New England Fishery Management Council
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DRAFT MEMORANDUM

DATE: September 24, 2018

TO: Herring Committee

FROM: Staff

SUBJECT: **Preliminary analysis of Amendment 8 alternatives modified by the Herring Committee**

The Herring Committee met on September 19, 2018 to identify final preferred alternatives for Amendment 8. During that discussion, several motions were made to add alternatives that modify existing alternatives in Amendment 8. Some analyses conducted by PDT members during the meeting, and additional analyses prepared since the meeting are included in this memo. If the Council approves these new alternatives, their analyses will be included and improved upon for the final Environmental Impact Statement.

1.0 Additional ABC Control rule – "Alternative 4b revised"

1. Description of alternative
2. Short-term analysis of Alternative 4b revised (2016-2018 and 2019-2021)
3. Long-term analysis of Alternative 4b revised

2.0 Additional measure to address potential localized depletion and user conflicts – 12nm coast wide prohibition of mid-water trawl gear in all areas

1. Description of possible alternative
2. Estimated herring and mackerel landings and revenues

In addition to Amendment 8 the Herring Committee discussed fishery specifications for fishing year 2019. A motion was made to recommend the Council request NOAA Fisheries take in-season action to set catch limits for fishing year 2019 with specific guidance for the specifications. However, the motion was postponed until the Council meeting. Some additional information has been included in this memo for that discussion at the Council meeting (Section 3.0).

1.0 ABC control rule Alternative 4b revised

The Herring Committee passed a motion to add an alternative in Amendment 8 that would modify Alternative 4b by increasing the maximum fishing mortality rate to 0.8 from 0.7, and leaving all the other control rule parameters the same. This section includes some preliminary analyses of that adjustment. The control rule parameters of this alternative are compared to the other alternatives in Amendment 8 in ***Table 1*** and ***Figure 1***.

Alternative 4 in Amendment 8 has six separate options (Alternatives 4a-4f). They are individual alternatives that all meet the criteria developed by the Committee and adopted by the full Council. In order for Alternative 4b revised to meet these criteria, the metric for "variation is yield" has to increase to 27%, compared to the original maximum of 25% identified by the Council. All other criteria are met with this control rule shape.

1. Set proportion of MSY at 100%, as low as 85%.
2. Set variation in yield <10%, as high as 25%.
3. Set probability of overfished at 0%, as high as 25%.
4. Set probability of ABC=0 between 0-10%.

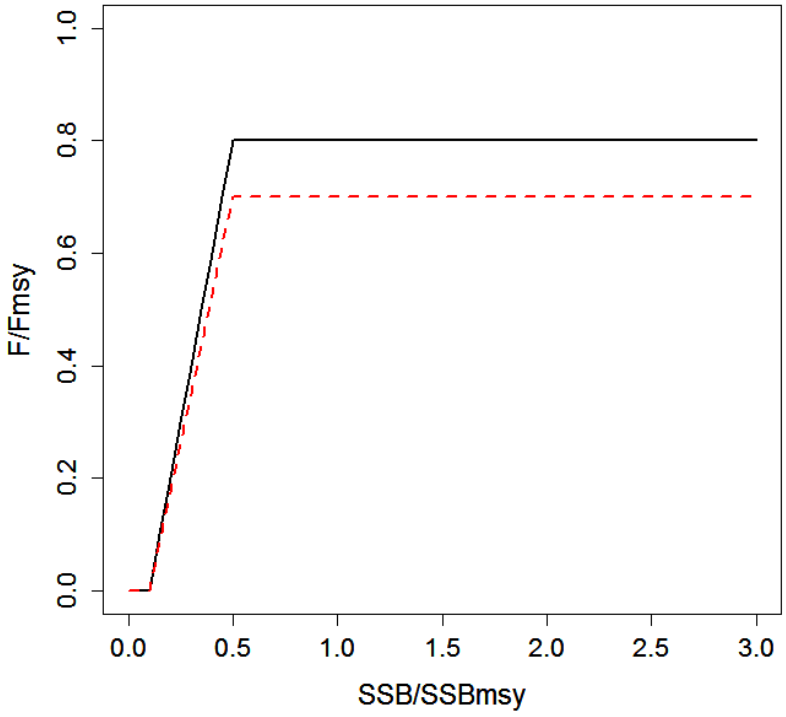
When the PDT used the Management Strategy Evaluation model developed for Amendment 8 with these criteria over 70 different control rule shapes fit these desired performance values. To reduce that to a practical number the Council added the three additional criteria below:

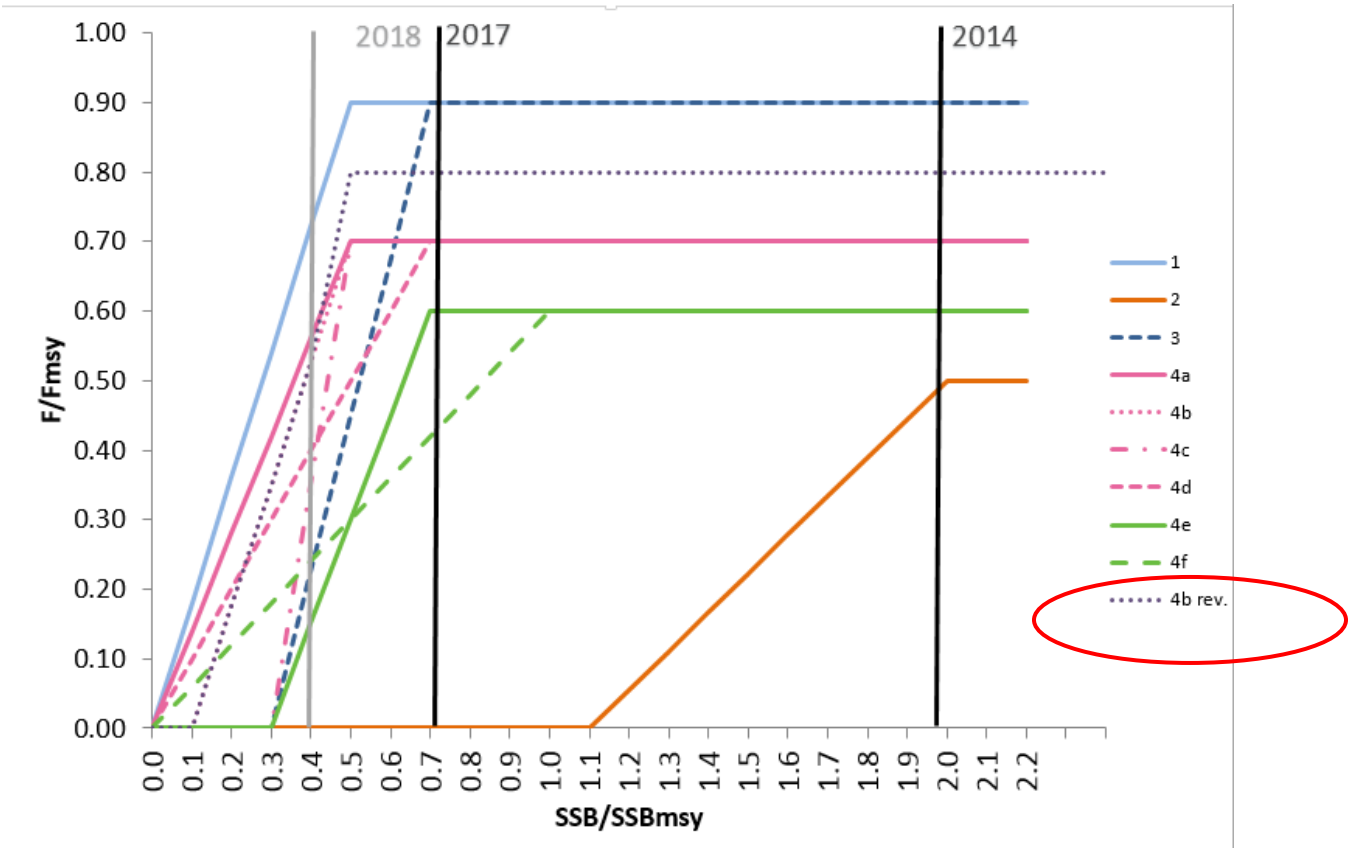
1. Remove any with an upper biomass parameter <0.5;
2. Set probability of overfished = 0;
3. Limit MSY to 88% only (removing shapes that allowed 85%-87%).

Table 1 – ABC CR alternatives with Alternative 4b revised compared to other Amendment 8 alternatives

	Upper Biomass Parameters	Lower Biomass Parameters	Max F
1. Strawman A	0.5	0.0	0.9
2. Strawman B	2.0	1.1	0.5
3. Parameters upfront	0.7	0.3	0.9
4a	0.5	0.0	0.7
4b	0.5	0.1	0.7
4b revised	0.5	0.1	0.8
4c	0.5	0.3	0.7
4d	0.7	0.0	0.7
4e	0.7	0.3	0.6
4f	1.0	0.0	0.6

Figure 1 – TOP: Alternative 4b revised recommended by the Herring Committee (black solid line) compared to Alternative 4b (red dashed line) and BOTTOM: Alternative 4b revised (purple dotted line) compared to all ABC control rule alternatives.





Short term impacts

2016-2018

If Alternative 4b revised was used to set specifications back in 2016-2018 the values in the bottom portion of ***Table 2*** would have been used. For comparison, results for other alternatives in Amendment 8 are presented again ("No Action" and projections for Alternatives 4a-4d that all have a max F of 0.7). A similar table was in Amendment 8 comparing potential ABCs for all alternatives (Table 94). ABCs for Alternative 4b revised would have been lower than No Action, Alternative 1, and Alternative 3, but higher than other Alternative 4 options and Alternative 2. Since biomass at that time was estimated to be above MSY, the maximum F would have been applied for all alternatives, and for Alternative 4b revised that is equal to 0.8.

