Atlantic States Marine Fisheries Commission

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MEMORANDUM

October 21, 2014

To: American Eel Management Board
From: Sheila Eyler, Technical Committee Chair
Re: Responses to Board Requests

The American Eel Technical Committee met on September 2, 2014 to review and discuss specific Board tasks assigned from the August Board meeting. Present on the call was: Alan Hazel (SC), Ande Ehlen (VA), Carol Hoffman (NY), Wilson Laney (USFWS), Garry Wright (NC), Heather Corbett (NJ), Jim Page (GA), Jordan Zimmerman (DE), Keith Whiteford (MD), Phil Edwards (RI), Sheila Eyler (USFWS), Tim Wildman (CT), Laura Lee (NC), Alex Haro (USGS), Mike Kaufmann (PA), Gail Wipplehauser (ME), Sean Doyle (DC), and Kate Taylor (ASMFC). Also listening in on the call were Steve Shepherd (USFWS) and Joe Cimino (VMRC).

These tasks reviewed by the TC included:

1. Quota Recommendation
2. Identification of American vs. other eels
3. Dr. Cadrin White Paper Review

Quota Recommendation

The SAS and TC have recommended that harvest be reduced in all life stages, but during the Board's discussion on potential management options there was confusion on what number the reduction should be applied against. Currently there are two baseline options being discussed in Draft Addendum IV: 1) the average landings from 1998-2010 or 2) landings from 2010 (terminal year of the assessment). The TC makes the following recommendations:

What years to use in the baseline for the yellow eel fishery?
The TC continues to support the use of the landing years of 1998 – 2010 as the baseline for determining the yellow eel quota. This is an average of several years included in the assessment, including high harvest years in the fishery. The TC recommends the use of an average given the uncertainty surrounding some landings data in some years. The TC recommends flexibility to adjust quota if additional information should come available to indicate increases in the eel population.

What should the reduction be from that level for the yellow eel fishery?
For yellow eels, annual harvest fluctuated significantly for each state during the proposed baseline years, with a CV of 12%. Therefore any reduction less than 12% from the baseline is likely not to provide a measurable harvest reduction. Since fishery targets were not established in the 2012 Benchmark Stock Assessment, the TC cannot provide guidance on what reduction level would ensure rebuilding of the American eel population. The TC notes that some states landings will be reduced as a result of Addendum III measures or have been reduced through changes in the fishery (e.g. bait availability).

What years to use in the baseline for the glass eel fishery?
For the glass eel fishery, the TC also recommends the use of the landing years of 1998 – 2010 as the baseline for determining the quota.

What should the reduction be from that level for the glass eel fishery?
When using the same analysis as yellow eels for glass eels, the CV is quite large (70%) due to the variable in landings. Based on this analysis, a reduction of 70% from the baseline would provide a measureable reduction in harvest. Since fishery targets were not established in the 2012 Benchmark Stock Assessment, the TC cannot provide guidance on what reduction level would ensure rebuilding of the American eel population.

If the yellow and glass eel recommendations are different, then why?
In recognition of the significant impact a 70% reduction would have to the glass eel fishery, and as well as taking into account uncertainty, the TC recommends that a 12% reduction from the baseline years in both fisheries (glass and yellow) is an acceptable precautionary approach for the initial implementation of a quota.

Table 1. Recommended baseline for a quota and with a 12% reduction (in pounds).

	Recommended Baseline 1998-2010 Harvest	With 12 % Reduction
Glass Eel Fishery	5,293	4,658
Yellow Eel Fishery	907,671	798,751

Identification of American vs. other eels

Dr. Louis Daniel asked for clarification on the procedures used to distinguish glass eels of other eel species from American eel glass eels. This was of particular concern to the southern states where there is overlap with the speckled worm eel *(Myrophis punctatus).*

Speckled worm eel glass eels co-occur with American Eel glass eels in the northwest Atlantic both north and south of Cape Hatteras (although much more extensively to the south of Cape Hatteras) and is likely the only other species of glass eel which could be confused with American eel. Refer to Appendix A for more detailed information on the distribution and overlap. However, there does not currently seem to be a problem with misidentification of speckled worm eels in current state run American eel surveys where this overlap exists. States are either not encountering them in enough quantity to make a difference or states are already aware of the presence of speckled worm eels and identify them in their survey. Therefore, the TC recommends:

