Atlantic States Marine Fisheries Commission

American Eel Management Board

August 1, 2023
10:15 – 11:45 a.m.
Hybrid Meeting

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 *(P. Edwards)*	10:15 a.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from February 2023	10:15 a.m.
3.	Public Comment	10:20 a.m.
4.	Consider Stock Assessment Subcommittee Report on Alternative Analysis of Index Methods for Setting Management Measures **Action** • Presentation of Stock Assessment Subcommittee Report *(S. Eyler)* • Consider Acceptance of 2023 Benchmark Stock Assessment and Peer Review Report for Management Use • Consider Management Response *(if necessary)*	10:30 a.m.
5.	Review Maine Glass Eel Quota Provision of Addendum V *(C. Starks)* **Action**	11:05 a.m.
6.	Review Maine Life Cycle Survey Report *(D. Carty)*	11:25 a.m.
7.	Consider Approval of 2024 Maine Aquaculture Proposal *(C. Starks)* **Action**	11:35 a.m.
8.	Other Business/Adjourn	11:45 a.m.

The meeting will be held at The Westin Crystal City, 1800 Richmond Highway, Arlington, VA; 703.486.1111, and via webinar; click here for details.

MEETING OVERVIEW

American Eel Management Board
August 1, 2023
10:15 – 11:45 a.m.
Hybrid Meeting

Chair: Phil Edwards (RI) Assumed Chairmanship: 10/21	Technical Committee Chair: Danielle Carty (SC)	Law Enforcement Committee Representative: Rob Beal (ME)
Vice Chair: Kris Kuhn (PA)	Advisory Panel Chair: Mari-Beth DeLucia (TNC)	Previous Board Meeting: February 1, 2023
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, PRFC, VA, NC, SC, GA, FL, D.C, NMFS, USFWS (19 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 2023

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. Consider Stock Assessment Subcommittee Report on Alternative Analysis of Index Methods for Setting Management Measures (10:30-11:05 a.m.) Action

Background

- The 2023 Benchmark Stock Assessment for American Eel was evaluated through the Commission's external peer review process in late 2022. The peer review panel endorsed the assessment as the latest and best information available on the status of the coastwide American eel stock for use in fisheries management. The Peer Review Panel also requested that additional work be done to establish threshold reference points in the management tool proposed (I_{TARGET}) and that work should be done using a simulation approach with management strategy evaluation (MSE) methods. The Panel also disagreed with the Stock Assessment Subcommittee (SAS) regarding the stock status.
- The Board reviewed the 2023 Benchmark Stock Assessment in February. Consistent with the Commission's Technical Support Group Guidance and Benchmark Stock Assessment Process, the Board tasked the SAS with providing justification for deviating from the advice from the peer review advice. In addition to providing justification, the Board also asked the SAS to provide additional analyses to show the influence of individual surveys on the resulting coastwide yellow eel index, consider other reference periods and

configurations for I_{TARGET}, and discuss how the habitat model may help assess eel in the future.
- The SAS produced a supplemental report including the work requested by the Board, and the additional simulation work on the Multivariate Auto-Regressive State-Space (MARSS) index and dynamic factor analysis (DFA) recommended by the Peer Review Panel (**Briefing Materials**).

Presentations
- Presentation of Stock Assessment Subcommittee Supplemental Report by S. Eyler

Board Actions for Consideration
- Consider Acceptance of 2023 Benchmark Stock Assessment and Peer Review Report for Management Use
- Consider Management Response *(if necessary)*

5. Review Maine Glass Eel Quota Provision of Addendum V (11:05-11:25 a.m.) Action

Background
- Addendum V to the American Eel FMP specifies that the Maine glass eel quota of 9,688 pounds can be extended through 2024. A new addendum is required to set the Maine glass eel quota for 2025 and beyond.

Presentations
- Addendum V Glass Eel Provision by C. Starks

Board Actions for Consideration
- Initiate management action to address expiring Maine glass eel quota provision

6. Review Maine Life Cycle Survey Report (11:25-11:35 a.m.)

Background
- Addendum IV requires any state or jurisdiction with a commercial glass eel fishery to implement a fishery-independent life cycle survey covering glass/elver, yellow, and silver eels within at least one river system.
- Maine Department of Marine Resources (ME DMR) carries out the life cycle survey to monitor each life stage (glass, yellow, and silver) in West Harbor Pond. Recent data were presented to the Technical Committee in July (**Briefing Materials**).

Presentations
- Maine Life Cycle Survey Report by D. Carty

7. Review and Consider Approval of 2024 Maine Aquaculture Proposal (11:35-11:45 a.m.) Action

Background
- Maine has submitted a proposal for aquaculture harvest in 2024, pursuant to Addendum IV to the American eel FMP. Maine's plan includes the harvest of 200 pounds of glass eel for use in domestic aquaculture facilities (**Briefing Materials**).
- The TC reviewed the Maine aquaculture plan, and found it is consistent with the requirements of Addendum IV and supports its approval.

Presentations
- 2024 Maine Aquaculture Proposal by C. Starks

Board Actions for Consideration

- Approve Maine’s aquaculture plan for 2024

8. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN EEL MANAGEMENT BOARD

The Westin Crystal City
Arlington, Virginia
Hybrid Meeting

February 1, 2023

These minutes are draft and subject to approval by the American Eel Management Board.
The Board will review the minutes during its next meeting.

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INDEX OF MOTIONS

ATTENDANCE

Board Members

Megan Ware, ME, proxy for P. Keliher (AA)
Steve Train, ME (GA)
Sen. Cameron Reny, ME, proxy for Rep. Hepler (LA)
Cheri Patterson, NH (AA)
Doug Grout, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Dan McKiernan, MA (AA)
Raymond Kane, MA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Phil Edwards, RI, proxy for J. McNamee (AA)
David Borden, RI (GA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Rob LaFrance, CT, proxy for B. Hyatt (GA)
John Maniscalco, NY, proxy for B. Seggos (AA)
Emerson Hasbrouck, NY (GA)
Joe Cimino, NJ (AA)
Peter Clarke, NJ, proxy for T. Fote (GA)
Adam Nowalsky, NJ, proxy for Sen. Gopal (LA)
Kris Kuhn**,** PA, proxy for T. Schaeffer (AA)
Loren Lustig, PA (GA)
John Clark, DE (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Lynn Fegley, MD (AA, Acting)
Russell Dize, MD (GA)
David Sikorski, MD, proxy for Del. Stein (LA)
Shanna Madsen, VA, proxy for J. Green (GA)
Chris Batsavage, NC, proxy for K. Rawls (AA)
Jerry Mannen, NC (GA)
Chad Thomas, NC, proxy for Rep. Wray (LA)
Ross Self, SC, proxy for M. Bell (AA)
Malcolm Rhodes, SC (GA)
Chris McDonough, SC, proxy for Sen. Cromer (LA)
Doug Haymans, GA (AA)
Spud Woodward, GA (GA)
Erika Burgess, FL, proxy for J. McCawley (AA)
Gary Jennings, FL (GA)
Dan Ryan, DC, proxy for R. Cloyd
Marty Gary, PRFC
Chris Wright, NMFS
Rick Jacobson, USFWS

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

Ex-Officio Members

Troy Tuckey, Technical Committee Chair
Rob Beal, Law Enforcement Representative

Staff

Bob Beal
Toni Kerns
Madeline Musante
Tina Berger
Kristen Anstead
Kurt Blanchard
Tracey Bauer
James Boyle
Jeff Kipp
Caitlin Starks

Guests

Debra Abercrombie, US FWS
Mike Armstrong, MA DMF
Travis Atwood
Pat Augustine, Coram, NY
Jessica Best, NYS DEC
Alan Bianchi, NC DENR
Jason Boucher, NOAA
Ingrid Braun, PRFC
Delayne Brown, NH F&G
Jeff Brust, NJ DEP
Mike Celestino, NJ DEP
Benson Chiles
Matt Cieri, ME DMR
Margaret Conroy, DE DFW
Heather Corbett, NJ DEP
Caitlin Craig, NYS DEC
Kyle Egan
Jacob Espittia, FL FWC

Guests (continued)

Sheila Eyler, US FWS
Glen Fernandes
Jared Flowers, GA DNR
Pat Geer, VMRC
Ben German, NOAA
Lewis Gillingham, VMRC
Angela Giuliano, MD DNR
Tyler Grabowski, PA F&B
Melissa Grader, US FWS
Jay Hermsen, NOAA
Emily Hill, US FWS
Peter Himchak
Carol Hoffman
Harry Hornick, MD DNR
Jesse Hornstein, NYS DEC
Jeff Kaelin, Lund's Fisheries
Kiana Kekoa, Ofc. Sen. Reed
Carrie Kennedy, MD DNR
Wilson Laney
Todd Mathes, NC DENR
Genine McClair, MD DNR
William McDavitt, NOAA
Joshua McGillt, VMRC
Meredith Mendelson, ME DMR
Steve Meyers
Kyle Miller, FL FWC
Kirby Rootes-Murdy USGS
Mike Nardolilli, ICPRB
Josh Newhard, US FWS
Thomas Newman
Tamara O'Connell, MD DNR
Scott Olszewski, RI DEM
Derek Orner, NOAA
Stacy Patman, Yamaha Marine
Paul Piavis, MD DNR
Jeffrey Pierce, MEFA
Michael Pierdinock
Nicole Pitts, NOAA
Bill Post, SC DNR
Rebecca Quinones, MA DMF
Jill Ramsey, VMRC
Harry Rickabaugh, MD DNR
Tara Scott, NMFS
Ethan Simpson, VMRC
Somers Smott, VMRC
Ken Sprankle, US FWS
Michael Stangl, DE DFW
Davud Stormer, DE DFW
John Sweka, US FWS
Beth Versak, MD DNR
Walt Vieser
Mike Waine, ASA
Craig Weedon, MD DNR
Keith Whiteford, MD DNR
K. Whitney, RIT
Tim Wildman, CT DEEP
Angela Young
Darrell Young, MEFA
Jordan Zimmerman, DE DFW
Erik Zlokovitz, MD DNR
Renee Zobel, NH F&G

The American Eel Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia, via hybrid meeting, in-person and webinar; Wednesday, February 1, 2023, and was called to order at 9:45 a.m. by Chair Phillip A. Edwards III.

CALL TO ORDER

CHAIR PHILLIP A. EDWARDS III: Welcome to the American Eel Management Board. I would like to call this meeting to order. My name is Phil Edwards; I am the Administrative Proxy for Rhode Island. With me today up front are Caitlin Starks and Dr. Kristen Anstead with the Commission, and Dr. Sheila Eyler, the Stock Assessment Chair. Later in the meeting Dr. Jared Flowers will join us, so he's the Chair of the Peer Review Panel.

APPROVAL OF AGENDA

CHAIR EDWARDS: I would like to start with the Approval of the Agenda. Are there any proposed modifications to the agenda? Please raise your hand. Is there anything online? Seeing none; the agenda is approved by consent.

APPROVAL OF PROCEEDINGS

CHAIR EDWARDS: Moving on to the approval of the proceedings for October 2021. The proceedings were in your materials.

Are there any corrections or edits? Anything online? Seeing none; I approve the October 2021 proceedings by consent.

PUBLIC COMMENT

CHAIR EDWARDS: Next item on the agenda is Public Comment for those items not on the agenda. At this time, we have one person signed in, Mike Nardolilli from the Interstate Commission on Potomac River Basin. Go ahead, Mike.

MR. MIKE NARDOLILLI: Thank you, Mr. Chairman, thank you members of the American Eel Management Board. I'm Mike Nardolilli; I'm the Executive Director of the Interstate Commission on the Potomac River Basin. In 1940, Congress approved the compact between the five jurisdictions in the Potomac River Basin, Virginia, West Virginia, Maryland, D.C. and Pennsylvania. I'm here today to just introduce myself, and hope that we can work together in the future.

You probably know of ICPRB best from our efforts to restore the shad to the Potomac River with Jim Cummings, our current biologist a few years ago. Some of my aquatic biologists have expressed an interest in helping restore the American eel to the upper reaches of the Potomac River, by working on eel ladders around Dams 4 and 5, which were leftovers from the old C&L Canal Base. We're here just to indicate that we are really hoping that we can work together, and I look forward to hearing about the American eel proceedings today. Thank you very much.

CHAIR EDWARDS: Thank you, Mike, for the introduction. Do we have anyone else online with a comment? Okay, that was the end of the Public Comment. We are now at Item Number 4, Review and Consider 2022 Benchmark Stock Assessment and Peer Review Report for Management Use and Respond if Necessary. Go ahead.

MR. JEFFREY PIERCE: Good morning, Chairman and American Eel Board. My name is Jeff Pierce; I'm with the Maine Elver Fishermen's Association from Maine. Marine Elver Fishermen and a number of NGOs have been working with the state of Maine.

The state of Maine has been working since 2012 to open up more habitat and full fish passage both upstream and downstream migration, which is most important to get the silver eels out. These river systems have been flourishing since we've been doing this work. The decisions you make today affect our

communities and our fishermen. We hope you all take that into consideration, as these are sentinel fisheries. Thank you.

REVIEW AND CONSIDER THE 2022 BENCHMARK STOCK ASSESSMENT AND PEER REVIEW REPORT FOR MANAGEMENT USE AND RESPONSE IF NECESSARY

CHAIR EDWARDS: Thank you, Jeff for the public comment. Is there any other public comment? Okay, we will move to Item 4, Review and Consider the 2022 Benchmark Stock Assessment and Peer Review Report for Management Use and Response if Necessary. We're going to have a series of three presentations, and a discussion and questions following.

STOCK ASSESSMENT REPORT

CHAIR EDWARDS: I would like to introduce Dr. Sheila Eyler, for the presentation on the stock assessment report.

DR. SHIELA EYLER: Thank you, Mr. Chair. Today I'll be presenting on the stock assessment for the American eel that was completed in late 2022. This is an outline of the material that will be covered into today's presentation. There are a number of challenges that complicate the assessment of the American eel stock that has the geographic distribution within the Atlantic States Marine Fisheries Commission.

It occupies a wide variety of habitats from the ocean to estuaries in fresh water. It's a panmictic species ranging from Brazil to Canada, which means they are a single stock. The stock is managed by several authorities, depending on its location within its geographic range. The life history characteristics vary by sex, location and area within the geographic range.

Other potential impacts to the population are difficult to quantify, including habitat loss from dams, climate change, and the nonnatives swim bladder parasites. These challenges lead to the inability to model and produce traditional reference points for the species. Previous assessment efforts through the Atlantic States were completed in 2005, '12 and '17. The 2005 assessment was not accepted for management use due to shortcomings in the assessment.

The 2012 Benchmark Assessment evaluated different modeling approaches and trend analyses, but reference points from the models were not accepted for management use. In 2017, there was an update to the benchmark with an extended time series, and supported the depleted status that was found in the 2012 Benchmark.

The current assessment has many of the same issues with the previous assessments that were not resolved. Attempted models and approaches from the previous peer review including the delayed difference model to develop reference points. Further exploration was also done on surplus production models and the traffic light approach. Other methods were considered in this assessment, including a GIS-based habitat analysis. Updating the indices and trend analyses, and evaluating the use of data poor methods for assessment that had been developed and simulation tested by the Northeast Fishery Science Center to provide management advice.

It's important to note that the SAS had issues with assessing the status of American eel stock, and that Is not unique to the American eel or to the United States. New Zealand has abandoned analytical stock assessment methods, and is currently proceeding with a habitat orientated assessment approach.

The European eel has been assessed by an ICES working group, and have identified similar challenges to assessing their stock, as what has occurred on the Atlantic Coast of the U.S. The Canadian Department of Fisheries and Oceans have assessed the American eel in Canada, and they were not able to develop reference points for their portion of the stock in their waters.

Now moving to the assessment. We have covered the life history and stock definition. The American eel ranges from Canada and Greenland south to Brazil on the Atlantic Coast. It's a single panmictic stock, with adults from all areas of the range traveling to the Sargasso Sea to spawn.

In this assessment, the only portion of the population that was assessed was from the U.S. Atlantic Coast indicated by the red circle. As a reminder of the eel life history, the life cycle. Adults from the entire range congregate in the Sargasso Sea to spawn. The eggs hatch and the larval eels travel ocean currents to reach the coast where they transform into glass eels, and then migrate inland.

Eels mature for the elver and yellow phases before becoming silver, and then begin their migration back to the Sargasso Sea. Depending on the location, the sex, eels can take between 5 and 20 years or more to reach maturity. As part of the assessment, the U.S. Geological Survey led a pilot effort to assess the eel stock using GIS based habitat models, and that work will be published separately from the assessment report, and a report by U.S. Geological Survey, and the work was led by John Young.

The pilot effort focused on the data-rich areas of the Chesapeake Bay and Delaware Bay watersheds. Eel occurrence records were collected for both watersheds, including fresh water areas, and the eel occurrence and abundance was evaluated against a suite of environmental predictor datasets, including dams, connectiveness to the ocean, temperature, substrate, and watershed use.

USGS was able to develop a spatial model for eels from 1995 into 2019, and they found out fragmentation from dams was a major factor in determining eel distribution within those watersheds. Unfortunately, reliable data only going back to 1995 and the lack of historical data does not allow us to fully understand the impact in habitat restrictions caused by dams on the population.

Further, the lack of eel data in other portions of its geographic range make assessing the larger eel stock challenging with this particular assessment method. Moving on to landings. This graph depicts the coastwide yellow eel landings in millions of pounds. Landings from 1998 to 2020 were validated through ACCSP.

The red line indicates the coastwide landings cap that is currently in place set at 916,473 pounds. For glass eel landings, the glass eel fishery currently is prohibited in all states except for Maine and South Carolina. Maine has had a quota since 2014, with the adoption of Addendum IV, and that quota is 9,688 pounds.

South Carolina does have some landings, but they are low since 2015, and remain confidential. In this graph that is provided by the Maine Department of Marine Resources, it shows glass eel landings in thousands of pounds in the gray bars, with price per pound shown with the black line. The glass eel quota here is shown in the red line.

Information on recreational catch is derived from the Marine Recreational Information Program, or MRIP. MRIP is designed to provide estimates of marine recreational fisheries catch and effort data. The orange bars in this graph depict the number of individuals that were released alive. The blue bar depicts the number of eels that were removed from recreational harvest.

Generally, the MRIP database has a low number of records for American eel, which is less than half a percent of the trips that are in that database encounter eel. The MRIP doesn't typically cover the geographic areas or gear that may be relevant to eel. There is also low precision associated with the time series with the percent standard error of greater than 50 percent.

The MRIP query tool itself presents a warning for any PSE values that are greater than 30 percent. Although this is the best information the SAS has of knowable for recreational landings, there is not high confidence that the MRIP survey adequately assesses recreational effort and removals.

That said, it is unlikely that there are significant removals from the recreational fishery compared to that of the commercial fishery. Moving on to fishery independent indices. There is a large number of datasets that were evaluated by the SAS, and we used a suite of criteria to each dataset, to determine whether or not it would be included in the assessment. Those criteria are listed on the slide.

In the end, a total of 49 datasets were retained for assessment. The evaluation of the YOY or young of year and yellow eel data are presented in the following slides. The elver data were not used in modeling, but additional information on those 10 indices can be found in the assessment report. We'll start with the YOY indices.

The SAS evaluated 25 different young of year indices. The individual indices listed here are rating from north to south, so on the top of the slide are the northern indices, and the bottom of the slide is the southern indices. The surveys were standardized for environmental variables, and trends in individual surveys were derived using the Mann-Kendall non barometric test for monotonic trend. This is the same method that was used to evaluate trend surveys in the 2012 and 2017 assessments. The right column indicates the trend for the respective survey. Note that NS indicates no significant trend. In the wildlife surveys there are two surveys that have increasing trends, five surveys with decreasing trends, and the remaining 18 surveys have no trend.

This graph depicts the environments of American eel YOY using the MARSS Index. The MARSS is a Multivariate Auto-Regressive State-Space, it's a package in R. This method can determine long term population trends among multiple time series, assuming each time series represents the same population.

In this case we're representing a single population, it's a panmictic population of American eel. Note that the MARSS scales to the first survey that is inputted into the code, so the Y axis units are not meaningful on these slides. Also note that the survey shows a declining trend part way through the time series, with more stable levels in recent years.

We got two decades worth of data from the state-mandated YOY surveys. Most of those surveys started in 2000 or 2001, and an evaluation was conducted to see if there were latitudinal or temporal patterns in those surveys. We found no patterns on the data on pigment stage, on weights or recruitment over time, but there was an increase in length and latitude with those surveys.

The SAS recommends that the biological sampling of the young of year become optional, so the measuring of length and pigment state for those YOY surveys is optional, although many of the states have indicated that it will continue to voluntarily collect this information. However, all states are required to continue to do their YOY surveys moving forward.

All right, moving on to yellow eels, we're looking at the indices here for yellow eels. The yellow eel surveys were standardized again using the Mann-Kendall Test, and it assessed 14 different eel surveys for this assessment. Two of those surveys had increasing trends, four surveys had decreasing trends, and the remaining eight surveys had no trends.

Again, in this graphic the surveys in the north are at the top of the slide and moving south to the bottom of the slide. The MARSS Index was used to combine the different yellow eel indices to develop a coastwide index. This index indicates the high abundance of yellow eels earlier in the time series, followed by declines in the late 1980s and early 1990s, and then a more recent decline since 2009.

The south considered several assessment methods that were reviewed and attempted during this benchmark assessment. Some are based on the recommendations of the prior peer review in 2012, and some showed potential for being useful to eel. In the end several assessment methods were identified, and those here in italics did not produce meaningful results, and were not useful for determining stock status or giving management advice.

They won't be mentioned further in this presentation, but there is information on these assessment methods in the report. The MARSS and Mann-Kendall Test were used to develop indices and describe trend analyses that we discussed in the previous slides. The Regime Shift Analysis, Delay Difference Model and Index-Based Assessments will be described in the next slides. The first assessment was a Regime Shift Analysis, and this shows the young of year analysis for the Regime Shift. It was used to identify potential change points in the population, and group years together that had similar index values. It was based on the MARSS Index.

For YOY the analysis indicates there are three different regimes, with higher abundance from 1987 to 2002, followed by a reduced abundance from 2003 to 2008, and then another reduction from 2009 to 2020. The index has generally been a low regime since 2003. Moving on to yellow eels for the Regime Shift.

The yellow eel time series also supports three different regimes with an initial high level from 1974 to 1988, followed by a large drop that includes two lower regimes from 1989 to 2020. This yellow eel Regime Shift output was later used in the assessment by assigning the high regime time period from 1974 to 1988 as a reference period for calculating abundance when we use the I/target method that we'll talk about shortly.

The Delay Difference Model was recommended by the 2012 Peer Review, and is a variation of the Biomass Dynamic Model that includes biological parameters and is fitted directly to the time series, and accounts for changes in growth and recruitment over time. It predicts the biomass of an age-structured population directly from the previous year's biomass, based on parameters for survival, growth, and recruitment.

The SAS developed the model and ran several sensitivity-runs and associated reference points, but we do not recommend this model's use for management at this time. The model was developed using an average eel, which was based on Chesapeake Bay data. We don't have enough data coastwide to adequately describe the large differences observed in sex, growth, size and behavior along the Atlantic Coast, or even between coastal and freshwater habitats.

The model was also developed for combining sexes, because we didn't have enough data to differentiate between the sexes, though we know that growth rates and size at maturity vary greatly between male and female eels. Ultimately, the model's parameterization of growth and length at maturity were unrealistic, so the model and its reference points are not recommended for management use by the SAS at this time.

Index-Based Methods is an approach to assess stocks when traditional stock assessment approaches to set catch limits cannot be used or otherwise fail. These methods have been simulation tested, and are based on the work by the Northeast Fisheries Center in 2020, and Carruthers et. al in 2015.

The SAS evaluated several index-based methods in the assessment, and focused specifically on developing an I/target for the American eel. The SAS was able to choose a reference period, and that was derived from the Regime -Shift Analysis I talked about earlier. It only required input of catch and abundance, which is available for American eel in this assessment.

The I/target used the MARSS yellow eel index and the yellow eel landings information. It worked by comparing the average index value for the past three years to a defined reference period. The I/target is defined by the average index taken during reference period. In this case the reference period was from 1974 to 1988, that was derived during the Regime Shift Analysis that was presented earlier, and then it's multiplied by an I/target multiplier. This multiplier is selected based on a biomass target, compared to the biomass of the reference period.

If you select a multiplier of 1, that means that you're shooting to have a biomass target equivalent to the reference period. If you pick something larger than 1, then you're looking to have a higher biomass than what occurred during the reference period. The NOAA work recommends using a multiplier of 1.5, which means the biomass during the reference period was half of what our target biomass would be.

The SAS settled on something a little bit less than 1.5, we used 1.25 as our multiplier, recognizing that the stock was exploited during the reference period, so it was appropriate to set a biomass target higher than the index during the reference period. The next step of I/target is to develop a threshold.

The threshold is calculated by taking 80 percent of the target value that is developed using the I/target method that we just talked about. That 80 percent value is recommended from the Northeast Fishery Center 2020 document. Then the catch recommendations are based on where the current three-year average of the index falls, relative to the target and threshold values.

I'll show some examples of this in a minute. But if the index falls below the threshold, the recommended catch will be further reduced, compared to what it had been if it had been between the index and the threshold values. This slide depicts the actual coastwide yellow eel landings in the black line, against the MARSS Yellow Eel Index in the blue line.

The grey box here depicts the reference period based on the Regime Shift Analysis from 1974 to 1988. The grey dash line is the I/target value, which is the average index value from the reference period for the time from 1974 to 1988, and it's multiplied by 1.25. That is the grey dash line that we have here.

Then the threshold value is 80 percent of the target value. That is indicated here by the orange line. Catch advice is developed by comparing the average catch over the reference period, and adjusting it by comparing the current average index of the I/target and I/threshold values. In years where the index was below the I/Threshold, which is the entire time series depicted here on this graph.

The recommended harvest level is further reduced because of low stock abundance. This slide compares actual harvest in the black line to what the recommended harvest levels would have been, assuming different biomass targets based on the average index from the high regime, as indicated in the blue, red and yellow lines.

To maintain a biomass target of the high regime from 1974 to 1988, the blue line indicates a level of harvest that should have occurred. That was that multiplier 1.0. It's the least conservative recommendation for harvest. To offer some higher biomass than what was available during the high regime period, than the 1.25 and 1.5 lines, which are red and yellow, should have been considered for harvest recommendations. Note that the SAS favored the multiplier 1.25, which is the red line, because the stock had a reduced carrying capacity during the reference period. The takeaway we find here is that regardless of the multiplier that is used, which represents the level of biomass we're trying to achieve or maintain.

The actual landings have exceeded the value recommended by I/target for the entire time series depicted here, except for 2020, and 2020 was an anomalous harvest year with COVID. The conclusion here on the Index-Based methods is the three-year average of the MARSS Index in 2020, which is the last year of the assessment, was below the threshold, and indicates that the stock is overfished.

Although the I/target method is not well suited to determine overfishing, the fact that removals or harvest have always been more than the recommended removals of this model, that could be viewed as overfishing is occurring. With the limitations of I/target, we can state that overfishing status is unknown, but likely.

Neither a 2012 or 2017 benchmark and update were able to define stock status. There was a lack of quantitative reference points and data limitations. But a depleted status was assigned to previous assessments, and depleted is defined as low levels of abundance. But it is unclear if fishing mortality is a primary cause of the reduced stock size.

The stock was at historic low levels, but other factors could have contributed to that status, including historical overfishing, habitat loss, food web alterations, predation, terminal mortality, environmental changes, toxins, contaminants and disease. With the current assessment, based on the I/target method, the stock is overfished, and based on the MARSS Index it has been in decline for multiple decades.

The stock is currently at its lowest abundance in the time series. Although other assessment methods were not covered in detail in this presentation, they generally support that the population is currently at low levels, and some methods point to a continued decline in the stock. Overfishing cannot be determined, but is likely given the removals compared to the I/target recommended removals.

Based on this assessment, the SAS recommends that yellow eel removals should be reduced. With respect to the next benchmark and updates, we recommend that we stay on a current schedule for benchmarks and assessment updates. In five years, we would do an update assessment, and then ten years another benchmark assessment for American eel.

While research recommendations are listed both in the 2012 and 2017 benchmark and update that remain important for American eel, but some of those recommendations are pulled out into the new 2022 assessment as highlights that will improve the next assessment. I won't go through those here, but you can reference the document for that.

In conclusion, eels are a difficult species to assess, as their life history strategies and panmictic nature do not conform well to traditional stock assessment methods. That said, the SAS made progress toward providing advice on stock status with this assessment. Young of year abundance has been in a lower regime, essentially since the beginning of the mandated YOY surveys out of states, which has been in place for nearly two decades. The SAS recommends that the biological sampling of the YOY catch, including length and pigment stage, no longer be required to be collected.

The GIS-based habitat models may be an alternative to traditional stock assessment methods, but it will be difficult to assess habitat availability beyond the current habitat use, given the lack of historical data, and more generally the lack of data across the species entire range. Abundance indices are more robust with each assessment iteration as the time series gets longer.

The trends for both YOY and yellow eel indicate that they have been in low abundance for recent years. Our analyses considered in this benchmark assessment suggest that American eel is at a very low population level. Some analyses point to continued decline in recent

years, and the MARSS indicates that the stock is at its lowest point in the time series. The population continues to be in depleted status from historic levels.

The I/target assessment method found that the stock status was overfished, being below all thresholds examined, and is likely experiencing overfishing for the last several decades. Given these persistent results of low abundance, and that the stock is likely overfished, the findings of this assessment would recommend reducing the coastwide quota for yellow eels. That concludes my presentation, thank you.

CHAIR EDWARDS: Thank you, Sheila, that was an excellent presentation and a tremendous amount of work.

PEER REVIEW REPORT

CHAIR EDWARDS: The next presentation will be the Peer Review Report by Jared Flowers.

DR. JARED FLOWERS: Thank you for having me today, we're going to talk about the Eel Stock Assessment Peer Review Panel Report. Just to give you a little overview of the process. The American Eel Stock Assessment Subcommittee and TC developed a new stock assessment, which there was the ASMFC Peer Review Workshop held December, 2022, where results were presented to the Peer Review Panel.

The Stock Assessment Review focused on data input, model results and the overall quality of the assessment. From that we produced the ASMFC Stock Assessment and Peer Review Report, and those are available on the Commission website. The Peer Review Panel consists of the Chair and two additional technical reviewers with expertise in eel biology and population dynamics, stock assessment modeling, and survey index standardization.

I served as Chair, and Dr. Hilaire Drouineau from the National Research Institute in Bordeaux, France, and Dr. Robert Leaf in the University of Southern Mississippi, Gulf Coast Research Lab were also on the panel. I want to acknowledge their work in this, and also acknowledge Pat and Commission staff for their guidance in this process.

The overall findings of the Review Panel, first the Review Panel endorses and supports the I/target approach for formulation of reference points for the fishery. But we do believe additional work is needed to establish sound reference points. We recommend a formal robustness test and index method using a simulation approach, seeing it is more appropriate to consider the American eel stock to be depleted rather than overfished. The Review Panel is uncomfortable with overfished terminology, because of uncertainty in the assessment methods, and does not believe a reliable status determination can be made at this time. Future assessments should focus on methods directly resulting in catch recommendations, specifically index-based methods, including I/target and stage-based-delay-difference models being the most promising report for management advice.

Therefore, habitat modeling for eel shows promise for understanding changes in carrying capacity and other spatial dynamics of the stock, and has delivered promising results for other eel species internationally; notably, New Zealand, and I believe Europe. Preliminary habitat work during this assessment should be further explored down the road.

We're going to go through the review findings based on each TOR. TOR Number 1, evaluate the definition of stock structure. The Panel concludes that we agree with assessing American eel on a coastwide scale, because of the panmictic nature of the species. The distribution extends beyond the United States Atlantic Coast, so ideally it would be nice to conduct stock assessments at a larger scale, you know beyond the Coast, but for this it's appropriate.

The majority of data originate from coastal areas where most of the commercial fishery

takes place, however, the species occupies many other areas and habitats, including freshwater areas and other ocean areas. Our first recommendation is, continue to expand data collection analysis to the Canadian, Gulf of Mexico and Caribbean Regions, recognizing the jurisdictional responsibilities for managing American eel.

The SAS did use data for fisheries in the Gulf of Mexico and the Canadian Region, although the landings weren't comprehensive, but they definitely were important. Recommendation 2, encourage future data collection analysis of American eel and freshwater habitats, including the habitat modeling.