Table 2 – ABC projections for 2016-2018 under different control rules

	No Action (Constant Catch that Produces Prob F>F_{MSY} = 0.50 in 2018)		
	2016	**2017**	**2018**
Median F	0.19	0.23	0.25
80%CI	0.13-0.29	0.15-0.36	0.15-0.42
Catch mt	111,000	111,000	111,000
80%CI	-	-	-
Prob SSB < SSBMSY (0.37$SSB_{F=0}$)	0.06	0.16	0.24
Prob SSB < 0.5$SSB_{F=0}$	0.24	0.41	0.49
Prob SSB < 0.75$SSB_{F=0}$	0.63	0.80	0.82
	Alts. 4a, 4b, 4c, 4d (0.7F_{MSY})		
Result	**2016**	**2017**	**2018**
F	0.17	0.17	0.17
Median Catch mt	100,000	86,000	84,000
Median SSB mt	565,000	484,000	466,000
Prob SSB < SSBMSY (0.37$SSB_{F=0}$)	0.03	0.04	0.08
Prob SSB < 0.5$SSB_{F=0}$	0.19	0.33	0.38
Prob SSB < 0.75$SSB_{F=0}$	0.63	0.81	0.83
	Alt. 4b REVISED (0.8F_{MSY})		
Result	**2016**	**2017**	**2018**
F	0.2	0.2	0.2
Median Catch mt	113,000	95,000	92,000
Median SSB mt	555,000	470,000	447,000
Prob SSB < SSBMSY (0.37$SSB_{F=0}$)	0.04	0.05	0.11
Prob SSB < 0.5$SSB_{F=0}$	0.21	0.37	0.43
Prob SSB < 0.75$SSB_{F=0}$	0.64	0.84	0.86

2019-2021

Based on the updated assessment, the ratio of 2018 SSB/SSBmsy is estimated to be 0.42 (42% of SSBmsy) if the full catch limit of 49,900 mt is harvested. That level of biomass is less than 0.5 (50% SSBmsy); therefore, allowable fishing mortality would be reduced under many of the control rule alternatives considered in Amendment 8. Under this scenario, the projected ABCs for 2019-2021 are very similar for Alternative 4b and Alternative 4b revised, but Alternative 4b revised is slightly higher (***Table 3***). Overall, the short-term impacts of Alternative 4b revised fall between Alternative 4b and Alternative 1 (***Figure 2*** through ***Figure 4***).

Table 3 – Comparison of short-term projections of ABC for 2019-2021 for Alternative 4b and Alternative 4b revised

4b original	2018	2019	2020	2021
Catch	49,900	18,980	15,541	29,615
F(ages 7-8)	0.51	0.29	0.17	0.2
SSB	79,673	54,526	60,355	128,666
P (overfishing)	0.5	0.1	0.01	0.02
P (overfished)	0.72	0.88	0.83	0.24
SSB/SSBmsy	0.42	0.29	0.32	0.68
4b revised	2018	2019	2020	2021
Catch	49,900	21,266	16,131	30,659
F(ages 7-8)	0.51	0.33	0.18	0.21
SSB	79,673	52,874	58,617	126,394
P (overfishing)	0.5	0.15	0.02	0.03
P (overfished)	0.72	0.88	0.84	0.26
SSB/SSBmsy	0.42	0.28	0.31	0.67

Figure 2 – ABC projections for Amendment 8, including Alternative 4b revised

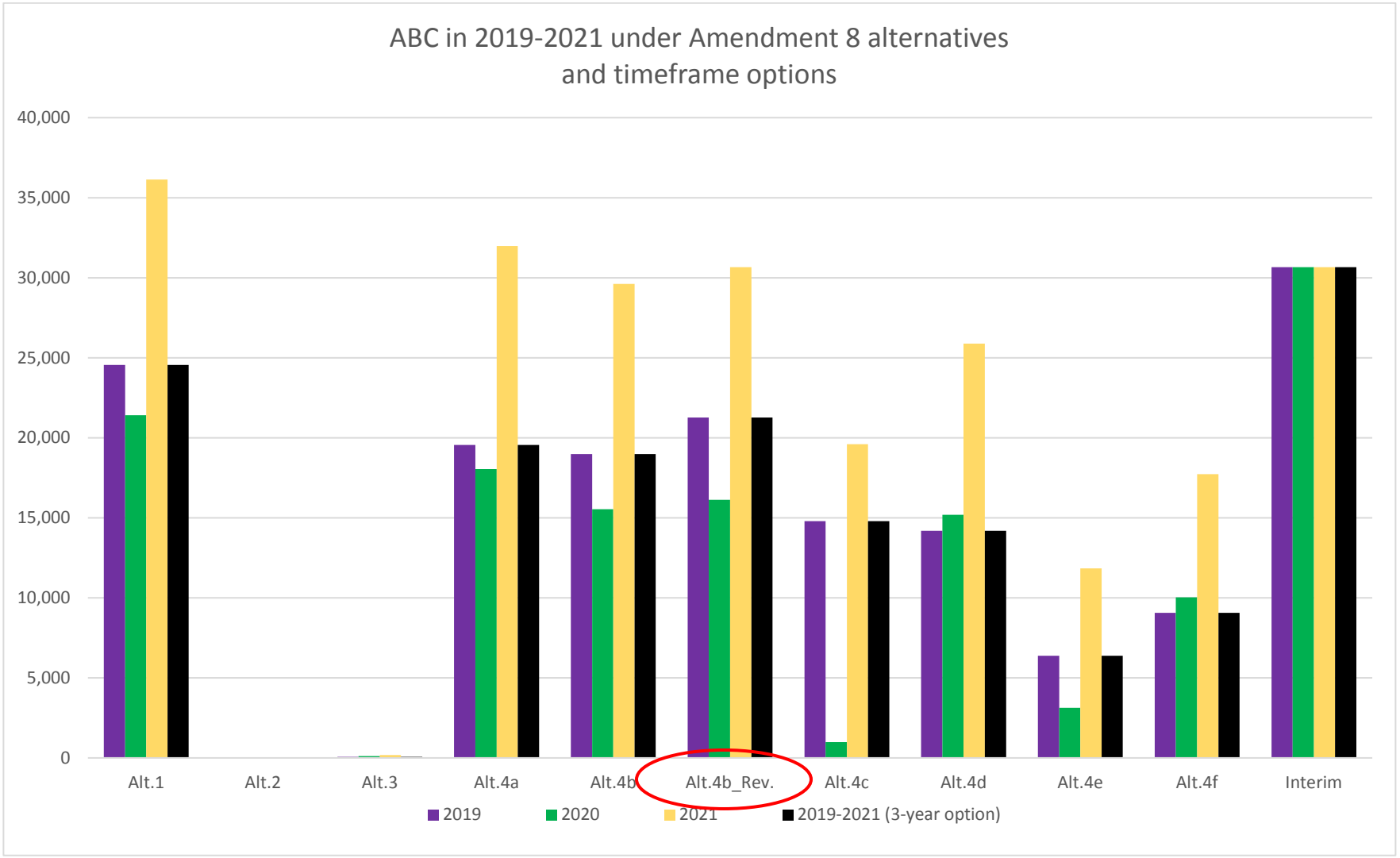


Figure 3 – Total ABC projections over three years, including Alternative 4b revised

