Atlantic States Marine Fisheries Commission

American Eel Management Board

August 2, 2017
10:15 – 11:15 a.m.
Alexandria, Virginia

Draft Agenda

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

1. Welcome/Call to Order (*J. Clark*) 10:15 a.m.

2. Board Consent 10:15 a.m.
   - Approval of Agenda
   - Approval of Proceedings from January 2017

3. Public Comment 10:20 a.m.

4. Consider North Carolina Glass Eel Aquaculture Plan for 2018 **Action** 10:30 a.m.
   (*K. Rootes-Murdy*)
   - Technical Committee Report
   - Law Enforcement Committee Report (*M. Robson*)

5. Consider 2016 Yellow Eel Landings Overage and Coastwide Cap **Possible Action** 11:00 a.m.
   (K.Rootes-Murdy)

6. Consider 2016 American Eel FMP Review and State Compliance **Action** 11:10 a.m.
   (*K.Rootes-Murdy*)

7. Other Business/Adjourn 11:15 a.m.

The meeting will be held at The Westin Alexandria, 400 Courthouse Square, Alexandria, Virginia; 703.253.8600

Atlantic States Marine Fisheries Commission

MEETING OVERVIEW

American Eel Management Board Meeting
August 2, 2017
10:15 – 11:15 a.m.
Alexandria, Virginia

Chair: John Clark Assumed Chairmanship: 8/15	Technical Committee Chair: Tim Wildman (CT)	Law Enforcement Committee Representative: Cornish
Vice Chair: Martin Gary	Advisory Panel Chair: Mari-Beth Delucia	Previous Board Meeting: January 31, 2017

Voting Members: **ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA, NC, SC, GA, FL, D.C., PRFC, USFWS, NMFS (19 votes)**

2. Board Consent:

- Approval of Agenda
- Approval of Proceedings from January 2017 Board Meeting

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-up 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 Board Chair will not allow additional public comment. 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 North Carolina Glass Eel Aquaculture Plan for 2018 (10:30 – 11:00 a.m.) Action

Background

- In August 2016 meeting, the Board approved the revised North Carolina Aquaculture Plan for 2017. The revised plan sought to improve harvest of glass eels as none were captured in 2016.
- North Carolina submitted a new Aquaculture Plan for 2018 through 2020 on behalf of the American Eel Farm (AEF) in June **(Briefing Materials)**.
- In July, the Technical Committee met to review the new aquaculture plan and provide technical feedback and recommendations for the Board's consideration (**Briefing Materials**). Later in the month, the Law Enforcement Committee met to review the new plan and provide feedback on enforcement and monitoring changes (**Supplemental Materials**)

Presentations

- North Carolina Glass Eel Aquaculture Plan for 2018-2020 by K. Rootes-Murdy

- Technical Committee Report by J. Zimmerman
- Law Enforcement Committee Report by M. Robson

Board actions for consideration at this meeting

- Consider approval of North Carolina's Aquaculture Plan for Implementation in 2018

5. Consider 2016 Yellow Eel Landings Overage and Coastwide Cap (11:00 – 11:10 a.m.) Possible Action

Background

- Addendum IV (2014) specified an annual coastwide cap for yellow eel harvest at 907,671 pounds. Two management triggers are also specified that if either are tripped, would implement state-by-state quotas the following year.
- Based on preliminary 2016 yellow eel landings data, the coastwide landings were 928,358 pounds, exceeding the coastwide cap. If the coastwide cap were exceeded again in 2017, state-by-state quotas would be implemented. (**Briefing Materials**)

Presentation

- 2016 Preliminary yellow eel landings and Addendum IV provisions by K. Rootes-Murdy

Board actions for consideration at this meeting

- Management action in 2017 for the yellow eel fishery

6. Fishery Management Plan Review (11:10 – 11:15 a.m.) Action

Background

- State compliance reports were due on September 1
- The PRT reviewed and compiled the annual FMP Review (**Briefing Materials**)
- New Hampshire, Massachusetts, Pennsylvania, the District of Columbia, South Carolina, and Georgia requested and meet the requirements for *de minimis* for yellow eel
- South Carolina requested but did not meet the requirements for *de minimis* for glass eel

Presentation

- Overview of the 2016 Fishery Management Plan Review by K. Rootes-Murdy

Board actions for consideration at this meeting

- Accept the 2016 FMP Review and approve *de minimis* requests

7. Other Business/ Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN EEL MANAGEMENT BOARD

The Westin Alexandria
Alexandria, Virginia
January 31, 2017

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

Pat Keliher, ME (AA)
Steve Train, ME (GA)
Rep. Jeffrey Pierce, ME, proxy for Sen. Langley (LA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Cheri Patterson, NH, proxy for D. Grout (AA)
G. Ritchie White, NH (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Raymond Kane, MA (GA)
Robert Ballou, RI, proxy for J. Coit (AA)
Lance Stewart, CT (GA)
Colleen Giannini, CT, proxy for M. Alexander (AA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Russ Allen, NJ, proxy for D. Chanda (AA)
Andrew Shiels, PA, proxy for J. Arway (AA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Kathy Knowlton, DE, proxy for R. Miller (GA)
Rachel Dean, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Lynn Fegley, MD, proxy for D. Blazer (AA)
Joe Cimino, VA, proxy for J. Bull (AA)
David Bush, NC, proxy for D. Brady (GA)
Michelle Duval, NC, proxy for B. Davis (AA)
Pat Geer, GA, proxy for Rep. Nimmer (LA)
Jim Estes, FL, proxy for J. McCawley (AA)
Sherry White, USFWS
Chris Wright, NMFS
Martin Gary, PRFC

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

Ex-Officio Members

Staff

Bob Beal
Toni Kerns
Kirby Rootes-Murdy
Kristen Anstead

Guests

Darrel Young, MEFA
Angela Young, MEFA
Arnold Leo, E. Hampton, NY

The American Eel Management Board of the Atlantic States Marine Fisheries Commission convened in the Edison Ballroom of the Westin Hotel, Alexandria, Virginia, January 31 2017, and was called to order at 4:15 o'clock p.m. by Chairman John Clark.

CALL TO ORDER

CHAIRMAN JOHN CLARK: This is the American Eel Board; we will be getting started right now. Will everybody on the Board please take your seats? Nobody signed up for public comment.

APPROVAL OF AGENDA

CHAIRMAN CLARK: Has everybody seen the agenda? Are there any changes or additions to the agenda? Seeing none; are there any objections to the agenda, and seeing none it is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN CLARK: Everybody has had a chance to look at the minutes from the last meeting. Are there any changes to the minutes? Seeing none; the minutes are approved.

REVIEW OF THE 2017 STOCK ASSESSMENT UPDATE SCHEDULE

CHAIRMAN CLARK: Now we'll move right on to Item 4, which is to Review the 2017 Stock Assessment Update Schedule; and I'll turn it over to Kristen.

MS. KRISTEN ANSTEAD: Today I'm going to review our timeline and expectations for our update that is due later this year. Just as a reminder, in April of last year the TC met to discuss the five-year trigger of either an update or a benchmark; and at that time recommended doing an update for 2017.

The TC got together in September to review the young-of-the-year surveys, but also to discuss what sort of timeline they could meet; as far as having the fishery independent data in and establish when we could have our terminal year. In December the SAS was repopulated. We have a couple of new members, Matt Cieri from Maine, and Troy from VIMS.

We had gotten a call in January to go over what datasets would be needed, and to assign tasks and develop a more solid timeline. This is where we are with our update. We've already sent out data requests to the states based on the TC feedback. They thought they could meet a 2016 terminal year, and so that's for the fishery independent data.

We expect that data to be in by March 1st, with the associated biological data to support the modeling. Some states felt that they could have preliminary landings by April or May. We want to make the terminal year for those 2016 as well; but we are fine with not finalizing those until the end of the year, because the landings are not included in the modeling approaches that we'll be updating.

We'll kind of stick that in at the end, so that's fine to not have those finalized until the end of the year. We'll spend the summer doing our analysis, and hope to present it at annual meeting in October; the full update. The update we will be adding more years to the modeling, and I just want to remind you we can't change the modeling structure or that would be a benchmark. That means for this update we will be updating the trend analysis from the last stock assessment, which is the Mann-Kendall, the Manly, the ARIMA, and the Power Analysis; as well as updating the growth analysis, and that is on a regional and coastwide level. We will not be updating the SB-SRA, because additional work is needed. That additional work would require a peer review; so that would have to wait for a benchmark.

We also will not be updating the traffic light approach, because that also needs more

improvements that would require a peer review. What you will get out of this update is the updated landings; both on a regional coastwide trends in abundance for the trend analyses. For these coastwide and regional abundances you'll have are they declining, staying the same, increasing. This will be for both young-of-the-year and the yellow eel surveys.

What you will not get out of this is an overfishing or overfished status. AREMA is the only one out of those trend analyses that produces reference points, but the Review Panel did not recommend them for use for management. We will not be getting any reference points out of this, it will just be is the stock depleted, what are the regional trends?

We are also updating the growth analysis, so the length, weight, age-at-length relationships by region and sex and how they differ, and an updated life history section; which we'll pull from the literature and any new research. I will just remind you why we're doing an update instead of a benchmark, and that is because in the last assessment the Review Panel and the SAS and the TC developed a list of required research recommendations that needed to be improved before the next benchmark is considered.

This is the list of sort of the critically needed research in order to start thinking about a benchmark; and when the TC reviewed this list and went back to the states to say has this work been initiated or completed? Not enough work had been done to start a benchmark; so that is why we're doing an update. I'll take any questions you have.

CHAIRMAN CLARK: Any questions for Kristen? Seeing none; I had one, Kristen. I was just wondering the whole idea of the depleted status of eels came from the DB-SRA. From the trend analysis we will not be getting that determination, we'll just know whether the stock has been increasing, decreasing or staying about the same?

MS. ANSTEAD: Correct. We certainly will not be getting an overfished/overfishing, but we will see has any movement happened in the trends regionally and coastwide.

CHAIRMAN CLARK: Okay I was just curious, because that was sort of the basis for going to the last addendum and putting in the coastal cap was based on that depleted status. Interesting that won't go ahead.

TECHNICAL COMMITTEE REPORT

CHAIRMAN CLARK: Seeing no further questions; I will now turn it over to Kirby for the Technical Committee report.

MR. KIRBY ROOTES-MURDY: This will be a pretty short presentation, we were working under the understanding that we were going to have less time, and so we truncated that. In addition, I'm giving this presentation rather than Tim Wildman, our TC Chair, as we were concerned that it wouldn't make sense for him to come down for a ten minute presentation.

Getting into it, I'm going to walk through just some of the items that the Technical Committee discussed when they met back in September of last year; the young-of-year surveys, the updates on nematode research, the Maine-life-cycle study and otolith exchange, and landings versus harvester reports. These were some of the discussion areas the TC had. I've crossed through points that Kirsten has touched on that were pertinent to the stock assessment update and schedule.

REVIEW YOUNG OF YEAR SURVEYS AND MAINE LIFE CYCLE SURVEY

MR. ROOTES-MURDY: The Technical Committee when they met back in September walked through all of the state young-of-year surveys from Maine down to Florida; everything from

the methods, the results, and some of the challenges.

For example, Georgia recently moved from having a young-of-year survey to a yellow eel, in part because of an inability to encounter a lot of young-of-year. What a lot of people have noted in these discussions was that many of the survey location sites were selected opportunistically, due to logistics of trying to set up the gear; and also to encounter young-of-year.

With that you don't always get great long term data from that approach. What the Technical Committee has recommended that moving forward if a state looks to try to either move their young-of-year survey to a different location or not conduct the young-of-year survey, because they're not encountering it; that they should replace it with another survey for a life stage, such as yellow or silver.

One of the challenges that did get some discussion by the group was that not all of the young-of-year surveys that the plan requires the states to implement provide equal or important information to the stock assessment process. It is something that they're trying to determine at the Technical Committee level; what the best approach is to really lay out which ones are very helpful in tracking a trend over time, and which ones aren't and then how best to recommend changing those.

One way that they're looking at doing this is that a couple of the members, Brad Chase and Laura Lee are conducting a power analysis. They initially pursued this research about a year or so ago and then stopped. They're looking to pick it back up, but basically try to use this power analysis to indicate which young-of-year surveys are tracking a trend, with regards to the population, which aren't.

Then from there start to hone in on those ones that aren't and how best to improve them or recommend a different survey approach. Other areas that the Technical Committee touched on was nematode research, we had a VIMS grad student Zoemma, who presented her results to the TC; largely trying to pull from information the states all provided regarding presence/absence for detecting nematodes in their coastal waters.

The TC was very interested in her results, and are hoping to have that presented again to the Technical Committee later this year, with the possible recommendation of having the Board receive a presentation from her; because it is very pertinent to management. Regarding the Maine-life-cycle study, we got an update from the Maine TC member who highlighted that due to staffing, gear, construction, at some of the survey sites, it created a lot of challenges in the first year of this survey to try to get great data.

There is a lot more hope on Year 2, because of dedicated staff member has been hired to complete this work, and improvements are expected in the second year. Then with regard to the otolith exchange, there has been a process set up by actually Kristen, to start that exchange among the states of I believe Maine all the way down to Florida. They are looking to discuss the results later this spring, possibly publish a report ahead of the stock assessment update; and there is the potential of an in-person workshop to go over that. Last, in talking about landings versus harvester reports. This was a topic that was brought up regarding how best to inform management coming out of the next stock assessment update. Because these terms have been used interchangeably, over the past few years there has been problems when you set quotas based on data that is a mix of these two; when in fact they're truly two different types of data.

There are efforts underway right now to try to get both landings and harvester report information updated through the terminal year for this 2017 stock assessment update. But in the interim time before that's completed, the stock assessment update is that states should be

using harvester reports, and that they should be largely evaluating them against landings.

Whichever of the two is the highest has been the standard approach in the past, but they also need to evaluate where there are discrepancies, to try to make improvements there, and that hopefully coming out of the stock assessment update there could be a more improved approach for reconciling those differences, and providing management with advice on which is more accurate moving forward. With that I'll take any questions.

CHAIRMAN CLARK: Kirby, would you also before you get to the questions, just address the implications of the TC talking about states discontinuing young-of-the-year surveys or transferring them due to the requirements of the plan?

MR. ROOTES-MURDY: Sure, so right now no states are allowed to just drop the survey requirement. What they can do is have these exceptions such as what Georgia went for, which is if you are no longer able to conduct a young-of-year survey based on challenges that have been laid out, to move to another survey type; so looking at a different life stage is primarily the way the Technical Committee is recommending those states work around that challenge in the future, if it arises for other states.

CHAIRMAN CLARK: That does have to be approved by the Board though, correct?

MR. ROOTES-MURDY: That's correct.

CHAIRMAN CLARK: Are there any questions for Kirby? Dan.

MR. DAN McKIERNAN: Kirby, could you elaborate on the nematode research and how that is deemed useful?

MR. ROOTES-MURDY: I can try. We have this grad student from VIMS, Zoemma, who has done work at basically trying to determine how nematodes are affecting early development of eels; and if it's deterring their growth. There are some other components to her study, not just looking at presence/absence. Maybe Kristen, if you remember, could speak to it a little bit more.

MS. ANSTEAD: Yes, I think she's trying to come up with a system where states can like she'll come up with a one-page laminated thing where states have a very easy protocol for determining whether or not there is nematode presence in their eels; and at what stage of development it is. Is it at the last stage of the eel being sick with this nematode or are they just infected? When we get to the next benchmark that could help us kind of talk about productivity in each of the regions, if we have regional data where the nematode is more present than others, we know that this effects the eels. Like Kirby said their growth or their ability to reproduce or their movement. It will factor in.

CHAIRMAN CLARK: Bob Ballou.

MR. BOB BALLOU: Thank you, Mr. Chair. I'm struck by the fact that now five years after the last benchmark, we're still lagging in terms of providing the research necessary to fill the gap and allow for the next benchmark to take place. How are things progressing in that regard? Is there a sense that that gap is likely to close in relatively short order? I guess the related question is, when is the next benchmark planned; and how likely is it that the research will be provided in time to make that happen?

MS. ANSTEAD: One thing the TC did do last year in the spring, was look at every research recommendation that was made in the last assessment and have states go in and say whether this work has started. Some of it has been. But when we thought about doing the benchmark, we thought if we put it off just a little bit longer it would give us better – because there was so much trouble with the modeling in the last one.