TOR 2, evaluate thoroughness and treatment of data used in assessment. The Panel concluded that the datasets used were comprehensive and appropriate for the stock assessment, and all potential data sources were requested and used where appropriate. The broad distribution of eel makes it difficult to collect representative relative abundance data. Our first recommendation was to take steps to account for autocorrelation in index standardization efforts.

The results we do think are unlikely to drastically change, and the recommendation is partially addressed by the inclusion of Julian day as a variable here. Recommendation 2, add more information about data standardization, including tables and figures to improve the understanding and digitalization of the standardized framework results. We do think the methods used were appropriate, but it would be nice if there were more detail provided.

TOR 3, evaluate methods and models used to estimate the population parameters and reference points. The Panel concluded that the SAS carried out comprehensive review of biological parameters of the American eel used in the analysis, and the SAS used the best scientific knowledge available for the assessment. The SAS tested several stock assessment methodologies, both updating formally used tools in previous assessments and testing new approaches that are novel. These efforts were used thoroughly and well executed. The aggregate indices per life stage, using a MARSS Method of currently the best available coast-wide indices, and can be used to indicate stock abundance variations over time. The index-based methods and stage-based-delay-difference modeling were demonstrated to have the most potential for management advice.

We don't have a recommendation especially for this, but they are kind of embedded in some of the other TORs. TOR 4, evaluate the method used to characterizes uncertainty. The Panel found that most of the models evaluated by the SAS to determine fishery and stock reference points. These are surplus production, egg-per-recruit model and delay-difference models.

Each of these approaches for various reasons, given poor or lack of fit, were unable to provide useful or reliable results. Both the Review Panel and the SAS agree that the surplus production model was not suitable for use. The egg-per-recruit model can derive reference points of value on local scales, where yellow and glass eel fisheries co-exist.

But the Review Panel considered that the egg-per-recruit approach was theoretical and caution should be used when interpreting results on a broader scale. The recommendation here is that the delay-difference model is the only non-index-based model with potential. More model development is needed to account for variability and uncertainty in the eel life-history characteristics across its range.

TOR 5, evaluate the diagnostic analyses performed. The SAS performed some useful diagnostic analyses, and the Review Panel concludes the diagnostics are insufficient to produce reliable reference points. The SAS systematically varied the I/target "mult" parameter, representing a relationship with the

reference period on biomass target, from 1.0 to 1.5 and 1.25 in what was used.

The SAS bootstrapped predicted confidence intervals of the MARSS time series, and used the resulting time series of the I/target method. However, the boot strapping approach is not ideal, as it ignores autocorrelation. The Review Panel recommends the development of an MSE style or MSE simulation model to test robustness of the assessment method, the index method and assessment frequency.

Also, the harvest control rule associated, including setting of catch limits based on the assessment. TOR 6, evaluate stock status determination and reference points used by the assessment. The Panel concludes that the term depleted is appropriate, and describes stock biomass for yellow eel, note depleted is only used as a descriptor and not a status determination. It's based on the SAS suite of modeling approaches, derived from the coastwide index of abundance.

The I/target approach does not allow determination of stock or fishery status with respect to traditional MSY-based biological reference points. Given that the catch advice from I/target, an evaluation should be performed to understand the following catch advice will result in stock biomass increasing. That kind of goes back to the modeling mentioned on the last four. For the recommendation, further evaluate the robustness of catch advice developed from I/target in recognition of process error associated with eels' complex life history. A significant portion of the stock is outside of the assessed area, and anthropogenic impacts other than fishery affecting the stock, the focus on yellow eel and the I/target approach versus excluding the other life stages, and also the error associated with landings data.

TOR 7, evaluate the incorporation of new information or attempts at novel approaches to assess the stock. We did conclude that the SAS should be commended for incorporating many new methods and information into the assessment that weren't available previously. The SAS has done an excellent job developing and updating the indices, and documenting the changes in the individual surveys over time.

Dealing with 80 indices is definitely commendable. The MARSS, delay-difference, and index-based methods incorporate a relatively new or updated methodologies for the updated previous assessment approaches used in view of elementary technology. The recommendation here is continue updating and refining the assessment approaches, and to continue to improve the favored approaches identified by the SAS and Review Panel.

TOR 8, review research recommendations. Research recommendations, the surplus production model and the TOR 8 assessment for traffic light assessment approaches should be discontinued. Based on the findings, these weren't as useful as the other preferred method. The future efforts should focus on the index-based method and stage-based-delay-difference models.

Habitat modeling should be explored in the future assessments to understand changes in the carrying capacity and other spatial dynamics of the stock, and also to promote international collaborations. The Panel agrees with the SAS and TC recommendation to make optional the biological sampling requirement for young of year surveys.

With the observed climate-induced changes in environmental conditions that have been noted in the North Atlantic, this might be influencing population productivity and abundance. Some of the timing of this coincides with what was seen in a regime-shift analysis, and this should be considered in future assessments.

TOR 9, recommend timing of the next benchmark assessment. The Panel concludes that the next benchmark assessment should be conducted after additional data are collected and progress is achieved, to keep addressing

the Panel's analytical recommendations, at a minimum of 5 years, consistent with eel's long generation time. I think relatively the same recommendation was made (muffled).

But we do recommend pursuing international assessments, including Caribbean, Canadian, Gulf of Mexico input. The Panel applauds inclusion of the Canadian and Gulf of Mexico data in this current assessment, but we really think future assessments would benefit from participation from areas at large. I think we're going to pass it on with questions at the end.

CHAIR EDWARDS: Thank you, Jared, excellent presentation. Our next presenter will be Kristen Anstead for the Commission.

DR. KRISTEN ANSTEAD: Thank you, I just have a few slides about potential paths forward for accepting this assessment and moving forward with how to manage this stock. I first want to reiterate that the SAS and the Peer Review Panel agree on a lot of things, and that the Peer Review Workshop was really productive, and we have some really meaningful recommendations with how to continue to assess eels for the next benchmark.

The Peer Review Panel said the MARSS Index was currently the best available coastwide index for eel, and they did endorse the use of I/target for managing eel. But in the report, as you just saw, the Panel concluded that more work is needed to test the robustness of the I/target method, using the MSE approach, before it could be used for management.

The SAS has met a couple times since we received the Peer Review Report a couple weeks ago, to discuss this path forward. Ultimately, this is where we start to differ from the Peer Review Panel. The SAS does not think the MSE simulation work will be a productive or timely exercise for eel for a few reasons.

Part of an MSE will be developing an operating model, and that's going to be challenging and time consuming, and may require outside expertise to complete. The methods from the research track paper, the Northeast Fishery Science Center paper with index-based methods, were designed as a Plan B approach that can be used when assessment models fail, such as our delay-difference model, or when there are strong retrospective patterns.

We argue that the I/target method was already simulation tested under different life histories. Note those life histories are different from those of eel, but what makes eel different are the very thing the SAS is unsure of, and that we struggled to model in the delay-difference approach. That is not to say there is not some room to test this method.

In the last few weeks, the SAS began work doing some bootstraps around the index, subsampling the indices, and some of the other recommendations that are in that Peer Review Report, to kind of test some of the decisions we made and how that might influence the recommendations coming out of I/target.

We have been working on that, and kind of thinking that through. There are also different formulations of the I/target that could be explored, and likely changing some of the decisions within I/target, like the multiplier, the reference period, the percent to set your threshold, will result in bigger differences than some of this index work.

But they are both potential paths forward to kind of see how sensitive this tool would be for management. The SAS and staff have been discussing possible paths forward. First the Board could choose status quo to maintain the current management under Addendum V, and maintain that 916,473-pound coastwide yellow cap.

Option 2 could be to task the SAS with exploring some simulation work like we've been doing, on the indices and around I/target, and different management strategies, such as the desire to rebuild the stock back to that reference period or maintain the stock where it currently is,

depending on the Board's goals for this fishery. Option 3 would be to do the MSE and simulation work as recommended by the Peer Review Panel. The SAS believes that work is significant enough to be another benchmark. We had said the next benchmark would be in 10 years, or the Board, it's the will of the Board, to ask for an assessment whenever you want one, so depending on the full stock assessment schedule at the Commission, that could be put in place if that is the path that we go.

The last three assessments have continued to find eel at its lowest abundance, and the SAS does not support the status quo option. We have reservations about Option 3, as I discussed previously. Ultimately, there are some disagreements between the SAS and the Peer Review Panel about the path forward.

The Commission's Guidance Document does address this, so I just want to put a slide up about what we say for scenarios like this. In cases where a SAS and Peer Review Panel do not agree, we present both approaches to the Board, as we have done today, and the Board can task the SAS or the Technical Committee with providing justifications for why they don't agree with the advice given, and ask them to provide ultimate analyses at a later date.

Then the SAS or TC would do that work, produce a report or a memo, and we could bring it back to the Board to make a final determination on status and management at a future meeting. If the Board is interested in that tasking in that Option 2 that the staff laid out, where we do some additional work. The staff has discussed that, and we would recommend that we postpone accepting this document until a later date, when we bring that work back.

If the Board accepts the reports today, that would indicate the Board agrees with the path forward proposed by the Peer Review Panel, and wants to pursue the MSE simulation work. Hopefully that will help some of the discussions that we'll probably have now about how to proceed with the stock assessment and managing the species. Thank you.

CHAIR EDWARDS: Thank you, Kristen. All right, I would like to open it up on some questions for our presenters.

MR. JOHN CLARK: Thanks to the Stock Assessment Committee and the Peer Review for that excellent information. But that is a heck of a lot of information we just got here. I'll try and go back to the presentation that Sheila gave. I noticed that it looked like the regime shift pretty much started around the same time we started state surveys in 2000, so clearly there was a lot more data going forward from that point. How much of an impact did that have on the changes that were seen in the trend, by having the extra data?

DR. ANSTEAD: For the yellow eel index, the Peer Review Panel did ask us to produce some plots, which we have since added to the benchmark that compare each individual index to the overall trend. You can see that for yellow eel, for example, Maine through Delaware are pretty in-step with that long range, you know the long trend, and the different shifts in time.

Then there are a couple indices, and we can see it in Mann-Kendall as well that there are a couple indices that are increasing, and that is not captured as much by that long-term index. It does matter, and that could be part of the simulation work, is kind of showing the Board more how the choice of indices varies. Unfortunately, the time of the indices is what we have, and of course we want all of the indices to go back further in time. But we just don't have that level of data.

MR. CLARK: Just a quick follow up on that. I mean some of those, having done the survey myself for many years with the glass eels. I know that they vary a lot from year to year. Does that have a lot to do with the non-significance in the trends you're seeing, because we would go from close to a million to maybe 100,000 a net, so it's quite a shift.

DR. ANSTEAD: Absolutely. That is what we're seeing, these indices are just wildly variable. There does seem to be an overall trend that we can pull out of putting them all together, but there are very noisy indices, the young of the year.

CHAIR EDWARDS: Thank you, John. Lynn Fegley.

MS. LYNN FEGLEY: Thank you to all of you for all of this work. This is a vexing species and a vexing topic. I really appreciate your work. I'm trying to understand. There are several phrases that I heard during these presentations. There is regime shift, there is carrying capacity, and there is reference period.

It sounded to me like the habitat analyses that were done, may start to point to a little more clarity about what's happening with carrying capacity. I'm wondering if you can help us understand a little bit. We've got this reference period set very early, when abundances were high.

What is the conversation around reconciling a regime shift, a changed carrying capacity, and where your reference period is, to guard against setting a reference period that's just now completely unattainable, but also recognizing the whole shifting baseline idea. I'm just curious, you know you hate to set expectations that are just too high to achieve.

DR. EYLER: With respect to carrying capacity specifically, so the habitat analysis that was done, which was focused on the Chesapeake and Delaware Bay areas, because we have the most data from that geographic area. But it does indicate that the presence of dams is what is restricting eel abundance.

I think that that probably holds true coastwide, even though the analysis did not encompass the entire coast. That said, the regime shift indicates that the high abundance that we have in the time series is from the late seventies to the early eighties. I mean you're talking about dam construction. Dam construction was done well prior to that time period.

If we're talking about habitat restriction, that occurred many decades before the high reference period. I think from a carrying capacity standpoint, that isn't the issue that we're in a low abundance state at this point, and I would follow that up with, in the last 15 to 20 years there has been a heck of a lot of work by the states and federal government to open up new habitat. There has been a lot of dam removals, water quality improvements, and other work that has been done to improve habitat across the eel range. Because they encompass both fresh water and estuary areas, the work of the habitat that has been done in the last two decades, should theoretically be opening up habitat for eel to increase our carrying capacity. That is not being translated in the MARSS Index.

CHAIR EDWARDS: Craig Pugh.

MR. CRAIG D. PUGH: My question is, I didn't see as we watched these regime changes in the population stages over those time periods. I don't know as if there was any incorporation with the effort involved. I know in our area marketability at this time has decreased significantly over the last 20, 25 years.

Also, eliminating the effort put forward and lowering the catch data. That would have a significant play through the year period. I was active in the fishery myself through the eighties and nineties. I ended in 2000. Not so much anymore, like I say, because marketability has dropped off so much. Where is the relationship here with the production and catch up?

DR. EYLER: With respect to the regime shift analysis, that is based on fishery independent surveys, so it's not based on catch and effort data. It's based on those indices that are conducted by the states and other agencies. That should not be driven by the fishery itself, and the economic drivers of the fishery.

MR. PUGH: I find that odd if the effort has dropped off and the analysis has taken the historical values of that data, then it should be recognized in some kind of incorporation in this. I don't necessarily agree with that analysis. I don't see where we get a clear picture. Unless we have a clear picture of what the true effort is on the east coast, which I know in our area is somewhat analytical.

But it seems as though our eels have increased as a bycatch in our blue crab fishery, but yet we still show these as depleted, even though we're seeing increases on a daily basis in our local areas. But yet we know that the marketability has caused a lack of effort on the part of the eel fishermen. Not only just a lack of effort, but I would say the loss of eel fishermen also in the area has been significant.

DR. ANSTEAD: Yes, we have some fishery dependent indices in the appendix of the assessment that can be viewed, and those were supplied by various states. We don't have an analysis on effort. I will say that there were representatives on the SAS and the TC that discussed this a little bit, that in their waters they are not seeing what we're seeing at a coastwide level.

That is something we should probably address now, which is the SAS has discussed this over and over. We know that Maryland and Delaware aren't seeing decreases in their catches or their indices. We talk about this at the SAS, and kind of the phenomenon of hyper stability, where a stock can collapse to the center of its range, and that is the center of its range.

We can have a depleted stock, where in the middle you are still seeing high catches, you are still seeing high CPUE, and the indices are fine. You can see that in the Maryland Index specifically, not as much in the Delaware, but that that Maryland Index continues to be fine, as well as their reported effort by their fishermen. It is something we've discussed. I guess the argument is, we saw this for example, with northern shrimp, where their indices and their catch were fine until they weren't. That is kind of the concern. This is all one stock. If it's a depleted stock and it continues to decline and decline, you'll start to see that focus into the center of the range. The fear is that that could be what we're seeing now.

CHAIR EDWARDS: Okay, we have Robert LaFrance online, and when we come back to the room, Russel Dize.

MR. ROBERT LaFRANCE: Thank you very much, excellent presentations, really fantastic information. I just want to follow up a little bit more on this issue of a GIS based or spatially-based analysis. I've heard a lot of discussion back and forth. But I don't know exactly what we would be doing from a recreation's perspective to pursue those types of efforts.

I'm wondering if you might be able to give us some insight as to what you would be looking to do in those areas, and how much time that might take. I know there is some historical problems with historic data, but if we don't start collecting data at some point in time, we'll never really know what's going on. Thanks, appreciate any response.

DR. ANSTEAD: Just clarity on the question. Is that what would the habitat model bring us in the future if we continue to develop it? Is that the question?

MR. LaFRANCE: Exactly.

DR. EYLER: Well, I think firstly it's important to note that developing the habitat model further is going to be very challenging for eel, because we have a lot of data on eel and their distribution in the Mid-Atlantic area. But we don't have that information in other parts of the coast. Because this is a panmictic stock, really, we should be looking at its entire range. We really don't have information from that perspective.

I think it gives us a sense of carrying capacity. Like I said, that assessment based on the Mid-Atlantic at least shows that dams are a driving factor in where eels are distributed in the basin. That's not a surprise. I personally am concerned that that type of habitat assessment isn't going to give us the information we need to manage eel stocks, particularly those that occur in the estuary, because that habitat model is going to focus on a lot of habitat that is not under the jurisdiction of many of the agencies that are at this table today.

MR. LaFRANCE: But I guess, to follow up on that if you don't mind, to the extent that we do have information over coastwide, more than just the Mid-Atlantic, maybe up into New England at least. Shouldn't we be collecting more data, and getting that dataset ready for the future?

DR. EYLER: I think potentially that could be useful as a recommendation by the Peer Review to develop the habitat assessment model further, and we can consider that with the assistance of the U.S. Geological Survey.

MR. LaFRANCE: Thank you very much.

CHAIR EDWARDS: Russel and then John Clark.

MR. RUSSELL DIZE: I appreciate all the work that is being done. But I don't understand one thing. That is, when you did the assessment on yellow eels, you did three assessments in the Hudson River area, and you only did one in the Bay. In the Bay, Chesapeake Bay, you did the assessment in the Sassafras River.

The Sassafras River is all the way up towards the Conowingo Dam, and it's heavily predated by blue catfish. Had you have done assessments, if you had done more assessments in Maryland part of the Bay, in my area, which is Tilghman Island, and I talk with eel fishermen all the time. We've lost all of our eel fishermen in the middle part of the Bay, because we can't sell the eels anymore.

All the crabbers are gone to clams, and the oversea market has dried up for yellow eels. But I don't understand why you would do twice as many tows, or assessments more in the Hudson River area than you did in the Chesapeake Bay, and when you did it in Chesapeake Bay, you did it in an area where probably the predation of blue cat is worse than anywhere else, except maybe the Potomac River.

We have lost our eel fishermen; they can't fish anymore around us. We have so many yellow eels in our area that one of my fellow watermen set an eel pot out to catch some small eels for trawling for rockfish, and the pot filled with yellow eels. We're not catching them, and I don't see why that we don't take all this in. When you just taking four assessments for the whole East Coast for yellow eel, I don't think you're doing justice to the survey, by not doing more in the Chesapeake Bay Area, especially in our area. Thank you, Mr. Chairman.

DR. EYLER: Okay, I think Kristen and I are going to split the response to that. First, I want to speak to the blue catfish issue specifically. In the Chesapeake Bay the blue catfish issue is relatively recent, especially in the upper Bay around the area of the Sassafras River. They've been recently established.

The length of the survey really would have only impacted the survey in the last few years. It's an interesting prospect. We do know that blue catfish do consume American eel. The population explosion in the Chesapeake Bay and potentially into the Delaware Bay is a concern for the species to increase predation. That doesn't speak specifically to where the surveys are located, and why that is located. I'll have Kristen speak to that.

DR. ANSTEAD: As Sheila covered in her presentation, we had about 80 fishery independent datasets that were submitted for consideration, and we dug into each of them to see, can we develop an index from this data. The indices that you see in the assessment were

the ones that we thought were tracking American eel.

We could develop an abundance index out of them, so of course we would like more indices everywhere. The Maryland index was included, as you noted. We also have a couple from VIMS in Virginia. Unfortunately, they have a gear change in the early part of the time series, so while we did use them to also describe the yellow eel population, they don't go as far back as the Hudson River indices. Of course, it would be great to be able to pull that index back, and we have the full time series in the benchmark, and it's a pretty similar trend from those VIMS surveys at that historic time period, but the gear changed so it's not really fair to include it. We would like them all to go back to the seventies so we could do that.

The Hudson River indices, yes, they are historic indices at this point, they go back the farthest in time, and they do have an influence on that overall trend. Although the trends are pretty consistent through the surveys, with the exception of the Maryland one and the end of one of the VIMS surveys. We can also, if the Board tasks us with more work, talk a little bit about the influence of the Hudson River indices they are driving a lot of that change, and they are historic indices. But we can work on that if you would like.

MR. DIZE: The survey in the Hudson River skews the whole problem with the yellow eels. Our problem isn't catching, our problem is selling. I can take you, according to where you do the survey, I can take you where we have an abundance of oysters in the last two years in the Chesapeake Bay.

I can take you in a spot and survey it, and you'll say it's the most oysters you've ever seen in your life. I can go two miles from that and tell you to take a survey, and you say never was an oyster here. It's according to where you take these surveys. I understand what you're saying that it's back over a long period of time.

But we've been catching eels in Chesapeake Bay over a long period of time also. I just think that to excuse the amount of yellow eels by not doing as many reports in the Chesapeake Bay as you do in the Hudson River, which is on a tow decline. Thank you very much. I know you've done a lot of work, but I just think when you're adjusting, how many yellow eels can be caught on the whole East Coast, and you're doing a major part of it in one area, you're skewing the report.

DR. ANSTEAD: Yes, noted. I guess the only final thing I would say is it's a single population, and we don't have information on which of these regions are producing the next generation of American eels. Is it the Hudson River or is it the Chesapeake Bay that is feeding our recruitment? We don't know that, and so that is also a challenge when we're modeling.

CHAIR EDWARDS: John Clark.

MR. CLARK: Thank you for allowing me a second question here. I want to follow up, Kristen, you spoke about the contraction of the range. I've been around this long enough I remember the first assessment in the early 2000s, and that was really instigated by the pretty much total extirpation of eels from the Lake Ontario, and Canada's understandable concern there. Yet at that time I recall in the Canadian Maritimes they were not seeing really any reduction at all in their yellow eel numbers.

Just from my experience with sampling eels in the Delaware, it seems almost like we have two populations. We have an estuarine population that grows quickly. We would rarely age an eel over five or six years old. Most of the females were out migrating, probably, by the time they were five. Yet when you went inland, I remember, and Sheila, I believe you did work on the Shenandoah, where you saw huge reductions in the silver eels coming out of that system, or even eels getting into that system. It just seems, is that still something you're seeing, where you're seeing like less change in the estuaries.

You know given the life history of eels, it seems like it would be very difficult to understand how the leptocephali would distribute only to the Mid-Atlantic, rather than the whole range, since they're just kind of drifting on the Gulf Stream before they turn into glass eels and move in. It's just a very confusing situation, and has that kind of persisted, that same type of pattern?

DR. ANSTEAD: Yes, we are still struggling with that as a Stock Assessment group that eel just behaves so differently depending on where you are. Freshwater, estuary, ocean, Maine to Florida. In fact, what we came up against in the delay difference model, how do you describe growth for eel, if this is one stock? You can't. That's what we struggle with when we're thinking about the MSE simulation.

Yes, we could come up with a bunch of different operating models that are likely representing estuary waters in Delaware, and the coastal waters somewhere else. But which one is correct? We don't know that, and it is a real challenge for eel. I'll just throw in a second plug here, which is we do have an ICES Workgroup for American eel. Sheila and I are both on it, as well as representatives from Maine and North Carolina.

We're partnering with Canada to look at all the data available to eel, and talk about these challenges and propose different stock assessment methods that could be used in the future, so internationally this is a problem. We're trying to collaborate with people to resolve the very issues you're talking about. But it remains a question mark if we can.

CHAIR EDWARDS: Yes, Chris Wright.

MR. CHRIS WRIGHT: Yes, for Option 2, you said that the Subgroup could get a report back to this Board this year. Do you know when, summer, annual?

DR. ANSTEAD: Probably not the next Board meeting, maybe later, the one after that. If you were interested in more simulation work, as well as evaluating the influence of the Hudson, as well as turning some different knobs within I/target. I guess it really depends on what the Board is interested in seeing.

CHAIR EDWARDS: Shanna.

MS. SHANNA MADSEN: Thank you to the entire staff, as well as the Peer Review Team, Doctors Eyler and Anstead. I really appreciate you guys being here today. This represents an awful lot of work. A lot of time in assessments we don't get to see all of this background work, all of the different models you attempted, and things like that. I really appreciate the time that you spent on all of these approaches. I have a series of questions, so apologies for the time, and you can cut me off whenever you need to, Mr. Chair. My first question is, I'm trying to dig in a little bit between the discrepancies between the Peer Review, as well as the SAS recommendations. My first question is in regards to the delay difference modeling. It sounded like, as we were going through the Peer Review Report, it is one of the models that the Peer Reviewers suggested for further development.

But then, in reading through the stock assessment report, it sounded like the SAS was less enthused, I guess, about that model. Can you talk about some of the differences, and why you all believe that it's probably not the best approach to go through at this time?

DR. ANSTEAD: The delay difference model?

MS. MADSEN: Yes.

DR. ANSTEAD: Yes, so the delay difference model has showed the most promise of any analytical model we have tried for eel. We did develop it, as well as develop reference points for it. But the challenge for us became describing growth, for example, as we were just talking about. Describing growth in one area is very different from describing growth in another area.

We came up against a few walls that way, with a kind of unique life history of eel. I think both the SAS, as well as the Peer Review Panel, think there could be more work done. We didn't manage it for this assessment, but if we were to do another benchmark in ten years, I think that model absolutely is still on the table.

But the additional work it might need is benchmark level. Kind of what we found here was kind of an initial go at it. But there were so many challenges, it just wasn't recommended for making management, because of those uncertainties. But I think there could still be room to improve, and the Peer Review Panel made some recommendations we can look into next time that we definitely would.

MS. MADSEN: If you don't mind a follow up. The other question I had was in regards too, and this is more just a characterization, so that I can kind of get my mind straight on the differences between the Peer Reviewers and again the SAS. It sounds like both of you sort of coincide with this idea that using this I/target methodology from the Northeast Fishery Science Center could be used here for eels.

But the place where you just diverge is the level of simulation testing that you think is appropriate. Is that a correct characterization? Like they want to go full blown MSE, lots and lots of simulation testing, and our SAS is saying, let's take a little bit more of the measured approach, and see what some of our simulation testing leads to in Option 2. Is that a correct characterization?

DR. ANSTEAD: Yes, although we can look to Jared if we need to. But I believe it was thought of more of an MSE light. I just want to make sure, not to misrepresent them. It's still a lot of work, but it might not be as much as other species.

MS. MADSEN: Right, so it's a diet MSE if you will. I guess I kind of equate that a bit to what we did for Atlantic menhaden, not a full blown MSE, but really having some of the conversations with the management board, the scientists, the technical members, to get an idea of where we wanted to go with that species, and running the simulation testing's that way.

I appreciate that. Then my final question, I think, is in relation to one of the things that Dr. Flowers did bring up. He said that he thought it would be important for us to do an evaluation, essentially, to see, and I don't think we need to get there just yet. I know this is a later step in the future. But to do an evaluation, essentially, to see if our catch advice actually helps to potentially improve our stock biomass.

Do you think that that is possible within, you know, we're aiming for this report to come back to the Board at some point during this year? Obviously, depending on what the Board's advice is to the SAS. Is that something that we could pursue later? Do you foresee that sort of being a part of the package that you present back to us in whatever timeframe?

DR. ANSTEAD: We can certainly try. But there is a point that I think directly speak to that, which is, we don't know if I/target, even if you do the right thing, will necessarily rebuild eel. We don't know if the MSE, what comes out of that, would guarantee to rebuild eel stock. This is what we think is the most appropriate, given this depleted status that something should be done.

We can try to test the relationship between the recommended catch and landings. But that is not what these index-based methods do. They don't guarantee anything, they are just recommending when you need to set a catch limit, and all you have are landings and indexes. You need to do something, and so this is a method for that.

MS. MADSEN: I'm finally done, thank you very much.

CHAIR EDWARDS: Roy Miller.

MR. ROY W. MILLER: Since we are on the step of potential next steps, I would like to explore a little bit the ramifications of depleted status versus overfished. We're not bound to the Magnuson-Stevens Act like the Councils are. If we were to declare this species overfished, like was a recommendation of at least part of what was presented today, as opposed to depleted.

But there is a subtle difference, in terms of how we would proceed. If we declared this species as being overfished, presumably we would be talking about reducing fishing. By depleted there is no imperative that we consider catch reductions. Where are we? I'm a little confused as to what's the best path forward? Which status are we in, since there was a little bit of difference between the SAS and the Peer Review Panel in that regard?

MS. CAITLIN STARKS: I just want to respond to the question of our obligation at the Commission to responding to those two different types of statuses. No, we don't have the same obligation as NOAA Fisheries would to responding to an overfished status and making a rebuilding plan. However, with the other species that we have at the Commission that use the depleted status, for example, shad and river herring. We have in the past acted on those statuses and reduced fishing mortality as a result of those. It is an option, and Toni, I think has something to add.

MS. TONI KERNS: Just a reminder why we have these two statuses. You know we developed these in coordination with the Assessment Science Committee, to recognize that there are times when fishing pressure is not the only thing that is causing a stock to not rebuild. But that doesn't mean if there are other pressures, it doesn't mean that there is nothing that the Board does in response. It's just recognizing these other factors that are part of its inability to rebuild. But it doesn't just give us a pass to not do anything.

CHAIR EDWARDS: Are there any other questions for the presenters? Lynn.

MS. FEGLEY: Just one quick question. Under Option 2, with the simulation work to explore yellow eel indices and sensitivity of I/target. Would the Board get back, would there be some exploration of changing that reference period? You know if you set a reference period halfway between, is that part of it? I just want everyone to be clear that there would be some discussion of what that reference period actually is.

DR. ANSTEAD: Yes, if the Board is interested in that we can certainly kind of do two things. One is, show the result of this index work that we've been working on. That was a recommendation from the Peer Review Panel. We could do that and then you could see the sensitivity of these indices to the final decision.

We can also show some different iterations of I/target if you make different choices, to show how different the answer would be. It is quite different, depending on what you choose. What the SAS formulated in the benchmark was kind of what we thought as the base run, with the intention of the PDT taking that and making various decisions for the Board to consider.

CHAIR EDWARDS: Are there any more questions online? Shanna.

MS. MADSEN: Just a question of process. Do we need a motion to move forward with one of these options, or is kind of a consensus of the Board appropriate here?

MS. STARKS: I believe we could move forward with consensus from the Board. If the desire is to take the SAS recommendation to do some additional work under what's presented here as Option 2. If we can get consensus on that we can go forward with that.

MS. MADSEN: I would at least like to speak in support of Option 2. I think it's the most measured approach, and I would really like to give our SAS more time to respond to the comments of the Peer Reviewers. I think you

have really good ideas moving forward. I think Lynn's question feeds into that.

Getting to see, you know what comes out of the PDT, what some of the options might look like changing the multipliers, modifying the time period, things like that. I think an iterative measured approach is appropriate here. I don't believe that Option 1 is appropriate, and I am uncomfortable pursuing Option 3, until we see what Option 2 kind of provides for us. That is my recommendation without a motion.

CHAIR EDWARDS: Rick Jacobson.

MR. RICK JACOBSON: I want to commend the Panel for the tremendous work they've done to evaluate this very complicated species with a complicated life history, and geographic distribution. I think the information they presented, quite frankly has been outstanding. I understand it is difficult to make decisions in the absence of perfect data and perfect analyses and perfect conclusions.

But we've got some really good information in front of us that indicates that if we were in a place where we could define what harvest quotas should be, we're above those. We've been above them for some time, and the stock has been declining in the wake of all of that. Whether fishing has been the one specific driver or not, is a completely different question. But yet, we're still in a place where we need to make a decision today that will affect what happens with the stock tomorrow.

I can support Option 2, and I appreciate the recommendation coming forward. I would just hope that this is not a measure that just kicks the can down the road, because we do need to make decisions on what levels of harvest are necessary. I can support Option 2. I could also support an option that would pursue Option 2 and include some reduction in harvest opportunity. But I agree, Option 1 is simply not tenable.

MS. STARKS: I just wanted to provide some additional information on this path that we've proposed for moving forward. This is something that is part of our technical guidance with the stock assessment. If there is a disagreement in a particular aspect between a Stock Assessment Subcommittee and the Peer Review Panel, there is this process for moving forward, where the Stock Assessment Subcommittee can be tasked by the Board to put together this type of report that we're suggesting.

That provides the information a Board needs to really make a decision about how to move forward, and what part the SAS has recommended versus what the Peer Review Panel has recommended they would like to move forward with. That's really what we're proposing to put together for the Board, and bring back to the Board at potentially the next meeting, to be able to make those types of decisions that Rick Jacobson just mentioned.

CHAIR EDWARDS: Are there any other questions? John Maniscalco.

MR. JOHN MANISCALCO: Given what Caitlin just outlined, would the Board have new catch advise in place for 2024? I guess that's my concern.

MS. STARKS: I think it would be a pretty tough thing to turn around in that amount of time.

CHAIR EDWARDS: Any other questions? We're going to open it up to the public. Kirby.