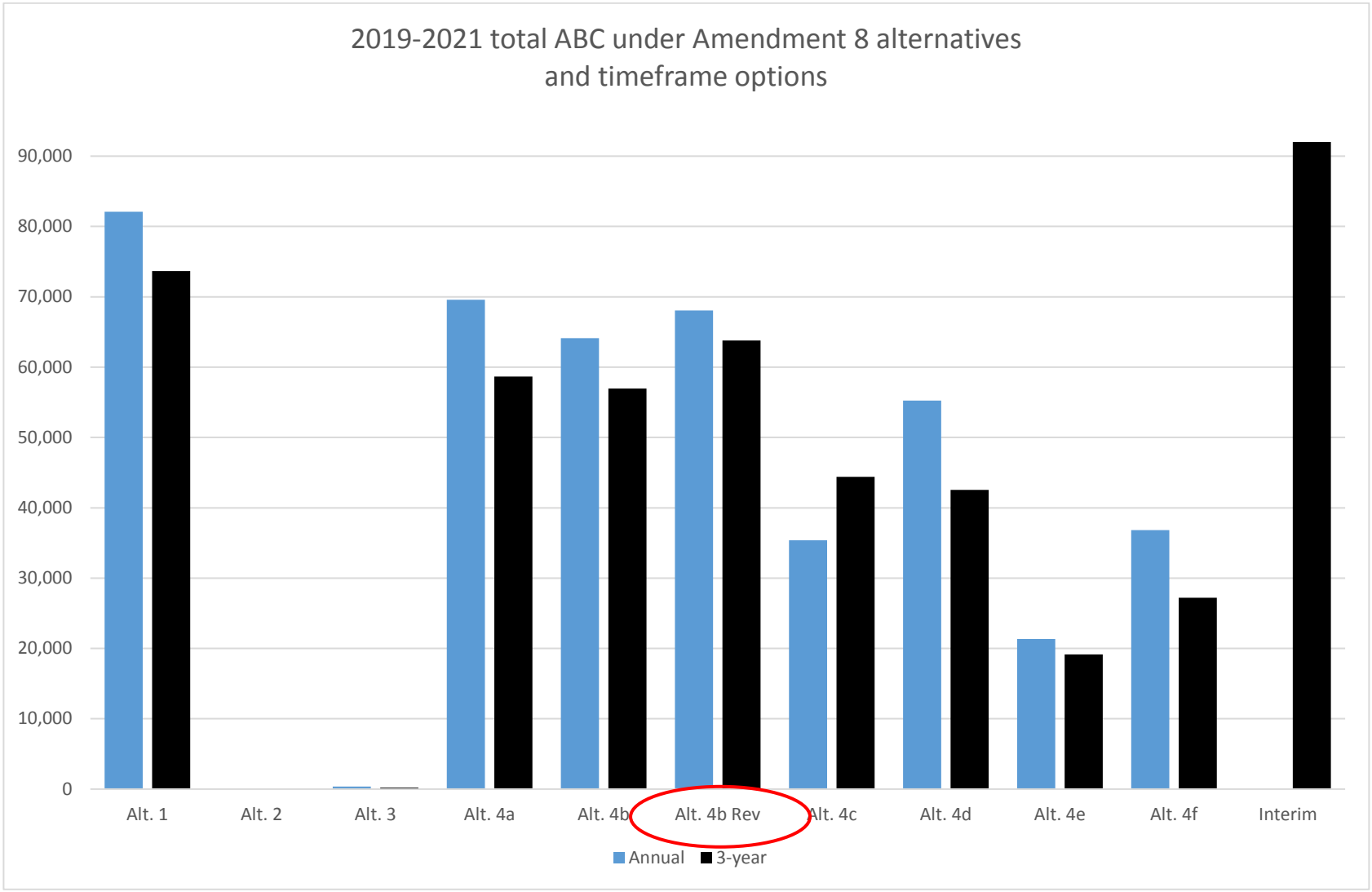
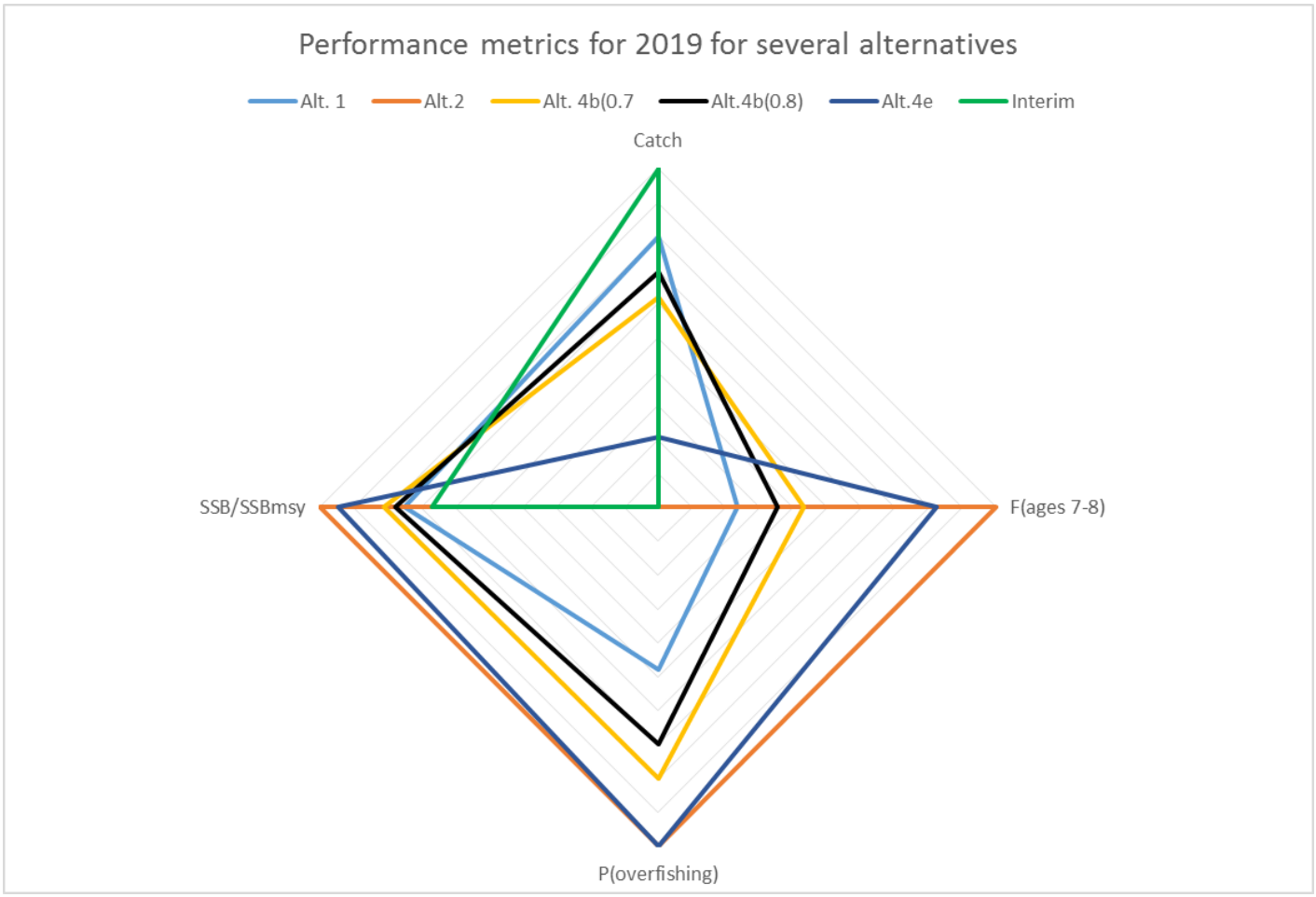


Figure 4 – Tradeoff plot for several ABC control rule alternatives comparing 2019 performance for several metrics



Long-term

Alternative 4b and 4b revised are expected to perform very similar in the long term, especially when the biased operating models are excluded (A,B, E and F). The results of the four metrics identified by the Committee to identify CR alternatives (yield relative to MSY, probability of fishery closure, probability of overfished, and variation in yield) have very similar performance for many of the alternatives (***Table 5***). Some variation does exist for other metrics such as probability of overfishing and proportion of years biomass is less than Bmsy (***Table 5***).

Table 4 – Median values for several performance metrics for Alternatives 4b, 4b revised, and Alternative 1 under four unbiased operating models

Operating Model		4b	4b revised	1
C	yield / MSY	0.82	0.85	0.85
	P of fishery closure	0	0	0
	P overfished	0	0	0.04
	Var in yield	0.24	0.23	0.27
D	yield / MSY	0.81	0.85	0.84
	P of fishery closure	0	0	0
	P overfished	0	0	0.06
	Var in yield	0.25	0.24	0.27
G	yield / MSY	0.88	0.91	0.89
	P of fishery closure	0	0	0
	P overfished	0.02	0	0.1
	Var in yield	0.29	0.26	0.33
H	yield / MSY	0.87	0.91	0.88
	P of fishery closure	0.04	0	0
	P overfished	0	0.02	0.1
	Var in yield	0.3	0.27	0.34

Table 5 – Median values for several performance metrics for Alternatives 4b, 4b revised, and Alternative 1 under four unbiased operating models

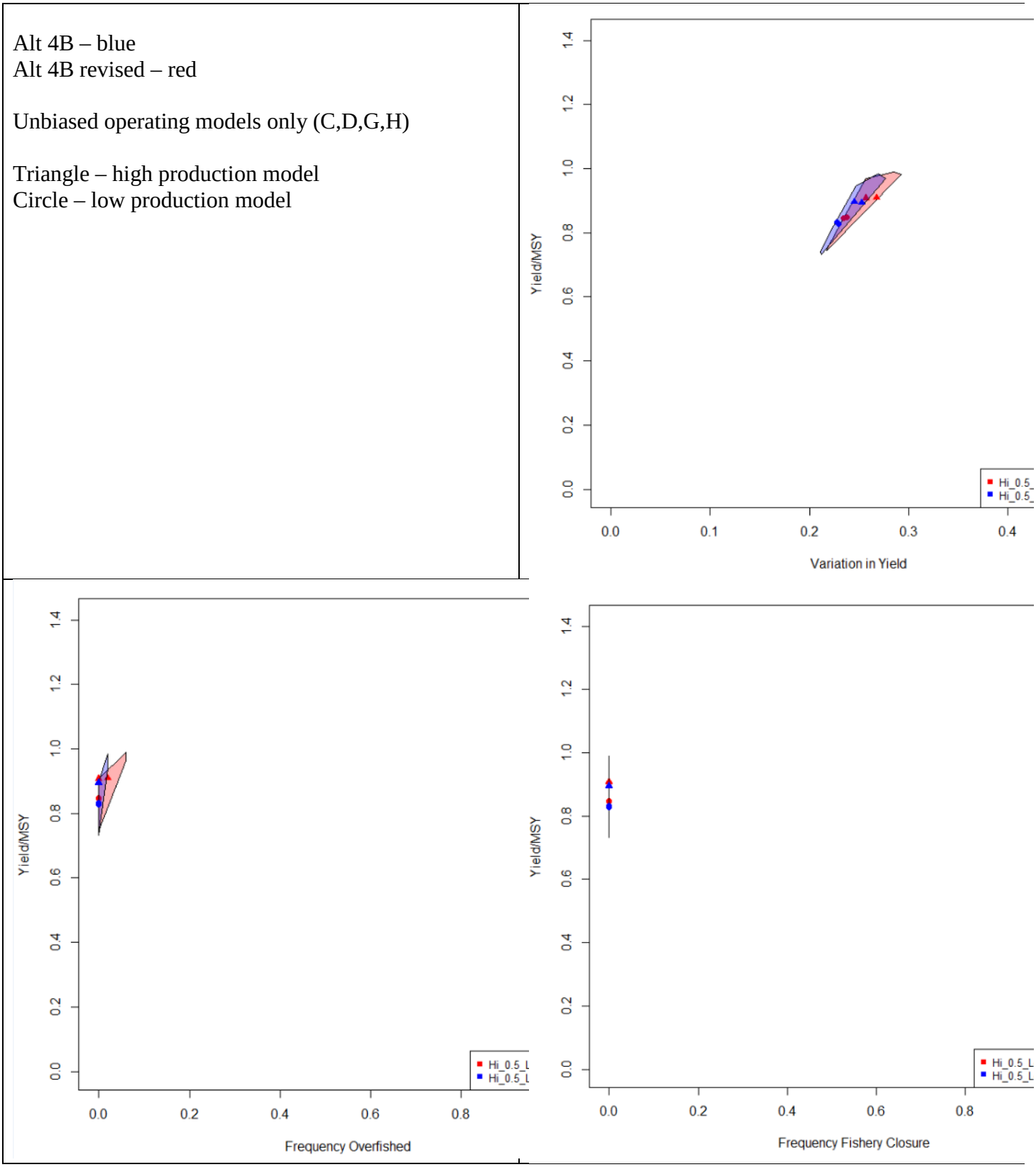
		4b	4b revised	1
C	P overfishing	0.14	0.20	0.34
	B < Bmsy	0.33	0.43	0.54
D	P overfishing	0.14	0.20	0.34
	B < Bmsy	0.33	0.44	0.54
G	P overfishing	0.18	0.24	0.36
	B < Bmsy	0.30	0.38	0.48
H	P overfishing	0.20	0.24	0.36
	B < Bmsy	0.32	0.38	0.50

