Atlantic States Marine Fisheries Commission

MEETING OVERVIEW

American Eel Management Board Meeting
August 05, 2015
8:00 a.m. – 8:45 a.m.
Alexandria, Virginia

Chair: John Clark Assumed Chairmanship: 8/15	Technical Committee Chair: Sheila Eyler (USFWS)	Law Enforcement Committee Representative: Cornish
Vice Chair: VACANT	Advisory Panel Chair: Martie Bouw	Previous Board Meeting: October 27, 2014

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 October 2014 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. Technical Committee Report (8:15– 8:35 a.m.)

Background

- Addendum IV requires that any state or jurisdiction with a commercial glass eel fishery must implement a fishery-independent life cycle survey covering glass, yellow, and silver eel life stages within at least one river system.
- Maine developed a life cycle survey for TC review. The TC formulated recommendations to the Board regarding Maine's Life cycle survey proposal (**Briefing Materials**).

Presentation

- Technical Committee Report by Sheila Eyler, TC Chair

5. Update on Addendum III Implementation (8:35– 8:45 a.m.)

Background

- Addendum III, implemented in January of 2014, established the following yellow eel measures:
    - 9" min size for yellow eel recreational and commercial fisheries
    - ½" x ½" min mesh size for yellow eel pots
    - allowance of 4x4" escape panel in pots of ½" x ½" mesh for 3 years
    - Recreational 25 fish bag limit per day per angler
    - Crew and Captain involved in for-hire are exempt and allowed 50 fish bag limit per day
- Delaware Department of Natural Resources worked with its state legislature to change the yellow eel measures under Addendum III since management authority for eel measures is under the authority of the Delaware legislature.
- Delaware legislature did not approve the changes. Delaware's minimum size limit is 6 inches in the commercial and recreational fisheries, there is no minimum mesh size for pots, and the recreational possession limit is 50 eel per day (**Supplemental Materials**).

Presentation

- Review of Delaware's yellow eel measures for consistency with the American Eel Fishery Management Plan by M. Waine

Board Actions for Consideration

- Consider if Delaware's minimum size limit, commercial pot mesh size, and recreational possession limit is in compliance with the American Eel FMP

6. Elect Vice-Chair (8:45 a.m) Action

Background

- Vice-Chair seat is vacant.

Board Actions for Consideration

- Elect a Vice-Chair

7. Other Business/ Adjourn

State of Delaware
American Eel Fishery Annual Report

September 1, 2015

The Delaware Legislature did not amend the Delaware Code in 2014 or 2015 to implement the management changes required by Addendum III of the Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan (FMP) for American eel. The State of Delaware is currently out of compliance with the minimum pot mesh size, minimum length, and possession limits for recreational fishermen requirements of the FMP. Delaware continues to conduct the young-of-the-year abundance survey mandated by the FMP and the commercial harvest data collection program recommended by the FMP.

1. Commercial fishery

a. Synopsis of regulations in place

1. *Open Season*: All year
2. *Minimum Length*: 6 inches total length
3. *Trip Limit*: No limit
4. *Eel Pot Limit:* No limit
5. *Minimum Mesh Size:* None

A commercial eel fishing license is required to take and sell 50 or more eels per day or to fish more than two eel pots per day. The eel fishery is currently an open fishery with licensing fees of $115.00 for residents and $1,150.00 for nonresidents. Legal commercial fishing gear includes fyke or hoop nets, seines,

minnow traps, or eel pots. Eel pots are not restricted in mesh size or overall size. Commercial eel fishing is restricted to tidal waters.

b. Estimates of directed harvest

1. Pounds landed by life stage and gear type

Commercial eelers in Delaware landed 62,388 pounds of American eel in 2014, a 23% decrease from the 80,811 pounds landed in 2013 and 41% less than mean annual landings from 1999 through 2014 (104,863 lbs.). The 2014 landings were the third lowest reported since logbook reporting was made mandatory in 1999. (Figure1). All reported eel landings in Delaware are harvested via baited pots.

American eels ranked sixth in pounds landed and third in value among all fish species landed commercially in Delaware during 2014 (G. Glanden, DDFW, personal communication). Delaware Bay and River ports, including ports on Delaware Bay and River tidal tributaries, accounted for 88% of 2014 landings with the Inland Bays and other Sussex County ports accounting for the remaining 12% of landings (Table 1a).

The number of commercial eel licenses sold rose to 66 from the 62 sold in 2013. However, 2014 was the ninth year in a row in which fewer than 70 eel licenses were issued. Of the 66 commercial licenses issued, only 19 licensees reported landing eels in 2014 while 32 reported they did not fish for eels and 15 did not submit any report.

2. Biological data taken from commercially-caught American eel

A sub-sample of 225 commercially caught American eels were measured and weighed with 211 individuals aged to estimate the age/length/weight composition of the commercial catch.

Sampled eels ranged in length from 236 to 660 TL (Total length) with a mean length of 392 mm, and ranged in weight from 23 to 791 g with a mean weight of 125g. The length-weight relationship derived from 2014 commercial data predicts a weight of 110.7 g for an eel of 392 mm TL, as defined by the following formula:

$$W=1.543E\text{-}6L^{3.029}$$

The sampled eels ranged in age from 2 to 9 years old, with a mean age of 4. Approximately 82% of total eels sampled were yellow eels between 3 and 5 years old, with 59% of the total number sampled between age 4 and 5 years. The mean length at age increased steadily from ages 3 through 7, although there was much overlap in the range of lengths at each age (Figure 2). American eels aged 7, 8 and 9 comprised only 9% of the catch which suggested that eels older than 6 were uncommon among eels caught with commercial gear in Delaware tidal waters in 2014. The mean age of the 2014 commercially caught aged eels

was the same as the mean age of the 2007 through 2013 commercially caught eels (DDFW 2014).