Why not wait and get the data we really want, so we hope soon? That was part of the motivation of doing the update, was keep it in people's minds, reevaluate the trends. It is still valuable work and it will restate what we need to try to make that sooner. Three to five years, hopefully, but I can't say.

OTHER BUSINESS

UPDATE ON AMERICAN EEL FARM PROJECT IN NORTH CAROLINA

CHAIRMAN CLARK: Any further questions? Seeing none; moving on to our next agenda item. Under other business, Dr. Duval has an update on the American Eel Farm project in North Carolina, where they're looking at raising glass eels.

DR. MICHELLE DUVAL: Yes, for the opportunity to provide the Board with some input. I just wanted to let folks know that the American Eel Farm attempted to deploy some nets on the White Oak River, on the 18th of the month, but had some boat problems; so that was unsuccessful.

But they did manage to get a net deployed in that river system on the 23rd of last week, and apparently they have harvested 52 glass eels; that is individuals, not pounds.

I also just wanted to let folks know that Marine Patrol did conduct an inspection of the facility; it took about an hour and a half.

The owner was very cooperative, didn't find anything out of alignment. Tanks were ready to hold eels, so everything went according to expectations and I'll just also note that our Legislature is in session again. We're undergoing a transition in terms of administration so things are going to be somewhat unsettled, I think for a little bit.

But we are finalizing our legislative requests for this upcoming year, and one of those as we discussed at the last Board meeting is to amend the statutory language that inadvertently roped our marine patrol officers into not having the ability to inspect folks without a reasonable suspicion. Now that doesn't necessarily apply to the Eel Farm, because they are permitted, there are very stringent permits requirements as we discussed at the last Board meeting; but I did just want to let folks know that.

ADJOURNMENT

CHAIRMAN CLARK: Any questions? Seeing none; and with no other business coming before the Board, we are adjourned.

(Whereupon, the meeting was adjourned at 4:34 o'clock p.m., January 31, 2017.)

North Carolina Aquaculture Plan for American Eel Pursuant to Addendum IV to the ASMFC Interstate Fishery Management Plan for American Eel

North Carolina Department of Environmental Quality
Division of Marine Fisheries
PO Box 769
Morehead City, NC 28557

May 2017

BACKGROUND

Globally, the U.S. is a minor producer of aquaculture products, ranking 15th in a United Nations Food and Agriculture Organization report (FAO 2014). It would be beneficial to expand aquaculture in the U.S. as approximately 91% of seafood (by value) consumed in the U.S. originates overseas. Roughly half of this comes from aquaculture and has driven the U.S. seafood trade deficit to over $11.2 billion annually (NOAA 2016). By passing the National Aquaculture Act of 1980 (and subsequent amendments), Congress put forth that it was in the national interest and the national policy to encourage the development and reduce regulations of aquaculture in the U.S. However, the past 37 years has not changed anything. The US still is only producing about 1% of the annual global production.

In the early 1990s North Carolina was one of several states to impose a 6-inch minimum size limit in part to protect elvers/glass eels for local aquaculture while awaiting recommendations on glass eel/elver fishery development that was expected in the Atlantic States Marine Fisheries Commission fishery management plan for American eel (ASMFC 2000). The April 2000 American eel FMP (Report #36) also shows that the states of New York, Rhode Island, Delaware, Maryland and PRFC also took the same measure to protect aquaculture development between 1992 – 1995.

In October 2014, the ASMFC adopted Addendum IV to the Interstate Fishery Management Plan for American Eel (ASMFC 2014);

http://www.asmfc.org/uploads/file//55318062Addendum_IV_American_Eel_oct2014.pdf).

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, the North Carolina Division of Marine Fisheries (NCDMF) is submitting the following Aquaculture Plan for approval. The NCDMF has selected tributaries in watersheds where the state can objectively show American eels in these areas minimally contribute to the spawning stock of American eel. Only one aquaculture operation, the American Eel Farm (AEF), has requested to be included in the Aquaculture Plan for consideration.

POUNDS REQUESTED

North Carolina requests to harvest 200 lb. of glass eels, the maximum amount allowed under the Aquaculture Plan provision of Addendum IV to the Interstate Fishery Management Plan for American Eel.

DATES OF HARVEST

Glass eels shall be harvested from January 1, through May 30, annually or until 200 lb. of glass eels are harvested, whichever occurs first.

DURATION OF HARVEST

The duration of harvest requested is for a three (3) year period. A renewal plan will be submitted by June 1, 2020 and at that time additional harvest years will be requested along with any modifications deemed necessary to ensure the success and continued approval of the plan.

METHOD OF HARVEST

NCDMF will limit the number of individuals authorized to harvest under this plan (3 individuals). Glass eels shall be harvested using either fyke nets, dip nets or Irish eel ladders. Fyke nets shall be constructed as follows:

- Shall be thirty (30) feet or less in length from cod end to either wing tip (net length equals the wing length plus the distance from throat to cod end)
- Shall be fitted with netting that measures 1/8-inch bar mesh or less
- Shall contain a ½-inch or less bar mesh excluder panel that covers the entrance of the net
- Shall have no more than two funnels, one cod end, and two wings

Dip nets shall be constructed as follows:

- Shall be no more than 30 inches wide at the widest point of the net mouth
- Shall be fitted with netting that measures 1/8-inch bar mesh or less

Irish eel ladders:

- Location and construction shall need final approval

To mitigate the harvest of elvers (fully pigmented eels), all captured eels shall be graded upon capture on the water using a 1/8-inch bar mesh non-stretchable grading screen and any eels that fail to pass through the screen will be immediately returned to the water where captured. Any eels that pass through the screen will be harvested and count toward the 200 lb. annual glass eel harvest limit.

THE CURRENT AND PAST STATUS FOR AQUACULTURE PURPOSES

For more than three or four decades now 100% of our nations' natural resource of glass eels have been exported overseas to the Asian market. With most of these eels being placed in

Chinese fish farms for grow out. Products are then made (mostly kabiaki unagi) and sent back to the US increasing our trade deficit. There have been many cases over the years where the FDA has ban eel products due to unapproved growth hormones as well as other unapproved chemicals being found when tested.

American Eel Farm (formally North Carolina Eel Farm) has been the only exception. Throughout the early to the late 2000's glass eels were purchased from Maine fisherman and brought to the farm for grow out. There was a time when the former owner paid just $60/pound.

Currently, 100% of the glass eels harvested in Maine and South Carolina are exported. No grow out data on any commercial level is being collected. No value-added job opportunities for US employees is realized. No US market being developed.

MINIMAL CONTRIBUTION

While we have no quantitative data on the abundance of glass eels, it could be argued the harvest of 200 lb. of glass eels is limited enough to have a minimal impact on the spawning stock of American eel (see Appendix 1). Natural mortality is thought to be very high during the early life stages (leptocephalus, glass eel, and elver) due to the high fecundity of American eel (ASMFC 2000, 2012). Assuming a mortality rate of ~97-98%, of the 200 lb. of glass eels proposed to be harvested, approximately 195 lb. would otherwise perish naturally in the wild.

The American eel has a broad geographic distribution range from the Caribbean to Canada. And is found in many US interior states as well. It is well known that there is no successful commercial hatchery on the planet for the *Anguilla rosrtata.* It is also accepted by the scientific community that the species dates well back in history and has the characteristic of panmixia (*Conclusive evidence for panmixia in the American eel, Cote). Anguilla rostrata's* panmictic population allows for all individuals to be a potential partner. This provides for a very large single biomass spanning along the entire eastern seaboard of the US.

ATLANTIC SEABOARD WATERSHED

The **Atlantic seaboard watershed** is a watershed of North America along both:

- The Atlantic Canada (Maritimes) coast south of the Gulf of Saint Lawrence Watershed, and
- The East Coast of the United States north of the watershed of the Okeechobee Waterway. The relatively narrow continental area is demarcated on the south by drainage to the Okeechobee Waterway (which drains both westward to the Gulf and eastward to ocean), the Eastern Continental Divide (ECD) to the west, and the Saint Lawrence divide to the north. US physiographic regions of this watershed are the Atlantic Plain and the Appalachian Mountains & Highlands. Major sub-watersheds of the Atlantic Seaboard are the following (north-to-south):

Sub-watersheds adjacent to the Saint Lawrence divide

- Chedabucto Bay: 2,148 square miles (5,560 km^2)
- Gulf of Maine: 69,115 square miles (179,010 km^2)
- Long Island Sound: 16,246 square miles (42,080 km^2)
- Lower New York Bay: >14,000 square miles (36,000 km^2)

Other notable sub-watersheds

- Delaware Bay: 14,119 square miles (36,570 km^2) — larger than several, but not adjacent to either divide
- Chesapeake Bay: 64,299 square miles (166,530 km^2) — adjacent to both divides (at the Triple Divide point)

Sub-watersheds adjacent to the Eastern Continental Divide

- Albemarle Sound: >14,380 square miles (37,200 km^2)
- Winyah Bay: >7,221 square miles (18,700 km^2)
- Santee River: >4,531 square miles (11,740 km^2)
- Savannah River: 9,850 square miles (25,500 km^2)
- St. Johns River: 8,840 square miles (22,900 km^2)
- Biscayne Bay: >2,800 square miles (7,300 km^2)
- Kissimmee River: >3,000 square miles (7,800 km^2)

The catch data of the American eel shows that the majority of wild caught adults come from the Chesapeake Bay and the Delaware Bay water basins. The figure is about 800,000 pounds per year from both. Catch data also reflects that the overwhelming majority of glass eels are harvested in Maine from the Gulf of Maine watershed. Any harvesting in the North Carolina watershed of Albemarle Sound for glass eels would clearly have little impact on the massive biomass migrating along the eastern seaboard with help from the Gulf Stream and Labrador Currents.

Additionally, it is understood that the voting members of ASMFC took into consideration that all states may have applications for an aquaculture quota and included that language in Addendum IV. That would be a total of 2,800 pounds harvested from the biomass migrating out of the Sargasso Sea. In the past three years there has only been an aquaculture plan submitted by the state of North Carolina. Primarily due to the ideal conditions for aquaculture that exist in the southeast and specifically the state of North Carolina.

LOCATION OF HARVEST

North Carolina's internal waters are classified as either inland, joint or coastal fishing waters. The North Carolina Marine Fisheries Commission (NCMFC) and NCDMF have jurisdiction of coastal waters while the North Carolina Wildlife Resources Commission (NCWRC) has jurisdiction of inland waters and both agencies (NCWRC and NCMFC/NCDMF) have authority within joint waters. Other than a few specific regulations, none of which pertain to American eel, commercial activities and recreational activities using commercial gear (devices) occurring in joint waters is under the jurisdiction of the NCMFC/NCDMF. For the purposes of this plan, all glass eel harvest will be restricted to either coastal or joint waters.

GLASS EEL HARVEST SITES

1.) Albemarle Sound and tributaries
2.) Pamlico Sound and tributaries
3.) Newport River and tributaries
4.) North River and tributaries

NCDMF MONITORING PROGRAM

In addition to Aquaculture Operations/Collection General Permit Conditions in rule (NCMFC Rule 15A NCAC 03O .0502) and Aquaculture Operations/Collection Specific Permit Conditions (NCMFC Rule 15A NCAC 03O .0503F), to monitor and regulate the harvest of glass eels, the NCDMF will issue an Aquaculture Collection Permit (ACP) to the AEF with additional permit conditions specific to the N.C. Aquaculture Plan that only apply while engaged in glass eel harvest (ACP) or grow out (AOP) activities authorized under the N.C. Aquaculture Plan for American Eel. To aid in monitoring and enforcement the NCDMF will limit the number of individuals authorized to harvest under the ACP (3 individuals). The permittee listed on the ACP must possess a valid North Carolina Standard Commercial Fishing License (SCFL) or Retired Standard Commercial Fishing License (RSCFL) issued by the NCDMF. The permittee listed on the ACP shall provide names and licensing data for all designees in the harvest of glass eels. Any vessels used for glass eel harvest under the ACP shall have a valid North Carolina Commercial Fishing Vessel Registration (CFVR) issued by the NCDMF. Restrictions will be placed on the ACP requiring certain conditions and procedures to be followed, such as:

GENERAL CONDITIONS

- Glass eels harvested from N.C. coastal fishing waters shall not be exported or sold until they reach the minimum legal size of nine inches total length.
- No more than one (1) permittee and two (2) designees shall be authorized to harvest under the ACP
- No more than two (2) mates will be allowed to assist the permittee or designees while fishing for glass eels
- The permittee/designee(s) and any vessel participating in the glass eel harvest must be properly licensed by the NCDMF and abide by all fisheries rules and permit conditions
- Fyke nets, dip nets, and Irish eel ladders are the only gear authorized to use for glass eel harvest under the ACP
- No more than thirty (30) fyke nets and/or dip nets and/or Irish eel ladders in any combination may be fished by the permittee/designee(s) under the ACP
- A fyke net may not be placed within fifty (50) feet of any part of another fyke net
- All gear shall be removed from the water from 12:01 pm on Friday through 12:01 pm on Sunday. This creates a 48-hour rest period to allow glass eels to migrate up these smaller systems to help minimize the impact to the spawning stock.
- January 1 through May 30, fyke and dip nets for glass eel harvest may be fished at all hours during the week. Fyke nets may have their cod ends closed during the day, however from 12:01 pm on Friday through 12:01 pm on Sunday fyke nets may remain in the water but the terminal portion of a fyke net cod end shall contain a rigid device with an opening not less than three (3) inches in diameter and not exceeding eight (8) inches in length that is not obstructed by any other portion of the net and dip nets may not be used. This creates a 48-hour rest period to allow glass eels to migrate up these smaller systems to help minimize the impact to the spawning stock.
- Immediately report to NCDMF if a net is tampered with and location of the net and the date and time it was noticed
- Report to NCDMF when each fyke net is removed from the water. If a net is moved, the new coordinates must be reported once the net is reset. If multiple nets are moved the

same day, coordinates may be provided once all the nets have been reset. If a net(s) is removed and not reset, it must be reported upon returning to the landing site.
- Purchased American eels (glass eels, elvers, or yellow eels) shall be kept separate from eels that were harvested as glass eels within N.C. and grown out to yellow eels
- All gear and harvest restrictions detailed in the Method of Harvest section will be listed as conditions under the ACP

BEFORE HARVEST

Fishermen harvesting glass eels under the ACP shall call-in to NCDMF the following information:

- Daily:
    - Landing site they will be leaving from and returning to once fishing activity is complete
    - Names of individual(s) involved shall be reported at the beginning of the season and any changes or additions would be immediately reported.
    - Number of fyke nets, dip nets, and Irish eel ramps that will be used
    - Description and registration number of the boat(s) to be used for harvest shall require a one time and report and if any changes occur they would need to be reported
    - Description and license plate number of the vehicle(s) to be used for harvest shall require a one time and report and if any changes occur they would need to be reported

DURING HARVEST

- Require the use of a 1/8-inch bar mesh non-stretchable mesh grading screen to cull the glass eels at the harvest site to limit the harvest of elvers

AFTER HARVEST

- GPS coordinates of each net once they are set, if multiple nets are set the same day, coordinates can be provided once all the nets have been set.
- Require AEF to hold all glass eels that perish during transport to the facility and all eels that perish in the facility for inspection
- All glass eels that perish during transport will count against the 200 lb. harvest limit
- Require AEF to call-in or email to NCDMF by 5:00 pm each day the total harvest for the previous day in pounds to the nearest 0.1 lb. of glass eels received (including those days when no glass eel harvest occurred). Zero pounds shall only be reported if no glass eels are harvested and received.

The above conditions and procedures will allow the NCDMF to limit the effort (amount of gear and number of individuals) involved in glass eel harvest under the Aquaculture Plan. These controls will allow the NCDMF to ensure the glass eel harvest does not exceed what is authorized in the Aquaculture Plan. Any harvest that exceeds the 200 lb. harvest limit shall be immediately returned to the water where captured.

ENFORCEMENT CAPABILITIES AND PENALTIES FOR VIOLATIONS

Violations of the ACP permit conditions will be addressed according to the NCDMF SOP for Permit Violations and suspensions will be carried out in accordance with NCMFC Rule 15A NCAC 03O .0504 (see Appendix II).

