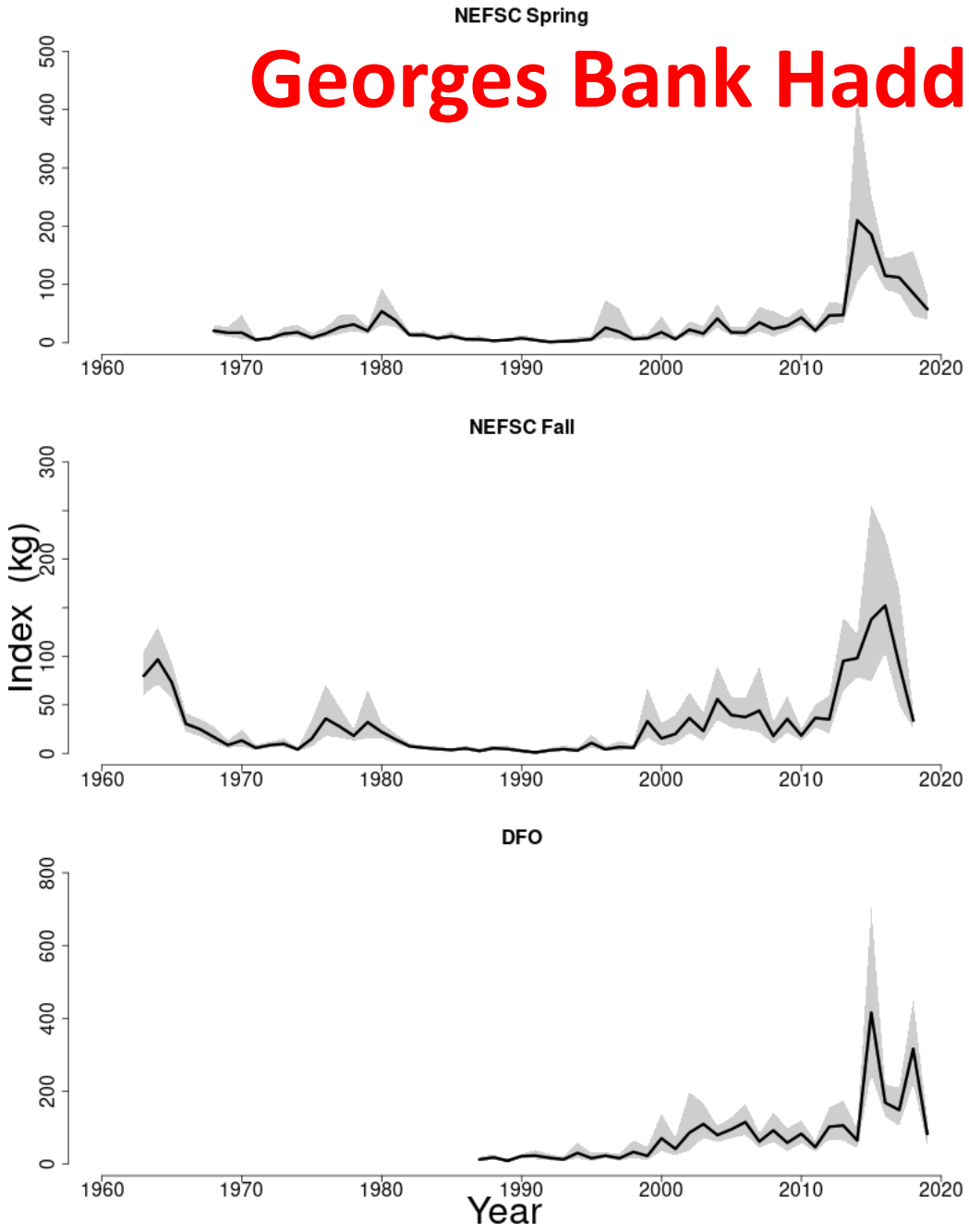




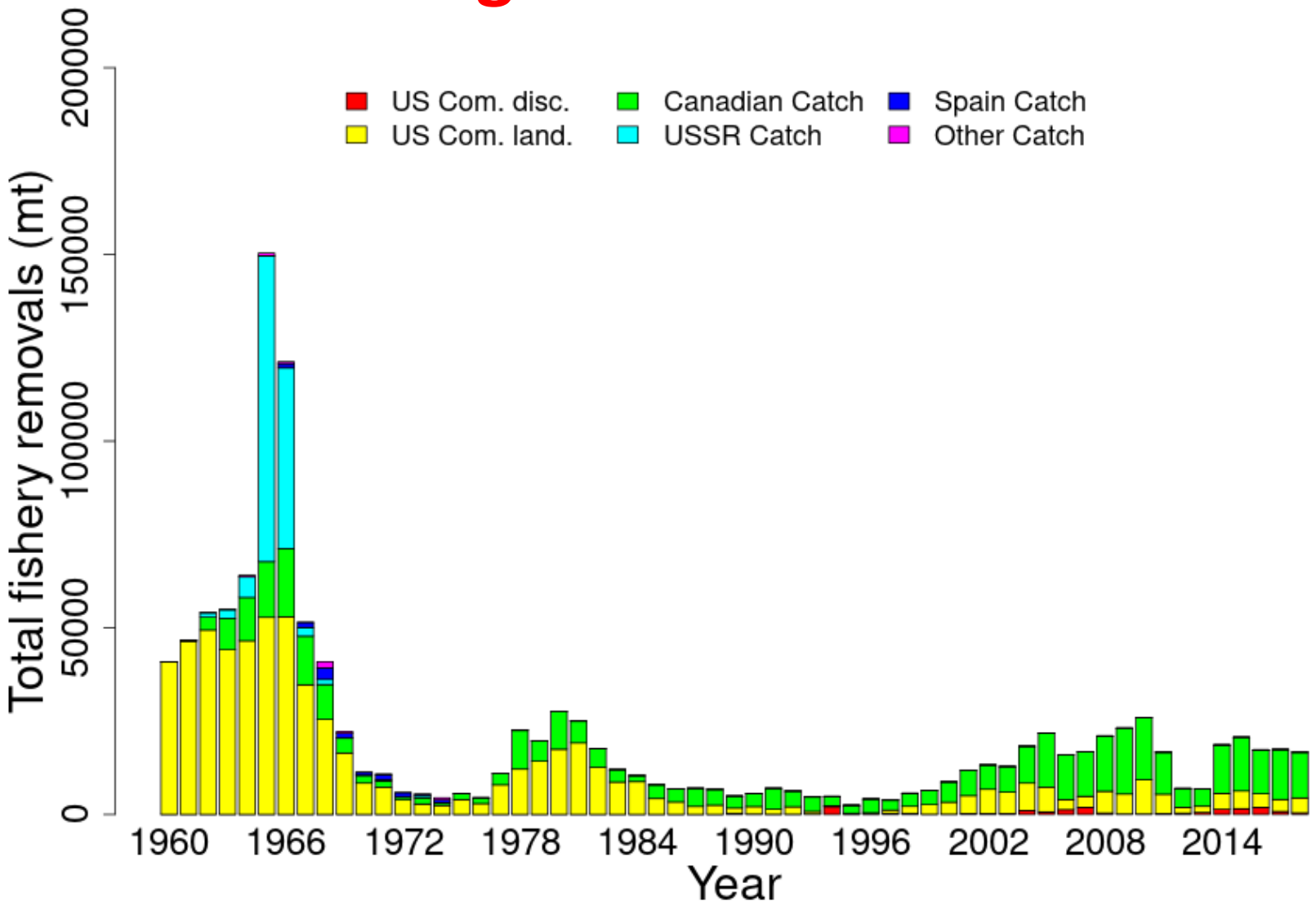
Georges Bank Haddock



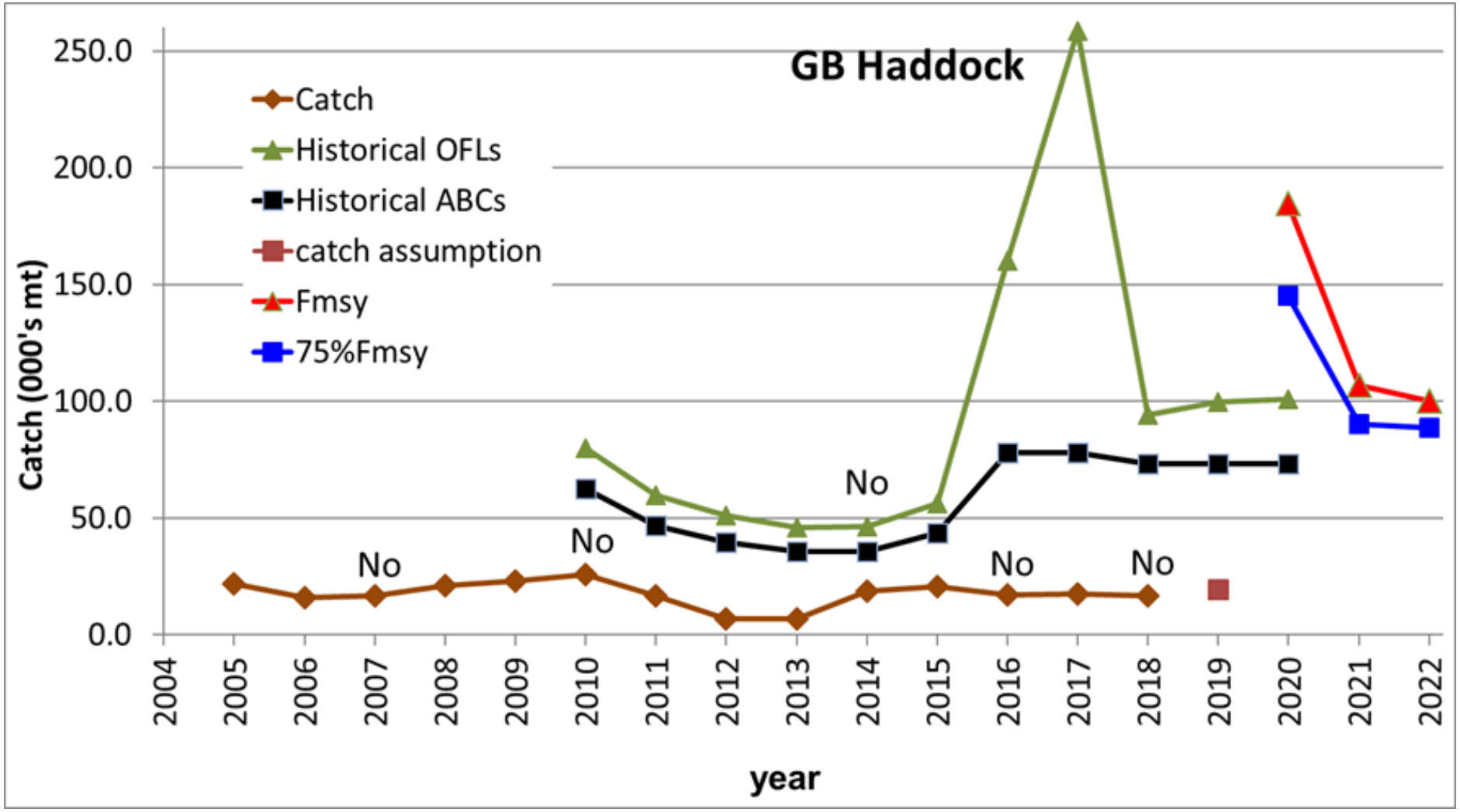
Georges Bank Haddock



Georges Bank Haddock



Georges Bank Haddock



Georges Bank Haddock

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$
2010	25,903	80,007	62,515			
2011	16,670	59,948	46,784			
2012	6,935	51,150	39,846			
2013	6,828	46,185	35,783			
2014	18,601	46,268	35,699			
2015	20,687	56,293	43,606			
2016	17,274	160,385	77,898			
2017	17,387	258,691	77,898			
2018	16,647	94,274	73,114			
2019		99,757	73,114	19,455		
2020		100,825	73,114		184,822	145,367
2021					106,805	90,337
2022					100,009	88,856

Georges Bank Haddock

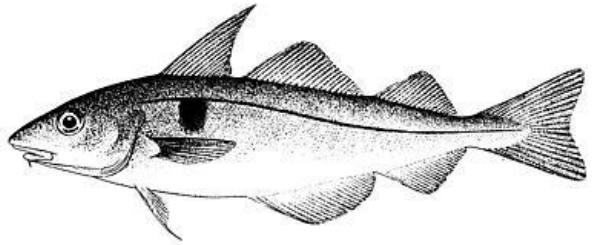
75%F_{MSY} Projection

year	OFL	ABC	F	SSB
2020	184,822	145,367	0.36	594,412
2021	116,883	90,337	0.36	549,918
2022	114,925	88,856	0.36	470,979

75%F_{MSY} Last Year Constant Projection

year	OFL	ABC	F	SSB
2020	184,822	88,856	0.21	611,549
2021	130,773	88,856	0.31	611,849
2022	129,580	88,856	0.31	532,886

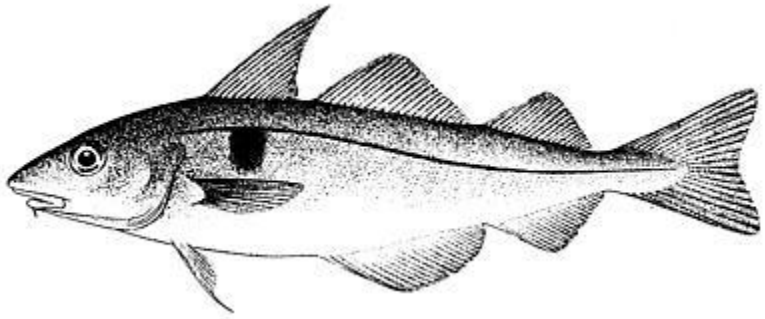
Gulf of Maine Haddock



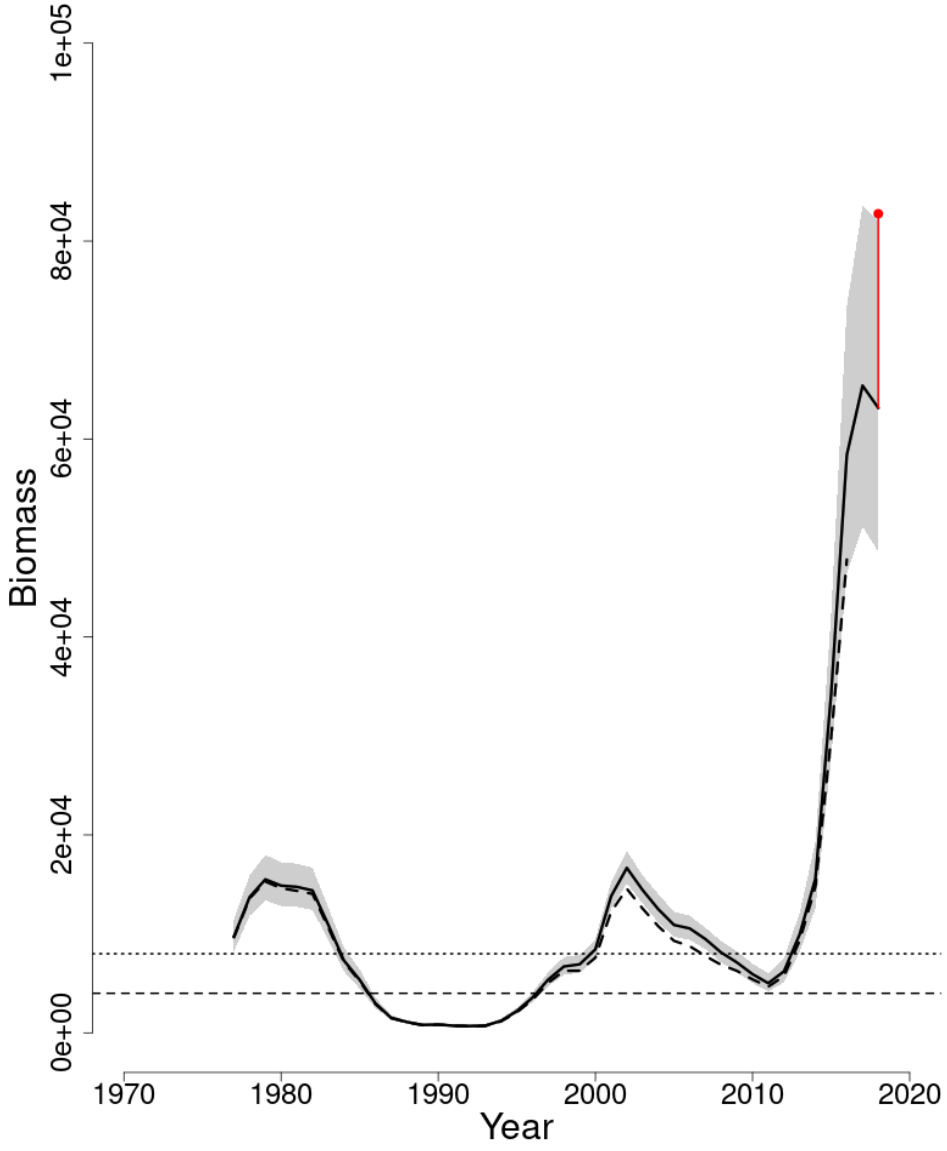
MODEL	ASAP
STOCK STATUS	Not Overfished & Overfishing is not occurring
REBUILDING	Rebuilt
RETROSPECTIVE ADJUSTMENT	Yes (increase adjustment)
UNCERTAINTIES	retrospective error
REVIEWER COMMENTS	Panel found it appropriate to make adjustments to account for the retrospective pattern as a matter of protocol. The Panel suggests that the PDT present both retrospective adjusted and unadjusted projections to the SSC to demonstrate the impact of this decision.
CHANGES	New MRIP time series is incorporated in the model.