3. Estimated percent of harvest going to food versus bait

Yellow eels for food use comprised 44,327 pounds or 71% of total reported landings, and bait eels comprised the remaining 18,061 pounds or 29% of the total (Table 1b). Different proportions of bait eel landings were caught in the spring and fall (14% and 49% respectively). In most years, greater than 75% of bait landings occur in the fall, which coincides with the height of the recreational striped bass fishery along the Atlantic coast. Eels in the bait eel size range were sold as food eels when there was insufficient demand for bait eels. Conversely, a small proportion of large eels (<100 lbs.) were sold as bait to boats participating in the White Marlin Open in Ocean City, Maryland.

c. Estimates of export by season

Delaware did not require dealers to report the final destination of commercially caught eels but the landings reports submitted by eelers provided information on the timing and disposition of the landings. Annual eel landings were highest in the spring and fall with peaks occurring in April through May and September through October. Eel cooperators reported that most bait eels were delivered to bait dealers supplying coastal recreational fisheries in Delaware, Maryland, Virginia and the Carolinas, although there is an increasing demand for bait eels supplied to recreational fisheries on large southern freshwater lakes and impoundments. The food eels were sold almost exclusively to a single eel dealer, but several eelers mentioned the possible entry of other eel buyers in future years.

d. Harvest data provided as CPUE

Effort, measured in eel pot days decreased by 15% between 2013 and 2014. Catch per pot day, measured in pounds caught per pot per day fished decreased 9% between 2013 and 2014 (Figure 1). Delaware eelers averaged 1.32 pounds of eels per eel pot per day during 2014, below the mean catch per pot per day (1.70) for the time series.

2. Recreational Fishery

a. Synopsis of regulations in place

1. *Open Season*: All year

2. *Minimum Length*: 6 inches total length

3. *Possession Limit*: 50 per day

4. *Eel Pot Limit*: 2 per person

b. Estimate of Delaware 2014 Total Recreational Catch (A + B1 + B2) from the Marine Recreational Information Program (MRIP) report (Glanden and Newlin 2015).

Months (2014)	Number of eels caught[1]
March-April	0
May-June	1,324
July –August	681
September – October	927
TOTAL	2,932

[1] Eels caught was an estimate based on creel surveys and included eels kept and eels released. Eels caught were reported in numbers not pounds. Neither individual nor aggregate weight estimates were made in the report.

The 2014 estimated recreational catch was 70% lower than the 2013 estimated catch (9,766), 88% lower than the 2012 estimated catch (25,067), and 92% lower than the 2011 estimated catch (34,551).

3. Fishery-independent monitoring

a. Young-of-the-year abundance survey for 2014

The 2014 young-of-the-year abundance survey summary is in Appendix 1

b. Other fishery-independent data

Delaware Division of Fish and Wildlife have several ongoing fisheries research projects that regularly capture American eels. American eels captured during the course of these projects were counted and measured, and subsamples of the captured eels were kept for age analysis. Researchers from the University of Delaware completed a study of silver eel emigration from the Indian River drainage in 2004 (Barber 2004). Researchers from Delaware State

University completed a study of eel movements in Silver Lake, a freshwater impoundment in the St. Jones drainage, in 2006 (Thomas 2006). Further, researchers from Delaware State University have monitored eel movement, growth, population size, and air bladder parasite infestation in the tidal portion of the St. Jones River from 2006 to 2009 (Cairns 2009).

c. Projects planned for the next five years

Delaware will continue all current eel monitoring projects. No new projects are planned.

4. Characterization of other losses

Delaware has several power and industrial plants that extract large amounts of cooling water through intakes open to nearby waters. Most of these intakes are located along the Delaware River in the Wilmington area, but there is also a large power plant on Indian River in Delaware's Inland Bays. Two major power plants contracted previous independent studies on fish impingement of their cooling water intake screens, the first of which is located near Wilmington, DE while the second is located near Millsboro, DE. American eels comprised less than 1% of fish caught during two years of impingement sampling at the Edge Moor Power Plant on the Delaware River near Wilmington (Entrix Inc. 2002). Fourteen American eels were caught during impingement samples and 20 juvenile American eels were caught during entrainment samples taken from December 1999 through November 2000. Thirty two American eels were caught in impingement samples and 16 juvenile American eels were caught in entrainment samples taken from December 2000 through November 2001. American eels comprised less than 1% of all fish caught during two years of sampling at the Indian River Power Plant on Indian River near Millsboro (Entrix 2003). Six American eels were caught in impingement samples and 31 juvenile American eels were caught during entrainment samples taken from December 1999 through November 2000. Six American eels were caught in impingement samples and 26 juvenile American eels were caught in entrainment samples taken from December 2000 through November 2001. However, both plants operate 24 hours per day and the impingement/entrainment estimates provided were likely underestimating total concentrations of fish, thus the annual mortality generated could be substantial. In 2010, Indian River Power Station Unit 2 was shut down permanently. Unit 1 followed in 2011, and, most recently, Unit 3 was retired in 2013, effectively eliminating 30 to 40 billion gallons of cooling water drawn annually from Indian River and the associated mortality on fish due to impingement/entrainment of these 3 power generating units.

Bycatch mortality of American eel in other fisheries was not quantified but was likely low considering most fishing methods commonly used in Delaware do not target and are thus less likely to capture eels.

Poaching losses were likely minimal during 2014 as no glass eel poaching citations/arrests were made during 2014.

Delaware Division of Fish and Wildlife took American eels for scientific purposes in order to comply with the American eel FMP during 2014 (n = 981). Eels kept for measurements during the glass eel monitoring conducted from February through March exhibited five percent mortality. An additional number of glass eel mortalities occurred during the monitoring period due to handling stress but no estimate was made as to the total. The Division also acquired 211 yellow eels during 2014 for age and growth analyses from Delaware commercial fishermen.

References cited

Barber, R. 2004. Sex ratio of silver American eels (Anguilla rostrata) migrating out of two southern Delaware streams. Master's thesis, University of Delaware, Newark.

Cairns, C. M. 2009. Population ecology of yellow-phase American eels (*Anguilla rostrata*) in the St. Jones River, Delaware. Master's thesis, Delaware State University, Dover.

Delaware Division of Fish and Wildlife (DDFW). 2014. State of Delaware American eel fishery annual report. Fishery management plan compliance report to ASMFC. Delaware Division of Fish and Wildlife, Dover, DE 19901.

Entrix, Inc. 2002. An ecological risk-based 316(B) evaluation for the Edge Moor Power Plant. Prepared for: Conectiv, Inc. Wilmington DE.

Entrix, Inc. 2003. An ecological risk-based 316(B) evaluation for the Indian River Generating Station. Prepared for: NRG Energy Millsboro, DE.

Newlin, S. and G. Glanden. 2015. Marine recreational fishing in Delaware 2014. Annual landings report. Delaware Division of Fish and Wildlife, Dover, DE 19901.