MR. KIRBY ROOTES-MURDY: Good morning, this is Kirby Rootes-Murdy with the U.S. Geological Survey. Good to see some friendly faces around the table. I want to join the chorus and commend the Stock Assessment Subcommittee in doing such a thorough and great job introducing the stock assessment.

USGS is at the ready to provide additional analysis support, through both the Technical Committee and the SAS, in addition to John

Young's GIS habitat modeling work. I would just offer a consideration for this Board, as you're reviewing and thinking about, for example, catch reductions, is to take a step back and consider the species range again.

You know as Kristen noted, there is an ICES workgroup. There is current collaboration with Canada DFO, as well as coordination with U.S. Fish and Wildlife Service outside of those that have worked on the assessment, in terms of providing information as part of CITES obligations. For next steps, the U.S. is one of the handful of countries that are harvesting American eel.

I would ask for you all to consider that in moving forward with any tasking of the TC. When it comes to items around harvest that you will also consider how to continue moving forward with communicating with these other countries in our current framework, whether it's through Fish and Wildlife or other agencies, to ensure that those other countries catch systems are being considered with any changes you all are considering as well.

CHAIR EDWARDS: Is there any other public comment on this agenda item? We will turn to Rob LaFrance online.

MR. LaFRANCE: I just wanted to follow up and ask, under Option 2 is where I'm leaning towards as well. When you come back, when they come back either in the annual meeting or when we get back. Will it also include some management recommendations, or is it still like trying to get a better understanding of the assessment? I saw something about maybe an amendment recommendation, so I'm just wondering what that meant.

DR. ANSTEAD: What we would bring back to the Board would be the additional work with some indices, as well as some additional work we can do on I/target. I think before we had gone through Peer Review the idea was with I/target, but then the PDT will take that and make different decisions, possibly, than we made, depending on Board interest and to put out for public comment.

That is not what this task is. This task would give the Board clarity on how these tools and indices are operating to make decisions, whether to accept this assessment and the Peer Review Report, as well as any future management advice. This is not equivalent to a draft addendum or any other management document, it's just additional work to help you all choose a path forward. I think that's why it's unlikely it would provide 2024 catch advice.
MR. LaFRANCE: Thank you very much.

CHAIR EDWARDS: Are there any more questions? Eric Reid.

MR. ERIC REID: Do you mind if I make a comment, Mr. Chairman? Okay, so at this point I would like to move this on if you don't mind. I support Ms. Madsen's quest for a consensus statement. With that, staff is recommending to us that we recommend to them to do what they are asking us to do, which has happened before. Let's move this along and give the staff what it wants, and we'll talk about this when we get a little better informed. That's where I'm at, thank you.

CHAIR EDWARDS: Is there any disagreement among members of the Board? Okay, we don't have to have a motion, we'll move along with Option 2. Malcolm Rhodes.

DR. MALCOLM RHODES: I agree totally with this. I just want to get an idea of the time table. Are we looking at the ability to get this done by the summer meeting, by the annual meeting? I mean what would be an acceptable time table, so we have kind of a time certain on the table?

DR. ANSTEAD: The TC hasn't discussed this at all, and the SAS has had superficial conversations about it. I think we would aim for summer, annual meeting at the latest.

DR. RHODES: Thank you.

DR. EYLER: There is an unlikely chance that we could bring something back to the May meeting, but we'll aim for summer meeting.

CONSIDER FISHERY MANAGEMENT PLAN REVIEW AND STATE COMPLIANCE FOR THE 2021 FISHING YEAR

CHAIR EDWARDS: Okay, we'll move on to the next item on the agenda, Consider Fishery Management Plan Review and State Compliance for the 2021 Fishing Year, and I'll turn it over to Caitlin Starks.

MS. STARKS: I'll give a brief review of the American eel FMP Review for the 2021 Fishing Year. I'll start off with an overview of the status of the FMP, then I'll skip over the stock status information as we just discussed that. I'll go over the commercial and recreational fishery information for 2021, the state compliance reports, and wrap up with some recommendations from the Plan Review Team.

Eel are currently managed under Addendum V to the FMP, which is what established the coastwide cap for yellow eels of 916,473 pounds. It also maintained the aquaculture provisions that allow the states to harvest up to 200 pounds of glass eels for aquaculture within approved harvest proposals.

Right now, Maine is the only state that has aquaculture harvest, or had in 2021, and they have 138.91 pounds of glass eel harvested for aquaculture. Then per Addendum IV, any state that harvests over 750 pounds of glass eel per year must implement a fishery independent life cycle survey. In that case, Maine did harvest over 750 pounds, and they continued their fishery independent life cycle survey of glass, yellow, and silver eels in 2021.

That is now carried out at West Harbor Pond as of 2019. Fishery landings for 2021 reported in the FMP are from the state compliance reports, and the estimated commercial landings for 2021 for yellow and silver eels were approximately 427,000 pounds. This is a 64 percent increase from the 2020 landings, which were very low as a result of both COVID-19, as well as market changes. But the 2021 landings are still lower than what we saw in 2019. For 2021, Maryland, Virginia and New Jersey combined accounted for 87 percent of the total coastwide 2021 landings.

Then for glass eels, Maine and South Carolina are the only states with landings. Maine harvested 9,106 pounds in 2021, which is below their quota of 9,688 pounds, and South Carolina's landings are confidenti al, but they do remain under 750 pounds, and therefore they do not have to implement that life cycle survey.

Recreational harvest estimates are no longer provided in state compliance reports as of 2009, and this is as a result of the MRIP survey design being unsuitable for eels, because it does focus on coastal and estuarine fishing sites, and as a result the PSEs for the MRIP results are very high, and unreliable numbers for eel.

For the glass eel fishery, the FMP and its addenda currently require all of the states to implement young of year surveys, to maintain harvest regulations with a limit of 25 pigmented eels per 1 pound of glass eels, and 1/8th of an inch mesh. It also has Maine's glass eel quota, commercial monitoring and reporting, and the life cycle survey for glass eel harvest over 750 pounds.

The PRT found that there haven't been any changes to the state regulations on these issues, and all states are compliant with these requirements. For the yellow eels the FMP addenda require a minimum size limit of 9 inches, a minimum mesh size of 1/2 an inch by 1/2 an inch, and escape panel, a recreational bag limit of 25 eel per day, and up to 50 per day allowed for for-hire crews and Captains for bait.

The coastwide harvest cap, as well as a two-year management trigger of a 10 percent overage of the coastwide cap. Again, the PRT found that there haven't been any changes to state regulations, and all the states are in

compliance with these requirements. Then for silver eels, the FMP requirements are a seasonal closure for the September 1 to December 31, with no take except for from baited pots and traps and spears.

There was a one-year exemption for the weir fishery in the Delaware River and its tributaries in New York, which has been continued since 2014. But it is restricted to 9 permits that may be transferred for the New York weir fishery. The PRT noted one issue regarding silver eels, which is that Florida regulations don't prevent harvest of silver eels from pound nets from September 1st to December 31st, but the state is unaware of any active pound net fisheries in the past 10 to 15 years.

The FMP also requires at least monthly trip level reporting by both harvesters and dealers, as well as sustainable fishery management plans, including fishing mortality plans, transfer plans for quota from the yellow to glass eel fishery, and aquaculture plans for watersheds that contribute minimally to the spawning stock. All these plans must scientifically demonstrate that they'll not increase overall fishing mortality on American eel.

As I mentioned, Maine is the only state currently with an active aquaculture plan, and they submitted a proposal for the 2022 fishing year, and that was approved by the Board in August, 2021. The PRT noted a few other issues in the compliance reports, just to mention. First, many states have been unable to provide information on the percent of the commercial harvest of eel that's sold as food, versus what's sold for bait.

Only Maine, New York, New Jersey, Delaware and Florida were able to provide this information in 2021. New York was also unable to provide data on the commercial CPUE for the 2021 fishing year, and New Jersey was unable to complete the fishery independent monitoring requirements in 2021, due to some continued COVID-19 restrictions.

Several states have requested and qualified for *de minimis* status, and that means that for the life stage for which they're requesting *de minimis*, the state's average commercial landings for the preceding two years have been less than 1 percent of the coastwide commercial landings for that life stage.

For 2022, New Hampshire and Massachusetts, Pennsylvania, D.C., Georgia and Florida all requested *de minimis* status for their yellow eel fisheries. However, Florida's 2021 landings exceeded 1 percent of the coastwide landings, so they do not qualify for *de minimis*. The rest of the states that applied do qualify for *de minimis* status.

Under the FMP, *de minimis* status would exempt a state from having to adopt the commercial and recreational fishery regulations for that particular life stage, and the fishery dependent monitoring requirements for that life stage. If Florida is not granted *de minimis* status, then the state would need to implement those requirements.

These are the recommendations from the PRT to the Board. I'll note that a number of these have been maintained from last year's report. First the PRT recommends the Board consider the notes on state compliance that I've given. Note the drop in recent years yellow eel harvest. They also suggested reevaluating the requirement that states provide estimates of the percent of harvest that's for food versus bait.

In addition to that task the Committee on Economics and Social Science with a market analysis to determine if this information is useful for management, and should be collected or not. They also recommend the states continue to work with law enforcement on including information on illegal harvest of eels in the compliance reports, and also recommend New York separate their yellow and silver eel landings in the report if possible.

They lastly recommended that states should try to quantify their upstream and downstream passage for eel, and provide that information to the TC for evaluation. As we discussed, this would be useful information to have for some habitat analysis. With that the Board's action for consideration today is to approve the FMP Review and State Compliance Reports for the 2021 fishing year, and *de minimis* requests from New Hampshire, Massachusetts, Pennsylvania, D.C. and Georgia for the yellow eel fisheries. I can take any questions.

CHAIR EDWARDS: Are there any questions for Caitlin? Okay, would somebody be willing to put forward a motion? John.

MR. MANISCALCO: More comment. DEC is working with U.S. Fish and Wildlife and Cornell University to assess the proportion of eels from the weir fishery that is silver versus yellow, and we hope that will be completed soon. That's ongoing. Thanks.

CHAIR EDWARDS: Thank you, any other questions? Okay, would somebody be willing to put forward a motion? John Clark.

MR. CLARK: Yes, I would move to approve the Fishery Management Plan Review and State Compliance for the 2021 Fishing Year. Is there a motion already made that has all the *de minimis* in it? Okay. Well now, I'll just read it. Move to approve the American eel FMP Review and State Compliance Reports for the 2021 Fishing Year and *de minimis* request from New Hampshire, Massachusetts, Pennsylvania, District of Colombia, and Georgia for their yellow eel fisheries.

CHAIR EDWARDS: Is there a second? Doug Grout. Would anyone like to discuss around the motion? Okay, I'll read the motion for the record. Move to approve the American eel FMP Review. We have a question from, online? Erika Burgess.

MS. ERIKA BURGESS: Thank you, Mr. Chair. Can we get a clarification on what the actual percentage Florida was of the coastwide landings?

MS. STARKS: I would have to pull up my Excel Spread Sheet for you.

MS. BURGESS: It would have been helpful to have that in the FMP Review.

MS. STARKS: All right, I can pull that up quickly.

CHAIR EDWARDS: Erika, are you planning to make any changes to the motion over those numbers?

MS. BURGESS: Yes, with the numbers, I have a requested amendment to the motion, or put a second. I need the class this afternoon to tell me what I'm going to do.

MS. STARKS: Sorry, give me one moment.

MS. KERNS: While Caitlin is running numbers, I just wanted to introduce the new ISFMP Staff member. She is sitting in the back of the room; Chelsea Tuohy is back there. She is raising her hand, if she'll stand up. As I said in an e-mail last week, she'll be working on summer flounder, northern shrimp, and scup and bluefish.

Please introduce yourself. We're super excited to have her onboard. In addition, the Legislative Lunch, which I know it's not right now, but just letting everybody know where it is. It's in those two rooms that are straight through those doors, which is called Crystal 5 and 6.

MS. STARKS: Florida's landings for yellow eel in 2021 were 2.2 percent of the coastwide landings.

MS. BURGESS: If I can follow up. It's challenging for Florida; we have not had an expansion of our fishery. That resulting increase in share of coastwide landings is actually a result of overall coastwide landings going down. Our fishery is under half of what it was three

years ago. Rulemaking in this office, as many states know, is challenging. To move forward on any additional requirements for not receiving *de minimis* status would be a challenge.

MS. KERNS: It's the prerogative of the Board whether or not you want to allow another state to have *de minimis*. You can ask the PRT to say what the implications would or would not be. I recommend that we do have this new *de minimis* policy, but we wouldn't change any FMP until the Board directed that FMP to be changed for the new *de minimis* policy.

If we do move forward with an addendum, and that is something that the Board wants to do, then we can do that. I would say hold off until we know if you're going to respond to the landings changes on an FMP change. But the Boards have approved *de minimis* status in the past for states that are above. It's the prerogative of the Board.

CHAIR EDWARDS: Joe.

MR. JOE CIMINO: Sorry if I missed this. This is an annual determination then, so in one year out another? There is a potential that they could just be back in *de minimis* status next year. Then I guess a question maybe for Toni. Was there some recommendation in the *de minimis* overall policy of looking at like three-year averages and stuff like that?

MS. KERNS: They were looking at those either two or three years that we averaged.

MS. STARKS: Eel uses a two-year average.

CHAIR EDWARDS: Are there any other questions?

MS. KERNS: Joe, the threshold in the *de minimis* policy, it is based on the average of three years of landings, and then it's less than 1 percent of the coastwide landings.

CHAIR EDWARDS: Erika.

MS. BURGESS: Mr. Chair, correct me if I'm out of order, but I believe at this point I could offer a substitute motion, which would be to have the motion up there, but to add Florida to the list of states with an approved *de minimis* request.

MS. STARKS: Erika, you can make a motion to amend.

MS. BURGESS: Okay, I would like to make a motion to amend to include Florida in the list of states with *de minimis* status.

CHAIR EDWARDS: Okay, can we have a second? John Maniscalco. Any discussion on this motion? Rick.

MR. JACOBSON: Did I just hear two pieces of information, one that the most recent harvest for Florida was 2 point something percent, and that the policy calls for those that qualify for *de minimis* status are less than 1 percent of the coastwide harvest?

MS. STARKS: Yes. It's less than 1 percent of the coastwide harvest for the last two years, which I'm currently calculating.

MS. KERNS: The policy is the average of the last three years, but this FMPs is two years.

CHAIR EDWARDS: Doug Grout.

MR. DOUGLAS E. GROUT: Would we have to do an addendum to change the average to three years, or does the policy supersede what's in the current management plan?

MS. KERNS: The policy does not supersede the FMP. Changes to the FMP would be made to reflect the policy. But the Board still has the prerogative to do something different if they so choose, in terms of the approval of these requests.

MR. GROUT: Just a follow up, I guess at this point, if we were to support this motion, this amendment was to pass. I would also, I will put

up a motion to try to develop an addendum to change the *de minimis* policy to more reflect the current policy of three years, change the management plan so that it reflects a three-year average.

MS. STARKS: Just a quick follow up question on that. Would it be your intention to move forward with such an addendum before we potentially move forward with an addendum to consider changing the coastwide landings cap for yellow eel?

MR. GROUT: If we were to approve this amendment to allow Florida, could we get a change to, if we were to wait until we had an addendum to change the cap. Could we get that done before the next time we have to approve *de minimis* or not?

MS. STARKS: That is highly unlikely, given the timeline for an addendum to change the TAC would probably take place starting potentially later this year, which is when you would reevaluate *de minimis*. Just I want to make one more clarification on Florida's current status. The landings for 2021 and 2020 combined are 1.4 percent of the total coastwide landings from those two years.

CHAIR EDWARDS: Erika.

MS. BURGESS: I appreciate that clarification, Caitlin. I think it might make others around the table feel more comfortable. I believe it was Delaware that we recently allowed two years to go for spot and croaker, or one of the species, where they were just over. I believe that this would follow a pattern or a practice that other boards have taken. Thank you.

CHAIR EDWARDS: Lynn.

MS. FEGLEY: I just wanted to speak in favor of the amendment. I think we should be careful about splitting hairs here. What is interesting is that this is not the result of Florida's fishery growing, this is the result of the total fishery contracting, and Florida maybe just didn't contract quite as fast as everybody else. When we do this, you know assuming we're going to set a new cap. Everybody's rules are going to change, and that's going to reshuffle where our landings are proportionally to everyone all over again. I think this is a fair addendum to the motion.

MS. KERNS: Just another point. I don't think that we would be able to move super quickly on an addendum for this, because I think that the TC or the SAS would need to really take some consideration. In addition, in the policy, there are recommendations for sampling requirements and this species does have sampling requirements for non *de minimis* states.

I think it would be important for the TC and SAS to have the time to go through what they would really be recommending states be exempt from and not exempt from if we're going to make a change to the addendum. Erika is correct, spot and croaker have routinely let other states that sort of fluctuate right on the borderline to be *de minimis.*

CHAIR EDWARDS: Okay, are there any other questions? I'll read the motion into the record. Just call the question for the motion to amend. Is there any opposition to this motion? Doug Grout.

MR. GROUT: Just saying that we have opposition to the motion.

CHAIR EDWARDS: Please raise your hand to opposition to the motion. Could I have the votes in favor? Abstentions and null votes. The motion passes 15 approved, 3 oppositions, 1 abstention and 1 null.

I'll read the motion now as amended. Move to approve the American eel FMP Review and State Compliance Reports for the 2021 Fishing Year and *de minimis* request from New Hampshire, Massachusetts, Pennsylvania, District of Colombia, Florida and Georgia for their yellow eel fisheries.

Please raise your hand in favor of the motion. Please raise your hand in opposition. Any abstentions? Any null votes? The motion passes 18 to 1.

ELECT VICE-CHAIR

CHAIR EDWARDS: Moving on to the next agenda item, Elect a Vice-Chair. Do we have any nominations? Shanna.

MS. MADSEN: From one Commonwealth to another, I would like to nominate Kris Kuhn as our American Eel Management Board Vice-Chair.

CHAIR EDWARDS: Do we have a second? Seconded John Clark. Is there any discussion around this motion**? Any opposition? Without seeing any opposition, this motion is approved by the Board by consent.**

ADJOURNMENT

CHAIR EDWARDS: Our last agenda item, is there any Other Business to come before this Board? Not seeing any, can I have a motion to adjourn this meeting? Malcolm Rhodes, seconded by Doug Grout. Thank you everyone.

(Whereupon the meeting adjourned at 11:15 p.m. on Wednesday, February 1, 2023)

Atlantic States Marine Fisheries Commission

American Eel Supplemental Report: Responses to Board and Peer Review Requests

Prepared by the
ASMFC American Eel Stock Assessment Subcommittee

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Draft for Board Review

Vision: Sustainably Managing Atlantic Coastal Fisheries

Reviewed and Approved on June 27, 2023, by the
ASMFC American Eel Technical Committee

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EXECUTIVE SUMMARY

This report outlines the follow-up work the Stock Assessment Subcommittee (SAS) was tasked with after the 2023 American Eel Benchmark Stock Assessment and Peer Review Reports were presented to the American Eel Management Board (Board) in February 2023. The Peer Review Panel concluded that additional work is needed to establish threshold reference points in the management tool proposed (I_{TARGET}) and that work should be done using a simulation approach with management strategy evaluation (MSE) methods. The Panel also stated that it is more appropriate to consider American eel depleted rather than overfished and likely experiencing overfishing as the SAS suggested. The SAS disagreed with the Panel on these two points. Consistent with the Commission's Technical Support Group Guidance and Benchmark Stock Assessment Process, the Board tasked the SAS with providing justification for deviating from the advice from the peer review advice. In addition to providing justification, the Board also asked the SAS to provide additional analyses to show the influence of individual surveys on the resulting coastwide yellow eel index, consider other reference periods and configurations for I_{TARGET}, and discuss how the habitat model may help assess eel in the future.

To address this task, the SAS completed additional simulation work on the Multivariate Auto-Regressive State-Space (MARSS) index and explored a dynamic factor analysis (DFA) as recommended by the Peer Review Panel. A leave-one-out analysis was completed to evaluate the influence of single surveys on the coastwide trends and each of the resulting indices were analyzed using a regime shift analysis, the basis for determining a reference period for I_{TARGET}. Several I_{TARGET} configurations explored the threshold value used in that analysis in addition to changing the reference period and the multiplier used within the tool, as well as including a survey from South Carolina that was mistakenly omitted during the benchmark. A response was provided for why the I_{TARGET} method can be used without an MSE and how the habitat model will help assessments in the future. Finally, the SAS defined stock status, gave examples of management responses to each stock status, and ultimately conceded that depleted is likely the most appropriate status for American eel.

The conclusions of this report are:

- The simulated MARSS model fits were very similar to the MARSS model fit in the 2023 stock assessment report.
- Overall, omitting a single survey from the MARSS index had little effect on the general coastwide abundance pattern, resulting regimes identified, or the choice of the reference period for I_{TARGET}.
- Omitting all three Hudson River surveys, which is not recommended, shortens the time series and results in the largest change to the MARSS index and identified regimes.
- The application of DFA on the current suite of indices is not ideal due to their differing time series lengths and missing data, but may be promising in the next benchmark.
- Changing the threshold value in I_{TARGET} results in recommended catches from 202,453 – 518,281 lbs, and the choice of configuration should be determined by a Plan Development Team through a management document to reflect the goals of the fishery.

Other configurations were explored for the multiplier and reference period, but changing those from the base run is not recommended by the SAS.

- If the assessment and I_{TARGET} are accepted for management, the South Carolina Department of Natural Resources Electrofishing Survey should be included in the analysis.
- Population projections are not possible using the index-based method, I_{TARGET}.
- Data limitations restrict the development of a coastwide habitat model, but advances in modeling may help in the future.
- An MSE could be considered during the next benchmark, but in the meantime the I_{TARGET} tool can be used for management because it was designed for when an assessment model fails.
- Based on the definitions of depleted, overfishing, and overfished, the American eel stock is depleted and coastwide yellow eel catch should be decreased. If reference points are established through the use of I_{TARGET}, overfishing and overfished statuses could be determined.

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1 INTRODUCTION

In February 2023, the American Eel Management Board (Board) was presented the 2023 American Eel Benchmark Stock Assessment and Peer Review Reports (ASMFC 2023). As part of the assessment, a management tool was developed for setting the coastwide catch limit for yellow eels and for determining stock status (I_{TARGET}). The Peer Review Panel found that the stock assessment sufficiently addressed all terms of reference, but recommended additional work to test the robustness of the I_{TARGET} method for setting catch limits using a simulation approach within a management strategy evaluation (MSE) framework before it is used for management.

At the Board meeting, the Stock Assessment Subcommittee (SAS) argued that the simulation work within an MSE framework, as recommended by the Peer Review Panel, may not be a productive exercise for eel. The inability to estimate life history parameters throughout the species' range remains a challenge and data limitations would constrain the usefulness of the MSE exercise. Additionally, the SAS believes that a simulation within an MSE to explore the I_{TARGET} approach is unnecessary since I_{TARGET} has already been simulation-tested and peer-reviewed as part of NEFSC 2020. The methods in NEFSC 2020 are specifically designed for when an assessment model fails, as the delay-difference model has for American eel in its current form (ASMFC 2023). In addition to the disagreement about the usefulness of an MSE, the SAS and Peer Review Panel also provided differing advice on stock status. Consistent with the Commission's Technical Support Group Guidance and Benchmark Stock Assessment Process, the Board tasked the SAS with providing justification for deviating from the advice from the Peer Review Panel the peer review advice and completing some follow-up work to address several of the Peer Review Panel and Board comments.

This report responds to the MSE exercise (Section 10) and the difference in stock status between the SAS and Peer Review Panel (Section 9.4). As requested by the Board, this report also defines a stock status of depleted versus overfished (Section 9), describes how the habitat model could assist in future stock assessments (Section 8), and discusses why the management tool proposed will not be able to make predictions on biomass or abundance increases in response to harvest reductions (Section 6.2).

In addition to those responses, the SAS has completed work to address questions and follow-up tasks from the Peer Review Panel and the Board. For example, the Peer Review Panel suggested iteratively deriving the Multivariate Auto-Regressive State-Space (MARSS) index by subsampling the indices, and the Board expressed concerns about the influence of the Hudson River indices on the overall trend of the coastwide yellow eel index. To address these issues, the SAS conducted simulations to determine how uncertainty in annual indices of abundance influence the final MARSS yellow eel index (Section 2). Additionally, a leave-one-out sensitivity analysis was done where each 1 of the 14 yellow eel indices was dropped and the MARSS index was re-calculated (Section 3). The same approach was applied to exclude entire regions like the Hudson River or the Chesapeake Bay indices. Together these analyses show if an individual index or group of indices influences the trends seen in the coastwide yellow eel index. The results of those sensitivities around the MARSS index were then inputted into the regime shift

analysis to determine if changes in the indices resulted in changes in the regimes, and thus the choice of reference period in I_{TARGET} (Section 4), which was another concern the Board expressed during the February meeting. The SAS also expanded a dynamic factor analysis that was initiated during the Peer Review workshop (Section 5). Finally, the SAS explored different threshold values for I_{TARGET} to address the Peer Review comment that more work is needed on the threshold and to give the Board more options (Section 6). Different reference periods and multipliers for I_{TARGET} were also provided as sensitivity runs, as was the inclusion of an additional South Carolina abundance index that was mistakenly left out of the benchmark (Section 7 and Appendix A).

2 MARSS RESAMPLING

The yellow eel fishery-independent surveys have uncertainty associated with their annual indices of abundance. This uncertainty was not included in the MARSS model fitting and the MARSS model was fit to annual point estimates. To explore the effects of this uncertainty on the final MARSS model results, simulations were conducted to determine how uncertainty in annual indices of abundance may influence the final fitted MARSS model and how this may then influence recommended harvest by the I_{TARGET} method.

MARSS simulations were conducted by randomly drawing a value for each fishery-independent survey for each year the survey was conducted from a normal distribution. The mean of the distribution was equal to the point estimate of the survey and the standard deviation was equal to the standard deviation of the point estimate. These randomly chosen values were then ln transformed prior to fitting the MARSS model. In cases where a randomly chosen value was ≤0, a value of ln(0.01) was substituted. Fitting of the simulated MARSS models was conducted in the same manner as in the 2023 stock assessment report assuming American eels are one panmictic species with a single underlying population growth rate across all surveys (U model = equal) and similar process errors across all surveys (Q model = diagonal and equal), but unequal observation errors (R model = diagonal and unequal).

Each simulated MARSS model fit was used to calculate a recommended catch of American eels according to the same methods used in the 2023 stock assessment report. The reference period for the MARSS index was 1974 – 1987 with reference period average annual landings equal to 2,747,352 pounds of eel. The target index (I_{TARGET}) was set to 1.25 times the average simulated MARSS index value over the reference period. Finally, the $I_{THRESHOLD}$ value was set to 0.8 time the I_{TARGET} value.

The resulting distribution of simulated MARSS model fits was very similar to the MARSS model fit in the 2023 stock assessment report (Figure 1). There was a high period of abundance from 1974 – 1987 followed by a steep decline in abundance through the early-1990s and another decline after 2010 through the terminal year of 2020.

The corresponding recommended catch from the application of the I_{TARGET} method to the simulated MARSS model fits was also similar to that in the 2023 stock assessment report (Figure 2). Throughout the simulated time series, the recommended catch would have been substantially less than the observed catch except in 2020 when observed catches were at their lowest point, likely as a result of the COVID-19 pandemic. The median simulated recommended

catch in the terminal year was 255,285 pounds (95th percentile range: 190,411 – 337,171 pounds).

These simulation results suggest that conclusions about trends in the coastwide population of yellow eels based on the MARSS model and recommended catch of based on the I_{TARGET} method are robust to uncertainty in individual point estimates of relative abundance from fishery-independent surveys.

3 LEAVE-ONE-OUT SENSITIVITY ANALYSIS

It was evident in the 2023 stock assessment report that the trends in the coastwide yellow eel abundance index based on a fitted MARRS model were influenced by the longest time series of fishery-independent surveys. The longest time series came from the Hudson River with the Hudson River Estuary (HRE) monitoring survey being the one that extended furthest back in time (1974). To see plots of the individual yellow eel surveys compared to the resulting MARSS index trend, see ASMFC 2023 Figures 150-163. To further explore the influence of any one survey on the final MARSS model index, a sensitivity analysis was conducted in which each individual survey was omitted from the data one at a time and the MARSS model fit to the remaining surveys. Additional model fits were conducted where the time series was truncated to begin in 1980, omitting all Hudson River surveys, and omitting all Chesapeake Bay surveys. Finally, a MARSS model fit was made to a dataset including only a single survey from each of the geographical regions for American eels defined in the 2012 stock assessment report.

Overall, omitting a single survey had little effect on the general pattern of the MARSS model index (Figure 3 and Figure 4). In all cases except one, the MARSS model index showed the same decline from the mid-1980s through the early 1990s. The exception was the case where all Hudson River surveys were omitted, which showed a dramatic decrease during the 1980s followed by a sharp increase through the 1990s, and then another decrease (Figure 3). With the omission of all Hudson River surveys, the next longest time series was the Delaware River Trawl survey and the early portion of the MARSS model index thus followed patterns in this survey. A commonality among all of these sensitivity analyses was that they all showed a decline near the end of the time period examined (2010 – 2020) with the lowest abundance in the terminal year.

Since there are several indices available in some areas but not others along the Atlantic coast, a sensitivity run was completed where only one index from each region was used. If there were multiple indices in a region, the longest time series was used. The longest time series in each region were: the MA Rainbow Smelt survey (Gulf of Maine), Farmill River Electrofishing survey (Southern New England), HRE Trawl (Hudson), Delaware River Trawl (Delaware Bay/Mid-Atlantic), VIMS Seine (Chesapeake Bay), and SC Rediversion Canal survey (South Atlantic). When a MARSS model was fit to only these six surveys, the large decline in abundance from the mid-1980s through the early-1990s was still evident (Figure 5). However, the lowest abundance occurred in the early 2000s followed by an increase to the late-2000s and a slight decline from 2010 – 2020.

These sensitivity analyses showed that the MARSS model abundance index can be influenced by the suite of surveys included, and the length of their time series. However, no single survey completely drives the trends in the final abundance index time series. There was concern that

the Hudson River surveys were driving the final MARSS model abundance index and the choice of 1974 – 1986 as a reference period with relatively high abundance. The Hudson River is a large system representing a significant portion of the coastwide stock, and to completely exclude the Hudson River from the analysis seems inappropriate. Also, the three independent surveys from the Hudson River showed similar trends in the early portion of the time series suggesting that these trends are not an artifact of observation error in any single survey. The results of this sensitivity analysis suggest that the final MARSS model abundance index is robust to deviations due to any single survey and it appears to be the best index of coastwide abundance of the species along the US Atlantic coast. It is noted in ASMFC 2023 that American eel is regarded as a single, panmictic population and the current assessment is not rangewide, i.e., does not include data from Canada, Gulf of Mexico, Caribbean, or elsewhere. Completing a rangewide assessment remains as a research recommendation and in the meantime, the data used in ASMFC 2023 represent the best data available for US Atlantic coast management.

4 REGIME SHIFT SENSITIVITY ANALYSIS

A regime shift analysis was completed for each of the yellow eel MARSS indices produced as part of the sensitivity runs in Section 3. Sequential t-test Analysis of Regime Shifts (STARS) was used to identify change points in the time series using the same methods as ASMFC 2023. Briefly, a regime cut-off length of ten years was used, although regimes shorter than ten years may still be detected by the analysis. Huber's h=2 was used for down-weighting outliers and a significance value of P=0.05 was used to determine significance. As a reminder, in ASMFC 2023, this analysis determined that the yellow eel abundance index was in a high regime from 1974-1987 (ASMFC 2023 reports the first regime as 1974-1988, but that is an error and it should be 1974-1987), a low regime in 1988-1999, and an even lower regime in 2000-2020. The reference period for I_{TARGET} was 1974-1987 based on this analysis as well as the fact those years seemed to be a stable, if variable, point for both landings and index.

Overall, omitting a single survey had little effect on the general pattern of the MARSS model index (Section 3; Figure 3-Figure 4) and therefore little effect on the regimes identified by STARS (Table 2). Of the 18 sensitivity runs, 13 resulted in the same regimes as the base or different by only one year. Excluding the VIMS Seine Survey, NY HRE, or all the indices from the Chesapeake Bay resulted in regimes that were different from the base by more than one year around the cutoff points, but generally still had similar patterns in the regimes, i.e., a high regime at the beginning of the time series, a lower regime in the middle, and the lowest regime through the terminal year. The two notable differences in the results were when all the indices from the Hudson River were excluded from the MARSS index and for the sensitivity run "Regional Longest Surveys" where the MARSS index was comprised of the longest survey from each region (Section 3; Figure 5). When all the Hudson River indices were dropped, the time series was shorter (1980-2020) because the indices from that river are the only sources of data before 1980. Without the Hudson River indices, the regimes flipped with 1980-1994 being a low regime and 1995-2020 being a high regime. When the MARSS index is built using only the longest index available from each region, the results indicate four regimes. Like the many of the other sensitivities, the first regime in the beginning of the time series is high and is followed by

a low regime, then an even lower regime, but then the last regime increases but is still considered low.