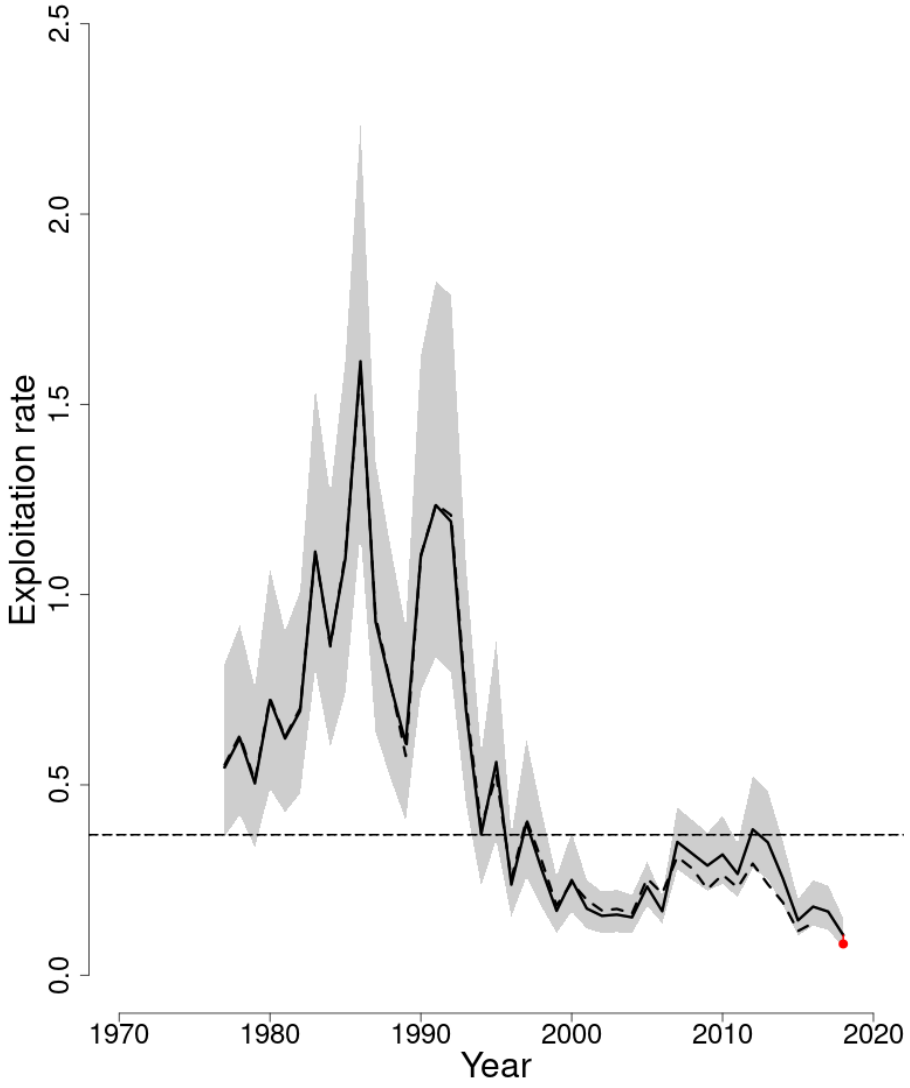
Gulf of Maine Haddock

	2017	2019
F_{MSY} *proxy*	0.455 (0.380 - 0.538)	0.369 (0.307 - 0.447)
SSB_{MSY} (mt)	6,769 (2,525 - 27,545)	7,993 (3,218 - 34,191)
MSY (mt)	1,547 (584 - 6,160)	1,597 (651 - 6,797)
Median recruits (age 1) (000s)	1,498 (275 - 17,307)	1,789 (285 - 17,883)
Overfishing	No	No
Overfished	No	No