Thomas, J. C. 2006. American eel behavioral patterns in Silver Lake, Dover, Delaware. Master's thesis, Delaware State University, Dover.

Table 1a. Delaware consolidated commercial eel landings, in pounds, by area and market category, 2014.

Area Fished	Pot-days fished	Number of eeling trips	Landings (lbs.) by market grade		Total landed (lbs)	Ex-vessel value
			Bait eels	Yellow eels		
Delaware River and associated tidal creeks	12,394	72	8,725	5,245	13,970	$34,925
Delaware Bay and associated tidal creeks	23,954	173	9,173	31,724	40,897	$102,242
Inland Bays	10,859	46	163	7,358	7,521	$18,803
Total	47,207	291	18,061	44,327	62,388	$155,970

Table 1b. Delaware consolidated commercial eel landings, in pounds, by season and market category, 2014.

Season Fished	Pot-days fished	Number of eeling trips	Landings (lbs.) by market grade		Total landed (lbs)	Ex-vessel value
			Bait eels	Yellow eels		
March-May	13,530	90	2,490	18,926	21,416	$53,540
June-August	9,586	58	6,663	1,461	8,124	$20,310
September-December	24,091	143	8,908	23,940	32,848	$82,120
Total	47,207	291	18,061	44,327	62,388	$155,970

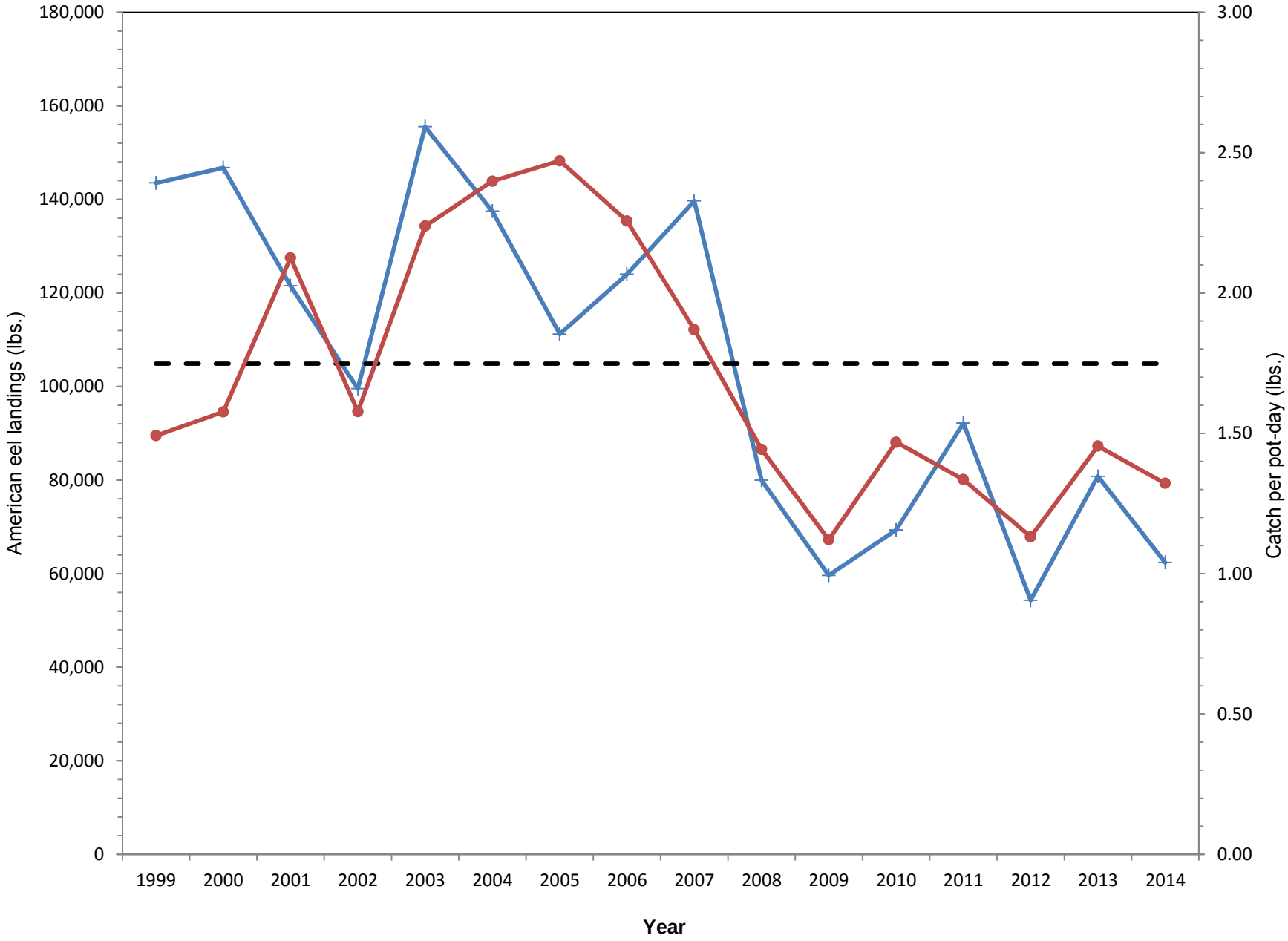

Figure 1. American eel commercial landings in pounds (+) and pounds caught per pot-day (●) in Delaware during 1999 through 2014. Mean landings (104,863 lbs.) for the time series represented by the dotted line.

