Atlantic States Marine Fisheries Commission

Shad and River Herring Management Board

February 6, 2019
1:15 p.m. – 2:15 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(J. Clark)*	1:15 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2017	1:15 p.m.
3.	Public Comment	1:15 p.m.
4.	Report on NOAA Fisheries 5-year Status Review of River Herring (*T. Trinko*)	1:25 p.m.
5.	Progress Update on Shad Benchmark Stock Assessment (*J. Kipp*)	1:40 p.m.
6.	Consider Approval of Massachusetts Shad Sustainable Fishery Management Plan (SFMP) for Merrimack River **Final Action** • Review SFMP and Technical Committee Memo (*K. Sprankle*)	1:50 p.m.
7.	Update on Technical Committee Review of Inconsistencies with Harvest and Monitoring Requirements of Amendments 2 and 3 (*K. Sprankle*)	2:05 p.m.
8.	Other Business/Adjourn	2:15 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW

Shad and River Herring Management Board Meeting
Wednesday, February 6, 2019
1:15 – 2:15 p.m.
Arlington, Virginia

Chair: John Clark (DE) Assumed Chairmanship: 2/17	Technical Committee Chair: Ken Sprankle (FWS)	Law Enforcement Committee Representative: Furlong (PA)
Vice Chair: Mike Armstrong	Advisory Panel Chair: Pam Lyons Gromen	Previous Board Meeting: October 17, 2017
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (19 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2017

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Report on NOAA Fisheries 5-year Status Review of River Herring (1:25 – 1:40 p.m.)

Background

- In August 2013 NOAA Fisheries determined that listing alewife and blueback herring as threatened or endangered under the Endangered Species Act (ESA) was not warranted. However, at that time, they committed to revisiting the status of both species in 3 to 5 years.
- In August 2017, a new status review of alewife and blueback herring was initiated to determine whether listing either species as endangered or threatened under the ESA is warranted. NOAA Fisheries committed to publishing a revised listing determination for river herring no later than January 31, 2019.

Presentations

- NOAA Fisheries River Herring Status Review by T. Trinko

5. Update on Shad Stock Assessment Progress (1:40 – 1:50 p.m.)

Background

- The American shad benchmark stock assessment was initiated in October 2017, with a scheduled completion date in late 2019.
- In March 2018 the Stock Assessment Subcommittee (SAS) and TC met for the Data Workshop, and in November 2018 the SAS met for the Methods Workshop.

- At the Methods Workshop, the SAS recommended a revised assessment timeline with the completion date moved from Annual Meeting 2019 to Summer Meeting 2020. (**Briefing Materials**)

Presentations

- Update on Shad Stock Assessment Progress by J. Kipp

6. Consider Approval of Massachusetts Shad Sustainable Fishery Management Plan (SFMP) for Merrimack River (1:50 – 2:05 p.m.) Final Action

Background

- The Massachusetts Division of Marine Fisheries submitted an updated SFMP for recreational and commercial harvest of American shad in the Merrimack River. The plan includes recent data and requests to maintain the existing management measures from the 2012 SFMP. Commercial shad fishing will remain prohibited in all rivers in the state. (**Briefing Materials**)

Presentations

- Overview of the Merrimack SFMP and Technical Committee Recommendations by K. Sprankle

Board actions for consideration at this meeting

- Approve the Massachusetts Sustainable Fishery Management Plan Update

7. Update on Technical Committee Review of Inconsistencies with Harvest and Monitoring Requirements of Amendments 2 and 3 (2:05 – 2:15 p.m.)

Background

- In October 2017 the TC identified several inconsistencies between state SFMPs and the requirements of Amendments 2 and 3. Subsequently, the Board tasked the TC to develop proposed improvements to the Amendments with regard to several items: 1) Management and monitoring of rivers with low abundance and harvest of shad and river herring; 2) Standardization of Sustainable Fishery Management Plan (SFMP) requirements; 3) Incorporation of stock assessment information into SFMPs and discussion on the timeline for renewing plans; 4) Clarification of *de minimis* requirements as they pertain to SFMPs; and 5) Review of the number of years of data are required before developing a SFMP. (**Briefing Materials**)
- The TC has met several times to develop this task, though work has focused primarily on the first item. The TC has noted that items 2, 3, and 5 could be addressed in concurrently with the ongoing Benchmark Assessment for American shad. A subset of the TC has formed a task group to address this task. (**Briefing Materials**)

Presentations

- Update on Technical Committee Review of Inconsistencies with Harvest and Monitoring Requirements by K. Sprankle

8. Other Business/Adjourn

Shad and River Herring 2019 TC Tasks

Activity level: Medium

Committee Overlap Score: Medium (Multi-species committees for this Board)

Committee Task List

- January-August 2019: TC Task to recommend improvements to Amendments 2 and 3 related to the following items:
    - Management and monitoring of rivers with low abundance and harvest of shad and river herring
    - Standardization of Sustainable Fishery Management Plan (SFMP) requirements: content, metrics, and management responses to triggers
    - Incorporation of stock assessment information into SFMPs and discussion on the timeline for renewing plans
    - Clarification of *de minimis* requirements as they pertain to SFMPs
    - Review of the number of years of data are required before developing a SFMP
- 2020 Shad Benchmark Stock Assessment
    - SAS assessment work ongoing throughout 2019
    - November 2019: Assessment Workshop

TC Members: Ken Sprankle (Chair, USFWS), Mike Brown (ME), Mike Dionne (NH), Brad Chase (MA), Patrick McGee (RI), Jacque Benway Roberts (CT), Robert Adams (NY), Brian Neilan (NJ), Josh Tryninewski (PA), Johnny Moore (DE), Rob Bourdon (MD), Ellen Cosby (PRFC), Joseph Swann (DC), Eric Hilton (VA), Holly White (NC), Jeremy McCargo (NC), Bill Post (SC), Chad Holbrook (SC), Jim Page (GA), Reid Hyle (FL), Ruth Hass-Castro (NOAA), Wilson Laney (USFWS)

Shad SAS: Michael Bailey (Chair, USFWS), Ken Sprankle (TC Chair, USFWS-CT), Joey Ballenger (SC), Mike Bednarski (VA), Wes Eakin (NY), Chad Holbrook (SC), Kevin Sullivan (NH), Joe Zydlewski (USGS), Jacque Benway-Roberts (CT), Kiersten Curti (NOAA-Fisheries), Angela Giuliano (MD), Jason Boucher (DE)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

SHAD AND RIVER HERRING MANAGEMENT BOARD

The Marriott Norfolk Waterside
Norfolk, Virginia
October 17, 2017

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ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Cheri Patterson, NH, proxy for D. Grout (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Ritchie White, NH (GA)
Mike Armstrong, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT, proxy for M. Alexander (AA)
Sen. Craig Miner, CT (LA)
Lance Stewart, CT (GA)
Sen. Phil Boyle, NY (LA)
John Maniscalco, NY, proxy for J. Gilmore (AA)
Emerson Hasbrouck, NY (GA)
Heather Corbett, NJ, proxy for L. Herrighty (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Andy Shiels, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Roy Miller, DE (GA)
Lynn Fegley, MD, proxy for D. Blazer (AA)
Rachel Dean, MD (GA)
Allison Colden, MD, proxy for Del. Stein (LA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Cathy Davenport, VA (GA)
Rob O'Reilly, VA, proxy for J. Bull (AA)
Michelle Duval, NC, proxy for B. Davis (AA)
David Bush, NC, proxy for Rep. Steinburg (LA)
Malcolm Rhodes, SC (GA)
Robert Boyles, SC (AA)
Pat Geer, GA, proxy for Rep. Nimmer (LA)
Rep. Thad Altman, FL (LA)
Spud Woodward, GA (AA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Sherry White, USFWS
Derek Orner, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Brad Chase, Technical Committee Chair
Larry Furlong, Law Enforcement Representative

Staff

Bob Beal
Toni Kerns
Kirby Rootes-Murdy
Jeff Kipp
Caitlin Starks
Jessica Kuesel
Shanna Madsen

Guests

The Shad and River Herring Management Board of the Atlantic States Marine Fisheries Commission convened in the Hampton Roads Ballroom V of the Marriott Waterside Hotel, Norfolk, Virginia, October 17, 2017, and was called to order at 8:00 o'clock a.m. by Chairman John Clark.

CALL TO ORDER

CHAIRMAN JOHN CLARK: Due to technical difficulties the first seven minutes of the meeting was not recorded. The Chairman had a Call to Order, went through the Approval of the Agenda, Approval of Proceedings from August, 2017 and Public comment was taking place when the recording began.

MR. JEFFREY PIERCE: (Reading a letter from the Alewife Harvesters of Maine) "…restoration efforts active based on achievable goals. Thank you for your time; signed Landis Hudson, and thank you for allowing me speak".

CHAIRMAN CLARK: Thank you, Jeff. Does anybody else have any comments? Seeing none; we'll move on to Agenda Item Number 4, which is Discuss Shad Stock Assessment Process Recommendations; and Jeff Kipp will take that.

DISCUSS SHAD STOCK ASSESSMENT PROCESS RECOMMENDATIONS

MR. JEFF KIPP: Good morning everyone. Just to remind the Board, at the August Board meeting following the presentation of the River Herring Assessment Update, we mentioned that there were some anticipated challenges with updating the 2007 American ~~Shad~~ shad benchmark stock assessment. We wanted to kind of go back and reconsider that assessment process and how to move forward.

We took those anticipated challenges to the Assessment Science Committee; and had a discussion with that Committee on the assessment process for shad. The recommendation by ASC out of that discussion was to move to a benchmark stock assessment for American shad. We originally scheduled to provide an update to the assessment in 2018.

But given that recommendation to move to a benchmark, we anticipate now a longer process with a completed assessment in 2019. But that will give us the opportunity to go back and take a fresh look with some new perspectives; and also the ability to incorporate some new data time series that have come online since that 2007 assessment.

Also in addition to that given the change in workload from an update assessment to a benchmark assessment, we will likely be coming to this Board, probably by e-mail, and requesting some additional membership for the Stock Assessment Subcommittee. If there are any questions on ASCs recommendation or the process moving forward, I could take those now.

CONSIDER APPROVAL OF SHAD AND RIVER HERRING SUSTAINABLE MANAGEMENT PLANS

CHAIRMAN CLARK: Thank you, Jeff for that update. We'll move on now to the next item on our agenda; which is to Consider Approval of Shad and River Herring Sustainable Management Plans. We'll have Brad Chase, who is Chairman of the Technical Committee, will present the Sustainable Fishery Management Plans for the six states that have these to be reviewed.

CONNECTICUT RIVER AMERICAN SHAD SUSTAINABILITY PLAN

MR. BRAD CHASE: Good morning. We have six plans to review this morning; they are all updates from plans that were approved by the Board in 2011-2012, and we're going to start with the Connecticut River American Shad Sustainability Plan. This again is a five-year update. It was generated by the Connecticut Department of Energy Environmental Protection.

This plan is specific to the Connecticut River. It's the only river in Connecticut that is open for shad fishing. There is a commercial drift net fishery that occurs in the river; and it's the only river in the state that allows recreational fishing as well. The fishery has mandatory annual reporting for commercial landings, and recreational landings are monitored periodically by a roving creel survey.

The fish are intercepted also at the first major dam at Holyoke, Massachusetts at a fish lift, and a count occurs there by the Massachusetts Division of Fish and Wildlife. It also includes the collection of biological data. Connecticut also conducts the juvenile shad survey; it's been conducted since 1978.

The commercial shad fishery is executed through area gear and seasonal restrictions. It has a season from April 1 through June 15. Most of the permit holders are aging. It is a fishery where there are few participants; and they're not getting any younger. They've seen a lot of variation in the catch, the effort, and number of participants over time.

I'll run through the commercial landings here from 1990 to 2016. You can see larger landings at the early part of the time series; and then slight improvements in the recent five-year-plan period. The recreational fishery permits are required. There is a catch limit of six shad. It's an aggregate catch limit for American hickory shad.

Similar to commercial landings, the recreational landings have been declining in recent years. Anecdotal and creel information suggests that the last ten years has shown fewer fishermen participating in the traditional fishery areas. Here is a graph showing recreational landings from 1990 to the present; with sharp declines overall and very stable low landings in recent years. For fishery independent monitoring they have the fish lift at Holyoke, Massachusetts; it's operated daily, and it produces a census count of fish that are passing, as well as biological data.

Then as I mentioned, they also have a juvenile abundance index of American shad. It's been conducted since 1978, and it's a weekly seine survey from mid-July to mid-October at seven fixed stations, from Holyoke, Mass, down to Essex, Connecticut. What Connecticut has done is they've developed a stop-light approach, and it has three response metrics. The first one is on passage; and this uses the number of adult shad that are passing at the Holyoke fish lift.

It's a proxy for the total run count in the river. The trigger they use for management response is 140,000 shad; it's considered to be a good number, and below that would trigger some management concerns. The second response metric is recruitment; and this is defined as three consecutive years below the 25th percentile of the time series for the juvenile seine survey. This metric provides an early warning of recruitment failure or population decline due to poor stock recruitment. The third response metric is escapement. This is a measure of fishing pressure, when the stock expresses the proportion of total run escaping the fishery to spawn. They've picked a 90 percent as a conservative trigger.

Over time they've had a very high escapement rate. From 1990 to 2016 the median was 96 percent. This is simply the number of fish the fish lift compared to the harvest totals. Here are those response metrics graphically. Here is the fish lift numbers from 1975 to present; where the blue line running across is the metric at 140,000 shad.

What you can see is in the recent years of the previous plan, they've had some nice improvements, and they've been well above this threshold. Here is a juvenile index. The 25th percentile is about a geometric catch-per-unit effort mean of four. You can see a lot of variability here, a lot of fluctuations.

The highest value in the data series occurred this past year; which is good news. Here is the escapement metric; 90 percent is the blue line running across. You can see most years they are well above that with a very high escapement rate; because the fishery is quite small in the river, and large numbers of fish are passing at the lift.

Here is a schematic of the stop-light approach; and it's quite simple. If you have three favorable findings for those metrics then you have a green valuation; everything is a go. There is low risk, low management concerns. If you have a single one of those metrics falling below the threshold, then you have a yellow response; and that will trigger some review of the conditions.

If you have two negative responses it's an orange, and then three you obviously have a red and there will be a management response in response to that. Here is a table that summarizes the results since the last four years of the previous plan. What you can see is for all these metrics they are really well above the thresholds.

There has been one that has fallen below; 2013 the juvenile index was below that trigger. That would have resulted in a yellow card, so to speak; otherwise things have been going very well with this system. To summarize, Connecticut would like to continue using these metrics and thresholds for their sustainability fishery management plan for shad in the Connecticut River.

Again, the last four years of monitoring have only produced one case where they had a threshold below the metric. To summarize counts, the Holyoke fish lift has been increasing, as well as juvenile abundance index in recent years, resulting in strong escapement. The TC reviewed the plan, and we had very few comments.

We asked for a table to summarize benchmarks and responses to be inserted into the plan. We asked for improved language to define what management responses would occur if thresholds were actually exceeded; and this was done. Then the TC recommended the Board approve the plan. I guess what I'll do is take questions after each plan; since we have six, so if there are any questions I would be glad to take them.

CHAIRMAN CLARK: Are there any questions on the Connecticut plan? Seeing none; Brad, would you please proceed.

POTOMAC RIVER FISHERIES COMMISSION

MR. CHASE: The next plan is for the Potomac River Fisheries Commission; and we don't have a presentation on this. It's a very brief plan. Again, it's an update on the previous plan from 2012. It is simply an allowance for the commercial gillnet fishery to have a bycatch of shad in the Potomac River. The previous plan allowed two bushels per day per license holders for both pound and gillnets fishing. They have mandatory daily harvest reporting.