All charges for violations will be charged under N.C. General Statute § 113-187 (d) (4): Violating the provisions of a special permit or gear license issued by the Department. All fines will be at the discretion of the court; however, fines may not always be levied for the first offense.

The call-in requirements under the Monitoring Program section will allow enforcement officers to know when and where lawful harvest is occurring. It will also allow for random inspections to take place at the harvest and landing sites to ensure the conditions of the permit and all applicable NCMFC rules and regulations are being followed. Random inspections will also be performed at the aquaculture facility to ensure the proper records are being kept to account for all eels in the facility as required under N.C. General Statute § 113-170.3 and NCMFC Rule 15A NCAC 03O .0502 (8) (see Appendix III).

SIZE LIMIT EXEMPTION

The intent is to raise the eels as close as possible to the legal minimum size of 9 inches total length prior to sale. Given the difficulty in measuring live eels, prior to sale, all eels shall be graded using a ½-inch by ½-inch non-stretchable mesh grading screen. Any eels that do not pass through the grading screen may be sold and any that pass through the grading screen shall remain in the possession of the AEF until such time as the eels are large enough to not pass through the grading screen. On inspection, a 10% tolerance by number will be allowed for eels that pass through the grading screen.

PRIOR APPROVAL OF PERMITS

The AEF has all necessary permit approvals in place with the exception of an Aquaculture Collection Permit from the NCDMF. This permit will be issued upon approval of the Aquaculture Plan by the ASMFC American Eel Management Board. The permits currently held by the AEF are:

- North Carolina Department of Agriculture Aquaculture Operation Permit valid until 2017
- North Carolina Division of Marine Fisheries Aquaculture Operation Permit renewed annually. To be eligible for an ACP, an Aquaculture Operation Permit is required (see Appendix IV: NC Marine Fisheries Commission (NCMFC) Rule 15A NCAC 03O .0501 (e))
- North Carolina Division of Marine Fisheries Standard Commercial Fishing License
- North Carolina Division of Marine Fisheries Dealer License

As noted in NCMFC Rule 15A NCAC 03O .0501 the appropriate licenses from the Division of Marine Fisheries must be held by the permittee. A North Carolina Standard Commercial Fishing license is required to fish commercial gear such as fyke nets, a Commercial Fishing Vessel

Registration (CFVR) is required for vessels used to harvest seafood and a Dealer License is required to sell fish taken from the coastal fishing waters.

DESCRIPTION OF THE MARKET

The AEF indicated they have identified clients for food and bait markets domestically as well as overseas. The long-term intent is to develop and expand the US domestic market as much as possible. For proprietary business reasons, specific details were not provided.

DESCRIPTION OF THE FACILITY

American Eel Farm
1633 NC HWY 41 West
Trenton, NC 28585

History, Design, Capacities and Technical Facts

The AEF, located in Trenton, North Carolina, is a state-of-the-art Recirculated Aquaculture System (RAS) which has been operating since 2003

Below are two You Tube links that show videos of the facility:

https://www.youtube.com/watch?v=4YnQn7aivw4

https://www.youtube.com/watch?v=1wUiwmzO-TI

It is a proven Danish system designed overseas by Inter-Aqua Advance for eel grow-out and imported to the US by William Bokolar and Marty Bouw to US into the state of VA. The state of VA granted an 800 kilogram harvester permit for glass eels in 1999 as outlined in the ASMFC American eel April 2000 FMP Report #36 for this facility.

The AEF was initially operated in North Carolina as the North Carolina Eel Farm (corporate filing date May 21, 2002). It was purchased from the original owners by George Koonce and transported to Jones County. The original location suffered a hurricane and was moved to its current location. The facility has a 15-year operation history in North Carolina. There is no other facility specifically designed to grow out glass eels to yellow eels at a commercial level in the US. The facility has the capacity to easily grow-out in excess of 900 pounds of glass eels. There is historical proprietary data on a large scale commercial level that no current fish farm, University, or government agency in the US can match.

The facility has three separate closed recirculating systems. The two main systems are identical RAS units each containing twelve (12) 1,000 gallon tanks and independent water treatment systems for both RAS units. Each RAS contains twelve (12) raceway tanks with 900 US usable gallons. Water is purified, restructured and super oxygenated.

Raceway Tanks

Each section contains 12 raceway tanks. The facility has two separate treatment sections and 2 large 10,000 gal temporary storage tanks with filtration and aeration. Each raceway tank is

equipped with a fine screen outlet complete with a tertiary motorized brush system, to keep the mesh clean. In each tank, there are also level switches that give alarm for high water level. These large rectangular fiberglass tanks hold about 1,000 gallons of water. Here is the home of the eels while we are their stewards.

Each tank is outfitted with aeration provided by large Sweetwater pumps and back-up emergency oxygen lines which automatically activate in case of a power outage. Each tank also can be isolated from the system and individually cleaned if necessary without draining entire system.

There are three automatic feeders for the first three tanks that are ideal for the small eels. As they are graded the larger eels can be fed by hand or additional automatic feeders can be installed.

Monitoring Systems

There is a new Pacific Oxyguard water quality monitoring system that monitors pH, oxygen saturation levels, water levels and temperature. The system can send alarms remotely and is programmed to call to a farm manager's cell phone as well as four other programmed numbers if any levels drop or change as per settings logged into system. The system can be expanded by adding more test probes and programming if desired.

This system design is based on proven *Anguilla anguilla*, *A. mossambica*, *A. bicolor* and *A. marmorata* aquaculture techniques. The systems are technically sound, energy efficient, and easy to operate. The system has been successful with American eels as proven by recorded growth rates, low food conversions and low incidence of disease and mortality.

Mechanical Filtration

Attached to those 24 tanks is a complete water treatment unit equipped with a HydroTech drum filter type 803 / 40 micron mechanical filtration unit. This unit has a max flow of 31,500 gal/hour or 63,000 gal/hour if both sections are in operation. The two drum filters sieve feces and other large particles out of the water. The filters are continuously sprayed (adjustable timing possible) with water to self-clean. The waste water runoff from this event drains into a small channel within the drum filter and then drains into a system pipe which gravity feeds into the main channel in the tank room that runs the full distance from tank #1 to tank #24 where the waste water is then pumped into a small settling pond on the property by a sump pump through a 12" PVC drain pipe.

Biological Filtration

After mechanical filtration, water is gravity fed into 2 parallel 18 foot tall silos (four total for both sections) with patented Inter Aqua Advance (IAA) A/S Moving Bed Bio Reactor (MBBR) technology for biological treatment of the water (removal of ammonia and dissolved organic matter). Each silo has a volume of 1,300 gallons and is 55 % filled with IAA bio-curler bio media. This technology is superior to simple trickling filter bioreactors in that the attached blower motors run constantly to keep the media moving. This also acts as a self-cleaning process within the silos and contributes to the CO_2 stripping process. Nitrifying bacteria create a film on the media and converts ammonia to a nitrate. Safe for the fish and excellent for growing plants! Two steps: NH3 + O2 ? NO-2 + 3H+ + 2e-, NH3 + O2 + 2H+ + 2e- ? NH2OH + ?H2O.

With an optimum temperature for the growth of the eel at 24 degree C. or 74 degree F. The water treatment unit will be able to handle up to 250 lb. dry feed per day per section (500 lb. per day total). After the MBBR water flows by gravity into a common pump sump.

The water can be circulated with 3 separate pumps (per section, 6 pumps total), one 3 HP Low Head main pump and two 3 HP medium pressure pumps with 20 psi into two oxygen-cones (per section 4 total) for supersaturating of liquid oxygen into the water. In total the 3 pumps give a minimum flow capacity of 31,500 gal/hour (63,000 gal/hour total).

CO^2 Stripper

There is a carbon dioxide stripper for tanks #1 - #24 which has counter flow packed tower technology and utilizes structured packing of vacuum formed sheets of PVC. These packing's will provide maximum wettability, thereby maximizing the stripping effort.

Ultraviolet Lighting (UV)

Water flows through the center of a cylindrical housing. The water passes through the device and the UV lighting assists in disinfecting the water by destabilizing the DNA of germicidal bacteria The water is surrounded by UV bulbs in special waterproof housings. The DNA in the bacteria is "blown-up". The UV system has recently had the bulbs updated. However there have been reports that a UV disinfection system is not needed with eels so this system may be reconsidered.

Super Oxygenation

The water is injected through a top mount opening into 10 foot tall Oxygen cones (4 total). As it spills into the pool below a vortex is created and splashing occurs. The water is restructured as bubbles are produced. Liquid Oxygen is injected into these bubbles under 20 PSI pressure (PV=nPT). There is a back-up liquid oxygen system tied into the main oxygen source with two air stones per raceway as a safety net. It is serviced simply by attaching the flow meter to a large liquid oxygen tanks. Should there be the need, the main liquid oxygen source would back feed the 26 tanks with 150 PSI automatically.

Water Supply

The system is supported by three deep water wells all of which are operable and are wired with three phase wiring for better conservation as well as on independent breakers so as to always allow for a water source to be actively supplying water. One is about 300’ deep and the other two about 200’. Jones County is part of the North Atlantic Coastal Plain aquifer. And is conveniently located where the Castle Hayne, Pee Dee and Black Creek aquifers intersect. Additionally, there is public water tied into the facility.

Water Softening System

There is a large commercial grade water softening system that all water passes through prior to entering any portion of the facility. The purpose is to change the molecular structure of the Ferrous Iron from the ground water to prevent it from becoming Ferric Iron once oxidized. The rust colored sediment that can cause operating issues.

Valve System

The facility has many valves which assist in directing water flow. Also enables the operator to isolate any section, component or well source.

There is 440 electric service at pole. There is a heating system that can heat the water entering from the wells prior to entering the main water source if needed by passing heated water through several tubes mounted in the well reserve tanks for both sections. These well reserve tanks are equipped with automated on/off valves allowing water to be called automatically from the well when the water level reaches a preset level.

The water is distributed back to the raceway tanks via a common pipe manifold situated on the wall at the end of the tanks, with a separate valve to each tank for maintenance. A flow rate of 31,500 gal/hour (per system or 63,000 gal/hour total) will give an exchange rate of 3 to 5 times/hour to maintain self-cleaning and an adequate oxygen level in the raceway.

There is a third system which has two large 9,000 gallon tanks supported by similar filtration, aeration and small bio-reactors. This system is separate from the other two. Total capacity for AEF is about 50,000 gallons with about 40,000 being usable. Additionally, there is plenty of room to expand on the flat 2-acre site on which the facility is located. With 226 days a year of sun and a mean annual temperature of 70 degrees there is also a great opportunity to develop a medium to large scale aquaponics system on site.

In addition to the main tank room and the state-of-the-art water treatment room there is a main office area, sales office area, employee dinning, a furnished residential area, a full bathroom with laundry, a feed room, packaging room, a mechanical room, an electrical room, storage rooms and two large covered exterior areas one @ 15' X 85' and the other @ 15' X 50'. The grounds are gated and there is a security system with 16 infrared cameras capable of being viewed remotely. The facility has cable connections for internet and TV as well as two satellites for backup. The steel building construction is insulated with pressed foam to help minimize temperature fluctuations on hot or cool days. The roof was replaced with a steel roof about six years ago. There is a heating system but it is not necessary to use when system is running due to local climate and the ground water temp of 68 degrees.

With the general geographic location being the Southeast USA along with the well-insulated building the water temperature for maximum growth rate could be efficiently maintained. Trenton, NC has a climate that is very suitable to aquaculture/agriculture in general. The annual average mean temperature is 70 degrees where the ideal temp for grow-out of eels is 74 degrees. There is no snow fall (very rare) and few days below freezing (very rare).

Eel Grow Out

Eels can be stocked in high densities in the raceway tanks. Stocking densities of 300 kg/m^3 or 2(+) lb./gal are often seen in eel farms. It is estimated that juvenile eels have an oxygen demand of 300 mg/kg/hour. The liquid oxygen system at the AEF is sufficient to reduce mortality and sustain eels in high densities. Estimated grow out time from the glass eel phase to 9 inches averages around 210 days. Individual eels grow at different rates so total grow out time will be longer. Due to the varying growth rates, it is estimated that one-third of the eels will be harvested in 5 - 7 months, another group will be harvested at 8 - 10 months, and the rest will be harvested at 11 - 12 months after harvest.

A large mobile stainless-steel grading machine in the main tank room will be used to grade the eels every four to six weeks. A well-managed RAS eel farm can expect a weaning rate of 80 - 90%. Eels feed ratio is greater than 1:1 in most studies depending on the amount of protein in the feed. There are studies in Japan and China that show a faster grow out however this outline is one the AEF is comfortable with.

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FIGURES

Figure 1. General location of proposed harvest areas (green circles) along the North Carolina coast.

APPENDIX I

TESTIMONY PRESENTED TO THE COMMITTEE ON MARINE RESOURCES
RE: H.P. 137, AN ACT TO RESTRICT THE TAKING OF EELS LESS THAN 6 INCHES IN LENGTH FROM MAINE COASTAL WATERS (EMERGENCY)

by
James D. McCleave
February 23, 1995

INTRODUCTION

The purpose of my testimony is primarily to educate the members of the committee, other legislators and interested persons about the unique life cycle of a truly fascinating and somewhat mysterious fish, the American eel. The unusual life cycle has some important implications for management and conservation of this species, which are different than for most species of fishes. I will present several of these implications. Finally, I do offer an opinion on the soundness of this particular bill.

I am a Professor of Oceanography and a Cooperating Professor of Zoology at the University of Maine, where I have been since 1968. I have conducted research on the biology of the American eel and the European eel since the early 1970s and have published more than 25 scientific papers on them. I also teach about eels in my classes at the University, and I occasionally have participated in workshops on eels with my European colleagues. A copy of my résumé is appended.

I offer this testimony as a friend of the eel, an awesome fish, and as a friend of eel fishers of all types. It is not my intention to support one group of harvesters over another. My conclusions and opinions are biologically based. The economics of the eel fishing and aquaculture industries and the economic consequences of management decisions are left to the realm of other experts.

LIFE CYCLE OF THE AMERICAN EEL

American eels are highly migratory, with spawning and larval development occurring in the ocean, and feeding and growth occurring in estuaries and fresh waters (rivers, streams, ponds, and lakes) [catadromous life cycle].[1] Spawning occurs near the surface over very deep water in a large area of the Sargasso Sea (Figure 1) and only there, meaning there is a single breeding population for the species. The Sargasso Sea is a large portion of the western North Atlantic Ocean east of the Bahamas and south of Bermuda. Spawning occurs in winter. Eggs hatch in a day or two in the warm water, releasing a long-lived larval stage [leptocephalus], which is flattened from side-to-side and shaped somewhat like a willow leaf. The leptocephali drift and swim in the upper few hundred feet of the

[1]My language is intended to be understood by the nonspecialist. However, the appropriate scientific terms are included in brackets for completeness and to allow direct reference later in the document.

ocean for several months, growing slowly to a length of 2-2.5 inches. The leptocephali dramatically alter their shape [metamorphose] to resemble a miniature, transparent eel, called a glass eel, during the subsequent autumn and winter. This metamorphosis occurs at sea, perhaps near the edge of the continental shelf. The glass eels enter estuaries and ascend rivers during winter and spring, earlier at the southern end of their range, later at the northern end. (My research group at the University of Maine has contributed substantially to this knowledge.) It is during the spring ascent that glass eels, sometimes termed elvers, are harvested commercially in Maine.

The glass eels in estuaries and fresh waters rapidly develop rather drab pigmentation in their skin, dark on the back and often yellowish on the belly, leading to the name yellow eel for this stage. Growth is generally slow, and yellow eels spend several years in estuaries and inland waters. Growth and age at maturity are not well known. Males probably remain as yellow eels for 4-6 years or more, and grow to about 12-18 inches or so. Females remain as yellow eels for many more years, probably 6-20 years in New England and the Maritime Provinces. During this growth period, yellow eels are fished commercially in estuarine and fresh waters, using baited traps or pots.

During late summer and early autumn, maturing yellow eels undergo a second metamorphosis in preparation for a migration to sea to spawn. The pigment on the belly frequently becomes an iridescent silvery, leading to the term silver eel. Silver eels migrate from fresh waters and estuaries to sea in late summer and autumn in the northern part of their range, including Maine, and later in the southern part of the range. During this migration in Maine, silver eels are fished commercially in fixed weirs or nets set across streams and rivers.