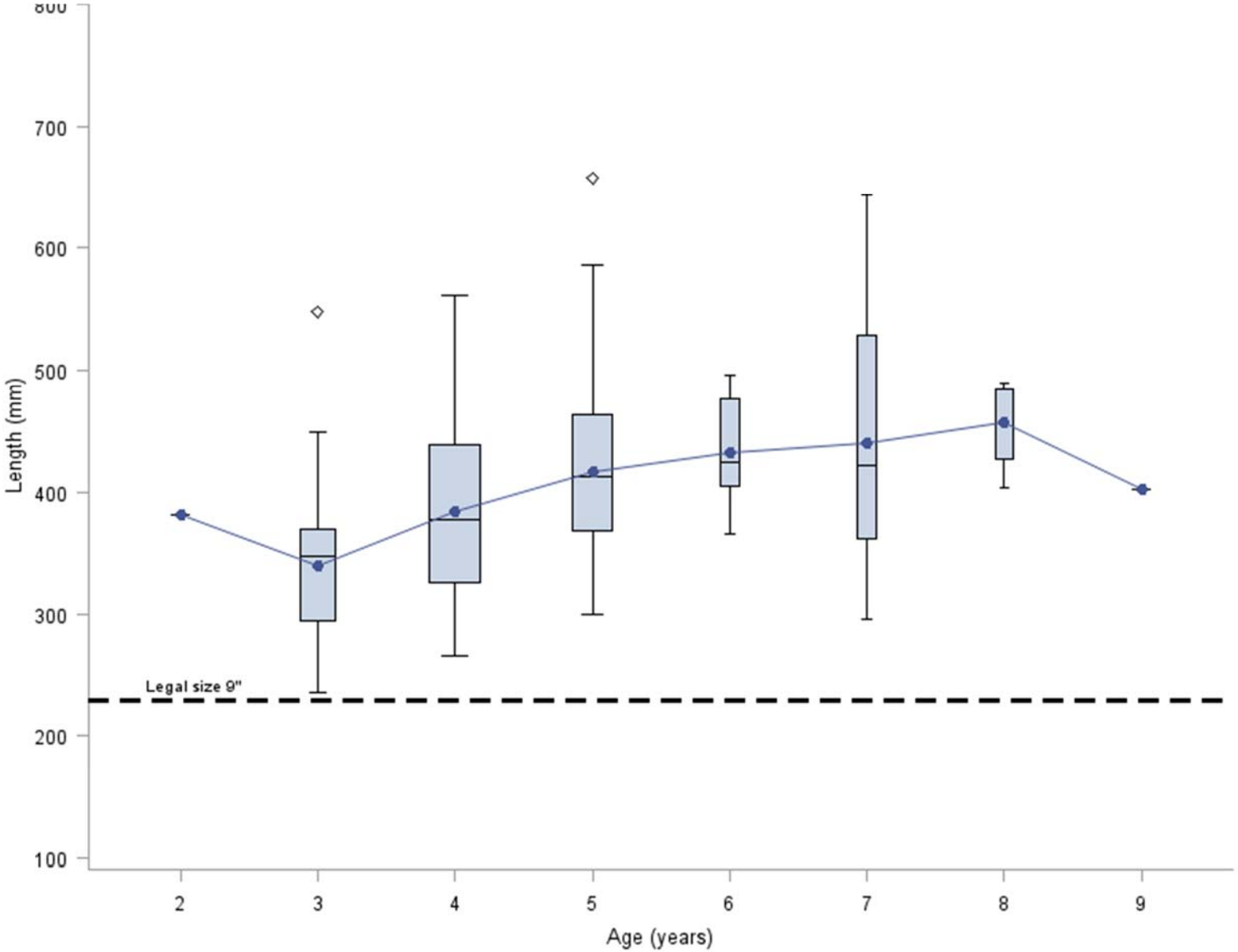

Figure 2. Boxplot of length by age for all 2014 commercially-caught American eels (N=203). Line connects mean values, box represents median, 25 and 75 quartiles, and whiskers extend to furthest values. Box width increases with number of observations. No box drawn if age represented by a single observation.

Appendix 1.

Glass eel monitoring in Delaware during 2014

The Atlantic States Marine Fisheries Commission (ASMFC) Interstate Fishery Management Plan (FMP) for American eel, passed in October 1999, requires all member states to monitor the migration of glass eels to freshwater. Perceived declines in glass eel numbers during the past 20 years were a major impetus to passing an FMP for American eel (ASMFC 2000). Delaware established a glass eel monitoring program in February 2000 and monitored glass eels during February, March, and April 2014 to compliment previous years.

Monitoring site

Delaware chose to monitor a single sample site, in compliance with the FMP, due to logistical constraints associated with eel sampling. The site chosen was the spillway of Millsboro Pond in southern Delaware (Figure 1). Millsboro Pond spillway is approximately 12 miles from the Atlantic Ocean and it is the first barrier glass eels migrating to freshwater encounter in Indian River. The sampling location was considered to be the best location in the state by Delaware Division of Fish and Wildlife (DDFW) Enforcement Officers for capturing elvers, based on poaching activity in the mid-1990s. The site also complies with the FMP recommendations for optimal site location: at the head of tide of small streams or estuaries and as close to the Atlantic Ocean as possible. Indian River is part of Delaware's Inland Bay system, which supports an active yellow eel fishery. Approximately 13.4% of Delaware's 2014 commercial eel landings came from the Inland Bays (Glanden and Newlin 2015).

Monitoring materials and methods

Glass eels were captured with a 4-foot x 4-foot mouth, 1/32-inch mesh wingless elver fyke. This gear was copied from a net confiscated from glass eel poachers by DDFW Enforcement Agents, who reported that this was the gear of choice among glass eel poachers. The cod end of the fyke was attached to a 4-foot x 2-foot x 2-foot live car, also of 1/32-inch mesh, to prevent large catches of elvers from being suffocated in the confines of the fyke's cod end.

The fyke was set along the edge of the southern bridge foundation in the spillway at the base of the dam at Millsboro Pond facing downstream. This part of the spillway was reported by DDFW Enforcement Officers to be the best area of the spillway to catch glass eels, based on observations of glass eels, and numbers of eel poachers. Counter currents at this part of the spillway ensured water flowed into the net at all tide stages and caused water to flow into the net during outgoing tides.

Monitoring began on February 4 and continued for eight weeks until April 4 for a total of 26 days fished. Storm conditions on several potential monitoring days required removal of the fyke from the sampling site which resulted in the net not being fished every day of each monitoring week.

The net was typically set each sampling week between 0830 hr and 0930 hr or 1230 hr and 1330 hr (depending on the time of low tide) on Monday, then emptied and reset 24 hours later on Tuesday through Thursday, and finally emptied and removed on Friday prior to the weekend.

Date, time of set, moon phase, water flow, water temperature, salinity, and dissolved oxygen were recorded at the start of each sample, and date, time of catch, water flow, water temperature, salinity, dissolved oxygen and gear condition (anomalies) were recorded at the conclusion of each sample.

The captured glass eels were counted each time the net was emptied. If many glass eels were caught, the catch was volumetrically enumerated with a splitter box (Winner and McMichael 1997) and released on the upstream side of the dam to avoid repeated capture. All eels were kept for measurements if they numbered 60 or less, otherwise a sub-sample of 60 was retained. Specimens were measured to the nearest millimeter, weighed to the nearest 0.01 g and assigned a pigmentation stage based on the method developed by Haro and Krueger (1988).

