Terms of Reference for the 2019 Atlantic Menhaden Single Species Benchmark Stock Assessment and Peer Review
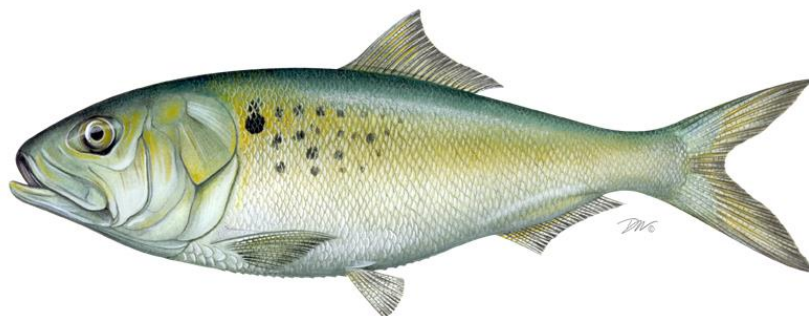
May 2, 2018

1. Define population structure based on available data. If alternative population structures are used in the models (e.g., coast-wide or regional), justify use of each population structure.

2. Evaluate new information on life history such as growth rates, size at maturation, natural mortality rate, and migrations and review potential impacts of environmental change on these characteristics.

3. Characterize precision and accuracy of fishery-dependent and fishery-independent data used in the assessment, including the following but not limited to:

    a.   Provide descriptions of each data source (e.g., geographic location, sampling methodology, potential explanation for outlying or anomalous data)

    b.   Describe calculation and potential standardization of abundance indices. Consider the consequences of environmental factors on the estimates of abundance or relative indices derived from surveys.

    c.   Discuss trends and associated estimates of uncertainty (e.g., standard errors)

    d.   Justify inclusion or elimination of available data sources.

    e.   Discuss the effects of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, ageing accuracy, sample size) on model inputs and outputs.

4. Develop models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, and analyze model performance.

a. Briefly describe history of model usage, its theory and framework, and document associated peer-reviewed literature. If using a new model, test using simulated data.

b. Clearly and thoroughly explain model strengths and limitations.

c. Justify choice of CVs, effective sample sizes, or likelihood weighting schemes.

d. Describe stability of model (e.g., ability to find a stable solution, invert Hessian)

e. Perform sensitivity analyses for starting parameter values, priors, etc. and conduct other model diagnostics as necessary.

f. If multiple models were considered, justify the choice of preferred model and the explanation of any differences in results among models.

5. State assumptions made for all models and explain the likely effects of assumption violations on synthesis of input data and model outputs. Examples of assumptions may include (but are not limited to):

a. Choice of stock-recruitment function.

b. No error in the catch-at-age or catch-at-length matrix.

c. Calculation of M. Choice to use (or estimate) constant or time-varying M and catchability.

d. Choice of equilibrium reference points or proxies for MSY-based reference points.

e. Choice of a plus group for age-structured species.

6. Characterize uncertainty of model estimates and biological or empirical reference points.

7. Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.

8. Recommend stock status as related to reference points (if available). For example:

    a. Is the stock below the biomass threshold?

    b. Is F above the threshold?

9. Compare trends in population parameters and reference points with current and proposed modeling approaches, including the results of the ecological-based benchmark stock assessment. If outcomes differ, discuss potential causes of observed discrepancies.

10. If a minority report has been filed, explain majority reasoning against adopting approach suggested in that report. The minority report should explain reasoning against adopting approach suggested by the majority.

11. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

12. Recommend timing of next benchmark assessment and intermediate updates, if necessary relative to biology and current management of the species.

1. Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:

   a. Presentation of data source variance (e.g., standard errors).

   b. Justification for inclusion or elimination of available data sources,

   c. Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),

   d. Calculation and/or standardization of abundance indices.

2. Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:

a. Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?

b. If multiple models were considered, evaluate the analysts' explanation of any differences in results.

c. Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, plus group treatment).

3. Evaluate the diagnostic analyses performed, including but not limited to:

    a. Sensitivity analyses to determine model stability and potential consequences of major model assumptions

    b. Retrospective analysis

4. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

5. If a minority report has been filed, review minority opinion and any associated analyses. If possible, make recommendation on current or future use of alternative assessment approach presented in minority report.

6. Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.

7. Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods/measures.

8. Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.

9. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.

10. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.

Current SAS

- Amy Schueller (Chair, NMFS)
- Joey Ballenger (TC chair, SC DNR)
- Matt Cieri (ME DMR)
- Micah Dean (MA DMF)
- Rob Latour (VIMS)
- Chris Swanson (FL FWC)
- Jason McNamee (RI DMF)
- Ray Mroch (NMFS)
- Alexei Sharov (MD DNR)
- Max Appelman, Kristen Anstead, Katie Drew (ASMFC)

ERP Assessment TORs

For Board Review

May 2, 2018

ASSESSMENT TERMS OF REFERENCE

1. Review and evaluate the fishery-dependent and fishery-independent data used in the Atlantic menhaden single-species assessment, and justify inclusion, elimination, or modification of those data sets.

TOR #2

2. Characterize precision and accuracy of additional fishery-dependent and fishery-independent data sets, including diet data, used in the ecological reference point models, including but not limited to:

- Provide descriptions of each data source (e.g., geographic location, sampling methodology, potential explanation for outlying or anomalous data)
- Describe calculation and potential standardization of abundance indices.
- Discuss trends and associated estimates of uncertainty (e.g., standard errors)
- Justify inclusion or elimination of available data sources.
- Discuss the effects of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, ageing accuracy, sample size) on model inputs and outputs.

TOR #3

3. Develop models used to estimate population parameters (e.g., F, biomass, abundance) of Atlantic menhaden that take into account Atlantic menhaden's role as a forage fish and analyze model performance.

– Briefly describe history of model usage, its theory and framework, and document associated peer-reviewed literature. If using a new model, test using simulated data.

– Justify choice of ecological factors (e.g., predator species, other prey species, environmental factors) as appropriate for each model

– Describe stability of model (e.g., ability to find a stable solution, invert Hessian)

– Justify choice of CVs, effective sample sizes, or likelihood weighting schemes as appropriate for each model.

– Perform sensitivity analyses, model diagnostics, and retrospective analyses as appropriate for each model.

– Clearly and thoroughly explain model strengths and limitations, including each model's capacity to account for environmental changes

4. Develop methods to determine reference points and total allowable catch for Atlantic menhaden that account for Atlantic menhaden's role as a forage fish.

5. State assumptions made for all population and reference point models and explain the likely effects of assumption violations on synthesis of input data and model outputs.

6. Characterize uncertainty of model estimates and reference points as appropriate for each model.

7. Evaluate stock status for Atlantic menhaden from recommended model(s) as related to the respective reference points (if available).

8. Compare trends in population parameters and reference points among proposed modeling approaches, including the results of the single-species benchmark assessment. If outcomes differ, discuss potential causes of observed discrepancies.

9. If a minority report has been filed, explain majority reasoning against adopting approach suggested in that report. The minority report should explain reasoning against adopting approach suggested by the majority.

10. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

11. Recommend timing of next benchmark assessment and intermediate updates, if necessary relative to biology and current management of the species.

REVIEW PANEL TERMS OF REFERENCE

1. Evaluate the justification for the inclusion, elimination, or modification of data from the Atlantic menhaden single-species benchmark assessment.

TOR #2

2. Evaluate the thoroughness of data collection and the presentation and treatment of additional fishery-dependent and fishery-independent data sets in the assessment, including but not limited to:

- Presentation of data source variance (e.g., standard errors).

- Justification for inclusion or elimination of available data sources,

- Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),

- Calculation and/or standardization of abundance indices.

3. Evaluate the methods and models used to estimate Atlantic menhaden population parameters (e.g., F, biomass, abundance) that take into account Atlantic menhaden's role as a forage fish, including but not limited to:

- Evaluate the choice and justification of the recommended model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?

- If multiple models were considered, evaluate the analysts' explanation of any differences in results.

- Evaluate model parameterization and specification as appropriate for each model (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, choice of ecological factors)

4. Evaluate the methods used to estimate reference points and total allowable catch.

5. Evaluate the diagnostic analyses performed as appropriate to each model, including but not limited to:

- – Sensitivity analyses to determine model stability and potential consequences of major model assumptions
- – Retrospective analysis

6. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

7. If a minority report has been filed, review minority opinion and any associated analyses. If possible, make recommendation on current or future use of alternative assessment approach presented in minority report.