Silver eels migrate to the Sargasso Sea, *spawn once and die*. Little is known of this migration or actual spawning, but it seems likely that autumn migrants are the spawners of the subsequent winter. Evidence of the timing and location of spawning comes from the distribution in space and time of small leptocephali. (My research group at the University of Maine has contributed substantially to this knowledge.)

The yellow stage of the American eel ranges from the eastern Gulf of Mexico, all along the east coast of the US, through the states and provinces bordering the Gulf of Maine, to the states and provinces bordering the Gulf of St. Lawrence, to Newfoundland and Labrador. Yet all spawning of the resulting silver eels occurs in the Sargasso Sea.

POINTS OF EMPHASIS FROM THE LIFE CYCLE

- There is a single breeding population for the entire species regardless of where the yellow eels resided [panmixis]. All genetic evidence suggests that a female from Maine is as likely to spawn with a male from Georgia as with a male from Nova Scotia.
  - This means there is no 'homing' of offspring from eels of the Penobscot or Kennebec Rivers to those rivers.

- ◇ Glass eels entering the Maine rivers are just the same genetically as those entering elsewhere within the range.

- There is a single spawning by a female in her lifetime [semelparity]. An adult female may have to grow for 15 years before reaching maturity and spawning *once*.

- Females develop large numbers of eggs [high fecundity], probably 400,000-3,000,000 eggs per female increasing with female size.

- Nearly all the eggs produced by a female and fertilized by a male will die before reaching maturity [high mortality]. This is natural in fecund species; otherwise the earth would be covered with eels.

- Females are much larger at sexual maturity than males [sexual dimorphism].
  - ◇ Most females are larger than 20 inches (50 cm) at maturity.
  - ◇ Most males are less than 18 inches (45 cm) at maturity.

- Determination of whether an eel becomes a male or female is not completely under genetic (chromosomal) control, but the process of sexual determination is not fully understood.

HYPOTHESES RELEVANT TO CONSERVATION

There are two hypotheses, for which there is some scientific evidence, which are important to decisions on conservation of the species. Both hypotheses follow logically from an overriding hypothesis that eels encountering more productive waters have a greater tendency to become males, while those encountering less productive waters have a greater tendency to become females. (There is a body of life history theory that supports this different life history strategy for males and females.)

- There is a gradual increase in the proportion of eels that become females from the estuary toward the headwater streams, i.e. increasing up a given drainage. Within a river drainage, more productive waters are generally found in the lower reaches, especially the estuary.
  - ◇ If correct, this means that Merrymeeting Bay has a lower proportion of females than the higher waters of the Kennebec River.

- There is a gradual increase in the proportion of eels that become females from the southern part of the range to the northern part of the range [a cline]. Along the range of the eel, more productive waters are generally found to the south, less productive waters to the north, including Maine.

- If correct, this means that Maine is likely to have a greater proportion of female eels within its population than, say, Georgia.

MY OPINION ON EEL MANAGEMENT-CONSERVATION

Because of the wide range of the species, and because the species is a single breeding population, one political jurisdiction alone cannot conserve the species. However, Maine can act responsibly from an understanding of the eel's life history.

I will now argue against this bill. The first line of reasoning is on the basis of prudent interpretation of the implications of the life cycle. The second line of reasoning is on the basis of a scenario for interpretation of the high fecundity-high mortality consequences in this species.

From both lines of reasoning, I am led to the conclusion that *there is no biological basis underlying the restriction of harvest proposed by this legislation.* For certain, in my mind, there is *no emergency*. This is not to state that development of sound management and conservation practices are not needed.

IMPLICATIONS FROM THE LIFE CYCLE

In a one-time spawning [semelparous], fecund species with a long lifetime before that one reproduction, prudent conservation strategy would increasingly protect females the closer they get to reproduction. Mortality is high in a fecund species, but the rate of mortality declines exponentially with size. Mortality rate in leptocephali must be enormous; mortality rate in glass eels must be enormous as well. However, mortality rate in females larger than, say, 15 inches is probably very low. (Here I refer to natural mortality, not mortality from people's activities of fishing, damming, polluting, etc.)

Maine, acting in prudent fashion, might choose to protect preferentially maturing females. I stress females because only females produce young. One male may mate with many females, but only females bear eggs.

If the cline in increasing proportion of females from south to north is correct, Maine and the Maritime Provinces might give increased thought to protecting females. A greater proportion of the reproductive potential may be in the northern part of the species' range.

If there is an increasing proportion of females farther up a drainage, it may be prudent to harvest differentially fewer eels farther up drainages.

Weir fisheries, pot fisheries with mesh-size limits, and eel-size limits all shift the harvest toward a greater percentage of females. Because of the sexual dimorphism, the larger the mesh or the larger the size limit, the greater the pressure is transferred to prereproductive females. Further, because females are longer lived than males, greater fishing pressure is transferred to prereproductive females. This is exactly opposite from the desirable effect. It is more logical, if anything, to place a maximum size limit on the harvest of eels. Such a measure

is clearly against conventional wisdom for managing fishes, but this is an unconventional species.

States and provinces that do not allow weir fisheries prudently protect females, whether they know it or not. Only Maine and, to a very limited degree, New York allow weir fisheries for eels.

Likewise, states and provinces that restrict commercial fishing in fresh waters prudently protect females, whether they know it or not. Most states have a substantial or complete restriction on such fishing. Not Maine.

On the other hand, most states and provinces have minimum size limits on commercial eel harvest, generally 4 inches, 6 inches or 8 inches. I do not believe these jurisdictions made those regulations on any basis other than transfer of practices from management of other species, such as trout or bass. In the extreme, Prince Edward Island has a minimum size limit of 18 inches for eels. Other Maritime Provinces are considering similar regulations. This practice would ensure that nearly all harvested eels would be females, a completely counterproductive measure.

Just because other jurisdictions have similar regulation, we should not make the assumption that the regulations have biological basis. Maine should strive gain the information necessary to base regulations in accord with the life cycle of the eel.

IMPLICATIONS FROM MORTALITY RATES

Management of commercial and recreational harvest of fishes (or tolerance of dams and pollution) has always been based on the assumption that there are compensatory mechanisms within the biology of the species, i.e. mechanisms that allow increased survival or increased reproduction of the nonharvested individuals, so the population does not decline. This is the concept of sustainable yield. The key to success of this approach is to understand what the compensatory mechanisms are and when they occur in the life cycle with respect to when harvest occurs.

Again, the eel is unique because of its high-fecundity, high-mortality characteristic. It seems unlikely to me that major compensatory mechanisms are to be found in the oceanic stages of the life cycle. The leptocephali probably have the highest mortality. Food limitation and inability to reach the continental shelf may be the critical factors, neither of which is under control of the leptocephali. Silver eels on migration to the Sargasso Sea to spawn probably have the lowest mortality, and they also have little opportunity for compensating mortality earlier in the life cycle.

In the elver-yellow eel stages, there is high mortality, but there is also the greatest likelihood of compensatory mechanisms for added mortality due to human activities. Because this is the growth phase, competition for food may occur among individual eels, causing starvation or at least slowing the growth. Reduced density of eels *may* result in higher survival, greater growth rate, and perhaps higher fecundity. On the other hand, not all outcomes of reduced density are

predictable. Because the mechanisms of gender determination are not known for eels, reduced density could increase the ratio of females to males (a positive compensatory mechanism) or decrease the ratio of females to males (a negative compensatory effect). However, most density-dependent effects are negative and have positive compensatory mechanisms.

I illustrate the subtle effects of compensatory mechanisms with a *hypothetical* numerical example. For the example, assume an average female has a fecundity of 1,000,000 eggs. Only one female and (less than) one male need to survive from those million eggs and reproduce to maintain a stable population. In the first scenario, I assume there is a compensatory mechanism for harvesting that can occur anytime after harvesting, regardless of when the harvesting occurs. In the second scenario, I assume there is a slightly greater compensatory mechanism in the yellow eel stage (likely, as described above).

- Scenario 1. Minor compensatory mechanism any time.
  - Fecundity 1,000,000 eggs produced by average female.
  - Assume 99.9% die at sea as leptocephali, leaving 1,000 glass eels.
  - Assume 99.2% of those die becoming silver eels, leaving 8 to migrate seaward.
  - Assume a harvest of half the migrating silver eels (4), leaving 4 migrants.
  - Assume 50% of those die, leaving 2 successful spawners.

  - Fecundity 1,000,000 eggs.
  - 99.9% die as leptocephali, leaving 1,000 glass eels.
  - Harvest half the migrating glass eels, leaving 500.
  - 99.2% die before becoming silver eels, leaving 4 to migrate.
  - 50% of those die leaving 2 successful spawners.

  - Conclusion: In this scenario, it does not matter when in the life cycle eels are harvested as long as the allowed harvest is set by actual mortality rates, rather than the hypothetical ones used in the examples here. Alternatively, harvest of a combination of life stages is possible, again as long as actual mortality rates are applied.

- Scenario 2. Greater compensatory mechanism in yellow eel stage.
  - Fecundity 1,000,000 eggs.
  - 99.9% die as leptocephali, leaving 1,000 glass eels.
  - Harvest half the migrating glass eels, leaving 500.
  - Now, if there is compensation such that mortality is reduced in the yellow eels stage by only 1%, 98.2% die before becoming silver eels, leaving 9 to migrate seaward.
  - Harvest half the migrating silver eels (4 or 5), leaving 4 to migrate.

- ◇ 50% of those die leaving 2 successful spawners.

- ◇ Conclusion: In this scenario, harvest of glass eels has no effect on the harvest of silver eels because of a compensatory mechanism in the yellow eel stage. Again harvest size needs to be determined with actual mortality rates.

CONCLUSIONS

I conclude from the two previous sections that there is no biological basis for assuming that harvest of glass eels *per se* is detrimental to the conservation of the American eel. Under certain conditions, the harvest of glass eels could have less detrimental effect on conservation than harvest of silver eels. Under certain conditions, the harvest of glass eels could occur while having little or no detrimental effect on harvest of silver eels.

I also conclude that the current regulatory structure for eels in the States and Provinces in the eel's range is not based upon sound biological principles. However, unregulated or unsoundly regulated commercial fishing in Maine and other jurisdictions is distinctly unwise. By testifying in opposition to this bill, I am not implying that there is not cause for concern and for possible regulations on commercial fishing for eels.

SCIENTIFIC RECOMMENDATIONS FOR CONSERVATION AND MANAGEMENT

In the short term for decision making in Maine, the following steps are important.

- Mortality rates and sources of mortality in the glass eel, yellow eel and early silver eels stages need to be determined to allow estimates of how much harvest could be allowed in what stages of life without deleterious effect on the stock.
  - ◇ Determine sources and rates of natural mortality, and determine whether there is density-dependent mortality, which involves determination of food-webs and predator-prey relations.
  - ◇ Determine sources and rates of anthropogenic mortality at different stages, which includes fishing mortality and nonfishing mortality (fish passage at dams, pollution, hydroelectric turbines, etc.).

- Fishing mortality needs to be determined from the activities of the fishing industry.
  - ◇ A licensing system for fresh waters and tidal waters specific to commercial fishing for eels should be instituted.
  - ◇ A reporting system for commercial catches by life-cycle stage or gear needs to be associated with the licensing system.

- Growth rates of males and females and fecundity of females of various sizes needs to be determined to allow assesment of harvest practices on the reproductive potential of the migrants that do migrate to sea to spawn.

- The distribution of sex ratio throughout selected drainages needs to be determined to allow assessment of harvest practices on abundance of females and males.

In the long term for decision making over the geographic range of the eel, the following steps are important.

- The mechanism of gender determination in eels needs to be understood, so effects of harvest practice on sex ratios can be determined.

- The distribution of sex ratio over the geographic range needs to be determined, so harvest practice could be adjusted over the range as appropriate to the life cycle.

APPENDIX II

NC Marine Fisheries Commission Rule 15A NCAC 03O .0504:

15A NCAC 03O .0504 SUSPENSION/REVOCATION OF PERMITS

(a) For violation of specific permit conditions (as specified on the permit), permits may be suspended or revoked according to the following schedule:

(1) violation of one specific condition in a three year period, permit shall be suspended for 10 days;
(2) violation of two specific conditions in a three year period, permits shall be suspended for 30 days;
(3) violation of three specific conditions in a three year period, permits shall be revoked for a period not less than six months.

If the permit condition violated is the refusal to provide information upon request by Division staff, either by telephone, in writing or in person, the Fisheries Director may suspend the permit. Such permit may be reinstated 10 days after the requested information is provided.

(b) All permits will be suspended or revoked when the permittee's license privilege has been suspended or revoked as set out in G.S. 113-171. The duration of the suspension or revocation shall be the same as the license suspension or revocation. In the event the person makes application for a new permit during any period of license suspension, no new permit will be issued during the suspension period. In case of revocation of license privileges, the minimum waiting period before application for a new permit to be considered will be six months.

(c) Permit designees shall not be permitted to participate in a permit operation during any period they are under license suspension or revocation.

(d) Upon service of a notice of suspension or revocation of a permit, it is unlawful to fail to surrender any permit so suspended or revoked.

Appendix III

NC General Statute 113-170.3:

G.S. 113-170.3. Record-keeping requirements.

(a) The Commission may require all licensees under this Article to keep and to exhibit upon the request of an authorized agent of the Department records and accounts as may be necessary to the equitable and efficient administration and enforcement of this Article. In addition, licensees may be required to keep additional information of a statistical nature or relating to location of catch as may be needed to determine conservation policy. Records and accounts required to be kept must be preserved for inspection for not less than three years.

(b) It is unlawful for any licensee to refuse or to neglect without justifiable excuse to keep records and accounts as may be reasonably required. The Department may distribute forms to licensees to aid in securing compliance with its requirements, or it may inform licensees of requirements in other effective ways such as distributing memoranda and sending agents of the Department to consult with licensees who have been remiss. Detailed forms or descriptions of records, accounts, collection and inspection procedures, and the like that reasonably implement the objectives of this Article need not be embodied in rules of the Commission in order to be validly required.

(c) The following records collected and compiled by the Department shall not be considered public records within the meaning of Chapter 132 of the General Statutes, but shall be confidential and shall be used only for the equitable and efficient administration and enforcement of this Article or for determining conservation policy, and shall not be disclosed except when required by the order of a court of competent jurisdiction: all records, accounts, and reports that licensees are required by the Commission to make, keep, and exhibit pursuant to the provisions of this section, and all records, accounts, and memoranda compiled by the Department from records, accounts, and reports of licensees and from investigations and inspections, containing data and information concerning the business and operations of licensees reflecting their assets, liabilities, inventories, revenues, and profits; the number, capacity, capability, and type of fishing vessels owned and operated; the type and quantity of fishing gear used; the catch of fish or other seafood by species in numbers, size, weight, quality, and value; the areas in which fishing was engaged in; the location of catch; the time of fishing, number of hauls, and the disposition of the fish and other seafood. The Department may compile statistical information in any aggregate or summary form that does not directly or indirectly disclose the identity of any licensee who is a source of the information, and any compilation of statistical information by the Department shall be a public record open to inspection and examination by any person, and may be disseminated to the public by the Department. (1997-400, s.5.1; 2001-213, s. 2.)

NC Marine Fisheries Commission Rule 15A NCAC 03O .0502:

15A NCAC 03O .0502 PERMIT CONDITIONS; GENERAL

The following conditions apply to all permits issued by the Fisheries Director:

(1) it is unlawful to operate under the permit except in areas, at times, and under conditions specified on the permit;

(2) it is unlawful to operate under a permit without having the permit or copy thereof in possession of the permittee or his or her designees at all times of operation and the permit or copy thereof shall be ready at hand for inspection, except for Pound Net Permits;

(3) it is unlawful to operate under a permit without having a current picture identification in possession and ready at hand for inspection;

(4) it is unlawful to refuse to allow inspection and sampling of a permitted activity by an agent of the Division;

(5) it is unlawful to fail to provide complete and accurate information requested by the Division in connection with the permitted activity;

(6) it is unlawful to hold a permit issued by the Fisheries Director when not eligible to hold any license required as a condition for that permit as stated in 15A NCAC 03O .0501;

(7) it is unlawful to fail to provide reports within the timeframe required by the specific permit conditions;

(8) it is unlawful to fail to keep such records and accounts as required by the rules in this Chapter for determination of conservation policy, equitable and efficient administration and enforcement, or promotion of commercial or recreational fisheries;

(9) it is unlawful to assign or transfer permits issued by the Fisheries Director, except for Pound Net Permits as authorized by 15A NCAC 03J .0504;

(10) the Fisheries Director, or his agent, may, by conditions of the permit, specify any or all of the following for the permitted purposes:

(a) species;
(b) quantity or size;
(c) time period;
(e) location;
(d) means and methods;
(f) disposition of resources;
(g) marking requirements; or
(h) harvest conditions.