The total catch in 2016 was 1,145 pounds, with a total catch including releases at 3,500 pounds. It's a very modest fishery. There has been a closure to direct fishing since 1982. They have a benchmark which is a geometric mean of 31.1 pounds per net per day that was derived from 1944 to 1952 fishery data; that was adopted by the 2007 stock assessment.

Very simple bycatch fishery, the TC reviewed it. We did ask them to clarify their language a little on what would happen, in terms of management responses if they did have exceedances. Otherwise, the TC recommends the plan be approved by the Board. Any questions on the Potomac River Fishery Commission plan?

CHAIRMAN CLARK: Seeing no questions, oh sorry, Cheri.

MS. CHERI PATTERSON: Hi Brad. I just have a question on what was drafted, indicating that the benchmark goal in the 2007 stock assessment has been exceeded each year since 2011.

MR. CHASE: I think what that means is that they've been above it. Sometimes you use the word exceeded to say that you were below it, but in this case they have been above it in each year since then. They've been doing quite well; and they've had really good improvements in the amount of shad that they're intercepting in their survey. It is exceeded in a good way.

CHAIRMAN CLARK: Are there any other questions? Seeing none; Brad, will you please proceed?

NORTH CAROLINA

MR. CHASE: Okay. Next we have up North Carolina. This again is a five-year update produced by the Division of Marine Fisheries and the Wildlife Resources Commission of North Carolina. North Carolina has relatively large number of shad runs and decent shad fisheries in their state. They have a large amount of spawning areas available to shad before they reach the first main stem dam.

They also have guidance from the stock assessment in 2007 that looked at the Albemarle Sound and Roanoke Rivers, and produced a benchmark for total mortality at Z30 of 1.01. This has been adopted and used. They also adopted this to be a proxy for the other rivers in the state; even though they did not have information for mortality rates in the other rivers.

In general they have a series of survey metrics that they use for the Albemarle and Roanoke System; as well as the Tar-Pam, Neuse, and Cape Fear Rivers. These will remain the same for this update; there will be no changes. I'll call your attention to the female catch-per-unit effort independent gillnet survey, the IGNS. That is going to come up again in the presentation; and this is one of the indices that they use.

They've had these indices occurring. They also look at female relative F parameters, and they have exceeded the threshold for three consecutive years for the Albemarle Sound. This resulted in management actions to reduce commercial landings. They've had moderate reductions in low landings and total landings for the Albemarle Sound. These were the only required changes or management actions in the river systems from the 2012 plan to the present plan. Recreational creel limits are similar for most systems. They target generally a ten-fish limit that's aggregate for both American and hickory shad, with some changes on that between the four systems.

Commercial seasons, they have four different seasons for the four areas, Albemarle Sound, Tar-Pamlico, Neuse River, Cape Fear River and all other areas. The plan is going to be updated with only two changes proposed. The first change is change the way they derive their relative F. They are going to compute it by dividing commercial landings by a hindcast-three-year average of their survey index, whereas the previous plan used the centered three-year average.

They are also going to change the way they addressed the 75th and 25th percentiles in their survey indices; by fixing these values for the five-year period moving forward for the five-year plan. North Carolina also requests that all of the present coastal fisheries for recreational and commercial fisheries remain open, and adopt the same management measures listed in this plan.

A little more information on the female relative F, centered versus hindcast. The centered was used originally because they had only so many years to work with; and with a few more years of data it is better to have a hindcast value to

make use of the previous three years. These graphs show that change that was adopted.

The TC asked for a table that summarized all the metrics, as well as management triggers; and here is that table. You can see they have a fair number of values and thresholds available, relative to most other states. They have a large series of potential management measures that they would adopt if they had thresholds exceeded.

The TC asked for a little more clarification on these, and that was provided. I'm going to run through some of the different systems; in terms of the catch and the characteristics of the catch as well. Here is the Albemarle-Roanoke System. The table is broken down by buck harvest as well as roe. In this system the catch has declined substantially in the previous period.

These are graphs of the different survey indices available for that system. For the Tar-Pamlico River System, you can see a similar decline; not as large in recent years. Here are the indices graphs. The electrofishing survey has declined in recent years. For the Neuse River, here are the harvest rates as well, the Neuse River indices, Cape Fear, a little more stability in harvest than the other rivers, Cape Fear indices.

Future considerations, they would like to consider alternative means for calculating effort from the fishery independent gillnet survey; and possibly incorporate the survey from the Tar-Pamlico and Neuse Rivers as parameters also. They want to consider incorporating uncertainty into their relative F estimate. Right now it's a simple proportion.

They would like to consider the use of alternative modeling approaches that can incorporate environmental parameters; perhaps a generalized linear model to do this. Then consider alternative ways to calculate relative F using recreational catch estimates and total catch from the independent surveys. The TC reviewed the plan; and we had limited recommendations and comments. We asked them to add that table that was provided. We asked for improved language in Section 3.1 on the application of management responses that occur when thresholds are reached. This was done. We asked for language to show that there are not significant fisheries occurring in unmonitored rivers. This is a theme that will come up again with a few other systems, where there are a few rivers where there is no monitoring occurring; and the TC had concerns over this, because it's not really allowed under Amendment 3, where all rivers should have monitoring occur, to demonstrate whether that harvest is sustainable.

We asked North Carolina to have language that would describe those fisheries in unmonitored rivers; and then we have further discussion on this with a memorandum prepared by the TC later on today. In conclusion, we recommended that the Board approve North Carolina's plan. Are there any questions on this plan?

CHAIRMAN CLARK: Emerson.

MR. EMERSON C. HASBROUCK: I did have a question in terms of that last bullet; add language to show that there are not significant fisheries occurring in unmonitored rivers. If the rivers are unmonitored, how does the state know that the fisheries are not significant? Right, if abundance is continuing to trend down and there are still fisheries; that's going to change the significance of the fishery, perhaps.

MR. CHASE: It's a good question, and it really is a dilemma that we're going to discuss as the morning goes on. Amendment 3 requires that all rivers have sustainable metrics to prove that they can be sustained. If there are no types of measures those fisheries should be closed or catch and release only.

The TC struggled with this; and we asked the states to provide some indication of what was

known for that particular river. Then we have a memo we're going to discuss later on, on what we think should be done to try to improve this situation. It is a bit of a dilemma. It's a bit of an inconsistency right now in the interpretation of Amendment 3 language.

CHAIRMAN CLARK: Are there any more questions about the North Carolina plan? Seeing none; please proceed, Brad.

SOUTH CAROLINA SHAD SUSTAINABLE FISHERY PLAN

MR. CHASE: Next up is the South Carolina Shad Sustainable Fishery Plan, produced by the South Carolina Department of Natural Resources. Their plan reviewed the status of open and closed fisheries. They also reviewed the performance of their sustainability indices and benchmarks in the previous five years.

They also discussed conservation measures and gear restrictions that were put in place in 2013, since the last plan, to reduce the bycatch of sturgeon in their shad fisheries. This map shows the fisheries that were closed for the 2012 plan; they are color coded, and there were six rivers that were closed. This map shows the eight river systems that are presently open; and that have requested to remain open.

Similar to North Carolina, South Carolina has a relatively large number of shad runs, and a large amount of shad habitat. They also do a very good job with their monitoring. Let me run through some of the individual river systems. The Pee Dee River has an open recreational fishery with no closed season; and a creel limit of ten fish per day. They have a gillnet-commercial fishery with seasonal restrictions and no harvest limit. This graph shows that catch-per-unit-effort index of shad, kilograms of shad per 92 meter net per-net hour from 1979 to the present. Then it has a 25th percentile, the annual-mean CPUE, which is used as a benchmark for the time series, a very long time series, fairly stable in recent years since the last plan has been above the benchmark.

For the Cooper River there is no commercial fishery. There is a recreational fishery that also has no closed season and a creel limit of ten fish per day. They derived their sustainability benchmark from a creel survey that has a recreational fishery index; the 25th percentile of 0.66 shad per angler hour.

You can see this has been well above that benchmark since the previous plan. For the Santee River, they have two benchmarks. There is one fishery dependent, the catch-per-unit effort for the last ten years for their gillnet fishery. They use the 25th percentile of 1.8 kilograms of shad per 92 meter net per hour.

This has been well above the benchmark with some variation in the past five years. This fishery has no closed season recreationally; and it has a commercial fishery with restrictions for their gillnet, no harvest limits. They also have a fishery independent benchmark, which is a 25th percentile of the annual mean catch-per-unit effort from fishery independent gillnet surveys. This has seven shad per 92 meter net per hour, and it's been conducted since 2008.

The Edisto River, this graph is showing the number of permits in the green bars; and then the catch-per-unit effort in the blue with the sustainability benchmark going across in red. It also has a recreational fishery with no closed season, commercial gillnet fishery with no harvest limit, and the benchmark is a 25th percentile of the annual catch-per-unit effort mean for the last ten years of 0.43 shad per 92 meter net per hour.

The Savannah River also has a recreational fishery with no closed season, and a commercial gillnet fishery with no harvest limit; and the benchmark here is shown. It's also 25 percentile of the annual mean catch-per-unit effort for the last ten years, 1.1 kilograms of

shad per 92 meter net per hour. This fishery has been above that sustainability benchmark since the last plan was imposed.

The Black River has only two participants; so it has confidentiality issues. It's a very small fishery. It's similar to the others. The recreational fishery has no closed season. There are no harvest limits for the commercial gillnet fishery, and it also has a benchmark for the annual mean catch-per-unit effort for the last ten years, derived from the commercial harvest.

The Combahee River is similar to the Black River; only two or fewer participants and it has similar benchmarks for its annual mean catch-per-unit effort for the last ten years. This one is 0.53 shad per net per hour fished. South Carolina would like to consider all open fisheries to be sustainable.

There is a 95 percent of the commercial harvest that occurs in Winyah Bay and the Santee Cooper River System. These stocks have been increasing in the last 40 years, and are relatively stable for the last ten years. The commercial fisheries in the black, Edisto and Combahee Rivers are small, and these stocks in these rivers remain stable but reduced from historic estimates. South Carolina proposes additional protections for these stocks in the form of restricting commercial and recreational fisheries. Here are those additional measures. They would like for those rivers to reduce the recreational bag limit from ten fish per day to five, and reduce the amount of nets allowed in those commercial gillnet fisheries as well. Part of the impetus here is to reduce the amount of sturgeon bycatch.

The TC reviewed this plan. We had several modest recommendations. We want to add a table summarizing benchmarks and responses. We asked to improve the language to define what management responses would occur if thresholds are reached. For the next plan we asked them to evaluate additional biological and juvenile abundance index metrics to use as plan metrics.

We also asked them to consider joint coordination with North Carolina on the Great Pee Dee River, as well as joint coordination with Georgia on common management responses for the Savannah River. With this we recommended approval to the Board for the South Carolina plan. Are there any questions on the South Carolina plan?

CHAIRMAN CLARK: One over here, Jay, Roy.

MR. JASON McNAMEE: A couple of questions on a couple of, I guess they're calling them benchmarks. I'm just a little confused. They look to be at least on two of them, their red line. It looked to be below where any of the data was. I'm just curious. It's supposed to be a percentile of the landings. Is there other data that's not presented on the graph that is being accounted for? That's my question.

MR. CHASE: It's a good question, and I puzzled on that at first. But what they're doing in most cases, they're selecting the previous ten years. In some cases that's going to raise that 25th percentile up above the whole time series. I think that might be what you're seeing. Let's bring up an example. Do you want to bring up the Cooper River and just take a look at that? If any Board members from South Carolina have any further insight on this, please chime in. But I think it's a case of using the previous ten years to develop that 25th percentile produces that.

CHAIRMAN CLARK: Follow up, Jay?

MR. McNAMEE: Yes. I think this is a good example. There were a couple that were even a little more extreme where that red line is set below where any of the data was represented. I see, so you're suggesting that that red line is set on a subset of those blue dots on there. I

presume in this case it would be some of the earlier time series.

MR. CHASE: Right, and the whole premise, it's the 25th percentile of the data distribution from the series. It's going to be set at that lower quartile to begin with. Then you're going to use the previous ten years to adjust it. In some cases I think it looks to be, it's not where you would expect the 25th percentile to be in some cases.

CHAIRMAN CLARK: Roy Miller.

MR. ROY W. MILLER: I noticed in the presentation some variation in the creel limits. Can you refresh my memory, Brad? What is the guidance in our plan, with regard to creel limits for American shad in sustainable fisheries?

MR. CHASE: In terms of Amendment 3, you're asking the guidance from Amendment 3? I believe that it's up to the jurisdictions to set those creel limits.

MR. KIRBY ROOTES-MURDY: My recollection is that depending on what the SFMP lays out for the benchmarks and their ability to monitor that that there isn't a threshold in which they have to have above or below a certain creel limit. It's really at the discretion of the state, depending on what they say that is sustainable for those systems.

MR. MILLER: Yes, I was wondering. Ten seems to be a common denominator in many systems. I just wondered if there was state-by-state flexibility on that.

CHAIRMAN CLARK: Okay any further questions? John.

MR. JOHN MANISCALCO: Back to the benchmark issue. I guess I'm a little confused. Your benchmark is defined by the last ten years; so is it a constantly changing measure? Yes.

MR. CHASE: I apologize. Could you repeat the question, please?

MR. MANISCALCO: My question, so if your benchmark is defined by the last ten years of data. Is it a constantly changing mark, or are you using that 2005 to 2015 time series moving on for the future?

MR. CHASE: What has happened I think; a number of states have used that as a benchmark that changes with each year. Other states such as North Carolina with a previous plan, they chose to fix theirs for the five-year period. It's the decision of the states to what they do in that case. Jeff just reminded me that there were some concerns about the situation with the 25th percentile for some of these graphs. We asked South Carolina to clarify that with their final plan. This point has been brought up by others as well.

CHAIRMAN CLARK: Any further questions? Seeing none; Brad, please proceed with the shad tour of the south.

GEORGIA

MR. CHASE: Okay, next up is the state of Georgia. The Wildlife Resources Division produced this update of their 2012 plan. They have five coastal rivers with shad fisheries; two are presently open for commercial fishing, the Altamaha and the Savannah River; and there are five that are open for recreational fishing.

But recreational fishing really occurs just in the two rivers the Savannah and the Ogeechee River. There is no recreational fishery currently occurring in the Satilla and St. Marys River, although the plan asks that these rivers remain open. Here is a graph on commercial landings in the Altamaha River from 1980 to the present; and you can see these landings have declined substantially over time, with relatively low landings in recent years.

They also derived estimates of total population size and exploitation rates for a mark-and-recapture study conducted in the Altamaha River. Here are the graphs that show those data. In the red we have the exploitation rate, and in the black you have the population size, the population estimate from the mark and recapture study. You can see this graph is really going the way we would like to see them go; with numbers of fish going up, and exploitation rate going down. Here is the catch-per-unit effort fishery independent index; which is the number of shad caught per gillnet foot per hour. This metric is at 1.11 shad per foot hour. In the recent years of the previous plan, you can see they've been well above that benchmark. To summarize the Altamaha River, they have landings that have been fairly stable for the last 15 years.

The population estimates have been over 200,000 fish in recent years; and the exploitation rate has been below 20 percent since 2010. The independent gillnet CPUE benchmark has remained, or the actual survey results remained above the benchmark in recent years. They would like to maintain the current benchmark and utilize the same for both commercial and recreational fisheries. They propose no regulatory changes in the present plan.

