Atlantic States Marine Fisheries Commission

Sturgeon Management Board

May 23, 2013
8:45 – 9:45 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 *(R. Allen)* 8:45 a.m.

2. Board Consent 8:45 a.m.
   - Approval of Agenda
   - Approval of Proceedings from February 2013

3. Public Comment 8:45 a.m.

4. NOAA Fisheries Atlantic Sturgeon Draft Biological Opinion and Population Estimation Analysis Update *(J. Bullard)* 8:50 a.m.

5. Consider FMP Review and State Compliance *(K. Taylor)* **Action** 9:35 a.m.

6. Other Business/Adjourn 9:45 a.m.

The meeting will be held at: the Crowne Plaza Hotel, 901 North Fairfax Street, Alexandria, Virginia • 703-683-6000

MEETING
OVERVIEW

Atlantic Sturgeon Management Board Meeting
May 23, 2013
8:45 - .m.
Alexandria, Virginia

Chair: Russ Allen (Assumed 5/12)	Technical Committee Chair: Dewayne Fox (DE)	Law Enforcement Committee Rep: Brannock/Meyer
Vice Chair: John Clark	Advisory Panel Chair: Vacant	Previous Board Meeting: October 2012
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 February 19, 2013

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

4. NOAA Fisheries Atlantic Sturgeon Draft Biological Opinion and Population Estimation Analysis Update (8:50 – 9:35 a.m.)
Background • The Northeast Fisheries Science Center (NEFSC) has been working on a batch Biological Opinion (BiOp) for the seven major northeast federal fisheries that encounter Atlantic sturgeon (monkfish, groundfish, skate, spiny dogfish, bluefish, squid, mackerel, butterfish, summer flounder, scup, and black sea bass) as required through the Section 7 consultation process. The Draft BiOp will be available in May. **(Supplemental Material)** • In the efforts to complete the BiOp the NEFSC has developed a method to improve the abundance estimates for sturgeon that live in the ocean for most or all of the year and used it to estimate the population size. **(Briefing CD)**
Presentations • Draft Biological Opinion and Population Analysis by J. Bullard and K. Damon-Randall

5. Fishery Management Plan Review (9:35 – 9::45 a.m.) Action
Background • State compliance reports are due October 1st (**Briefing CD)** • The Plan Review Team reviewed each state report and compiled the annual FMP Review **(Supplemental Material)**
Presentations • Overview of the FMP Report by K. Taylor
Board Actions for consideration • Approve 2012 FMP Review and State Compliance

6. Other Business/Adjourn

DRAFT **DRAFT** **DRAFT**

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

STURGEON MANAGEMENT BOARD

Crowne Plaza Hotel - Old Town
Alexandria, Virginia
May 2, 2012

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

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ATTENDANCE

Board Members

Terry Stockwell, ME, proxy for P. Keliher (AA)
Willis Spear, ME, proxy for S. Train (GA)
Rep. Walter Kumiega, ME (LA)
G. Ritchie White, NH (GA)
Douglas Grout, NH (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Jocelyn Cary, MA, proxy for Rep. Peake (LA)
Michael Armstrong, MA, proxy for P. Diodati (AA)
Pat Augustine, NY (GA)
Russ Allen, NJ, proxy for D. Chanda (AA)
Leroy Young, PA, proxy for J. Arway (AA)
Loren Lustig, PA (GA)
Mitchell Feigenbaum, PA, proxy for Rep. Vereb (LA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Tom O'Connell, MD (AA)
Russell Dize, MD, proxy for Sen. Colburn (LA)
Bill Goldsborough, MD (GA)
Rob O'Reilly, VA, proxy for J. Travelstead (AA)
Kyle Schick, VA, proxy for Sen. Stuart (LA)
Mike Johnson, NC, proxy for Sen. Jenkins (LA)
Michelle Duval, NC, proxy for L. Daniel (AA)
Sen. Ronnie Cromer, SC (LA)
Ross Self, SC, proxy for R. Boyles (AA)
Patrick Geer, GA, proxy for Rep. Burns (LA)
Jim Estes, FL, proxy for J. McCawley (AA)
A.C. Carpenter, PRFC
Jaime Geiger, USFWS
John Bullard, NMFS
Bryan King, DC

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

Ex-Officio Members

Staff

Robert Beal
Kate Taylor

Guests

Kelly Place, VA Waterman's Assn.