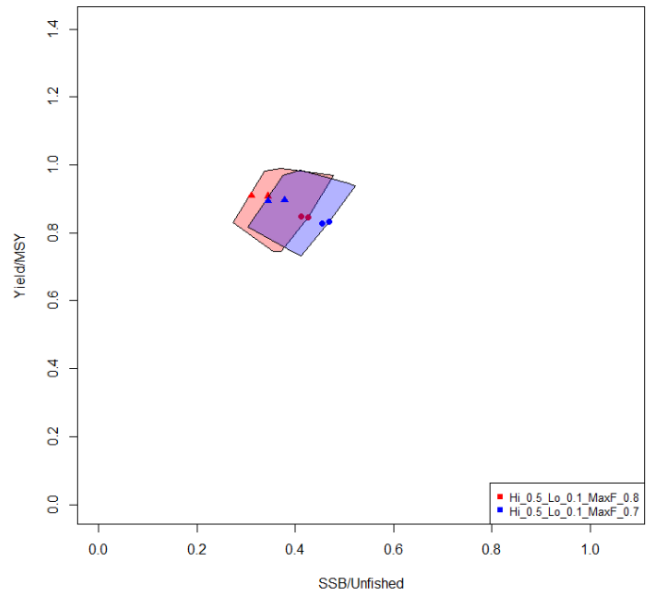
Figure 5 – Comparison of long-term impacts of Alternative 4b compared to Alternative 4b revised for several performance metrics

Alt 4B – blue
Alt 4B revised – red

Unbiased operating models only (C,D,G,H)

Triangle – high production model
Circle – low production model




Yield/MSY
SSB/Unfished
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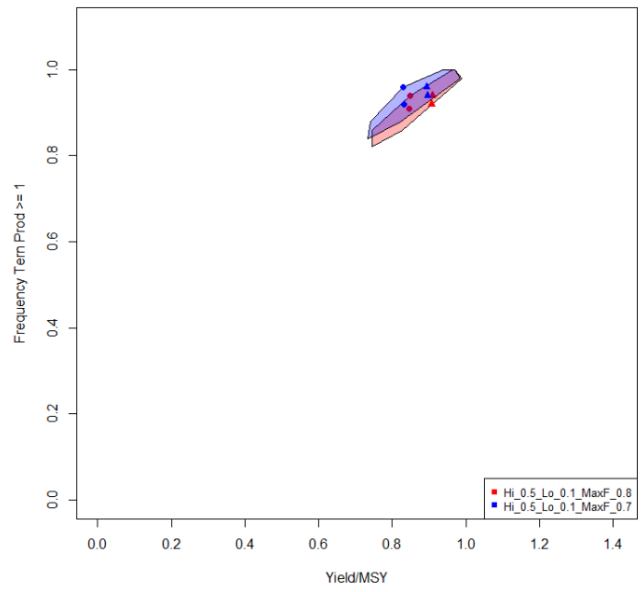
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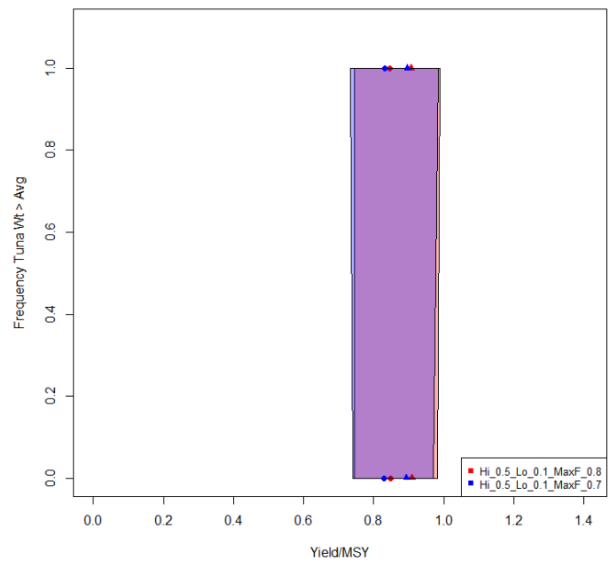

Frequency Tuna Wt > Avg
Yield/MSY
Hi_0.5_Lo_0.1_MaxF_0.8
Hi_0.5_Lo_0.1_MaxF_0.7

2.0 Measure to address potential localized depletion and user conflicts – 12nm coast wide prohibition of mid-water trawl gear

The Herring Committee passed a motion to adopt as preferred a coast wide 12 nautical mile prohibition on MWT gear from the Hague Line to the NC/SC border. The prohibition would be year-round in all herring management areas (1A, 1B, 2 and 3). This is essentially adopting Alternative 4 with seasonal sub-option A (year-round), and adding a new sub-option for area ("sub-option C" for all herring management areas).

Potential language if added to Amendment 8

Alternative 4: Prohibit midwater trawl gear inside of 12 nautical miles south of Area 1A (*Figure 6*)

Under Alternative 4, waters within 12 nautical miles would be closed to midwater trawl gear; for specific areas and times that vary based on the spatial and seasonal sub-options identified. If adopted, vessels with any Atlantic herring permit (limited or open access) could not use, deploy, or fish with midwater trawl gear in this area and season. A vessel with midwater trawl gear on board may transit the area, provided such midwater trawl gear is stowed and not available for immediate use. Vessels approved to use other gear types would still be permitted to fish for herring, i.e., purse seine or fixed gears, and small mesh bottom gear (only with approved gears and under specific regulations for small mesh exemption areas). Vessels that currently use midwater trawl gear would be permitted to convert to other gear types if they want to fish for herring in this area.

Area options (only one sub-option will apply)

Sub-option A – Herring Management Areas 1B, 2 and 3

This sub-option would include all areas south of Herring Management Area 1A. Because there is a seasonal prohibition on midwater trawl gear in Area 1A already, this option was developed to focus on coastal waters that do not already have measures in place to reduce the potential of negative impacts on other users that depend on herring for forage.

Sub-option B - Herring Management areas 1B and 3 only

This sub-option would limit the gear prohibition to Areas 1B and 3; there would not be any gear prohibitions in Herring Management Area 2. Most of the concerns raised during this process have been focused around the backside of the Cape and farther north. Therefore, this sub-option would not include any gear prohibitions for the southernmost Herring Management Area (Area 2).

Sub-option C – All Herring Management areas: 1A, 1B, 2 and 3

Seasonal options (only one sub-option will apply)

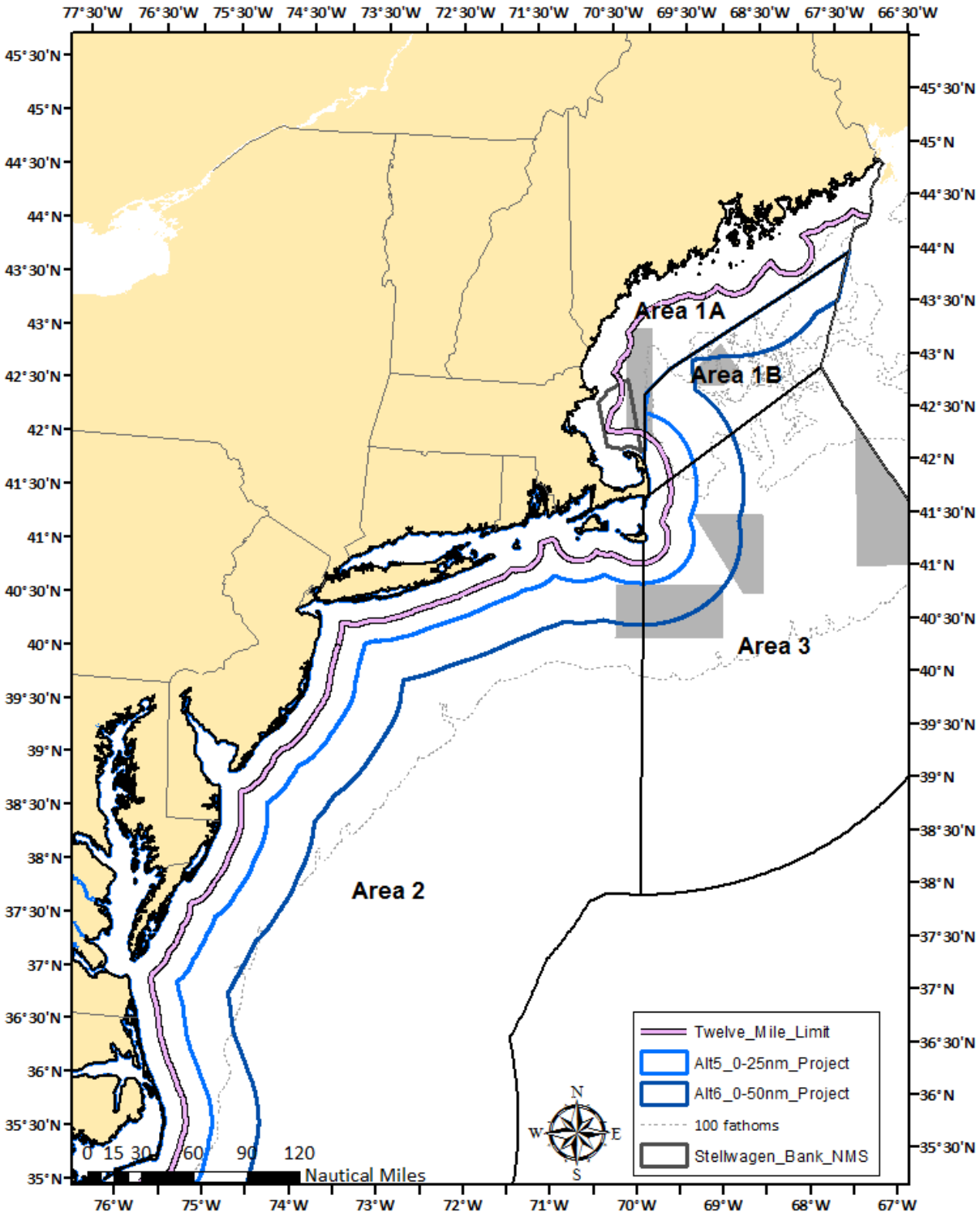
Sub-option A – Year round (12 months)