1. That each state from North Carolina through Florida be aware of the potential for speckled worm eel to occur concurrently in glass eel sampling for American eel. All eels should be identified and any species other than American eel should be removed from the catch, prior to reporting annual survey data. Florida currently removes any species other than American eel from their catch. North Carolina is identifying all catch in their glass eel surveys. Additionally, per Addendum III, Georgia only conducts a yellow eel survey.

Lastly, South Carolina's current sampling occurs ~40km upstream, so catch of speckled worm eels is not likely to be an issue.

2. Given the likelihood that climatic warming will continue and abundance of speckled worm eel north of Cape Hatteras may increase, states from Virginia north to at least New Jersey should periodically examine their glass eel monitoring catches for the presence of that species, if their sample sites are located in areas inhabited by speckled worm eel life stages.
3. Training on identification should be reviewed at the next TC meeting.

White Paper Review

The TC was tasked to review a white paper that was presented to the Board just before the August Board meeting. The white paper was drafted by Dr. Steve Cardin, Associate Professor of Fisheries Oceanography at the School for Marine Science and Technology and the Director of the Massachusetts Marine Fisheries Institute's Education Program. The TC makes the following responses to the white papers major points:

1. *Population Structure: ASMFC Stock Assessment method of analyzing trends within six… regions is inconsistent with the perception of a single population… and may not represent the entire resource.*

TC Response: The assessment was transparent in language that explains the range of assessment and the need to bring in data from other regions. A full assessment over the range of this species has not been close to possible given jurisdictional issues and data limits and gaps. The next assessment will try to incorporate data and staff from Canada and other jurisdictions.

2. *Depletion-Based Stock Reduction Analysis: The review Panel identified several problems with the DBSRA, including assumptions about changes in natural mortality and age at recruitment and unrealistic estimates of depletion in the 1890s. .*

TC Response: The stock assessment was upfront about the assumptions used in the development of the DBSRA model. The TC supports the Peer Review process and the results of the Panel in rejecting the "Overfished" status and instead recommending the stock be declared "Depleted". The TC agrees with Dr. Cadrin that the "Depleted" status is a "more appropriate interpretation of the assessment results." The TC notes that despite Dr. Cadrin's thoughtful insight, his text focuses on negative aspects of the DBSRA to support the AESA view and does not acknowledge that the Peer Review Panel had substantial praise for the application and utility of the model for a benchmark assessment and future assessments.

3. *Positive Indicators: The Assessment includes many sources of information that suggest a more positive conclusion [than declared].*

TC Response: There are signs that eel abundance in the US may have hit bottom in the mid-to-late 1990s and is improving according to some indices. Such trends have been observed in several indices and fisheries. It is not uncommon to have slight improvements from historic population and fishery lows prompt optimism of better times. Dr. Cadrin is overly supportive of some of those "positive" signs, likely without great familiarity with the indices. A more balanced technical review would have a section on "Negative Indicators" as well and mention of the occurrence and possible response of the spike in fishing mortality following the demand increase from the European food market in the 1970s and 1980s. Again, these points on positive indicators are a selective approach to support AESA's view. These recent upticks are brief signals that are more uncertain than positive in some cases and limited in their representation of the U.S. range. The stock may be improving, but if so, it is a slow upturn from the bottom with much uncertainty.

4. *USFWS Assessment: "From my view, I think that the Fish & Wildlife assessment is a more accurate evaluation of the available information."*

TC Response: The USFWS review served a totally different purpose from the ASMFC stock assessment. Further, that process had data through ~2005, while the stock assessment had data through 2010. The two processes can't be compared very well and the stock assessment contained a deeper and more thorough examination of recent data.