The Savannah River is the only system where they have a fishery dependent index that was developed; and this is from a gillnet fishery, and it's the kilograms of shad per trip, and the benchmark is 25.5 kilograms they use for the Savannah River. It's a more recent series from 2010; oh excuse me this is the electrofishing series, which was developed in 2010, below the new Savannah River Bluff the Lock and Dam.

It's a relatively new series they hope to develop and use in the next plan. To summarize for the Savannah River, they have commercial catch-per-unit effort, American shad has remained above the current benchmark since the last plan. They have a new electrofishing adult catch-per-unit-effort series they hope to develop for future plans.

They proposed changing the current benchmark to the 25th percentile to be consistent with South Carolina in this shared jurisdiction. They want to change it from 25.5 kilograms per trip to 9.03 kilograms per trip; and to use that benchmark for both commercial and recreational fisheries. They propose no changes for the Savannah River for this plan.

For the Ogeechee River they have electrofishing survey that looks at the catch of shad per hour; and they're developing a sustainability benchmark since 2010. Again, it's a recent series. They hope to develop this for use in future plans. The Ogeechee River is open only to recreational fishing. They had no survey data prior to 2010.

Now they have the electrofishing survey. They would like to utilize a benchmark from this survey at the 25th percentile. The proposed benchmark would be 3.7 shad per hour. They're proposing no regulatory changes for the Ogeechee River for this plan. For the Satilla and St. Mary's River, they've been closed to commercial fishing for a long time.

They are technically opened for recreational fishing due to statewide regulations; but there is no evidence of any activity occurring in these two rivers. They have occasional surveys that are conducted that do not find shad typically. This was an issue where the TC felt that to have these fisheries open they would need to have a sustainability fishery plan for the rivers.

Georgia disagreed and felt that it wasn't practical; that it would require changes to their regulations. They asked to have these rivers remain open. Here is another case where we have rivers that are open to fisheries, but there are no sustainability metrics. We are going to

ask the Board to consider how we can connect this problem with Amendment 3 language.

For the Georgia plan the TC reviewed it. We have a few recommendations. We discussed in detail again this whole question of having an open fishery with no monitoring or sustainability metrics. We asked Georgia to improve the language on their adaptive management for cases where their benchmarks would be exceeded.

We asked them to add a section for future objectives that included development of biological metrics such as length, age, and juvenile abundance indices that could be included in the next plan. With this we recommended the plan for approval by the Board. Are there any questions?

CHAIRMAN CLARK: Okay seeing no questions, Brad would you please proceed with Florida?

MR. CHASE: Sure.

CHAIRMAN CLARK: Excuse me, Virginia.

VIRGINIA

MR. CHASE: All right we're near the end here. Virginia is a plan that has no presentation; it's a very simple plan, very similar to the Potomac River's plan, where it simply allows a commercial bycatch in their gillnet fisheries, in the James, York, and Rappahannock Rivers. This has been approved since 2006, to allow for this minor bycatch to occur when shad are caught incidentally in fisheries for striped bass, croaker, catfish and other species.

They have a cap of 30 permits that are allowed, so it's a very small fishery. The bycatch is sampled by VIMS routinely. They bycatch harvest since 2011 since the last plan has been 4 percent of the total harvest; with 90 percent of total harvest going towards research and stocking efforts. At 4 percent it's a very small amount of the overall total harvest in a closed fishery.

The 2015 harvest estimate was 1,185 pounds of shad; which was estimated to be 332 fish, and 22 of 29 issued permits had landed some shad. This was a case of simply asking to maintain this bycatch allowance. The TC reviewed the plan; and our comments were quite limited. We just asked to have language inserted that would indicate that there is monitoring of the permittees to ensure there was not targeting occurring for shad.

There was some concern at the TC over whether there could be direct targeting with this plan. We asked, some language was inserted to ensure that there would be monitoring to prevent this, and that measures would follow if they identified some permittees as targeting shad under this plan. With that we recommend that the Board approve the shad plan. Any questions on the Virginia plan?

SUMMARY OF TECHNICAL COMMITTEE RECOMMENDATIONS

CHAIRMAN CLARK: Are there any questions? I don't see any; so Brad, you wanted to then summarize the TCs recommendations here?

MR. CHASE: All plans were recommended for approval by the Board; and the TC did generate a memo that summarized our concerns on a couple issues that were common to these plans. That was over the issues that I mentioned of having rivers where harvest was proposed to be open; with no sustainability metrics or no sustainability plan for that particular river.

Amendment 3 really doesn't allow for this. Amendment 3 directs states to close those fisheries or have catch and release only for recreational fisheries in those cases. Several states argued that they had these remote rivers that were not easy to monitor; with little evidence of recreational activity occurring, and

that it wasn't really practical to start a survey series to develop these sustainability metrics. The TC felt that we should come back to the Board; and ask the Board to consider directing the TC to look at this discrepancy, and develop ways to try to improve this. That is in the memo that we have for you.

Also at the same time, we felt there was some inconsistent application of the stock assessment recommendations for developing benchmarks related to mortality estimates. We felt there was a need to try to improve the standardization of the way benchmarks were developed; and to utilize the recommendations from the stock assessment on using mortality estimates.

Let me summarize the request the TC is making to the Board. We're asking the Board to task the TC with meeting in person to develop proposed improvements to Amendment 2 and 3, in regard to the following items. The management and monitoring of rivers with low abundance in harvest of shad and river herring, Number 2, to develop standardization of sustainable fishery management plan requirements, in terms of their content, the metrics, and the management responses to exceeding thresholds, .

Number 3, incorporation of stock assessment information into these plans, and develop discussion on timelines for renewing plans.

There was some discussion on whether we should adjust our timelines. Right now we're basically following a five-year plan for renewing these plans. We're also asking for looking at the clarification of de minimis status; and how it pertains to the sustainable fishery management plans.

There was some discussion that if a state has de minimis status that they should be able to maintain recreational fisheries in some of these fisheries that do not have monitoring. Again, review the number of years of data that is required before developing a sustainable fishery management plan. I think we've been using ten years as kind of the window to use a data series or a survey that could be acceptable for a benchmark.

But Amendment 3 and Amendment 2 really don't specify that; and it's been something we've just been adopting, so we wanted to get some clarification on that as well. These items, the TC feels all should be addressed. We think we probably should do this through an in-person meeting in the coming year; but that would take the direction from the Board for that to happen.

CHAIRMAN CLARK: Thanks, Brad. Are there any questions for Brad about the memo or the TC recommendations? John, go ahead.

MR. MANISCALCO: In the sustainable fishery plans that you reviewed. I think only North Carolina utilized an assessment-based F. I was just wondering if there are other states that utilize assessment based, say reference points in their management, and if you think the current state of science is good enough to support its use in management elsewhere.

MR. CHASE: It's a good question, and I think the upcoming benchmark stock assessment is going to look at that closely and assist with this. I think even North Carolina has a relative F that is used, which is a proportion; and they have this one F in one system. It is really something that was recommended in the 2007 stock assessment, and it really hasn't come to be. In most cases the data really isn't there to have age-structure mortality estimates produced. I think I can safely that is going to be a goal of the stock assessment update to address that.

CHAIRMAN CLARK: Okay next question is Justin.

MR. JUSTIN DAVIS: I just wanted to speak generally in support of the memo to the Board from the TC. I think given that we're five years into this process, it's a good idea to take the opportunity to sort of streamline and improve this process with these sustainable plans. I definitely think that this idea of sort of especially making sure that the management responses in these plans are more clear is a great idea.

I do think that we want to make sure though that in this effort to standardize the approach to get more prescriptive, to tie it more closely to the stock assessment, t. That we don't make it so rigid and prescriptive that it doesn't allow for states to sort of use the best available information they have to define whether their fisheries are sustainable. For instance, I found Georgia's argument that they had eight years of creel data from a couple of these rivers that showed the fishery was very small or nonexistent.

Mandating that they start monitoring those rivers on an annual basis isn't likely to change that picture. In Connecticut we have a similar situation, in which we conducted annual creel surveys on the Connecticut River for a number of years; which documented pretty well that the shad fishery had declined at very low levels. We have staff, who are on the river every spring, would notice if there was suddenly like a three or four-fold increase in the number of shad fishermen out there.

I do think that we want to, as we look to improve this process, maintain some latitude for states to be able to sort of if they don't have annual monitoring data, and feel like it would be an undue burden to take on those programs that they have an opportunity to present their best available information of the Technical Committee, and that the Technical Committee has the latitude to take that into consideration and make a determination on whether the fisheries are sustainable.

I think we have to keep in mind that the sustainability metrics aren't truly sustainability metrics in the truest sense of the word; they are metrics for appropriately precautionary management. I think we just need to make sure as we improve this process, we try to maintain some latitude here for states to use the information they have.

MR. CHASE: I agree. If I could just follow quickly, I think the TC felt that the first round of plans that were developed in 2011 and '12, were really done, it was the beginning of the process, and in many cases the information was all that was available to use either count data or catch-per-unit-effort data. At this point the TC feels that it's time to revisit the process; and see what we can do to improve the standardization.

CHAIRMAN CLARK: The next question is from Jay.

MR. McNAMEE: First, I'll commend the TC. These weren't necessarily stock assessments, but it was a lot of information to synthesize; so nice job with all of that. It looked like a big piece of work there, so good job. I will echo support for the Technical Committee recommendations. I think they all make a lot of sense; and in fact echoed a lot of the thoughts I was having as we were reviewing. I've got two comments, quick comments, because I think Justin covered a lot of it already. I will also acknowledge that I'm coming off the bench here on this Board. Mark Gibson usually sits in this seat; so I'm maybe not as up to speed as Mark would be. But again, I will support the need for some consistency in the metrics.

I understand that the information available is diverse; and you're doing the best you can with it. But I think there are thematic things throughout that you could probably pull together; and get a little more consistency. One

of the other things that I noticed is linking the metrics together where possible.

An example would be if you have recruitment metric, rather than setting a blind quartile for the benchmark, looking at that recruitment amount and matching it up with a relative abundance index, and finding those spots where it looks like that was a good level of recruitment to feed into the population. Just as an example that would be more of a, not quite an assessment, but trying to link it into a population dynamics type context.

MR. CHASE: A quick follow to that. One of the things the TC has been considering is asking for the use of generalized linear models to try to improve the datasets; and bring some of these different indices together in those types of models.

CHAIRMAN CLARK: The next question is from Michelle.

DR. MICHELLE DUVAL: I think just echoing some of what Justin said earlier about the TCs request for tasking. I think maintaining the flexibility for states to use the best information available; recognizing the diversity of information that is available throughout these different areas. I think having been around for the development of the sustainable fishery plan concept.

I absolutely support looking at trying to establish some consistency with how these plans were presented with the content that's within them, with thresholds for a given metric potentially standardizing some of the management responses. But I think my concern is just that any attempt to dictate, here are the metrics states should absolutely use, is really going to squeeze us into a corner where we may not be using the best information that we have available.

I would just ask the TC to keep that in mind. Then I think with regard to fishing activity that may or may not be occurring in unmonitored rivers. That really boils down to how you define a system. I think in the case of North Carolina, the plan that we have submitted is no different, with regard to the systems than the plan that we originally submitted back in 2012.

I think we're probably one of the states where we've actually had to take significant management action in of our systems in the Albemarle system. You saw our commercial season went from eight weeks down to three; because we hit some of the management triggers that we had set up. I would say that in terms of the areas where there is clearly zero to limited harvest, whether it's commercial or recreational occurring, and there is no spawning activity occurring.

We need to really keep in mind how we're defining a system here. I think with regards to issues like the Pee Dee River, you know we put forward in our plan that we would be more than willing to complement the measures that South Carolina has set up as a result of their monitoring; because their monitoring is occurring downstream of where any recreational fishing in the inland waters of North Carolina would be occurring. I think another voice that needs to be brought into the conversation as the TC debates this, is the Virginia Department of Game and Inland Fisheries; because a similar situation is happening with the Virginia stretches of the Meherrin, the Blackwater, and the Nottoway Rivers, which all flow into the Chowan in North Carolina.

Our staff reached out to some of our colleagues at that sister agency; and they really weren't aware that this change had occurred that if there was not monitoring occurring in some of these areas that harvest was supposed to be closed. I would recommend reaching out to folks at that agency; so that they can be a voice in this conversation as well. I guess finally, in terms of the incorporation of the Z-30

benchmarks that came out of the previous stock assessment.

I would ask that the TC go back and reread some of the minutes from the Board conversations that occurred back in 2008, as we were discussing this. Because there was a lot of conversation about the utility and uncertainty in some of those Z-30 benchmarks; particularly with regard to determination of natural mortality, particularly with regard to what we can control in terms of fishing mortality versus mortality that's occurring from other human-induced activities.

We had a pretty robust debate about that around the table. I would just note from the peer review report that it states that although the review panel considered the Z-30 benchmark sufficient for the region-wide comparisons presented in this assessment. This reference point is not directly linked to the management issues from many of the populations.

The Review Panel encourages the development of population-specific reference points appropriate for the alleviation of the threats that exist for many of these populations. I think there is a lot of information out there that the TC is going to need to consider as you all embark on this conversation.

CHAIRMAN CLARK: Brad, any of those things being considered by the TC already?

MR. CHASE: Very good recommendations. I think we've got some homework to do; and I think the TC shares those concerns. I think it's a good time to revisit this and see what we can do to improve the process.

CHAIRMAN CLARK: Okay next is Lynn.

MS. LYNN FEGLEY: I also echo support for this; particularly for any state that may want to consider how to allow some modest harvest. Having some consistency would be very helpful, but my question pertains to process. The TC will go and conduct these reviews, and come up with recommendations. Would we then be looking at an addendum to implement some of these things; or where do we go after we hear back from the TC?

CHAIRMAN CLARK: Kirby, do you want to respond to that?

MR. ROOTES-MURDY: The timing of all this really needs to be looked at relative to the upcoming stock assessment that Jeff laid out. We have kind of a two-part process. The TC, as Brad outlined, would like to get after this sooner rather than later. But in terms of a change to the management program, probably the best time to get after that would be following the upcoming benchmark stock assessment. At that point, as we always do, the Board would consider possible management action. That is where a potential change, either through an amendment or an addendum would be probably most appropriate.

CHAIRMAN CLARK: Pat.

MR. PATRICK C. KELIHER: I'll try to be brief here, because a lot of the things have been said. But the key point is flexibility here. I think states that would like to have a modest recreational fishery, in the case of Maine, is important to then not have any burdensome, costly measures put in place for monitoring those fisheries. For the case of the state of Maine, we've got roughly four areas where we have directed fisheries. We have a two-fish bag limit. If you saw all of these creel limits listed here were all ten-fish bag limits.

I think there needs to be some ways to address that. I would also say that I was looking back in the notes; and it looks like Maine had only requested de minimis status for our commercial fisheries. But in fact the letter that we sent in May was to request de minimis status on our

commercial and recreational fisheries; as associated with biological data and collection of that data. I just want to make sure that that is clear as well.

CHAIRMAN CLARK: Do you want to respond to that, Kirby?

MR. ROOTES-MURDY: Yes thank you, Pat. That communication might not have been fully conveyed to all the staff, as we've had some turnover. When we get to the FMP review, please be sure we'll have that noted but we can address that then.

CHAIRMAN CLARK: Cheri.

MS. PATTERSON: Yes I would like to make a motion. I would like to move that the Board approve the six SMFPs that were just presented. Do you want me to read that?

CHAIRMAN CLARK: Is that your motion?