This sub-option would prohibit the use of midwater trawl gear within 12 nautical miles year-round.

Sub-option B – June 1 – September 30 (4 months)

This sub-option would prohibit the use of midwater trawl gear within 12 nautical miles from June 1 – September 30 (4 month restriction).

Figure 6 – Alternative 4 with spatial sub-option "C", applies to all herring management areas 1A, 1B, 2 and 3 (light purple)



Potential Economic Impacts

Alternative 4 (12 nm)

- Area Sub-option C – coast wide from Hague Line to NC/SC border
- Seasonal sub-option A – year round

To estimate potential economic impacts of this alternative the existing analyses of Alternative 4 and Alternative 3 can be combined. Alternative 4 considers impacts of a MWT prohibition within 12nm in Areas 1B, 2 and 3, and Alternative 3 considers a prohibition of MWT in Area 1A year round. The Herring Committee alternative would therefore include Alternative 4 spatial sub-option A (Areas 1B, 2, and 3) with seasonal sub-option A (year round); as well as a portion of Alternative 3 (inside of 12nm only, rather than all of Area 1A). This section summarizes those potential additive impacts.

Overall, the impacts are expected to fall somewhere between options considered in Amendment 8; specifically impacts would potentially be between Alternative 4 and Alternative 6 (prohibiting MWT gear 50 nm from shore in Areas 1B, 2 and 3). The tables below are taken from Amendment 8 and a preliminary estimate of combined impacts is presented after because there was not sufficient time to estimate landings and revenues for a coast wide 12 nm alternative, but those more precise estimates would be added to the final EIS if this alternative is adopted. **The expected economic impacts of Alternative 4 is about 18% in terms of MWT revenues. When the 12nm prohibition is extended through Area 1A that is estimated to impact over 30% of MWT total revenues, an additional 10-15% potential impact. Therefore, the impacts are likely between Alternative 5 and Alternative 6 already considered in the DEIS.**

Alternative 4

Table 6 – Annualized Atlantic herring MWT landings south of Area 1A (Alternatives 4, 5, 6)

Sub-options		Description	Time period	Herring MWT landings south of Area 1A (mt)			
Area	Season			Inside 12 nm	Inside 25 nm	Inside 50 nm	Total
A	A	Areas 1B, 2 & 3; year round	2000-2007	9,793 (15%)	14,072 (21%)	19,913 (30%)	66,979 (100%)
			2007-2015	11,457 (20%)	15,583 (28%)	23,338 (42%)	56,205 (100%)
A	B	Areas 1B, 2 & 3; June-Sept	2000-2007	102 (0.3%)	194 (0.6%)	1,748 (5.8%)	29,911 (100%)
			2007-2015	780 (3.7%)	1,175 (5.5%)	4,173 (20%)	21,286 (100%)
B	A	Areas 1B & 3; year round	2000-2007	5,125 (7.7%)	6,696 (10%)	9,179 (14%)	66,979 (100%)
			2007-2015	4,326 (7.7%)	5,960 (11%)	10,315 (18%)	56,205 (100%)
B	B	Areas 1B & 3; June-Sept	2000-2007	75 (0.3%)	166 (0.6%)	1,720 (5.8%)	29,911 (100%)
			2007-2015	760 (3.6%)	1,155 (5.4%)	4,154 (20%)	21,286 (100%)

*Note: "*2000-2007" includes data through May 2007, pre-Amendment 1 implementation. "2007-2015" includes data from June 2007 onward. "Total" for all rows includes all landings south of 1A. *Source:* VTR

Table 7 – Annualized Atlantic herring and mackerel MWT revenue (Alternatives 4, 5, 6)

Sub-options		Description	Time period	Herring/mackerel MWT average nominal revenue			
Area	Season			Inside 12 nm	Inside 25 nm	Inside 50 nm	Total all areas
A	A	Areas 1B, 2 & 3; year round	2000-2007	$3.7M (13%)	$6.8M (24%)	$13M (45%)	$28.9M (100%)
			2007-2015	$3.3M (18%)	$4.9M (26%)	$8.0M (43%)	$18.7M (100%)
A	B	Areas 1B, 2 & 3; June-Sept	2000-2007	$29K (0.4%)	$52K (0.7%)	$0.5M (5.8%)	$7.9M (100%)
			2007-2015	$0.3M (4.4%)	$0.4M (5.9%)	$1.3M (19%)	$6.8M (5.7%)
B	A	Areas 1B & 3; year round	2000-2007	$1.4M (4.8%)	$1.8M (6.4%)	$2.6M (8.9%)	$28.9M (100%)
			2007-2015	$1.2M (6.4%)	$1.6M (8.6%)	$2.9M (16%)	$18.7M (100%)
B	B	Areas 1B & 3; June-Sept	2000-2007	$22K (0.3%)	$45K (0.6%)	$0.4M (5.1%)	$7.9M (100%)
			2007-2015	$0.2M (2.5%)	$0.4M (5.1%)	$1.3M (16%)	$7.9M (100%)

*Note: "*2000-2007" includes data through May 2007, pre-Amendment 1 implementation. "2007-2015" includes data from June 2007 onward. *Source:* VTR analysis.

Table 8 – Annualized Atlantic mackerel landings (mt) south of Area 1A, midwater trawl only (Alternative 4, 5, 6)

Sub-options		Description	Time period	Mackerel MWT landings south of Area 1A (mt)			
Area	Season			Inside 12 nm	Inside 25 nm	Inside 50 nm	Total
A	A	Areas 1B, 2 & 3; year round	2000-2007	2,618 (8.7%)	7,499 (25%)	21,341 (71%)	30,082 (100%)
			2007-2015	842 (12%)	2,116 (30%)	4,790 (69%)	6,993 (100%)
A	B	Areas 1B, 2 & 3; June-Sept	2000-2007	0	0	0	<10
			2007-2015	<1	<1	<1	<10
B	A	Areas 1B & 3; year round	2000-2007	59 (0.2%)	73 (0.2%)	146 (0.5%)	30,082 (100%)
			2007-2015	145 (2.1%)	203 (2.9%)	249 (3.6%)	6,993 (100%)
B	B	Areas 1B & 3; June-Sept	2000-2007	0	0	0	<10
			2007-2015	<1	<1	<1	<10

Alternative 3

The proportion of total revenue from Area 1A for MWT vessels has decreased since Amendment 1 prohibited access from June-September. Other measures have been adopted as well that have had impacts on the distribution of catch by area, but overall before Amendment 1 about 30% of total revenue for MWT vessels was from Area 1A, and that has decreased to under 20% (**Table 6**). The proportion of total catch from within 12 nm in Area 1A changes annually as well. Until more detailed analyses can be completed, it appears that about 75% of recent MWT activity has been within 12 nm in Area 1A (***Figure 7*** Figure 8). Therefore, if 75% of recent MWT revenue from area 1A is not available (0.75*$3.3 million) that would have an impact of about $2.5 million dollars annually. If that impact is added to the 12nm estimate of revenue impact from Alternative 4 (Areas 1B, 2 and 3), which is an additional $3.3 million in revenues from the other herring management areas, the total estimate of revenue impact could be about $5.8 million, or over 30% of total revenues.

In addition, NEFSC Cooperative Research Branch has been placing electronic logbooks (FLDRS) on MWT vessels for several years. The first vessel was hooked up in January 2014 and more have been added over the years. Currently seven paired and single MWT vessels are reporting catch on a tow-by-tow basis. Each tow, vessels report catch, location as well as other data. To help estimate the proportion of revenue within the various Amendment 8 alternatives, those data can be summarized by date and location (***Table 10***). The estimated revenue within Alternative 3 from these data is about 25% of total MWT revenue, and Alternative 4 is 16%. These estimates are very similar considering these are a sub-set of the fleet. When these data are plotted for the new modification of Alternative 4 recommended by the Herring Committee, a 12nm coast wide prohibition on MWT gear, the estimated revenue potentially impacted by that alternative is about 35% of total MWT revenues, again relatively similar to the estimate above of 30%.