The intent of the sensitivity runs for MARSS was to show the effects each survey had on the resulting abundance index trend for coastwide yellow eel and thus the choice of reference period in I_{TARGET} based on the regime shift analysis. The Board expressed concern that the Hudson River indices were having an undue influence on the resulting coastwide index and were not representative of trends seen outside of the region (e.g., Maryland and Delaware) and therefore it may not be appropriate to use the 1974-1987 high regime as a reference period. As discussed in the leave-one-out analysis (Section 3), these sensitivity runs show that no one index is driving the trends in the coastwide yellow eel index nor the regimes identified by the STARS analysis. Dropping one Hudson River index does not result in a significantly different answer. Dropping all three Hudson River indices results in the largest difference observed in the sensitivity analyses wherein the first regime is considered a low regime (1980-1994) followed by a high regime (1995-2020; Table 2). The only indices available for American eel before 1980 come from the Hudson River and those indices influence the early part of the time series. And yet, the Hudson River is a large system representing a significant portion of the coastwide stock and it is an important source of historical data for the stock. The SAS reiterates that to completely exclude the Hudson River from the analysis is inappropriate for a panmictic population.

5 DYNAMIC FACTOR ANALYSIS

The Peer Review Panel concluded that the index from MARSS (Figure 1) is currently the best available coastwide aggregated index and can be used to indicate stock abundance variations over time, but they also suggested that Dynamic Factor Analysis (DFA) could be used to explore the potential cause of conflicting trends among indices. Dynamic factor analysis is a multivariate time series analysis that can be used to detect common trends in time series (Zuur et al. 2003).

The SAS explored both the full time series (1974-2020) and an abbreviated time series (2006-2019) in the DFA using the 14 yellow eel indices (Table 1). DFA had convergence issues with the full time series and problems fitting the data. The lack of convergence is likely due to the numerous missing values (Holmes et al. 2021) since most indices do not go back to the start year of 1974. There are only 3 years when all 14 surveys are operating: 2010-2012 and 2014. Therefore, an abbreviated time series without missing years of data is not possible. The years of 2006-2019 were selected for the abbreviated time series because most surveys are operating during this time, although there are still several years of missing data.

Both time series (full and abbreviated) identified one trend in the yellow eel abundance data and for both time series, the DFA model converged for one trend and one trend had the lowest AIC value. Therefore, the DFA model indicates there is one trend in the yellow eel data, or conversely, no trend. With that said, both time series lengths tested had a lot of missing data for several years which is not ideal for applying DFA. Using DFA on the yellow eel indices may not be an appropriate application of this method given the amount of data missing from the various yellow eel surveys. The analysis in its current form does not elucidate the influence of

the Hudson River surveys on the coastwide MARSS index. If future assessments want to develop the DFA, indices should be developed specifically with that in mind (e.g., indices of the same length with no missing data). The indices developed for the current assessment were to support a coastwide index and modeling approaches used in the assessment which can handle missing data and series of varying lengths.

6 I_{TARGET} CONFIGURATIONS

6.1 Sensitivity Runs

Within the I_{TARGET} method (NEFSC 2020), there are a few values that need to be specified such as a reference period, multiplier, and threshold. The I_{TARGET} value is defined as the average index over the reference period times a multiplier which indicates a level of abundance that management is striving for. The threshold is a portion of the I_{TARGET} value that depends on the goals of the fishery. Inputs into the analysis are the time series of yellow eel catch and the MARSS index of yellow eel abundance. The base run of I_{TARGET} in ASMFC 2023 used a reference period of 1974-1987, a multiplier of 1.25, and a threshold of 0.8. The SAS explored several sensitivities for each of the values that are specified in I_{TARGET} which are described in the following sections.

6.1.1 Threshold Sensitivity Runs

The threshold value in the base run of I_{TARGET} was set at 0.8 in ASMFC 2023 based on NEFSC 2020. Within I_{TARGET}, suggested landings are adjusted up or down depending on how far above or below the three-year average index is from the I_{TARGET} value (I_{TARGET} is the average index from the reference period*1.25 in the base run for eel). If the three-year average index is below the threshold value (e.g., 0.8* I_{TARGET}), even larger reductions in catch are suggested. The SAS explored threshold values of 0.5-0.8, in 0.1 intervals, since the overfished threshold of half (0.5) of the target is appropriate in many fisheries (Carruthers et al. 2016) and 0.8 is used by NEFSC 2020. Depending on the threshold used and using the base multiplier of 1.25, the catch advice for 2020 would have varied from 202,453 lbs (threshold=0.8* I_{TARGET}) to 518,281 lbs (threshold=0.5* I_{TARGET}; Table 3; Figure 6). Of the three values to be specified in this method (i.e., reference period, threshold, and multiplier), the SAS suggests that the threshold could be set by the Board to reflect the goals of the fishery, where 0.8 would be more conservative and 0.5 would be less conservative, although still consistent with how other fisheries are managed.

6.1.2 Multiplier Sensitivity Runs

NEFSC (2020) used a multiplier equal to 1.5, indicating that the biomass target should be higher than the average index value during the reference period. Another option is to set the multiplier lower, at 1.0 for example, indicating that the average index over the reference period represented the biomass target for the population. Setting the multiplier to 1.5 is more conservative, while setting it at 1.0 would be less conservative. In the ASMFC 2023 base run, the SAS used a value of 1.25 since the reference period covers a time when the carrying capacity of the stock has declined due to habitat loss; however, this was balanced by the knowledge that fishing, exploitation, and stock depletion have been occurring well before the

reference period. Both 1.0 and 1.5 were included as sensitivity runs in ASMFC 2023 and are expanded here to 1.0-1.5 in 0.1 increments. Depending on the multiplier used and using the base threshold value of 0.8, recommended catch in 2020 varied from 140,593 lbs to 316,334 lbs (Table 3; Figure 7). The SAS reiterates that the choice of 1.25 is justified and was supported by the Peer Review Panel.

6.1.3 Reference Period Sensitivity Runs

The reference period should represent a stable or desirable period of abundance within the available time series. The base configuration of I_{TARGET} uses a reference period of 1974-1987, the high abundance period based on the results of the regime analysis. ASMFC 2023 used 1974-1988, which was an error and has been corrected in this report. The SAS and peer review panel both agreed that using the high regime as the reference period is appropriate, although the Board requested sensitivity runs that explored other options. The SAS decided to test the second regime, 1988-1999, as the reference period to eliminate the influence of the Hudson River indices early in the time series and to represent a time when more coastwide surveys were in operation. As a reminder, only indices from the Hudson River are available from 1974-1980 and the region represents three of the four indices available from 1980-1989 (Table 1). Since 1988-1999 is a low regime, the SAS believed that setting the multiplier to 1.5 instead of 1.25 would be justified, so both were tested in addition to setting it the multiplier to 1.0, although that is not recommended. Based on the change in reference period and multiplier, the recommended catch in 2020 ranged from 199,133 lbs to 448,049 lbs (Table 3; Figure 8). When the low regime (1988-1999) is used and the multiplier is adjusted to 1.5, the results are very similar to the base run using the high regime (1974-1987) and a multiplier of 1.25. The reference period should be set at the high regime (1974-1987) since that is the period of more desirable abundance in the time series.

6.1.4 Conclusions

Ultimately, the choice of the I_{TARGET} configuration for the threshold, multiplier, and reference period should be discussed by a Plan Development Team if the Board accepts the 2023 stock assessment for American eel and initiates a management document. The sensitivity analyses included in this report explore several options. The majority of the SAS continue to support a reference period of 1974-1987 and justification has been given for a 1.25 multiplier (ASMFC 2023), but ultimately the choices in configuration should reflect the management goals of the Board for this fishery, particularly for the threshold value (0.5-0.8).

6.2 Can I_{TARGET} make predictions on abundance increases in response to harvest reductions?

Survey or index-based methods have very limited or no ability to provide population-wide projections of either biomass or abundance. Surveys or indices only track a population's abundance and biomass across time, and index-based methods only compare those points in time with historical values. These methods generally do not include important population parameters, such as recruitment, intrinsic growth, mortality, or individual growth. While this allows them to be very useful in data-limited situations, they cannot be generally used to provide forecasts or projections under differing harvest scenarios. In contrast, model-based

approaches can and do often provide such projections and allow for harvest scenario testing but require much more data and information than is currently available for American eels.

7 SOUTH CAROLINA INDEX INCLUSION

After reviewing a draft of the 2023 American Eel Benchmark Stock Assessment and Peer Review Report (ASMFC 2023) in the February 2023 meeting materials, South Carolina Department of Natural Resources (SC DNR) contacted ASMFC staff in April to inquire about the omission of the SC DNR Electrofishing Survey as an index of relative yellow eel abundance. After investigating this issue, it appears that this survey data was provided for consideration to the SAS but got deleted from the state folder on the data sharing site, thus it was not considered by the index group during the assessment. SC DNR noted that it met the criteria developed by the SAS in ASMFC 2023 for fishery-independent indices. Therefore, to correct this error, the SAS evaluated the SC DNR Electrofishing Survey data, calculated a standardized index from the survey, and then re-ran the MARSS index, regime shift analysis, and I_{TARGET} base run to include SC DNR Electrofishing Survey in addition to the 14 yellow eel surveys already used. The recommended harvest when SC DNR Electrofishing Survey was included was similar throughout the time series to the original base run. The sensitivity runs that included SC DNR Electrofishing Survey were reviewed and the TC and SAS agree that if the assessment is accepted for management use and options for I_{TARGET} are developed by a Plan Development Team, the SC DNR Electrofishing Survey should be included as an index of relative abundance.

For details about the SC DNR Electrofishing Survey, the index standardization, and results of the sensitivity runs, see Appendix A.

8 HABITAT MODEL

From the Peer Review Report:

Habitat-based modeling: Habitat modeling consists of using GIS analyses to derive statistical relationships between eel abundance and habitat descriptors of the river network. This type of approach has recently been used in other parts of the world for similar species and delivered promising results (Beentjes et al. 2016; Hoyle 2016; ICES 2021; Briand et al. 2022; Mateo et al. 2022). The American eel work supported by the SAS is still in progress and currently consists of a pilot study in the data-rich Chesapeake region. Therefore, it is not possible to draw definitive conclusions on the relevance of results and on transferability of the approach to data-poor regions. It will likely depend on the availability and interoperability of both fish data and habitat data. The Review Panel considers habitat modeling an interesting option to explore in future assessments.

The peer reviewers reference a desire to see more exploration of a habitat-based approach for informing the American eel stock assessment, and rightly cite work that has been conducted on eel congeners in other parts of the world (New Zealand: Beentjes et al. 2016, Hoyle 2016; France and Europe: Briand et al. 2022, Mateo 2022). In the US, several studies have been conducted on American eel habitat relationships (Smogor 1995; Geer 2003; Wiley et al. 2004; Woods and McGarvey 2018), and while local-scale factors are yet to be definitive on habitat requirements for eel, restrictions on access to habitats, particularly fragmentation of river

systems by dams is well established as is the re-occupation of habitats after dam removal (Hitt et al. 2012). Ocean connectivity was also seen to be of primary importance for predicting occupancy in US river systems in a pilot analysis conducted by Young in parallel to the 2023 American eel benchmark stock assessment in the Chesapeake Bay region (*unpublished*). Recent efforts on American shad (Zydlewski et al. 2021) point the way for coupling habitat area and habitat fragmentation to a population model to estimate current and historic stocks by river system. While this analysis is promising, estimating habitat size and availability in the much larger area occupied by American eel, as well as the difficulty in estimating population parameters for all life phases of this panmictic catadromous species, is daunting and is highly reliant on the availability of georeferenced fishery-independent and -dependent biological response data in inland rivers, lakes, estuaries, and oceanic habitats. However, recent advances in geospatial predictor datasets may allow better quantification of river, stream, and lake habitat area, volume, and connectivity over broad areas using national-scale hydrography data sets (McManamay et al. 2018; McManamay and DeRolph 2019; King et al. 2021). Application of egg-per-recruit models as in Sweka et al. (2014) may allow for successfully linking escapement of inland habitats past dams to reproductive output. Continued development of these approaches is of interest to research and management partners in Canada and is being further developed as part of the ICES Workgroup on American eel (ICES 2023).

9 STOCK STATUS

9.1 Stock Status Definitions

The ASMFC uses the following definitions for stock status determinations:

> *Depleted* - Reflects low levels of biomass or abundance, though it is uncertain if fishing mortality or other factors such as habitat loss or environmental changes are the primary cause for reduced stock size.
>
> *Overfished* - Occurs when stock biomass or abundance falls below the threshold established by the Fishery Management Plan (FMP), impacting the stock's reproductive capacity to replace fish removed through harvest, and that decline is driven primarily by fishing mortality.
>
> *Overfishing* – Occurs when the rate of fishing (i.e., exploitation or fishing mortality) exceeds the threshold established in the FMP, negatively impacting the stock's reproductive capacity to replace fish removed through harvest.

Determining stock status means estimating one or more biological characteristics of a fishery (e.g., abundance or biomass) and comparing the estimated values to reference values that reflect a desirable condition. To do so typically requires the development of a statistical model or method to estimate biomass, fishing mortality, and biologically-based indicators or reference values. When a stock is found to be overfished or experiencing overfishing, action should be taken to reduce fishing pressure and/or increase biomass. A "depleted" stock status is often used by the ASMFC when a statistical model and reference points cannot be developed due to data limitations but trend analyses or other data-poor methods indicate that the stock is below historic levels. Within the ASMFC framework, the response to a stock status determination is

typically outlined in the species' FMP and action is subsequently taken by the Board. The ASMFC is not subject to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), which governs marine fisheries management in US *federal* waters and requires a rebuilding plan when a fishery is found to be overfished.

9.2 Examples of ASMFC Management Response to an Overfished and/or Overfishing Status

The 2018 benchmark stock assessment for striped bass indicated the stock was overfished and experiencing overfishing relative to the reference points defined in the assessment. To address the overfished status, the Management Board approved an Amendment to the striped bass FMP to rebuild the spawning stock biomass to the target level in a timeframe not to exceed 10 years, no later than 2029 (ASMFC 2022b). Based on the 2021 management track stock assessment for bluefish conducted by the Northeast Fisheries Science Center, the stock was overfished, but not experiencing overfishing. In response, the Management Board approved an Amendment to the bluefish FMP that initiated a seven-year rebuilding plan while revising its allocation and other FMP objectives (ASMFC 2021a). The 2017 assessment for tautog found that three of the four regional stocks were overfished and overfishing was occurring in two of the four regions. In response, an Amendment to the tautog FMP required the two regions that were overfished and experiencing overfishing to reduce catch by a specific percentage (which varied by region) and adjusted regulations in the remaining two regions (ASMFC 2017a).

9.3 Examples of ASMFC Management Responses to a Depleted Status

Unlike the clear definitions and expected response to an overfished or overfishing determination, a depleted stock status determination does not come with a clear path forward for managing the stock. The ASMFC has responded differently to depleted stock statuses in the past. For example, the northern shrimp stock is considered depleted relative to a stable period and a moratorium has been in place since the 2014 season (ASMFC 2021b). Similarly, Atlantic sturgeon was found to be depleted compared to historical levels when it was assessed in 2017 (ASMFC 2017b) and the moratorium implemented in 1998 was maintained. Recognizing the depleted status of river herring in many rivers along the Atlantic coast, management responded by requiring states with fisheries to develop sustainable fishery management plans (SFMPs), which are reviewed by the Technical Committee and approved by the Board, in order to maintain commercial and recreational fisheries (ASMFC 2009). States or jurisdictions without SFMPs are required to prohibit commercial and recreational harvest. The same management response was implemented for American shad when the 2007 stock assessment found many populations along the coast to be near all-time lows (ASMFC 2010).

American eel was found to be depleted and at or near historically low levels in 2012. In response, management established stricter measures for the commercial and recreational fisheries, implemented monitoring requirements, and set a coastwide yellow eel quota, which was an average of 1998-2010 landings (907,671 lbs; ASMFC 2013). At that time, the American Eel TC recommended a coastwide cap on yellow eel landings with a 12% reduction in the catch (798,750 lbs; ASMFC 2013). In 2018, the Board increased the cap to 916,473 lbs to account for revised landings values during the 1998-2010 years (ASMFC 2018) even as the 2017 stock

assessment update found the stock to be at lower levels than the 2012 benchmark and the TC recommended no increases in landings at any stage.

9.4 SAS Justification of Stock Status

In the assessment report (ASMFC 2023), the SAS determined that the American eel stock was overfished and has likely been experiencing overfishing in the last few decades based on the results of the index-based method used. While this method does not lend itself well to defining exploitation-based reference points, the results of I_{TARGET} and other analyses in the assessment indicated a decline in the stock. Therefore, the SAS was comfortable with a determination of overfished and made the recommendation that yellow eel catch should be lower.

The Peer Review Panel stated in their report (ASFMC 2023) that while the modeling approaches used in the assessment were appropriate, they were uncomfortable using the overfished terminology because of the uncertainty in the methods. The Panel stated that the analyses in the assessment all showed a decline in the stock and concluded that the qualitative term 'depleted' is more appropriate.

Recognizing that the SAS did not use a traditional method to determine an overfished status and that factors other than fishing likely contribute to the decline in the stock, the SAS acknowledges that a stock status of depleted is appropriate. And yet, with each stock assessment (ASMFC 2012, 2017, 2023), the methods used indicate lower and lower coastwide yellow eel abundance despite the coastwide catch having been maintained at roughly the same level, on average, since the mid-1990s with the exception of the COVID years. Therefore, the SAS believes fishing is having an effect on the trends and that yellow eel fishing should be decreased coastwide, but concedes that the status of the stock is likely influenced by a myriad of factors other than fishing. If the Board accepts the 2023 stock assessment and management tool and initiates a management document using I_{TARGET}, reference points would be established and the stock could be considered using overfished and overfishing definitions in the future.

10 RESPONSE TO MSE

During the review, several Panel members expressed interest in using management strategy evaluation (MSE) to help provide insights and to test the robustness of the I_{TARGET} methods for eels. As outlined by the Panel, a simulation could be constructed as was done for the European eel (Lambert 2011) using plausible virtual population trajectories. Simulation testing could then be conducted to examine sensitivities around assumptions of removals outside the US, the relative importance of coastal versus freshwater fractions of populations, stock-recruitment relationship, catch levels, and other factors. While such an examination is possible, it is likely unfeasible, given the timeframe and resources available currently.

Building a plausible simulation requires underlying knowledge of important population parameters such as recruitment, natural mortality, or intrinsic growth. While rough approximations could be made based on the assumed life history of the American eel, experience has shown that simulations and their results tend to be very sensitive to those assumed parameters. A model-based rather than index-based approach would have been more fruitful if the SAS had this level of information. Building such a simulation, choosing the

appropriate parameters and sensitivities, and examining the output would require extensive analysis and vetting through a new peer review. Additionally, stakeholder involvement could both enhance and slow this process considerably. While the suggestion to conduct an MSE may be appropriate as a long-term research and modeling objective, such an endeavor would require years of work and more resources than the SAS currently has available.

It should also be noted that extensive simulation testing across various life-history strategies has already been conducted for the I_{TARGET} and other index-based methods; both worldwide (Carruthers 2015) and in the Northeast (NEFSC 2020). While eels may have a different life history from the small pelagic or groundfish species tested in NEFSC 2020, those differences are the very same issues that make building a plausible simulation so challenging.

Given the above reasons, the SAS recommends that a full or partial MSE be considered as a future research objective, perhaps during the next benchmark peer review. In the intermediate time frame, the SAS will incorporate some of the Panel's suggestions to help illustrate the potential uncertainties inherent in the I_{TARGET} approach.

11 CONCLUSIONS

At the February 2023 meeting, the Board tasked the SAS with completing some additional sensitivity analyses and simulation work around the yellow eel indices, providing more options within the proposed management tool, determining stock status in response to the Peer Review Panel's report, and explaining why an MSE is not necessary for using I_{TARGET} for management and how the habitat model could help assessments in the future. The follow-up work exploring the yellow eel indices indicated that no single survey was driving the trends in the final yellow eel abundance index (Section 3 and 4). The three indices from the Hudson River did influence the beginning of the time series since those surveys are the longest time series available for eel and are the only surveys available prior to 1980 and represent three of the four surveys available prior to 1989 (Table 1). The SAS does not think it is appropriate to drop the entire region from the analysis since the Hudson River is a large system representing a significant portion of the coastwide stock, and likely a large portion of the available biomass. The results of the index simulations (Section 2) and leave-one-out sensitivity analyses (Section 3) show that the coastwide yellow eel MARSS index is robust to deviations due to any single survey and is the best index of coastwide abundance currently.

Several additional options were explored in this report for the proposed management tool, I_{TARGET} (Section 6.1). The resulting recommended harvest varies depending on the specifications made to three values in the tool: the reference period, threshold, and multiplier. The decisions made for each of these values should be based on the goals of the fishery. Throughout the sensitivity runs, the SAS reiterates the choice of 1974-1987 as the reference period and 1.25 as the multiplier, although other options were presented in Section 6.1. The choice of the threshold value between 0.5 and 0.8 should be chosen to reflect the goals of the fishery where 0.8 is more conservative and 0.5 is less conservative but still justifiable for managing fisheries. And finally, in Section 6.2, the SAS provided a discussion on why the index-based method cannot make predictions on abundance in response to harvest reductions.

In ASMFC 2023, the SAS concluded that the American eel stock is overfished, likely experiencing overfishing. The Peer Review Panel stated that a stock status of depleted is more appropriate for eel. To address this disagreement, the SAS provided definitions of each of those statuses in Section 9.1. Given that American eel is likely in a depleted state due to factors such as habitat loss, low water quality in many river systems, the swim bladder parasite, limited upstream and downstream passage, and other environmental factors, the SAS agrees with the Peer Review Panel that the stock is depleted. The majority of the SAS thinks that continued fishing pressure on a depleted stock is likely contributing to the continued decline in abundance seen over several assessments (ASMFC 2012, 2017, 2023). Additionally, the management response to a depleted status for American eel was compared to other depleted species such as northern shrimp, Atlantic sturgeon, and river herring in Section 9.3.

The SAS recommends that a full or partial MSE be considered as a future research objective, but it is not necessary at this time for using I_{TARGET} to manage the fishery (Section 10). I_{TARGET} has already been simulation tested for various life-history strategies (Carruthers 2015; NEFSC 2020) and it is currently a tool for managing a fishery when the stock assessment model has failed, as it has for American eel. To address some of the Peer Review comments, some simulation work was done for the yellow eel index in Section 2. To develop a plausible full simulation model for American eel, knowledge of parameters such as recruitment, natural mortality, or growth would be needed and those are not available for coastwide American eel at this time. While the suggestion to conduct an MSE may be appropriate as a long-term research and modeling objective, such an endeavor would require years of work and more resources than the SAS has available currently.

In Section 7 (and Appendix A), the SAS noted that a survey from South Carolina was mistakenly not considered during the benchmark. Once this error was pointed out in April, the SAS reconsidered the data, developed an index of relative yellow eel abundance, and re-ran the MARSS, regime shift analysis, and I_{TARGET} to include it. The SAS and TC are recommending that if the assessment and I_{TARGET} are used for management, the additional South Carolina index should be included since it represents the best available data.

In Section 8, the SAS described the application of habitat models in other parts of the world and a similar application in the US for American shad. At this time, the data is limited for developing a comprehensive habitat model to couple with a population model for American eel but modeling advances in the future may make it possible.

In conclusion, the simulation and sensitivity analyses show that the coastwide yellow eel index is robust to the inclusion or exclusion of individual indices. Future research should consider both habitat models and an MSE. In the meantime, the Board can consider using I_{TARGET} to set a coastwide catch. The choice of the I_{TARGET} configuration for the threshold, multiplier, and reference period should be discussed by a Plan Development Team if the Board accepts the 2023 stock assessment for American eel and initiates a management document. The sensitivity analyses done in this report explore several options. The majority of the SAS continues to support a reference period of 1974-1987 and justification has been given for a 1.25 multiplier (ASMFC 2023), but ultimately the choices in configuration should reflect the management goals of the Board for this fishery, particularly for the threshold value (0.5-0.8). It is this threshold

value which is most uncertain in the opinion of the SAS, and thus the best parameter to vary when examining trade-offs and risk. The stock is at or near historically low levels due to a combination of historical overfishing, habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, disease, and potentially continued fishing pressure. American eel's stock status was depleted in the 2012 benchmark stock assessment and each subsequent re-assessment (ASMFC 2017, 2023) has found yellow eel abundance levels to be lower than the previous assessment. The American eel stock remains depleted and in need of management action.

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13 TABLES

Table 1. The 14 yellow eel indices used in the coastwide MARSS index. Trends are the results from the Mann-Kendall test indicating the direction of the trend (*P*-value < α; α = 0.05). NS = not significant.

State	Site	Gear	Model	Years of Survey	Trend
NH	Rainbow Smelt Fyke Net Survey	Fyke Net	NB GLM year+temp+river	2010-2020	NS
MA	Rainbow Smelt Fyke Net Survey	Fyke Net	NB GLM year+temp+offset(effort)	2004-2019	NS
CT	Farmill River	Electrofishing	Population estimate	2001-2012, 2014	NS
CT	Eightmile River	Electrofishing	Population estimate	2001-2003, 2005-2017, 2019	NS
NY	HRE Monitoring	Epibenthic sled & tucker trawl	Quasi-poisson GLM year+temp+river mile+water volume	1974-2017	↓
NY	Hudson Juvenile Alosine	Beach Seine	NB GLM year+station+temp	1985-2019	↓
NY	Hudson Juv Striped Bass	Beach Seine	NB GLM year+station+temp	1980-2019	↓
NJ	Delaware River Seine	Seine	NB GLM year+station+temp	1998-2019	NS
DE	Delaware Juvenile Trawl	Trawl	Nominal index with delta distribution	1980-2019	NS
PA	Delaware River Area 6	Electrofishing	Nominal	2005-2020	↓
MD	Sassafras River	Pot	Nominal	2006-2019	↑
VA	VIMS Trawl Survey	Trawl	NB GLM year+salinity+offset(effort)	1996-2019	NS
VA	VIMS Seine Survey	Seine	NB GLM year+salinity	1989-2019	↑
SC	Rediversion canal	Aluminum ladder	Quasi-poisson GLM year+temp+gear condition	2003, 2005-2007, 2009-2020	NS

Table 2. Regimes identified from the leave-one-out sensitivity analysis on the MARSS yellow eel index. Regimes were identified as high (green), middle (yellow), low (red), or very low (dark red) by the analysis. Sensitivity runs with the same regimes as the base run are indicated in the table, as are sensitivity runs with regimes similar to the base run (plus or minus one year).

Sensitivity Run	Regimes	Same as Base	Same or Similar to Base +/- one year
Base	1974-1987, 1988-1999, 2000-2020	X	X
1980 Cutoff	1980-1986, 1987-1998, 1999-2020		X
Drop MD Sassafras	1974-1987, 1988-1999, 2000-2020	X	X
Drop VIMS Seine	1974-1987, 1988-1996, 1997-2020		
Drop VIMS Trawl	1974-1987, 1988-1999, 2000-2020	X	X
Drop PA Area 6	1974-1987, 1988-1999, 2000-2020	X	X
Drop NJ Delaware River Seine	1974-1987, 1988-1999, 2000-2020	X	X
Drop DE Trawl	1974-1988, 1989-2020		X*
Drop MA Rainbow Smelt	1974-1987, 1988-1999, 2000-2020	X	X
Drop NH Rainbow Smelt	1974-1987, 1988-1999, 2000-2020	X	X
Drop HRE	1980-1985, 1986-2000, 2001-2020		
Drop Hudson River Alosine	1974-1986, 1987-1998, 1999-2020		X
Drop Hudson Striped Bass Seine	1974-1986, 1987-1998, 1999-2020		X
Drop CT Eightmile	1974-1987, 1988-2000, 2001-2020		X
Drop CT Farmill	1974-1986, 1987-1998, 1999-2020		X
Drop SC Redivision	1974-1987, 1988-1999, 2000-2020	X	X
Drop All Hudson Indices	1980-1994, 1995-2020		
Drop All CB Indices	1974-1987, 1988-1996, 1997-2020		
Include Longest Survey from Each Region	1974-1985, 1986-1997, 1998-2007, 2008-2020		

*collapses last two regimes into one

Table 3. Resulting recommended catch for 2020 based on the sensitivity analysis around the threshold and multiplier values for the I_{TARGET} method as well as the reference period. Values used in the base run of I_{TARGET} in ASMFC 2022a are indicated in the table.

Reference Period	Multiplier Value	Threshold Value	Recommended 2020 Catch (lbs)
1974-1987 (Base)	1.25 (Base)	0.5	518,281
1974-1987 (Base)	1.25 (Base)	0.6	359,917
1974-1987 (Base)	1.25 (Base)	0.7	264,429
1974-1987 (Base)	1.25 (Base)	0.8 (Base)	202,453
1974-1987 (Base)	1.00	0.8 (Base)	316,334
1974-1987 (Base)	1.10	0.8 (Base)	261,433
1974-1987 (Base)	1.20	0.8 (Base)	219,676
1974-1987 (Base)	1.30	0.8 (Base)	187,180
1974-1987 (Base)	1.40	0.8 (Base)	161,395
1974-1987 (Base)	1.50	0.8 (Base)	140,593
1988-1999	1.00	0.8 (Base)	448,049
1988-1999	1.25 (Base)	0.8 (Base)	286,751
1988-1999	1.50	0.8 (Base)	199,133

14 FIGURES

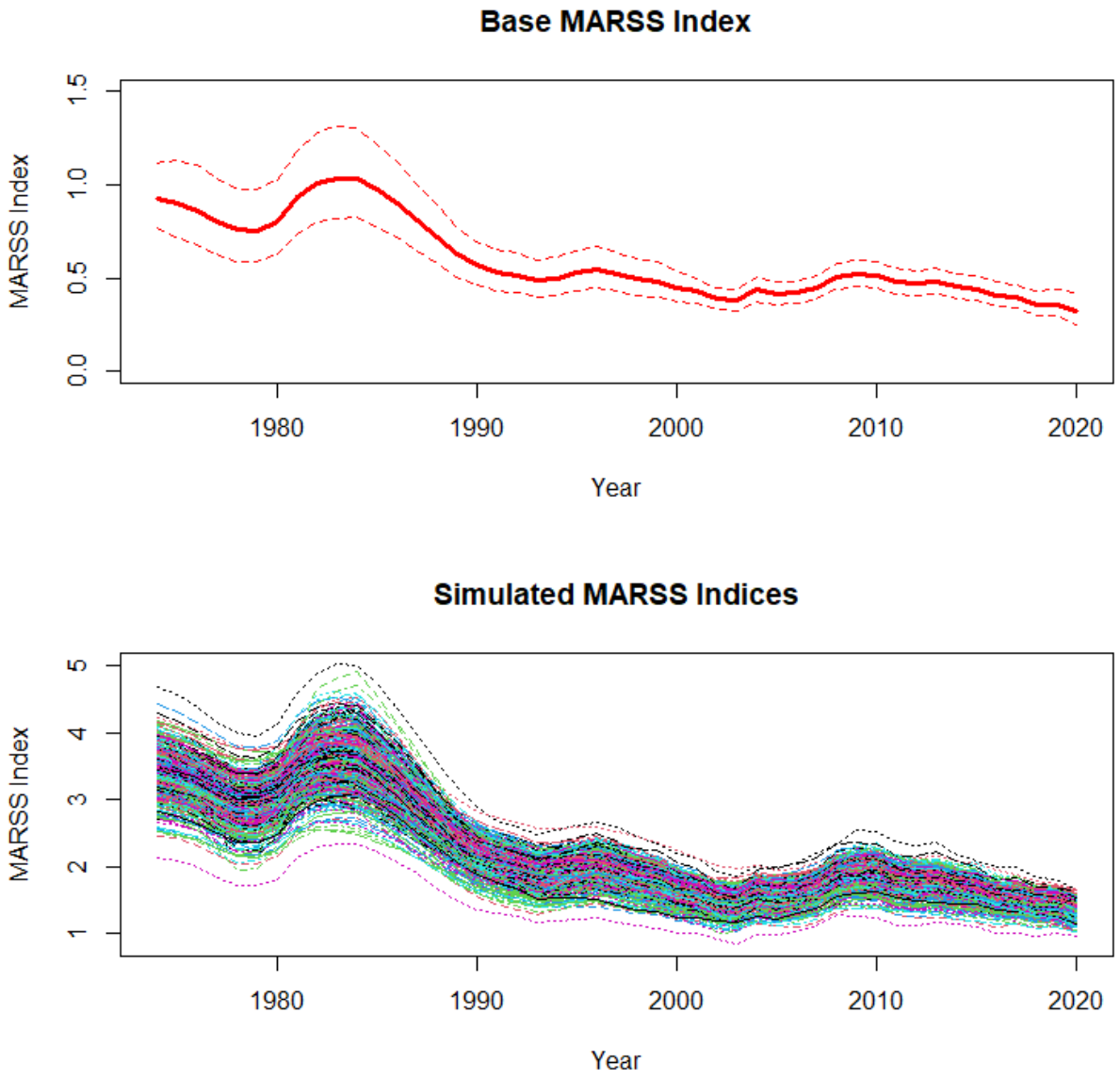

Figure 1. Base MARSS model abundance index (top) and simulated MARSS model abundance index (bottom) showing the results of 500 simulations. Scales on the y-axis differ simply because of the order of individual surveys input to the MARSS model fit. (The MARSS package scales the resulting index to the first survey entered into the model.)