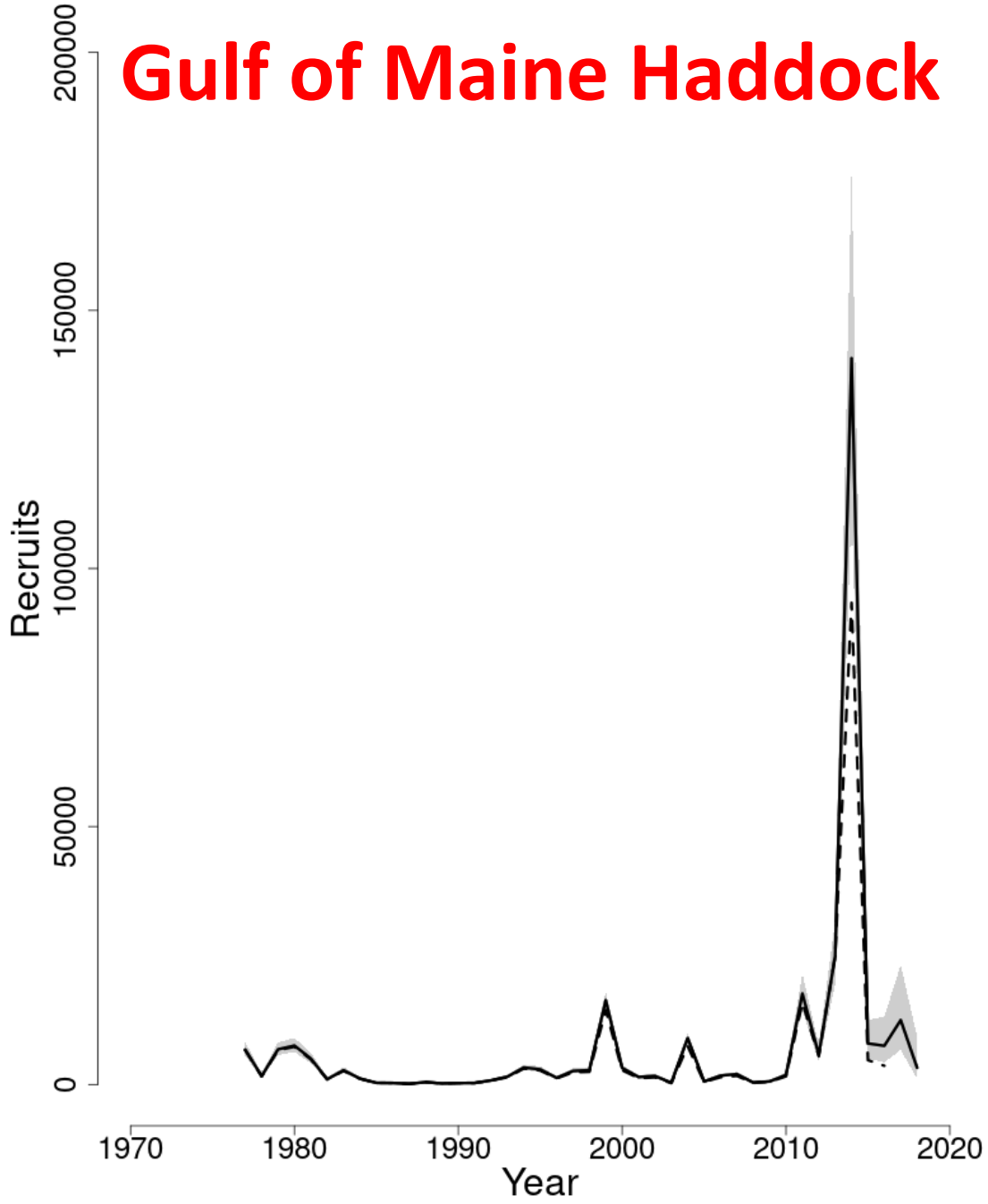


Gulf of Maine Haddock

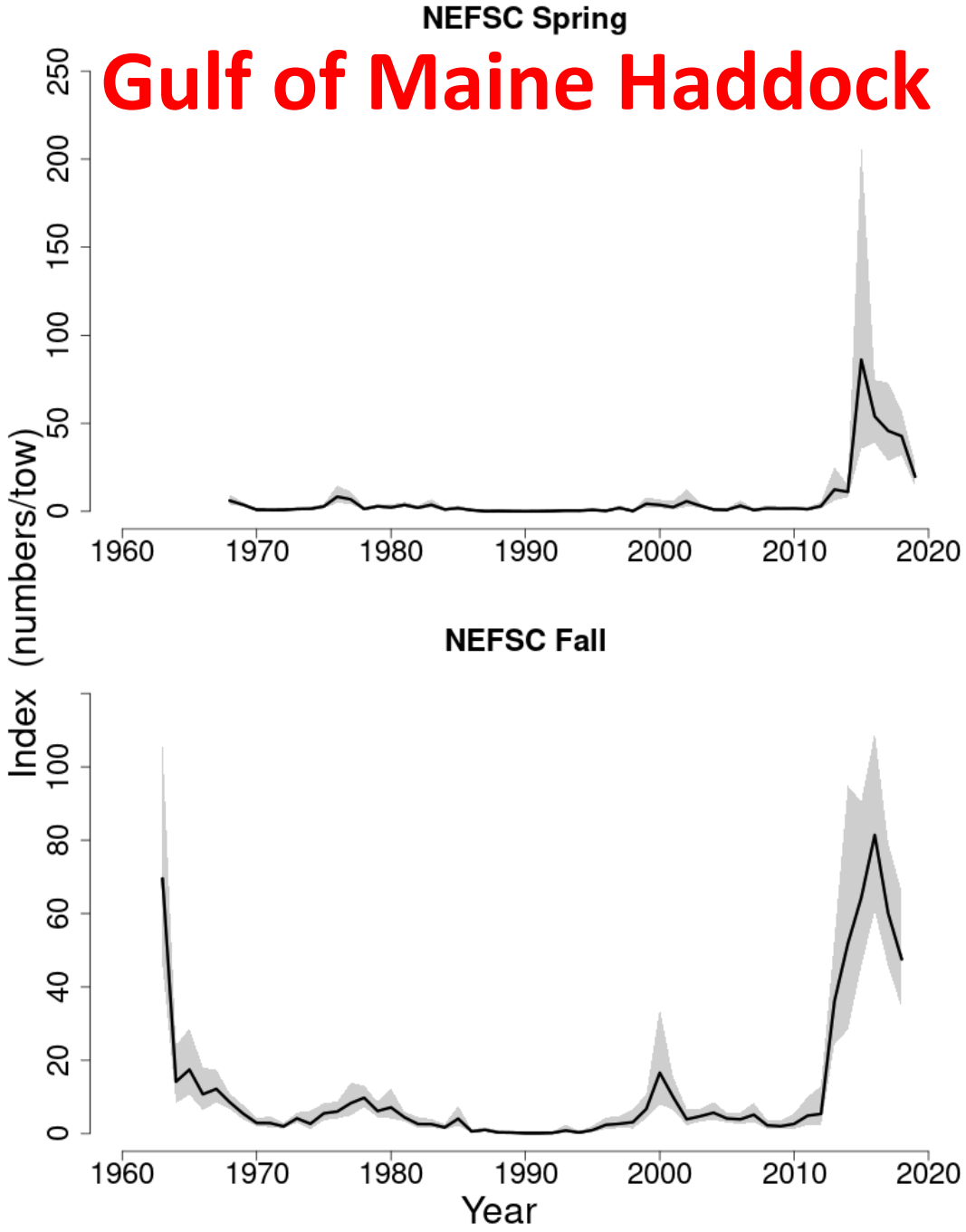




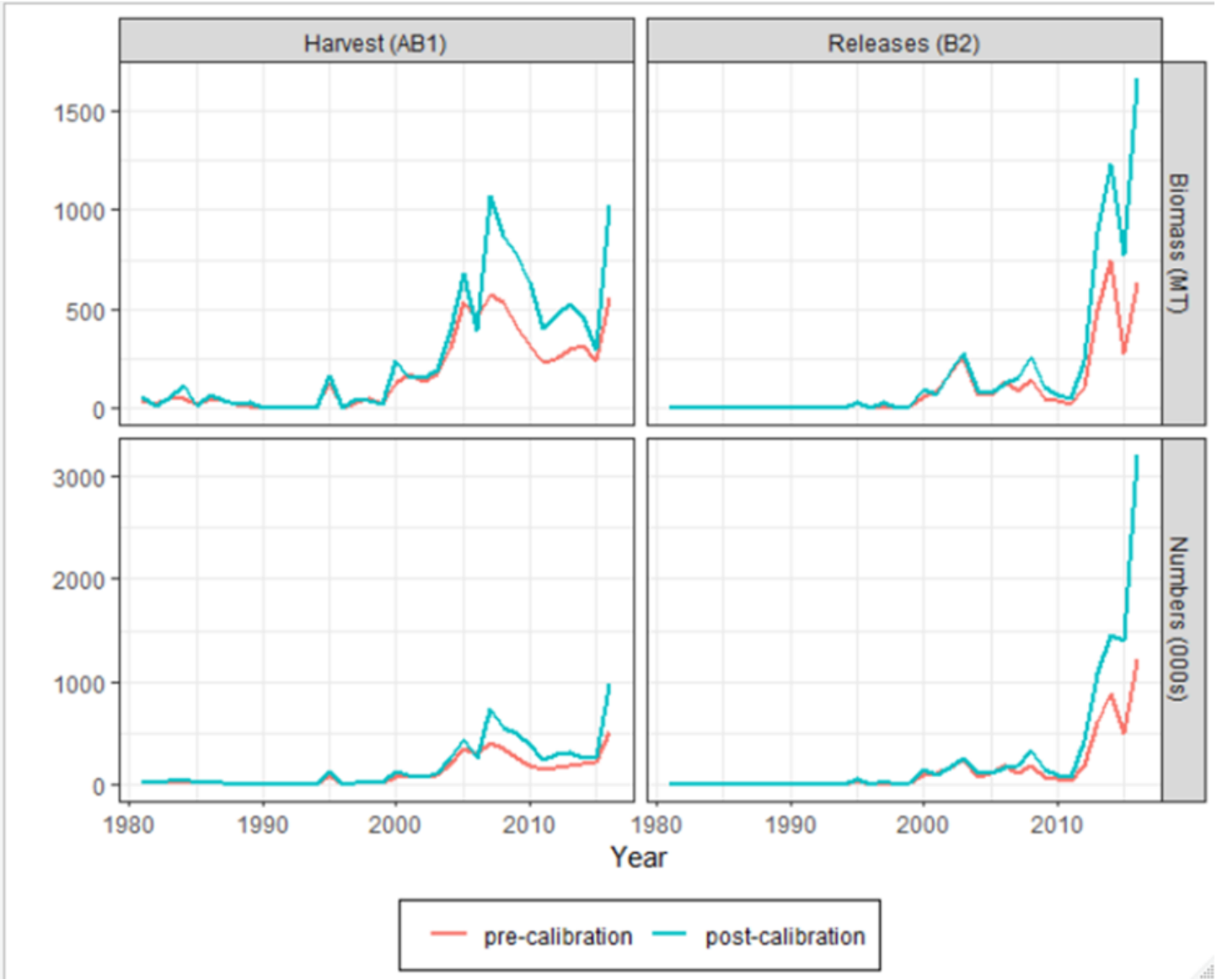
Gulf of Maine Haddock



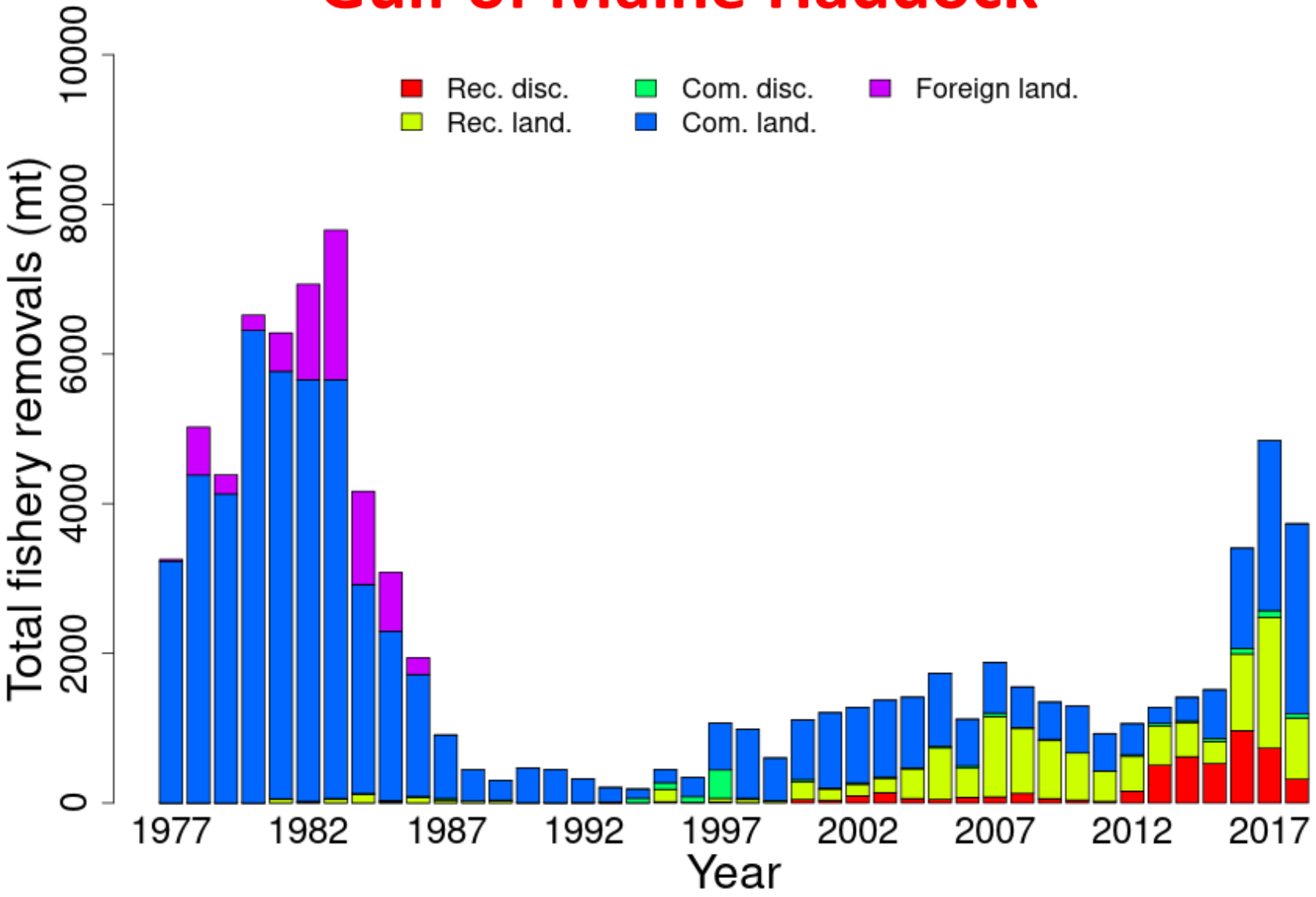
Gulf of Maine Haddock



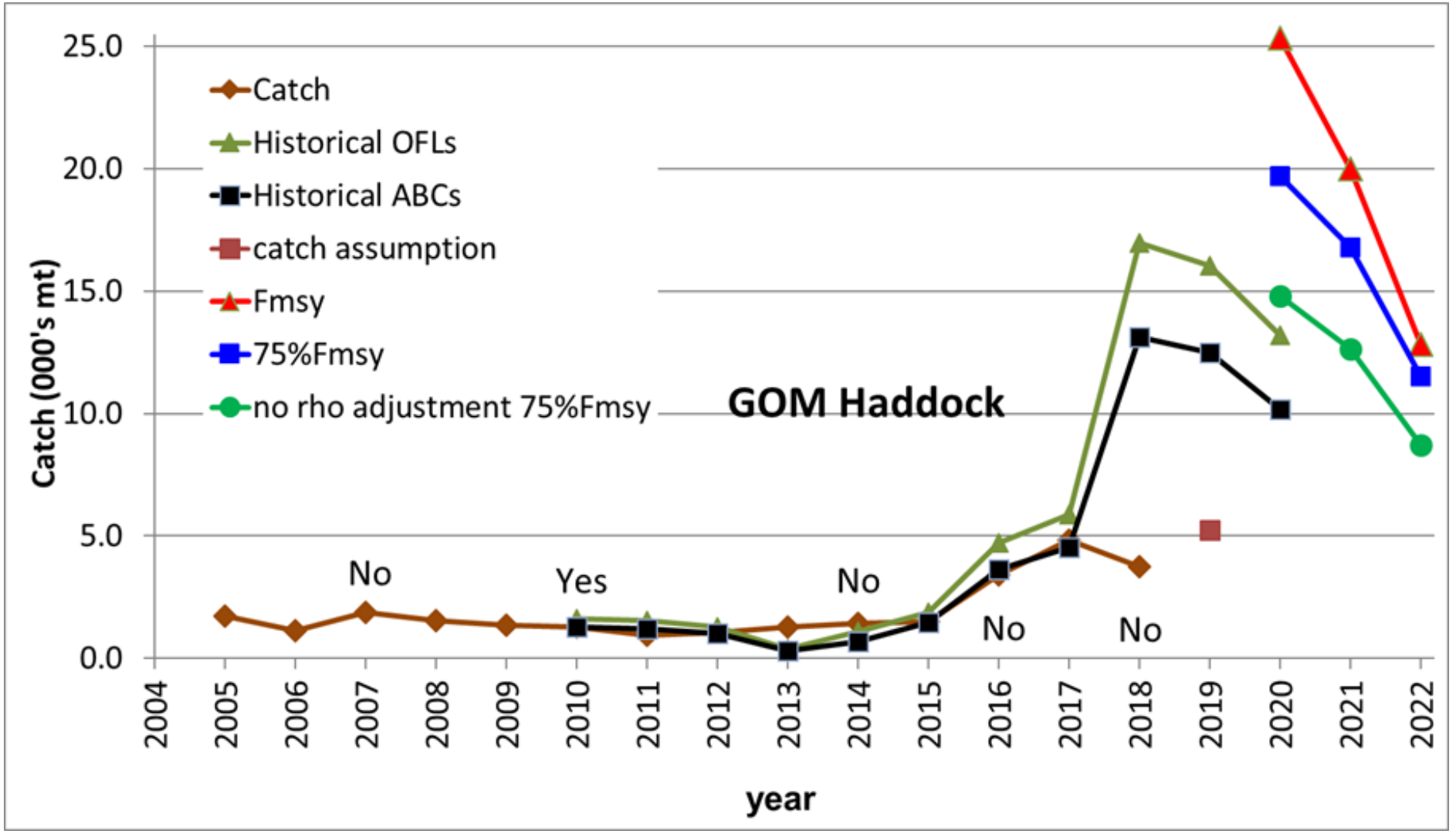
Gulf of Maine Haddock



Gulf of Maine Haddock



Gulf of Maine Haddock



Gulf of Maine Haddock

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$	no rho adj $75\%F_{MSY}$
2010	1,295	1,617	1,265				
2011	926	1,536	1,206				
2012	1,060	1,296	1,013				
2013	1,277	371	290				
2014	1,412	1,085	677				
2015	1,513	1,871	1,454				
2016	3,406	4,717	3,630				
2017	4,843	5,873	4,534				
2018	3,731	16,954	13,131				
2019		16,038	12,490	5,239			
2020		13,200	10,186		25,334	19,696	14,800
2021					19,996	16,794	12,634
2022					12,811	11,526	8,700

Gulf of Maine Haddock

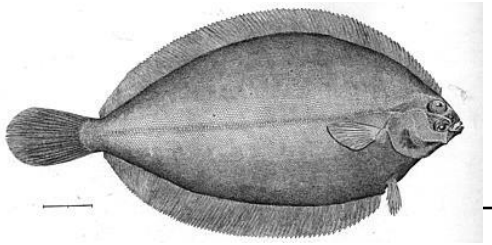
75%F_{MSY} Projection

year	OFL	ABC	F	SSB
2020	25,334	19,696	0.28	94,793
2021	21,521	16,794	0.28	73,776
2022	14,834	11,526	0.28	60,503

75%F_{MSY} Last Year Constant Projection

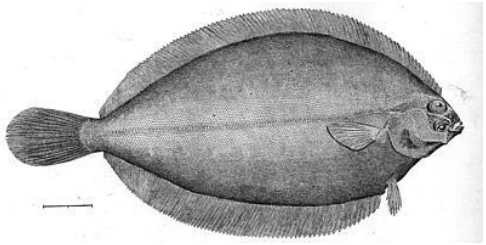
year	OFL	ABC	F	SSB
2020	25,334	11,526	0.16	97,150
2021	23,709	11,526	0.17	83,044
2022	17,945	11,526	0.23	73,542

Witch Flounder



MODEL	Empirical approach (swept-area) Level 1
STOCK STATUS	Overfished & Overfishing is unknown
REBUILDING	2043 (Frebuild based on the 2007-2015 exploitation rate)
RETROSPECTIVE ADJUSTMENT	N/A
UNCERTAINTIES	No analytical model or biomass reference points, cannot quantify 2013 year class.
ASSESSMENT COMMENTS	Uncertainty in the catch creates additional uncertainty surrounding the exploitation rate estimate. Uncertainties associated area-swept expansion factors.

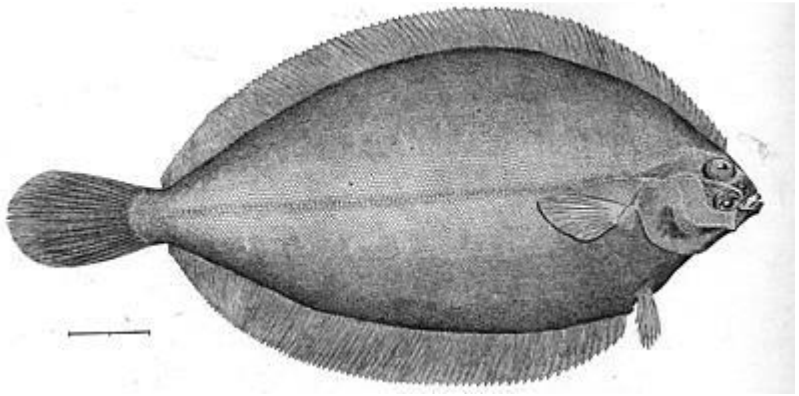
Witch Flounder



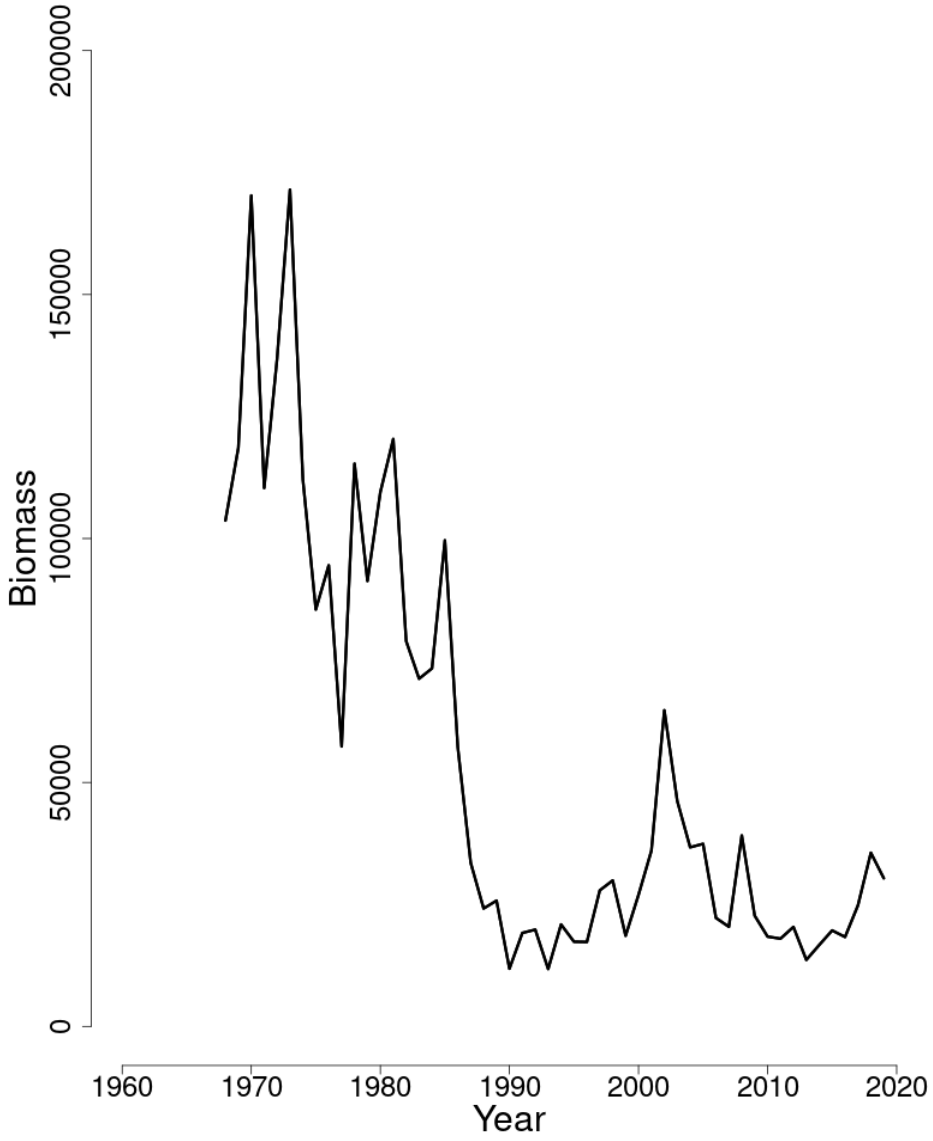
Changes	Incorporation revised catchability coefficients using length and diurnal effects.

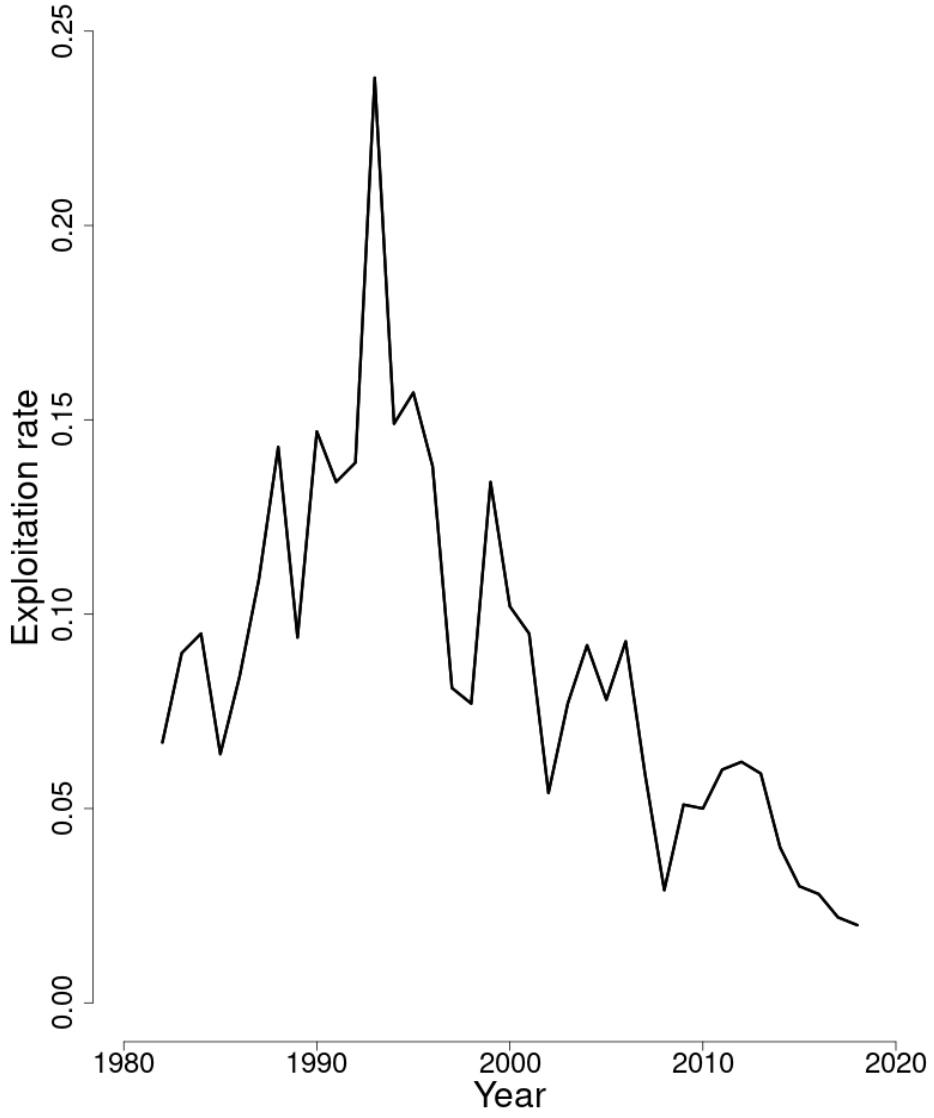
Witch Flounder

	2017	2019
F_{MSY} *proxy*	NA	NA
SSB_{MSY} (mt)	NA	NA
MSY (mt)	NA	NA
Overfishing	Unknown	Unknown
Overfished	Yes	Yes