Table 9 – Annualized Atlantic herring and mackerel revenue year-round within Area 1A, MWT gear only (Alternative 3)

Jan 2000 – May 2007		June 2007 – December 2015	
Inside 1A	**All areas**	**Inside 1A**	**All areas**
$8,723,038 (30.2%)	$28,860,674	$3,338,647 (17.8%)	$18,734,867

Table 10 – Estimate of herring and mackerel revenues within a subset of Amendment 8 alternatives from MWT vessels that participate in the voluntary study fleet program

Alt. #	Sub-Option	Description	Herring ($)	Mackerel ($)	Total Value Inside	% of Total Value
3		1A Closed	3,978,165	3,853,260	7,831,425	25.20%
4	A-A	12 mile - 1B, 2, 3 - Year Round	4,021,929	880,934	4,902,863	15.78%
4	C-A	12 Mile - All Areas - Year Round	6,733,374	4,320,494	11,053,868	35.58%

Figure 7 – MWT herring landings (2011-2015)

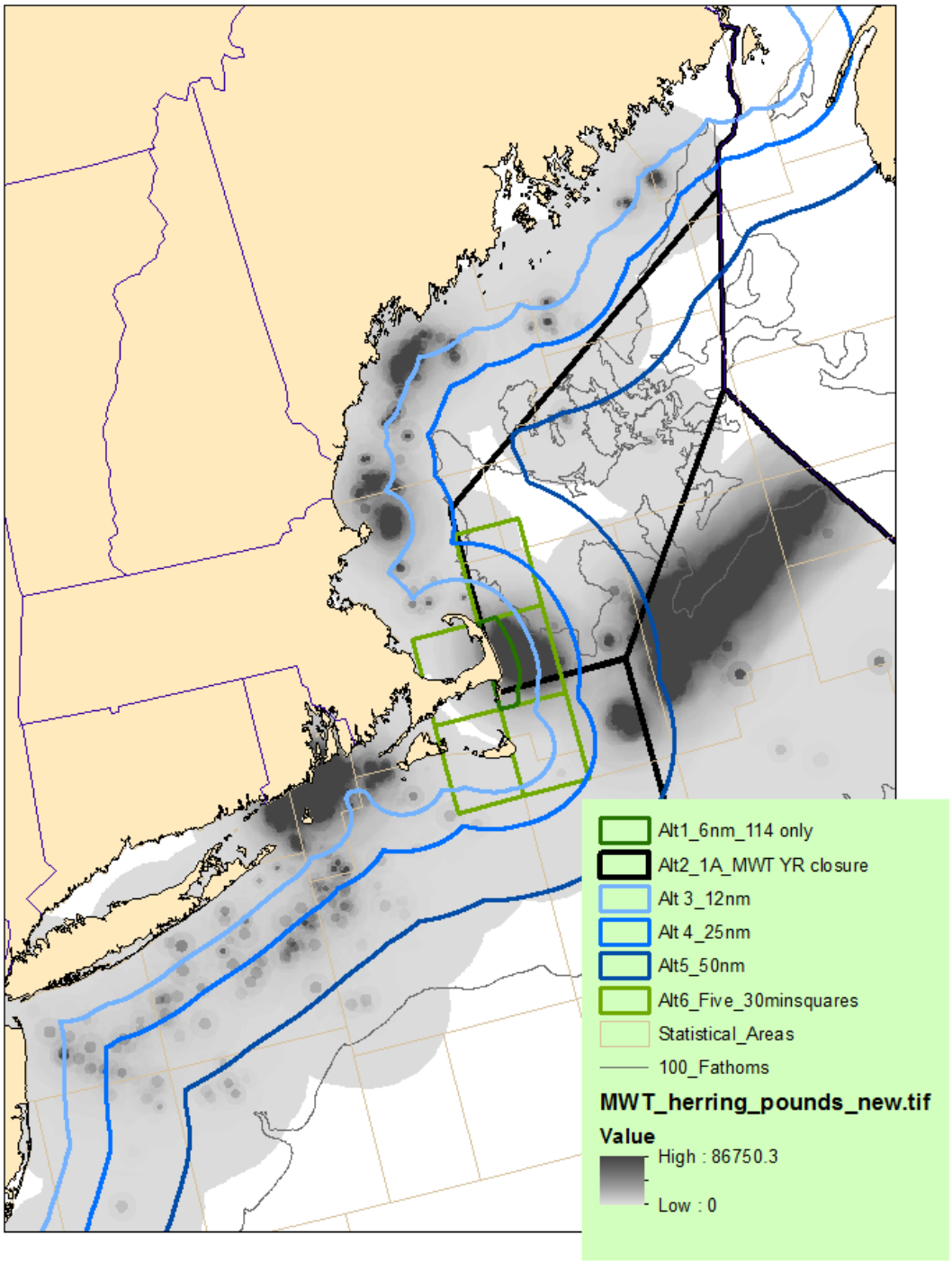
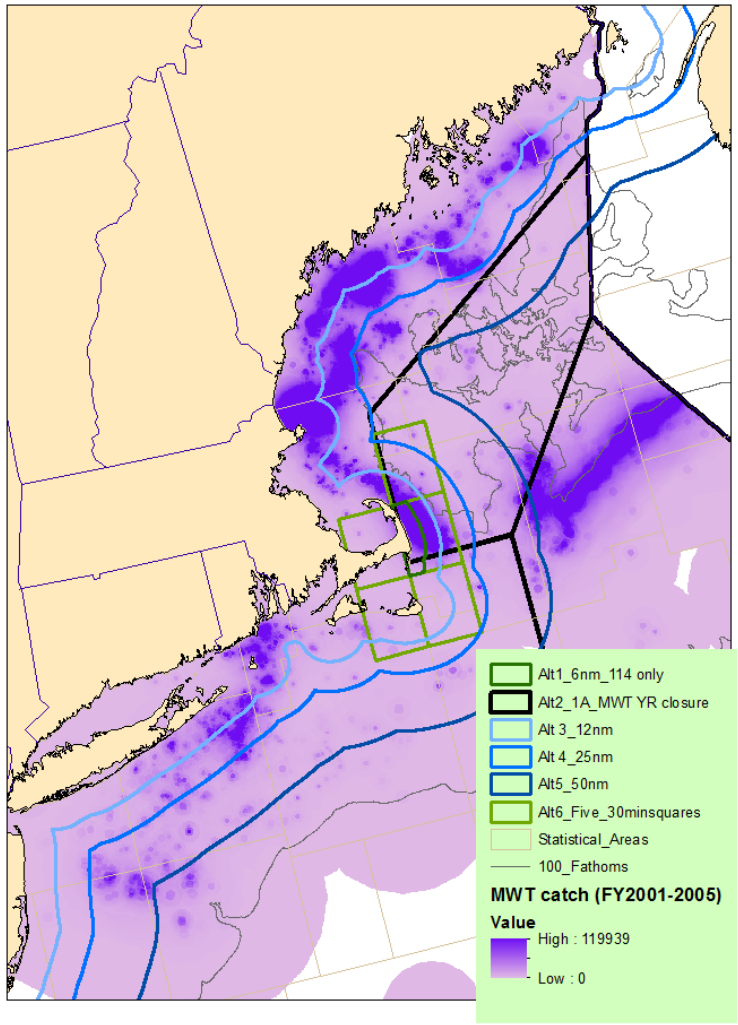
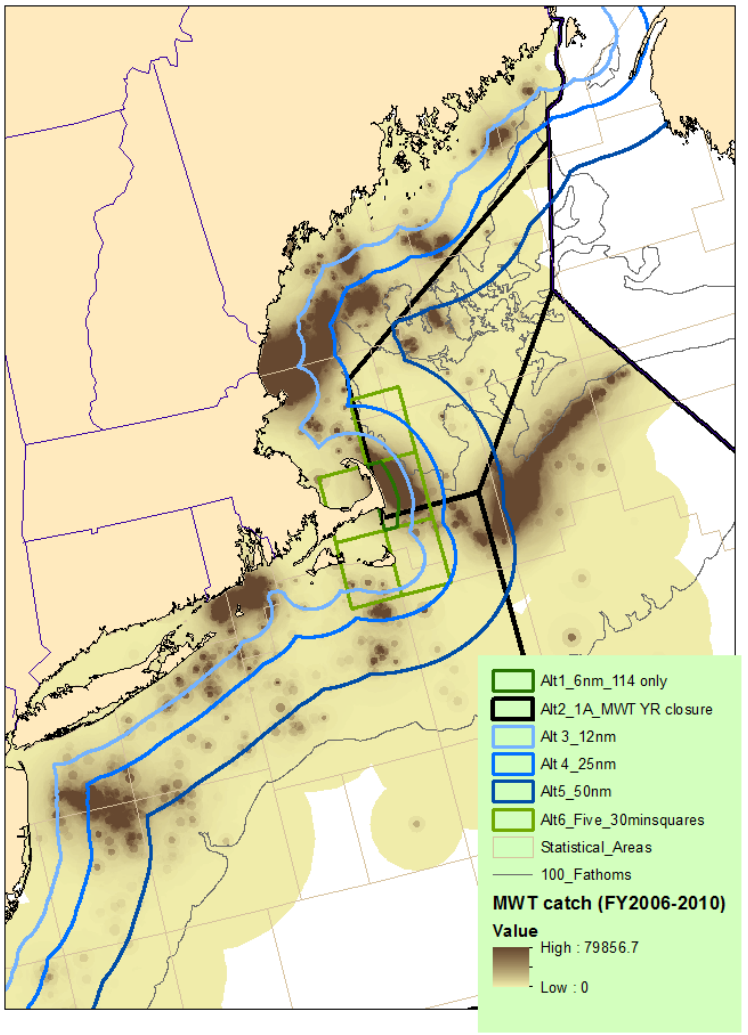


Figure 8 - **MWT herring landings 2001-2005 (on left) and 2006-2010 (on right)**





Impacts on Atlantic herring fishery

Alternative 4 - Area sub-option A (Areas 1B, 2 &3) and seasonal sub-option A (year-round). The impacts on the Atlantic herring fishery of Alternative 4, area sub-option A, seasonal sub-option A are expected to be ***negative relative to all the other Alternative 4 sub-options, primarily impacting midwater trawl vessels***; it would result in the most times/areas closed. From 2000-2007, Atlantic herring landings attributed to MWT fishing inside 12 nm in Areas 1B, 2, and 3 were 15% of the annual herring MWT landings for these Areas (**Table 7**). Since 2007, the 12 nm zone became more important, comprising 20% of the total. Atlantic herring and mackerel revenue attributed to MWT fishing in this area/season has been about $3.3-3.7M/year, 13-18% of the fishery-wide MWT revenue since 2000. If midwater trawls can no longer fish inside 12 nm in Areas 1B, 2, and 3 year-round (except for RSA fishing), the Area 1B sub-ACL is not expected to be fully harvested, though Area 1B is a small fraction of the total sub-ACL. Given the *importance* of the area/season of this option to the MWT fishery in the past, this option *may impede* the ability to harvest optimum yield, unless the allowable catch is harvested with other gear types.