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Appendix A
Identification of American and Speckled Worm Eels along the US Atlantic Coast

Technical Committee Response

This response was prepared by American Eel Technical Committee (TC) members Kimberly Bonvechio (FL), Allan Hazel (SC), Wilson Laney (USFWS-SE), Jim Page (GA) and Garry Wright (NC), in consultation with the entire TC. We were assisted by Dr. Dennis Allen, University of South Carolina, Belle W. Baruch Institute for Marine and Coastal Sciences, Baruch Marine Field Laboratory, Georgetown, South Carolina; Dr. Kenneth W. Able, Rutgers University, Institute of Marine and Coastal Sciences, Rutgers Marine Field Station, Tuckerton, New Jersey; Patrick Geer, Marine Fisheries, Georgia Department of Natural Resources; Dr. Todd Kellison National Marine Fisheries Service (NMFS), and Dr. Chris Taylor National Ocean Service, Beaufort Laboratory, Pivers Island, Beaufort, NC; Bill Post, Marine Resources Division, South Carolina Department of Natural Resources, Charleston, SC; and Cheree Steward, Florida Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Eustis, FL.

Background

Dr. Daniel's question is based on the fact that there are other species of eels which have glass eel life stages, and some of these may geographically and temporally overlap with American eel glass eel stage ingress/recruitment and fishery windows. If that is occurring it necessitates the ASMFC fishery-independent glass eel survey protocol distinguish and separate any non-American glass eels from those of other species, and that fishery-dependent data from the two jurisdictions with active glass eel fisheries (ME and SC) receive the same adjustment, again if glass eels of other eel species are present in the catch at their monitoring stations.

The TC undertook to determine whether glass eels of other species recruit to East Coast estuaries or rivers at the same time as American eel glass eels, and if so, over what geographic range. Dr. Daniel specifically mentioned the speckled worm eel (*Myrophis punctatus*) as a species of interest. As a reminder, the glass eel stage of eels is the post-metamorphic stage occurring after the leptocephalus stage, in which individuals have attained adult body form but remain unpigmented (Leiby 1979a, 1979b). This is typically the stage at which individuals of some species recruit to east coast estuaries, although in many cases leptocephalus stages are captured as well (Able et al. 2011; K. Able, personal communication).

We reviewed relevant published literature, including ASMFC American Eel Compliance Reports, and interviewed federal agency and university researchers who have long time series of ingressing larval fish data from US East Coast inlets from NJ (K. Able), NC (T. Kellison and C. Taylor) and SC (D. Allen). We found that primarily the speckled worm eel, but also occasionally other eel species, have glass eel life stages which either routinely co-occur or could occasionally co-occur (*Ophichthiidae; Muraenidae; Ophidiidae*) with American eel glass eels (for example, see Ross et al. 2007; Able et al. 2011; Able and Fahey 2010; NMFS, Beaufort Laboratory, unpublished data, personal communication from T. Kellison; Baruch Marine Field Laboratory, unpublished data, personal communication from D. Allen). Co-occurrences of American eel and speckled worm eel glass eels, as well as glass eels of other eel species, are more likely at sampling sites located closer to the Atlantic Ocean, where salinities are mesohaline or higher (D. Allen, Baruch Marine Field Laboratory, personal communication), and are much less likely if monitoring or capture sites are located further inland in oligohaline or predominately fresh waters. Glass eel stages of speckled worm eels also typically commence burrowing behavior soon after metamorphosis and are not thereafter susceptible to most sampling gears (Able et al. 2011).

The speckled worm eel occurs in the western Atlantic Ocean from as far north as Nova Scotia (as larvae; Able et al. 2011, page 238) through New Jersey, Bermuda and North Carolina to southeast Brazil, including the Gulf of Mexico, West Indies and coast of Central America (Able et al. 2011; Frose and Pauly 2010, as cited in Vaslet et al. 2011). Able et al. (2011) indicate that higher levels of abundance occur at inlets in SC (North Inlet) and NC (Beaufort Inlet) during the winter and early spring, with much lower abundances in NJ (Little Egg Inlet) in winter and spring and again in the summer. Metamorphic individuals and glass eels settle and burrow in estuarine sediments and thereafter become relatively unavailable to many sampling gears. Able et al. (2011) assembled a scheme for identifying the different morphological stages of speckled worm eel based on specimens and the literature (see their Table 2). In the glass eel stage, the body length continues to decrease (from 54 to 42 mm TL), pigmentation develops on the head and caudal fin, elver teeth begin to form, anterior and posterior nostrils are widely separated, head length is relatively larger, and greatest body depth is markedly smaller than in the leptocephalus stage (Able et al. 2011). The glass eels of speckled worm eels are therefore readily distinguishable from those of the American eel upon close examination.