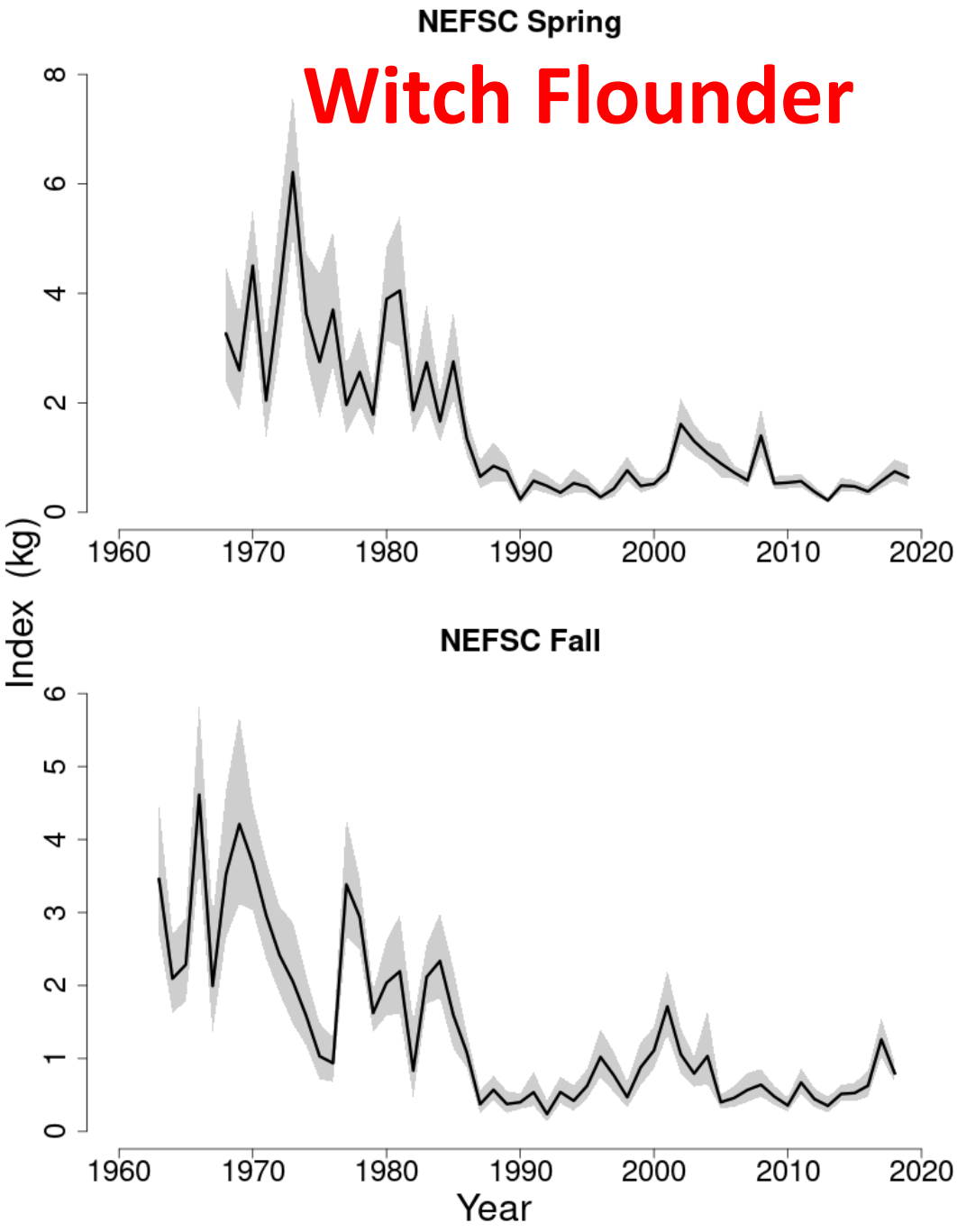


Witch Flounder

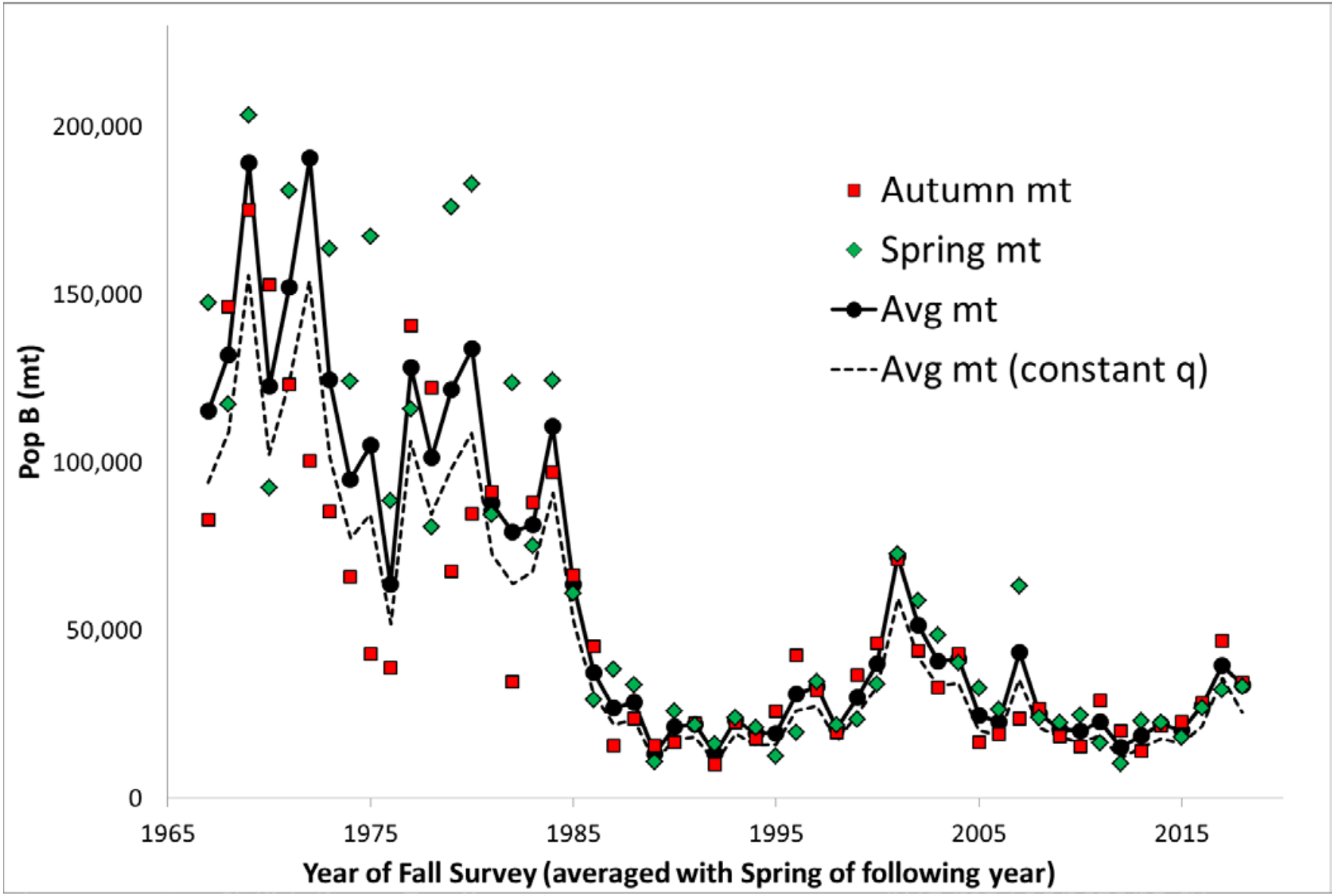




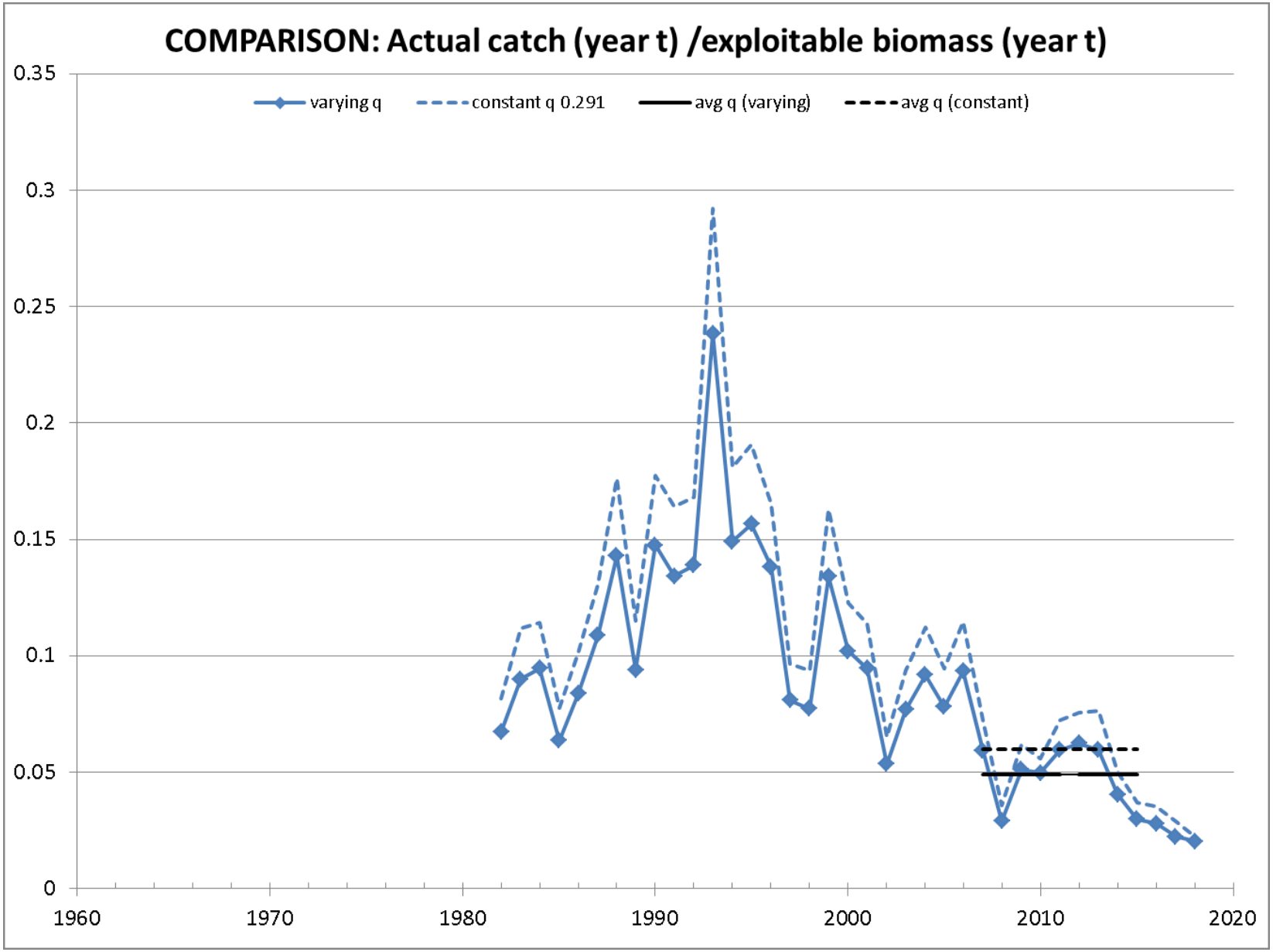
Witch Flounder



Witch Flounder



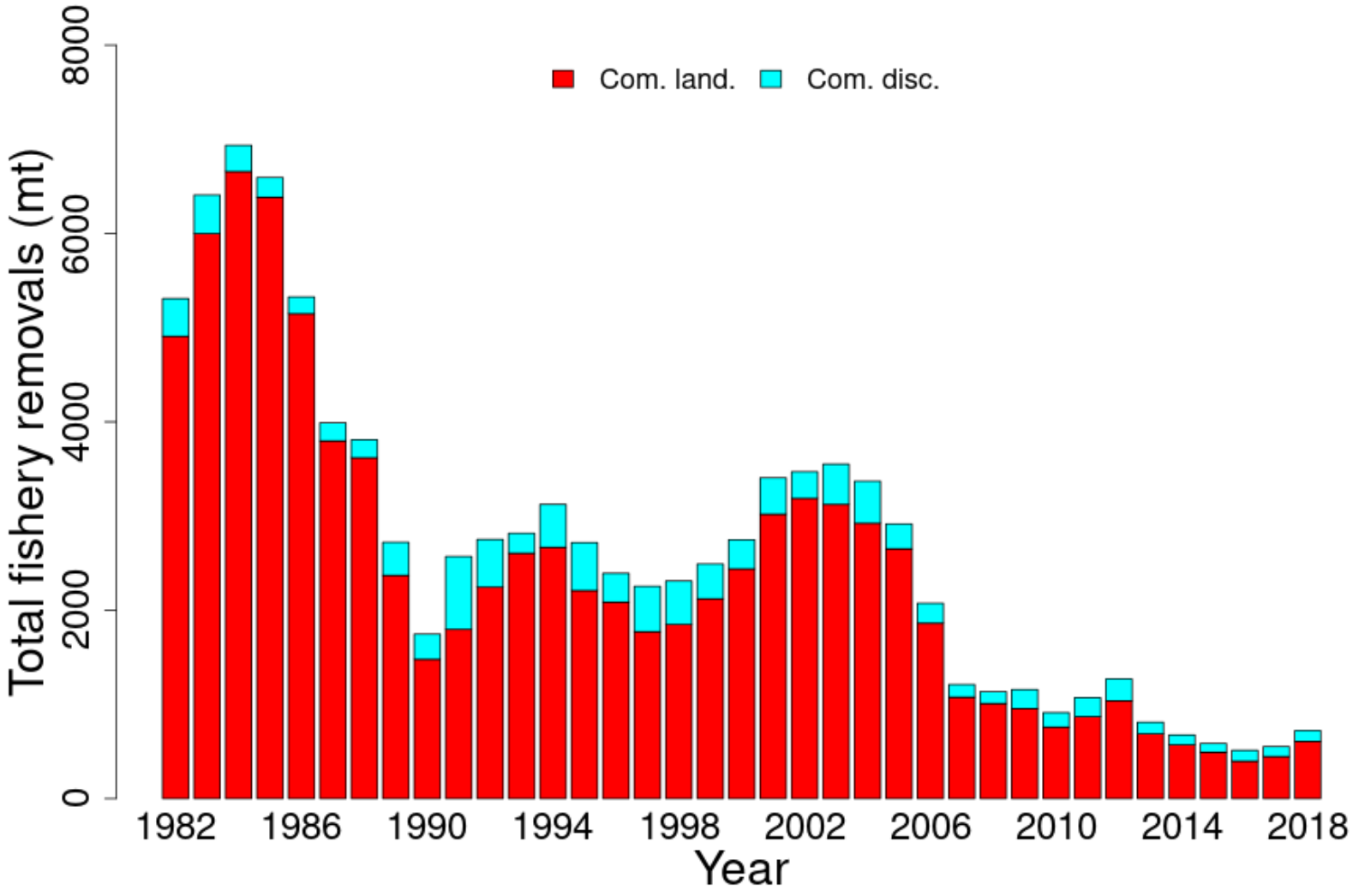
Witch Flounder



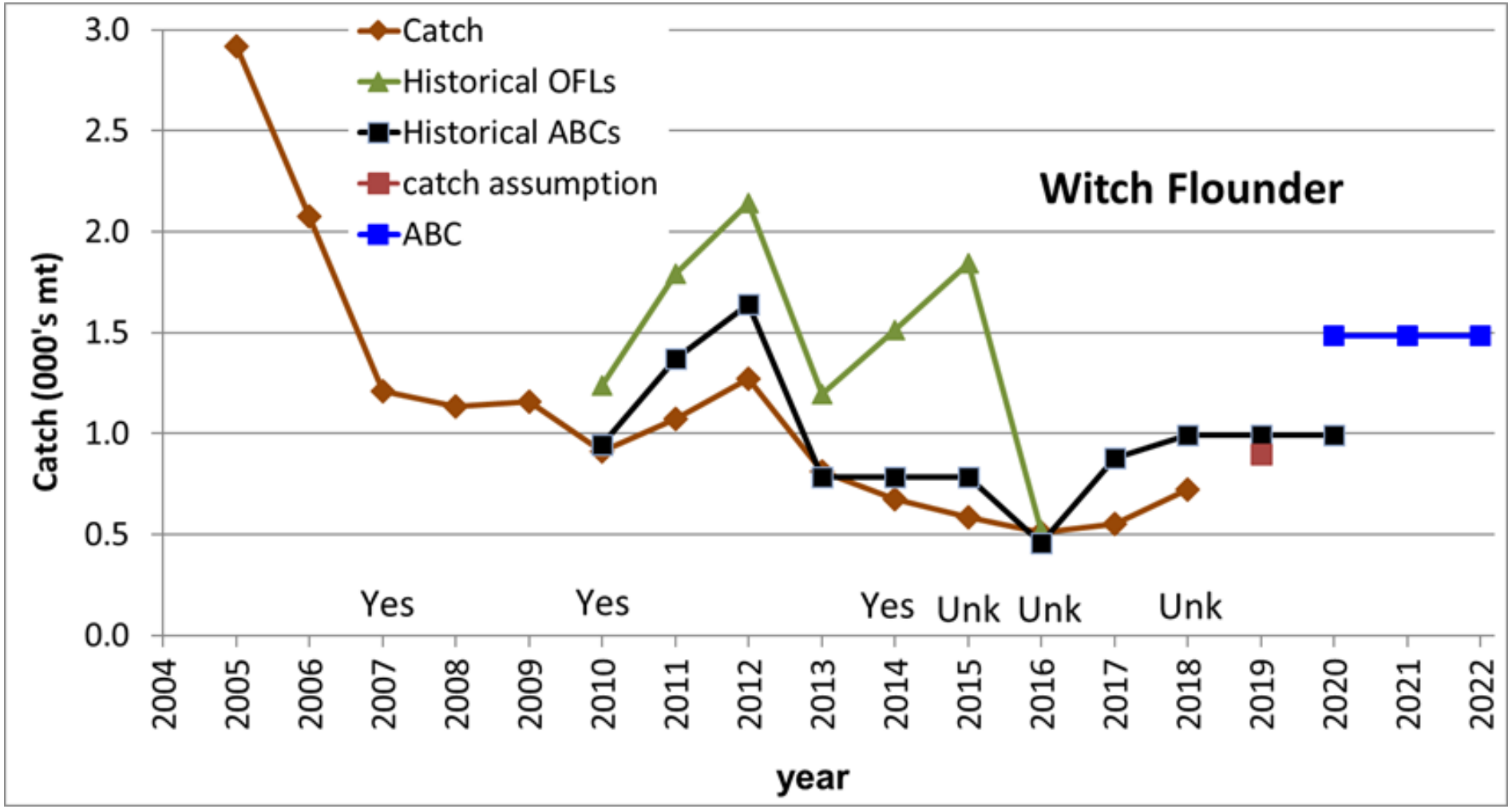
Witch Flounder

	Revised annual catchability (q varies by year)	Constant catchability (q = 0.291)
Mean exploitation rate for 2007-2015	0.049	0.060
3 year moving average of exploitable biomass (mt)	30,259	24,815
Estimated catch advice (mt) for 2020	1,483	1,489

Witch Flounder



Witch Flounder



Witch Flounder

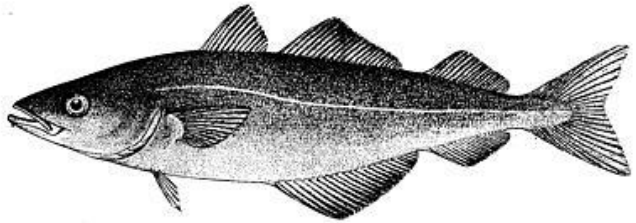
Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	ABCs
2010	913	1,239	944			
2011	1,072	1,792	1,369			
2012	1,270	2,141	1,639			
2013	811	1,196	783			
2014	676	1,512	783			
2015	586	1,846	783			
2016	512	521	460			
2017	552	Undefined	878			
2018	722	Undefined	993			
2019		Undefined	993	896		
2020		Undefined	993		-	1,483
2021					-	1,483
2022					-	1,483

Witch Flounder

ABC = exploitation rate x 3 year average of exploitable biomass

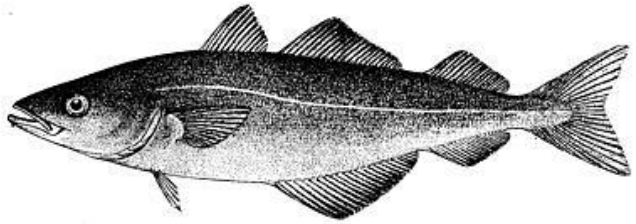
year	OFL	ABC
2020	unknown	1,483
2021	unknown	1,483
2022	unknown	1,483

Pollock



MODEL	ASAP (Level 2)
STOCK STATUS	Not Overfished & Overfishing is not occurring
REBUILDING	Rebuilt
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Selectivity assumption in both surveys and the fishery, retrospective pattern, strength of 2013 year class