Any fishery closure may hamper adaptability to changing conditions and may result in foregone revenue. It is difficult to determine if fishing would be precluded altogether or shift to other areas. To some degree, the ability of herring MWT vessels to fish in other management areas/seasons would mitigate negative impacts, particularly offshore, which is more accessible to the MWT fleet than other gear types. However, there are several constrains to doing so (e.g., carrier limits, operational constraints, herring are migratory, increased costs of fishing offshore. Costs for trips occurring outside of 12 nm are generally double those occurring inside 12 nm.

Impacts for ***purse seine and SMBT vessels may be more neutral***, unless there is increased crowding from effort shifts. Given the regulatory restrictions on SMBTs, it is unlikely that this gear would expand substantially into Areas 1B and 3. Use of purse seines is unlikely on the "back side of the Cape" and offshore, as purse seining is difficult in strong tides, rough ocean conditions, and when herring occur in deep water. MWT vessels may shift to fishing outside of 12 nm within Area 1B and still harvest the sub-ACL, but most fishing in Area 1B is currently inside of 12 nm.

Impacts on Atlantic mackerel fishery

Area sub-option A (Areas 1B, 2 &3) and seasonal sub-option A (year-round). The impacts on the Atlantic mackerel fishery of Alternative 4, area sub-option A, seasonal sub-option A are expected to be ***negative relative to all the other Alternative 4 sub-options***; it would result in the most times/areas closed. From 2000-2007, Atlantic mackerel landings attributed to fishing with midwater trawl year-round in areas inside 12 nm, south of Area 1A were 8.7% of the total for all areas by that gear type (**Table 9**). Since then, the contribution has increased to 12%, though total mackerel landings declined by 77%. Atlantic herring and mackerel revenue attributed to MWT fishing in this area year-round has been about $3.3-3.7M/year, 13-18% of the fishery-wide MWT revenue since 2000 (**Table 8**).

Impacts on American lobster fishery

The impacts on the American lobster fishery of Alternative 4 are expected to be ***negative to low negative relative to Alternative 1,*** depending on the Alternative 4 options selected. There would be more times and areas closed to the herring midwater trawl fishery, potentially impairing the bait market. As herring prices are generally insensitive to quantity changes, if this measure reduces herring landings, then the price of herring for bait could increase, potentially increasing costs for the lobster fishery. Considering just the recent (2007-2015) herring revenue from the areas/seasons under consideration, and depending on the options selected, the impacts

of Alternative 4 would be ***negative relative to Alternative 2, negative to neutral relative to Alternatives 3, 7 and 8, neutral to positive relative to Alternatives 5 and 6,*** depending on if bait supply becomes more limited***.*** Impacts would be ***negative relative to Alternative 9,*** as a new seasonal closure would likely be more negative than removing the January-April Area 1B closure, which may lower costs to the lobster fishery. ***Of the Alternative 4 sub-options, A/A would have the most negative impact and B/B would be least negative***.

Impacts on predator fisheries and ecotourism

The impacts on predator fisheries and ecotourism of Alternative 4 are expected to be ***uncertain, but potentially low positive relative to Alternative 1***. Assuming that removing overlap between the midwater trawl Atlantic herring and predator fisheries and ecotourism is a positive outcome for the predator fisheries and ecotourism, this alternative would have a positive effect, based on the overlap analysis, with its assumptions and limitations. If MWT fishing shifts to other times/areas remaining open, there may be negative impacts to the degree new overlaps result. If it is replaced by other gear types, negative outcomes for predator fisheries may result from overlap with these gears. Fishing within 12 nm in Areas 1B, 2 and 3 is most important to the herring MWT fishery during December and January; however, user overlaps are likely to be highest in the late spring-fall.

When Alternative 4 is extended into Area 1A, these low positive impacts would be even higher because Area 1A contains more areas with overlap for the tuna and whale watch industries. Alternative 3 by far has contained more overlap of MWT effort and tuna/whale watch use areas, especially in the fall when the overlap index of these users is the highest.

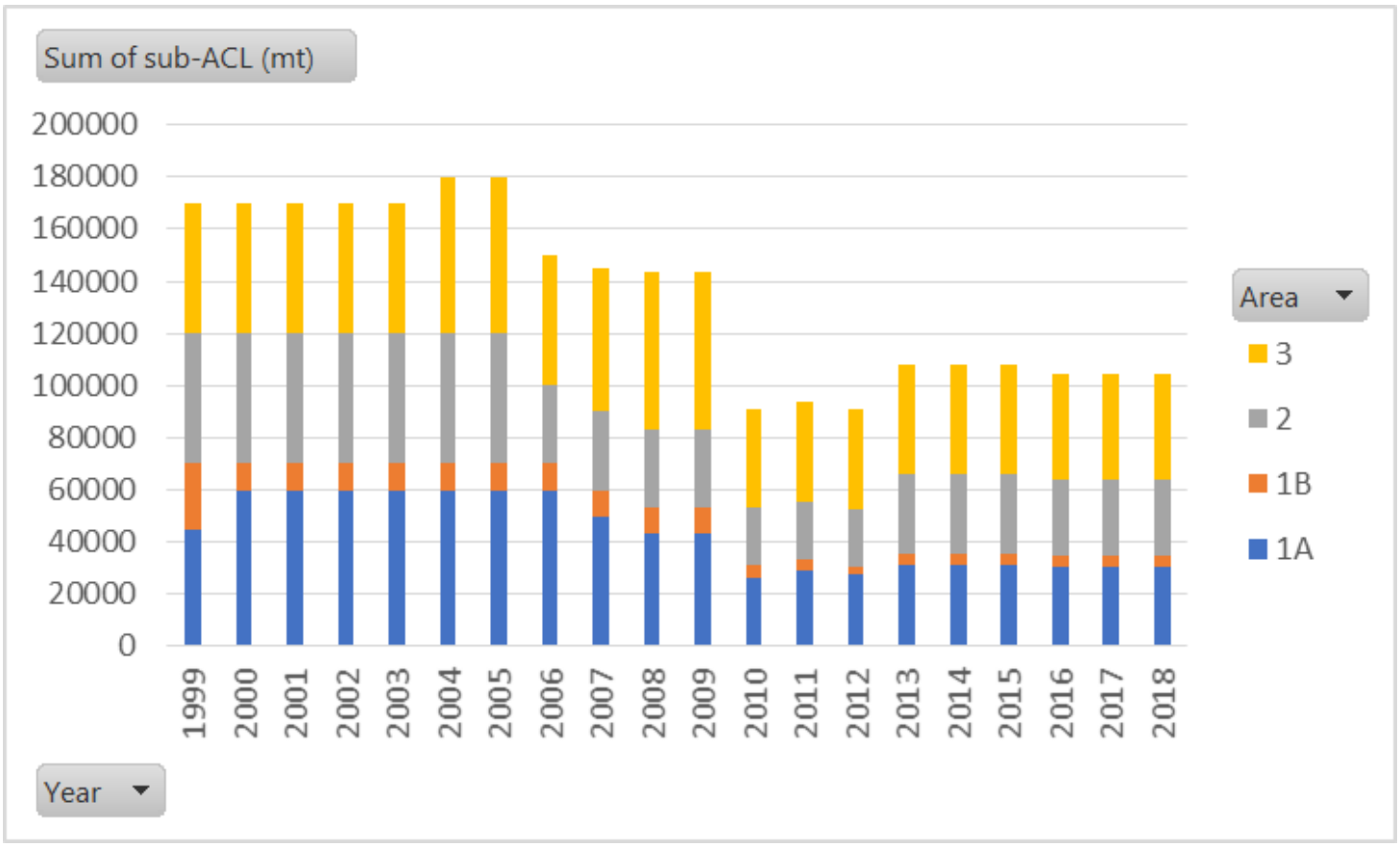
Impacts on EFH and bycatch

It is possible some MWT vessels will decide to convert gear type, especially if faces with a prohibition that could impact 30% of total revenues. It is not practical to do so in all areas and is expensive. However, ***if vessels convert to bottom trawl gear as a result of this measure, there could be negative impacts on EFH and bycatch*** since that gear type is estimated to have more negative impacts on the seafloor and bycatch compared to MWT and purse seine gears. Small mesh bottom trawl can only be used in certain areas.

3.0 Sub-ACLs for herring management areas

Herring catch limits have declined over time since the FMP was implemented in 1999 (Figure 7). The first reduction was in 2006, followed by another relatively large reduction starting in 2010. The total catch limit has been over 1000,000 mt in more recent years, 2013-2018.