The overlap of speckled worm eel glass eel stage with that of American eels in Florida was previously noted by ASMFC TC member Kim Bonvechio (Florida Fish and Wildlife Conservation Commission). Florida's American Eel Compliance Reports provided to ASMFC (e.g., see Bonvechio and Williams 2007, Bonvechio 2014) provided information on the size and length-weight relationship of glass eels of both species (see Figures 1-3). The issue was brought to the attention of the TC; however to our knowledge, no other state has examined their catches for the presence of speckled worm eel glass eels, nor have past survey catches been adjusted for that species. The NMFS Beaufort Bridge Net survey samples, which constitute the NC monitoring, are sorted to species, so the glass eels are not combined (T. Kellison, personal communication). Although many other species of eels occur in waters of the northwest Atlantic Ocean, many of them are marine species (see Ross et al. 2007) and glass eels of those species are not likely to be encountered inshore (K. Able, D. Allen, personal communications). Florida staff also have not found any other species of eel glass eels other than speckled worm eels in their samples (per K. Bonvechio, personal communication). Given that only one sample containing speckled worm eel glass eels was encountered in the NJ sampling (see Able et al. 2011, Table 3, page 252), and that collection of leptocephali in estuaries north of Cape Hatteras is "…likely much less frequent and larvae are much less abundant as indicated by the collections at Little Egg Inlet (New Jersey) over numerous years," (Able et al. 2011) it appears that the only other species of glass eel which requires consideration at this time is that of the speckled worm eel, in areas south of Cape Hatteras.

It is possible that states further north may see increasing numbers of speckled worm eel glass eels in the future as temperatures warm in response to climate change on the east coast (Able et al. 2011, page 255; Hare and Able 2007). The increasing frequency of milder winters may allow species spawned in southern areas (Bahamas, Gulf of Mexico, Sargasso Sea) to be more frequently encountered and become more abundant in areas north of Cape Hatteras (Able and Fahay 2010). Significant positive relationships between water temperature and the arrival, peak and final dates of larval occurrences as well as between temperature and abundance in NJ also suggest potential for increased occurrence further north under a future warming regime (Able et al. 2011, pages 255-256).

Current South Atlantic Sampling Protocols

Florida has already undertaken to identify all the speckled worm eel glass eels in their fishery-independent survey, and has adjusted their glass eel monitoring catch accordingly since 2006 by removing all non-American glass eels from their samples (Bonvechio and Johnson 2007, Bonvechio 2014). As noted above, speckled worm eel glass eels are easily distinguished from American eel glass eels by virtue of their teeth, pigmentation and insertion of the dorsal fin. They are easier to distinguish as preserved specimens, and much more difficult to identify when alive; however they do have a different mode of swimming which is a further noticeable difference. Ms. Bonvechio advises that in some years, speckled worm eel glass eels may comprise as much as 25 percent of the glass eel catch in the Florida samples. In Florida at the Guana Dam monitoring station, the speckled worm eel glass eels recruit during the same temporal period, and encompass the same size range, as the American eel glass eels (Figure 1, Figure 2). The length weight relationships differ (Figure 3).

Georgia historically conducted glass eel monitoring at two sites within the Altamaha River watershed (J. Page, personal communication), a small tributary of Hudson Creek which drains to the Altamaha River delta (Doboy Sound) and a canal located further upriver. Salinity at the Hudson Creek site ranged from 3-10 ppt. The canal site was predominantly fresh water. Glass eel catches at both of these sites were small; therefore in 2013, Georgia elected to cease glass eel monitoring and instead transitioned to sampling yellow eels in the belief that sampling that life stage would provide better fishery-independent information (J. Page, personal communication). Georgia has not examined their glass eel survey samples specifically to determine whether speckled worm eel glass eels were present; however, they did identify glass eels of unknown species and those data are available upon request.