Monitoring results and discussion

The fyke-net captured an estimated 292,766 glass eels during the 26 sample days at the Millsboro Dam spillway during 2014. Catches ranged from 96 to 95,296 eels per sample day (Table 1), with a median of 1,444. The geometric mean was 1,819 glass eels per sample day (Table 3), sixth highest in the fifteen year time series. The highest daily catch occurred during the third week of February and the second week in March (Figure 2). Daily catch fluctuated widely during the monitoring period.

Sampled glass eels ranged in total length from 48.2 to 71.1 mm NL (Notochord Length), with a mean length of 60.7 mm NL and in weight from 0.08 to 0.36 grams, with a mean weight of 0.19 grams. The daily length range varied and displayed no obvious trend during the monitoring period (Figure 3).

Pigmentation stage of the sampled glass eels ranged from 1 to 7, with a mean stage of 3 during the monitoring period. Daily mean pigmentation stage displayed an increasing trend during the sampling period (Figure 4), suggesting that most of the recruitment to advanced stages in Indian River occurred later in the monitoring period. In previous years, the mean pigmentation stage tended to decrease during high catch weeks and increase during low catch weeks presumably because the catch during high catch weeks was comprised mostly of recent recruits to Indian River while the catch during low catch weeks was comprised of glass eels that had been in Indian River for a longer period (DDFW 2014).

Water temperature ranged from 2.9° to 13.7° C, with a mean temperature of 7.4° C during the monitoring period (Table 2a). Glass eel abundance was not significantly correlated to water temperature during the monitoring period.

Water flow at the spillway ranged from 98 to 233 cubic feet per second (cfs) with a mean flow of 151 cfs during the monitoring period (Table 2b). Mean flow in 2014 was 31% higher than the mean flow for the 2000 through 2013 monitoring periods, 116 cfs. Flow was not correlated to glass eel abundance in 2014.

Millsboro Dam spillway, a large source of freshwater in close proximity to the ocean, was highly attractive to migrating glass eels. This site proved to be very effective for glass eel monitoring because it concentrated migrating glass eels in a small area. However, those features of the Millsboro Dam spillway that made it an excellent location for glass eel monitoring likely made it a detriment to glass eel survival. Although the dam was not high, it had a nearly vertical wall and the water flowing over the dam tended to shoot out rather than flow down the face of the dam at that time of year, which suggested glass eel passage over the dam was unlikely. The large number of glass eels caught at the base of the spillway suggested that glass eels migrate to the spillway and remain there for a time as they attempt to move further upstream. Although the substantial eel landings from the Inland Bays (see Activity 6b) indicated glass eels blocked from upstream passage at the Millsboro Pond spillway eventually disperse, the concentration of glass eels at the spillway while they attempted upstream passage must have provided bountiful prey for predators in the area and, in past years, has provided an ideal location for glass eel poaching. The 2014 glass eel catch was the fifth highest annual catch for the time series, but was 63% lower than the highest annual glass eel catch (2013). Nearly 33% of the 2014 catch occurred on March 11 (Table 3). The geometric mean daily catch was 73% lower than the 2013 geometric mean. Low catches in 2008 -2010 indicated a declining trend in American eel recruitment to Indian River, however, catches over the last three years show a definitive increase in American eel recruitment (Figure 5).

References

Atlantic States Marine Fisheries Commission (ASMFC). 2000. Interstate fishery management plan for American eel. 79pp.

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Haro, A. J. and W. H. Krueger. 1988. Pigmentation, size and migration of elvers, *Anguilla rostrata* (LeSueur), in a coastal Rhode Island stream. Can. J. Zool. 66:2528-2533.

Winner, B. L. and R. H. McMichael. 1997. Evaluation of a new type of box splitter designed for subsampling estuarine ichthyofauna. Transactions of the American Fisheries Society 126: 1041-1047.

Table 1. Glass eels caught by date at Millsboro Dam spillway during February and March 2014.

Date	Glass eels	
	Number caught	% of total
2/4/2014	2,080	0.71%
2/5/2014	416	0.14%
2/6/2014	96	0.03%
2/18/2014	153	0.05%
2/19/2014	2,624	0.90%
2/20/2014	30,464	10.41%
2/21/2014	62,208	21.25%
2/25/2014	984	0.34%
2/26/2014	167	0.06%
2/27/2014	124	0.04%
3/6/2014	1,552	0.53%
3/7/2014	1,216	0.42%
3/11/2014	95,296	32.55%
3/12/2014	10,112	3.45%
3/13/2014	49,664	16.96%
3/14/2014	13,056	4.46%
3/20/2014	1,336	0.46%
3/21/2014	10,368	3.54%
3/25/2014	206	0.07%
3/26/2014	239	0.08%
3/27/2014	213	0.07%
3/28/2014	1,072	0.37%
4/1/2014	2,464	0.84%
4/2/2014	1,328	0.45%
4/3/2014	2,880	0.98%
4/4/2014	2,448	0.84%
All	292,766	100%

Table 2. (a) Water temperature (°C) by month during 2001 through 2014 glass eel monitoring periods at Millsboro Pond spillway.

Year	Month	Minimum Temp.	Maximum Temp.	Mean Temp.
2001	February	4.93	8.61	6.59
2001	March	4.72	12.26	8.22
2002	January	4.76	10.62	6.75
2002	February	3.89	10.96	7.30
2002	March	6.69	13.00	9.78
2003	January	2.70	2.70	2.70
2003	February	3.30	4.23	3.61
2003	March	6.37	15.45	10.90
2003	April	7.36	14.00	10.11
2004	February	2.63	6.94	4.94
2004	March	7.34	12.43	9.50
2004	April	7.25	9.80	8.63
2005	February	3.70	8.08	5.89
2005	March	2.10	10.99	6.77
2005	April	10.16	13.60	12.20
2006	February	3.77	8.07	5.69
2006	March	3.01	16.20	8.89
2007	February	1.20	5.47	3.71
2007	March	2.70	17.30	9.82
2007	April	8.80	16.10	13.73
2008	February	2.58	11.51	6.61
2008	March	7.54	12.00	10.38
2009	February	1.19	5.65	3.17
2009	March	8.71	12.02	10.50
2009	April	10.96	14.32	12.38
2010	March	3.33	14.64	9.58
2010	April	13.34	21.12	16.63
2011	February	4.08	6.12	5.13
2011	March	7.57	13.70	10.54
2011	April	9.24	16.11	13.47
2012	February	3.71	11.50	7.60
2012	March	7.50	17.20	12.83
2012	April	14.70	16.60	15.65
2013	February	4.40	7.60	6.03
2013	March	3.40	11.80	7.86
2013	April	10.80	12.00	11.23
2014	February	2.90	8.50	5.47
2014	March	3.40	11.30	7.31
2014	April	10.70	13.70	12.43

Table 2. (b) Water flow (cubic feet per second) at Millsboro Pond spillway during 2001 through 2014 glass eel monitoring periods.