MS. PATTERSON: Move to accept the Sustainable Fishery Management Plan Updates for shad for Connecticut, Potomac River Fisheries Commission, North Carolina, South Carolina, and Georgia; and task the Technical Committee with developing proposed improvements to Amendments 2 and 3, to address SFMP inconsistencies with the management documents.

CHAIRMAN CLARK: Do we have a second? Pat Geer. Discussion of the motion. David.

MR. DAVID V. BORDEN: To the maker of the motion, does this include the requirement for the states to implement the Technical Committee recommendations; which were put up on the Board on a river-system-specific basis? In other words, they had language changes that they wanted implemented as part of the proposal.

CHAIRMAN CLARK: Cheri.

MS. PATTERSON: It's my understanding that they did make those changes. Am I incorrect? When they resubmitted the plans they had made those changes?

MR. CHASE: Yes in those cases, and the one question mark remaining is over what to do with rivers that are unmonitored, but have harvest.

MS. PATTERSON: However, that is being addressed through the TC process.

MR. CHASE: Correct.

MS. PATTERSON: Okay, thank you.

CHAIRMAN CLARK: Okay, further discussion? Seeing none; oh, Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: I think staff added Virginia to the motion after Cheri read it. We may want to make sure that the maker and seconder are comfortable with Virginia being included as well.

MS. PATTERSON: I'm very comfortable with that.

CHAIRMAN CLARK: Pat. Very good, are there any objections to the motion?

MR. ROOTES-MURDY**: I would just like to perfect the motion. We have SFMPs for Connecticut, Potomac River Fisheries Commission, North Carolina, South Carolina, Georgia; and then Virginia is a bycatch plan, so it's not their SFMP,** just so the Board is clear on that.

CHAIRMAN CLARK: It looks like it is being modified again. Are the maker and seconder? Okay. Roy.

MR. MILLER: Mr. Chairman, as long as we're going to be technical with the motion, wasn't

the Potomac River Fisheries Commission plan a bycatch plan as well?

CHAIRMAN CLARK: Good question. Okay, we've got another change.

MR. ROOTES-MURDY: Just to clarify. The Potomac River Fisheries Plan I believe is an SFMP and not a bycatch plan.

CHAIRMAN CLARK: Okay is this our final motion? The maker and seconder are good with this. **Are there any objections to the motion? Seeing none; then the motion carries unanimously.**

CONSIDER APPROVAL OF THE 2017 FMP REVIEW AND STATE COMPLIANCE REPORTS

CHAIRMAN CLARK: Now we're on to the next agenda item; which is to consider approval of the 2017 FMP Review and State Compliance Reports, and Caitlin Starks will take that.

MS. CAITLIN STARKS: Hopefully this will look familiar, as you all just went through the 2015 FMP Review at the last meeting. This will be the FMP Review for the 2016 fishing year for shad and river herring. To start we have a figure here of the commercial landings from 1950 to 2016, for river herring and American shad.

As you can see there are steep declines starting in the '70s with stable low catch for the most recent years for both species groups. This is in part due to the moratoria implemented in Amendments 2 and 3. For shad commercial landings the states with landings remain Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia. For river herring states landings were from Maine, New York, Maryland, and South Carolina. In 2016, a total of 239,067 pounds of American shad were landed; which is a 50 percent decrease from landings in 2015. There were 100,079 pounds of hickory shad landed, which is a 35 percent decrease from 2015, and 1.97 million pounds of river herring were landed in 2016, which is 2 percent less than 2015 numbers.

South Carolina and North Carolina had the highest landings of American shad, respectively, and river herring I won't disclose, because it's confidential. Moving on, several states are conducting passage counts that are required by Amendments 2 and 3 for river herring and shad. These are occurring in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, Pennsylvania, Maryland, and South Carolina.

The total coastwide river herring counts were 5.51 million fish; and for shad 540,917. It's a 44 percent increase for river herring compared to 2015, and a 12 percent decrease for shad compared to 2015. Several states are also participating in stocking efforts. In Maine, Massachusetts, Rhode Island, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia, there are stocking efforts being conducted.

In 2015 there were 23,535,342 shad stocked of hatchery origin; and this represents a 9 percent increase from 2015. There were also 974,728 alewife stocked in Maine, ~~.~~ ~~T~~though these fish were wild caught and transported upstream to spawning areas; but were not hatchery raised, and therefore are not addressed in the FMP review.

As part of the annual compliance reports the states also report any sturgeon interactions with the shad and river herring fisheries, and in 2016, 147 interactions were reported in total; and these occurred in Rhode Island, Connecticut, New Jersey, the Delaware Bay, PRFC, Virginia, North Carolina, South Carolina, and Georgia.

All of these sturgeons were released alive with the exception of two fatalities, which occurred in North Carolina. Several states have

requested de minimis status for their shad and river herring fisheries. For shad these states are Maine, New Hampshire, Massachusetts, and Florida; and for river herring just New Hampshire and Florida. These states all qualify for de minimis status and the PRT recommends approving these requests. In the review of the compliance reports the PRT did not encounter any other compliance issues. That is all, so any questions?

CHAIRMAN CLARK: Are there any questions for Caitlin? Michelle.

DR. DUVAL: Not a question, just a comment about some of the information that is in the FMP Review. At the top of Page 6 in the review, there is a sentence in there that says recent commercial landings continue to decrease, despite North Carolina restricting the commercial harvest of river herring in 2015. Then the next sentence notes that river herring landings were reported from North Carolina. North Carolina didn't have any river herring landings in either 2015 or 2016; because we've actually had a no harvest provision since 2007, not 2015.

I think there might be some confusion that in 2015 we actually removed a discretionary harvest provision that the Director had that allowed for extremely minimal harvest, the four days surrounding the Easter weekend to provide herring for festivals. That discretionary harvest provision was removed. The maximum amount that had ever been harvested under that very narrowly permitted discretionary harvest provision was 1,800 pounds in any one year. I think there is some language that I can work with staff on to correct that statement there on the top of Page 6.

CHAIRMAN CLARK: Do you want to respond to that, Caitlin?

MS. STARKS: Thanks, Michelle. I can definitely work with you on that.

CHAIRMAN CLARK: Then we had a question from Pat.

MR. KELIHER: I just want to confirm that Maine's request for de minimis status was for both recreational and commercial.

CHAIRMAN CLARK: Thanks, Pat. Are there any other questions? Justin.

MR. DAVIS: I just have a sort of process related question. The Plan Review Team is conducting the Fisheries Management Plan Review, and then the Technical Committee is reviewing the Sustainable Fishery Management Plans. I'm just wondering to what degree is that process coordinated; or how is it sequenced? Was sort of the Technical Committee doing the SFMP Reviews before the Fisheries Management Plan Review?

CHAIRMAN CLARK: Do you want to respond to that, Kirby?

MR. ROOTES-MURDY: Sure thing. This year is kind of unusual, given that the SFMPs have not been annually reviewed. This is the first time we've done that in a while, with many of the states seeking to update their plans and get them kind of recertified in that way. We did have the PRT go through and look at compliance reports, and then we did a conference call having the Technical Committee go through each of these SFMPs this year.

As you can see in the meeting materials there are some notes about how both in the Plan Review Team's look at the compliance and the TCs look at the SFMPs, there were notes on the SFMPs between those two groups. But again, this is kind of an unusual year where we don't normally have that kind of joint review or separate reviews of the same plan.

CHAIRMAN CLARK: Does that answer your question, Justin? Okay, are there any further questions? Cheri.

MS. PATTERSON: Yes, on Page 13, the PRT is looking for clarification from the Board as to whether it's the intent of Amendments 2 and 3 to reinstate recreational fishery monitoring coastwide; and if so should there be some sort of template. Can you indicate how much of a recreational fishery there is that would institute the need for a large, wide scale, creel survey template; understanding that the MRIP Survey is problematic in this venue?

MR. ROOTES-MURDY: Yes, I think one of the things the Plan Review Team kind of struggled with is that we know that there are a number of states that have recreational fisheries; but we don't have a great handle on what the catch is in a number of those systems. Moving forward, both in considering the next upcoming assessment, trying to better account for that either removals or biological sampling that could be benefited from looking at those systems more, is something the PRT was trying to get a better handle on, if we were to go down that road. But as you've noted, MRIP does not sample shad and river herring well; and therefore we can't really use that as a basis these days for assessing them.

CHAIRMAN CLARK: Follow up, Cheri.

MS. PATTERSON: Well, I think it might be difficult for some states to put together a coastwide creel survey. I think that that is not the intent of Amendments 2 and 3; to reinstate one coastwide. Where do we move forward with this conversation?

MR. ROOTES-MURDY: I think similar to the question that was raised about when a management change would happen, with regards to shad, coming out of the next benchmark stock assessment would be probably the best time to look at the current state requirements for monitoring, and maybe consider it then if that is the pleasure of the Board, but timing wise that would probably be the best venue to do so.

CHAIRMAN CLARK: Okay, I had another question from Michelle.

DR. DUVAL: Not a question, Mr. Chairman but just a comment specifically in regards to this topic; in terms of a creel survey template. In North Carolina we've worked with our partners at the Wildlife Resources Commission; our sister agency. Our staff has worked with their staff beginning in 2010-2011 to expand our creel surveys up into the estuarine and up into the freshwater portions of all of our river systems that you saw in the Sustainable Fishery Plan for shad.

It's specifically because MRIP was not sampling those fisheries very well, so we feel like we do have reliable recreational harvest information in those systems. I guess I would just note that one of the two systems that the TC was concerned about in our plan as being unmonitored, we have excellent creel sampling there.

There is zero recreational harvest in the system. I guess I would just note that as this conversation moves forward, as Cheri said, that there is possibly a template that the Plan Review Team of the TC could look to; and I would encourage folks to reach out to the TC members from North Carolina in that regard.

CHAIRMAN CLARK: Are there any further questions, discussion? Seeing none; we'll entertain a motion. Roy Miller.

MR. MILLER: I move that we accept the review of the fishery management plan for shad and river herring for the 2016 fishing year; with the corrections so noted by Board members today.

CHAIRMAN CLARK: Thank you, Roy, do we have a second? Justin. Roy, would you modify that for the de minimis?

MR. MILLER: **Sure, I'll read it again. Move to accept the 2017 FMP Review of the 2015**

fishing year and state compliance reports; and approve de minimis requests for Maine, New Hampshire, Massachusetts, and Florida for shad, and de minimis request for New Hampshire and Florida for river herring.

CHAIRMAN CLARK: Justin, are you okay with the changes? Okay good. Are there any objections to the motion? Oh, excuse me, I'm sorry, Pat.

MR. KELIHER: I just want to make sure that it's clear; because it says something different in the document that I'm reading that my request was for commercial only, and it was for recreational and commercial. I want the record to be clear on this.

CHAIRMAN CLARK: I will just turn that over to you. Kirby, is that clear from this that it includes both recreational and commercial?

MR. ROOTES-MURDY: To clarify. If it would be helpful, we could specify that in here that it is both commercial and recreational for Maine if that is your pleasure.

CHAIRMAN CLARK: If we can make those changes are the maker and seconder of this motion okay with that? Both are in agreement. Okay. **Oh, and are they also okay with clarifying that it's 2016 not 2015? Okay, good. Are we settled with this motion right now? Good. Now, are there any objections to this motion? Seeing none; the motion is approved**.

OTHER BUSINESS

CHAIRMAN CLARK: That brings us to our final action, which is Other Business/Adjourn.

This really isn't another business item, but Kirby pointed out to me in the Supplemental Materials there was a sheet outlining the activity level for this plan. I think it's over there at the table also, but it shows that this is a highly active plan right now. There are a lot of tasks that are being assigned to the Technical Committee and the Stock Assessment Committee. I guess other than making the Board aware of that are there any comments you would like to make about that, Kirby?

MR. ROOTES-MURDY: No. We've moved to include this information for all the species boards, so please be sure to look at that in the supplemental materials. But given today's discussion, it is just important to note that with the change in the upcoming stock assessment, and then this TC tasking that that will continue to elevate maybe a shad and river herrings task to what we've been calling kind of a high activity level. Just to be cognizant of that for future shad and river herring discussions.

ADJOURNMENT

CHAIRMAN CLARK: Is there any other business to come before this Board? Seeing none; the Board is adjourned, thank you.

(Whereupon the meeting adjourned at 9:27 o'clock a.m. on October 17, 2017)

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

American Shad Methods Workshop
Meeting Summary

Providence, Rhode Island
November 5-8, 2018

Shad Technical Committee and Stock Assessment Committee Members: Michael Bailey (Chair, USFWS), Ken Sprankle (TC Chair, USFWS-CT), Joey Ballenger (SC), Mike Bednarski (VA), Wes Eakin (NY), Chad Holbrook (SC), Kevin Sullivan (NH), Joe Zydlewski (USGS), Jacque Benway-Roberts (CT), Kiersten Curti (NOAA-Fisheries), Angela Giuliano (MD), Bobby Adams (NY), Pat McGee (RI)

ASMFC Staff: Jeff Kipp, Caitlin Starks, Julie Defilippi Simpson

Public: Jason Boucher (NOAA-Fisheries), Dr. Dan Stich (SUNY-Oneonta), Erin Gilligan (SUNY-Oneonta), Dr. Yan Jiao (Virginia Tech), Rujia Bi (Virginia Tech)

The Stock Assessment Subcommittee (SAS) convened in Providence, Rhode Island to conduct the Methods Workshop for the 2019 Benchmark Stock Assessment for American shad. The primary objectives of the workshop were to review final data inputs for assessment analyses, define stock structure, and determine the appropriate analyses for each stock.

The SAS received updates from data subgroups on inputs for the assessment. These included updates from the Life History Subgroup on growth, natural mortality, morphometric relationships, maturity, and fecundity; the Age and Composition Subgroup on ageing error and catch-at-age development; the Indices Subgroup on indices of abundance; and the Hydropower Subgroup on remaining needs for determining barrier effects on stocks. The SAS also received updates on commercial landings data from ACCSP and incidental catch estimates from NOAA Fisheries. These updates indicated that several data sets still had not been made available for the stock assessment or needed further review for accuracy.

The SAS completed the definition of stock structure and identified assessment methods for 31 stocks. The SAS also reviewed work by two academic collaborators: SUNY-Oneonta (Dr. Dan Stich and Erin Gilligan) and Virginia Tech (Dr. Yan Jiao and Rujia Bi), on methods to support the assessment.

Given the difficulties in finalizing data for the assessment and the workload required for the number of stocks being assessed, the SAS requested that the assessment timeline be modified with a completion date of August 2020.

Massachusetts Sustainable Fishing Plan for American Shad (*Alosa sapidissima*)

Submitted to:

Atlantic States Marine Fisheries Commission

Prepared by:

John J. Sheppard and Bradford C. Chase

Massachusetts Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, MA 02114

October 2018

1. Introduction

American shad *(Alosa sapidissima)* are presently managed under Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring. Amendment 3 contains the provision to close state fisheries for shad (except for catch and release only) for states without an approved sustainable fisheries management plan (SFMP) by January 2013. The purpose of this SFMP for Massachusetts is to allow the continuation of shad fishing in the Merrimack and Connecticut rivers while planning for population restoration in those rivers and others where populations are low and limited information is available.