REVIEWER COMMENTS	Stock status is insensitive to the shape of the survey selectivity patterns at older ages. Convergence issues in conducting the retrospective analysis; perhaps the model is overparameterized due to separate commercial and recreational fleets. Due to the risk-prone nature of managing under the assumption of dome-shaped selectivity, the panel recommends a decision table be used to communicate the results of the base assessment model and the sensitivity model.

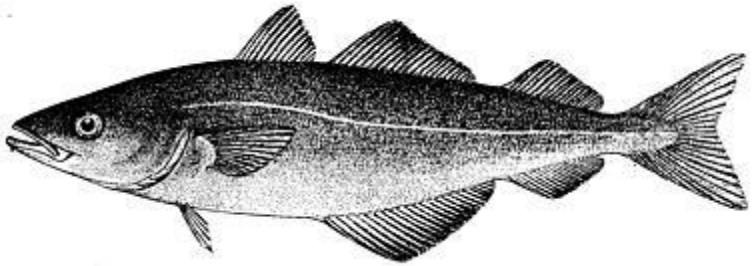
Pollock



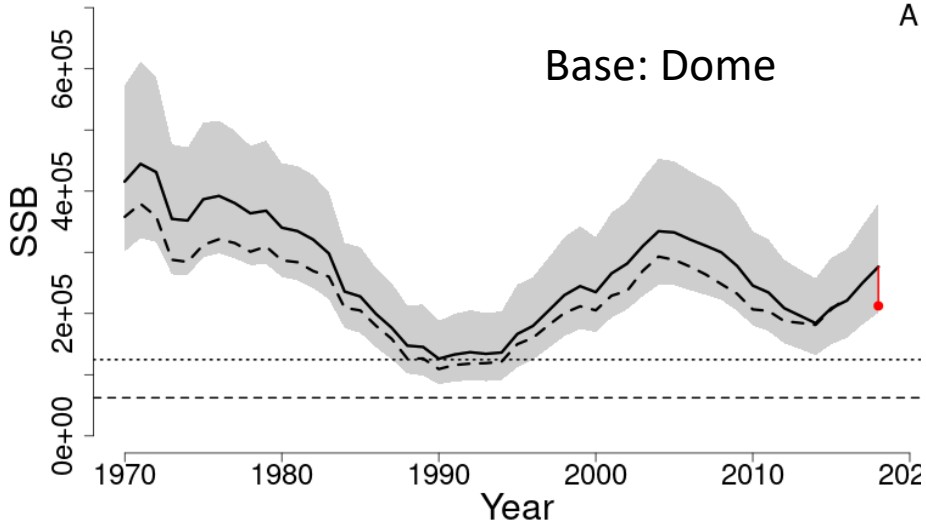
CHANGES	New MRIP time series is incorporated in the model.

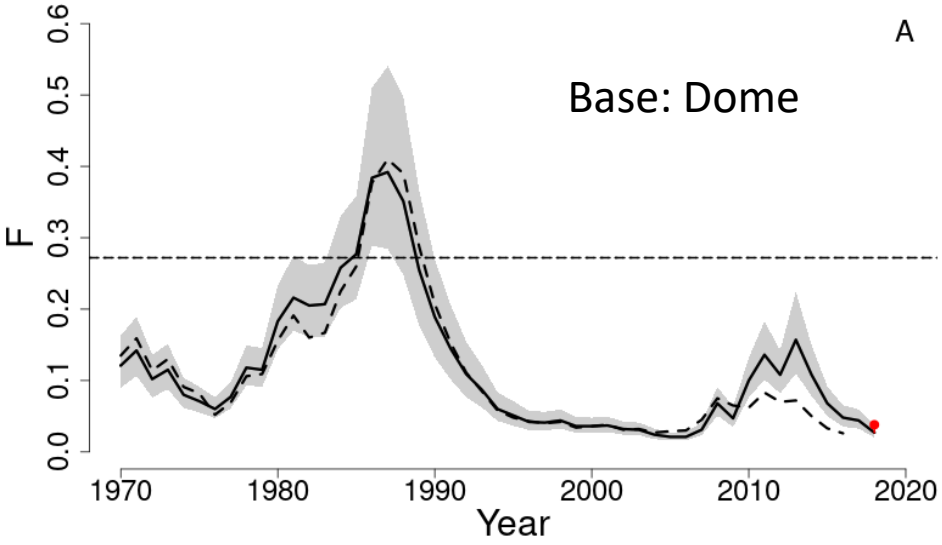
Pollock

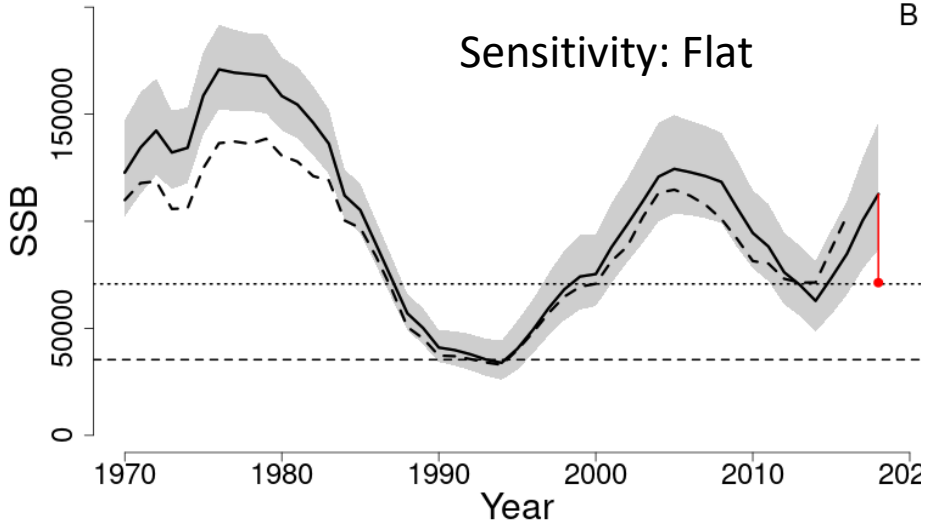
	2017 base	2017 flat sel sensitivity	base	flat sel sensitivity
F_{MSY}	0.260	0.249	0.272	0.260
SSB_{MSY} (mt)	105,510	60,738	124,639 (98,701 - 158,416)	70,721 (55,964 - 89,609)
MSY (mt)	19,427	11,692	19,856 (14,471 - 27,709)	12,007 (8,876 - 16,407)
Median recruits (age 1) (000s)	22,183	13,067	25,312	14,503
Overfishing	No	No	No	No
Overfished	No	No	No	No

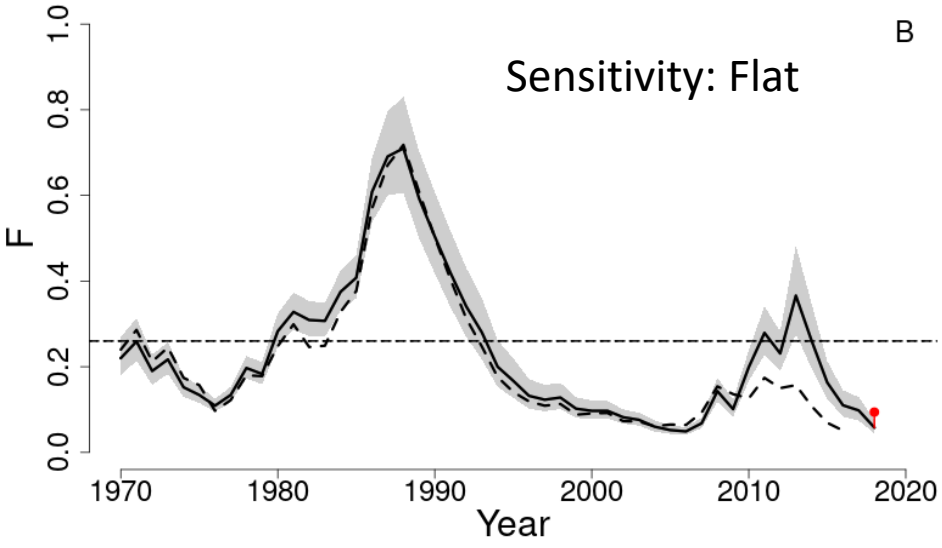


Pollock

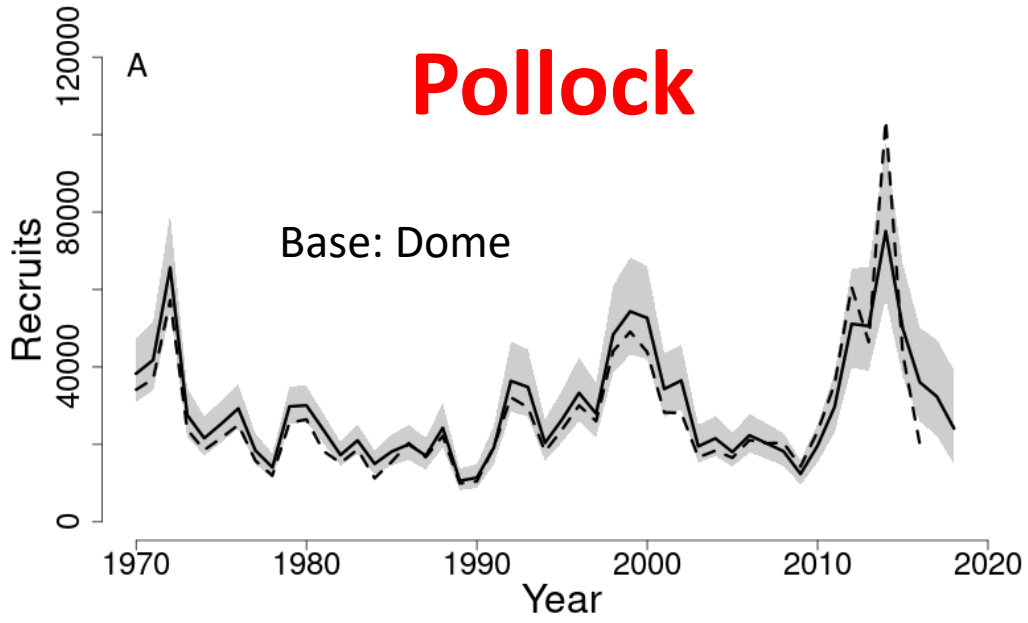

A
Base: Dome
SSB
0e+00
2e+05
4e+05
6e+05
1970
1980
1990
2000
2010
Year

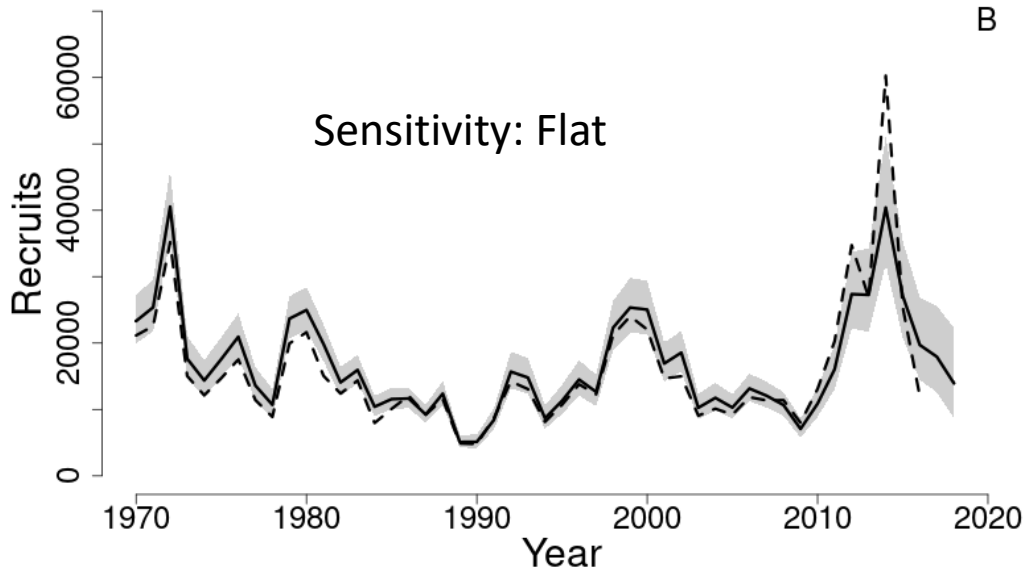

A
Base: Dome
F
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1970
1980
1990
2000
2010
2020
Year