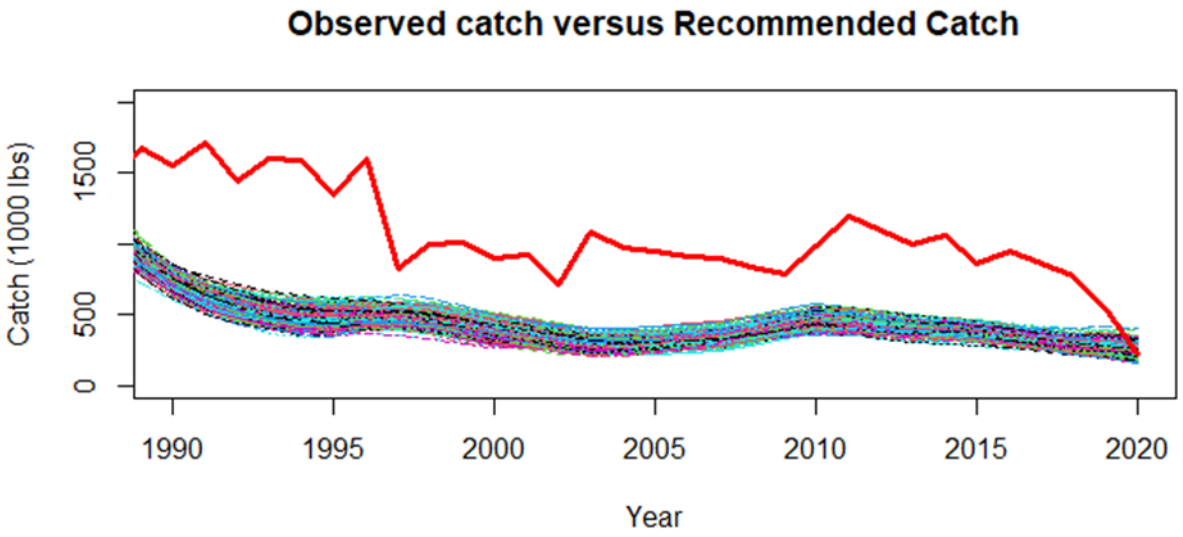

Figure 2. Comparison of 500 simulations of the recommended catch of American eels from the base run of the I_{TARGET} method to the observed landings. The median recommended catch in 2020 was 255,285 lbs (95th percentile range: 190,411 – 337,171 lbs).

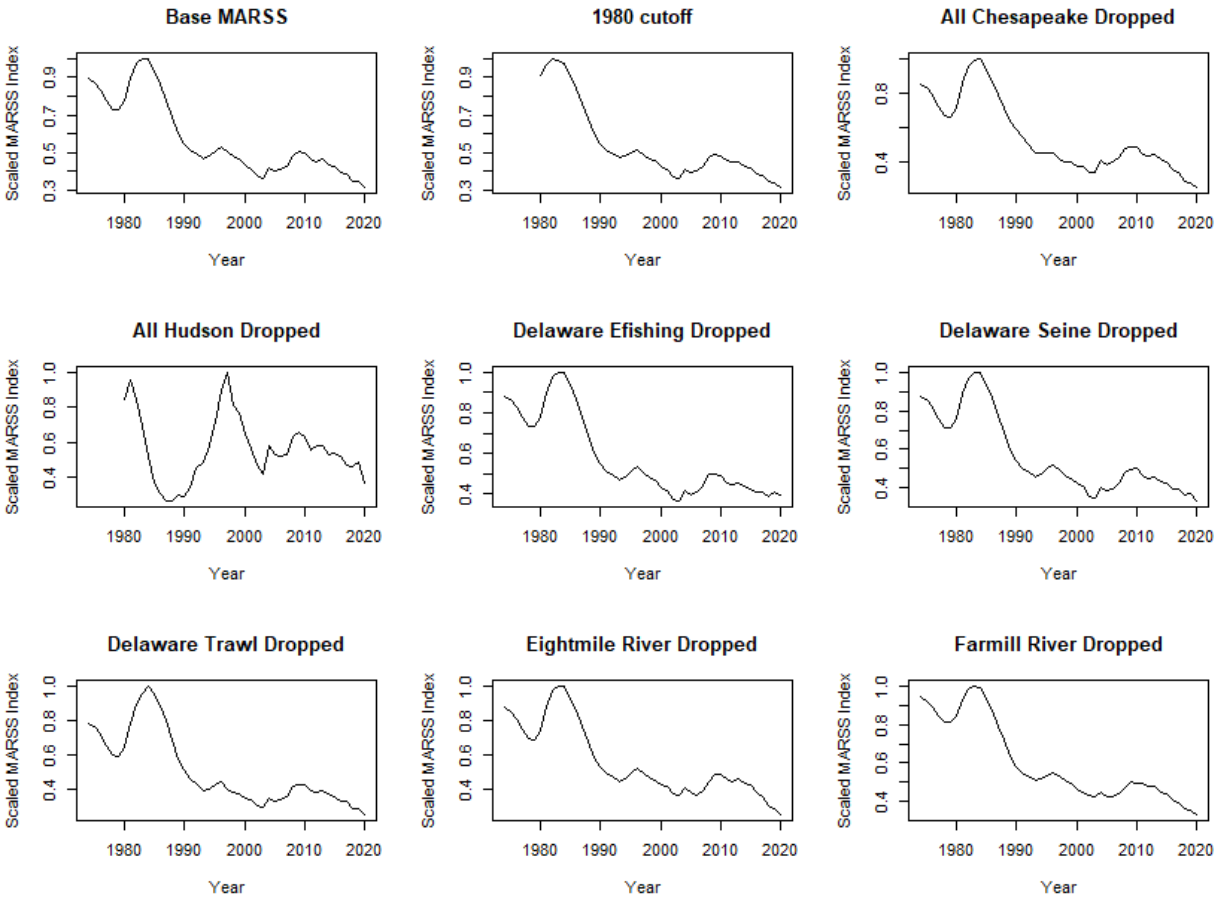

Figure 3. Results of the leave-one-out sensitivity analysis. The upper left panel shows the base MARSS model abundance index with all 14 yellow eel surveys included. Other panels indicate which survey was omitted from the model fit. Indices have been scaled to a maximum of 1.0 to facilitate comparisons.

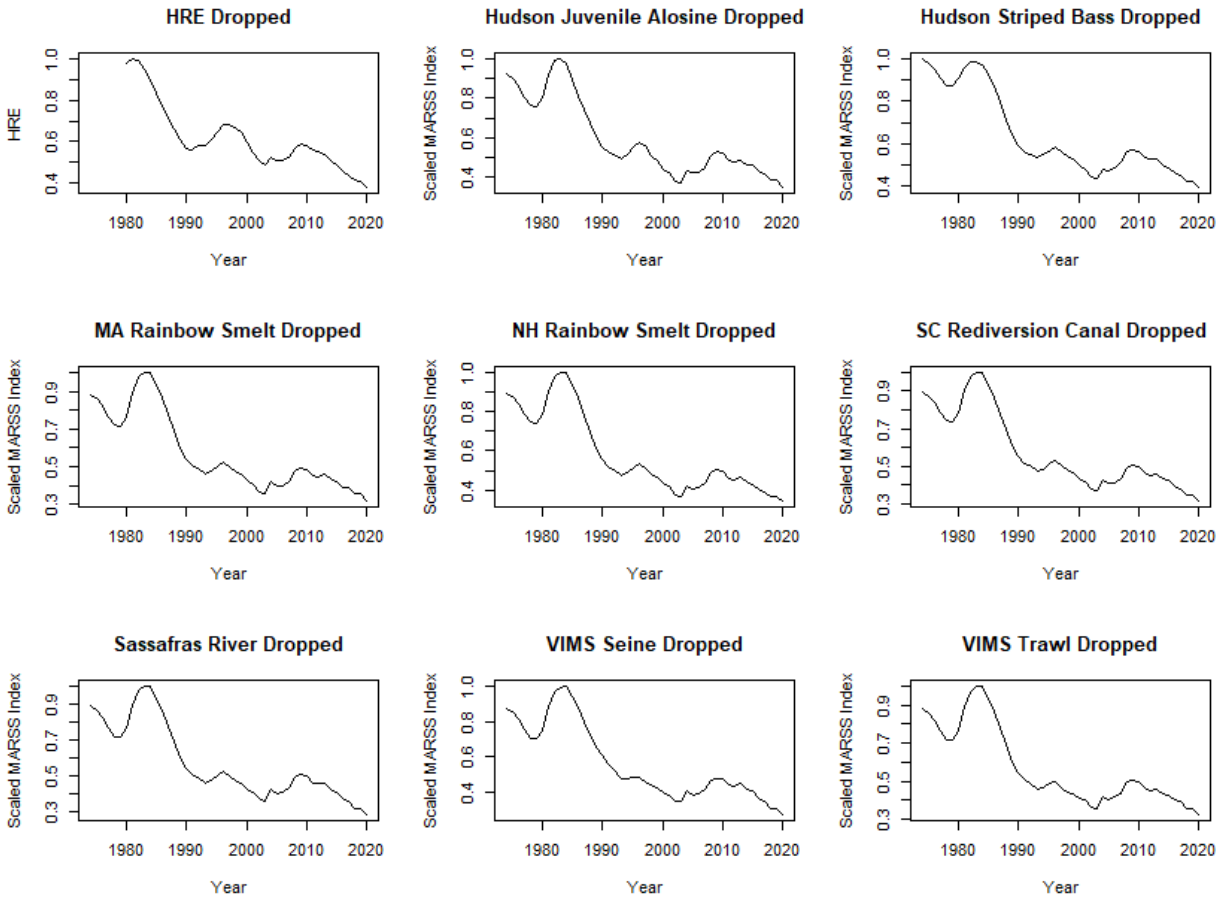

Figure 4. Results of the leave-one-out sensitivity analysis. Panels indicate which survey was omitted from the model fit. These can be compared to the upper left panel in Figure 3 showing the base MARSS model abundance index with all 14 yellow eel surveys included. Indices have been scaled to a maximum of 1.0 to facilitate comparisons.

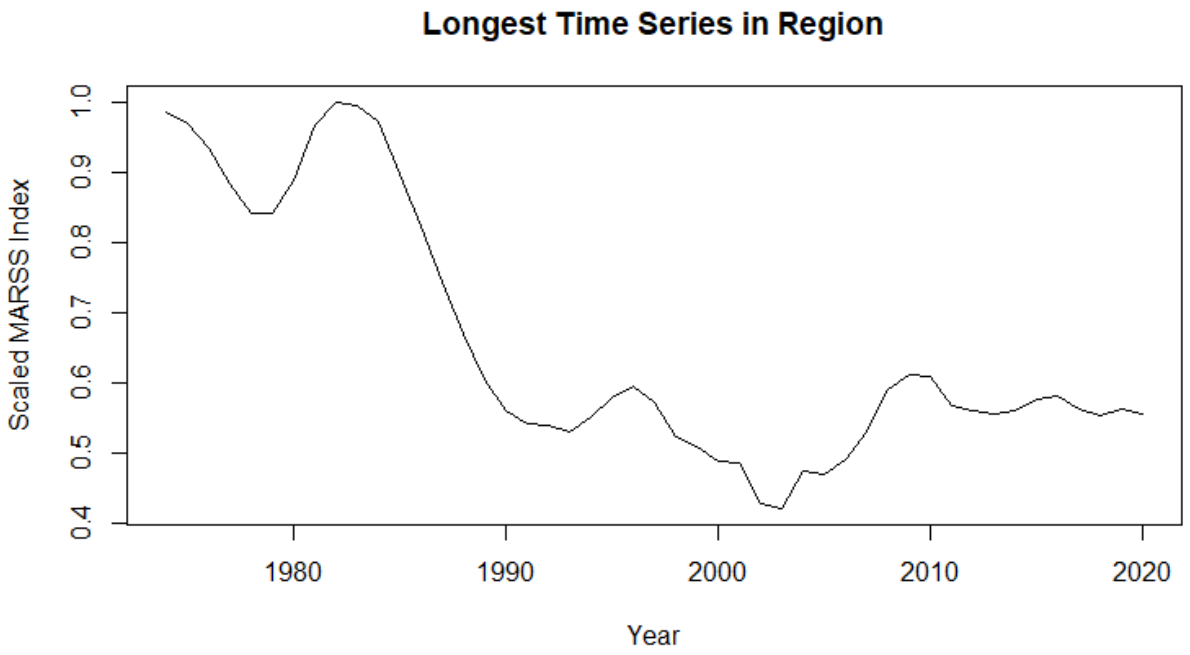

Figure 5. MARSS model abundance index when including the longest time series from each geographical region of the Atlantic coast as defined in the 2012 American eel stock assessment report. These surveys included: MA Rainbow Smelt survey (Gulf of Maine), Farmill River Electrofishing survey (Southern New England), HRE Trawl (Hudson), Delaware River Trawl (Delaware Bay/Mid-Atlantic), VIMS Seine (Chesapeake Bay), and SC Rediversion Canal survey (South Atlantic). The index was scaled to a maximum of 1.0 to facilitate comparisons with other scenarios.

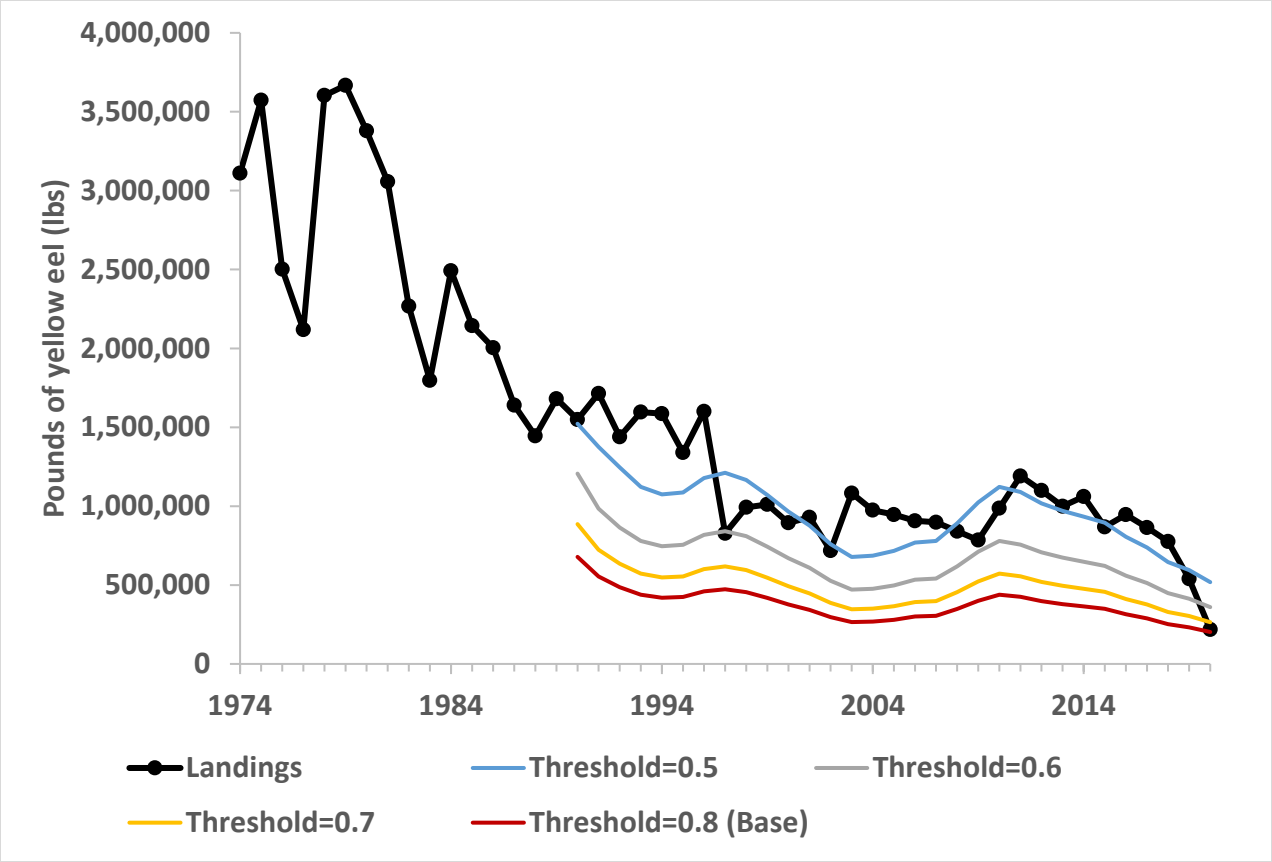

Figure 6. Coastwide landings (black line) and recommended removals (colored lines) from I_{TARGET} when the threshold value is varied. The threshold sensitivities tested were 0.5*I_{TARGET} through 0.8*I_{TARGET} in 0.1 increments. For these sensitivity runs, the reference period was 1974-1987 and the multiplier was held constant at 1.25.

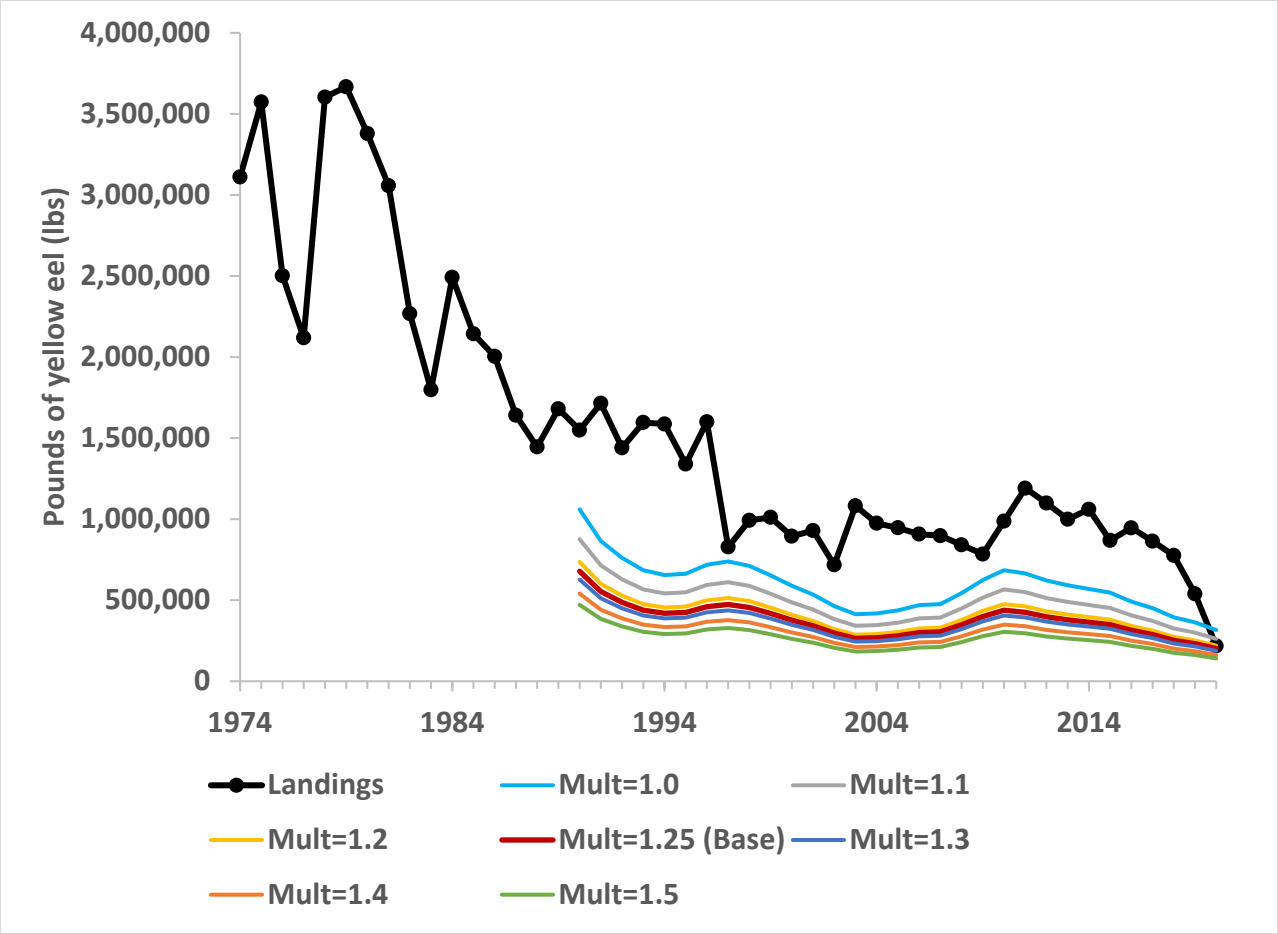

Figure 7. Coastwide landings (black line) and recommended removals (colored lines) from I_{TARGET} when the multiplier value is varied from 1.0-1.5 in 0.1 increments. The base run used a multiplier of 1.25 as indicated in the figure. For these sensitivity runs, the reference period was 1974-1987 and the threshold value was held constant at 0.8*I_{TARGET}.

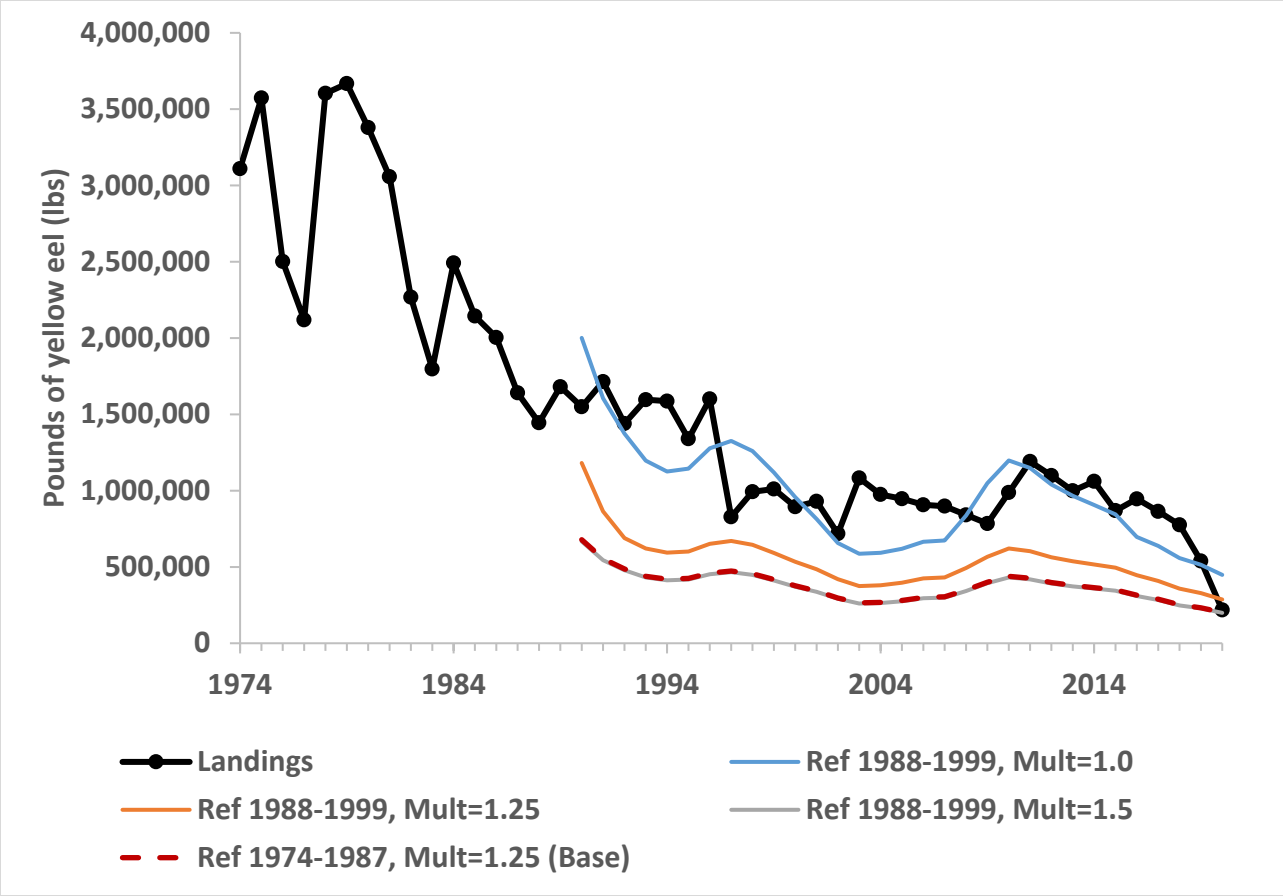

Figure 8. Coastwide landings (black line) and recommended removals (colored lines) from I_{TARGET} when the reference period is changed to 1988-1999 and the multiplier was varied from 1.0 to 1.5. The base run used a 1974-1987 reference period and a 1.25 multiplier as indicated in the figure. For these sensitivity runs, the threshold value was held constant at 0.8*I_{TARGET}.

15 APPENDIX A: SC DNR ELECTROFISHING SURVEY

Survey Design and Methods

The SC DNR Electrofishing Survey operates within the oligohaline portions of the Combahee, South Edisto, Ashley, Cooper, and Waccamaw/Sampit/Winyah Bay Rivers (Figure A1). The survey has a stratified random design where five strata are identified (one for each river) with fixed station locations identified for each river system. The survey has been in operation since 2001 and occurs monthly where five to six stations per strata per month are sampled. Catch is identified by species and a subsample is collected for biological sampling, including age and length. Due to COVID, the survey did not operate from the end of March through May in 2020.

Biological and Environmental Sampling

Depth, salinity, dissolved oxygen, temperature, tidal stage, sampling duration, and location are recorded during this survey. Lengths are consistently recorded throughout the time series and some age, weight, sex, and maturity data is also available.

Evaluation of Survey Data

Mean length was consistent across years (Figure A2) and averaged 376.0 mm ± 138.5 mm (± SD). The data was subset to the areas that most reliably encountered eel which were the ACE Basin, Charleston Harbor, and Winyah Bay. While the survey encountered eel in all months, the index was subset to April – November when catches were the highest. Available covariates for the GLM framework included year, depth, salinity, dissolved oxygen, temperature, tidal stage, sampling duration, stratum, and location. Duration was used as an offset in the GLM. The best-fitting model assumed a negative binomial distribution and included year, stratum, and the offset for effort. While the SC DNR staff advised that 2020 data could be used, the index was calculated with and without it. Ultimately, 2020 was dropped from the index to be consistent with how missing data due to COVID was handled in other data sets used the 2022 assessment.

Abundance Index Trends

While the index for 2001-2020 was calculated and provided (Figure A3), the index was recalculated to omit 2020 data since it represented a year with decreased sampling during some of the months in the index. For 2001-2019, the index increased from 2001 to a peak in 2003 followed by a steady decline through the terminal year (Figure A4). While there was a slight increase in abundance in 2016-2017, 2019 was the lowest value in the time series. The 2001-2019 time series was used in the sensitivity runs for MARSS, the regime shift analysis, and I_{TARGET} in the following sections.

MARSS Index

Two sensitivity runs were done to test the choice of SC indices on the resulting MARSS coastwide yellow eel index. First, the MARSS index was recalculated by dropping the SC Rediversion Survey and including the SC DNR Electrofishing Survey. Second, a MARSS index was calculated that included both SC indices, in addition to the other 12 yellow eel indices previously used. In both cases, the resulting index and confidence intervals were similar to the original MARSS index, although both sensitivity runs were more similar to each other than to the original MARSS (Figure A5).

Regime Shift Analysis

The two recalculated MARSS indices (MARSS with SC DNR Electrofishing Survey substituted for SC Rediversion and MARSS including both SC indices) were analyzed to identify regimes in the time series using the same methods as ASMFC 2022. The regimes were slightly different from the previous regime shift analysis. Using the original MARSS index, the regimes were 1974-1987 (high), 1988-1999 (low), and 2000-2020 (lower). Using either of the recalculated MARSS indices, the regimes identified were 1974-1986 (high), 1987-1997 (low), and 1998-2020 (lower; Figure A6). While the overall pattern was very similar, the change points identified were slightly different by 1-2 years. This would change the reference period in I_{TARGET} from 1974-1987 to 1974-1986.

I_{TARGET}

The proposed management tool, I_{TARGET}, was rerun with the revised reference period of 1974-1986 and the two recalculated MARSS indices (MARSS with SC DNR Electrofishing Survey substituted for SC Rediversion and MARSS including both SC indices). All other configurations in I_{TARGET} remained the same as the base run (e.g., multiplier=1.25, threshold=0.8). With the revised MARSS indices, the recommended harvest in the terminal year was 187,729 lbs (for MARSS with SC DNR Electrofishing) or 187,920 lbs (for MARSS with both SC indices) compared to the 202,453 lbs from the original base run. While the point values are marginally different, the recommended harvest between the revised and original base run are fairly consistent (Figure 7A).

Conclusions

The SC DNR Electrofishing Survey reliably encounters American eel and would have been included as an abundance index had it been considered during the assessment. Due to miscommunication, this data was not included and the TC and SAS agree that this error should be corrected if the assessment is used for management since it represents the best available science. The substitution of the SC DNR Electrofishing Survey for the SC Rediversion Survey or the inclusion of both SC yellow eel indices resulted in slightly different management advice but overall the results are consistent with the previous trends and conclusions. The TC and SAS recommend including both SC indices. Additionally, the SAS and TC recommend that the Assessment Science Committee (ASC) develop guidelines for how to handle survey issues like this in stock assessments since similar questions have arisen in other assessments.

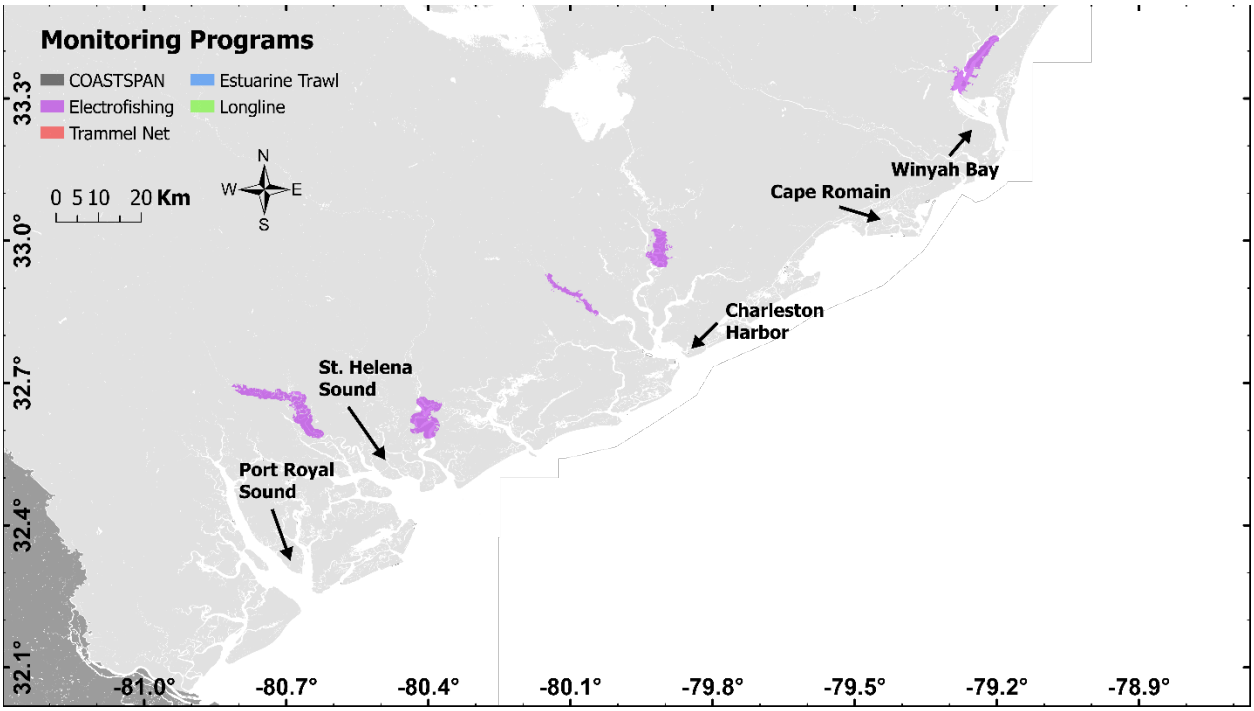

Figure A1. Map of the South Carolina Department of Natural Resources Electrofishing Survey.