2. Current Regulations

American shad are managed in Massachusetts jointly by the Division of Marine Fisheries (DMF) and the Division of Fisheries and Wildlife (*MassWildlife*). DMF manages shad passage and harvest in marine waters up the first dam or head of tide and *MassWildlife* manages shad passage and harvest in freshwater above the first dam or head of tide. Under current laws and regulations no commercial fishery for American shad presently operates within the Commonwealth of Massachusetts. Under Massachusetts General Laws (Chapter 130), American shad may be taken by hook and line only. The Code of Massachusetts Regulations (322 CMR 6.17) restricts the harvest of American shad to the Merrimack and Connecticut Rivers, with a three fish per angler possession limit. All other waters are catch and release only. Regulations at 322 CMR 4.12 prohibit the landing of net caught shad, even when taken outside of Massachusetts waters in the Exclusive Economic Zone or in the territorial seas of another state.

3. Current Status of Stocks

Four river systems in Massachusetts support recreational American shad fisheries that are predominantly catch and release. These are the Merrimack River, the North River and its tributaries of Pembroke and Marshfield, the Palmer River, and the Connecticut River. Three other rivers are considered to support shad runs due to recent observations of adult shad during spring (*see* Appendix, Table A1). Coastal runs of American shad in the Commonwealth are relatively small compared to the Mid-Atlantic and South Atlantic regions. The Connecticut and Merrimack rivers have the most potential to support large American shad runs, both have multi-jurisdictional anadromous fish management and restoration plans in effect. Following the section on state-wide reported landings, the plan will be divided into sections on the Merrimack River and Connecticut River. Finally, brief discussion will be included on the remaining small rivers that have limited information on existing shad runs or fisheries.

A. Statewide Landings

The prohibition of catching shad by net in 1987 essentially eliminated commercial harvest in Massachusetts. Since 1987, landings have been reported by the National Marine Fisheries Service (NMFS) (Table A2), with few shad landings in recent years. The origin of these harvested shad is uncertain but is expected to some degree to represent illegal landings made inadvertently within fisheries that were not targeting shad. Recreational catch estimates are made with high variability; showing higher catch in the late 1990s and low catch in recent years (Table A3). The recreational survey is also limited by incomplete statewide coverage of all areas where shad occur.

Merrimack River

Merrimack River. The Merrimack River flows for 204 km from tributaries in New Hampshire to the Atlantic Ocean. The lower 78 km of the river are in Massachusetts and the first dam is the Essex Dam, located at 42º 41' 57.942" N and 71º 09' 57.086" W at 48 rkm in Lawrence, Massachusetts. The drainage area of the Merrimack River is 12,970 km^2. A US Geological Survey streamflow gauge station has been maintained since 1923 in Lowell at drainage area 12,005 km^2 (#01100000) at approximately 66 rkm. Mean monthly discharge for the time series at this station during the spring are: 19,400 cfs – April; 11,700 cfs – May; 6,700 cfs – June; and 3,740 cfs – July (http://waterdata.usgs.gov/ma/nwis/).

Historically, the shad spawned in the Merrimack River as far in the watershed as Lake Winnipesaukee in central NH and its tributaries. Prior to dam construction, the shad run in the Merrimack River supported important fisheries that landed several hundred thousand shad annually (Stolte 1981). By the late 19th century, Goode (1884) considered the Merrimack River shad run to be insignificant due to passage barriers. Anadromous fish are managed by the Merrimack River Anadromous Fish Restoration Program that is comprised of US Fish and Wildlife Service (USFWS), NMFS, US Forest Service, DMF, *MassWildlife*, and NH Dept. of Fish and Game representatives. Fishways are present on the first three dams in the Merrimack River. The lowermost dam, the Essex Dam, was first built in 1848 and presently has a spillway width of 920 ft and height of 31 ft. Several fish passage facilities have been operated at the dam since construction. Since 1983 passage has been provided by a fish lift. The fish lift is operated by the dam owner, Consolidated Hydro, Incorporated Energy (FERC Project No. 2800).

The next dam upstream is the Pawtucket Dam in Lowell MA at 70 rkm. The Pawtucket Dam was built in 1830, enlarged in 1876, and presently has a spillway width of 1086 ft and height of 15 feet. A vertical-slot fishway and fish lift became operational in 1986 at the Pawtucket Dam. The fishways are operated by the Lowell Hydroelectric Project (FERC Project No. 2790). The third dam upstream is the Amoskeag Dam in Manchester, NH, at 119 rkm, that has a pool and weir fishway where shad counts are monitored by the New Hampshire Department of Fish and Game. The next two dams in NH (Hooksett and Garvins) presently have no fish passage facilities.

Shad Spawning/Nursery Habitat. There is a large amount of existing and potential shad nursery habitat in the Merrimack River. Currently, upstream passage in the Merrimack River is blocked at the Hooksett Dam at 132 rkm. The Merrimack River Shad Restoration Plan (MRTC 2010) estimated that there was approximately 5,687 acres of potential mainstem nursery habitat downstream of the Hooksett Dam. The plan also identified 700 acres of potential nursery habitat available in tributaries to the Merrimack River downstream of the Hooksett Dam. Restoring passage at Hooksett and Garvins would provide another 3,802 acres of habitat currently unavailable to spawning shad.

The Technical Committee for the Anadromous Fishery Management of the Merrimack River first introduced a strategic plan for restoration in the Merrimack River that contained an interim objective of annually passing 35,000 shad at the Essex Dam fish lift (USFWS 1997). The 1997 plan recognized that variable river discharge can alter both fish lift operations and attraction flows to the fish lift entrance which can influence the passage efficiency of shad present below the dam annually. The shad restoration plan for the Merrimack River was updated in 2010 (MRTC 2010) and contains shad restoration targets based on habitat units.

Coordination within the Merrimack River Watershed

The Massachusetts Division of Marine Fisheries accepts the restoration goals of the cooperative Merrimack River Anadromous Fish Restoration Program as specified in the updated shad restoration plan (MRTC 2010). Based on upstream habitat units and the assumed production metric of 100 shad per acre of habitat, the MRTC (2010) goal for passage is 744,083 shad at the Essex Dam and 651,173 shad at the Pawtucket Dam. The plan provides detailed recommendations for achieving shad restoration goals through fish passage improvements and stocking measures with long-term monitoring and program evaluation.

Additionally, the state of New Hampshire also accepts the restoration goals of the cooperative Merrimack River Anadromous Fish Restoration Program as documented in their American Shad Fishing/Recovery Plan submitted to the ASMFC Shad and River Herring Technical Committee in 2012 (NHFG 2011). New Hampshire presently has closed both the recreational and commercial shad fisheries to harvest while allowing catch and release for sportfishing in the Merrimack River. Discussions were held with NH Fish and Game staff over the need to coordinate further on this SFMP update; however, given that their fishery is closed to harvest, no further action was taken.

A. Landings

No Merrimack River-specific shad landings data are available. Harvest in MA has been restricted to hook and line since 1987. Communications with local fishing clubs and bait and tackle shops indicate a small sportfishery persists with relatively low participation and low retention of shad.

B. Fishery Independent and Dependent Indices

i. Juvenile Abundance Indices: There have been no historical or recent efforts to create a juvenile abundance index on the Merrimack River.

ii. Fish Lift Monitoring of Spawning Run

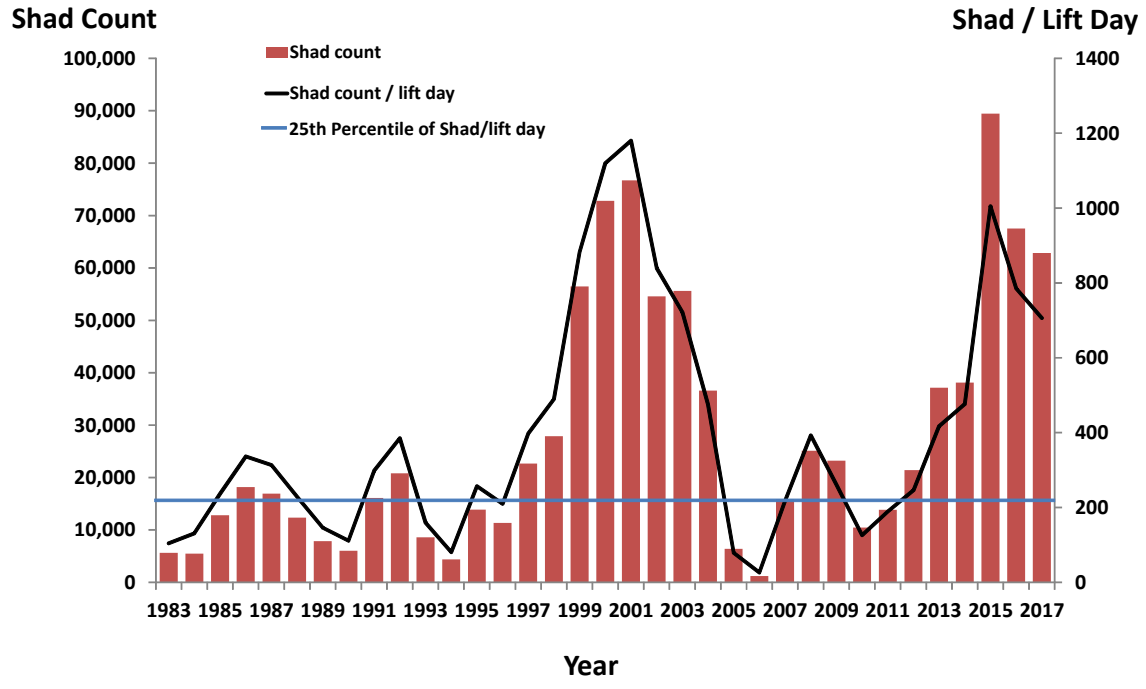
Long-term fishery independent indices for shad are available from fish lift data at large hydropower dams on the Merrimack River. Cooperative monitoring efforts have been ongoing in the Merrimack River since 1969 involving the USFWS, DMF and *MassWildlife*. The Merrimack River shad run is considered to be of sufficient size to support out-of-basin transfers for restoration efforts. The monitoring efforts include annual spawning stock surveys at the fish lifts, biological sampling, and determination of age structure and population mortality and survival estimates. *MassWildlife* is responsible for reporting shad monitoring at the two fish lifts in MA. The most recent performance report for the Essex Dam (covering March 1, 2017 through February 28, 2018) was prepared by *MassWildlife* (Slater 2018a).

From 2007 to 2017, approximately 700-1700 adult shad were collected annually at the Essex Dam for hatchery propagation and restoration efforts in the Merrimack River, Charles River and Maine rivers. American shad fish passage counts at the Essex Dam fish-lift from 1983–2017 are presented in Table A4 and Figure 1. High water levels in

2005 and 2006 caused the closure of the fish lifts which severely limited counts and collections. The series mean count, excluding 2005/2006, is 29,350 shad, the median is 20,796 and the 25th percentile is 12,359. The lift counts can be standardized by the number of days when the lift was operating each season (Table A5). The lift day index has a series mean of 422 shad/lift day, a median of 313 shad/lift day and 25th percentile of 210 shad/lift day. The 25th percentile of the shad/lift day data series was adopted as a threshold for lower run sizes in the 2012 SFMP.

Essex Dam Lift Operations. The Essex Dam fish lift begins operating each year between April 15th and May 1st depending on flow conditions. The lift is typically operated from 0800 to 1600 with lifts occurring each hour. The lift frequency and range of time can be extended if large numbers of shad are present. The lift operation ceases when the shad run is complete, usually in the latter half of July. The installation of flash boards on the dam crest is critical to attract shad to the fish lift entrance and prevent them from aggregating at the base of the dam. During 2005 and 2006, high flows prevented the installation of flash boards until June. In 2010 the flash boards were replaced with an inflatable flashboard system. Data on the number of lifts each year are not available for every year in the time series. When available the tally of lifts and count of days that the lift operated can be used to standardize shad counts relative to operations.

Figure 1. American shad counts at the Essex Dam fish lift in Lawrence, MA, Merrimack River, 1983–2017. Source: *MassWildlife*, and USFWS Central NE Fisheries Resource Office.
Note: 2005 and 2006 counts are not included in the 25th percentile calculation due to high flow.



iii. Passage Efficiency

Existing fish passage limitations, including passage efficiency, have been reviewed and summarized in the Merrimack River Shad Restoration Plan (MRTC 2010). Downstream passage assessments are recommended by the Plan (MRTC 2010), along with specific recommendations to improve fish passage efficiency throughout the watershed. Presently, downstream passage efficiency studies are underway at the five main stem dams. Upstream passage efficiency at the Essex Dam in Lawrence has not been assessed, although specific efforts to improve passage have been implemented recently through the Technical Committee that should increase passage efficiency.

Upstream passage efficiency at the Pawtucket Dam in Lowell is low. Data collected between 1989 and 2009 indicates that on average only 29% of fish that pass through the Essex Dam fish lift eventually ascend the lift at the Pawtucket Dam. Sprankle (2005) conducted telemetry studies to assess passage efficiency at the Lowell Dam. Sprankle (2005) found that 66% of the shad radio tagged at the Essex Dam arrived at the pool downstream of the Lowell Dam and 55% entered the dam tailrace. Only 4% of the shad entering the tailrace passed the Lowell Dam fish lift. No ripe shad have been caught below the Essex Dam during electrofishing monitoring, indicating that no spawning habitat occurs below the dam and all shad are seeking to move upstream.

4. Fisheries to be Closed

Commercial fisheries for shad are presently closed in Massachusetts with no change proposed. Recreational fisheries are presently open to catch and release only with the exception of harvest allowed in the Merrimack River and Connecticut River with a three fish per day bag limit.

5. Fisheries Requested to be Open

This plan proposes to maintain recreational shad catch and harvest in the Merrimack River and Connecticut River. Shad fishing in all other Massachusetts rivers was changed to catch and release only with the 2012 SFMP.

6. Sustainability Targets

A. Definition.

A sustainable American shad fishery will not diminish future stock reproduction and recruitment.

B. Methods for Monitoring Fishery and Stock.

No stock abundance indices are available for Merrimack River shad other than the ongoing fish lift monitoring at the Essex Dam. This long-term census data is proposed as the basis for establishing sustainable fishery benchmarks. The Essex Dam fish lift count series has 35 years of census and CPUE data of the annual spawning run. Biological data on shad size, age, and sex composition has also been collected since the 1990s. Over time, these data can be evaluated for stock thresholds related to size, age, total

instantaneous mortality (Z) and repeat spawning ratio. Because the time series for age and mortality estimates and repeat spawning percentage is brief, the present plan will depend on the distribution of long-term fish lift data. Mortality thresholds will be presented in the 2018 SFMP but will serve as a warning threshold until additional data can be collected.

SFMP Performance. The SFMP for the Merrimack River was prepared and approved in 2012 using fish lift count data from 1983-2011 as a basis for the benchmark. Shad counts at the fish lift increased substantially during 2012-2017; averaging 17,694 shad/year in the last five years of the 2012 SFMP versus 59,019 shad/year in the most recent five years. Under this condition of rising spawning run counts, the benchmark was exceeded by a large margin in each year during 2012-2017.

Fish Lift Count Benchmark – Merrimack River. With the addition of 2012-2017 shad count data, the benchmark (25^{th} percentile of the 1983-2017 Essex Dam fish lift count data series) increases from 174 to 210 shad/lift day. This benchmark will serve as a spawning run threshold for management action. Three consecutive years below this benchmark will trigger consultation between *MassWildlife* and DMF to discuss reducing recreational harvest. This benchmark value will not vary annually, but will be updated with the next SFMP review.

Repeat Spawning Ratio. Ongoing shad scale aging will provide data on the ratio of repeat spawners in the spawning run. Repeat spawning ratio data are available for the Merrimack River from 2004-2017 (Table 1). The time series is too brief to allow the setting of a repeat spawning ratio benchmark or to discern any trends. This data collection will continue and be reported in the River Herring and American Shad ASMFC Compliance Report annually and considered further with the next SFMP review.