8. Recommend best estimates of stock biomass, abundance, exploitation, and stock status of Atlantic menhaden from the assessment for use in management, if possible, or specify alternative estimation methods.

9. Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.

10. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.

11. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.
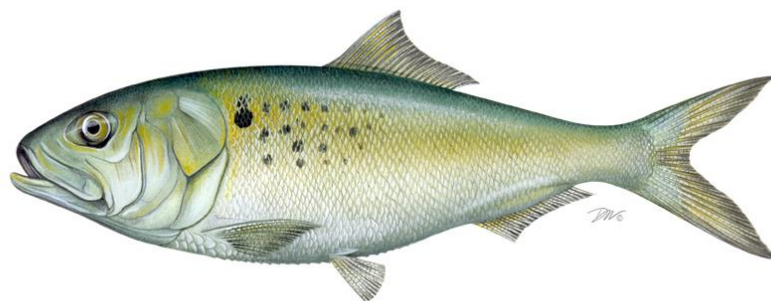
Overview

- Status of the FMP

- Status of the stock

- Status of the fishery

- Compliance requirements for 2017
    - Quota, biological sampling, Bay Cap

- State Implementation of Amendment 3

- PRT Recommendations

2017 fishery operated under Amendment 2 (2013)

- Established coastwide TAC and distributed this among the states based on landings from 2009-2011

- Timely reporting to minimize quota overages

- 6,000 lbs bycatch allowance for non-directed fisheries

- Chesapeake Bay reduction fishery cap set at 87,216 mt

- Episodic Event Set Aside (1% of overall TAC)

Addendum I (2016)

- Allows two licensed individuals to harvest up to 12,000 lbs of bycatch when working together from the same vessel fishing stationary multi-species gear

Amendment 3 (November 2017)

Changes from Amendment 2

- Maintains single-species reference points until menhaden-specific ERPs are available for management

- State allocations: 0.5% fixed minimum + 2009-2011 average landings

- 6,000 lbs bycatch allowance for incidental catch and small scale fisheries (defined applicable gear types)

- Chesapeake Bay reduction fishery cap set at 51,000 mt; no rollover of unused Cap

Status of the Stock

Reference Points	Benchmark	Current value
$F_{21\% (threshold)}$	1.85	0.51
$F_{36\% (target)}$	0.80	
$FEC_{21\% (threshold)}$	57,295	83,486
$FEC_{36\% (target)}$	99,467	

- 2017 SA Update
- Stock is not overfished and overfishing is not occurring
- Menhaden single-species and ecosystem-based benchmark assessments scheduled for 2019

Atlantic Menhaden Fishing Mortality (Ages 2-4)