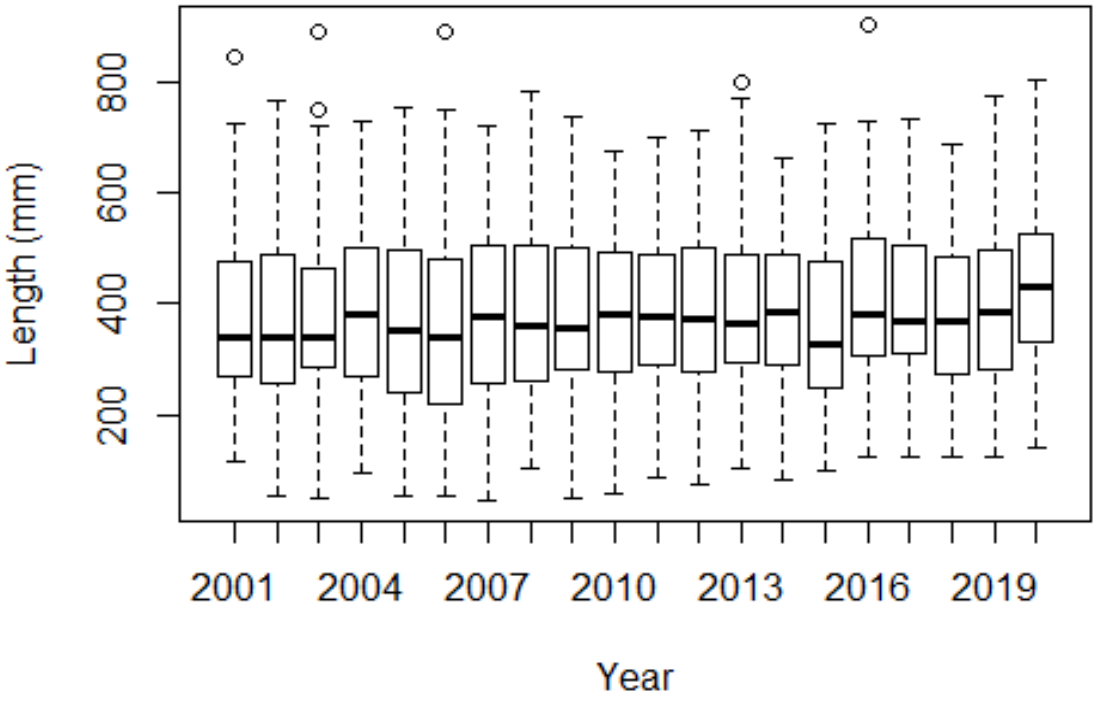

Figure A2. Boxplot of American eel lengths recorded in the South Carolina Electrofishing Survey.

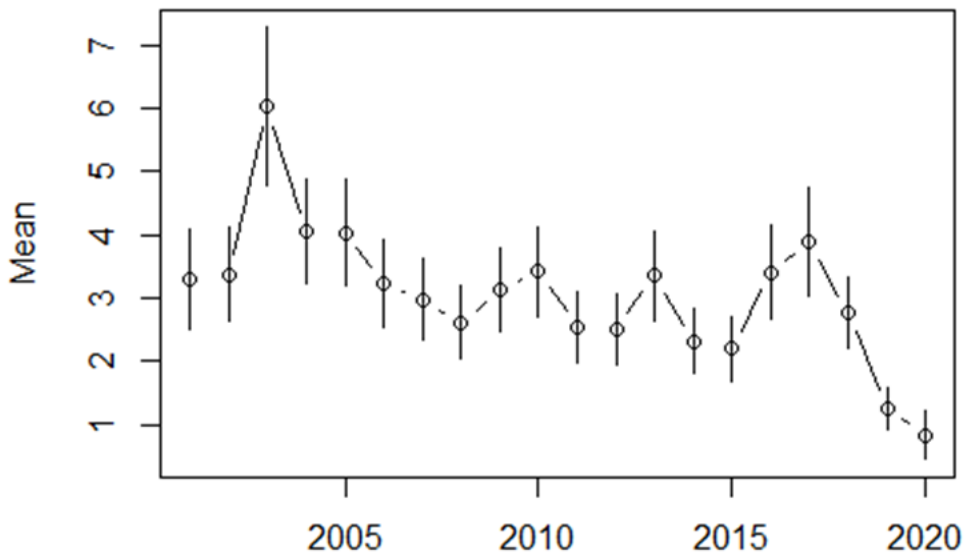

Figure A3. Standardized index of relative yellow eel abundance developed from the South Carolina Department of Natural Resources Electrofishing Survey, 2001-2020. The survey did not operate in March-May in 2020 due to COVID.

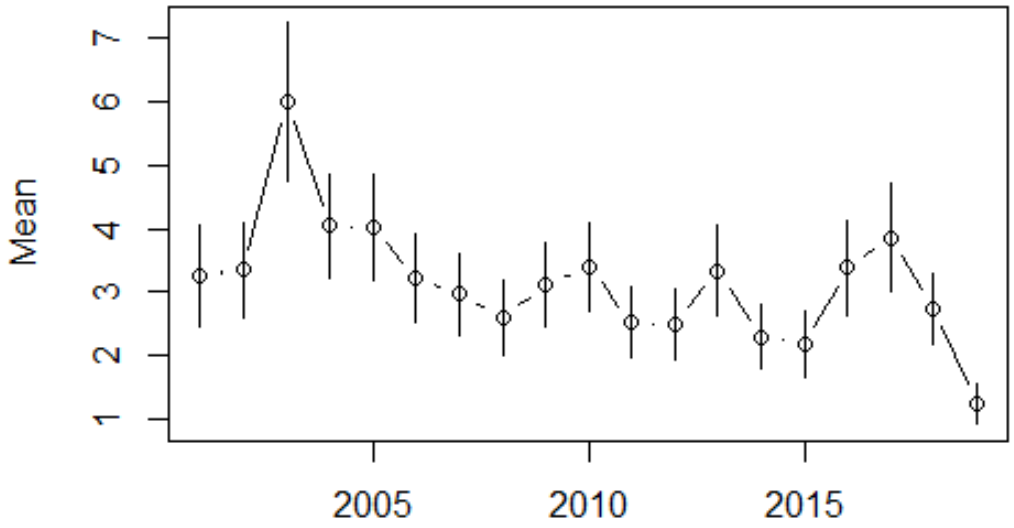

Figure A4. Standardized index of relative yellow eel abundance developed from the South Carolina Department of Natural Resources Electrofishing Survey, 2001-2019.

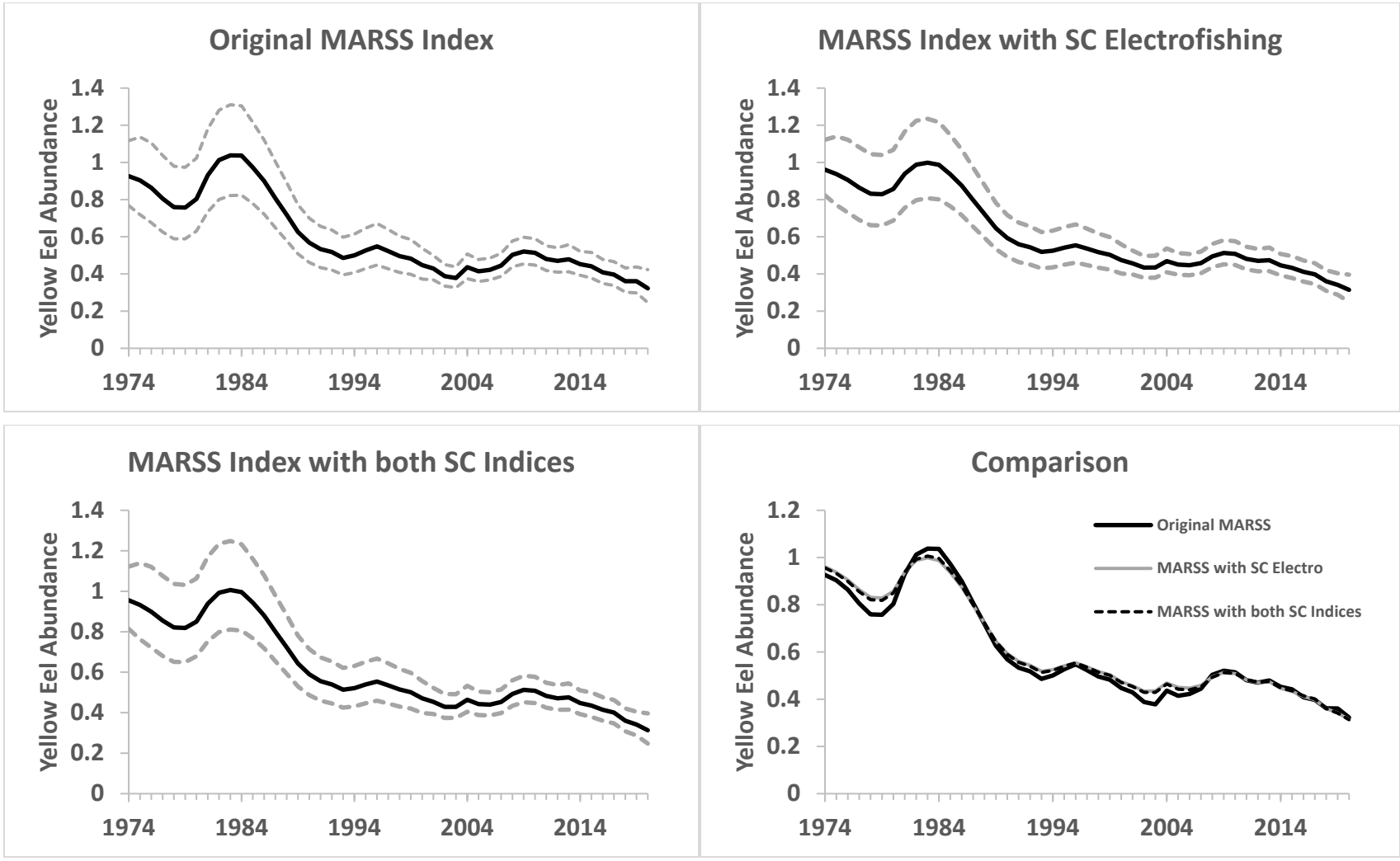

Figure A5. Comparison between the original MARSS index and the recalculated MARSS indices where SC DNR Electrofishing was substituted for SC Rediversion or where both SC indices were included.

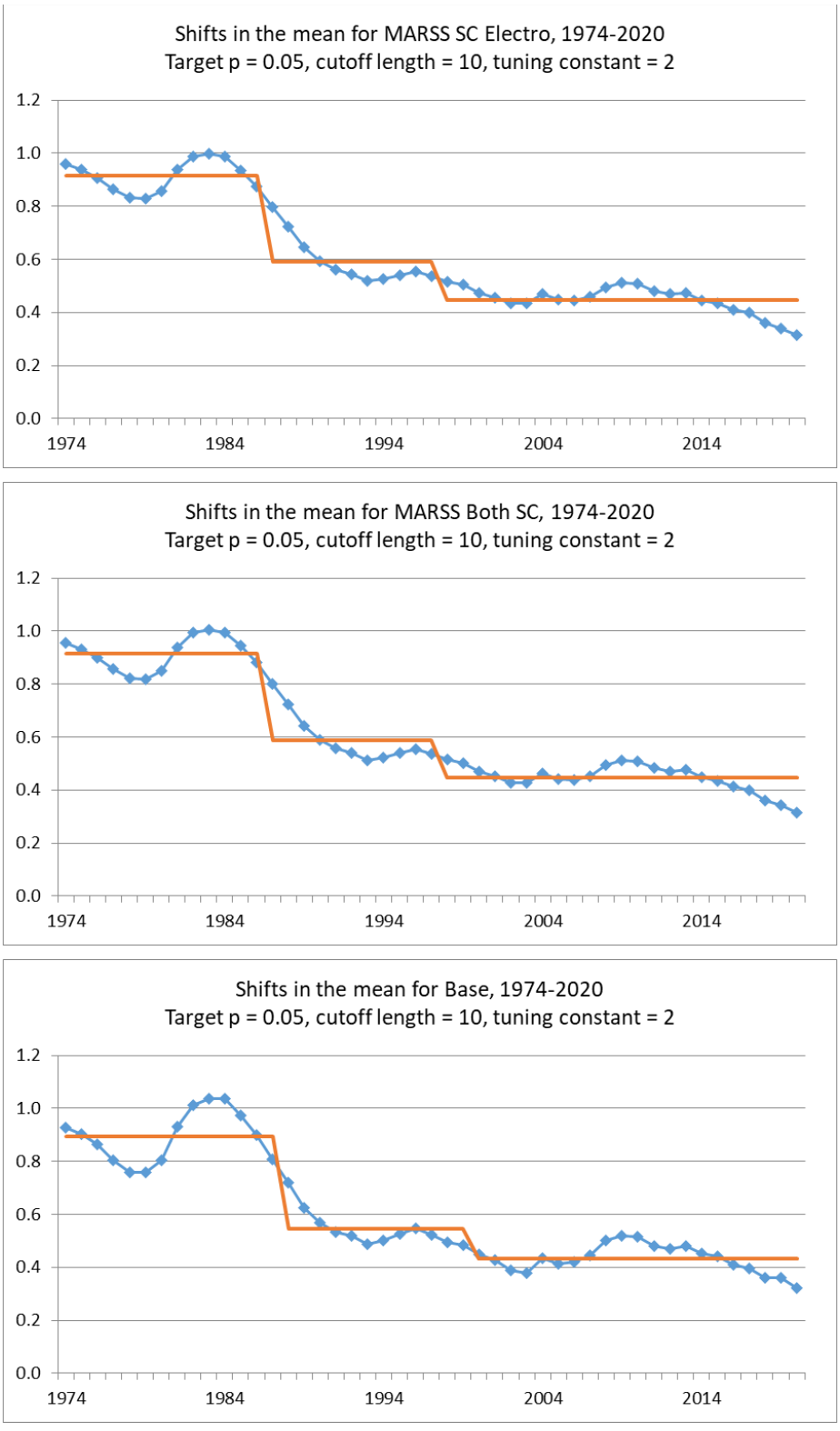

Figure A6. Comparison between the regimes for the recalculated (top, middle) and original MARSS indices (bottom).

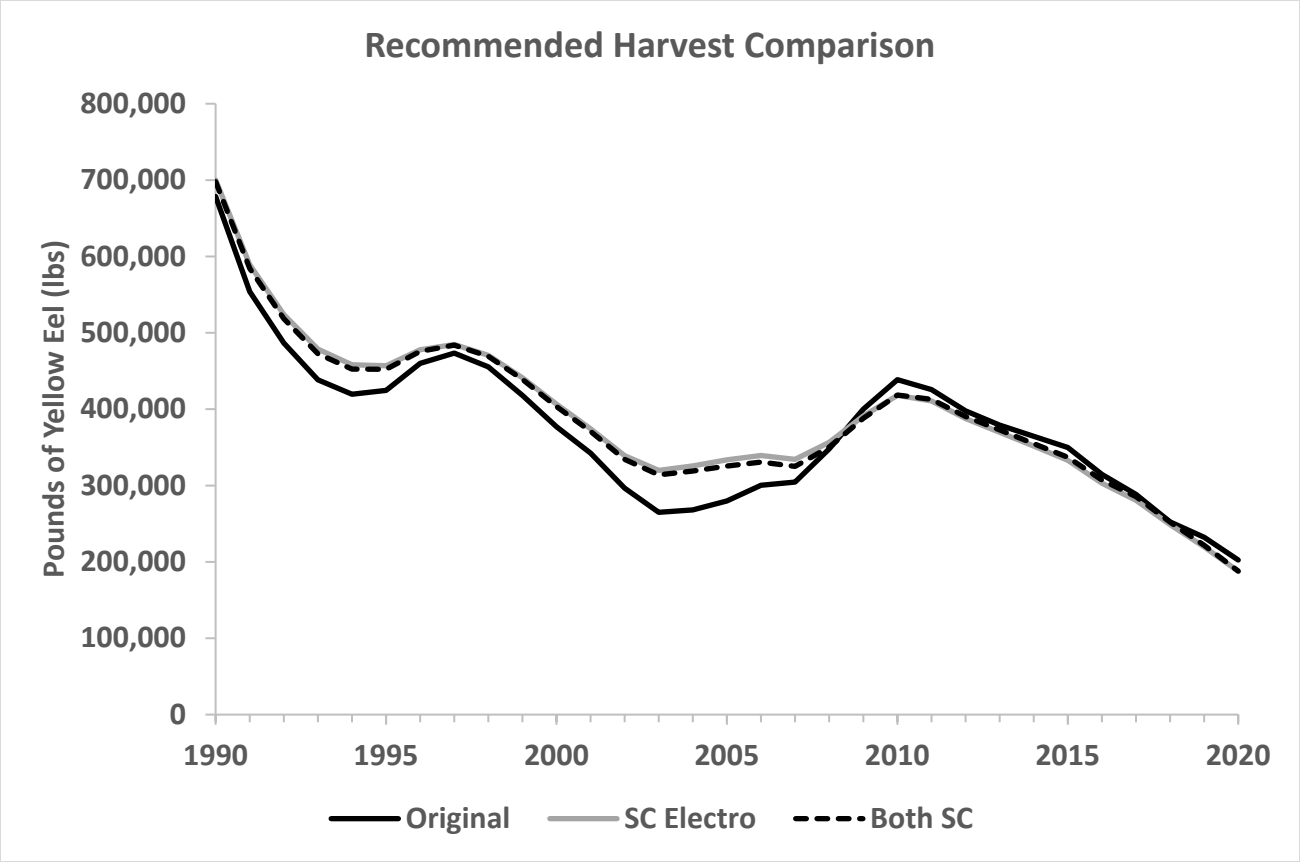

Figure A7. Comparison between the original and revised recommended catch from the I_{TARGET} method.

Atlantic States Marine Fisheries Commission

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American Eel Technical Committee & Stock Assessment Subcommittee Meeting Summary

Webinar
June 27, 2023

Technical Committee Members: Danielle Carty (TC Chair, SC), Casey Clark (ME), Chris Adriance (DC), Chris Wright (NOAA), Ingrid Braun (PRFC), Jen Pyle (NJ), Jim Page (GA), Jordy Zimmerman (DE), Keith Whiteford (MD), Kim Bonvechio (FL), Pat McGee (RI), Robert Atwood (NH), Tim Wildman (CT), Todd Mathes (NC), Troy Tuckey (VA), Zach Schuller (NY), Wendy Morrison (NOAA)

Stock Assessment Subcommittee Members: Sheila Eyler (SAS Chair, FWS), Matt Cieri (ME), Jason Boucher (NOAA), John Sweka (FWS), John Young (USGS), Troy Tuckey (VA), Keith Whiteford (MD), Margaret Conroy (DE), Laura Lee (NC)

ASMFC Staff: Kristen Anstead, Caitlin Starks

Additional Attendees/Public: Alan Bianchi, Emily Tekelenburg, Martin Gary, Raymond Kane, Philip Gwinnell, Jason Bartlett, Trey Mace

The American Eel Technical Committee (TC) and Stock Assessment Subcommittee (SAS) met via webinar to consider several items: (1) the Supplemental Report to the American Eel Benchmark Stock Assessment; (2) inclusion of an omitted survey index from South Carolina (SC) in the assessment; (3) updates on Maine's life cycle survey; and (4) Maine's aquaculture proposal for 2024.

1. American Eel Supplemental Report

The SAS was tasked with additional work following the peer review and Board review of the 2023 benchmark stock assessment. The tasks from the Board included providing justification for deviating from the peer review advice, providing additional analyses to show the influence of individual surveys on the resulting coastwide yellow eel index, considering other reference periods and configurations for I_{TARGET}, and discussing how the habitat model may help assess eel in the future.

The SAS Chair presented the report and its conclusions to the TC. The TC discussed the report and requested some minor edits. First, the TC requested the report clarify that the continued decline in the abundance trend in each assessment is specific to yellow eel, rather than all life stages. It also requested the addition of language acknowledging the lack of eel population data outside of the US Atlantic states range. Lastly the TC asked for the report to add more description of sensitivity run that included only the longest survey in each region.

With these changes, the TC approved the report for Board consideration at the August meeting.

2. South Carolina Electrofishing Survey Index

After reviewing a draft of the 2022 American Eel Benchmark Stock Assessment and Peer Review Report in the February 2023 meeting materials, South Carolina Department of Natural Resources (SC DNR) contacted ASMFC staff in April to inquire about the omission of the SC DNR Electrofishing Survey as an

index of relative yellow eel abundance. After investigating this issue, it appears that the survey data were provided for consideration to the SAS and meet the criteria developed for fishery-independent indices. However, the dataset was accidentally deleted from the data sharing site, and thus was not considered by the index group during the assessment.

To correct this error, the SAS evaluated the SC DNR Electrofishing Survey data, calculated a standardized index from the survey, and then re-ran the MARSS index, regime shift analysis, and I_{TARGET} base run to include SC DNR Electrofishing Survey in addition to the 14 yellow eel surveys already used. The recommended harvest when SC DNR Electrofishing Survey was included was similar throughout the time series to the original base run. The TC and SAS agree that if the assessment is accepted for management use and options for I_{TARGET} are developed by a Plan Development Team, the SC DNR Electrofishing Survey should be included as an index of relative abundance since its omission was an error. A section will be added to the supplemental report to address this issue.

3. Maine Life Cycle Survey

Maine Department of Marine Resources (ME DMR) staff presented recent data from the state's life cycle survey for American eel. The survey monitors each life stage (glass, yellow, and silver) using various methods in West Harbor Pond. The glass eel survey began in 2001, while the surveys for the yellow and silver eel stages began in 2018. The number of glass eel caught per year has varied, with 2022 resulting in the largest catch since the study began. All yellow eels are measured for length and weight and tagged with PIT tags. Silver eels are measured and weighed individually unless catches are large (typically > 50 individual eels), in which case a subsample is taken and the remaining eels are counted and weighed collectively. The number of silver eel captured peaked in 2021 and declined again in 2022. Maine also collects samples for otolith aging, sex determination, and presence of the swim bladder parasites from both yellow and silver eels.

4. Maine Aquaculture Plan for 2024

ME DMR staff presented Maine's proposal for aquaculture harvest in 2024, pursuant to Addendum IV to the American eel FMP. As in the previous three years, Maine's plan includes the harvest of 200 pounds of glass eel for use in domestic aquaculture facilities. Maine has again selected to work with American Unagi, which uses recirculating aquaculture system (RAS) technology. As in previous years, American Unagi is planning to source the glass eels from several regions in Maine's watersheds to limit the impacts to individual river systems and be consistent with the statewide approach of the existing fishery. The fishermen, volume, and harvest location will be identified for all eels entering the facility.

The Maine aquaculture plan is consistent with the requirements of Addendum IV. The TC has no concerns with the proposal and supports its approval.

State of Maine Aquaculture Plan for American Eel Pursuant to Addendum IV to the ASMFC Interstate Fishery Management Plan

Maine Department of Marine Resources
32 Blossom Lane
Augusta, ME 04330

May 31, 2023

Photo By American Unagi, LLC

Table of Contents

Background

The Maine Department of Marine Resources (MDMR) supports the development of domestic aquaculture in Maine. With Maine's existing fishery management measures and eel management infrastructure the State is in a good place to implement a domestic aquaculture quota into its current management plan. Connecting Maine's fishery to domestic aquaculture provides year-round jobs directly in eel grow-out, supports indirect jobs throughout the local seafood and marine-related industries, and produces an eel product grown under the high standards of US aquaculture production.

ME DMR solicited interested parties to participate in this quota request and has selected to work with American Unagi for FY2024. Over the course of the last nine years, American Unagi has utilized recirculating aquaculture system (RAS) technology, specifically using designs developed and successfully utilized for eels in Europe. This has allowed the company to grow high-value American eels in a controlled environment, certify sustainability and source, and provide a level of product supply to growing customer segments that prefer locally grown/sourced and fully traceable seafood products. Given the success of seven years of pilot production, American Unagi scaled production to 240 MT with the construction of a site in Mid-Coast Maine; the company started operating out of this facility in 2022.

In October 2014, the ASMFC adopted Addendum IV to the Interstate Fishery Management Plan for American Eel. Addendum IV implemented a provision allowing states and jurisdictions to submit an Aquaculture Plan to allow for the limited harvest of American eel glass eels (hereinafter "glass eels") for use in domestic aquaculture facilities. Specifically, Addendum IV states: "*Under an approved Aquaculture Plan, states and jurisdictions may harvest a maximum of 200 pounds of glass eel annually from within their waters for use in domestic aquaculture facilities provided the state can objectively show the harvest will occur from a watershed that minimally contributes to the spawning stock of American eel. The request shall include: pounds requested; location, method, and dates of harvest; duration of requested harvest; prior approval of any applicable permits; description of the facility, including the capacity of the facility the glass eels will be held, and husbandry methods; description of the markets the eels will be distributed to; monitoring program to ensure harvest is not exceeded; and adequate enforcement capabilities and penalties for violations*." Pursuant to Addendum IV to the Interstate Fishery Management Plan for American Eel, ME DMR is submitting the following Aquaculture Plan for approval. ME DMR received one application for FY2024 and has elected to work with American Unagi. American Unagi is requesting a domestic aquaculture quota for its commercial facility.

Previous Years Harvests

In 2019, the first year of fishing the Maine aquaculture quota, American Unagi obtained glass eels from the Medomak River, Pemaquid River, Megunticook Stream, and Somes Pond outlet. The four sites listed are commonly fished for glass eels and are routinely monitored by Marine Patrol Officers. These sites also have obstacles for passage, including several impassible dams for eels. In particular, Megunticook Stream has a steep gradient and multiple dams without upstream or downstream passage and Somes Pond is small. As a result, these locations would likely not produce a large number of adult eels. The company chose to only harvest 130.5 lbs for 2019.

In 2020, due to issues around COVID-19 American Unagi did not fish its aquaculture quota.

In 2021, American Unagi harvested 138.91 lbs under the aquaculture quota. Locations of harvest in 2021 include the same sites as in 2019 (see Table 1). In addition, American Unagi obtained glass eels from the Orland River in 2021. The Orland River has several impassible dams, including the Orland Dam at the head-of-tide. Given the dam's placement, upstream passage is only effective during part of the tidal cycle and there is no dedicated downstream passage. Therefore, it is unlikely that this river contributes significantly to the adult population of eels. Glass eel harvest in the Orland River is also routinely monitored by Marine Patrol Officers.

In 2022, American Unagi harvested 200 lbs under the aquaculture quota. This is the maximum amount of quota allowed under an ASMFC approved Aquaculture Plan and the first time American Unagi harvested the full amount. As in 2019 and 2021, harvesters in 2022 obtained glass eels from Medomak River, Pemaquid River, Mequnticook Stream, Orland River, and Somes Pond outlet. In addition, American Unagi worked with several new harvesters fishing in the Mousam River, Presumpscot River, Ames Pond Outlet, and Flanders Stream. The Mousam River is a heavily dammed river in Maine, with 13 dams between Kennebunk and Mousam Lake, all which lack fish passage. The Presumpscot River includes 7 dams between Sebago Lake and the ocean; the first of these dams is the Cumberland Mills Dam which includes a denil fishway which is not appropriate for eels. Both Flanders Stream and Ames Pond are small waterways which are not expected to significantly contribute to the adult population of eels. Ames Pond is the smallest waterway harvested from in 2022 as it is only 6 acres in size and Flanders Stream has a watershed of 11.5 square miles. There is no upstream habitat from Ames Pond and there is a culvert barrier at its outlet to the ocean. These additional four harvest locations in 2022 are routinely monitored by Maine Marine Patrol.

In 2023, American Unagi again harvested 200 lbs under the aquaculture quota. As in previous years, harvesters obtained glass eels from Medomak River, Pemaquid River, Mequnticook Stream, Orland River, and Somes Pond outlet. Three new waterways were used for harvest in 2023 (Union River, Passagassawakeag River, St. Croix River), all of which contain multiple dams that significantly limit, or prevent, passage. The Union River has two impassible dams between Union River Bay and Graham Lake, including the Ellsworth Dam which is an operational hydroelectric power facility in Maine. The Passagassawakeag River similarly has two impassible dams between the Passagassawakeag Lake and Belfast Bay, including Holmes Mill Dam in Belfast, Maine. The St. Croix River forms the border between eastern Maine and Canada and has a history of being heavily dammed for hydropower. There are four main dams on the St. Croix River including the Milltown Power Station Dam which sits half a mile upstream of head of tide. The four dams have varying degrees of fish passage infrastructure, including no fishway, a vertical slot fishway, a pool-weir fishway, and a denil dam in very poor condition which significantly limits passage. There have been ongoing efforts to decommission the Milltown Power Station Dam; however, the dam was still in place during the 2023 elver season. The additional three harvest sites in 2023 are all used during Maine's elver season and are therefore routinely monitored by Marine Patrol. Harvest in 2023 under the elver aquaculture quota did not occur in the Mousam River, Presumpscot River, Ames Pond Outlet, or Flanders Stream.

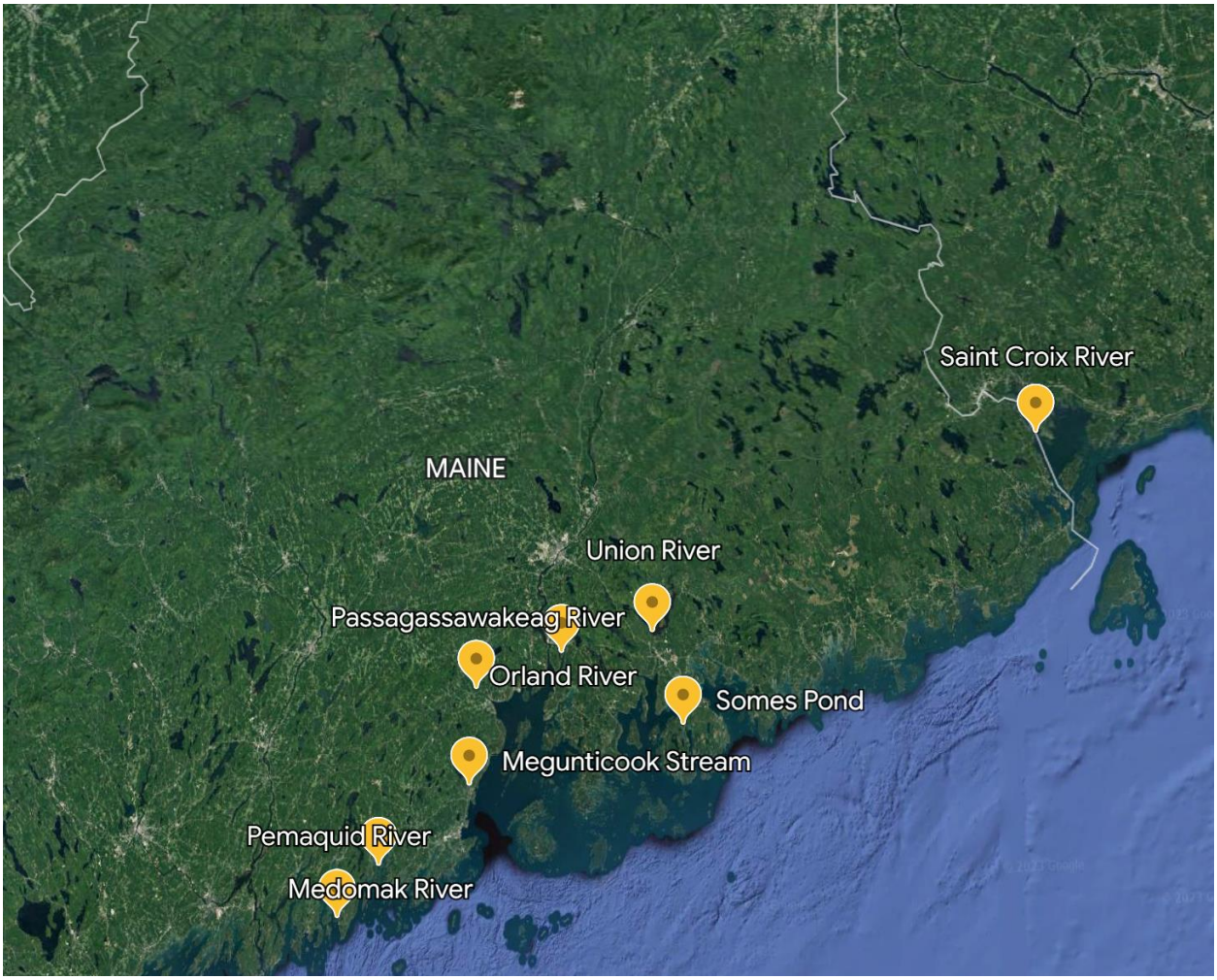

Figure 1: Locations of glass eel harvest under the aquaculture quota in FY2023. Source: Google Earth.