Table 1. Repeat spawning percentage (RSP) of sub-sampled American shad collected at the Essex Dam fish-lift, Merrimack River, 2004-2017 (Source: 2018 ASMFC River Herring and American Shad MA Compliance Report). The numbers in parentheses following RSP are the years of repeat spawning, with RSP (0) for virgin shad.

YEAR	*N*	*RSP (0)*	*RSP (1)*	*RSP (2)*	*RSP (3)*	*RSP (4)*	*RSP (5)*	*RSP (6)*	$Z_{(RPS)}$	$S_{(RPS)}$
2004	243	53	23	13	6	4	1	0	0.77	0.46
2005	182	53	25	13	8	2	0	0	0.81	0.44
2006	175	66	22	8	4	0	0	0	0.94	0.39
2007	208	76	15	7	1	0	0	0	1.25	0.29
2008	211	84	7	5	3	0	0	0	1.11	0.33
2009	151	32	45	15	5	3	1	0	1.02	0.36
2010	181	38	43	15	3	1	1	0	1.20	0.30
2011	259	58	19	13	8	2	0	0	0.82	0.44
2012	178	69	21	7	3	1	0	0	1.16	0.31
2013	144	64	26	7	3	1	0	0	1.13	0.32
2014	254	61	31	6	1	0	0	0	1.34	0.26
2015	292	78	12	9	1	0	0	0	1.45	0.23
2016	225	63	22	12	3	0	0	0	1.40	0.25
2017	244	62	24	14	0	0	1	0	1.10	0.33

Mortality Benchmark. Amendment 3 defined the shad mortality warning threshold as the level of total instantaneous mortality (Z) that resulted in a female spawning stock biomass that was 30% of the total female spawning stock biomass in a stock that experienced only natural mortality ($Z = M$). Amendment 3 provides benchmark values for New England shad runs of $Z_{30} = 0.98$ and $A_{30} = 0.62$ (annualized mortality). The Z_{30} benchmark will be adopted by the 2018 SFMP as a warning threshold until a longer Merrimack River time series is recorded or further ASMFC recommendations are made.

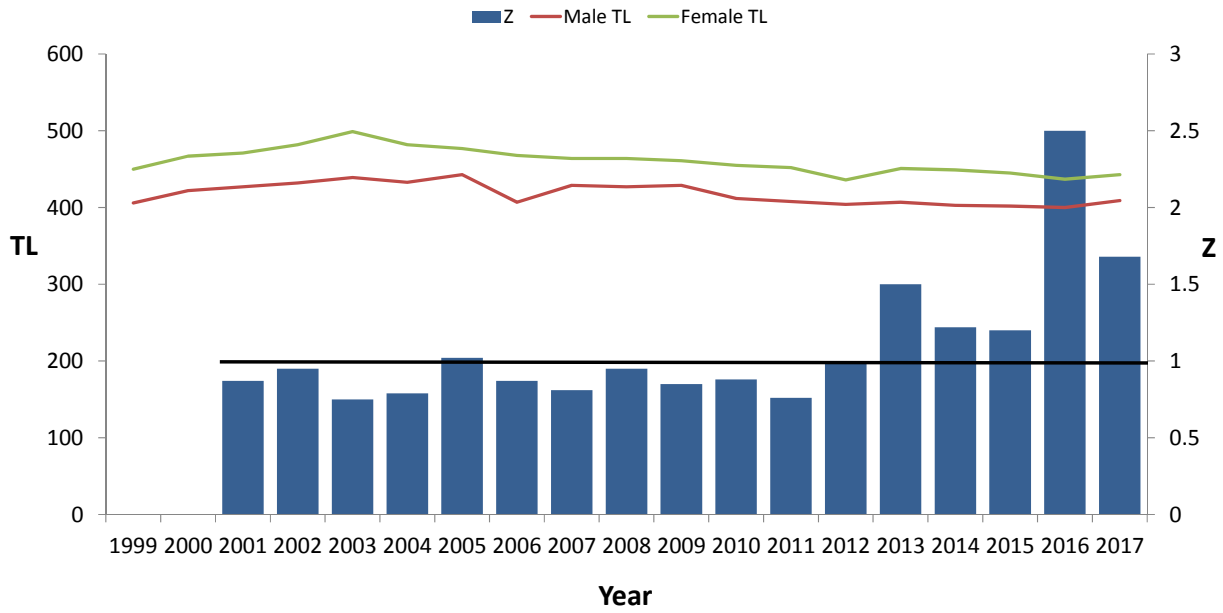
The total instantaneous mortality rate (Z) was estimated using the Chapman-Robson method, regression-based estimates, and catch curves from repeat spawning age data. The Chapman-Robson method is a probability-based estimator that has been shown to be more accurate and less biased than the linear regression-based catch curves, especially when sample size is small. Shad ages 5 through 10 were used in the analysis. The suitability of the 2001-2017 Merrimack River mortality estimates may be limited by many factors including small sample sizes, a brief data series, combined genders in the estimate, and the assumption that all mortality is natural. The Chapman-Robson results were selected as most suitable and reported in Table 2.

The trend to date is that Merrimack River shad mortality was at or below the Z_{30} until 2013, when it increased above the threshold and has remained high since (Figure 2). While Z has recently increased, total length for both males and females has been relatively stable since 1999. The mortality warning threshold was not exceeded under the 2012 SFMP but has been exceeded each year since 2013. With the recent conditions of increasing spawning run stock, higher mortality estimates resulting from increased recruitment is not unexpected, although this dynamic should be reviewed and considered annually in the MA shad compliance report.

Table 2. American Shad age, growth, and sex statistics for adult returns at the Merrimack River (1991–2017). Source: 2017 ASMFC River Herring and American Shad MA Compliance Report.

							Mean Age		Mean FL (mm)		Mean Wgt (kg)		C - R	
Year	Sample #	N (male)	N (Female)	% Male	% Female	Ratio (M:F)	Male	Female	Male	Female	Male	Female	Z	S
1991	107	61	46	57.0	43.0	1.3:1.0	4.7	5.3	434	475	1.13	1.59	Unk	Unk
1992	48	23	25	46.0	54.0	0.9:1.0	4.4	5.2	Unk	Unk	Unk	Unk	Unk	Unk
1993	32	6	26	19.0	81.0	0.2:1.0	4.5	5.0	Unk	Unk	Unk	Unk	Unk	Unk
1995	160	101	59	63.0	37.0	1.7:1.0	Unk	Unk	404	465	0.91	1.50	Unk	Unk
1999	212	146	66	69.0	31.0	2.2:1.0	4.8	5.6	406	450	0.91	1.32	Unk	Unk
2000	217	103	114	47.5	52.5	0.9:1.0	4.7	5.6	422	467	1.00	1.50	Unk	Unk
2001	204	115	89	56.4	43.6	1.3:1.0	6.0	6.6	427	471	1.04	1.47	0.87	0.42
2002	199	79	120	39.7	60.3	0.8:1.0	5.7	6.3	432	482	1.10	1.69	0.95	0.39
2003	115	39	76	39.7	60.3	0.5:1.0	5.9	6.7	439	499	1.16	1.92	0.75	0.47
2004	257	152	119	45.5	54.5	1.3:1.0	5.8	6.5	433	482	1.08	1.59	0.79	0.45
2005	200	105	95	52.5	47.5	1.1:1.0	5.9	6.1	443	477	1.11	1.51	1.02	0.36
2006	178	79	99	44.4	55.6	0.8:1.0	4.9	5.7	407	468	0.96	1.49	0.87	0.42
2007	212	99	113	46.7	53.3	0.9:1.0	4.4	5.1	429	464	1.16	1.55	0.81	0.45
2008	227	113	114	49.8	50.2	1.0:1.0	5.4	5.6	427	464	1.10	1.43	0.95	0.38
2009	214	96	118	44.9	55.1	0.8:1.0	5.9	6.5	429	461	1.08	1.38	0.85	0.43
2010	181	65	116	36.0	64.0	0.6:1.0	5.1	5.6	412	455	1.04	1.53	0.88	0.41
2011	258	148	110	57.0	43.0	1.3:1.0	5.7	6.6	408	452	1.01	1.39	0.76	0.47
2012	243	155	88	63.8	36.2	1.8:1.0	5.1	5.5	404	436	0.95	1.28	1.00	0.37
2013	144	69	75	0.48	0.52	0.9:1.0	5.3	5.9	407	451	0.93	1.40	1.50	0.20
2014	302	158	144	0.52	0.48	1.1:1.0	5.1	5.8	403	449	0.92	1.36	1.22	0.29
2015	357	175	182	0.49	0.51	0.9:1.0	4.9	5.4	402	445	0.92	1.35	1.20	0.30
2016	225	91	134	0.40	0.60	0.7:1.0	5.3	5.7	400	437	0.90	1.31	2.50	0.10
2017	246	115	131	0.47	0.53	0.9:1.0	5.5	5.9	409	443	0.92	1.32	1.68	0.19

Figure 2. Annual American shad average total length (TL) and mortality (Z) from spawning run samples at the Essex Dam fish lift in Lawrence, MA, Merrimack River, 1999-2017. Source: *MassWildlife*, and USFWS Central NE Fisheries Resource Office. The ASMFC Amendment 3 shad mortality warning threshold of Z_{30} = 0.98 is provided by the black line. The 2016 Z estimate may not be suitable because only two age classes were represented.



C. Timeframe.

These benchmarks and warning thresholds will be enacted on October 1, 2018 and remain active until a plan review is conducted after five years.

7. Proposed Regulation Modification to Support Targets

A. Recreational Bag Limits

No changes are proposed to shad fishing regulations for the 2018 SFMP update. *MassWildlife* and DMF implemented the regulation changes in 2012 to lower the bag limit for American shad from 6 fish per angler per day to 3 fish per angler per day in the Merrimack River and Connecticut River. Secondly, the harvest of shad in all other rivers was closed with shad fishing allowed as catch and release only.

B. Enforcement

Massachusetts Environmental Police are charged with enforcing recreational shad bag limits on the Merrimack River and the no possession regulation on other rivers. *MassWildlife* and DMF will coordinate with regional enforcement staff each spring to exchange information on illegal harvest.

8. Adaptive Management.

A. Evaluation Schedule. Fish lift count data, age structure data, mortality estimates, and repeat spawner percentages will be reported annually in the MA River Herring and American Shad ASMFC Compliance Report. These ongoing data collections will contribute to a revision of the 2018 SFMP when requested from ASMFC.

B. Consequences or Control Rules

Three consecutive years below the fish lift count 25th percentile benchmark at the Essex Dam on the Merrimack River will trigger consultation between *MassWildlife* and DMF to discuss reducing recreational harvest. These interim values will be revised when this plan is updated in the future. The Z_{30} shad mortality warning threshold has been exceeded each year since 2012. There is some concern related to the recent rise in shad mortality in the Merrimack River, although this is tempered by the expectation that recent improved recruitment is an influence on the higher mortality. This exceedance will receive annual attention and be documented in the annual compliance report and be used to supplement management decisions and actions if the fish lift benchmark is exceeded. A summary of SFMP metrics and thresholds is provided in Table A6.

C. Potential Future Benchmarks

Improved Essex Dam Lift Index. There is potential to modify the shad count index at the Essex Dam fish lift by standardizing the fish counts to environmental data such as discharge and water temperature, and operational data, and to model the results to improve the quality of this spawning run index of abundance. Discussions were held with the partners of the Merrimack River Anadromous Fish Restoration Program on this topic. For the 2018 SFMP it was agreed that much work was needed to bring environmental and operational data into the fish lift datafile were an index modeling exercise could be attempted. This investigation is recommended for a future SFMP update.

Connecticut River

The Connecticut River is the longest river in New England at 655 km and the largest in volume, with a mean freshwater discharge to Long Island Sound of 19,600 cfs. The Connecticut River defines the border between New Hampshire and Vermont and passes through the states of Massachusetts and Connecticut. The river is tidal to Windsor Locks, Connecticut at rkm 100. The lowermost fish passage facility is at the Holyoke Dam located at rkm 138 in the City of Holyoke and Town of South Hadley. The Holyoke Hydroelectric Project (FERC No. 2004) operates a 42.9 megawatt hydropower facility at the Holyoke Dam. The Holyoke Dam is 30 ft high and 985 ft in length, impounds a 2,290 acre reservoir, and includes six hydroelectric generating systems. The upstream fish passage facilities are two fish lifts, one at the Hadley Falls Station tailrace and the other at the bypass reach. Fish passage facilities for the Holyoke Dam are described in detail in the 2010 Annual report on upstream fish passage (HGE 2011).

Shad have been managed cooperatively on the Connecticut River since 1967 by the Connecticut River Atlantic Salmon Commission (CRASC). The states of Connecticut, Massachusetts, New Hampshire and Vermont, as well as the USFWS and NMFS are signatories of the Commission. The 1967 agreement stated restoration goals of a total Connecticut River population of two million shad, and passage of one million shad above the Holyoke Dam. The Commission approved a shad management plan in 1992 that retained these goals while seeking to restore shad to its historic range in the Connecticut River Basin (CRASC 1992). This management plan was updated in 2017 (CRASC 2017) with refined restoration objectives, including:

- Achieve and sustain a minimum river-wide population of 1.7 million American shad; that includes a run of over 1.0 million shad downstream of Holyoke Dam, and passage of greater than 687,000 shad at the Holyoke Dam.
- Achieve and sustain a target adult return rate of 203 shad per hectare in the main stem.
- Achieve an adult stock structure with a 5-year running repeat spawning average of 15%.

Shad Spawning/Nursery Habitat.

Reported in Connecticut plan

Coordination within the Connecticut River Watershed

The Connecticut River Atlantic Salmon Commission has coordinated extensive efforts to manage and restore shad in the watershed over the last 40 years. The Commonwealth of Massachusetts is a cooperator in the Commission's shad plan and benefits from this long-term commitment and experience. All Connecticut River shad restoration goals and population benchmarks will be directly adopted from the existing shad plan. Details on the management plan or fishway operations are available in other documents (CRASC 1992; HGE 2011).

Recreational rod and reel fisheries for shad occur in the states of Connecticut and Massachusetts in the Connecticut River and a traditionally important commercial gill net is conducted in Connecticut presently at low levels of harvest. The Connecticut Department of Energy and

Environmental Protection (CT DEEP) has been monitoring the gill-net fishery since the 1970s and has conducted an annual seine survey in the river since 1978 that produces a juvenile index for shad. Commercial shad landings in Connecticut have been less than 100,000 pounds annually since 2004 and the numbers of gill-net permits issued has declined to less than 12 in recent years. The recreational harvest of shad is only allowed in the Connecticut River in Connecticut with a 6 shad (combined American and Hickory shad) per angler bag limit. Connecticut was approved to maintain its existing commercial fishery and recreational fishery through their 2012 SFMP (CT DEEP 2012) that was updated in 2017 (CT DEEP 2017).

The Connecticut 2017 SFMP uses a "stop light" approach to monitoring and maintain a sustainable fishery for shad in the Connecticut River. This approach has two stock status (response) metrics and a fishing rate (stressor) metric that guide management responses. The PASSAGE response metric is based on the Holyoke Dam fish lift counts is a proxy for total run size. The PASSAGE response threshold of 140,000 shad passed at the fish lift is derived from Juvenile Abundance Index (JAI) values that vary independent of adult run size. It was found that lift counts in the range of 150,000 to 160,000 produced a wide range of year classes - suggesting sufficient stock reproductive capacity to support future reproduction and recruitment. The threshold of 140,000 was selected as a conservative target.