In South Carolina, where a 32-year bi-weekly time series of larval fish is available for North Inlet, other eel species are captured, including speckled worm eels (Able et al. 2011; D. Allen, Baruch Marine Field Laboratory, personal communication). North Inlet is a relatively high-salinity system, with no significant sources of freshwater input. American eel and speckled worm eel are the two larval eels captured, with fewer American eels encountered. The single station sampled by South Carolina Department of Natural Resources, Marine Resources Division (see Hazel 2014), is located at Upper Goose Creek Reservoir, a tributary to the Cooper River. Given the predominance of freshwater inflow at this site, and its location 40 river kilometers from the Atlantic Ocean, the presence of speckled worm eel glass eels concurrent with American eel glass eels appears unlikely; however, South Carolina has not examined its glass eel catches to ascertain whether other eel species glass eels were present (Bill Post, Marine Resources Division, SC Department of Natural Resources, personal communication to WL).

The North Carolina Division of Marine Fisheries (NCDMF) terminated their fishery-independent survey for American eel glass eels in 2009, indicating that budget reductions precluded the continuance of that survey (NC DENR 2014). The NCDMF indicated that it would rely on the NMFS Beaufort Bridge Net Survey for data on glass eels. The time series for the Beaufort Bridge Net Survey is now complete through 2010 (T. Kellison, Beaufort Laboratory, NMFS, personal communication to WL) and additional sample processing is anticipated which should complete sample analysis through 2013, sometime next year. The time series documents that American eel and speckled worm eels do co-occur in the Beaufort samples, and have completely overlapping ingress periods (Beaufort Laboratory, NMFS, unpublished data; T. Kellison, October 2, 2014). The database has records of only a few other eel species/taxa (Beaufort Laboratory, NMFS, unpublished data; message from T. Kellison, October 2, 2014): *Ophichthus cruentifer* (Margined Snake Eel, n = 2); *Ophichthiidae* (Snake Eels, n = 19); *Muraenidae* (Moray Eels, n = 1); *Ophidiidae* (Cusk Eels, n = 15); and anguilliforms (n = 32). Given the low numbers, the presence of these other eel species is not likely to inflate estimates of American eel glass eels, especially since all fish larvae captured in the Beaufort Bridge Net Survey are identified to species.

Table1. Total abundance per month for 1986-2010 for eel species. Counts include glass eel, leptocephali and elvers.

Taxa	Total	January	February	March	April	May	October	November	December
Anguilla rostrata	1,550	236	340	563	257	9		21	124
Myrophis punctatus	53,435	14,482	20,202	5,200	260	15	10	1,626	11,640
Congridae	359	1	9	262	85	1		1	
Anguilliformes	31	2	3	5	3				18
Muraenidae	1			1					