(11) unless specifically stated as a condition on the permit, all statutes, rules and proclamations shall apply to the permittee and his or her designees; and

(12) as a condition of accepting the permit from the Fisheries Director, the permittee agrees to abide by all conditions of the permit and agrees that if specific conditions of the permit, as identified on the permit, are violated or if false information was provided in the application for initial issuance, renewal or transfer, the permit may be suspended or revoked by the Fisheries Director.

APPENDIX IV

NC Marine Fisheries Commission Rule 15A NCAC 03O .0501:

15A NCAC 03O .0501 PROCEDURES AND REQUIREMENTS TO OBTAIN PERMITS

(a) To obtain any Marine Fisheries permit, the following information is required for proper application from the applicant, a responsible party, or person holding a power of attorney:

(1) Full name, physical address, mailing address, date of birth, and signature of the applicant on the application. If the applicant is not appearing before a license agent or the designated Division contact, the applicant's signature on the application shall be notarized;

(2) Current picture identification of applicant, responsible party, or person holding a power of attorney. Acceptable forms of picture identification are driver's license, North Carolina Identification card issued by the North Carolina Division of Motor Vehicles, military identification card, resident alien card (green card), or passport; or if applying by mail, a copy thereof;

(3) Full names and dates of birth of designees of the applicant who will be acting under the requested permit where that type permit requires listing of designees;

(4) Certification that the applicant and his designees do not have four or more marine or estuarine resource convictions during the previous three years;

(5) For permit applications from business entities:

(A) Business Name;

(B) Type of Business Entity: Corporation, partnership, or sole proprietorship;

(C) Name, address, and phone number of responsible party and other identifying information required by this Subchapter or rules related to a specific permit;

(D) For a corporation, current articles of incorporation and a current list of corporate officers when applying for a permit in a corporate name;

(E) For a partnership, if the partnership is established by a written partnership agreement, a current copy of such agreement shall be provided when applying for a permit; and

(F) For business entities, other than corporations, copies of current assumed name statements if filed and copies of current business privilege tax certificates, if applicable; and

(6) Additional information as required for specific permits.

(b) A permittee shall hold a valid Standard or Retired Standard Commercial Fishing License in order to hold a:

(1) Pound Net Permit;

(2) Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean; or

(3) Atlantic Ocean Striped Bass Commercial Gear Permit.

(c) A permittee and his designees shall hold a valid Standard or Retired Standard Commercial Fishing License with a Shellfish Endorsement or a Shellfish License in order to hold a:

(1) Permit to Transplant Prohibited (Polluted) Shellfish;

(2) Permit to Transplant Oysters from Seed Oyster Management Areas;

(3) Permit to Use Mechanical Methods for Shellfish on Shellfish Leases or Franchises;

(4) Permit to Harvest Rangia Clams from Prohibited (Polluted) Areas; or

(5) Depuration Permit.

(d) A permittee shall hold a valid:

(1) Fish Dealer License in the proper category in order to hold Dealer Permits for Monitoring Fisheries Under a Quota/Allocation for that category; and

(2) Standard Commercial Fishing License with a Shellfish Endorsement, Retired Standard Commercial Fishing License with a Shellfish Endorsement or a Shellfish License in order to harvest clams or oysters for depuration.

(e) Aquaculture Operations/Collection Permits:

(1) A permittee shall hold a valid Aquaculture Operation Permit issued by the Fisheries Director to hold an Aquaculture Collection Permit.

(2) The permittee or designees shall hold appropriate licenses from the Division of Marine Fisheries for the species harvested and the gear used under the Aquaculture Collection Permit.

(f) Atlantic Ocean Striped Bass Commercial Gear Permit:

(1) Upon application for an Atlantic Ocean Striped Bass Commercial Gear Permit, a person shall declare one of the following gears for an initial permit and at intervals of three consecutive license years thereafter:
(A) gill net;
(B) trawl; or
(C) beach seine.
For the purpose of this Rule, a "beach seine" is defined as a swipe net constructed of multi-filament or multi-fiber webbing fished from the ocean beach that is deployed from a vessel launched from the ocean beach where the fishing operation takes place.
Gear declarations shall be binding on the permittee for three consecutive license years without regard to subsequent annual permit issuance.

(2) A person is not eligible for more than one Atlantic Ocean Striped Bass Commercial Gear Permit regardless of the number of Standard Commercial Fishing Licenses, Retired Standard Commercial Fishing Licenses or assignments held by the person.

(g) Applications submitted without complete and required information shall not be processed until all required information has been submitted. Incomplete applications shall be returned to the applicant with deficiency in the application so noted.

(h) A permit shall be issued only after the application has been deemed complete by the Division of Marine Fisheries and the applicant certifies to abide by the permit general and specific conditions established under 15A NCAC 03J .0501, .0505, 03K .0103, .0104, .0107, .0111, .0401, 03O .0502, and .0503 as applicable to the requested permit.

(i) The Fisheries Director, or his agent may evaluate the following in determining whether to issue, modify, or renew a permit:

(1) Potential threats to public health or marine and estuarine resources regulated by the Marine Fisheries Commission;

(2) Applicant's demonstration of a valid justification for the permit and a showing of responsibility as determined by the Fisheries Director; and

(3) Applicant's history of habitual fisheries violations evidenced by eight or more violations in 10 years.

(j) The Division of Marine Fisheries shall notify the applicant in writing of the denial or modification of any permit request and the reasons therefor. The applicant may submit further information, or reasons why the permit should not be denied or modified.

(k) Permits are valid from the date of issuance through the expiration date printed on the permit. Unless otherwise established by rule, the Fisheries Director may establish the issuance timeframe for specific types and categories of permits based on season, calendar year, or other period based upon the nature of the activity permitted, the duration of the activity, compliance with federal or state fishery management plans or implementing rules, conflicts with other fisheries or gear usage, or seasons for the species involved. The expiration date shall be specified on the permit.

(l) For permit renewals, the permittee's signature on the application shall certify all information as true and accurate. Notarization of signature on renewal applications shall not be required.

(m) For initial or renewal permits, processing time for permits may be up to 30 days unless otherwise specified in this Chapter.

(n) It is unlawful for a permit holder to fail to notify the Division of Marine Fisheries within 30 days of a change of name or address, in accordance with G.S. 113-169.2.

(o) It is unlawful for a permit holder to fail to notify the Division of Marine Fisheries of a change of designee prior to use of the permit by that designee.

(p) Permit applications are available at all Division Offices.

Marine Fisheries
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
BRAXTON C. DAVIS
Director

MEMORANDUM

TO: ASMFC American Eel Technical Committee

FROM: Todd Mathes, N.C. Division of Marine Fisheries

DATE: July 3, 2017

RE: Update on N.C. American Eel Aquaculture Plan with regards to the 2017 harvest season and modifications to the proposed May 2017 Plan (2018-2020 harvest seasons)

May 2016 Plan (2017 Harvest Season) - Background

August 4, 2016, the Atlantic States Marine Fisheries Commission's American Eel Management Board approved North Carolina's Aquaculture Plan for May 2016 (2017 fishing season), allowing up to 200 pounds of glass eels to be harvested for aquaculture purposes.

In May 2016, NCDMF worked with the American Eel Farm (AEF) to develop the new 2017 NC Aquaculture Plan along with input from DMF Biologists, Marine Patrol Officers and MP Communications, Habitat and Enhancement Section, Aquaculture Program Coordinator, and License and Statistics (Trip Ticket). NCDMF had many phone conversations with the AEF, and set up an in person meeting to work through the process of modifying the previous aquaculture plan.

On May 31, 2016, NCDMF submitted the NC Aquaculture Plan to the ASMFC, on July 7, 2016, the N.C. Aquaculture Plan was presented to the ASMFC Technical Committee who recommended the plan for approval, and on August 4, 2016, the American Eel Management Board approved the 2017 N.C. Aquaculture Plan.

Prior to the start of the 2017 harvest season (Jan 1, 2017), NCDMF staff met on a conference call to discuss the upcoming glass eel harvest season and to finalize the permit conditions (completed December 13, 2016).

On December 13, 2016, the Aquaculture Permit Program Coordinator met with the AEF owner to discuss/explain the permit conditions. AEF questioned if several of the previously agreed upon permit conditions could be modified.

From December 14-31, 2016, NCDMF staff worked to figure out if any of their requests could be accommodated. One request that was of high importance to AEF was for a second

permittee. Given that the ASMFC Board approved the plan with only one permittee, the only thing we could offer the AEF was to have a different individual listed as the permittee.

On December 31,2016, NCDMF received the required net identification information prior to the deployment of any nets.

On January 5, 2017, the permit conditions were sent via mail and email to the AEF, and on January 10, 2017, the AEF signed the permit conditions (received by NCDMF January 12, 2017).

2017 Glass Eel Harvest Activities

The AEF did not set any nets the first three weeks of January. They attempted to deploy their first fyke nets on January 18, however they had mechanical problems and did not launch the boat. On January 23, 2017, the AEF deployed their first fyke net of the season.

The first week of fishing (January 23-27, 2017), in terms of reporting, were problematic for the AEF. They had many reporting requirements, which they helped develop, they determined were too burdensome.

On January 27, 2017, the AEF received a violation/citation for blocking more than two-thirds of a navigable waterway. On the same day, NCDMF received a phone call from the AEF saying that all nets had been removed from the water and they were not going to fish until the issues with the reporting requirements had been resolved. The AEF believed there were too many reporting requirements and they were being set up for failure. The AEF quit fishing and requested a meeting with the Division Director, Marine Patrol Colonel, and lead managers and biologists to review the reporting requirements. After the meeting, there were two modifications: 1) the AEF could email (previously only call) the American Eel Biologist by noon with the previous days catch, and 2) the permit conditions would be combined from two documents into one document for ease of use. No other modifications were made.

Throughout February, March and the beginning of April, the AEF successfully deployed fyke nets and harvested limited numbers of glass eels. During the entire harvest period, NCDMF staff worked with the AEF to try and accommodate their requests, while staying within the bounds of the May 2016 N.C. Aquaculture Plan.

On April 20, 2017, the AEF removed all their nets from the water and stopped fishing for the 2017 glass eel season.

2017 Glass Eel Harvest Results

- 12 of 17 weeks the AEF had fyke nets deployed; the AEF waited three weeks after the opening of the glass eel season (Jan. 1, 2017) before setting any nets. Also, there were two, one week periods at the end of the season when the AEF decided not to fish.

- Fyke nets were fished 44 out of 85 days available to be fished (there was no fishing on Saturdays and Sundays throughout the season)
- Majority of fishing effort was in the White Oak River, but the AEF also deployed a few nets in Dawson, Orchard, and Pierce creeks within the Neuse system (Figure 1).
- 775 glass eels, weighing approximately 0.25344 pounds (1 glass eel = 0.149747899 grams) were harvested (Table 1, Figure 2)
- 51 glass eels were released alive (Table 1, Figure 2)
- 199.74656 pounds of unused glass eel quota remained
- 23 elvers were captured and released (Table 1)
- The maximum number of deployed fyke nets per week was 14
- CPUE data – poor data due to: 1) changing harvest locations, 2) different net dimensions, 3) gear modifications (crab protection), 4) reporting issues, 5) inconsistent fishing effort, and 6) periods of no fishing.

AEF Violations

Citations by N.C. Marine Patrol in 2017:

- January 27, 2017: the AEF was charged with use of a fixed or stationary net as to block more than two-thirds of any natural or manmade waterway, sound, bay, creek, inlet or any other body of water (rule violation).
- March 24, 2017: the AEF was charged with violating conditions of aquaculture plan for not fishing their gear within the approved timeframe (having fyke nets in water two hours after sunrise without having the rigid device installed in cod end keeping nets open; permit violation).
- April 6, 2017: the AEF was charged with violating conditions of aquaculture plan for not fishing their gear within the approved timeframe (having fyke nets in water two hours after sunrise without having rigid device installed in cod end keeping nets open). In addition, one fyke net was seized (permit violation).

Citations by N.C. Wildlife Resources Commission in 2017:

- March 20, 2017: the AEF was charged with operating a motor vessel without proper navigational lights (rule violation).
- March 20, 2017: the AEF was charged with operating a motor vessel with invalid registration number (vessel was registered in another state and had been in NC for more than 90 days; rule violation).
- March 20, 2017: the AEF was charged with taking nongame fish (American eel) by method other than hook and line from inland waters of N.C. (rule and permit violation)

Hearings have not occurred for any of the above violations so the legal outcome is still unknown.

May 2017 Plan (2018-2020 Harvest Seasons)

The May 2017 N.C. Aquaculture Plan was submitted on behalf of the AEF, who were solely responsible for drafting the new plan for the 2018-2020 harvest seasons. Based on our experience managing the 2017 glass eel harvest season and numerous discussions with the AEF concerning what worked and did not work in the 2016 plan, the NCDMF decided to allow the AEF to draft a plan that would give them the best opportunity to successfully harvest glass eels, while still satisfying the aquaculture plan requirements in Addendum IV. Table 2 outlines the

May 2016 and May 2017 N.C. Aquaculture Plan sections side by side for comparative purposes to better see the modifications that were made.

Tables

Table 1. American Eel Farm summary catch and effort statistics for the 2017 glass eel harvest season. The double line represents the shift in sampling periods (24 hour sets to 12 hour sets). *There were several weeks when the AEF did not fish or have any nets deployed. [+]The AEF had a vehicle accident that prevented them from checking their nets – NCDMF Marine Patrol aided the AEF in fishing nets.

	# of nets deployed									
Week date	Average	Min	Max	Total # days fished	Total # hours fished	Average hours fished	Total # glass eels harvested	Total # glass eels released	Total # elvers released	Glass eel CPUE (# glass eels /hour)
2-6 Jan*	-	-	-	-	-	-	-	-	-	-
8-13 Jan*	-	-	-	-	-	-	-	-	-	-
15-20 Jan*	-	-	-	-	-	-	-	-	-	-
22-27 Jan	6.3	0	10	4	623.3	23.1	42	0	0	0.084
29 Jan-3 Feb	3	0	9	1	216	23.3	0	0	0	0
5-10 Feb	3.3	0	10	2	480	23.0	0	0	0	0
12-17 Feb	11.8	9	14	5	1,236.6	22.9	41	0	4	0.032
19-24 Feb	14	14	14	5	1,671.7	23.9	313	0	11	0.187
26 Feb-3 Mar[+]	7.3	0	11	1	792	72	64	0	1	0.081
5-10 Mar	5.3	0	10	3	278	12.6	239	0	4	0.845
12-17 Mar	5.7	3	7	5	323.5	12.9	26	10	2	0.091
19-24 Mar	5	0	8	5	274	13.0	10	2	0	0.082
26-31 Mar	7.5	5	9	5	472	13.1	0	25	0	0
2-7 Apr	8.3	6	9	5	570.6	13.6	40	14	1	0.085
9-14 Apr*	-	-	-	-	-	-	-	-	-	-
16-21 Apr	2.4	0	3	3	114.4	12.7	0	0	0	0
23-28 Apr*	-	-	-	-	-	-	-	-	-	-
Total	6.7	0	14	44	7052.1	23.2/13	775	51	23	0.124

State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021

Table 2. Comparison between the May 2016 N.C. Aquaculture Plan and the proposed May 2017 N.C. Aquaculture Plan highlighting the modifications.