Table 1: Characteristics of the rivers/watersheds of glass eel harvest under the aquaculture quota.

River/watershed	Tributary Name[1]	Drainage Area	River Mile[1]	Years Harvested	Presence of Hydro	Number of Impassible dams[4]	Number of Passible Dams
Pemaquid River	n/a	46.9 sq mi	n/a	2019/2021/2022/2023	no	2	0
Medomak River	n/a	74 sq mi	n/a	2019/2021/2022/2023	no	3	0
Megunticook River	n/a	30.82 sq mi	n/a	2019/2021/2022/2023	yes	7	0
Somes Pond Outlet[5]	n/a	pond is 104 acres	n/a	2019/2021/2022/2023	no	3	2
Orland River	n/a	112.7sq mi	n/a	2021/2022/2023	no	4	0
Union River	n/a	545.48 sq. mi	n/a	2023	yes	2	0
Passagassawakeag River	n/a	90.49 sq mi	n/a	2023	no	2	0
St. Croix River	n/a	1500 sq mi	n/a	2023	yes	2	2
Mousam River	n/a	117 sq mi	n/a	2022	yes	13	0
Presumpscot River	n/a	648 sq mi	n/a	2022	yes	3	4
Flanders Stream	n/a	11.5 sq mi	n/a	2022	no	0	0
Ames Pond outlet	n/a	pond is 6 acres	n/a	2022	no	0	0

*

Notes
1 -Tributary name and river mile- do not pertain as elvers as are harvested at the head of tide of the river system noted.
2 - The only river system with a USGS gauge station is Mousam River [station number 10169500; West Kennebunk, Maine]
3 -Tidal amplitude for all sites is 10-12 feet.
4 -Number of dams from Maine Stream Habitat Viewer, dams either have no fish passage or passage for alewife (Alaskan steeppass or Denil) that is not appropriate for eels.
5 - First fishway on Somes Pond outlet is a Denil.

Table 2 presents CPUE for glass eel harvest in 2019, 2021, 2022, and 2023. There is no CPUE available for the 2020 season because no glass eels were harvested under the aquaculture quota that year. CPUE is calculated by assessing the number of pounds harvested from each waterway, the number of fishermen who harvested aquaculture quota at each waterway, and the estimated hours of tides they fished. The higher

CPUEs in 2022 and 2023 follow trends in the broader Maine elver fishery where quotas were quickly caught by early May, roughly a month ahead of the end of the elver season on June 7[1].

Table 2: CPUE (average pounds per hour) under the Maine aquaculture quota.

River	2019 Average lbs per hour	2021 Average lbs per hour	2022 Average lbs per hour	2023 Average lbs per hour
Pemaquid River	0.54	0.07	0.87	0.76
Medomak River	0.56	0.03	0.52	0.83
Megunticook River	0.41	0.09	1.67	0.50
Somes Pond Outlet	1.12	0	1.67	1.67
Orland	n/a	0.15	0.83	0.83
Presumpscot	n/a	n/a	0.83	n/a
Mousam	n/a	n/a	0.83	n/a
Ames Outlet	n/a	n/a	0.83	n/a
Flanders Stream	n/a	n/a	0.83	n/a
Union River	n/a	n/a	n/a	0.95
Passagassawakeag	n/a	n/a	n/a	0.56
St. Croix	n/a	n/a	n/a	0.67

Pound Requested

American Unagi is requesting 200 pounds for the 2024 fishing year.

Location of Harvest

The Aquaculture Plan proposal requirements were modified based on the following criteria (as recommended by the Technical Committee):

> *States and jurisdictions may develop a Plan for aquaculture purposes. Under an approved Aquaculture Plan, states and jurisdictions may harvest a maximum of 200 pounds of glass eels annually from within their waters for use in domestic aquaculture facilities. Site selection for harvest*

[1] Maine's elver season runs from noon on March 22 to noon on June 7 (12 M.R.S. §6575)

will be an important consideration for applicants and reviewers. Suitable harvest locations will be evaluated with a preference to locations that have:
(1) established or proposed glass eel monitoring,
(2) are favorable to law enforcement and
(3) watershed characteristics that are prone to relatively high mortality rates.

Watersheds known to have features (ex. impassible dams, limited area of upstream habitat, limited water quality of upstream habitat, and hydropower mortality) that would be expected to cause lower eel productivity and/or higher glass eel mortality will be preferred targets for glass eel harvest. This is not an exclusive requirement, because there will be coastal regions with interest in eel aquaculture where preferred watershed features do not occur or are not easily demonstrated. In all cases, the applicant should demonstrate the above three interests were prioritized and considered.

In Maine glass eel monitoring currently occurs at West Harbor Pond, where the eel life cycle study is occurring. Removing glass eels from that site would compromise Maine's required study.

As in previous years, Unagi is planning to source the glass eels from several regions in Maine's watersheds to limit the impacts to individual river systems and be consistent with the statewide approach of the existing fishery. In addition to data for regulatory measures, having full traceability and accountability of the facility's eels is important to the company's end market so the fishermen, volume, and harvest location will be identified for all eels entering the facility.

As previously mentioned, the sites of harvest used in previous years are commonly fished for glass eels and are all routinely monitored by Marine Patrol Officers. Many of these waterways also have features which make them unlikely to produce a large number of adult eels. Megunticook Stream has a steep gradient and multiple dams without upstream or downstream passage; Somes Pond is small; Orland River has the Orland Dam at head-of-tide which significantly limits upstream passage to parts of the tidal cycle; and the Union River has a hydroelectric dam in Ellsworth, Maine.

Dates of Harvest

Aquaculture harvest will be limited to the current glass eel fishing season per State of Maine. By law, the elver season occurs between March 22 and June 7 (Appendix A; 12 M.R.S.A. §6575).

Methods of Harvest

A licensed harvester will be required to fish for all eels used for domestic aquaculture. Licenses are issued by the Department of Marine Resources (Appendix A; 12 M.R.S.A. §6505-A, and §6302-A). For the aquaculture quota, one or more individuals will be issued a specialty aquaculture fishing allowance by the ME DMR Commissioner which permits the harvester to harvest glass eels for aquaculture purposes beyond the limits of their personal harvest quotas.

Glass eels shall be harvested only by dip net or elver fyke net, with the size and construction in compliance with current Maine law (Appendix A; 12 M.R.S.A. §6001). A license issued under this section must identify the number and types of nets that the license holder may use (Appendix A; 12 M.R.S.A. §6505-A). Elver

fyke nets must display a tag issued by the Department when they are submerged (Appendix A; 12 M.R.S.A. §6505-B).

Additional harvest measures include a prohibition on fishing in the middle third of any waterway, within 150 feet of a fishway or a dam with a fishway, and specific area closures where fishing for elvers is prohibited (12 M.R.S.A. §6575-B; §6575-C; §6575-F; §6575-G). As adopted via rulemaking in 2021, there is now a tending requirement so that the contents of fyke nets and Sheldon box traps are removed at least once every 16 hours (Chapter 32). The tending requirement is intended to reduce by-catch and elver mortality by requiring harvesters to check nets and box traps on a regular basis.

Finally, no person may fish for, take, possess or transport pigmented eels. All catches shall be screened and graded immediately upon harvest, whereas all eels failing to pass through 1/8" bar mesh net, as well as all bycatch will be returned to the water.

Monitoring Program

The Maine glass eel fishery has been managed under a Total Allowable Catch (TAC) established by the Atlantic States Marine Fisheries Commission (ASMFC) since 2014. In 2014, the TAC was 11,749 lbs, which was determined by calculating a 35% reduction from the 2013 Maine landings of elvers. The TAC was subsequently dropped to 9,688 lbs in Addendum IV and maintained at this level in Addendum V. This TAC was based on the Maine landings achieved during the 2014 season. In October 2021, the American Eel Management Board voted to extend Maine's glass eel quota at its current level of 9,688 lbs for an additional three years (2022-2024). Landings have typically approached the TAC, except for the 2015 season, when poor weather prevented fishermen from filling their quotas. By law, 21.9% of the annual TAC is allocated to the four federally recognized Indian Tribes in the state.

Concurrent with the implementation of the TAC, Maine implemented an individual quota system for state license holders, calculated based on harvester reported landings during the 2011, 2012, and 2013 seasons. The individual quota system is monitored using a "swipe" card.

The swipe card system was created in 2013 to enable Maine to monitor the elver quota. The system was designed to allow dealers to enter data daily and allow ME DMR staff to quickly analyze that data within 24 hours of receipt. Additionally, the swipe card system was developed as the mechanism to monitor the individual fishing quota of harvesters.

Swipe cards are issued annually to each elver license by a Marine Patrol Officer. At that time, the license holder signs an acknowledgement form that indicates their understanding of their individual quota and the penalties associated with exceeding their quota. Harvester sales are checked daily against their quota, and when the harvester's quota is reached or exceeded, the swipe card is deactivated by ME DMR Landings Program staff.

Each elver dealer has a swipe card reader for the permanent facility, as well as all vehicles used to transport elvers. Dealers are required to submit swipe card transaction reports (including negative reports) by 2 p.m. for each day of the elver season (March 22nd to June 7th). If dealers are delinquent with two days' worth of reports the swipe card system will not allow dealers to purchase elvers from harvesters until they submit all

outstanding reports or create a negative report for the missing days. A dealer-to-dealer program was added in 2015. The dealer-to-dealer program requires a card swipe each time dealers moved elvers to another location or dealer. The dealer-to-dealer program uses the same hardware and software as the harvester to dealer system and is also subject to daily reporting including negative reports.

For the aquaculture quota, ME DMR will issue separate aquaculture amounts to the assigned harvesters for a total allocation of 200 pounds. When the facility is assigned its quota, it will designate the licensed harvesters that will be collecting the 200lbs. The aquaculture facility will be required to hold an elver dealer permit and license its buying station, transport vehicles, and facility. The permitted aquaculture facility will be the only dealer allowed to swipe aquaculture quota cards in addition to regular individual harvester cards. The data collection on these transactions from harvester to facility will include the harvester's name, harvest site, harvest method, date, and pounds. When the 200-pound quota is achieved, cards will be deactivated.

Due to the nature of the production, the facility will also be able to provide a status report to ME DMR on glass eel survival when eels are moved from glass eel intake system into production facility at approximately four months from arrival (see facility description for more details).

Penalties for Violation

Since 2012, Maine has made numerous law changes to close any remaining loopholes and create the proper penalties for elver violations. The majority of elver violations were criminalized in 2014, changing from a civil violation, to a Class D crime with a $2000 fine. At the same time, mandatory license revocations were imposed for the second violation of several elver offenses, including untagged gear, fishing out of season, or exceeding the individual fishing quota. In addition to the $2000 fine, individuals who exceed their quota are subject to a "pecuniary gain" fine, where they must pay back to the State the value of any elvers that were taken in excess of their quota. The Department is authorized to deny the renewal of the license of an individual who has failed to pay their pecuniary gain fine in its entirety prior to the following elver season. Prior to the 2020 season, ME DMR submitted a bill that was passed into legislation that made the penalty for buying or selling elvers without using the swipe card system permanent revocation of the license for the first offense.

Harvester, dealers, and aquaculture facilities may have random inspection of the facility and places of harvest conducted to ensure all rules and regulations under conditions of permit(s) are being adhered to. An aquaculture facility permit would hold to these same penalties and loss of license for violations.

Regardless of specific penalties that may be provided in law, the Commissioner also has the authority to suspend any licenses or certificates issued by the Department if a person is convicted or adjudicated in court of violating any marine resources law or regulation. In addition, the Commissioner may pursue license suspension without criminal conviction or civil adjudication through an administrative process.

Prior Approval of Permits

American Unagi was first approved to hold and grow eels by ME DMR in 2014. During the course of operating the pilot facility, American Unagi worked closely with the State regulators on permitting for its operations. The company holds the necessary permits to buy, culture, and sell American eels.

For purchasing elvers from licensed Maine harvesters, American Unagi holds a ME DMR Elver dealer license that is renewed annually. Under this permit, the company has permitted a buying station, transport vehicle, and facility. For sale of grown product, the company holds a ME DMR Wholesale Dealer Permit that is renewed annually. Starting in 2021, American Unagi was issued a Land-Based Aquaculture permit by ME DMR for its facility in Mid-Coast Maine. All permits have been renewed for 2023.

Description of Market (s)

American Unagi has already been supplying domestic outlets for the eel produced in its facility. The company successfully launched processed eel products in 2020, including butterflied and smoked eels, and is planning to expand its sale of live and further develop processed products for domestic consumption. For propriety reasons, specific details are not being provided.

Description of facilities (design, capabilities, and technical facts)

American Unagi operates at a 240MT commercial scale land-based recirculating aquaculture plant in Mid-Coast Maine which was completed ahead of the 2022 season. There were no changes to the facility between 2022 and 2023.

Following the formula for success of eels and RAS, American Unagi engaged a worldwide leader in RAS design in eels to assist in assessing the feasibility of its commercial plant, develop a schematic design, provide detailed operations and equipment costs to develop the plant. The farm consists of two separate systems: a glass eel system and a grow-out system. When glass eels are brought in, they will go into the glass eel system which also serves as quarantine area. This recirculated system includes 18 round tanks of 2.25 meter diameter and 100 cm deep. Every 12 minutes the water is filtered and then recycled. The outlet of the fish tank is equipped with a brushing machine, basically a cylindrical screen that is constantly brushed to prevent clogging. The brushing machine is fed with water from the bottom center of the tank, pulling up dead and dying fish and feces. Glass eels are held in this system for 1-4 months as they are acclimated to commercial aquaculture diet. Once the glass eels reach a weight of 3-5 grams, they are size graded and moved into the grow-out system. This system has two series of tanks split into “nursery” and “grow-out”. The first series of nursery tanks hold the eels from 3-5 grams until around 20 grams. The eels are then moved to the largest series of tanks within the same systems, where they are grown to market size.

Each system has its own filtration equipment. The wastewater leaving the tanks is first sieved with a drumfilter; a rotating sieve that is equipped with a sieve cloth with 36-40 micron openings. Once the screen gets clogged with solids it automatically starts a rinsing cycle, spraying the waste into a gutter that is collected and processed. From the drumfilter the water is pumped into a biofilter for the stripping of carbon dioxide and for conversion of ammonia (NH3) into the relatively harmless nitrate (NO3). The biofilter is a moving bed biological reactors (MBBR’s). These are energy efficient, compact, and are more efficient in

maintaining heat than other biofilters. From the biofilter the water flows by gravity through an MHO oxygen reactor to add pure oxygen and then by gravity back to the fish tanks.

A monitoring/control system is used for guarding pH, temperature, and oxygen. All fish tanks are equipped with water level sensors. Together with some pressure sensors these are connected to an alarm system that dials out to cell phones. Additionally, the facility is equipped with video surveillance for both security and monitoring purposes.

During the course of the aquaculture process there are some expected mortalities and the losses are anticipated in the production planning. In American Unagi's experience, the largest period of mortality occurs during weaning process after glass eels first arrive. While the company has seen as little as 1% loss, it anticipates as high as 10% loss into its production planning to accommodate for this expected mortality. Therefore, to produce 240 MT annually the company will stock up to 620 lbs of glass eels, with up to 200 lbs of this being secured under the domestic aquaculture permit and the remaining 420 lbs thru the standard quota system. Each year when the glass eels are stocked into the facility, the first one to four months they are kept separate from previous year classes. During this intake period the company tracks growth, survival, and numbers for the years glass eels that would be available to MDMR for review and tracking.

During the production process the eels are size graded every 6-8 weeks. Given eel is a non-domesticated species there is a very big variance between the performance of different individuals. A fast grower may reach market weight in just 6 months but other fish may still weigh a few grams after one year. As a result of the growth variation, the farm population in the grow-out tanks will comprise of 2-3 year classes of eel. As part of operating a successful aquaculture facility, meticulous records of growth, survival, and biomass are a necessary part of the business so during the course of the grow-out the farm maintains records of current eels onsite. In addition to supporting the successful operation of the business, these records are also used to support that best management practices are being followed.

References

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Jessop, B.M. 2000. Estimates of population size and instream mortality rate of American eel elvers in a Nova Scotia River. Transactions of the American Fisheries Society 29: 514-526.

Oliveira, K. and J.D. McCleave. 2000. Variation in population and life history traits of the American eel, Anguilla rostrate, in four rivers in Maine. Environmental Biology of Fishes 59: 141-151.

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§6001. DEFINITIONS

13-F. **Elver.** "Elver" means a member of the species Anguilla rostrata in that stage of its life cycle when it is less than 6 inches in length.

[1995, c. 536, Pt. A, §1 (NEW) .]

13-G. **Elver fyke net.** "Elver fyke net" means a fyke net that is 30 feet or less in length from cod end to either wing tip, is fitted with netting that measures 1/8-inch bar mesh or less, contains a 1/2-inch or less bar mesh excluder panel that covers the entrance of the net, and consists of not more than one funnel end, one cod end and 2 wings.

[1997, c. 575, §1 (AMD) .]

13-H. **Elver dip net.** "Elver dip net" means a dip net with a hoop of not more than 30 inches in diameter and fitted with netting that measures 1/8 inch bar mesh or less.

[1999, c. 7, §1 (AMD) .]

40-A. **Sheldon eel trap.** "Sheldon eel trap" means a box trap with a netted wing 10 feet or less in length used to intercept and direct elvers into the trap.

§6302-A. TAKING OF MARINE ORGANISMS BY FEDERALLY RECOGNIZED INDIAN TRIBES

1. **Tribal exemption; commercial harvesting licenses.** A member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians who is a resident of the State is not required to hold a state license or permit issued under section 6421, 6501, 6502-A, 6505-A, 6505-C, 6535, 6601, 6602, 6701, 6702, 6703, 6731, 6745, 6746, 6748, 6748-A, 6748-D, 6751, 6803, 6804 or 6808 to conduct activities authorized under the state license or permit if that member holds a valid license issued by the tribe, nation or band or the agent of the band to conduct the activities authorized under the state license or permit. A member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians issued a tribal license pursuant to this subsection to conduct activities is subject to all laws and rules applicable to a person who holds a state license or permit to conduct those activities and to all the provisions of chapter 625, except that the member of the tribe, nation or band:

A. May utilize lobster traps tagged with trap tags issued by the tribe, nation or band or the agent of the band in a manner consistent with trap tags issued pursuant to section 6431-B. A member of the tribe, nation or band is not required to pay trap tag fees under section 6431-B if the tribe, nation or band or the agent of the band issues that member trap tags; [2011, c. 598, §17 (AMD).]

B. May utilize elver fishing gear tagged with elver gear tags issued by the tribe, nation or band or the agent of the band in a manner consistent with tags issued pursuant to section 6505-B. A member of the tribe, nation or band is not required to pay elver fishing gear fees under section 6505-B if the tribe, nation or band or the agent of the band issues that member elver fishing gear tags; and [2011, c. 598, §17 (AMD).]

C. Is not required to hold a state shellfish license issued under section 6601 to obtain a municipal shellfish license pursuant to section 6671. [1997, c. 708, §1 (NEW); 1997, c. 708, §3 (AFF).]

[2013, c. 254, §1 (AMD) .]

2. **Tribal exemption; sustenance or ceremonial tribal use.** Notwithstanding any other provision of law, a member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians who is a resident of the State may at any time take, possess, transport and distribute:

A. Any marine organism, except lobster, for sustenance use if the tribal member holds a valid sustenance fishing license issued by the tribe, nation or band or the agent of the band. A sustenance fishing license holder who fishes for sea urchins may not harvest sea urchins out of season; [2011, c. 598, §17 (AMD).]

B. Lobsters for sustenance use, if the tribal member holds a valid sustenance lobster license issued by the tribe, nation or band or the agent of the band. The sustenance lobster license holder's traps must be tagged with sustenance use trap tags issued by the tribe, nation or band or the agent of the band in a manner consistent with trap tags issued pursuant to section 6431-B; however, a sustenance lobster license holder may not harvest lobsters for sustenance use with more than 25 traps; and [2011, c. 598, §17 (AMD).]

C. Any marine organism for noncommercial use in a tribal ceremony within the State, if the member holds a valid ceremonial tribal permit issued to the tribal member by the Joint Tribal Council of the Passamaquoddy Tribe or the governor and council at either Passamaquoddy reservation, by the Penobscot Reservation Tribal Council, by the Aroostook Band of Micmacs Tribal Council or its agent or by the Houlton Band of Maliseet Indians Tribal Council or its agent. [2013, c. 254, §2 (AMD).]

For purposes of this subsection, "sustenance use" means all noncommercial consumption or noncommercial use by any person within Passamaquoddy Indian territory, as defined in Title 30, section 6205, subsection 1, Penobscot Indian territory, as defined in Title 30, section 6205, subsection 2, Aroostook Band Trust Land, as defined in Title 30, section 7202, subsection 2, or Houlton Band Trust Land, as defined in Title 30, section 6203, subsection 2-A, or at any location within the State by a tribal member, by a tribal member's immediate family or within a tribal member's household. The term "sustenance use" does not include the sale of marine organisms.

A member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians who takes a marine organism under a license or permit issued pursuant to this subsection must comply with all laws and rules applicable to a person who holds a state license or permit that authorizes the taking of that organism, except that a state law or rule that sets a season for the harvesting of a marine organism does not apply to a member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians who takes a marine organism for sustenance use or for noncommercial use in a tribal ceremony. A member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians issued a license or permit under this subsection is exempt from paying elver gear fees under section 6505-B or trap tag fees under section 6431-B and is not required to hold a state shellfish license issued under section 6601 to obtain a municipal shellfish license pursuant to section 6671. A member of the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians who fishes for or takes lobster under a license or permit issued pursuant to this subsection must comply with the closed periods under section 6440.

[2013, c. 254, §2 (AMD) .]

3. **Lobster, sea urchin, scallop and elver licenses; limitations.** Pursuant to subsection 1:

A. The Passamaquoddy Tribe and Penobscot Nation may each issue to members of its tribe or nation, as the case may be, up to 24 commercial lobster and crab fishing licenses in any calendar year, including all licenses equivalent to Class I, Class II or Class III licenses and student licenses, but not including apprentice licenses. Licenses issued under this paragraph are subject to the eligibility requirements of section 6421, subsection 5; [2011, c. 598, §17 (AMD).]

A-1. The Aroostook Band of Micmacs or its agent may issue to members of the band up to 10 commercial lobster and crab fishing licenses in any calendar year, including all licenses equivalent to Class I, Class II or Class III licenses and student licenses, but not including apprentice licenses. Licenses issued under this paragraph are subject to the eligibility requirements of section 6421, subsection 5; [2011, c. 598, §17 (NEW).]

A-2. The Houlton Band of Maliseet Indians or its agent may issue to members of the band up to 10 commercial lobster and crab fishing licenses in any calendar year, including all licenses equivalent to Class I, Class II or Class III licenses and student licenses, but not including apprentice licenses. Licenses issued under this

paragraph are subject to the eligibility requirements of section 6421, subsection 5; [2013, c. 254, §3 (NEW).]

B. The Passamaquoddy Tribe may not issue to members of the tribe more than 24 commercial licenses for the taking of sea urchins in any calendar year. Sea urchin licenses must be issued by zone in accordance with section 6749-P; [2011, c. 598, §17 (AMD).]

C. The commissioner shall adopt rules authorizing the Penobscot Nation to issue to members of the nation commercial sea urchin licenses if the commissioner determines that sea urchin resources are sufficient to permit the issuance of new licenses. The commissioner may not authorize the Penobscot Nation to issue more than 24 commercial sea urchin licenses to members of the nation in any calendar year; [2011, c. 598, §17 (AMD).]

C-1. The commissioner shall adopt rules authorizing the Aroostook Band of Micmacs or its agent to issue to members of the band commercial sea urchin licenses if the commissioner determines that sea urchin resources are sufficient to permit the issuance of new licenses. The commissioner may not authorize the Aroostook Band of Micmacs or its agent to issue more than 24 commercial sea urchin licenses to members of the band in any calendar year; [2011, c. 598, §17 (NEW).]

C-2. The commissioner shall adopt rules authorizing the Houlton Band of Maliseet Indians or its agent to issue to members of the band commercial sea urchin licenses if the commissioner determines that sea urchin resources are sufficient to permit the issuance of new licenses. The commissioner may not authorize the Houlton Band of Maliseet Indians or its agent to issue more than 24 commercial sea urchin licenses to members of the band in any calendar year; [2013, c. 254, §3 (NEW).]

D. The Penobscot Nation may not issue to members of the nation more than 20 commercial licenses for the taking of scallops in any calendar year, except that the commissioner shall by rule allow the Penobscot Nation to issue additional commercial licenses to members of the nation for the taking of scallops if the commissioner determines that scallop resources are sufficient to permit the issuance of new licenses; [2011, c. 598, §17 (AMD).]

D-1. The Aroostook Band of Micmacs or its agent may not issue to members of the band more than 10 commercial licenses for the taking of scallops in any calendar year, except that the commissioner shall by rule allow the Aroostook Band of Micmacs or its agent to issue additional commercial licenses to members of the band for the taking of scallops if the commissioner determines that scallop resources are sufficient to permit the issuance of new licenses; [2011, c. 598, §17 (NEW).]

D-2. The Passamaquoddy Tribe may not issue to members of the tribe more than 20 commercial licenses for the taking of scallops in any calendar year, except that the commissioner shall by rule allow the Passamaquoddy Tribe to issue additional commercial licenses to members of the tribe for the taking of scallops if the commissioner determines that scallop resources are sufficient to permit the issuance of new licenses; [2013, c. 8, §1 (NEW).]

D-3. The Houlton Band of Maliseet Indians or its agent may not issue to members of the band more than 10 commercial licenses for the taking of scallops in any calendar year, except that the commissioner shall by rule allow the Houlton Band of Maliseet Indians or its agent to issue additional commercial licenses to members of the band for the taking of scallops if the commissioner determines that scallop resources are sufficient to permit the issuance of new licenses; [2013, c. 254, §3 (NEW).]

E. The Penobscot Nation may not issue to members of the nation commercial licenses for the taking of elvers in any calendar year that exceed the following limits:

(1) Eight licenses that allow the taking of elvers with 2 pieces of gear; and

(2) Forty licenses that allow the taking of elvers with one piece of gear.

The commissioner shall by rule allow the Penobscot Nation to issue additional commercial licenses to members of the nation for the taking of elvers if the commissioner and the Penobscot Nation determine that elver resources are sufficient to permit the issuance of new licenses; [2015, c. 391, §3 (AMD).]

E-1. The Passamaquoddy Tribe may issue to members of the tribe commercial licenses for the taking of elvers with one piece of gear; [2015, c. 391, §4 (AMD).]

F. The Aroostook Band of Micmacs or its agent may not issue to members of the band more than 8 commercial licenses for the taking of elvers in any calendar year, except that the commissioner shall by rule allow the Aroostook Band of Micmacs or its agent to issue additional commercial licenses for the taking of elvers to members of the band if the commissioner determines that elver resources are sufficient to permit the issuance of new licenses; and [2013, c. 8, §1 (AMD).]

G. The Houlton Band of Maliseet Indians or its agent may not issue to members of the band more than 16 commercial licenses for the taking of elvers in any calendar year except that the commissioner shall by rule allow the Houlton Band of Maliseet Indians or its agent to issue additional commercial licenses for the taking of elvers to members of the band if the commissioner determines that elver resources are sufficient to permit the issuance of new licenses. [2015, c. 391, §5 (RPR).]

The Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs, Houlton Band of Maliseet Indians and Department of Marine Resources shall report on the status of the sea urchin, scallop and elver fisheries to the joint standing committee of the Legislature having jurisdiction over marine resources matters by January 15th of each even-numbered year.

Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter 2-A.

§6302-B. ELVER QUOTA FOR FEDERALLY RECOGNIZED INDIAN TRIBES IN THE STATE

If the commissioner adopts an elver individual fishing quota system pursuant to section 6505-A, subsection 3-A, this section governs the allocation of the elver quota to federally recognized Indian tribes in the State. [2013, c. 485, §3 (NEW).]

1. **Annual allocation.** In accordance with section 6505-A, the commissioner shall annually allocate 21.9% of the overall annual quota of elver fishery annual landings to the federally recognized Indian tribes in the State. If the Passamaquoddy Tribe, the Penobscot Nation, the Aroostook Band of Micmacs and the Houlton Band of Maliseet Indians reach an agreement regarding the division of this 21.9% portion of the overall annual quota among them and communicate in writing that agreement to the commissioner prior to March 1st of the year in which the quota is allocated, the commissioner shall allocate that portion of the quota in accordance with that agreement. If no agreement is reached, the commissioner shall allocate that portion of the quota in accordance with the following:

A. To the Passamaquoddy Tribe, 14% of the overall annual quota; [2013, c. 485, §3 (NEW).]

B. To the Penobscot Nation, 6.4% of the overall annual quota; [2013, c. 485, §3 (NEW).]

C. To the Houlton Band of Maliseet Indians, 1.1% of the overall annual quota; and [2013, c. 485, §3 (NEW).]

D. To the Aroostook Band of Micmacs, 0.4% of the overall annual quota. [2013, c. 485, §3 (NEW).]

In making any allocations under this subsection, the commissioner shall reserve a portion no greater than 10% of each allocation in order to ensure that the quota is not exceeded.

[2013, c. 485, §3 (NEW) .]

2. **Individual allocations.** The following provisions govern the allocation of the quotas established under subsection 1 to members of each of the federally recognized Indian tribes.

A. The commissioner may enter into an agreement with a federally recognized Indian tribe in the State that does not provide for individual allocations of the quota established under subsection 1 to members of that tribe, nation or band. If the commissioner enters into an agreement pursuant to this paragraph, the following provisions apply.

(1) An elver transaction card under section 6305 must be issued to each person to whom the tribe, nation or band issues a license under section 6302-A, subsection 3.

(2) The holder of a license issued under section 6302-A, subsection 3 must meet the reporting requirements established by rule pursuant to section 6173.

(3) The quota established under subsection 1 applies to all elvers taken under licenses issued by the tribe, nation or band under section 6302-A, subsection 3.

(4) When the quota established under subsection 1 is reached, the department shall notify the tribe, nation or band. When the quota established under subsection 1 is reached, the holder of a license issued by the tribe, nation or band under section 6302-A, subsection 3 may not thereafter take, possess or sell elvers. Taking, possessing or selling elvers after the quota established under subsection 1 is reached is deemed a violation by the license holder of the prohibition on fishing in excess of the person's individual quota in section 6505-A, subsection 3-A. [2015, c. 391, §6 (NEW).]

B. This paragraph governs the allocation of the quotas established in subsection 1 to members of a federally recognized Indian tribe in the State when the commissioner has not entered into an agreement with members of the tribe, nation or band under paragraph A that applies to members of that tribe, nation or band.

(1) If there is no agreement under paragraph A between the commissioner and the Passamaquoddy Tribe, the Passamaquoddy Tribe shall allocate to each person to whom it issues a license under section 6302-A, subsection 3, paragraph E-1 a specific amount of the quota allocated to the Passamaquoddy Tribe under subsection 1, paragraph A and shall provide documentation to the department of that allocation for each individual license holder. The Passamaquoddy Tribe shall allocate all of the quota that it has been allocated and may not alter any individual allocations once documentation has been provided to the department.