Year	Minimum Flow	Maximum Flow	Mean Flow
2001	84	168	117
2002	27	44	34
2003	90	373	203
2004	91	254	124
2005	98	390	143
2006	64	151	103
2007	92	211	126
2008	40	87	56
2009	66	91	76
2010	149	405	228
2011	48	108	70
2012	41	118	60
2013	88	239	152
2014	98	233	151

Table 3. Total, median and geometric mean glass eel catch at Millsboro Pond spillway during 2000 through 2014 glass eel monitoring periods.

Year	Number of samples	Total caught	Mean	Median	Geometric mean (GM)	Upper 95% C.I. of Geometric mean	Lower 95% C.I. of Geometric mean	% change of GM from previous year
2000	21	151,176	7,199	612	864	1,680	444	
2001	25	343,066	13,723	6,083	4,808	8,364	2,763	456%
2002	26	239,180	9,199	9,526	5,832	8,577	3,966	21%
2003	25	81,233	3,249	837	626	1,379	284	-89%
2004	28	148,642	5,309	2,820	1,937	3,773	995	210%
2005	27	150,634	5,579	1,576	1,202	2,487	581	-38%
2006	28	252,043	9,002	3,344	2,398	4,776	1,204	99%
2007	25	318,053	12,722	1,136	1,252	2,706	579	-48%
2008	17	40,126	2,360	792	690	1,433	332	-45%
2009	21	32,482	1,412	1,168	819	1,380	489	19%
2010	25	50,414	2,017	1,552	649	1,319	319	-21%
2011	26	97,907	3,766	1,695	1,748	2,593	1,179	169%
2012	29	440,924	15,204	12,208	10,011	15,875	4,147	473%
2013	27	796,815	29,512	16,576	6,733	15,431	2,937	-33%
2014	26	292,766	11,977	1,444	1,819	3,574	925	-73%
All Years		2,345,880	224,478	150,905	1,972	2,363	1,646	

Figure 1. Location of Millsboro Pond spillway (arrow) on Indian River, Delaware. Spillway is approximately 12 miles from Indian River Inlet.

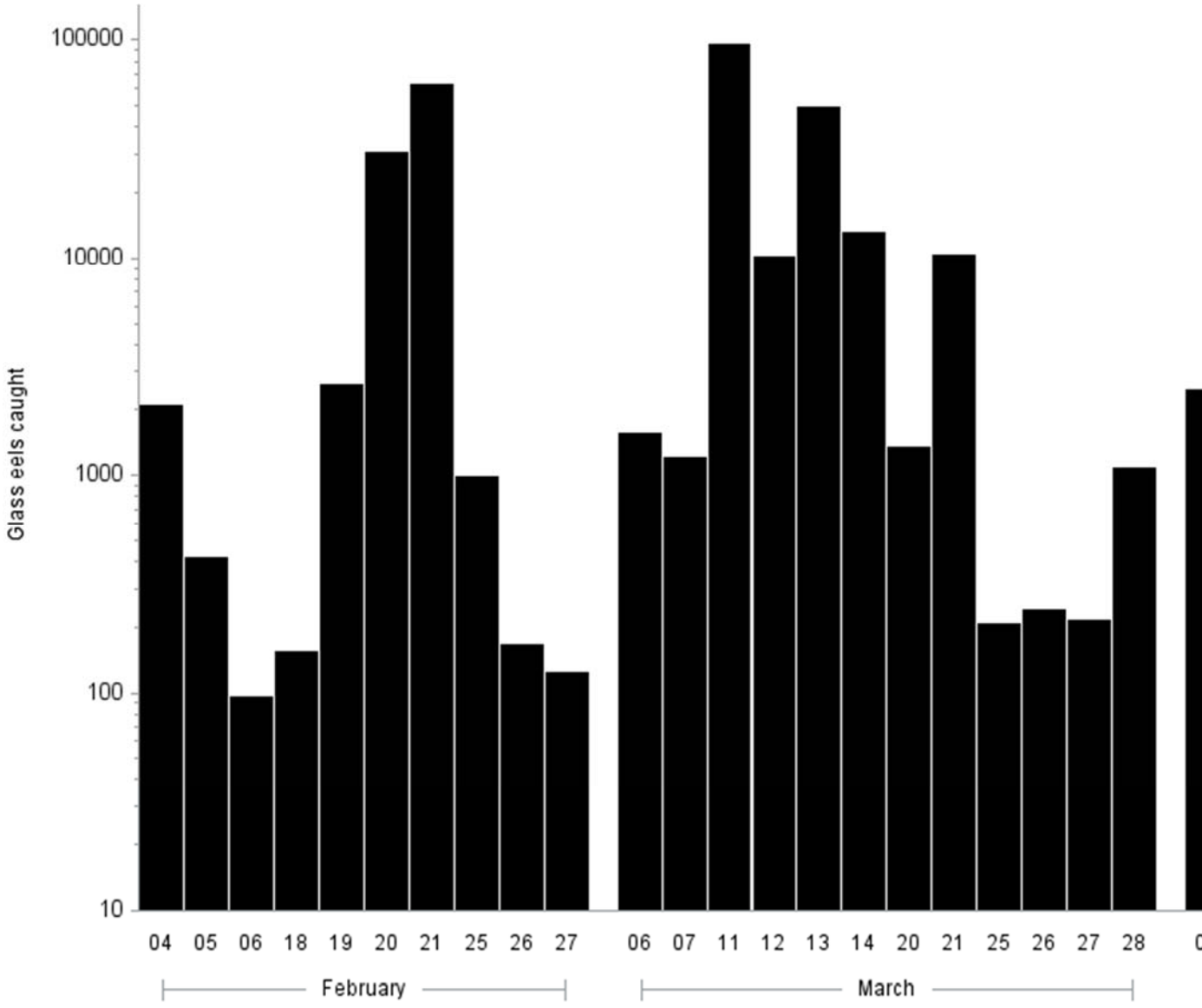

Figure 2. Glass eel catch by date during 2014 monitoring period. The response axis scale is irregular due to the large variation i