Section Heading	2016 Plan	2017 Plan	Modification
DATES OF HARVEST	January 1 to April 30	January 1 to May 30	• extended harvest season by 1 month
DURATION OF HARVEST	1-year period	3-year period	• extended plan from a 1-year to a 3-year plan
METHOD OF HARVEST	Fyke and dip nets	Fyke and dip nets + Irish eel ladder	• added Irish eel ladder
THE CURRENT AND PAST STATUS FOR AQUACULTURE PURPOSES		Most harvested glass eels are exported, it's extremely important to support and promote domestic aquaculture	• added new paragraph
MINIMAL CONTRIBUTION	Harvest sites located in areas that have been heavily impacted by human development. No harvest in Albemarle Sound, the Tar-Pamlico River Basin, or areas such as National Wildlife Refuges, National Estuarine Reserves, National Forests, National Seashores, North Carolina Coastal Reserves, North Carolina State Parks, North Carolina Preserves, North Carolina Strategic Habitat Areas, and Natural Heritage Natural Areas.	Harvesting glass eels from any North Carolina waters would have little impact on the massive biomass of eels migrating along the eastern seaboard (most wild caught yellow eels come from Chesapeake Bay and Delaware Bay water basins). Also, the ASMFC has already taken into consideration the impact of the 200 pound per state harvest and allocated an amount that would total 2,800 pounds for aquaculture purposes coastwide.	• changed minimal contribution justification
ATLANTIC SEABOARD WATERSHED		Most yellow eel harvest comes from Chesapeake and Delaware bays, therefore any glass eel harvest in N.C. would have a minimal impact on the population. Also, the ASMCF has already determined that allocating 200 pounds of glass eels per state would have a minimal impact to the population.	• added new paragraph

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Section Heading	2016 Plan	2017 Plan	Modification
LOCATION OF HARVEST – Harvest Sites	Eleven (11) primary sites and three (3) alternate sites: 1. Bradley Creek 2. Futch Creek 3. Goose Creek 4. Howe Creek 5. Mill Creek 6. Queen Creek 7. Sanders Creek 8. Saucepan Creek 9. Shallotte River 10. Whiskey Creek 11. White Oak River, and 1. Dawson Creek 2. Orchard Creek 3. Pierce Creek	Four (4) sites: 1. Albemarle Sound and tributaries 2. Pamlico Sound and tributaries 3. Newport River and tributaries 4. North River and tributaries	• removed the primary sites and alternate sites (n=13), and replaced them with the Albemarle/Pamlico sounds and their tributaries, and the Newport and North rivers
NCDMF MONITORING PROGRAM – General Conditions	It is unlawful to fail to provide a complete inventory of the fyke nets prior to January 1, 2017, including the Net ID number and identifying gear characteristics (e.g., wing mesh, cod end mesh, wing length, funnel length, number of cod ends, number of funnels, etc.).	No requirement	• no Net_ID numbers
	1 harvester; 2 mates	3 harvesters; 2 mates each	• increased number of authorized harvesters (3 total) • increased the number of mates (6 total)
	Fyke and dip nets	Fyke and dip nets + Irish eel ladder	• added Irish eel ladder
	No more than 15 total pieces of gear	No more than 30 total pieces of gear	• increased number of pieces of gear to 30 total

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Section Heading	2016 Plan	2017 Plan	Modification
	January 1 through February 28, 2017, fyke and dip nets for glass eel harvest may be fished at all hours during the week. Fyke nets may have their cod ends closed during the day, however from 12:01 pm on Friday through 12:01 pm on Sunday fyke nets may remain in the water but the terminal portion of a fyke net cod end shall contain a rigid device with an opening not less than three (3) inches in diameter and not exceeding six (6) inches in length that is not obstructed by any other portion of the net and dip nets may not be used.	January 1 through May 30, fyke and dip nets for glass eel harvest may be fished at all hours during the week. Fyke nets may have their cod ends closed during the day, however from 12:01 pm on Friday through 12:01 pm on Sunday fyke nets may remain in the water but the terminal portion of a fyke net cod end shall contain a rigid device with an opening not less than three (3) inches in diameter and not exceeding eight (8) inches in length that is not obstructed by any other portion of the net and dip nets may not be used.	• extended period by 3 months • changed length of the rigid device to 8 inches
	Fyke nets shall be fished at least once every twenty-four (24) hours	No requirement	• removed requirement
	March 1 through April 30, 2017, fyke nets and dip nets for glass eel harvest may only be fished and the cod ends closed from two hours before sunset through two hours after sunrise	No requirement	• removed requirement, will no longer be required to remove nets from the water over the weekend during this period
	During the March 1 through April 30, 2017 period, from two hours after sunrise through two hours before sunset the gear may remain in the water and the terminal portion of a fyke net cod end contain a rigid device with an opening not less than three (3) inches in diameter and not exceeding six (6) inches in length that is not obstructed by any other portion of the net	No requirement	• removed requirement
	Tamper evident tags shall be used to secure the cod ends of the net closed while the gear is fishing	No requirement	• removed requirement
	Tamper evident tags shall be used to secure the cod ends open when the gear is not fishing	No requirement	• removed requirement

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Section Heading	2016 Plan	2017 Plan	Modification
NCDMF MONITORING PROGRAM – Before Harvest	GPS coordinates of each net once they are set, if multiple nets are set the same day, coordinates can be provided once all the nets have been set.		• moved item to After Harvest Section
	Daily - Names of individual(s) involved reported daily	Beginning of the season - Names of individual(s) involved reported only at the beginning of the season; any changes or additions would be immediately reported.	• only reported one time at the beginning of the season
	Daily - Description and registration number of the boat(s)	Beginning of the season - see above	• only reported one time at the beginning of the season
	Daily - Description and license plate number of the vehicle(s)	Beginning of the season - see above	• only reported one time at the beginning of the season
NCDMF MONITORING PROGRAM – During Harvest	Record the time the gear began and ended fishing, and the number of pounds of glass eels harvested from each piece of gear (individual fyke or dip net).	No CPUE data collected	• removed requirement
	Record the weight of elvers captured from each piece of gear	No elver data collected	• removed requirement
NCDMF MONITORING PROGRAM – After Harvest		GPS coordinates of each net once they are set, if multiple nets are set the same day, coordinates can be provided once all the nets have been set.	• moved item from Before Harvest Section
	Require fisherman to call-in to NCDMF the total harvest in pounds prior to leaving the last harvest site and report an estimated time of arrival (within a 15-minute time frame) at the landing site.	No requirement	• removed requirement
	Once all gear is fished, the fisherman must travel directly to the designated landing site	No requirement	• removed requirement
	Once at the designated landing site all eels must be offloaded and transported directly to the AEF facility	No requirement	• removed requirement

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Section Heading	2016 Plan	2017 Plan	Modification
	Require AEF to call-in or email to NCDMF by 12:00 pm (noon) each day the total harvest for the previous day in pounds to the nearest 0.1 lb. of glass eels received	Require AEF to call-in or email to NCDMF by 5:00 pm each day the total harvest for the previous day in pounds to the nearest 0.1 lb. of glass eels received	• change in reporting time (5 hours later)
	Require AEF to provide CPUE data from each piece of gear (individual fyke or dip net) by the 10th of the following month.	No requirement	• removed requirement
DESCRIPRION of the FACILITY			• additional information was provided regarding system specifications

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Figures

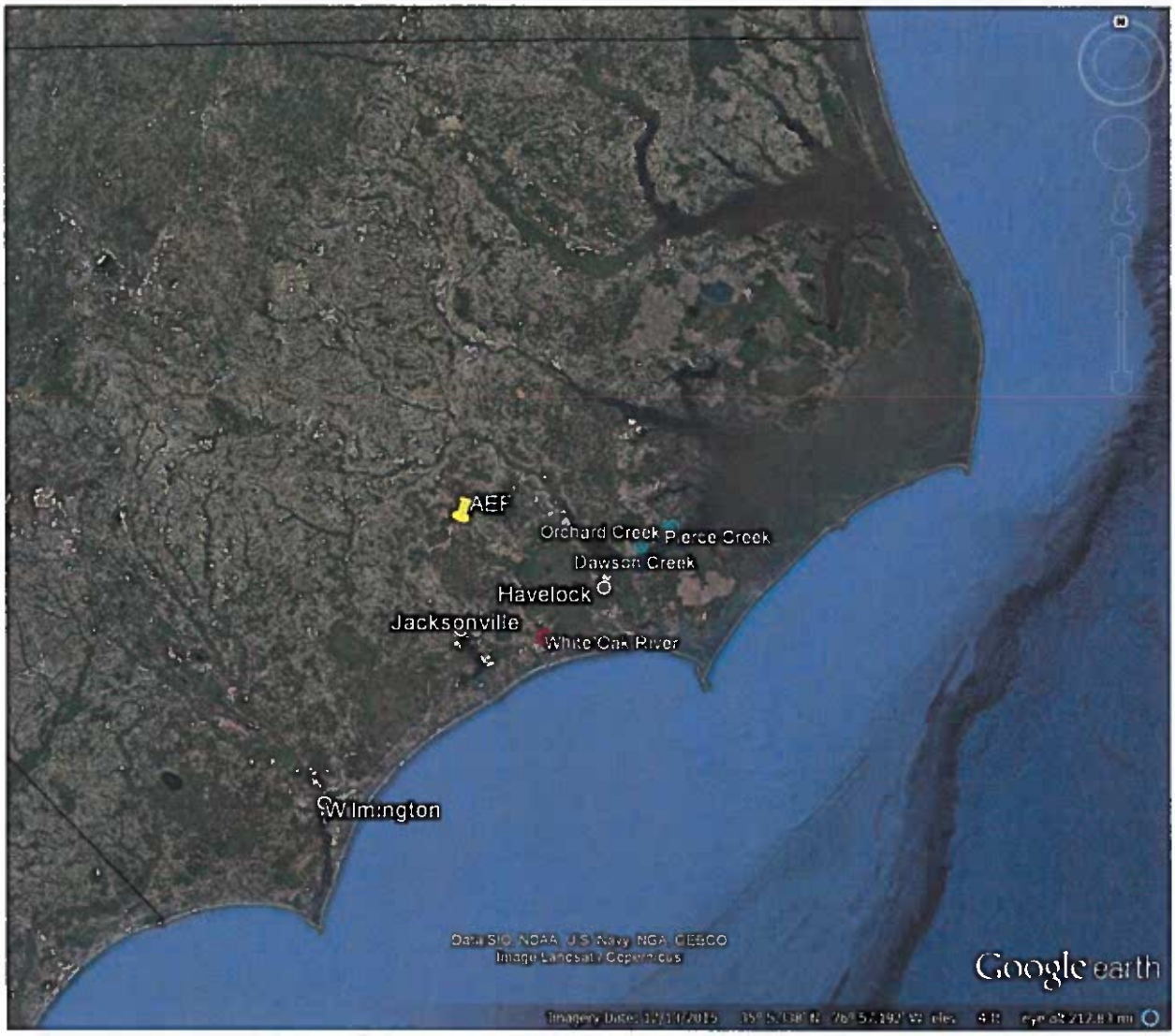

Figure 1. Approved sampling locations with fishing effort in 2017 (most effort occurred in the White Oak River).

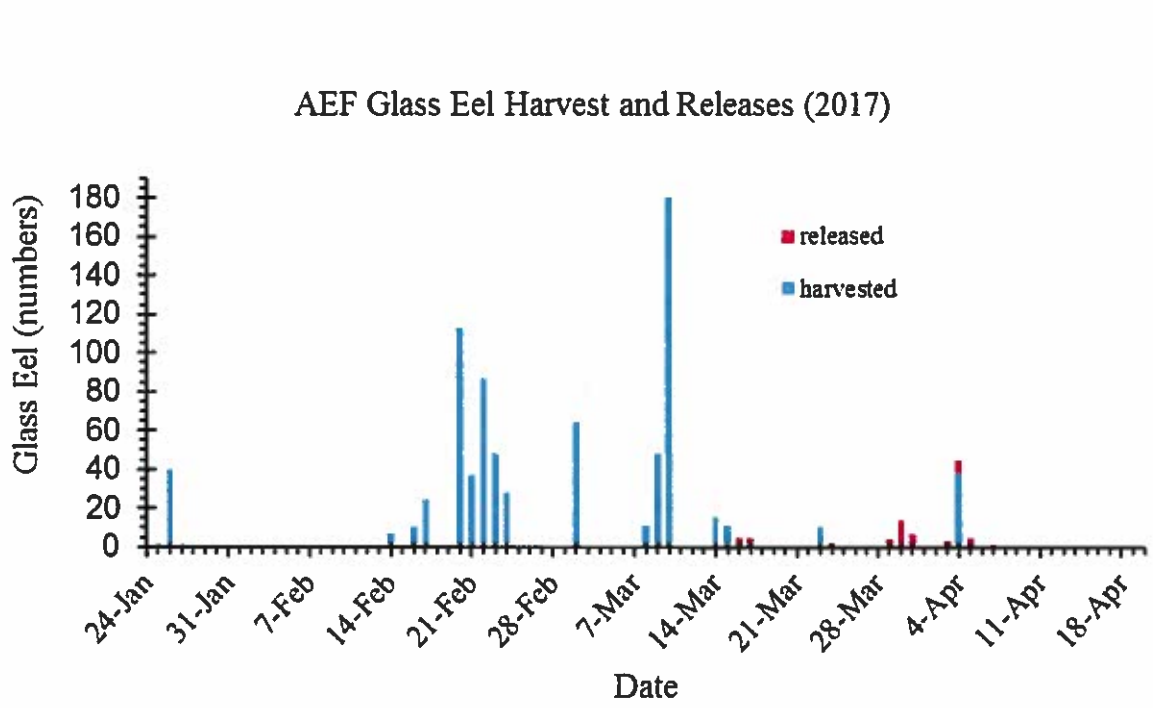

Figure 2. Number of glass eels harvested and released by day during the 2017 fishing season.

Atlantic States Marine Fisheries Commission

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American Eel Technical Committee
Meeting Summary

July 6, 2017

TC Attendance: Robert Eckert (NH), Patrick McGee (RI), Carol Hoffman (NY), Jennifer Pyle (NJ), Michael Kaufmann (PA), Jordan Zimmerman (DE; TC Vice-Chair), Keith Whiteford (MD), Troy Tuckey (VIMS), Todd Mathes (NC), Jason Rock (NC), Andrew Watson (SC), Ryan Harrell (GA) Wilson Laney (USFWS), Sheila Eyler (USFWS), Kirby Rootes-Murdy (ASMFC), Kristen Anstead (ASMFC)

Board Members: Michelle Duval (NCDMF; Commissioner Proxy)

Members of the public: Rick Allyn (AEF), Michael Yates (AEF), Zoemma Warshafsky (VIMS), Steve Murphy (NC DMF)

The American eel Technical Committee (TC) met via conference call July 6th, 2017, to get an update on Zoemma Warshafsky's nematode research project at VIMS, review and make recommendations regarding an aquaculture plan from North Carolina for 2018-2020, get an update on ongoing American eel ageing projects, and discuss the progress and timeline of the stock assessment update.

1) **Updated Nematode Research & Discussion**

Zoemma Warshafsky updated the TC on the progress of her master's thesis work at VIMS investigating if the parasitic nematode, *Anguillicoloides crassus*, is contributing to the decline of the American eel in the Chesapeake Bay. She is also collecting information for upcoming stock assessments to better estimate mortality. Her results indicate that glass eels have more larval stage nematodes than adults and that glass eels have lower infection rates than yellow eels and elvers which are highly infected. The probability of swim bladder damage increases with length and there is more damage in the winter than in the summer months. The highest force of infection, or the transition from disease negative to positive, was at age 2 and during winter months (Nov-Feb). Ultimately she did find that the disease increased mortality for diseased versus healthy fish. If the TC is interested in Warshafsky developing a quick reference field guide so that state samplers who collect biological data for American eels can score the rate of infection using the same protocol coast-wide, she is willing to work with the TC to accomplish that goal. She will also continue to update the TC as her thesis progresses.

2) **NC Update to Eel Aquaculture Plan & Discussion**

Background: Addendum IV to the Interstate Fishery Management Plan for the American Eel includes a provision for states to submit an Aquaculture Plan to allow for the harvest of glass eels. In December 2015, NC and the American Eel Farm (AEF) submitted an aquaculture plan for

2016 which was reviewed by the TC. After amending the plan to reflect the recommendations of the TC, it was presented to the American Eel Management Board and approved in February 2016. Due to delays in NC permitting, fishing began late in the season and no glass eels were captured in 2016. Therefore, NC amended the plan for the TC to consider as a second year pilot program for 2017. This plan was also amended and then approved by the Board.