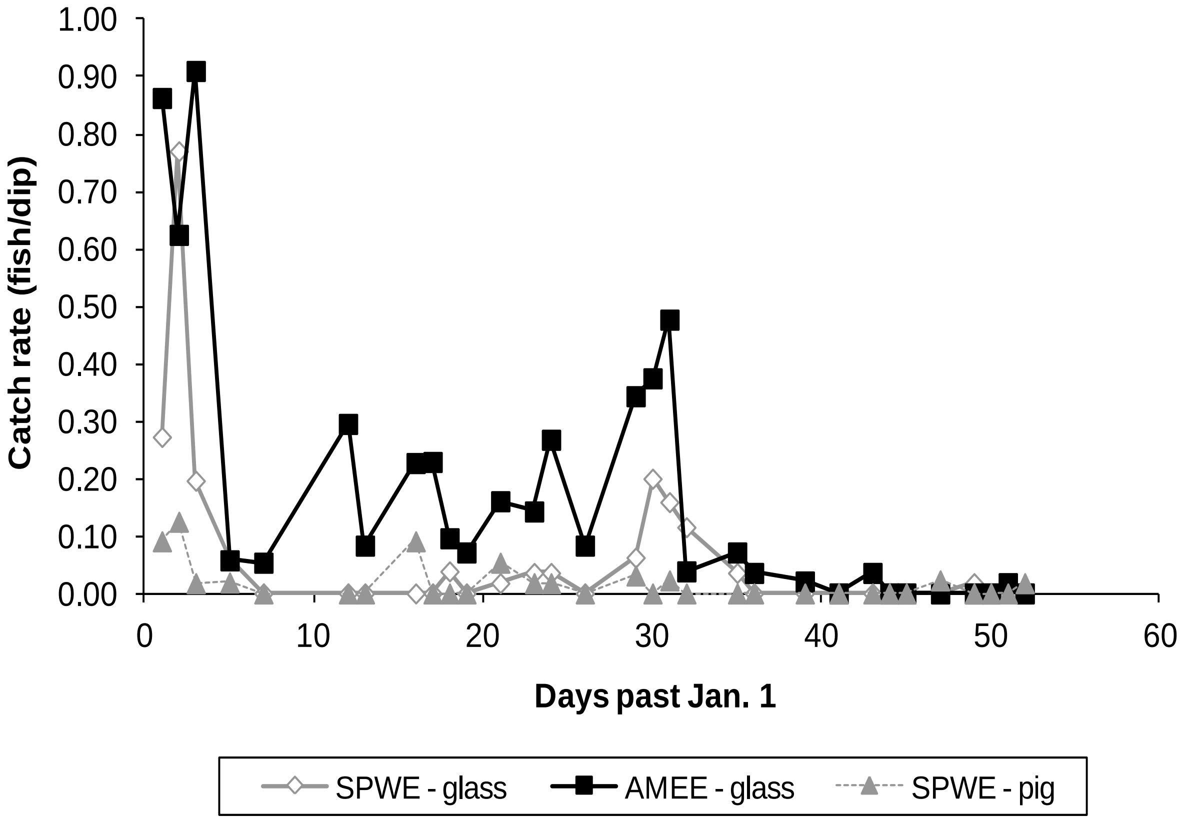

Figure 1. Catch rate of juvenile pigmented (pig) and glass American (AMEE) and speckled worm (SPWE) eels collected at Guana River Dam, Florida, in 2006 (after Figure 6 in Bonvechio and Johnson (2007)).