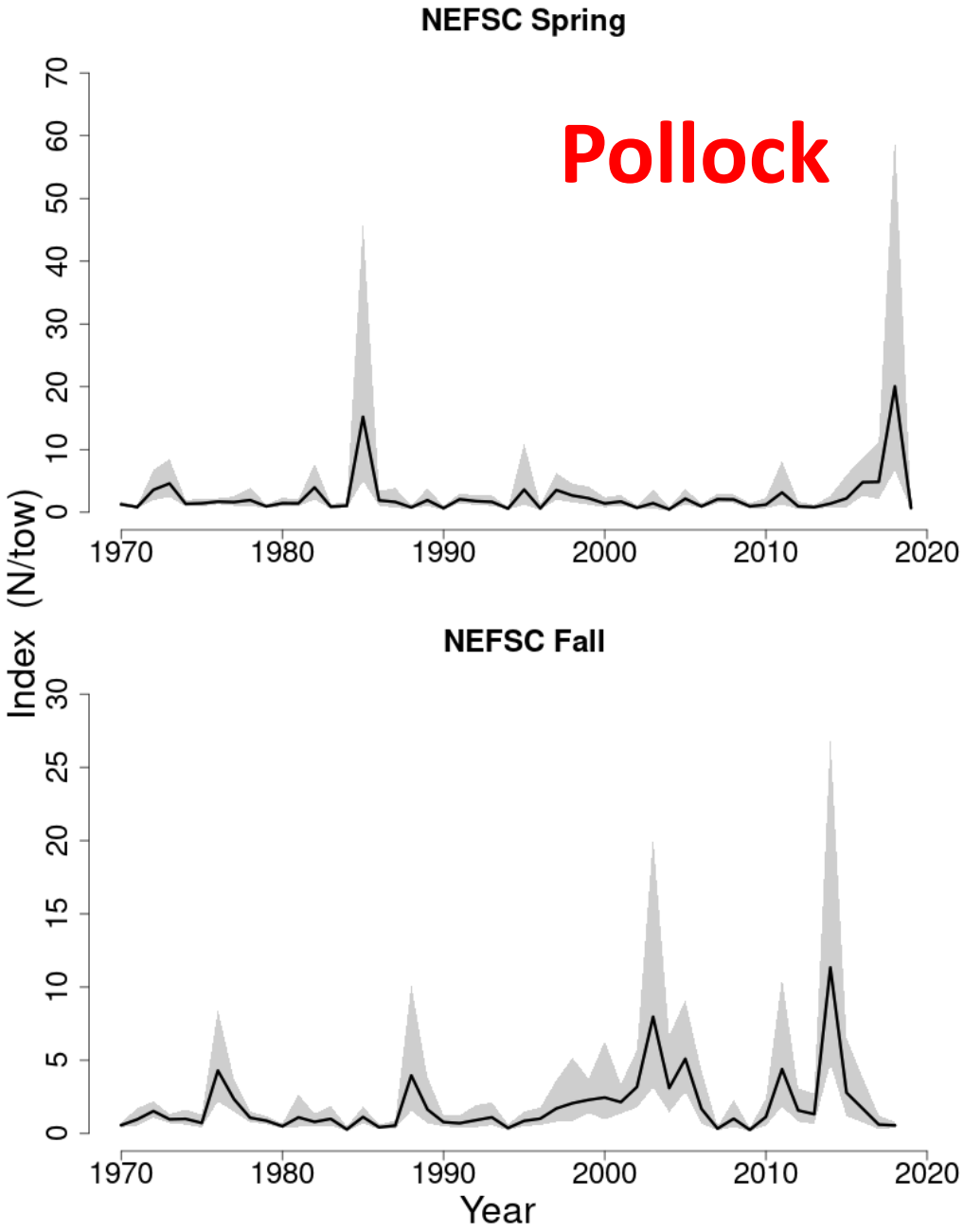

B
Sensitivity: Flat
SSB
0
50000
150000
1970
1980
1990
2000
2010
Year


B
Sensitivity: Flat
F
0.0
0.2
0.4
0.6
0.8
1.0
1970
1980
1990
2000
2010
2020
Year

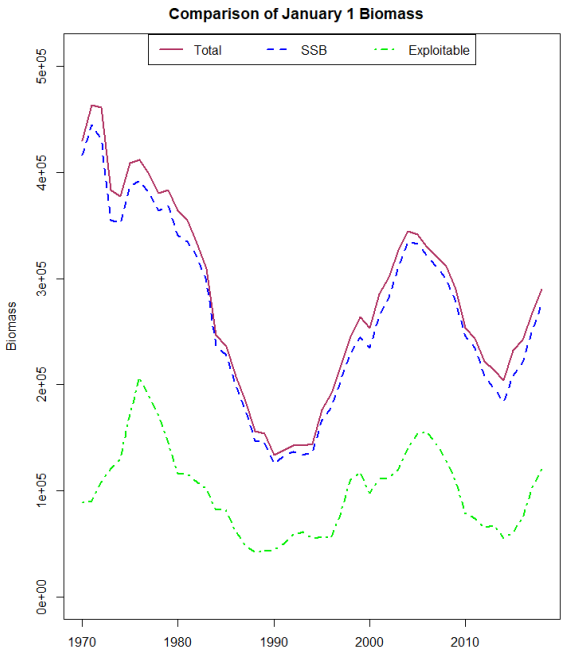
Pollock

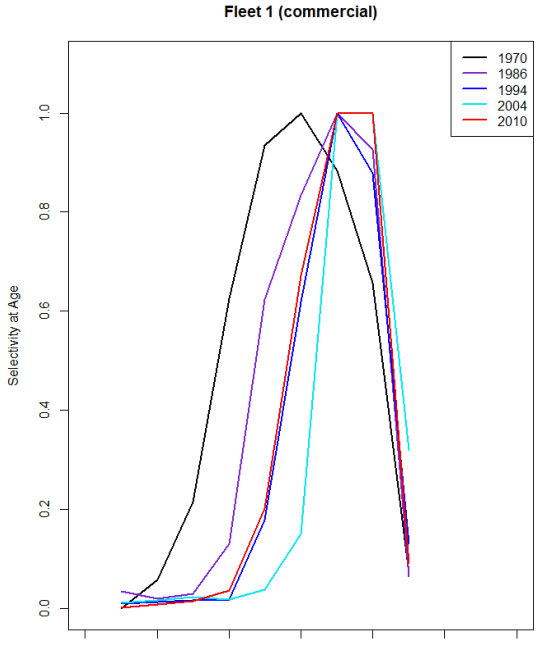

A
Base: Dome
Recruits
0
40000
80000
120000
1970
1980
1990
2000
2010
2020
Year


B
Sensitivity: Flat
Recruits
0
20000
40000
60000
1970
1980
1990
2000
2010
2020
Year

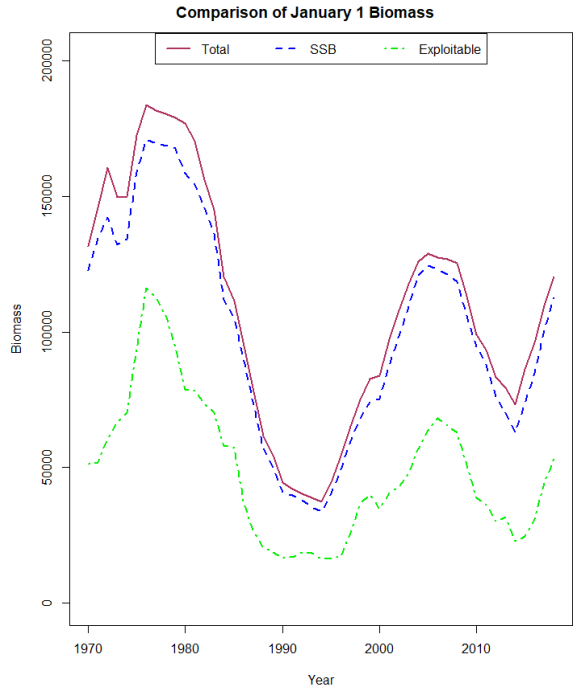

NEFSC Spring
Pollock
Index (N/tow)
0
10
20
30
40
50
60
70
1970
1980
1990
2000
2010
2020
NEFSC Fall
0
5
10
15
20
25
30
1970
1980
1990
2000
2010
2020
Year