2017 Glass Eel Harvest Activities: Todd Mathes updated the TC on the 2017 fishing season which served as a second year pilot program. The AEF fishermen encountered some mechanical issues with their boat and gear and were not able to set nets the first few weeks of January. AEF experienced some challenges with the reporting requirements and also received violations by NC Marine Patrol and Wildlife Resources Commission unrelated to reporting requirements. Despite some setbacks, they did fish 12 of the 17 weeks, catching approximately 0.25 lbs (775 glass eels) of the maximum 200 pounds allowed for use in domestic aquaculture.

Proposed 2018-2020 Aquaculture Plan: Todd Mathes presented the NC Aquaculture Plan for American eel for 2018-2020. He indicated that the plan has been revised by the AEF and was being submitted by NCDMF on AEF's behalf. Multiple changes were made from the previously approved plans including an extended 3-year term (2018-2020) and fishing season (addition of one month, now January 1-May 30), use of an Irish eel ladder, expanding the location of the harvest (from 11 creeks and rivers to 2 sounds and 2 rivers), removing multiple monitoring program requirements, and increasing the number of harvesters and allowable pieces of gear. The TC asked questions and discussed the changes. Mathes explained that the extended terms and fishing season, as well as the expanded sites to include northern waters in NC, were to give the AEF more opportunity to be successful and to provide more stability from a business perspective. There was concern that by harvesting in northern waters using an Irish eel ramp, for example, bottlenecks could occur and taking 200 lbs of glass eels from one river system could represent a large proportion of the entire run of glass eels in that river. It was pointed out by Mathes that this could be a concern regardless of gear and that the AEF is restricted to Coastal and Joint fishing waters and not allowed to fish in inland waters where bottlenecks would be present. Similarly, some members of the TC found the expansion of fishing area problematic since the previously stated intent was to target areas that were more urban and in smaller watersheds where removal of glass eel was less likely to affect future adult eel recruitment. As was discussed the last two years, the TC conceded that it was not possible at this time to prove or disprove that the 200 lbs represents a minimal contribution in any of these systems, particularly without a dedicated YOY survey in the region.

The TC was concerned about many of the removed reporting requirements, such as removing ID tags on gear and not requiring tamper evident tags as well as expanding the fishing area but Mathes stated that the NC Marine Patrol Colonel has reviewed this, has officers in all the proposed areas, and feels confident they could enforce the requirements although ID tags should still be used to identify individual gears. Additionally, the tamper evident tags did not work as planned according to Mathes and there was no reported tampering by the AEF. Removing the requirement to fish fyke nets at least once every 24-hours also did not seem prudent to some TC members because of the possibility of eel mortality and bycatch. There

were also many concerns about other removed reporting requirements, such as not requiring the collection of CPUE data, since one of the justifications for the previous plan was that it would provide the TC with data on glass eel ingress and abundance from NC. Some TC members acknowledged that the CPUE data may not be that informative initially, but that if this proposal continued for future years the data would be necessary. Ultimately, several TC members expressed that some of their concerns were ameliorated by the fact that the maximum amount of harvest allowed in Addendum IV for aquaculture purposes is 200 lbs of glass eels.

The TC does not support the AEF's proposal in its current form. Given that the project has thus far failed to fish for AEF's full time and gear allocation and has come in well below the quota, the proposal would be accepted by the TC contingent on the following recommendations:

- The proposal should be for one year, not three, and if the 2018 fishing year is successful and in compliance with the requirements then the implementation period could be increased to two years. This would also prevent the AEF from having the entire 200 lbs of allowable harvest for the state for several years, and thus preventing the entry of any other aquaculture companies.
- Remove the language 'While we have no quantitative data on the abundance of glass eels, it could be argued the harvest of 200 lb. of glass eels is limited enough to have a minimal impact on the spawning stock of American eel.' This statement is not the opinion of the TC and the NC Memo further elaborated on this opinion that many TC members found misleading.
- Require net ID numbers and that gear specifications need to be reported so that CPUE calculations can be properly interpreted. [**Please note**: NC staff indicated following the call that AEF will mark their nets with unique ID numbers.]
- Require that fyke nets shall be fished at least once every 24 hours due to concerns over inducing addition mortality. [**Note:** NC DMF staff noted concern with this recommendation in cases of inclement weather that may not allow harvesters to get back to gear location within a 24 period.]
- Require CPUE data collection, including the time the gear began and ended fishing and the number of glass eels harvested from each piece of gear (individual fyke or dip net), as well as the location of the gear (even if location changes daily and/or weekly). This data should continue to be provided by the 10th of the following month.

In addition to the TC recommendations, ASMFC staff indicated that members of the Commission's Law Enforcement Committee will be reviewing the harvest reporting, monitoring, and gear modifications indicated in the new proposal and will aim to provide the Board will feedback at the ASMFC Summer Meeting. Lastly, the TC recommendations will be shared with NC DMF staff and the AEF staff to allow for them to reconsider elements of their proposal the TC raised concerns over.

3) **Progress on the Stock Assessment Update**

Kristen Anstead updated the TC on the progress of the stock assessment update which is scheduled to be presented to the Board in October. Landings and fishery-independent data sets that were previously used in the trend or growth analyses will all be updated. The trend

analyses and tests will include ARIMA, Mann-Kendall, Manly, and power. Progress has been made on the analyses and report writing and thus far the stock assessment subcommittee is on target to meet their deadline. The TC should anticipate reviewing and discussing this document in late August-early September.

4) **American Eel Ageing Project**

Anstead also updated the TC on the ASMFC American eel ageing project that has been underway since last year. The sample exchange and analysis indicated a lot of bias and imprecision in eel ageing along the coast. To address this, an in-person ageing workshop is scheduled for January next year. At the workshop, participants will develop processing and age reading protocols and revisit the exchange samples. The ageing workshop will be open to one ager per state/ageing lab with preferential treatment given to those that participated in the exchange. For any questions contact Anstead.

5) **Other Business**

Preliminary yellow eel landings: Kirby Rootes-Murdy presented the preliminary 2016 yellow eel landings to the TC. Addendum IV established a coast-wide catch cap set at 907,671 lbs which was based on the average harvest of 1998-2010. There are two management triggers: (1) the coast-wide cap is exceeded by more than 10% in a given year or (2) the coast-wide cap is exceeded for two consecutive years regardless of percent over. If either triggers is tripped, there would be an implemented state-by-state commercial yellow eel quota. Preliminary 2016 landings indicate that 928,358 lbs of yellow eel were harvested coast-wide, exceeding the catch cap but not by 10%. If the landings also exceed the cap in 2017, there is a likelihood of going to state-by-state quota. In the meantime, Rootes-Murdy is working on drafting a memo to the Board regarding this issue and finalizing the landings.

NC's Senate Bill 410: Dr. Michelle Duval updated the TC on a recent NC bill that was passed by both houses of the NC legislature and has implications for American eel in that state. The bill would exempt American eels imported from Virginia or South Carolina intended for aquaculture operations from some permitting requirements. Currently, imported marine organisms entering NC need an importation permit and health certification from a pathologist to prove that they are disease-free and do not pose a risk to NC. The bill was introduced to address industry concerns regarding the extra expense associated with the health certification which has limited the import of yellow eel sold as bait. The bill is currently on the desk of the governor who will need to sign or veto it in 10 or 30 days or it will automatically become law. As it is written now, it applies to all eel life stages (glass, yellow, silver) although it was noted that Virginia does not have a glass eel fishery.

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MEMORANDUM

July 14, 2017

TO: **American Eel Management Board**

FROM: **Kirby Rootes-Murdy, Senior FMP Coordinator**

SUBJECT: **2016 Preliminary yellow eel landings**

This memo provides information on the preliminary 2016 yellow eel landings and potential implications for the 2018 fishing season. Addendum IV (2014) established a coast-wide catch cap set at 907,671 pounds, which is based on the average harvest level from 1998-2010. Under the cap, there are two management triggers. Upon reaching either of these triggers, the Board is required to alter the management program as specified below in order to ensure the objectives of the management program are achieved.

Management Triggers

1. The coastwide catch cap is exceeded by more than 10% in a given year (998,438 pounds).

2. The coastwide catch cap is exceeded for two consecutive years, regardless of percent over.

Management Response

If either trigger is tripped, then there would be automatic implementation of a state-by-state commercial yellow eel quota. The annual coastwide quota is set at 907,669 pounds, with state allocations specified in Table 1 (last column 'Final Quota').

As of July 2017, the preliminary yellow eel landings for 2016 are 928,358 pounds. Though the 2016 landings are preliminary and subject to change, if the landings remain above the coastwide cap and the cap is exceeded again in 2017 (current fishing year), state-by-state quotas would be implemented in 2018 per the provisions of Addendum IV. While annual compliance reports are due by September 1 annually, preliminary 2017 yellow eel landings could be determined by Spring 2018. Under this potential scenario, the Board would be notified in Spring 2018 of preliminary 2017 landing data and whether management triggers were tripped.

Please contact me if you have any questions by email at krootes-murdy@asmfc.org or by phone at (703)842-0740.

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Table 1. State by State yellow eel quotas under Addendum IV.

	2010 Landings	2011-2013 Harvest Average	Initial Allocation Based on Harvest Average	Initial Quota	After Filtering Method is Applied	Final Quota
Maine	2,624	5,104	0.48%	3,943	3,907	3,907
New Hampshire	80	134	0.01%	82	2,000	2,000
Massachusetts	277	450	0.04%	329	2,000	2,000
Rhode Island	4,642	1,750	0.16%	1,314	3,946	4,642
Connecticut	164	2,073	0.19%	1,561	2,000	2,000
New York	13,220	46,058	4.26%	34,997	15,220	15,220
New Jersey	107,803	110,058	10.19%	83,713	91,633	94,899
Delaware	68,666	75,249	6.97%	57,260	58,366	61,632
Maryland	511,201	612,665	56.72%	465,968	465,968	465,968
PRFC	57,755	50,446	4.67%	38,365	49,092	52,358
Virginia	78,076	103,433	9.58%	78,702	78,702	78,702
North Carolina	122,104	53,350	4.94%	40,583	103,788	107,054
South Carolina	2			0	2,000	2,000
Georgia	103	1,162	0.11%	904	2,000	2,000
Florida	11,287	18,231	1.68%	13,802	13,287	13,287
Total	978,004	1,080,160	100%	821,523	893,909	907,669

2016 REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR **AMERICAN EEL** ***(Anguilla rostrata)***

2015 FISHING YEAR

Prepared by the American Eel Plan Review Team
July 2017

2016 REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN FOR AMERICAN EEL
(Anguilla rostrata)

I. Status of the Fishery Management Plan

Date of FMP approval:	November 1999
Addenda:	Addendum I (February 2006) Addendum II (October 2008) Addendum III (August 2013) Addendum IV (October 2014)
Management unit:	Migratory stocks of American Eel from Maine through Florida
States with a declared interest:	Maine through Florida, including the District of Columbia and the Potomac River Fisheries Commission
Active committees:	American Eel Management Board, Plan Review Team, Technical Committee, Stock Assessment Subcommittee, and Advisory Panel.

The ASMFC American Eel Management Board first convened in November 1995 and finalized the Fishery Management Plan (FMP) for American Eel in November 1999 (ASMFC 2000a). The goal of the FMP is to conserve and protect the American eel resource to ensure ecological stability while providing for sustainable fisheries. In support of this goal, the following objectives are included:

The FMP requires all states and jurisdictions to implement an annual young-of-year (YOY) abundance survey to monitor annual recruitment of each year's cohort. In addition, the FMP requires a minimum recreational size and possession limit and a state license for recreational fishermen to sell eels. The FMP requires that states and jurisdictions maintain existing or more conservative American eel commercial fishery regulations for all life stages, including minimum size limits. Each state is responsible for implementing management measures within its jurisdiction to ensure the sustainability of its American eel population.

In August 2005, the American Eel Management Board directed the American Eel Plan Development Team (PDT) to initiate an addendum to establish a mandatory catch and effort monitoring program for American eel. The Board approved Addendum I at the February 2006 Board meeting.

In January 2007, the Management Board initiated a draft addendum with the goal of increasing escapement of silver eels to the spawning grounds. In October 2008, the Management Board approved Addendum II, which placed increased emphasis on improving the upstream and downstream passage of American eel. The Management Board chose to delay action on management measures in order to incorporate the results of the 2012 stock assessment.

In August 2012, the Management Board initiated Draft Addendum III with the goal of reducing mortality on all life stages of American eel. The addendum was initiated in response to the findings of the 2012 Benchmark stock assessment, which declared American eel stock along the US East Coast as depleted. The Management Board approved Addendum III in August 2013.

Addendum III requires states to reduce the yellow eel recreational possession limit to 25 eel/person/day, with the option to allow an exception of 50 eel/person/day for party/charter employees for bait purposes. The recreational and commercial size limit increased to a minimum of 9". Eel pots are required to be ½" by ½" minimum mesh size or have at least a 4" by 4" escape panel of ½" by ½" mesh escape panel. The glass eel fishery is required to implement a maximum tolerance of 25 pigmented eels per pound of glass eel catch. The silver eel fishery is prohibited to take eels from September 1st to December 31st from any gear type other than baited traps/pots or spears. The addendum also set minimum monitoring standards for states and required dealer and harvester reporting in the commercial fishery.

In October 2014, the Board approved Addendum IV. The addendum was also initiated in response to 2012 American Eel Benchmark Stock Assessment and the need to reduce mortality on all life stages. The Addendum established a coast-wide cap of 907,671 pounds of yellow eel, reduced Maine's glass eel quota to 9,688 pounds (2014 landings), and allowed for the continuation of New York's silver eel weir fishery in the Delaware River. For yellow eel fisheries, the coast-wide cap was implemented for the 2015 fishing year and established two management triggers: (1) if the cap is exceeded by more than 10% in a given year, or (2) the coast-wide quota is exceeded for two consecutive years regardless of the percent overage. If either one of the triggers are met then states would implement state-specific allocation based on average landings from 2011-2013.

II. Status of the Stock

In 2009, the Management Board initiated a benchmark stock assessment. After reviewing over 100 surveys and studies, the American Eel Stock Assessment Subcommittee (SAS) selected 19 YOY surveys and 15 yellow eel surveys along the East Coast for use as indices of abundance in the assessment. Despite the large number of surveys and studies available for use, the American eel stock is still considered data-poor because very few surveys target eels and collect information on length, age, and sex of the animals caught. Additionally, eels have an extremely complex life history that is difficult to describe using traditional stock assessment models. Therefore, several data-poor methods were used to assess the American eel resource.

The first set of analyses (trend analyses) aimed to determine if there was a statistically significant trend in the fishery-independent survey data and whether or not there was evidence for significant trends on the regional and coast-wide scales. The second approach involved a Depletion-Based Stock Reduction Analysis (DB-SRA) model, which uses trends in historical catch to estimate biomass trends and maximum sustainable yield. Both the trend analyses and DB-SRA results indicated that the American eel stock declined in recent decades, and the prevalence of significant downward trends in multiple surveys across the coast is cause for concern. Therefore, the stock status for American eels is depleted, although overfishing and overfished status in relation to the reference points could not be used with confidence. The benchmark stock assessment was peer reviewed in March 2012 and was approved for management use in May 2012.

In 2003, declarations from the International Eel Symposium (AFS 2003, Quebec City, Quebec, Canada) and the Great Lakes Fisheries Commission (GLFC) highlighted concerns regarding the health of eel stocks worldwide. In 2010, Canada Department of Fisheries and Oceans (DFO) conducted a stock assessment on American eels in Canadian waters and found that region-specific status indices show that abundance is very low in comparison to levels in the 1980s for Lake Ontario and upper St. Lawrence River stock, and is either unchanged or increasing in the Atlantic Provinces. A joint stock assessment by both Canada DFO and the Commission was recommended by the SAS as an approach for the next assessment.

The next stock assessment update is scheduled to be completed by fall 2017.

III. Status of the Fishery

American eel currently support commercial fisheries throughout their range in North America, with significant fisheries occurring in the US Mid-Atlantic region and Canada. These fisheries are executed in riverine, estuarine, and ocean waters. In the US, commercial fisheries for glass eel/elver exist in Maine and South Carolina and a silver eel weir fishery exists in New York's Delaware River, whereas yellow eel fisheries exist in all states and jurisdictions with the exception of Pennsylvania and the District of Columbia.