The RECRUITMENT response threshold is defined as three consecutive years below the 25th percentile of the JAI geometric mean time series. The ESCAPEMENT stressor threshold was selected as 90% of the total shad run "escaping" ((lift counts – total harvest)/lift counts) the fishery to spawn. This value was conservatively selected using the median escapement value of 96% for 1990 to 2016.

The details of the CT DEEP "stop light" approach for their shad SFMP are provided in CT DEEP (2017). All three thresholds will be adopted in the Massachusetts SFMP as warning metrics that will trigger consultations between *MassWildlife*, MA DMF and CT DEEP. The fish lift response metric for CT DEEP has a different basis, resulting in a lower threshold, than the MA DMF fish lift metric. For this reason the management trigger will occur with a single exceedance as to three years for other SFMP metrics.

A. Landings

No Connecticut River-specific shad landings data in MA are available. The fishery has been restricted to hook and line since 1987. Communication with local fishing clubs and bait and tackle shops indicate a small sportfishery persists and that is mainly catch and release.

B. Fishery Independent and Dependent Indices

i. Juvenile Abundance Indices (JAI)

The CT DEEP maintains a juvenile shad population index generated from a Connecticut River seine survey. The seining occurs weekly from mid-July to mid-October at seven fixed stations between Holyoke, MA, and Essex, CT. The survey has generated a JAI since 1978 using the geometric mean catch per seine haul. The JAI series was accepted in Amendment 3 of the ASMFC Shad and River Herring Fishery Management Plan using the 25th percentile of time series data as the threshold for management action. When three

consecutive JAI values fall lower than the 25th percentile management action will be required to address juvenile recruitment failure (CT DEEP 2017). The Connecticut JAI is the only data source for juvenile shad indices that could be adopted for the MA SFMP.

ii. Fish Lift Monitoring of Spawning Run

American shad fish passage counts at the Holyoke Dam fish-lift from 1967 – 2017 are shown in Figure 3. A single fish lift operated from 1955 to 1975 and a second fish lift became operational in 1976. The 2012 SFMP used the entire count period for setting management benchmarks. This update will use the period of 1976-2017 when the two lifts were consistently operated. *MassWildlife* is responsible for reporting shad monitoring at the two fish lifts in MA. The most recent performance report for the Holyoke Dam (covering March 1, 2017 through February 28, 2018) was prepared by *MassWildlife* (Slater 2018b).

Holyoke Dam Fish List Operations. The Holyoke fish lift begins operations on April 1st each year or when flows fall below 40,000 cfs and continues until July 15th. Details on fish lift operations are provided in HGE (2011).

iii. Passage Efficiency

The numbers of adult shad that pass the Holyoke Dam represent a variable proportion of the Connecticut River population. The percentage of Connecticut River shad passing upstream of the Holyoke Dam has increased since 1975 to approximately 40-60% annually (Leggett et al. 2004). A study in 1992 estimated average annual fish lift efficiency to be close to 50% (CRASC 1992). However, as a result of FERC relicensing in 2001 the lifts were rebuilt with larger hoppers and faster lift rate and these changes may have resulted in a change in passage efficiency. An ongoing cooperative tagging study involving CRASC participants is expected to provide additional data to address passage efficiency at the Holyoke Dam.

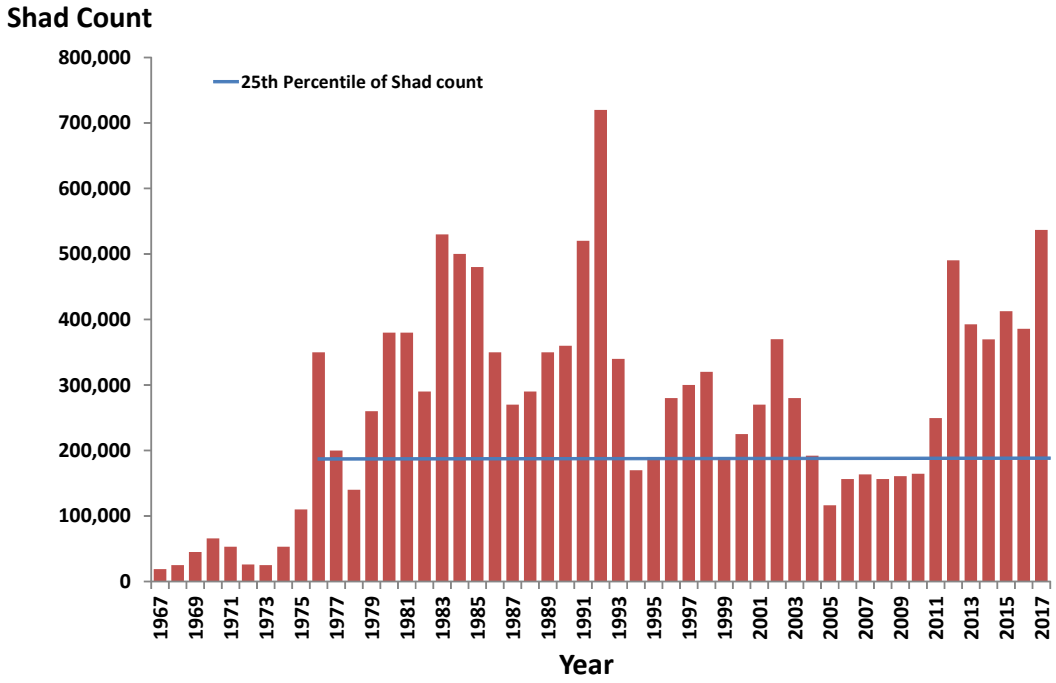
4. Fisheries to be Closed

Commercial fisheries for shad are presently closed in Massachusetts with no change proposed. Recreational fisheries for shad in Massachusetts are presently close to catch and release only at all rivers except the Merrimack River and Connecticut Rivers where a three fish daily bag limit is allowed.

5. Fisheries Requested to be Open

No changes are proposed to shad fishing regulations for the 2018 SFMP update. The 2018 SFMP update continues to allow recreational shad catch and harvest in the Merrimack River and Connecticut River, and catch and release fishing in all other Massachusetts rivers.

Figure 3. Monitoring counts of American shad recorded at the Holyoke Dam, Holyoke, MA, Connecticut River, 1967-2017. Source: USFWS Connecticut River Coordinator's Office. The 25th percentile benchmark is derived from 1976-2017 counts.



6. Sustainability Targets

A. Definition.

A sustainable American shad fishery will not diminish future stock reproduction and recruitment.

B. Methods for Monitoring Fishery and Stock.

Fish Lift Count Benchmark – Connecticut River. The 25th percentile of the 1976-2017 fish lift count data series of 194,000 shad at the Holyoke Dam is proposed as a spawning run benchmark for management action (Table A6). Three consecutive years below this benchmark will trigger consultation between *MassWildlife* and DMF to discuss reducing recreational harvest. This interim value will be updated and revised as necessary in future reviews of the plan.

The use of fish lift days of operation was considered to standardize the fish lift count data at Holyoke Dam. Records for the total number of days when the fish lift was in operation were available from 1980-2017. However, this period does not include the lower shad counts earlier in the time series, and there are operational changes that need to be considered and accounted for before using count data on fish per lift day. For the 2018 SFMP update, it is recommended to use the total lift counts for the entire data series (1976-2017) and to consider other metrics in future plans.

Connecticut DEEP SFMP Metrics. All three CT DEEP thresholds will be adopted in the Massachusetts SFMP as warning metrics. The exceedance of the PASSAGE, RECRUITMENT, or ESCAPEMENT thresholds described earlier in this section and outlined in Table A6 will trigger management consultations between *MassWildlife*, MA DMF and CT DEEP. We anticipate continued coordination with CT DEEP on the application of Connecticut River SFMP thresholds in future MA SFMP updates.

C. Timeframe.

These benchmarks and warning thresholds will be enacted on October 1, 2018 and remain active until a plan review is conducted after five years.

7. Proposed Regulation Modification to Support Targets

A. Recreational Bag Limits

MassWildlife and DMF changed the harvest regulations in 2012 to lower the bag limit from 6 to 3 shad per angler per day in the Merrimack and Connecticut Rivers. Secondly, the fishing for shad in all other rivers were closed to harvest and allowed as catch and release only.

B. Enforcement

Massachusetts Environmental Police are charged with enforcing recreational shad bag limits in the Merrimack River and the upcoming no possession regulation in other rivers. *MassWildlife* and DMF will coordinate with regional enforcement staff each spring to exchange information on illegal harvest.

8. Adaptive Management.

A. Evaluation Schedule. Fish lift count data and biological thresholds will be reported annually in the MA River Herring and American Shad ASMFC Compliance Report. These ongoing data collections will contribute to a revision of the SFMP when requested by ASMFC.

B. Consequences or Control Rules

Three consecutive years below the fish lift count 25th percentile benchmark at the Holyoke Dam and/or exceedances of the CT DEEP SFMP metrics will trigger consultation between MA DMF, *MassWildlife* and CT DEEP to discuss management responses. These interim values will be revised when this plan is updated in the future. A summary of SFMP metrics and thresholds is provided in Table A6.

C. Potential Future Benchmarks

Improved Holyoke Dam Lift Index. There is potential to modify the shad count index at the Holyoke Dam fish lift by standardizing the fish counts to discharge and water temperature and operational data. For this to be attempted, daily records need to be summarized for all variables. Substantial work is needed to bring these data into the

Holyoke lift datafile and conduct the necessary quality assurance and control review before attempting to standardize the lift data.

Connecticut River Mortality Threshold. Using shad mortality estimates has been considered as a potential threshold or benchmark for the Connecticut River. The low percentage of repeat spawners and older cohorts has been a limiting factor for generating mortality estimates. During the period of 2006-2015, a mean of 5% of the Connecticut River shad run were repeat spawners (CRASC 2017). Future SFMPs should revisit the available size/age data for shad in the Connecticut River to consider the utility of mortality estimates.

CATCH AND RELEASE RIVERS

In addition to the shad runs on the Merrimack and Connecticut rivers, shad have been recently documented in the Palmer River, Jones River, North River, Neponset River, and Charles River, with modest sportfishing know to occur in the North River tributaries and the Palmer River. Shad fishing in the five smaller river systems have been managed as catch and release fisheries since 2013. Both *MassWildlife* and DMF are interested in expanding monitoring to include the runs in these five river systems.

Charles River Hatchery Evaluation (% wild vs. hatchery). In 2004, the USFWS and DMF began an experimental hatchery operation using American shad from the Merrimack River system as a source for stocking in the Charles River. USFWS and DMF have released between 700,000 and eight million oxytetracycline (OTC) marked shad fry annually into the Charles River in Waltham from 2006 through 2016. Recaptures of OTC marked shad were first made in the Charles River in 2011. Future evaluations on the contribution of hatchery stocking to spawning runs may result in additional population targets in the Charles River. Additionally, an acoustic telemetry project was conducted in the Charles River from 2015-2017 to provide information on shad spawning run movements.

Spawning Run Electrofishing Study. An exploratory study was initiated by DMF in 2016 to monitor the presence and abundance of American shad in two coastal river systems in Massachusetts. The South River and Indianhead River historically supported viable recreational fisheries for shad, however no recent data on catch or harvest of shad exist for either of these systems. Between 11 and 15 electrofishing trips were made to the two rivers in 2016 and 2017. Total length, sex and scales for aging were sampled from each shad (Table 3).

Indices of abundance (catch-per-unit-effort) for each river system were calculated to examine trends over the course of the spawning run. Additional analyses of gear efficiency including capture efficiency and capture probability as well as determining minimum sample sizes were conducted to assist the goals of developing standardized sampling protocols and long-term indices of population demographics.

Table 3. Population demographic information of American Shad from the (A) South and (B) Indianhead Rivers (2016 – 2017).

(A) South River

					Mean TL (mm)		Mean Age		C - R	
Year	N captured	CPUE (N/min)	N (male)	N (female)	Male	Female	Male	Female	Z	S
2016	77	0.51	44	20	489	503	6.0	5.6	0.9	0.4
2017	97	0.42	56	17	483	524	5.6	6.1	1.5	0.2

(B) Indianhead River

					Mean TL (mm)		Mean Age		C - R	
Year	N captured	CPUE (N/min)	N (male)	N (female)	Male	Female	Male	Female	Z	S
2016	107	0.36	61	46	488	512	5.9	6.0	1.4	0.2
2017	117	0.39	78	25	488	512	5.7	6.0	1.4	0.2

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Appendix

Table A1. Rivers in Massachusetts with American shad runs present.

River	***Drainage***	***Drainage Area*** *(m^2)*	***Q -- cfs*** *(mean May)*	***Fishery Status***
Connecticut	Connecticut River	8,332	21,400	Sportfishery – 3 fish bag
Palmer	Buzzards Bay	28	10*	minor sportfishery - 0 fish bag
Jones	South Shore	20	43	no known targeting of shad
North	South Shore	30	69	minor sportfishery - 0 fish bag
Neponset	Boston Harbor	101	392	no known targeting of shad
Charles	Boston Harbor	227	370	no known targeting of shad
Merrimack	Merrimack River	4,635	11,800	Sportfishery – 3 fish bag

* The stream flow gauge in the Palmer River was located far upstream of shad habitat.

Table A2. Massachusetts American shad landings, 1990-2017. The landings data were provided by the NMFS Fisheries Statistic and Economic Division, Northeast Regional Office.

Year	*MA Landings (No.)*	*Atlantic States (No.)*	*Shad Landings (% from MA)*
1990	5,605	3,553,473	0.16
1991	638	2,808,898	0.02
1992	308	2,435,127	0.01
1993	423	2,105,863	0.02
1994	286	1,493,906	0.02
1995	454	1,653,322	0.03
1996	134	1,583,079	0.01
1997	752	1,837,170	0.04
1998	1,765	2,174,226	0.08
1999	223	1,067,312	0.02
2000	268	890,624	0.03
2001	1,051	722,178	0.14
2002	424	1,471,850	0.03
2003	1,109	1,509,898	0.07
2004	530	1,136,527	0.05
2005	0	302,435	0.00
2006	102	193,855	0.05
2007	44	168,993	0.03
2008	31	100,901	0.03
2009	0	88,165	0.00
2010	0	105,477	0.00
2011	215	94,833	0.23
2012	10	118,189	0.01
2013	0	141,832	0.00
2014	0	40,256	0.00
2015	0	43,259	0.00
2016	0	14,075	0.00
2017	0	26,330	0.00

Table A3. Recreational estimates of total catch of American shad in Massachusetts (Source: MRFSS/MRIP, uncalibrated for FES and APAIS improvements).

Year	*TOTAL CATCH (TYPE A + B1 + B2)*	*PSE*
1981	3,545	100
1983	2,533	100
1989	6,628	43
1990	11,817	70.1
1991	737	100
1993	10,930	61.7
1994	2,053	100
1996	1,115	100
1997	45,548	50.5
1998	73,152	39.1
1999	69,206	28.8
2000	15,992	40.4
2001	3,405	52.7
2004	1,673	100
2006	55,232	52.3
2007	1,588	100
2008	4,452	71.2
2009	1,850	100
2010	0	
2011	0	
2012	-	
2013	0	
2014	-	
2015	0	
2016	-	
2017	2,042	59.5

Table A4. American shad counts at the Merrimack River (Essex Dam Fish Lift, Lawrence), and the Connecticut River, (Holyoke Dam Fish Lift, Holyoke), Massachusetts, 1983–2017.
Note*: the Merrimack River series mean excludes 2005-2006 with high, disruptive spring flow.