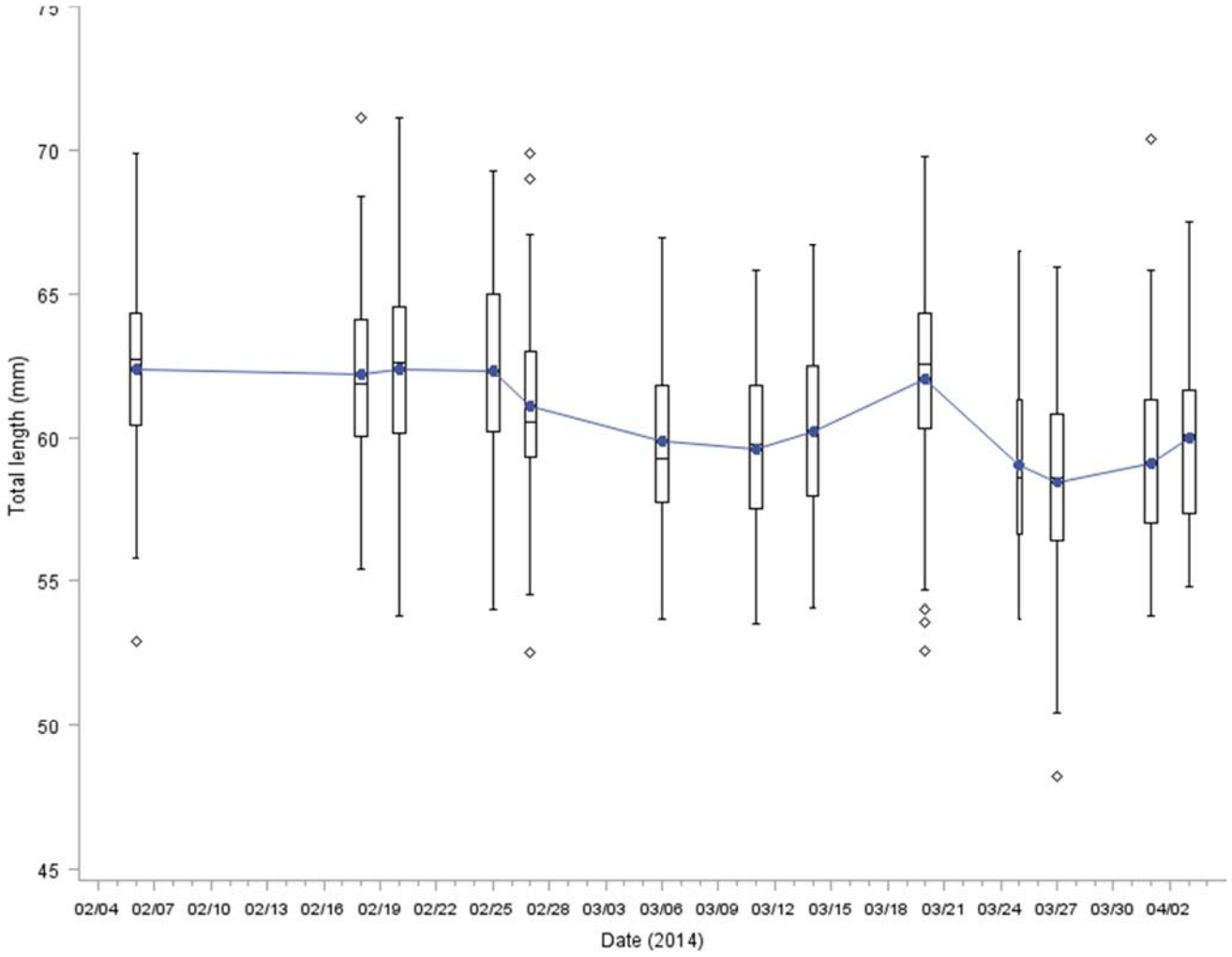

Figure 3. Boxplot of glass eel total length by date during 2014 monitoring period. Line connects mean values, box represents median, 25th and 75th quartiles, whiskers extend to furthest value within 1.5 times the interquartile range, and diamonds represent outside values. Box width increases with number of observations.