Atlantic Menhaden Fecundity
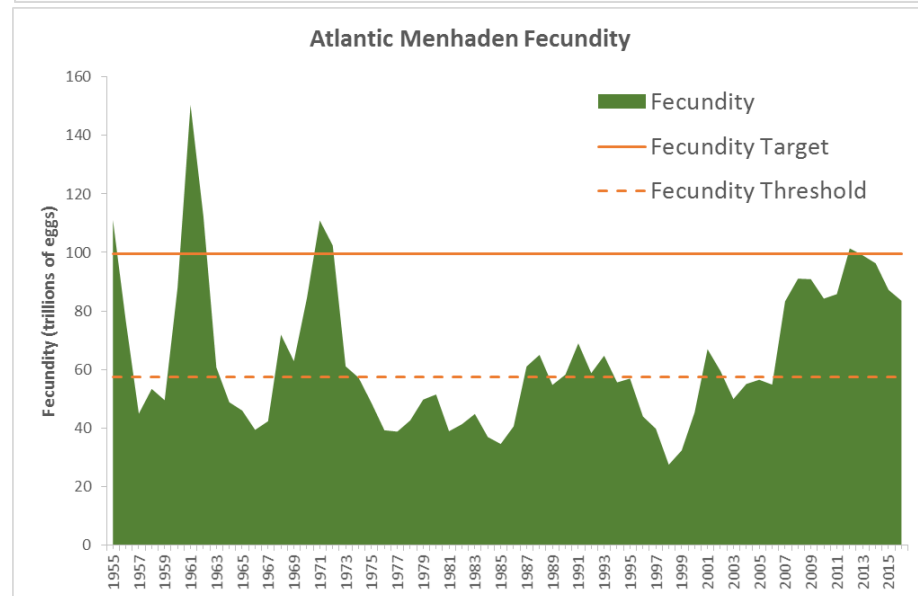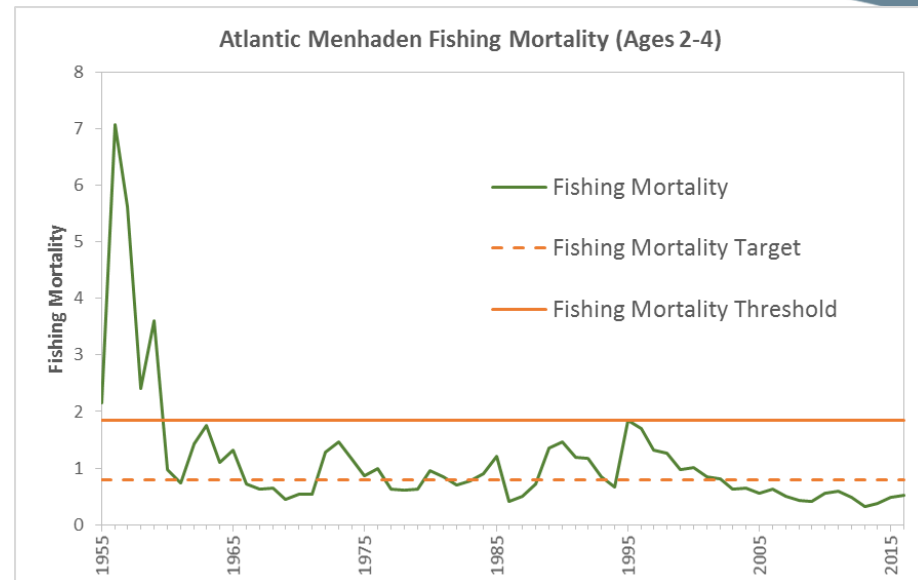
Status of the Fishery, 2017

- **TAC: 440.9 million pounds (200,000 MT)**
- **Directed harvest (excluding bycatch)= 378.12 mil pounds**
  - 14% under the TAC
  - 4.7% decrease from 2016
- **Bycatch harvest = 2.73 million pounds**
  - 6% increase from 2016 bycatch landings
  - Does not count towards TAC
- **Total harvest (including bycatch and EESA)= 380.85 million pounds**
  - 4.6% decrease from 2016

2016 Status of the Fishery

- **Bait harvest: 96.62 million pounds**
  - 1.8% increase from 2016
  - 5.2% below the previous 5-year average
  - NJ, VA, ME, MA and MD landed the largest shares
- **Reduction harvest: 284.2 million pounds**
  - 6.2% decrease from 2016
  - 8% below the previous 5-year average
- **Chesapeake Bay Reduction Harvest and Cap**
  - 2017 Cap was 87,216 MT + roll over
  - 2017 harvest ~20,000 MT