Year	Merrimack River	Connecticut River
1983	5,629	530,000
1984	5,497	500,000
1985	12,793	480,000
1986	18,173	350,000
1987	16,909	270,000
1988	12,359	290,000
1989	7,875	350,000
1990	6,013	360,000
1991	16,098	520,000
1992	20,796	720,000
1993	8,599	340,000
1994	4,349	170,000
1995	13,861	190,000
1996	11,322	280,000
1997	22,661	300,000
1998	27,891	320,000
1999	56,461	190,000
2000	72,800	225,000
2001	76,717	270,000
2002	54,586	370,000
2003	55,620	280,000
2004	36,593	192,000
2005	6,382	116,511
2006	1,205	156,352
2007	15,876	163,466
2008	25,116	156,492
2009	23,199	160,649
2010	10,442	164,439
2011	13,835	249,480
2012	21,396	490,431
2013	37,149	392,698
2014	38,107	369,807
2015	89,467	412,656
2016	67,528	385,717
2017	62,846	536,670
Series Mean	29,350*	268,125

Table A5. American shad counts at the Essex Dam Lift on the Merrimack River, Lawrence, MA. The lift data source is the USFWS Central NE Fishery Office. The discharge data source is the USGS National Water Information System, Station No. 01100000.

Year	American Shad (No.)	Shad Count Index (No.)	Lift Days (No.)	Shad per Lift Day	Lifts (No.)	Lift Start Date	Lift End Date	Mean Q April	Mean Q May	Mean Q June	Mean Q July
1983	5,629	5,629	54	104.2		5/9/1983	7/9/1983	23,870	16,980	9,277	2,158
1984	5,497	5,497	42	130.9		5/9/1984	7/31/1984	27,650	16,240	23,660	7,606
1985	12,793	12,793	54	236.9		5/1/1985	7/22/1985	8,150	5,705	2,665	1,982
1986	18,173	18,173	54	336.5	506	5/2/1986	7/25/1986	14,070	5,842	7,782	4,368
1987	16,909	16,909	54	313.1	467	5/15/1987	7/23/1987	37,440	10,020	6,198	4,837
1988	12,359	12,359	54	228.9	485	5/9/1988	7/15/1988	12,480	14,080	4,061	3,563
1989	7,875	7,875	54	145.8		5/1/1989	7/28/1989	17,120	18,990	11,250	3,758
1990	6,013	6,013	54	111.4		5/1/1990	7/31/1990	16,750	14,840	7,128	3,187
1991	16,098	16,098	54	298.1		5/1/1991	7/14/1991	12,520	9,242	3,310	1,613
1992	20,796	20,796	54	385.1		5/4/1992	7/31/1992	12,350	8,774	7,046	3,850
1993	8,599	8,599	54	159.2		5/10/1993	7/15/1993	31,730	6,829	3,361	1,334
1994	4,349	4,349	54	80.5		5/2/1994	7/9/1994	23,330	13,020	3,951	2,324
1995	13,861	13,861	54	256.7		5/1/1995	7/9/1995	6,979	6,077	3,243	1,687
1996	11,322	11,322	54	209.7	325	5/20/1996	7/12/1996	24,300	21,270	5,834	8,611
1997	22,661	22,661	57	397.6	412	5/6/1997	7/7/1997	25,600	13,070	4,158	3,737
1998	27,891	27,891	57	489.3	443	5/4/1998	7/22/1998	15,790	10,900	20,940	8,730
1999	56,461	56,461	64	882.2	632	4/28/1999	7/2/1999	10,860	5,748	1,994	1,765
2000	72,800	72,800	65	1120.0	618	5/1/2000	7/7/2000	23,170	12,660	7,469	3,515
2001	76,717	76,717	65	1180.3	501	5/7/2001	7/20/2001	26,020	7,375	8,390	2,750
2002	54,586	54,586	65	839.8	558	4/29/2002	7/12/2002	12,310	11,920	8,273	2,173
2003	55,620	55,620	77	722.3		5/10/2003	7/3/2003	20,750	12,010	7,939	2,559
2004	36,593	36,593	77	475.2		4/29/2004	7/15/2004	22,730	11,930	5,850	3,397
2005	6,382		81			5/12/2005	7/19/2005	26,860	15,800	12,240	6,385
2006	1,205		46			4/17/2006	5/12/2006	7,554	27,810	22,410	9,813
2007	15,876	15,876	73	217.5		5/10/2007	7/16/2007	29,380	14,680	6,354	3,558
2008	25,116	25,116	64	392.4		5/13/2008	7/14/2008	26,640	11,910	3,638	6,668
2009	23,199	23,199	89	260.7		4/20/2009	7/17/2009	19,930	8,757	9,806	15,340
2010	10,442	10,442	83	125.8		4/24/2010	7/15/2010	23,600	5,670	3,497	1,895
2011	13,835	13,835	73	189.5		5/2/2011	7/15/2011	22,230	15,130	6,410	2,550
2012	21,396	21,396	87	245.9		4/16/2012	7/13/2012	6,298	10,730	10,060	1,968
2013	37,149	37,149	89	417.4		4/15/2013	7/12/2013	14,390	8,069	12,880	11,370
2014	38,107	38,107	80	476.3		4/22/2014	7/10/2014	25,700	11,580	5,401	6,099
2015	89,467	89,467	89	1005.2		4/20/2015	7/17/2015	17,850	5,128	5,751	5,034
2016	67,528	67,528	86	785.2		4/21/2016	7/15/2016	8,463	5,225	2,779	1,604
2017	62,846	62,846	89	706.1		4/17/2017	7/14/2017	22,160	16,880	11,030	5,458
Mean		29,350		422							
Median		20,796		313							
25th %		12,359		210							

Table A6. Summary of Massachusetts American Shad Sustainable Fishery Management Plan metrics and thresholds for 2018 plan update.

River	Index Site	Time Series	SFMP Metric	Threshold Level	Threshold Value	Threshold Status	Management Trigger
Merrimack River	Essex Dam Fish Lift	1983 - 2017	Benchmark	25th percentile	210 shad / lift day	Above	3 years below benchmark triggers mgt discussion on reducing rec. harvest
	Essex Dam Fish Lift	2001 - 2017	Warning	Z_{30} = 0.98	Z > 0.98	Fail 2013-2017	Annual review of biological data and documentation in compliance report
Connecticut River	Holyoke Dam Fish Lift	1976 - 2017	Benchmark	25th percentile	194,000 annual count	Above	3 years below benchmark triggers mgt discussion on reducing rec. harvest
	CT DEEP Juvenile Shad Index	1978 - 2016	Warning	25th percentile	3.96 geometric mean	Above	3 years below benchmark triggers mgt discussion on reducing rec. harvest

Atlantic States Marine Fisheries Commission

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Shad & River Herring Technical Committee
Call Summary

November 20, 2018

Technical Committee Members in Attendance: Ken Sprankle (Chair, USFWS), Mike Brown (ME), Mike Dionne (NH), Brad Chase (MA), Patrick McGee (RI), Jacque Benway Roberts (CT), Robert Adams (Vice Chair, NY), Brian Neilan (NJ), Josh Tryninewski (PA), Johnny Moore (DE), Rob Bourdon (MD), Ellen Cosby (PRFC), Eric Hilton (VA), Holly White (NC), Jeremy McCargo (NC), Bill Post (SC), Jim Page (GA), Ruth Hass-Castro (NOAA), Wilson Laney (USFWS)

ASMFC Staff: Caitlin Starks, Jeff Kipp

The Shad and River Herring Technical Committee (TC) met via conference call to review the Massachusetts Sustainable Fishery Management Plan (SFMP) update for shad in the Merrimack River, discuss progress and next steps on the October 2017 Board task regarding improvements to Amendments 2 and 3, and receive an update on the ongoing American shad benchmark stock assessment.

MA Sustainable Fishery Management Plan Update
Brad Chase presented the updated shad SFMP for the Merrimack River to the TC. The SFMP proposes maintaining recreational shad catch and harvest in the Merrimack River and Connecticut River with no change to the current regulations, and includes updated passage-based sustainability targets for both the Connecticut and the Merrimack Rivers. The 25th percentile benchmarks have increased for both rivers, and increasing fish lift counts for 2012-2017 are well above the benchmarks. Mortality (Z) thresholds will also be presented in the 2018 SFMP, but because the available time series is short, they will serve as a warning threshold until additional data can be collected. The SFMP notes that fish lift effectiveness is affected by water temperature, discharge, spill operations and other operational actions; future plan updates will aim to standardize lift count data by these factors.

The TC discussed the time series used to set the sustainability benchmarks. Bill Post noted that for the SC SFMP, the TC recommended using the most recent 10 years to set sustainability targets, whereas the MA plan uses the full time series. The TC agreed that the data used for setting targets may vary by river system based on factors like data quality and management goals, but there should be a discussion of the criteria used to determine the appropriate time series to ensure the TC is evaluating SFMPs in a consistent way. This discussion can occur as part of the TC task to clarify SFMP requirements for content and metrics.

Overall, the TC did not have any concerns with the MA SFMP update, and recommended Board approval. The TC also supported improving the SFMP in the future by modeling fish lift operation and effectiveness to standardize count data.

TC task regarding improvements to Amendments 2 and 3

As part of the October 2017 Board task, the TC has been working to identify areas where harvest regulations or monitoring are inconsistent with the requirements of Amendments 2 and 3. Following the last TC call in September, staff and the TC created a database for documenting information on river herring and shad harvest, management and monitoring for all river systems. The database was reviewed on the call to identify missing information and provide guidance on completing the table. The TC recommended several changes to the table to better capture the pertinent information; staff will make those changes and distribute an updated version. The group decided that a subset of the TC would form a working group to address this particular aspect of the task by completing the data tables, identifying areas of inconsistency with the Amendments, and proposing recommendations for resolving those issues. Staff, Ken Sprankle, Bobby Adams, Brad Chase, Brian Neilan, Mike Brown, Holly White and Jeremy McCargo will participate in this working group.

Shad Assessment Update

Jeff Kipp updated the TC that the Stock Assessment Subcommittee (SAS) met November 5-8 for the assessment methods workshop. During the workshop the group identified several data sets that have not been made available to the assessment, in particular un-digitized data. A new hard deadline of January 1, 2019 has been set for data submission; following this date no new data may be added to the assessment. TC members were requested to review the data inventory and resolve any discrepancies for their state or jurisdiction. ACCSP staff will also be reaching out to states for commercial landings data validation. Lastly, Ken Sprankle indicated there are still outstanding responses from TC members on hydropower and barrier information. Ken will reach out individually to TC members for information to add to the assessment report.

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Shad & River Herring Technical Committee
Call Summary

September 24, 2018

Technical Committee Members in Attendance: Ken Sprankle (Chair, USFWS), Mike Brown (ME), Mike Dionne (NH), Robert Adams (NY), Jacque Benway Roberts (CT), Josh Tryninewski (PA), Johnny Moore (DE), Rob Bourdon (MD), Ellen Cosby (PRFC), Eric Hilton (VA), Holly White (NC), Jeremy McCargo (NC), Bill Post (SC), Chad Holbrook (SC), Jim Page (GA), Reid Hyle (FL), Ruth Hass-Castro (NOAA)

ASMFC Staff: Caitlin Starks

The Shad and River Herring Technical Committee (TC) met via conference call to discuss the October 2017 Board task to develop proposed improvements to Amendments 2 and 3 with regard to the following items:

1. Management and monitoring of rivers with low abundance and harvest of shad and river herring
2. Standardization of Sustainable Fishery Management Plan (SFMP) requirements: content, metrics, and management responses to triggers
3. Incorporation of stock assessment information into SFMPs and discussion on the timeline for renewing plans
4. Clarification of *de minimis* requirements as they pertain to SFMPs
5. Review of the number of years of data are required before developing a SFMP

The group noted that items 2, 3, and 5 could be addressed in concurrently with the ongoing Benchmark Assessment for American shad. The assessment process will involve a comprehensive review of existing datasets, and should provide more clarity on the available information across the coast that could be used to standardize SFMPs.

TC discussion was primarily focused on item 1. Last fall, the TC identified several inconsistencies between state SFMPs and the requirements of Amendments 2 and 3. Amendments 2 and 3 require all states and jurisdictions to submit SFMPs for all systems that remain open to river herring and shad harvest, respectively. Additionally, the Amendments specify required fisheries dependent and independent monitoring for a number of rivers. However, in several states there are cases where rivers are legally open to recreational harvest of shad or river herring, but the management and/or monitoring of these rivers is not consistent with the requirements of the FMP.

To fully ascertain the extent of the issue, during the conference call each TC member identified waterways in their state where limited harvest of either species is allowed, and whether monitoring occurs for those areas. Following the call, staff and the TC will use this information to create a database including details on harvest, management and monitoring for each of these systems in order to identify all cases of inconsistency with the FMP requirements.

With regard to item 4, the TC will continue to discuss how the Amendments' language on *de minimis* requirements can be clarified. Specifically, the group will need to consider from which specific FMP requirements states with *de minimis* status would be exempt, and propose changes to the Amendments for Board consideration.

The TC was also made aware that an updated SFMP for the Merrimack River in Massachusetts would be distributed to them for email review following the call. Any concerns with the proposed update would be addressed at the next TC meeting.

Finally, the TC unanimously elected Robert Adams as the new Vice-Chair.

Shad & River Herring Technical Committee
Call Summary

January 7, 2019

Technical Committee Task Group Members: Ken Sprankle* (Chair, USFWS), Mike Brown (ME), Brad Chase (MA), Robert Adams (Vice Chair, NY), Brian Neilan (NJ), Holly White (NC), Jeremy McCargo (NC), Jim Page (GA)

** Ken Sprankle was unable to participate due to being furloughed by the federal government shutdown*

ASMFC Staff: Caitlin Starks

On the November 20, 2018 conference call of the Shad and River Herring Technical Committee (TC), the TC designated a smaller task group to develop the October 2017 Board task regarding improvements to Amendments 2 and 3. This task group (TG) met via conference call on January 7, 2019 to advance work on identifying and describing conflicts between the requirements of the Amendments and state management and monitoring programs.

TC task regarding improvements to Amendments 2 and 3

The TC has been developing a database to document cases where harvest regulations or monitoring programs seem to be inconsistent with the requirements of Amendments 2 and 3. Staff presented updates to the database to the task group, including a classification scheme to identify rivers that are legally open to river herring or shad harvest, but either lack a sustainable fishery management plan (SFMP) or monitoring. The task group described several types of conflicts with the Amendments' requirements, including:

- Tributaries of river systems that do have SFMPs and monitoring, but the tributaries are not explicitly addressed in the SFMP;
- Rivers legally open to harvest without a SFMP and/or monitoring, but where no harvest of shad or river herring is suspected;
- Rivers with harvest addressed by a SFMP, but without monitoring to support sustainability

The task group discussed each conflict identified in the database, and made note of additional information needed to understand the situation. The group outlined next steps for this task as follows:

1. Complete the database by following up individually with TC members to fill in missing data and validate the information provided.
2. For all identified conflicts, follow up with the state TC representative to document the reason for the conflict and any additional pertinent information to each case.
3. Develop several potential options for resolving each type of conflict (e.g. redefining the river system in the SFMP to include tributaries).
4. Present all cases of conflict and potential solutions to the full TC for further discussion. The TC may then develop recommendations to the Board for potential paths for resolving each conflict.

Robert Adams and Brian Neilan agreed to follow up with other TC members to complete the first two steps. The task group will carry out the rest of the steps over the next several months with the potential to report to the Board in summer 2019.