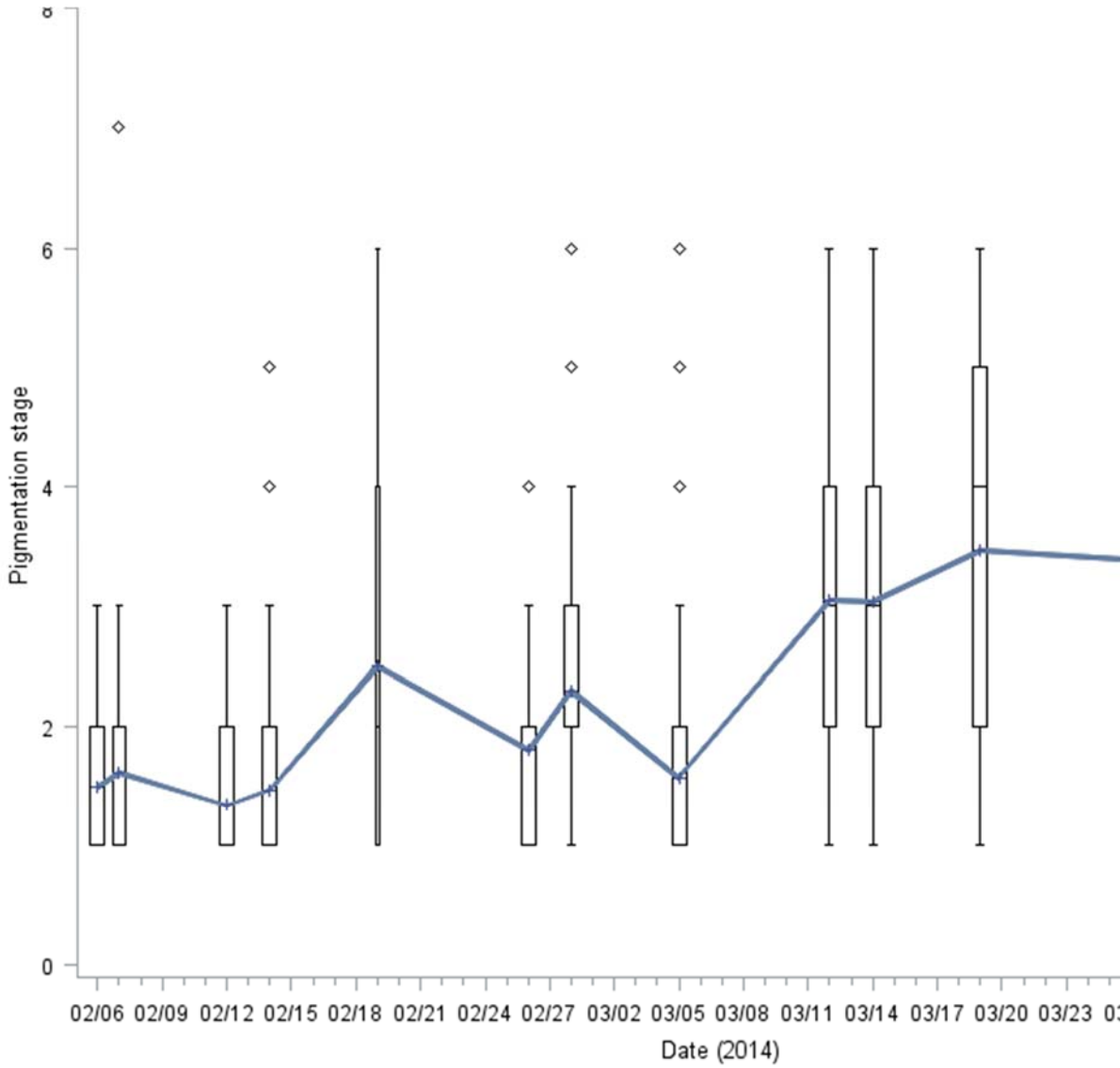

Figure 4. Boxplot of glass eel pigmentation stage by date during 2014 monitoring period. Line connects mean values, box represents median, 25th and 75th quartiles, whiskers extend to furthest value within 1.5 times the interquartile range, and diamonds represent outside values. Box width increases with number of observations.

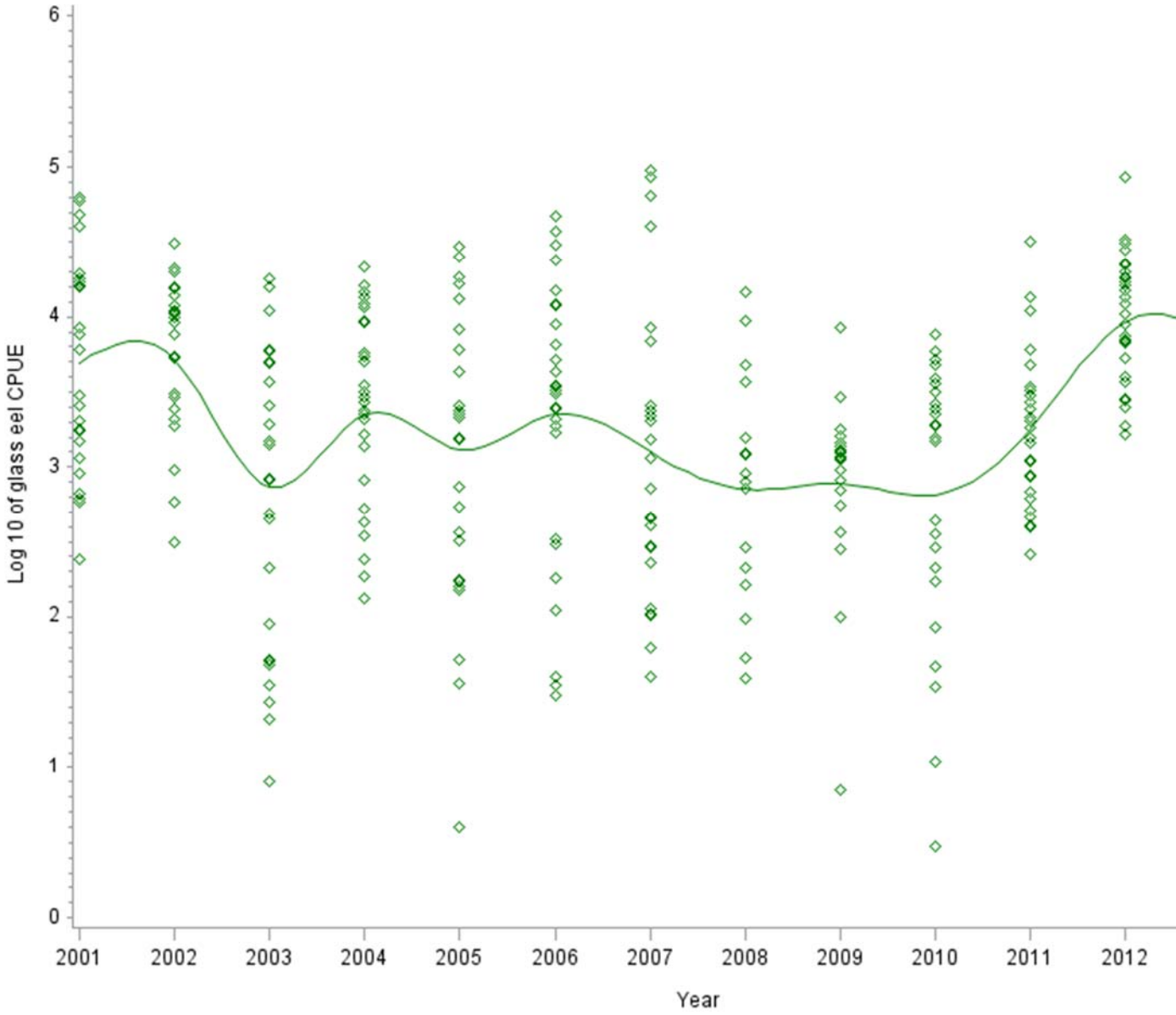

Figure 5. Scatter and smooth line plot of the $\log_{10}$ CPUE vs. year for 2001 through 2014 glass eel monitoring.