Atlantic Menhaden Landings
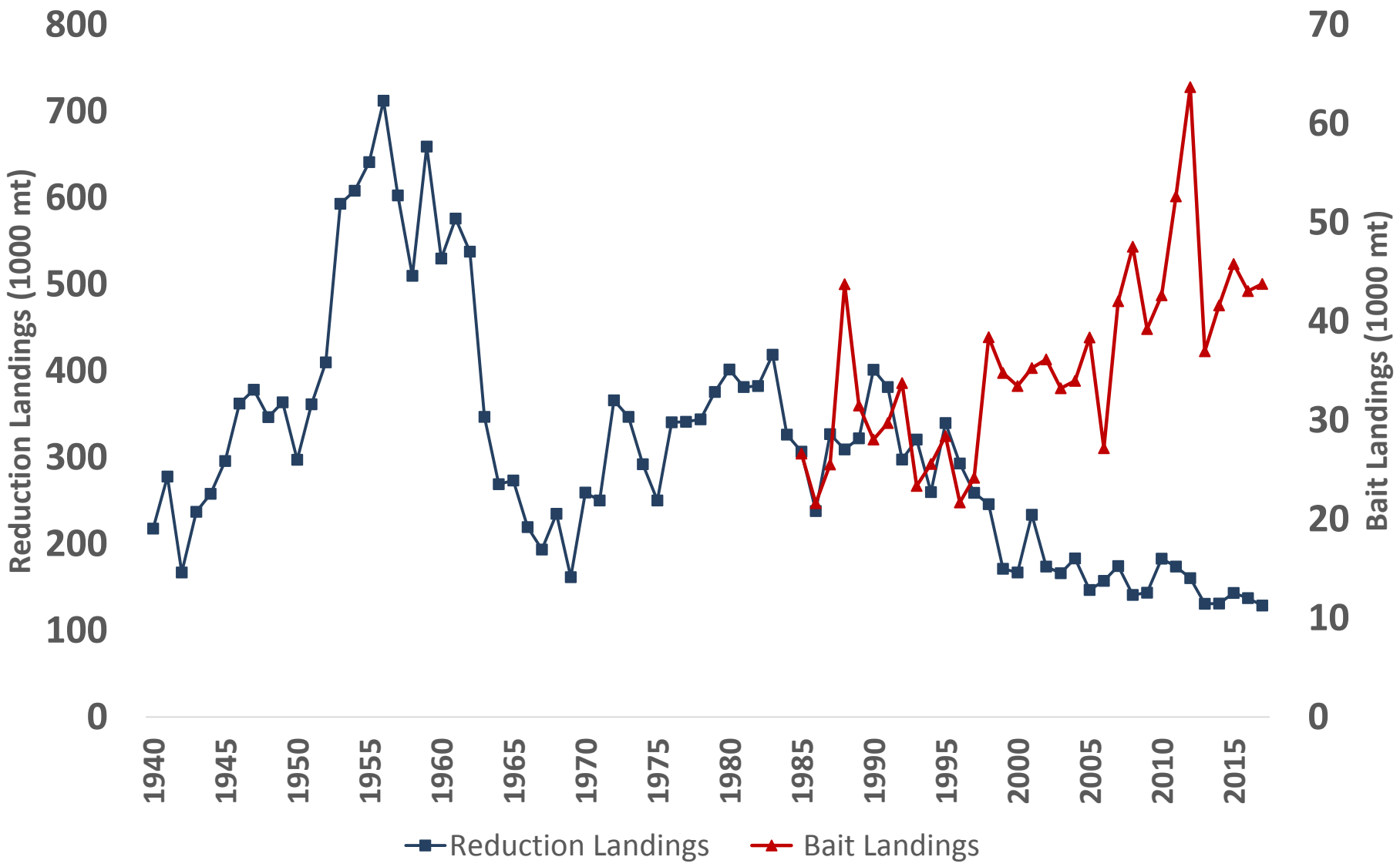
2017 Bycatch Analysis (Table 2)

Table 2. Total number of bycatch trips

Bins (LBS)	2013	2014	2015	2016	**2017**	Total	% Total Trips 2013-2017
1-1000	1,875	3,673	3,146	1,450	**2,458**	12,602	70%
1001-2000	252	517	584	148	**399**	1,900	11%
2001-3000	148	318	316	73	**135**	990	5%
3001-4000	110	190	139	48	**82**	569	3%
4001-5000	131	206	132	48	**94**	611	3%
5001-6000	158	265	196	108	**197**	924	5%
6000+	130	109	140	33	**22**	434	2%
Total	2,804	5,278	4,653	1,908	**3,387**	18,030	