Although eel have been continuously harvested, consistent data on harvest are often not available. Harvest data from the Atlantic coastal states (Maine to Florida) indicate that the harvest fluctuated widely between 1970 and 1980, but showed an increasing trend that peaked in 1979 at 3,951,936 pounds. Harvest has declined since then, with the lowest harvest of 641,225 pounds occurring in 2002. Because fishing effort data are unavailable for the entire time series, finding a correlation between population numbers and landings data is difficult.

Commercial

Commercial landings have decreased from the high of 3.95 million pounds in 1979 to a low of 641,000 pounds in 2002, and have only recently begun to exceed one million pounds. State reported landings of yellow/silver eels in 2015 totaled 865,070 pounds[1] (Table 1), which represents a 18.3% decrease in landings from 2014 (1,059,840 pounds). Yellow eel landings increased in New York but decreased in all other states and jurisdictions. In 2015, state reported landings from Maryland and Virginia together accounted for 66% of the coast-wide commercial total landings. Landings of glass eels were reported from Maine and South Carolina, totaling 5,442 pounds.

Table 1. 2015 Commercial Landings by state and Life Stage[1]

	State Reported	
	Glass	**Yellow**
Maine	5,259.44	4,130
New Hampshire	No Fishery	0
Massachusetts	No Fishery	2,502
Rhode Island	No Fishery	1,538
Connecticut	No Fishery	3,052
New York	No Fishery	53,389
New Jersey	No Fishery	88,828
Pennsylvania	No Fishery	No Fishery
Delaware	No Fishery	44,708
Maryland	No Fishery	493,043
D.C.	No Fishery	No Fishery
PRFC	No Fishery	31,588

[1] Harvest data for 2015 comes from the 2016 State Compliance Reports.

Virginia	No Fishery	78,869
North Carolina	No Fishery	57,791
South Carolina	Glass: 182.29	Confidential
Georgia	No Fishery	Confidential
Florida	Glass: 0 Elver: 0	5,632
Total	**Glass: 5,442 Elver: 0**	**865,070**

Table 2. State commercial regulations for the 2015 fishing year.*

State	Min Size Limit	License/Permit	Other
ME	Glass no min size	Daily dealer reports/swipe card program; monthly harvester report of daily landings. Tribal permit system in place for some Native American groups.	Harvester license lottery system.
	Yellow 9”	Harvester/dealer license and monthly reporting. Tribal permit system in place for some Native American groups.	Seasonal closures. Gear restrictions. Weekly closures.
NH	9”	Commercial saltwater license and wholesaler license. No dealer reports. Monthly harvester reporting includes dealer information.	Gear restrictions in freshwater.
MA	9"	Commercial permit with annual catch report requirement. Registration for dealers with purchase record requirement. Dealer/harvester reporting.	Traps, pots, spears, and angling only. Mesh restrictions.
RI	9"	Commercial fishing license. Dealer/harvester reporting.	Gear restrictions.
CT	9"	Commercial license (not required for personal use). Dealer/harvester reporting.	Gear restrictions.
NY	9"	Harvester/dealer license and reporting.	Gear restrictions. Maximum limit of 14” in some rivers.
NJ	9"	License required. No dealer reports. Monthly harvester reporting includes dealer information.	Gear restrictions.
PA	NO COMMERCIAL FISHERY		
DE	9"	Harvester reporting, no dealer reporting. License required.	Commercial fishing in tidal waters only. Gear restrictions.
MD	9"	Dealer/harvester license and monthly reporting.	Prohibited in non-tidal waters. Gear restrictions. Commercial crabbers may fish 50 pots per day, must submit catch reports.

DC	NO COMMERCIAL FISHERY		
PRFC	9"	Harvester license and reporting. No dealer reporting.	Gear restrictions.
VA	9"	Harvester license required. Dealer/harvester monthly reporting.	Mesh size restrictions on eel pots. Seasonal closures.
NC	9"	Standard Commercial Fishing License for all commercial fishing. Dealer/harvester monthly combined reports on trip ticket.	Mesh size restrictions on eel pots. Seasonal closures.
SC	Glass no min size	Fyke and dip net only permitted. Dealer/harvester monthly combined reports on trip ticket.	Max 10 individuals. gear and area restrictions.
	Yellow 9”	Pots only permitted. Dealer/harvester monthly combined reports on trip ticket.	Gear restrictions.
GA	9"	Personal commercial fishing license and commercial fishing boat license. Dealer/harvester monthly combined reports on trip ticket.	Gear restrictions on traps and pots. Area restrictions.
FL	9”	Permits and licenses. Harvester reporting. No dealer reporting.	Gear restrictions.

* For specifics on licenses, gear restrictions, and area restrictions, please contact the individual state.

Recreational

Available information indicates that few recreational anglers directly target American eel. For the most part, hook-and-line fishermen catch eel incidentally when fishing for other species. American eel are often purchased by recreational fishermen for use as bait for larger gamefish such as striped bass, and some recreational fishermen may catch their own to use as bait.

The National Marine Fisheries Service (NMFS) Marine Recreational Information Program (MRIP, formerly the Marine Recreational Fisheries Statistics Survey) shows a declining trend in the catch of eel during the latter part of the 1990s. As of 2009, recreational data are no longer provided for American eel, due to the unreliable design of MRIP that focuses on active fishing sites along coastal and estuarine areas.

Table 3. State recreational regulations for the 2015 fishing year.*

State	Size Limit	Possession Limit	Other
ME	9"	25 eels/person/day	Gear restrictions. License requirement and seasonal closures (inland waters only). Bait limit of 50 eels/day for party/charter boat captain and crew.
NH	9"	25 eels/person/day	Coastal harvest permit needed if taking eels other than by angling. Gear restrictions in freshwater.
MA	9"	25 eels/person/day	Nets, Pots, traps, spears, and angling only; seasonal gear restrictions and mesh requirements.

RI	9"	25 eels/person/day	
CT	9"	25 eels/person/day	
NY	9”	25/eels/person/day	Maximum limit of 14” in some rivers. Bait limit of 50 eels/day for party/charter boat captain and crew.
NJ	9"	25 eels/person/day	Bait limit of 50 eels/day for party/charter boat captain and crew.
PA	9"	25 eels/person/day	Gear restrictions. Bait limit of 50 eels/day for party/charter boat captain and crew.
DE	9"	25 eels/person/day	Two pot limit/person.
MD	9"	25 eels/person/day	Gear restrictions.
DC	9"	10 eels/person/day	
PRFC	9"	25 eels/person/day	
VA	9"	25 eels/person/day	Recreational license. Two pot limit. Mandatory annual catch report. Gear restrictions. Bait limit of 50 eels/day for party/charter boat captain and crew.
NC	9"	25 eels/person/day	Gear restrictions. Non-commercial special device license. Two eel pots allowed under Recreational Commercial Gear license. Bait limit of 50 eels/day for party/charter boat captain and crew.
SC	9”	25 eels/person/day	Gear restrictions. Permits and licenses. Two pot limit
GA	9”	25 eels/person/day	
FL	9”	25 eels/person/day	Gear restrictions. Wholesale/Retail purchase exemption applies to possession limit for bait.

* For specifics on licenses, gear restrictions, and area restrictions, please contact the individual state.

IV. Status of Research and Monitoring

The FMP requires states and jurisdictions with a declared interest in the species to conduct an annual YOY survey to monitor annual recruitment of each year’s cohort. In 2015, the states of Rhode Island (Gilbert Stuart), New Jersey (Patcong Creek) and Maryland (Turville Creek) had above average YOY counts. Rhode Island’s Irish elver ramp at Gilbert Stuart recorded its third highest count in the time series and significantly higher than 2014. The 2015 catch at New Jersey’s Patcong Creek site was the third highest in the 15 year time series. The 2015 CPUE at Maryland’s Irish elver ramp on Turville Creek exceeded levels seen in 10 of the last 13 years. All other states with YOY surveys (Maine through Massachusetts; Connecticut-New York, Delaware, PRFC, Carolina, and Florida had below average survey counts. Pennsylvania, D.C., North Carolina, and Georgia do not have YOY surveys, but instead have yellow eel surveys.

The FMP does not require any other research initiatives in participating states and jurisdictions. Nonetheless, the American Eel TC has identified several research topics to further understanding of the species’ life history, behavior, and biology. Research needs for American eel include:

High Priority

- Accurately document the commercial eel fishery to understand participation in the fishery and the amount of directed effort.
- Investigate, develop, and improve technologies for American eel passage upstream and downstream at various barriers for each life stage. In particular, investigate low-cost alternatives to traditional fishway designs for passage of eel.
- A coastwide sampling program for yellow and silver American eels should be formulated using standardized and statistically robust methodologies.
- Regular periodic stock assessments and the establishment of sustainable reference points for eel are required to develop a sustainable harvest rate and to determine whether the population is stable, decreasing, or increasing.
- Research the effects of the swim bladder parasite *Anguillacolla crassus* on the American eel's growth and maturation, migration to the Sargasso Sea, and the spawning potential.
- Evaluate the impact, both upstream and downstream, of barriers to eel movement with respect to population and distribution effects. Determine relative contribution of historic loss of habitat to potential eel population and reproductive capacity**.**

Medium Priority

- Investigate survival and mortality rates of different life stages (leptocephalus, glass eel, yellow eel, and silver eel) to assist in the assessment of annual recruitment. Continuing and initiating new tagging programs with individual states could aid such research.
- Tagging Programs: A number of issues could be addressed with a properly designed tagging program. These include:
    - Natural, fishing, and/or discard mortality; survival
    - Growth
    - Validation of aging method(s)
    - Reporting rates
    - Tag shedding or tag attrition rate
- Research contaminant effects on eel and the effects of bioaccumulation with respect to impacts on survival and growth (by age) and effect on maturation and reproductive success.
- Investigate fecundity, length, and weight relationships for females throughout their range; growth rates for males and females throughout their range; predator-prey relationships; behavior and movement of eel during their freshwater residency; oceanic-behavior, movement, and spawning location of adult mature eel; and all information on the leptocephalus stage of eel.
- Assess characteristics and distribution of eel habitat and the value of habitat with respect to growth and sex determination.
- Identify triggering mechanism for metamorphosis to mature adult, silver eel life stage, with specific emphasis on the size and age of the onset of maturity, by sex. A maturity schedule (proportion mature by size or age) would be extremely useful in combination with migration rates.

Low Priority

- Perform economics studies to determine the value of the fishery and the impact of regulatory management.
- Review the historic participation level of subsistence fishers in wildlife management planning and relevant issues brought forth with respect to those subsistence fishers involved with American eel.

- Examine the mechanisms for exit from the Sargasso Sea and transport across the continental shelf.
- Research mechanisms of recognition of the spawning area by silver eel, mate location in the Sargasso Sea, spawning behavior, and gonadal development in maturation.
- Examine age at entry of glass eel into estuaries and fresh waters.
- Examine migratory routes and guidance mechanisms for silver eel in the ocean.
- Investigate the degree of dependence on the American eel resource by subsistence harvesters (e.g., Native American Tribes, Asian and European ethnic groups).
- Examine the mode of nutrition for leptocephalus in the ocean.
- Provide analysis of food habits of glass eel while at sea.

V. Status of Management Measures and Issues

The FMP requires that all states and jurisdictions implement an annual YOY abundance survey by 2001 in order to monitor annual recruitment of each year's cohort. Addendum III requires a 9 inch minimum size restriction in the commercial and recreational yellow eel fisheries, as well as the use of ½ by ½ mesh in the commercial yellow eel pot fishery. The recreational bag limit is 25 fish/angler/day, and the silver eel fishery is restricted, as is the development of pigmented eel fisheries.

Proposed Endangered Species Act Listing of American Eel

The US Fish and Wildlife Service (USFWS) reviewed the status of American eel in 2007 and found that, at that time, protection under the Endangered Species Act was not warranted. The American eel were later petitioned for listing as threatened under the Endangered Species Act (ESA) in April 2010 by the Center for Environmental Science, Accuracy, and Reliability (CESAR, formally the Council for Endangered Species Act Reliability). The USFWS published a positive 90 day finding on the petition in September 2011, acknowledging that the petition may be warranted and that a status review would be conducted. CESAR filed a lawsuit in August 2012 against the USFWS for failure to comply with the statutes of the ESA, which specifies a proposed rule based on the status review be published within one year of the receipt of the petition. A Settlement Agreement was approved by the court in April 2013, which required the USFWS to publish a 12-month finding by September 30, 2015. In the published finding, the USFWS determined that a listing under the ESA was not warranted.

VI. Current State-by-State Implementation of FMP Compliance Requirements

The PRT reviewed the state compliance reports for 2015. The PRT notes the following changes with states implementing the required provisions of the American Eel Fishery Management Plan:

<u>Glass Eel Fishery Measures:</u>

- The Board exempted Florida from establishing size and bag limits until there is evidence that a fishery exists. In 2013 and 2014 glass eel harvest occurred, but FL imposed a 9" min size in both the recreational and commercial fisheries to end the emerging glass eel fishery in 2015.

<u>Yellow Eel Fishery Measures:</u>

- Connecticut implemented gear specifications for pots to use either constructed of ½" by ½" mesh or that include a 4" by 4" panel of such mesh to allow escape panels. Steps were taken to bring gear into compliance by October 31, 2015.

Silver Eel Fishery Measures:

- Florida does not have a regulation preventing harvest of eels from pound nets from September 1 through December 31, but the state is unaware of any active pound net fishery in the past 10-15 years.

Reporting Measures:

- New Hampshire and New Jersey do not have dealer reporting, but harvesters report some information on dealers. Delaware, the Potomac River Fisheries Commission, and Florida do not have dealer reporting.

In addition to the monitoring program changes implemented with Addendum III and Addendum IV, the following changes were made to the YOY survey in 2015:

- Maine- implemented initiated planning of an eel life cycle study, with the first year to be implemented in 2016.
- New Hampshire – An Irish elver trap was installed on the Lamprey river and a box trap was installed on the Oyster river in order to expand the YOY monitoring program. Sampling occurred on the Oysters River in 2014 and 2015.
- Massachusetts- An Irish elver trap sampled on the Parker River was discontinued due to low to intermittent catches.
- Georgia – Due to changes in the American eel FMP, Georgia ceased to conduct the YOY survey in 2014. It was replaced with a pot survey designed to capture information on yellow-phase eels occurring in the Altamaha River. GA has decided to cease creel survey sampling on the Satilla River in 2015 and solely concentrate on sampling on the Altamaha River.

Section 4.4.2 of the FMP stipulates that states may apply for *de minimis* status for each life stage if (given the availability of data), for the preceding two years, their average commercial landings (by weight) of that life stage constitute less than 1% of the coast-wide commercial landings for that life stage for the same two-year period. States meeting this criterion are exempted from having to adopt commercial and recreational fishery regulations for a particular life stage listed in Section 4 and any fishery dependent monitoring elements for that life-stage listed in Section 3.4.1.

Qualification for *de minimis* is determined from state reported landings found in compliance reports. In 2015, New Hampshire, Massachusetts, Pennsylvania, the District of Columbia, South Carolina, and Georgia requested *de minimis* status for their yellow eel fisheries. All states that applied for *de minimis* of the yellow eel fishery meet the *de minimis* criteria. The state of South Carolina requested *de minimis* status for its glass eel fishery, but does not meet the 1% landings criteria for this life stage.

VII. Recommendations/Findings of the Plan Review Team

1. The PRT recommends the Board consider state compliance issues as detailed in Section VI.

2. The PRT recommends *de minimis* be granted to New Hampshire, Massachusetts, Pennsylvania, the District of Columbia, South Carolina, and Georgia for their yellow eel fisheries.

3. The PRT requests that state personnel highlight notable trends in annual reports. The PRT also requests that state personnel describe any circumstances that prevented sampling from occurring as

required in the FMP and Addendum I, or reasoning for sampling not occurring in a manner consistent with previous years.

4. The PRT requests that states collect biological data from both commercial and recreational landings.

5. The PRT requests that states provide estimates of the percent of harvest going to food versus bait, and of exports by season. The PDT requests that states work with the law enforcement agencies to include information on any confiscated poundage from illegal or undocumented fisheries.

6. The PRT requests that states that do not regulate their personal use fishery be required, at a minimum, to permit participants in this fishery and collect harvest data in order to provide an estimate of effort and catch.