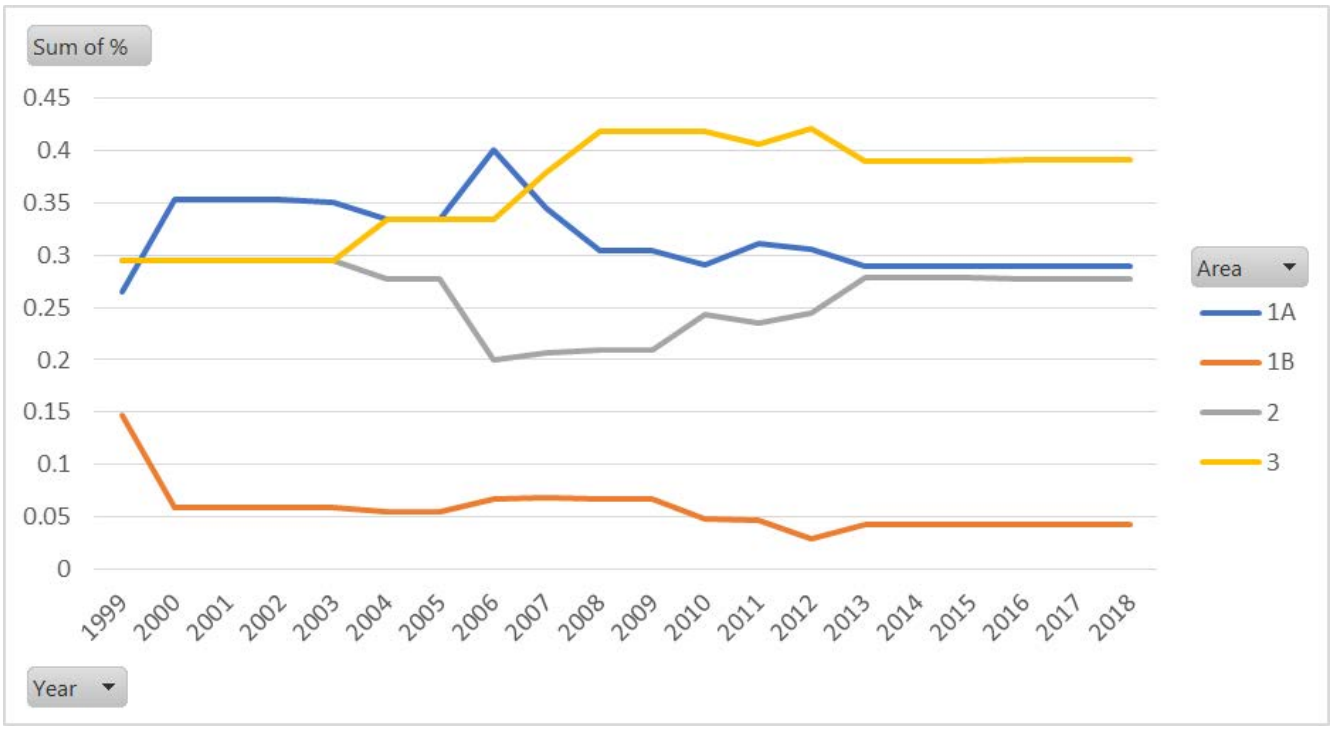
Figure 9 - Allocation by area per year (1999-2018) in mt.



The proportions of total catch by area have been relatively consistent over time (Figure *8*). The original proportions were based on what is known about the distribution of spawning components. Over the years the proportions have changed in one direction or the other. The specifications package for 2010-2012 and 2013-2015 considered a wider range of allocation proportions (some as high as 58% for Area 1A) but the Council has maintained the proportions relatively consistent over time.

- **Area 1A** started under 30% in 1999, increased to 35% in 2000-2005, was 40% in 2006, and has been about 30% since 2007. When the TAC was reduced in 2007 Area 1A was reduced due to lower survey trends in the GOM.
- **Area 1B** has been very consistent over time, it started at 15% for year 1 under the FMP, then 6-7% until 2009, and 3-5% from 2010-2018.
- **Area 2** started just under 29% through 2005, then 20% in 2006 and increase back to almost 30%.
- **Area 3** also started at 29% in 1999 and that allocation remained through 2003, then it was set at 33% for several years, then 38-42% since.

Figure 10 - Percent of total ACL allocated per area (1999-2018)



In 2018, upon considering a request from the Council, NOAA Fisheries implemented an in-season action to reduce herring sub-ACLs for the remainder of the 2018 fishing year. The intent was to lessen the impact of inevitable reductions for 2019-2021 based on assessment projections. The Council suggested that the management area sub-ACLs should reflect 2017 fishing activity to the extent possible, noting that Area 2 should be higher because 2018 fishing in that area had already exceeded the 2017 level. NOAA Fisheries reduced the catch limits in late August using area proportions relatively similar to the Councils suggestion to reflect 2017 activity.

Figure 9 and Table 10 compare the allocation and catch by management area for 2004-2017. Table 11 is the proportion of catch by area compared to total catch for 2010-2017, since total catch was reduced.

Figure 11 Utilization by area – Allocation in blue and catch in orange

Table 11 – Herring sub-ACLs and landings by area for 2010-2017 including percent of sub-ACL catch per area

	1A			1B			2			3			Total		
Year	sub-ACL	Landings	%	sub-ACL	Landings	%	sub-ACL	Landings	%	sub-ACL	Landings	%	sub-ACL	Landings	%
2010	26,546	28,424	107.1%	4,362	6,001	137.6%	22,146	20,831	94.1%	38,146	17,596	46.1%	91200	72852	79.9%
2011	29,251	30,676	104.9%	4,362	3,530	80.9%	22,146	15,001	67.7%	38,146	37,038	97.1%	93905	86245	91.8%
2012	27,668	24,302	87.8%	2,723	4,307	158.2%	22,146	22,482	101.5%	38,146	39,471	103.5%	90683	90562	99.9%
2013	31,200	29,820	95.6%	4,600	2,458	53.4%	30,000	27,569	91.9%	42,000	37,833	90.1%	107800	97680	90.6%
2014	31,200	32,898	105.4%	4,600	4,399	95.6%	30,000	19,626	65.4%	42,000	36,323	86.5%	107800	93246	86.5%
2015	31,200	29,406	94.3%	4,600	2,889	62.8%	30,000	15,214	50.7%	42,000	33,256	79.2%	107800	80765	74.9%
2016	30,300	27,806	91.8%	4,500	3,624	80.5%	29,100	14,594	50.2%	40,900	18,777	45.9%	104800	64801	61.8%
2017	30,300	28,682	94.7%	4,500	2,639	58.6%	29,100	3,617	12.4%	40,900	14,134	34.6%	104800	49072	46.8%
AVG	29,708	29,002	97.7%	4,281	3,731	91.0%	26,830	17,367	66.7%	40,280	29,304	72.9%	101,099	79,403	79.0%
MEDIAN	30,300	29,044	95.1%	4,500	3,577	80.7%	29,100	17,420	66.6%	40,900	34,790	82.8%	104,800	83,505	83.2%

Table 12 – Percent of total catch per herring management area (2010-2017)

	1A	1B	2	3
Year	% of total landings	% of total landings	% of total landings	% of total landings
2010	39.0%	8.2%	28.6%	24.2%
2011	35.6%	4.1%	17.4%	42.9%
2012	26.8%	4.8%	24.8%	43.6%
2013	30.5%	2.5%	28.2%	38.7%
2014	35.3%	4.7%	21.0%	39.0%
2015	36.4%	3.6%	18.8%	41.2%
2016	42.9%	5.6%	22.5%	29.0%
2017	58.4%	5.4%	7.4%	28.8%
AVG	36.5%	4.7%	21.9%	36.9%
MEDIAN	36.0%	4.7%	21.8%	38.8%

If the ABC control rule recommended by the Herring Committee is used, the projection for ABC is 21,266 mt for 2019. However, the SSC has not reviewed that yet and may have a different recommendation to account for scientific uncertainty.

Furthermore, there are other set-asides that are removed before the annual catch limit (ACL) is determined in the specifications setting process that have not been incorporated yet. For example, the management uncertainty buffer used in the past (difference between ABC and ACL) has removed 6,200 mt to account for the Canadian weir fishery, state water catch, and discards. If that is applied to an ABC of 21,266mt that leaves just over 15,000 mt. Additionally, research set-aside can be up to 3% of each sub-ACL. For Alternative 4b revised that would be about 450 mt (3% of 15,066 mt). The other set-aside applied is one for the fixed gear fishery in eastern Maine. Recently 295 mt have been set-aside and it is not used it is added back to the Area 1A quota. The Herring Committee did not make any final recommendations about what 2019 specifications should be, but did discuss an option that would maintain a fixed gear set-aside, but reduce it proportionally with the ABC. For example, in the last specification package the FGSA was 295 mt under a 111,000 mt ACL. Therefore, if the total ABC for 2019 is 21,266 the fixed gear set-aside would be 56 mt using the same proportion.

Table 13 – Example set-asides for Alternative 4b revised

Note: This is just an example for 2019. The ABC is not known yet and decisions have not been made about any set-asides.

Alternative 4b revised ABC	21,266
Management uncertainty buffer	6,200
Research set-aside	452
Fixed Gear set-aside	56
Total ACL	14,558

Table 14 Example allocations for FY2019 (specification proportions in blue compared to 2018 in-season proportions in yellow).

Note: This is just an example for 2019. The ABC is not known yet and decisions have not been made about any set-asides.

	2019 based on recent spec proportions		2019 based on 2018 In-season proportions	
1A	4,207	28.9%	8,111	55.6%
1B	626	4.3%	773	5.3%
2	4,047	27.8%	2,392	16.4%
3	5,678	39.0%	3,311	22.7%
Total	14,558		14,588	