**Average number of bycatch trips per year = 3,606

2013-2016 Bycatch Analysis

Table 3. Average bycatch landings by gear type and jurisdiction, 2013-2017

State/Jurisdiction	ME	NH	RI	CT	NY	NJ	DE	MD	PRFC	VA	FL	Sum lbs (NonConf)	% of Total
Stationary Gears While Fishing													
Pound net	-	-	64,545	-	183,813	C	-	1,579,981	682,950	90,087	-	2,601,376	56.37%
Anchored/stake gill net	39,860	-	C	C	25,100	79,850	30,622	15,777	3,213	892,409	C	1,086,831	23.55%
Pots	-	-	-	-	3,425	-	C	C	-	-	C	3,425	0.07%
Fyke nets	-	-	-	-	-	C	-	C	52	62	-	114	0.00%
Mobile Gears While Fishing													
Cast Net	-	-	C	563	183,813	C	-	C	-	-	173,150	357,526	7.75%
Drift Gill net	-	-	-	-	-	66,958	35,988	-	-	-	-	102,946	2.23%
Purse Seine	201,344	-	-	-	-	-	-	-	-	-	-	201,344	4.36%
Seines Haul/Beach	-	-	-	-	250,433	-	-	C	28	3,072	-	253,533	5.49%
Trawl	-	C	C	C	7,836	C	-	-	-	-	-	7,836	0.17%
Hook & Line	-	-	C	C	-	-	-	C	-	-	C	-	0.00%
Sum lbs (NonConf)	241,204	0	64,545	563	654,420	146,807	66,610	1,595,758	686,243	985,630	173,150	4,614,930	
% of Total	5.23%	0.00%	1.40%	0.01%	14.18%	3.18%	1.44%	34.58%	14.87%	21.36%	3.75%		

Episodic Events Set Aside

- ME, RI, and NY participated in program

- 4.69 million pounds harvested in 2017

- 285,398 pounds deducted from 2018 EESA

Year	Set Aside (lbs)	Landed (lbs)	% Used	State	Unused Set Aside Reallocated (lbs)
2013	3,765,491	-	-		3,765,491
2014	3,765,491	295,000	8%	RI	3,470,491
2015	4,142,040	1,883,292	45%	RI	2,258,748
2016	4,142,040	3,810,145	92%	ME, RI, NY	331,895
2017	**4,409,245**	**4,694,643**	**106%**	**ME, RI, NY**	**-285,398**

Quota Performance (Table 3)

State	Transfers	Total 2017 Quota	2017 Landings	Overage	2018 Quota (Amendment 3)
ME	195,180	367,062	344,130	-	2,439,114
NH		131	-	-	2,357,315
MA		3,660,454	3,697,744	37,290	6,027,724
RI		78,195	153,408	75,213	2,366,618
CT		76,152	76,152	-	2,432,640
NY	300,000	542,032	509,430	-	3,270,675
NJ		48,853,880	46,881,174	-	52,013,736
PA		-	-	-	2,357,183
DE		57,646	58,174	528	415,939
MD		5,991,662	2,912,256	-	9,002,733
PRFC		2,709,809	1,444,316	-	5,102,086
VA		372,443,990	316,592,852	-	376,543,327
NC	-495,180	1,655,815	755,136	-	4,540,560
SC		-	-	-	10,000
GA		-	-	-	-
FL		74,279	4,475	-	2,443,819
TOTAL		436,511,109	373,429,247	113,031	471,323,470

2017 Bio Samples (Table 6)

State	#10-fish samples required	#10-fish samples collected	Age samples collected	Length samples collected
ME	6	5	50	50
MA	6	5	50	50
RI	3	9	107	107
CT	1	0	0	0
NY	2	6	60	60
NJ	71	140	1400	1400
DE	1	1	225	225
MD	7	21	300	1058
PRFC	5	13	130	130
VA	74	92	920	920
NC	2	10	138	138
Total	**177**	**302**	**3380**	**4138**

De minimis

- The states of New Hampshire, Pennsylvania, South Carolina, Georgia, and Florida requested *de minimis* status for the 2018 fishing season

- All states qualify because they do not have a reduction fishery and their bait landings in the two most recent years did not exceed 1% of coastwide bait landings.

Amendment 3 Implementation

- Implementation plans were due Jan 1
- Implementation plans were to include proposed, or already implemented regulatory language which fulfils each of the requirements of Amendment 3
- PRT determined that each state has fulfilled the requirements of Amendment 3, with one exception;
  - VA's 2018 Chesapeake Bay harvest cap for the reduction fishery is higher than that permitted under Amendment 3

PRT Recommendations

- Approve de minimis status for New Hampshire, Pennsylvania, South Carolina, Georgia, and Florida

- Board motion to consider approving the 2018 FMP Review

Questions?