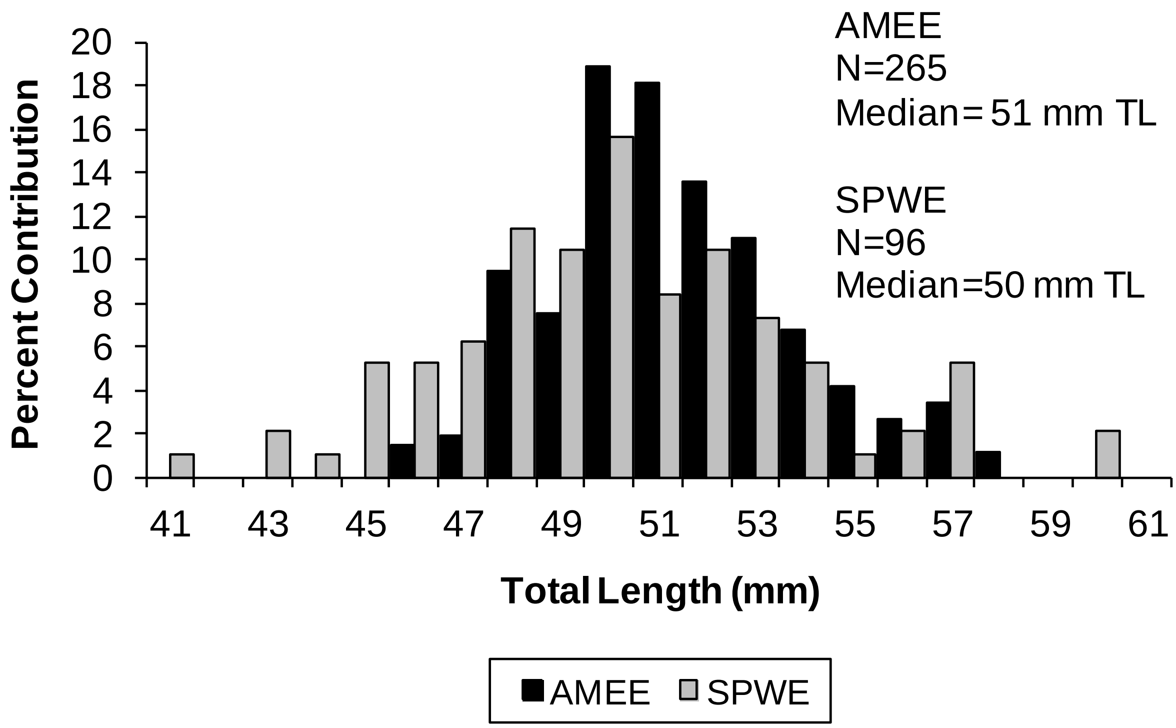

Figure 2. Length-frequency distribution of glass American (AMEE) and speckled worm (SPWE) eels collected at the Guana River Dam, Florida, in 2006 (after Figure 7, Bonvechio and Johnson (2007)).

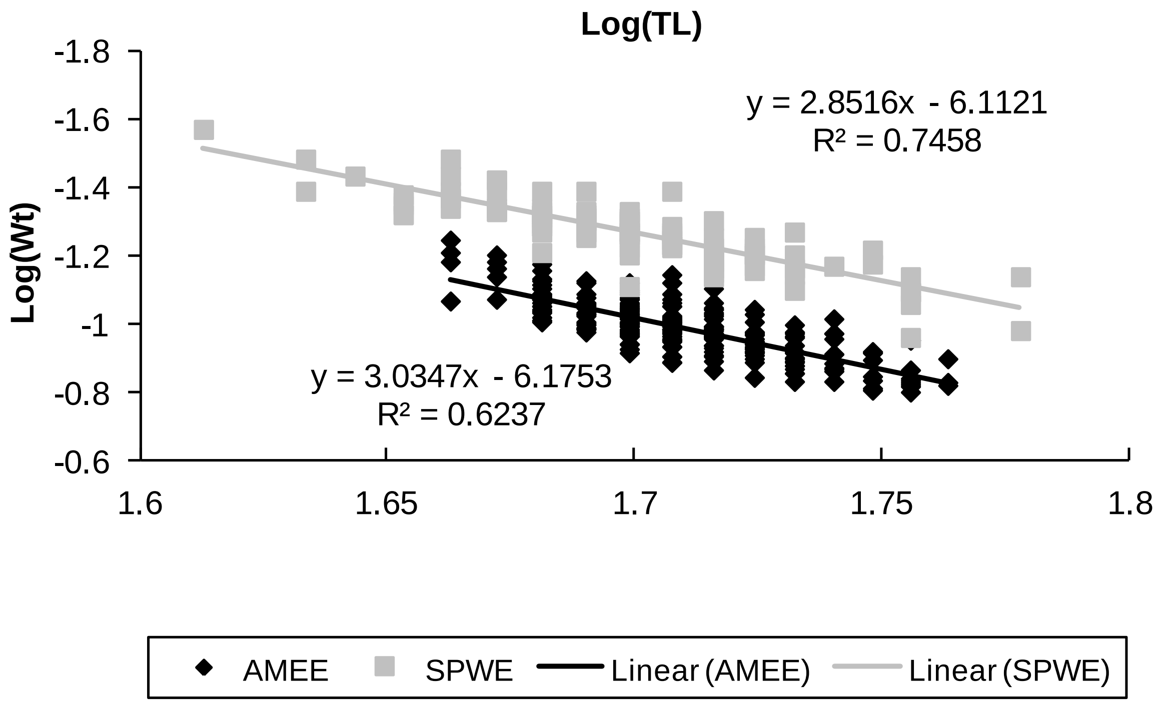

Figure 3. Length-weight regression for glass American (AMEE) and speckled worm (SPWE) eels collected at Guana River Dam, Florida, in 2006 (after Figure 8, Bonvechio and Johnson (2007)).

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