(2) If there is no agreement under paragraph A between the commissioner and the Penobscot Nation, the Penobscot Nation shall allocate to each person to whom it issues a license under section 6302-A, subsection 3, paragraph E a specific amount of the quota allocated to the Penobscot Nation under subsection 1, paragraph B and shall provide documentation to the department of that allocation for each individual license holder. The Penobscot Nation shall allocate all of the quota that it has been allocated and may not alter any individual allocations once documentation has been provided to the department.

(3) If there is no agreement under paragraph A between the commissioner and the Houlton Band of Maliseet Indians, the Houlton Band of Maliseet Indians shall allocate to each person to whom it issues a license under section 6302-A, subsection 3, paragraph G a specific amount of the quota allocated to the Houlton Band of Maliseet Indians under subsection 1, paragraph C and shall provide documentation to the department of that allocation for each individual license holder. The Houlton Band of Maliseet Indians shall allocate all of the quota that it has been allocated and may not alter any individual allocations once documentation has been provided to the department.

(4) If there is no agreement under paragraph A between the commissioner and the Aroostook Band of Micmacs, the Aroostook Band of Micmacs shall allocate to each person to whom it issues a license under section 6302-A, subsection 3, paragraph F a specific amount of the quota allocated to the Aroostook Band of Micmacs under subsection 1, paragraph D and shall provide documentation to the department of that allocation for each individual license holder. The Aroostook Band of Micmacs shall allocate all of the quota that it has been allocated and may not alter any individual allocations once documentation has been provided to the department. [2015, c. 391, §6 (NEW).]

The department shall issue an elver transaction card under section 6305 to a person licensed by the Passamaquoddy Tribe under section 6302-A, subsection 3, paragraph E-1, the Penobscot Nation under section 6302-A, subsection 3, paragraph E, the Houlton Band of Maliseet Indians under section 6302-A, subsection 3, paragraph G or the Aroostook Band of Micmacs under section 6302-A, subsection 3, paragraph F only upon receipt of adequate documentation specifying the individual quota allocated to that person by the tribe, nation or band under this subsection.

[2015, c. 391, §6 (RPR) .]

3. **Overage.** If the total weight of elvers sold by persons licensed by the Passamaquoddy Tribe, Penobscot Nation, Aroostook Band of Micmacs or Houlton Band of Maliseet Indians exceeds the quota allocated under subsection 1 to that tribe, nation or band, the commissioner shall deduct the amount of the overage from any future allocation to that tribe, nation or band. If the overage exceeds the overall annual quota allocated to that tribe, nation or band for the following year, the overage must be deducted from the overall annual quota allocations to that tribe, nation or band in subsequent years until the entire overage has been accounted for.

[2013, c. 485, §3 (NEW) .]

4. **Emergency prohibition.** The commissioner may adopt emergency rules to prohibit the Passamaquoddy Tribe, the Penobscot Nation, the Aroostook Band of Micmacs or the Houlton Band of Maliseet Indians from fishing for elvers under a license issued under this Title if the commissioner finds that the tribe, nation or band has authorized fishing for elvers in a way that the commissioner determines will cause the tribe, nation or band to exceed the annual allocation set forth in subsection 1.

[2015, c. 391, §7 (NEW) .]

SECTION HISTORY
2013, c. 485, §3 (NEW). 2015, c. 391, §§6, 7 (AMD).

§6404-N. Revocation based on conviction of failing to record the sale of elvers with an elver transaction card

The commissioner shall permanently revoke the elver fishing license, elver dealer's license or elver exporter's license of any license holder convicted of violating section 6505-A, subsection 1-D. [PL 2019, c. 163, §4 (NEW).]

§6505-A. ELVER FISHING LICENSE

(CONTAINS TEXT WITH VARYING EFFECTIVE DATES)

1. **License required.** Except as provided in section 6302-A and section 6302-B, a person may not engage in the activities authorized under subsection 1-A unless the person is issued one of the following elver fishing licenses under this section:

A. A resident elver fishing license for one device; [2003, c. 452, Pt. F, §11 (NEW); 2003, c. 452, Pt. X, §2 (AFF).]

B. A resident elver fishing license for 2 devices; [2003, c. 452, Pt. F, §11 (NEW); 2003, c. 452, Pt. X, §2 (AFF).]

C. A nonresident elver fishing license for one device; [2013, c. 468, §23 (AMD).]

D. A nonresident elver fishing license for 2 devices; [2013, c. 468, §23 (AMD).]

E. A resident elver fishing license with crew for one device; [2013, c. 468, §23 (NEW).]

F. A resident elver fishing license with crew for 2 devices; [2013, c. 468, §23 (NEW).]

G. A nonresident elver fishing license with crew for one device; or [2013, c. 468, §23 (NEW).]

H. A nonresident elver fishing license with crew for 2 devices. [2013, c. 468, §23 (NEW).]

The department may not issue a license under paragraph E, F, G or H until January 1, 2015.

[2013, c. 485, §5 (AMD) .]

1-A. **Licensed activity.** The holder of an elver fishing license or elver fishing license with crew may fish for, take or possess elvers. The holder of an elver fishing license or elver fishing license with crew may transport and sell within state limits elvers that the license holder has taken. The holder of an elver fishing license with crew is liable for the licensed activities under this subsection of an unlicensed crew member assisting that license holder pursuant to subsection 1-B. Only the license holder to whom a tag is issued may empty an elver fyke net.

[2013, c. 468, §24 (NEW) .]

1-B. **License limitations.** An elver fishing license with crew authorizes the license holder to engage in the licensed activities under subsection 1-A. The holder of an elver fishing license with crew may engage one unlicensed crew member to assist the license holder only in certain activities as authorized by rule, and the unlicensed crew member may assist only under the direct supervision of the license holder.

[2013, c. 468, §24 (NEW) .]

1-C. **Elver transaction card issued.** The department may issue an elver transaction card to each license holder under this section and to each license holder under section 6302-A, subsection 3, paragraphs E, E-1, F and G in accordance with section 6302-B. The department may charge each license holder an annual fee for the elver transaction card that may not exceed $35. Fees collected under this subsection must be deposited in the Eel and Elver Management Fund under section 6505-D. The license holder shall use the elver transaction card to meet electronic reporting requirements established by rule pursuant to section 6173. The elver transaction card must include the license holder's name and license number.

[2017, c. 250, §2 (AMD) .]

1-D. Use of elver transaction card required. The holder of an elver fishing license issued under this section or section 6302-A, subsection 3, paragraph E, E-1, F or G may not sell or transfer elvers the license holder has taken to an elver dealer licensed under section 6864 unless the holder of the elver fishing license presents to the elver dealer the elver transaction card issued to that person under subsection 1-C and that card is used to record the transaction between the license holder and the dealer so that the amount of elvers transferred or sold is deducted from the license holder’s quota.

[PL 2019, c. 163, §5 (AMD).]

1-E. **Elver transaction card limited.** A person may not possess an elver transaction card unless that person holds a license issued under this section or section 6302-A, subsection 3, paragraph E, E-1, F or G and the elver transaction card was issued to that person pursuant to subsection 1-C.

[2013, c. 468, §24 (NEW) .]

1-F. **Licenses issued.** The commissioner may issue up to 425 elver fishing licenses each year under this section.

[2017, c. 250, §3 (NEW) .]

2. **Eligibility.** An elver fishing license may be issued only to an individual who:

A. [1999, c. 534, §1 (RP).]

B. [1999, c. 534, §1 (RP).]

C. Possessed an elver fishing license in the previous calendar year; [2011, c. 549, §3 (AMD).]

D. [2005, c. 533, §1 (RP).]

E. Did not possess an elver fishing license in the previous calendar year because the commissioner had suspended the person’s license privileges for a length of time that included the previous calendar year; or [2011, c. 549, §3 (AMD).]

F. Becomes eligible to obtain an elver fishing license pursuant to the elver lottery under subsection 2-C. [2017, c. 250, §4 (AMD).]

[2017, c. 250, §4 (AMD) .]

2-A. **Elver license lottery.**

[2005, c. 533, §2 (RP) .]

2-B. **Elver lotteries.**

[2017, c. 250, §5 (RP) .]

2-C. **Elver license lottery.** The commissioner shall establish an elver fishing license lottery under which a person may become eligible for that license under subsection 2, paragraph F. An applicant to the lottery must submit a lottery application together with a $35 nonrefundable application fee no later than January 15th of the same calendar year as the lottery. An applicant may not submit more than 5 elver fishing license lottery applications per lottery year. In any year in which a lottery is held, the lottery must be held on or before February 15th.

The commissioner may adopt rules to implement the elver fishing license lottery, including provisions for the method and administration of the lottery. Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter 2-A.

Twenty-five dollars of the application fee collected under this subsection must be deposited in the Eel and Elver Management Fund established in section 6505-D and used to fund a life-cycle study of the elver fishery. Ten dollars of the application fee may be used by the department to fund the costs of administering the elver fishing license lottery.

[2017, c. 250, §6 (NEW) .]

3. **Limits on issuance.**

[2013, c. 8, §3 (RP) .]

3-A. **Elver fishing quotas.** The commissioner may adopt rules to establish, implement and administer an elver individual fishing quota system in order to ensure that the elver fishery annual landings do not exceed the overall annual quota established by the Atlantic States Marine Fisheries Commission. Except as provided in section 6575-L, a person issued a license under this section or section 6302-A, subsection 3, paragraph E, E-1, F or G may not take, possess or sell elvers in excess of the weight quota allocated to that person under the quota system. The rules must:

A. Establish an overall annual quota for the State; [2013, c. 485, §7 (NEW).]

B. Establish the amount of the overall annual quota under paragraph A that is allocated to persons licensed under this section and specify a formula to establish individual quotas for persons licensed under this section. The formula may take into account the amount of elvers a person licensed under this section lawfully harvested in previous seasons based on final harvesting reports. The rules must specify the date by which harvester reports are considered final for the purpose of determining individual quotas; and [2013, c. 485, §7 (NEW).]

C. Provide, in accordance with section 6302-B, that 21.9% of the overall annual quota under paragraph A is allocated to the federally recognized Indian tribes in the State and establish the amount of that portion of the overall annual quota allocated to the Passamaquoddy Tribe, the Penobscot Nation, the Houlton Band of Maliseet Indians and the Aroostook Band of Micmacs. [2013, c. 485, §7 (NEW).]

If persons issued licenses under this section collectively exceed the overall annual quota allocated to those persons pursuant to paragraph B, the number of pounds by which the license holders exceeded that overall annual quota must be deducted from the following year's overall annual quota allocated to persons licensed under this section. If the overage exceeds the overall annual quota allocated to persons licensed under this section for the following year, the overage must be deducted from the overall annual quota allocated to persons licensed under this section in subsequent years until the entire overage has been accounted for.

The commissioner may adopt or amend rules on an emergency basis if immediate action is necessary to establish and implement the elver individual fishing quota in advance of the beginning of the elver fishing season.

Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter 2-A.

[2015, c. 131, §1 (AMD) .]

4-A. **License fee.** Fees for elver fishing licenses are:

A. For a resident elver fishing license for one device, $55; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

B. For a resident elver fishing license for 2 devices, $63; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

C. For a nonresident elver fishing license for one device, $392; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

D. For a nonresident elver fishing license for 2 devices, $400; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

E. For a resident elver fishing license with crew for one device, $105; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

F. For a resident elver fishing license with crew for 2 devices, $113; [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

G. For a nonresident elver fishing license with crew for one device, $1,126; and [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

H. For a nonresident elver fishing license with crew for 2 devices, $1,134. [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

[2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF) .]

4-B. **License surcharge.** In addition to the license fee established in subsection 4-A, the commissioner shall assess a surcharge on each license issued under this section as follows:

A. For an elver fishing license issued under subsection 4-A, paragraphs A to D, $150; and [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

B. For an elver fishing license issued under subsection 4-A, paragraphs E to H, $300. [2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF).]

The surcharge fees collected under this subsection must be deposited in the Eel and Elver Management Fund established under section 6505-D.

[2017, c. 284, Pt. EEEEE, §8 (NEW); 2017, c. 284, Pt. EEEEE, §31 (AFF) .]

5. **Gear.** A person issued a license under this section may utilize one elver fyke net, one Sheldon eel trap or one dip net to fish for or take elvers without paying the fee required for a first net or trap pursuant to section 6505-B. A license issued under this section must identify the number and types of nets that the license holder may use pursuant to this section , section 6505-B and section 6575-B.

[2015, c. 391, §8 (AMD) .]

5-A. **Possession of elvers.** The holder of an elver fishing license may possess elvers only during the open season established in section 6575 and for up to 6 hours beyond the end of the open season.

[2013, c. 301, §10 (NEW) .]

6. **Minimum age.** A person who is under 15 years of age may not fish for or take elvers.

[2001, c. 421, Pt. B, §28 (AMD); 2001, c. 421, Pt. C, §1 (AFF) .]

7. **Nonresident licenses; reciprocity with other states.** A nonresident is eligible to purchase an elver fishing license only if the nonresident documents to the commissioner that the nonresident's state of residence allows Maine residents to purchase an elver license and fish for elvers in that state.

[1999, c. 7, §5 (NEW) .]

8. **Violation.**

[2013, c. 49, §8 (RP) .]

8-A. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §9 (NEW) .]

SECTION HISTORY
1995, c. 536, §A8 (NEW). 1997, c. 297, §§1,2 (AMD). 1999, c. 7, §§2-5 (AMD). 1999, c. 534, §§1-3 (AMD). 2001, c. 421, §§B27-29 (AMD). 2001, c. 421, §C1 (AFF). 2003, c. 20, §WW7 (AMD). 2003, c. 452, §F11 (AMD). 2003, c. 452, §X2 (AFF). 2005, c. 533, §§1,2 (AMD). 2007, c. 615, §15 (AMD). 2009, c. 213, Pt. G, §6 (AMD). 2011, c. 549, §§3-5 (AMD). 2013, c. 8, §§2, 3 (AMD). 2013, c. 49, §§8, 9 (AMD). 2013, c. 301, §§9, 10 (AMD). 2013, c. 468, §§23-25 (AMD). 2013, c. 485, §§5-7 (AMD). 2015, c. 131, §1 (AMD). 2015, c. 391, §8 (AMD). 2017, c. 250, §§2-7 (AMD). 2017, c. 284, Pt. EEEEE, §§7, 8 (AMD). 2017, c. 284, Pt. EEEEE, §31 (AFF).

§6505-B. ELVER GEAR FEES

1. **Elver fyke net and Sheldon eel trap fee.** A person may not submerge an elver fyke net or a Sheldon eel trap in the waters of the State to fish for or take elvers unless the net or trap owner pays annually the following fees:

A. Fifty dollars per net or trap for the use of an elver fyke net or Sheldon eel trap, except that the fee under this paragraph does not apply to an elver fyke net or Sheldon eel trap a person utilizes pursuant to section 6505-A, subsection 5. [2017, c. 284, Pt. EEEEE, §9 (AMD).]

B. [1999, c. 7, §6 (RP).]

C. [1999, c. 7, §6 (RP).]

[2017, c. 284, Pt. EEEEE, §9 (AMD) .]

2. **Tags for elver fyke net and Sheldon eel trap.** A person may not submerge an elver fyke net or Sheldon eel trap in the coastal waters of the State to fish for or take elvers unless a tag issued by the department is affixed to the shoreside wing of the net or trap and is clearly visible. The department may issue a replacement tag when an owner issued a tag documents that a net or trap has been damaged or lost.

[2001, c. 421, Pt. B, §30 (AMD); 2001, c. 421, Pt. C, §1 (AFF) .]

3. **Dip net fee.** A person may not utilize a dip net to fish for or take elvers without paying a fee of $50 per dip net annually.

This subsection does not apply to a dip net a person utilizes pursuant to section 6505-A, subsection 5.

[2017, c. 284, Pt. EEEEE, §10 (AMD) .]

4. **Payment with license.** The fees required under subsections 1 and 3 must be paid upon application for an elver fishing license under section 6505-A.

[1995, c. 536, Pt. A, §8 (NEW) .]

5. **Disposition of fees.** Fees collected under this section accrue to the Eel and Elver Management Fund established in section 6505-D.

A. [2017, c. 284, Pt. EEEEE, §11 (RP).]

B. [2017, c. 284, Pt. EEEEE, §11 (RP).]

[2017, c. 284, Pt. EEEEE, §11 (AMD) .]

6. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §10 (AMD) .]

SECTION HISTORY
1995, c. 536, §A8 (NEW). 1997, c. 297, §§3-5 (AMD). 1997, c. 575, §2 (AMD). 1999, c. 7, §6 (AMD). 2001, c. 421, §B30 (AMD). 2001, c. 421, §C1 (AFF). 2009, c. 213, Pt. G, §§7-9 (AMD). 2011, c. 549, §6 (AMD). 2013, c. 49, §10 (AMD). 2017, c. 284, Pt. EEEEE, §§9-11 (AMD).

§6505-D. EEL AND ELVER MANAGEMENT FUND

1. **Fund established.** The Eel and Elver Management Fund, referred to in this section as the "fund," is established as a dedicated, nonlapsing fund.

[1995, c. 536, Pt. A, §8 (NEW) .]

2. **Permissible uses.** The commissioner may use the fund to research and manage the State's eel and elver resources, to enforce the laws related to eels and elvers and to cover the costs associated with determining eligibility for elver fishing licenses.

[2011, c. 266, Pt. A, §17 (AMD) .]

3. **Plan required.**

[2011, c. 266, Pt. A, §18 (RP) .]

SECTION HISTORY
1995, c. 536, §A8 (NEW). 1999, c. 309, §2 (AMD). 2011, c. 266, Pt. A, §§17, 18 (AMD).

Article 5: ELVER AND EEL LIMITATIONS

§6575. OPEN SEASON; ELVER HARVESTING

1. **Open season.** It is unlawful for a person to fish for or take elvers within the waters of the State except during the open season from noon on March 22nd to noon on June 7th.

[2015, c. 391, §9 (AMD) .]

1-A. **Federally recognized Indian tribes; violation.** It is unlawful for a person to fish for or take elvers in violation of rules adopted by the commissioner under section 6302-B, subsection 4.

[2015, c. 391, §10 (NEW) .]

2. **Setting nets and traps.** It is unlawful for a person to immerse or leave immersed an elver fyke net or a Sheldon eel trap in any river, stream or brook of the waters of the State at any time other than the open season for elver fishing.

[1999, c. 7, §7 (AMD) .]

3. **Locating nets.** It is unlawful for a person to designate or claim by any means a location in which to set an elver fyke net or a Sheldon eel trap at any time other than the open season for elver fishing.

[1999, c. 7, §7 (AMD) .]

4. **Nets of certain sizes.**

[1999, c. 7, §7 (RP) .]

5. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §11 (NEW) .]

SECTION HISTORY
1995, c. 536, §A9 (NEW). 1995, c. 536, §A13 (AFF). 1997, c. 91, §4 (AMD). 1999, c. 7, §7 (AMD). 2013, c. 49, §11 (AMD). 2015, c. 391, §§9, 10 (AMD).

§6575-A. CLOSED PERIOD; ELVER HARVESTING

(REPEALED)

SECTION HISTORY
1995, c. 536, §A9 (NEW). 1995, c. 536, §A13 (AFF). 1997, c. 575, §3 (AMD). 1999, c. 7, §8 (AMD). 2011, c. 549, §7 (AMD). 2013, c. 49, §12 (RPR). 2013, c. 468, §26 (AMD). 2015, c. 391, §11 (RP).

§6575-B. METHOD OF ELVER FISHING; LIMITS ON GEAR

1. **Gear.** It is unlawful for a person to fish for or take elvers by any method other than by dip net, elver fyke net or Sheldon eel trap.

[1995, c. 536, Pt. A, §9 (NEW) .]

2. **Number of elver fyke nets and Sheldon eel traps.**

[1999, c. 7, §9 (RP) .]

2-A. **Number of nets and Sheldon eel traps.**

[1999, c. 534, §4 (RP) .]

2-B. **Type and amount of gear.** It is unlawful for a person to immerse elver fishing gear other than the types and amounts listed on the person's license pursuant to section 6505-A, subsection 5. A person may not immerse an amount of elver fishing gear that exceeds the amount of elver fishing gear listed on the person's license for the previous elver fishing season. A person may elect which types of gear are listed on the person's license prior to the issuance of the license for that elver fishing season. The commissioner may adopt rules to implement this subsection. Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter 2-A.

A. [2015, c. 391, §12 (RP).]

B. [2005, c. 533, §3 (RP).]

C. [2005, c. 533, §3 (RP).]

[2015, c. 391, §12 (AMD) .]

3. **Rebuttable presumption.** It is a rebuttable presumption that an elver fyke net, Sheldon eel trap or elver dip net immersed in any waters of the State at any time of the year is immersed for the purpose of fishing for or taking elvers.

[1999, c. 7, §11 (AMD) .]

4. **Prohibition on fishing from boats.** It is unlawful for a person to set or tend an elver fyke net or a Sheldon eel trap from a boat or to fish for or take elvers from a boat. A person may transport an elver fyke net, a Sheldon eel trap or a dip net by boat.

[1995, c. 536, Pt. A, §9 (NEW) .]

5. **Use of dip nets.** It is unlawful for a person to use a dip net to fish for or take elvers while standing in the coastal waters of the State.

[1997, c. 575, §4 (AMD) .]

6. **Prohibition on fishing from artificial platforms.** A person may not build or use an artificial platform to fish for elvers. This subsection does not prohibit fishing for elvers from piers or floats established for purposes other than elver fishing.

[1999, c. 7, §12 (NEW) .]

7. **Bycatch release.** A person immediately shall return alive into the waters of the State any species other than elver that is caught in an elver fyke net.

[1999, c. 7, §12 (NEW) .]

8. **St. Croix River; use of fyke nets prohibited.**

[2015, c. 391, §13 (RP) .]

SECTION HISTORY
1995, c. 536, §A9 (NEW). 1997, c. 91, §5 (AMD). 1997, c. 575, §4 (AMD). 1999, c. 7, §§9-12 (AMD). 1999, c. 534, §§4,5 (AMD). 2005, c. 533, §3 (AMD). 2013, c. 468, §27 (AMD). 2015, c. 391, §§12, 13 (AMD).

§6575-C. CLOSED AREAS; ELVER FISHING

1. **Dams with fishways.**

[2013, c. 49, §13 (RP) .]

2. **River herring traps.** A person may not fish for or take elvers within 50 feet of a licensed river herring trap.

[2011, c. 598, §25 (AMD) .]

3. **Portion of rivers, streams and brooks.** A person may not:

A. Fish for or take elvers at any time within the middle 1/3 of a river, stream, brook or other watercourse, as measured at mean high tide, within the coastal waters of the State; or [2003, c. 452, Pt. F, §14 (NEW); 2003, c. 452, Pt. X, §2 (AFF).]

B. Obstruct the middle 1/3 of any river, stream, brook or other watercourse, as measured at mean low tide, within the coastal waters of the State. [2003, c. 452, Pt. F, §14 (NEW); 2003, c. 452, Pt. X, §2 (AFF).]

[2003, c. 452, Pt. F, §14 (RPR); 2003, c. 452, Pt. X, §2 (AFF) .]

4. **Dip nets near elver fyke nets.** A person may not fish for or take elvers with a dip net in the mouth of an elver fyke net. For the purposes of this subsection, "mouth of an elver fyke net" means that area within an elver fyke net that is net-side of a straight line that runs from one meshed wing tip of the net to the other meshed wing tip.

[2003, c. 452, Pt. F, §15 (AMD); 2003, c. 452, Pt. X, §2 (AFF) .]

5. **Fyke net placement.** A person may not place or set an elver fyke net or take elvers from an elver fyke net when any portion of the net, including any anchoring device, is located within an imaginary line between the wing ends of another elver fyke net. Cod end anchoring devices may not exceed 10 feet in length and wing end anchoring devices may not interfere with or create a hazard to navigation within the middle 1/3 of a navigable watercourse. A marine patrol officer may open the cod end of a net that is located in violation of this subsection.

[1999, c. 7, §13 (NEW) .]

6. **Obstructing elver fyke nets.** A person may not set an elver fyke net or place an obstruction near an elver fyke net in a manner that interferes with the operation of an elver fyke net.

[1999, c. 7, §13 (NEW) .]

7. **Rulemaking; gear placement.** If necessary to conserve the elver resource, the commissioner may adopt rules pursuant to section 6171 relating to placement of elver fishing gear based on the configuration of specific rivers, streams, brooks or other watercourses. Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter II-A.

[1999, c. 7, §13 (NEW) .]

SECTION HISTORY
1995, c. 536, §A9 (NEW). 1997, c. 91, §6 (AMD). 1997, c. 575, §5 (AMD). 1999, c. 7, §13 (AMD). 2003, c. 452, §§F13-15 (AMD). 2003, c. 452, §X2 (AFF). 2011, c. 598, §25 (AMD). 2013, c. 49, §13 (AMD).

§6575-D. MOLESTING ELVER FISHING GEAR

1. **Prohibition.** Except as provided in subsection 1-A, a person other than a marine patrol officer or the license holder issued a tag for an elver fyke net may not utilize, transfer, alter, possess or in any manner handle the net unless that person has been issued a license to fish for elvers with an elver fyke net under section 6302-A, subsection 3, paragraph E, E-1, F or G or section 6505-A or a license to fish for elvers with crew with an elver fyke net under

section 6505-A and the license holder issued the tag for the elver fyke net is present and assisting in setting, tending or removing the net.

A. [1999, c. 7, §14 (RP).]

B. [2013, c. 468, §28 (RP).]

[2013, c. 468, §28 (AMD) .]

1-A. **Restriction on emptying net or trap; exception.** A person other than the license holder identified on the tag for an elver fyke net or a Sheldon eel trap may not empty that net or trap unless that person has been issued an elver fishing license for the same gear type and has been issued written permission by a marine patrol officer to tend that net or trap. A marine patrol officer may issue a person written permission for the person to tend the license holder's net or trap only for the purpose of releasing captured elvers into the waters of the State if the license holder is temporarily unable to tend that net or trap because of a disability or personal or family medical condition. If the license holder is unable to tend that net or trap for more than 2 consecutive weeks, the net or trap must be removed from the water.

[2013, c. 468, §28 (NEW) .]

2. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §14 (AMD) .]

SECTION HISTORY
1995, c. 536, §A9 (NEW). 1999, c. 7, §14 (AMD). 2001, c. 421, §B34 (AMD). 2001, c. 421, §C1 (AFF). 2011, c. 549, §8 (AMD). 2013, c. 49, §14 (AMD). 2013, c. 468, §28 (AMD).

§6575-F. WEST SIDE OF ORLAND RIVER CLOSED TO ELVER FISHING

A person may not fish for or take elvers within the portion of the Orland River between the west bank and the center of the river from the southernmost point of land on Fish Point to the dam in Orland. [1999, c. 18, §1 (NEW).]

SECTION HISTORY
1999, c. 18, §1 (NEW).

§6575-G. DAMS WITH FISHWAYS; ELVER FISHING

1. **Dams with fishways.** A person may not fish for or take elvers within 150 feet of any part of a dam with a fishway or within 150 feet of a fishway.

[2013, c. 49, §15 (NEW) .]

2. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §15 (NEW) .]

SECTION HISTORY
2013, c. 49, §15 (NEW).

§6575-H. SALE AND PURCHASE OF ELVERS

1. **Sale of elvers.** A person may not sell elvers except as follows.

A. A person may not sell elvers except to a person who holds a valid elver dealer's license under section 6864 or a person who, pursuant to section 6864, subsection 9, is an authorized representative of a person holding a license issued under section 6864. [2013, c. 301, §12 (NEW).]

B. A person may not accept payment for elvers in any form other than a check or cashier's check that identifies both the buyer, by whom the landings will be reported, and the seller, each of whom must be a person holding a license issued under section 6864, a person who, pursuant to section 6864, subsection 9, is an authorized representative of a person holding a license issued under section 6864 or a person holding a license issued under section 6302-A, subsection 3, paragraph E, E-1, F or G or section 6505-A. [2013, c. 468, §29 (AMD).]

[2013, c. 468, §29 (AMD) .]

1-A. **Purchase of elvers.** A person who holds a valid elver dealer's license under section 6864 or a person who, pursuant to section 6864, subsection 9, is an authorized representative of a person holding a license issued under section 6864 shall post at the point of sale the price that that buyer will pay.

[2013, c. 485, §8 (NEW) .]

2. **Violation.** A person who violates this section commits a Class D crime for which a fine of $2,000 must be imposed, none of which may be suspended. Violation of this section is a strict liability crime as defined in Title 17-A, section 34, subsection 4-A.

[2013, c. 49, §15 (NEW) .]

SECTION HISTORY
2013, c. 49, §15 (NEW). 2013, c. 301, §12 (AMD). 2013, c. 468, §29 (AMD). 2013, c. 485, §8 (AMD).

§6575-I. ASSISTING IN ILLEGAL HARVEST OF ELVERS

(REPEALED)

SECTION HISTORY
2013, c. 301, §13 (NEW). 2013, c. 468, §30 (RP).

§6575-J. Seizure of illegal elvers

In addition to any other penalty imposed, elvers that are taken, sold, purchased or possessed in violation of any law or rule pertaining to elvers are subject to seizure by any officer authorized to enforce this Part. The entire bulk pile containing illegal elvers may be seized. For the purposes of this section, "bulk pile" means all elvers in the possession of a person who fished for, took, possesses or bought elvers in violation of any law or rule regulating elvers under this Part. [PL 2019, c. 163, §6 (AMD).]

§6575-K. ELVER INDIVIDUAL FISHING QUOTA

1. **Prohibition on possession or sale of elvers in excess of elver individual fishing quota.** A person may not possess or sell a weight of elvers that exceeds the elver individual fishing quota that person has been allocated for the fishing season pursuant to section 6505-A, subsection 3-A, plus any additional quota the person may be authorized to take under section 6575-L.

[2015, c. 131, §2 (AMD) .]

2. **Prohibition on fishing after elver individual fishing quota has been reached.** Except as provided in section 6575-L, this section applies to fishing after a person's elver individual fishing quota has been reached. A person who has sold a weight of elvers that meets or exceeds that person's elver individual fishing quota may not fish for or possess elvers for the remainder of the season, except that such a person who has been issued a license to fish for elvers may in accordance with section 6575-D assist another person who has been issued a license to fish for elvers who has not met or exceeded that person's elver individual fishing quota as provided in section 6505-A, subsection 3-A. All gear tagged by a license holder who has met or exceeded that person's elver individual fishing quota must be removed. A marine patrol officer may seize the elver transaction card of a license holder who has met or exceeded that person's elver individual fishing quota.

[2015, c. 131, §2 (AMD) .]

3. **Violation.** An individual who in fact violates this section commits a crime in accordance with section 6204 for which a fine of $2,000 must be imposed, none of which may be suspended.

[2013, c. 485, §9 (NEW) .]

SECTION HISTORY
2013, c. 485, §9 (NEW). 2015, c. 131, §2 (AMD).

§6575-L. TEMPORARY MEDICAL TRANSFER

The commissioner may authorize a temporary medical transfer of the elver individual fishing quota allocated to a person under section 6505-A in accordance with this section. The holder of an elver fishing license who requests a temporary medical transfer under this section must maintain a valid elver fishing license during the duration of the temporary medical transfer. [2015, c. 131, §3 (NEW).]

1. **Temporary medical transfer requested prior to March 1st.** Notwithstanding section 6505-A, subsection 3-A, the commissioner may authorize a temporary medical transfer that permits the holder of an elver fishing license issued under section 6505-A to transfer the entire annual quota allocated to that person to another person holding an elver fishing license issued under section 6505-A if the following criteria are met:

A. The transferor reported elver landings in the prior fishing year; [2015, c. 131, §3 (NEW).]

B. The transferor is unable to fish the quota allocated to the transferor because the transferor has experienced a substantial illness or medical condition. The transferor shall provide the commissioner with documentation from a physician describing the substantial illness or medical condition; and [2015, c. 131, §3 (NEW).]

C. The transferor requests a temporary medical transfer in writing before March 1st of the fishing year for which it is being requested, except that the commissioner may adopt rules that provide a method for authorizing a temporary medical transfer requested after March 1st to address emergency medical conditions. [2015, c. 131, §3 (NEW).]

Rules adopted pursuant to this subsection are routine technical rules as defined in Title 5, chapter 375, subchapter 2-A.

[2015, c. 1, §5 (COR) .]

SECTION HISTORY
RR 2015, c. 1, §5 (COR). 2015, c. 131, §3 (NEW).