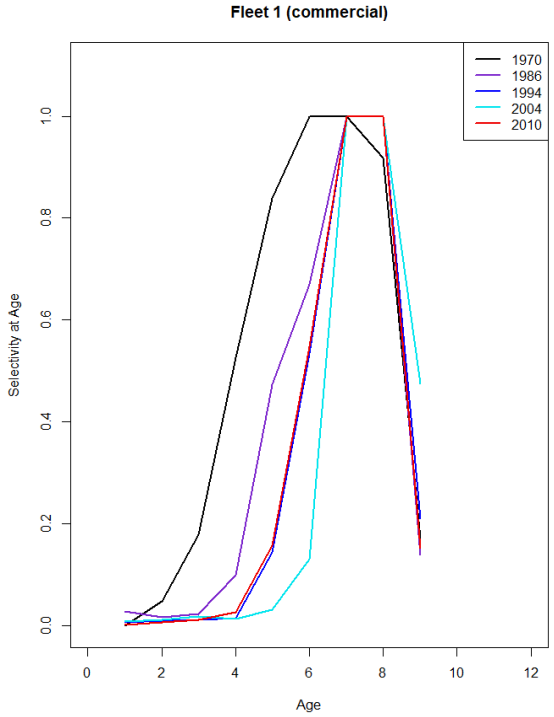
Pollock





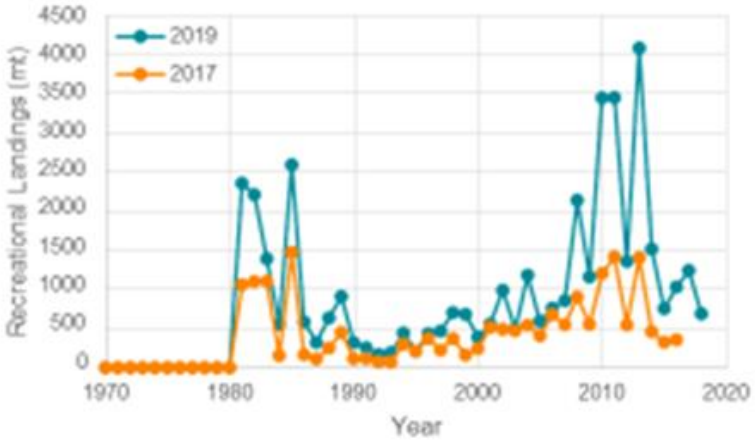
Dome

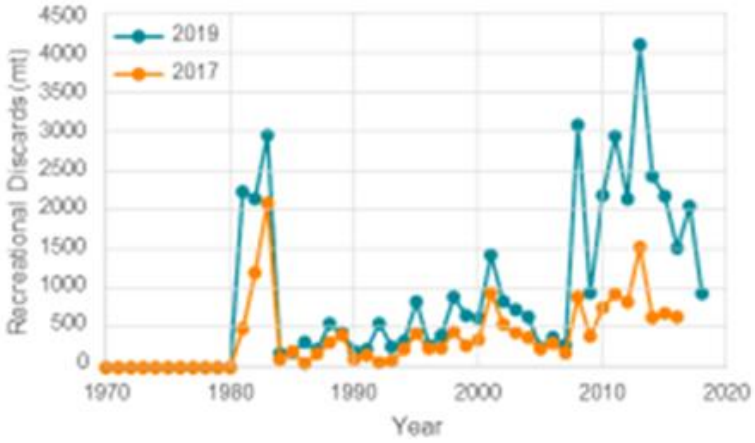


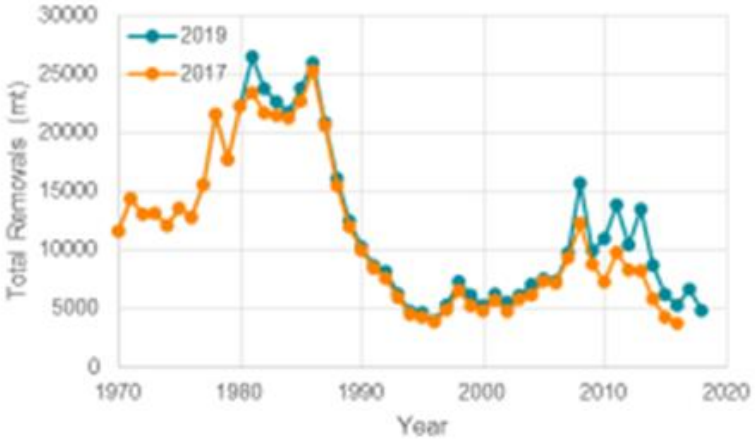


Flat

Pollock



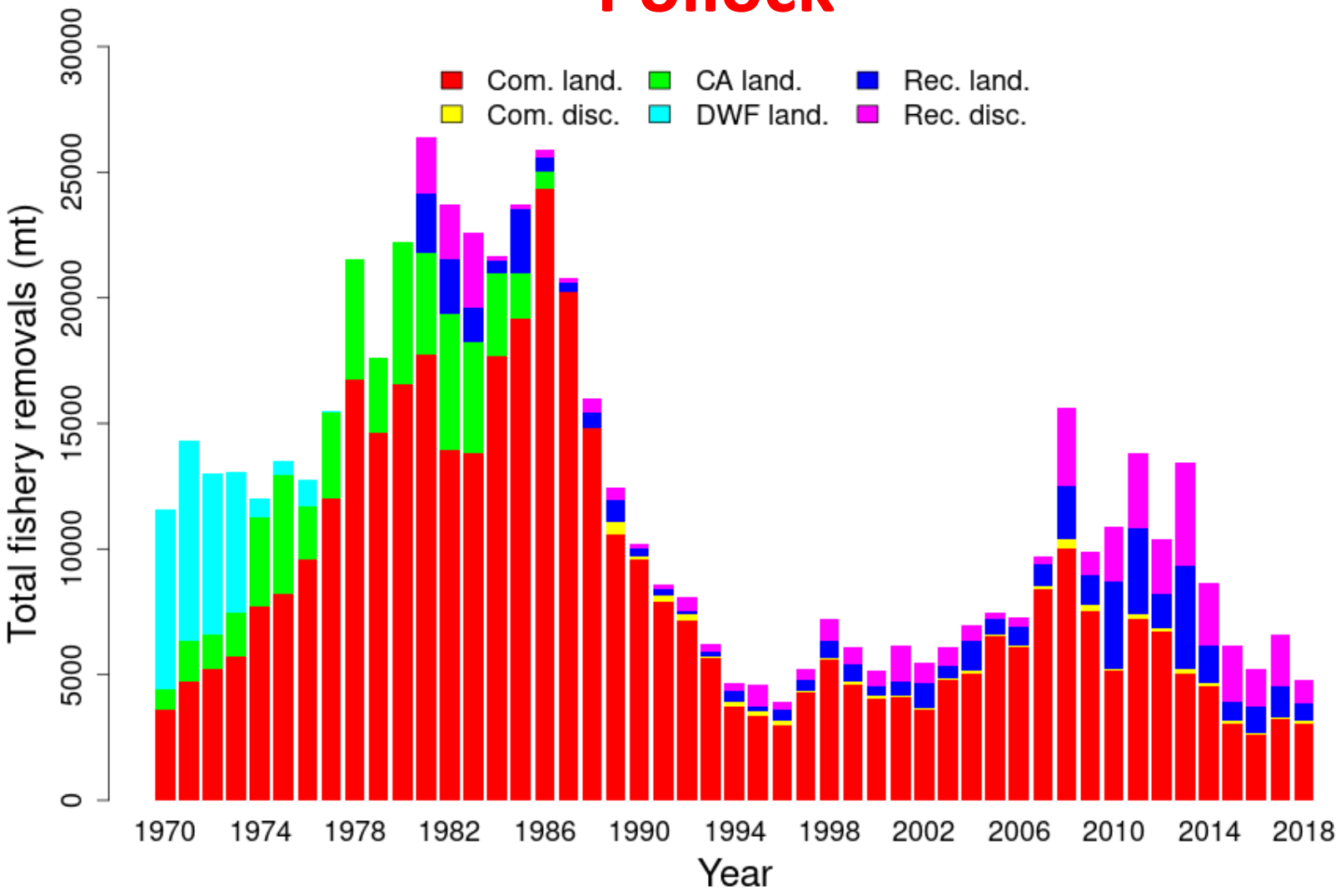




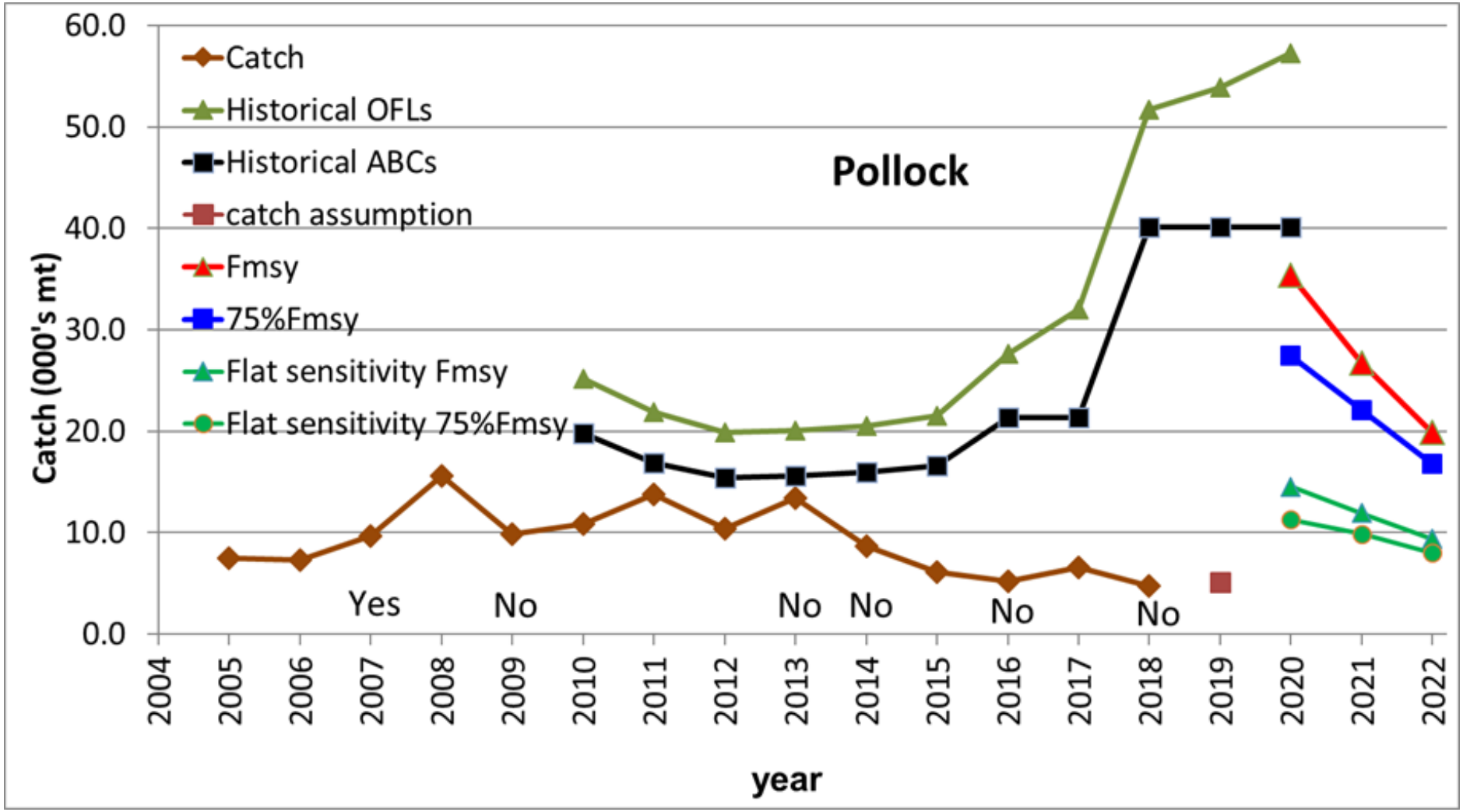
2019 Assessment: 2016 recreational removals account for 49% of total removals

2017 Assessment: 2016 recreational removals account for 27% of total removals

Pollock


Com. land.
CA land.
Rec. land.
Com. disc.
DWF land.
Rec. disc.
Total fishery removals (mt)
0
5000
10000
15000
20000
25000
30000
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
2014
2018
Year

Pollock


Pollock
Catch
Historical OFLs
Historical ABCs
catch assumption
Fmsy
75%Fmsy
Flat sensitivity Fmsy
Flat sensitivity 75%Fmsy
Catch (000's mt)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Yes
No
No
No
No
No
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
year

Pollock

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	$75\%F_{MSY}$	Flat F_{MSY}	Flat $75\%F_{MSY}$
2010	10,897	25,200	19,800					
2011	13,792	21,853	16,900					
2012	10,370	19,887	15,400					
2013	13,428	20,060	15,600					
2014	8,632	20,554	16,000					
2015	6,139	21,538	16,600					
2016	5,231	27,668	21,312					
2017	6,597	32,004	21,312					
2018	4,779	51,680	40,172					
2019		53,940	40,172	5,140				
2020		57,240	40,172		35,358	27,447	14,522	11,295
2021					26,765	22,062	11,924	9,867
2022					19,889	16,812	9,388	7,998

Pollock

Consequence Table

Biological status risk over the three years

state of nature

management catch

final

75%Fmsy final model catch in final model

	F	catch	SSB
2019	0.036	5,140	190,927
2020	0.204	27,447	200,992
2021	0.204	22,062	184,293
2022	0.204	16,812	173,453

sensitivity

75%Fmsy final model catch in sensitivity model

	F	catch	SSB
2019	0.092	5,140	65,237
2020	0.583	27,447	69,808
2021	0.841	22,062	50,041
2022	1.133	16,812	36,160

sensitivity

75%Fmsy sensitivity catch in final model

	F	catch	SSB
2019	0.036	5,140	190,927
2020	0.079	11,295	200,992
2021	0.076	9,867	200,898
2022	0.077	7,998	203,429

75%Fmsy sensitivity catch in sensitivity model

	F	catch	SSB
2019	0.092	5,140	65,237
2020	0.195	11,295	69,808
2021	0.195	9,867	66,606
2022	0.195	7,998	65,482

Pollock

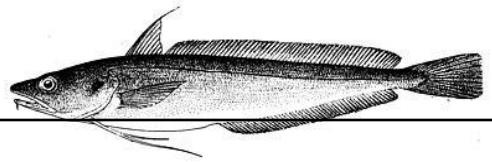
75%F_{MSY} Projection

year	OFL	ABC	F	SSB
2020	35,358	27,447	0.30	201,031
2021	28,475	22,062	0.30	184,358
2022	21,744	16,812	0.30	173,494

75%F_{MSY} Last Year Constant Projection

year	OFL	ABC	F	SSB
2020	35,358	16,812	0.18	201,031
2021	30,795	16,812	0.20	195,203
2022	24,087	16,812	0.27	190,204

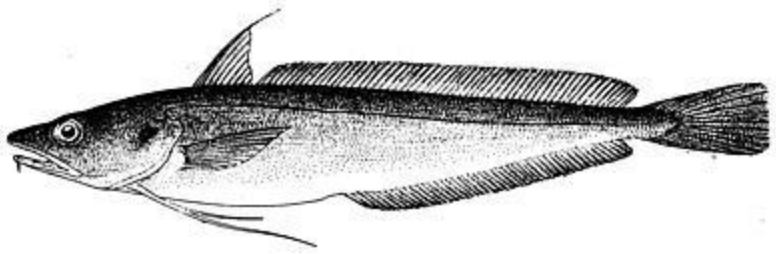
White Hake



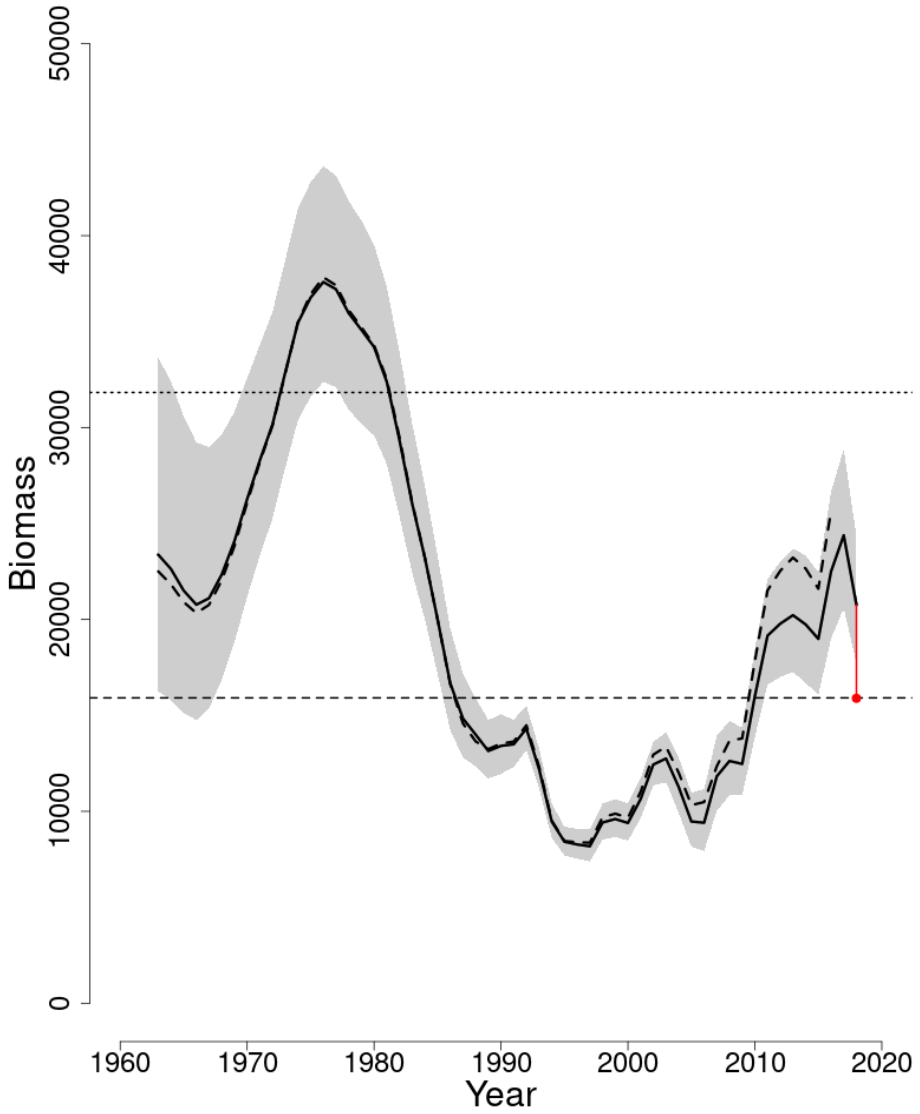
MODEL	ASAP (Level 2)
STOCK STATUS	Overfished & Overfishing is not occurring
REBUILDING	2014 (Did not rebuild)
RETROSPECTIVE ADJUSTMENT	Yes
UNCERTAINTIES	Species mis-identification, recent addition of an extra-large market category causing possible bias in the age composition, no commercial catch data prior to 1989 catchability of older age classes in surveys is low, pooled age length key used in 1963-1981 and 2003.
ASSESSMENT/ REVIEWER COMMENTS	Estimates of commercial landings and discards have decreased over time, but the white hake stock does not show age structure truncation. Species mis-identification impact recruitment, and market category conflation may impact cohort signals.

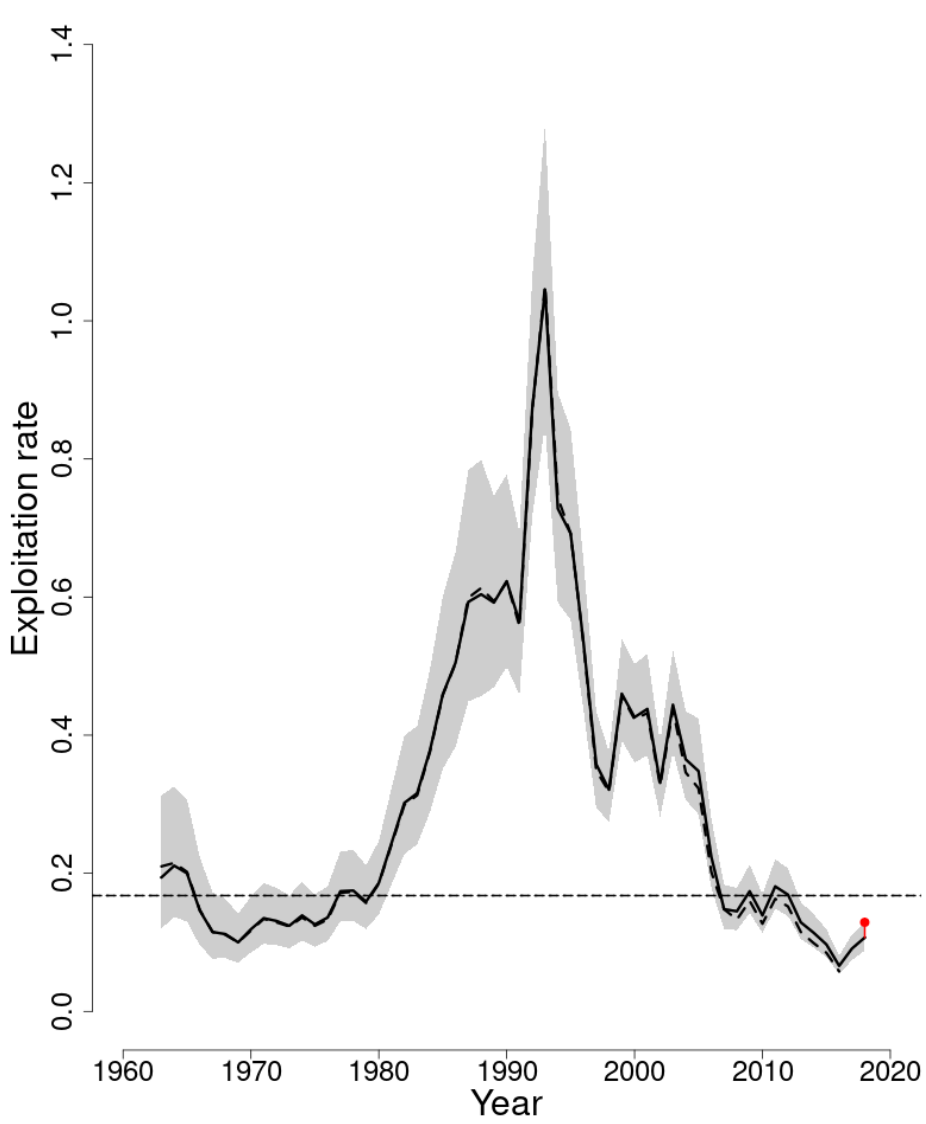
White Hake

	2017	2019
F_{MSY} *proxy*	0.1839	0.1677
SSB_{MSY} (mt)	30,948	31,828 (25,398 - 40,317)
MSY (mt)	4,867	4,601 (3,665 - 5,828)
Median recruits (age 1) (000s)	4,616	4,471
Overfishing	No	No
Overfished	No	Yes

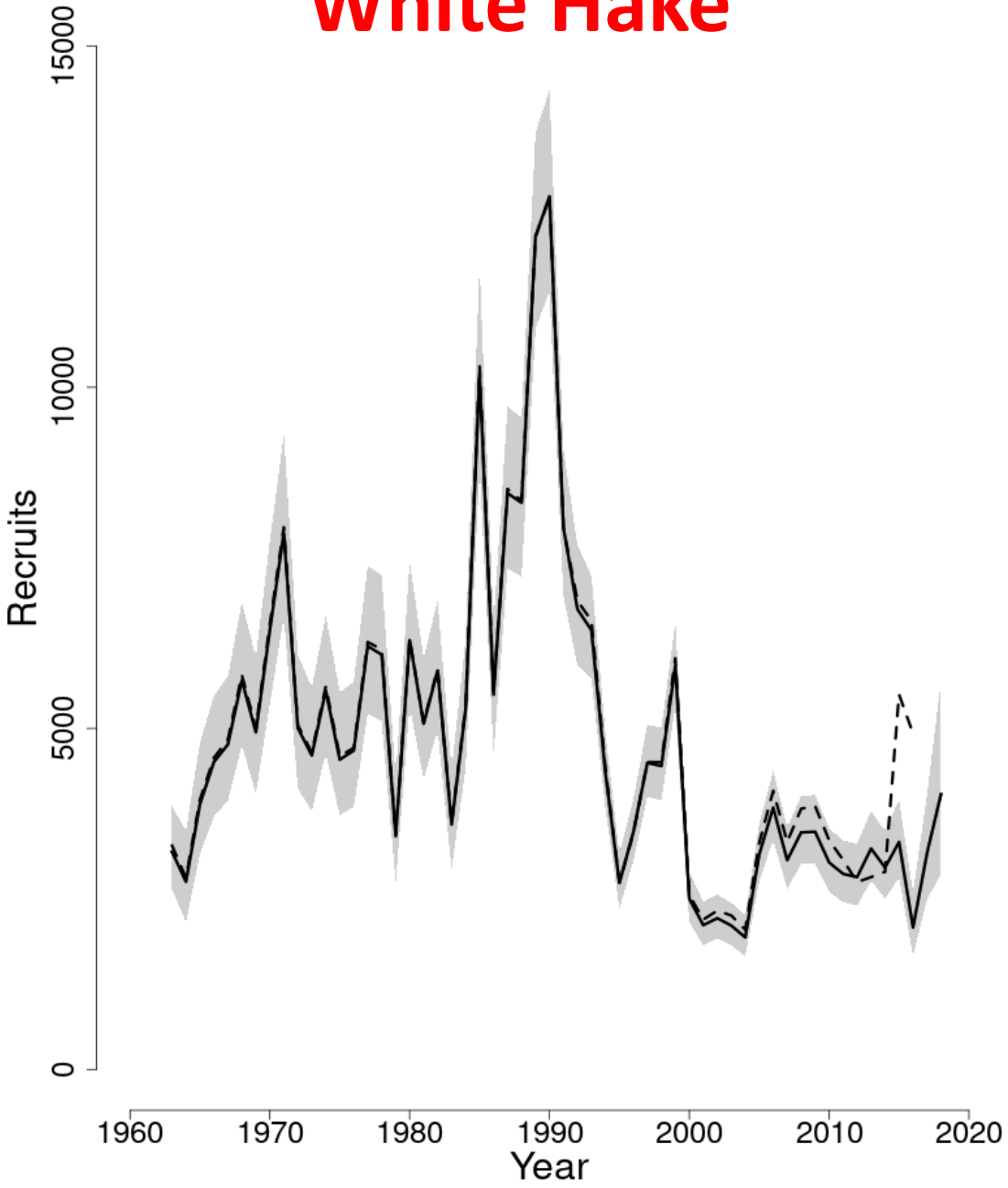


White Hake

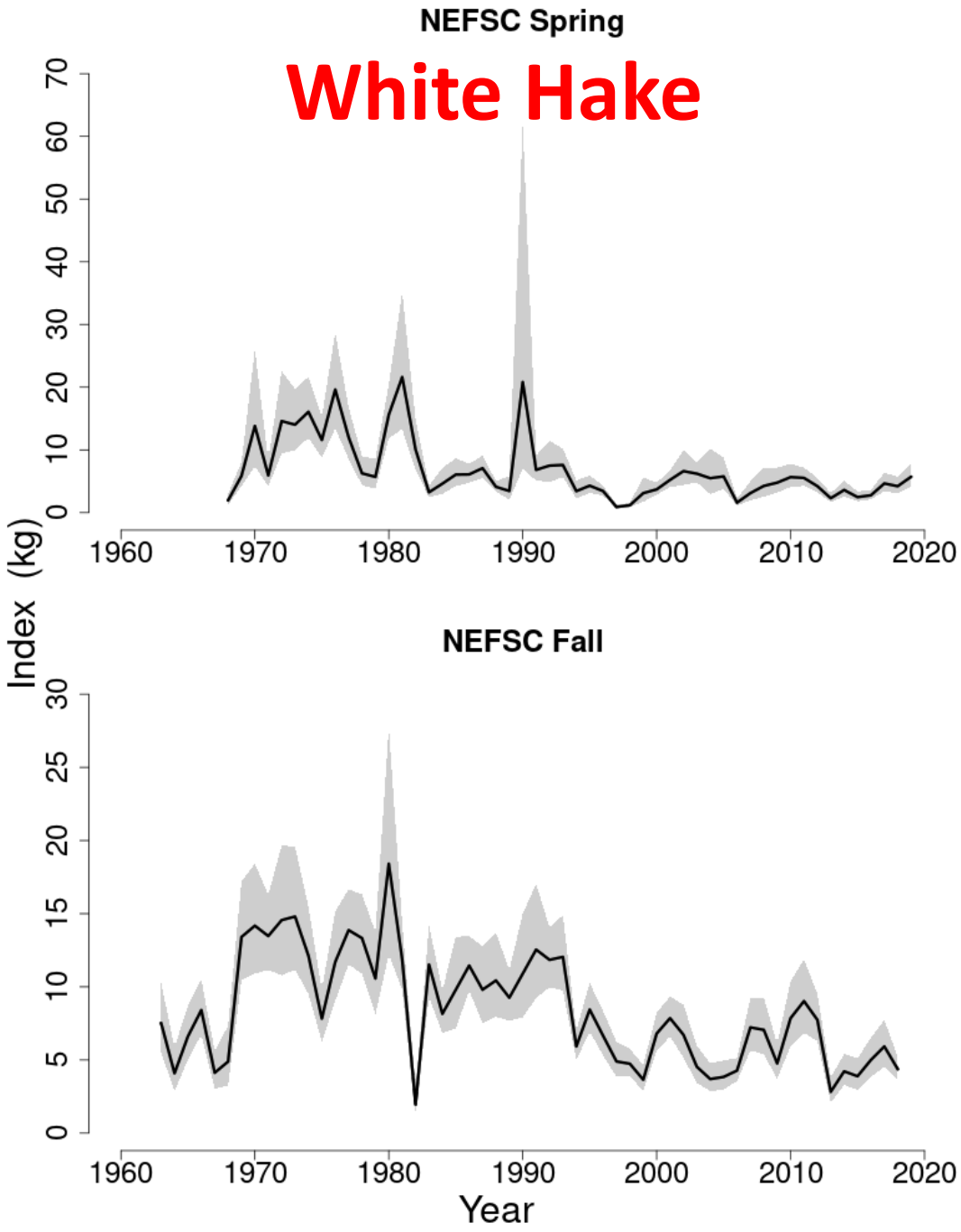

Biomass
0
10000
20000
30000
40000
50000
1960
1970
1980
1990
2000
2010
2020
Year


Exploitation rate
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1960
1970
1980
1990
2000
2010
2020
Year

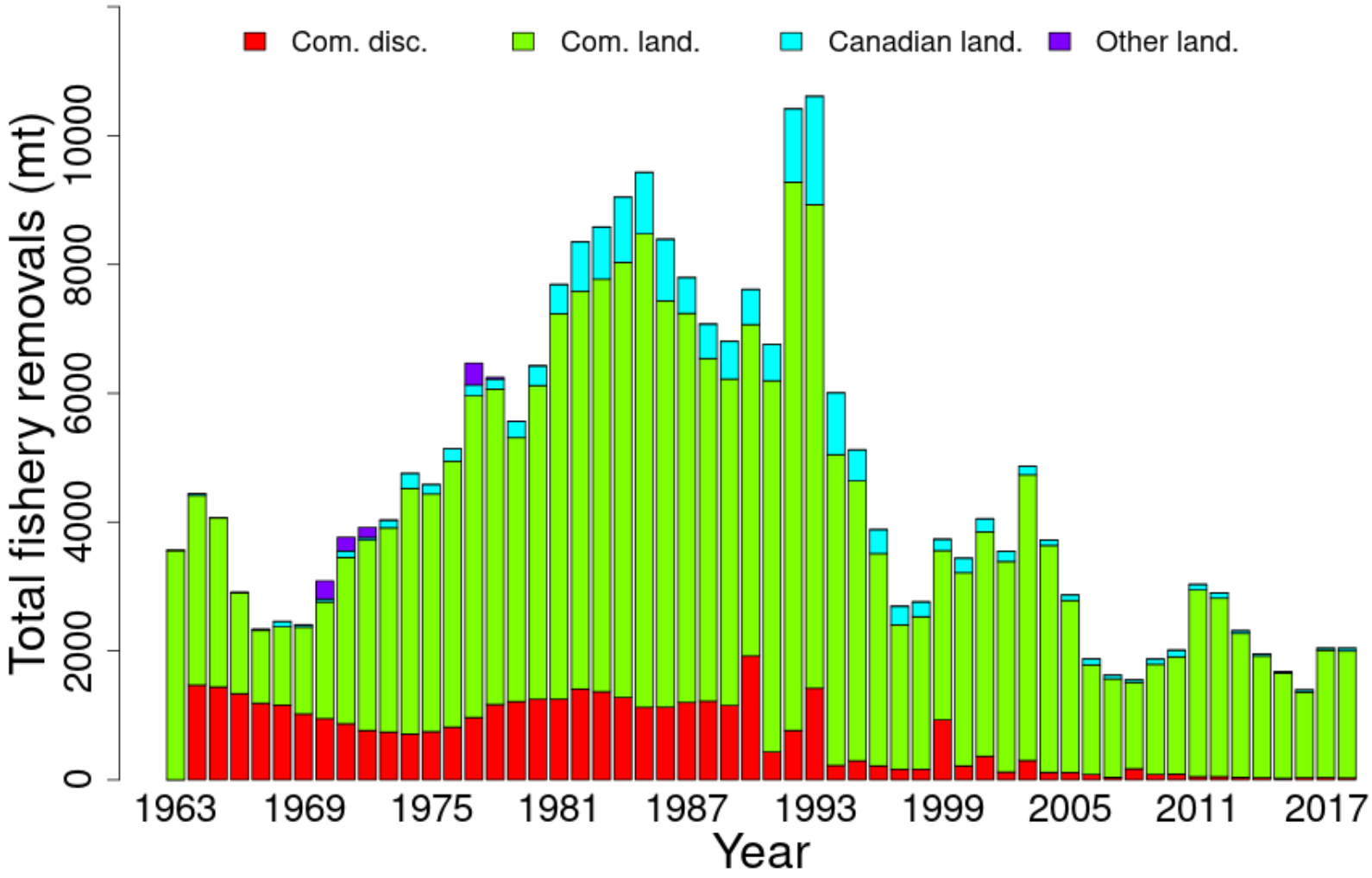
White Hake


Recruits
0
5000
10000
15000
1960
1970
1980
1990
2000
2010
2020
Year

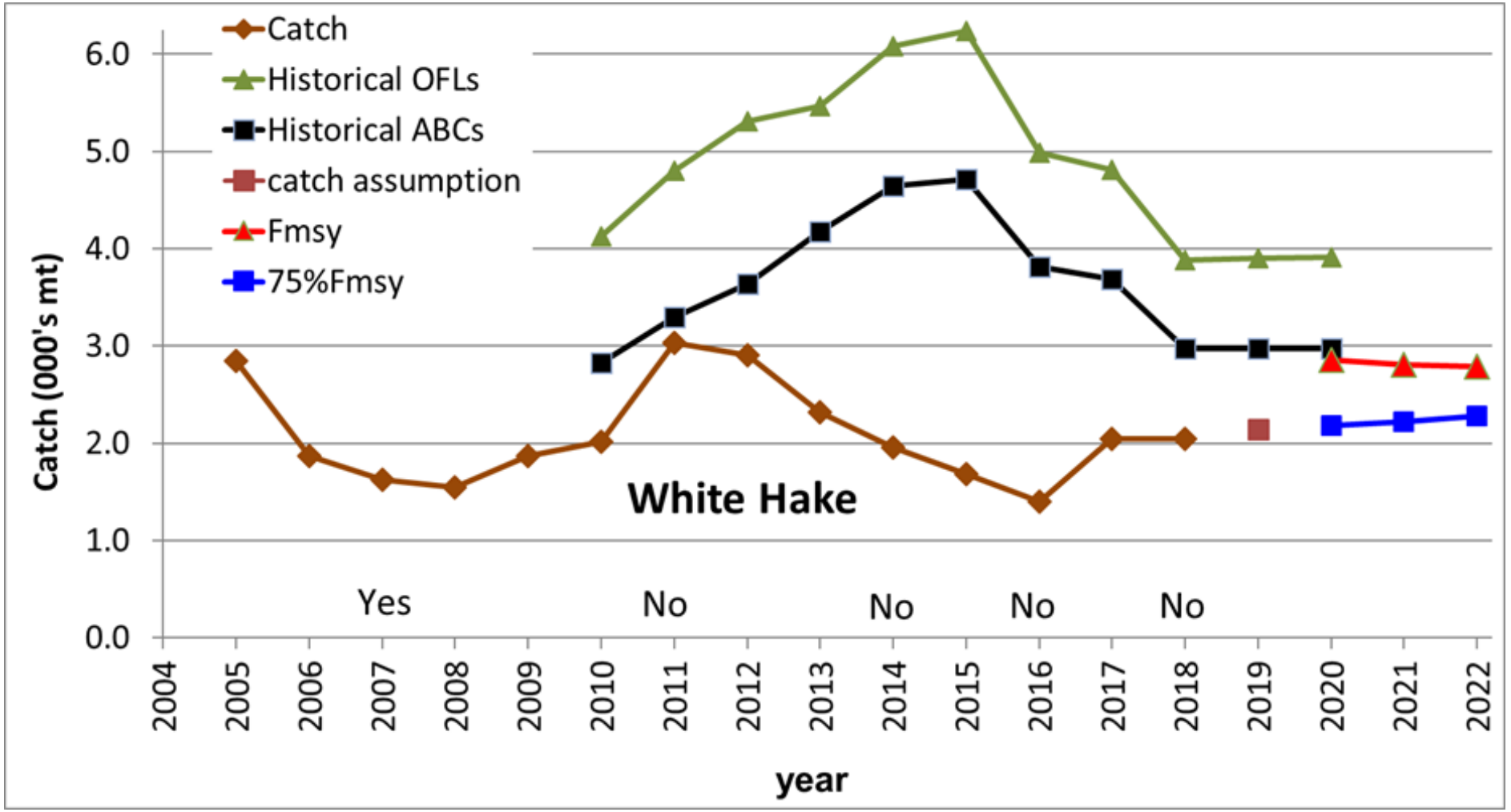
White Hake


NEFSC Spring
0
10
20
30
40
50
60
70
1960
1970
1980
1990
2000
2010
2020
NEFSC Fall
Index (kg)
0
5
10
15
20
25
30
1960
1970
1980
1990
2000
2010
2020
Year

White Hake


Com. disc.
Com. land.
Canadian land.
Other land.
Total fishery removals (mt)
0
2000
4000
6000
8000
10000
1963
1969
1975
1981
1987
1993
1999
2005
2011
2017
Year

White Hake


Catch
Historical OFLs
Historical ABCs
catch assumption
Fmsy
75%Fmsy
Catch (000's mt)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
White Hake
Yes
No
No
No
No
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
year

White Hake

Year	Catch	Historical OFLs	Historical ABCs	Catch Assumption	F_{MSY}	75%F_{MSY}
2010	2,012	4,130	2,832			
2011	3,034	4,805	3,295			
2012	2,903	5,306	3,638			
2013	2,316	5,462	4,177			
2014	1,955	6,082	4,642			
2015	1,680	6,237	4,713			
2016	1,396	4,985	3,816			
2017	2,043	4,816	3,686			
2018	2,044	3,885	2,971			
2019		3,898	2,971	2,140		
2020		3,916	2,971		2,857	2,186
2021					2,809	2,223
2022					2,791	2,279

White Hake

75%F_{MSY} Projection

year	OFL	ABC	F	SSB
2020	2,857	2,186	0.13	19,759
2021	2,906	2,223	0.13	20,305
2022	2,980	2,279	0.13	20,746

75%F_{MSY} First Year Constant Projection

year	OFL	ABC	F	SSB
2020	2,857	2,186	0.13	19,758
2021	2,906	2,186	0.12	20,308
2022	2,986	2,186	0.12	20,826


That's all Folks!

14 Groundfish Stocks

1. Southern New England/Mid-Atlantic Yellowtail Flounder
2. Cape Cod/Gulf of Maine Yellowtail Flounder
3. Georges Bank Winter Flounder
4. American Plaice
5. Southern New England/Mid-Atlantic Windowpane Flounder*
6. Gulf of Maine/Georges Bank Windowpane Flounder
7. Atlantic Halibut*
8. Georges Bank Cod*
9. Gulf of Maine Cod
10. Georges Bank Haddock
11. Gulf of Maine Haddock
12. Witch Flounder*
13. Pollock
14. White Hake

** Level 1 stocks*