The Sturgeon Management Board of the Atlantic States Marine Fisheries Commission convened in the Presidential Ballroom of the Crowne Plaza Hotel Old Town, Alexandria, Virginia, February 19, 2013, and was called to order at 3:35 o'clock p.m. by Chairman Russ Allen.

CALL TO ORDER

CHAIRMAN RUSS ALLEN: We will get started with the Sturgeon Board.

APPROVAL OF THE AGENDA

CHAIRMAN RUSS ALLEN: First up is approval of the agenda. Are there any changes to the agenda? If not; we will consider that approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN RUSS ALLEN: Approval of Proceedings from the October 2012 meeting; seeing there are no comments or changes to be made to that, we will consider those approved, also.

PUBLIC COMMENT

CHAIRMAN RUSS ALLEN: At this time I would like to open it up to public comment for anything that should come before the board today that is no the agenda. Seeing no one, we will move forward. I am going to turn it over to Kate and talk about review and populating the stock assessment subcommittee.

REVIEW AND POPULATE THE STOCK ASSESSMENT SUBCOMMITTEE

MS. KATE TAYLOR: The Sturgeon Management Board has initiated a benchmark stock assessment for Atlantic sturgeon that will begin in early 2013. ASMFC staff and the Sturgeon Technical Committee Chair have reviewed potential stock assessment subcommittee members and recommends the following people for the board's consideration today:

Mike Vanarsky from Massachusetts; Matt Fisher from Delaware; Dwayne Fox is the technical committee; Kathy Hattala and Andy Kahnle from New York; Laura Lee from North Carolina; Christine Lipsky from NOAA Fisheries; Jerry Mueller from U.S. Fish and Wildlife Service; Mike Locklear from North Carolina; Bill Post from South Carolina; Eric Schneider; an Dave Secor from the University of Maryland, Chesapeake Bay Lab. We expect to begin the assessment immediately and anticipate that it will be completed hopefully by late 2014. Thank you, Mr. Chair.

CHAIRMAN ALLEN: Does anybody have any comments or suggestions to go with this? If not, I will be looking for a motion to take this forward. Pat.

MR. PATRICK AUGUSTINE**: I so move that the board be populated as proposed.**

CHAIRMAN ALLEN: Second by Mr. Adler. We are not populating the board but the stock assessment subcommittee; it is true, Pat?

MR. AUGUSTINE: Okay.

CHAIRMAN ALLEN: I will ask if there are any objections to the motion. **If not, we will consider it approved unanimously**. Next up on the agenda is review of the NOAA Fisheries/ASMC Mid-Atlantic Gill Net Bycatch Workshop. Kate.

REVIEW OF THE NOAA FISHERIES/ASMC MID-ATLANTIC GILL NET BYCATCH WORKSHOP

MS. TAYLOR: This is just a brief review of a NOAA Fisheries and ASMFC Workshop that was held this past January. The workshop focused on Southern New England and Mid-Atlantic Sturgeon and Sea Turtle Gill Net Bycatch. The goal of the workshop was to bring together representatives of the fishing industry, scientists, conservation community and managers in order to identify technological solutions to reduce or mitigate bycatch while maintaining catch.

Industry representatives in attendance were mostly from the monkfish, dogfish, shark and striped bass fisheries. The new research was presented on the occurrence of sturgeon bycatch and the factors that contributed to increased interactions by Dwayne Fox, who is our technical committee chair, who could not be here today.

Additionally, research was presented on the gear technologies to reduce bycatch in the gill net fisheries in the regions. There was additional discussion on potential solutions or identification of further research needs, which focused on changing gears such as raising the footrope or changing the hanging ratio, changing how detectable the gear is to sturgeon through the use of deterrence such as lights, changing the orientation or location of the gear and the relationship of soak time to sturgeon bycatch mortality.

There will be a detailed summary of the workshop, which will be distributed. It should be ready I believe in a month or so. The workshop findings may be help to states that are in the process of developing any Section 10 permit applications. Thank you, Mr. Chair.

CHAIRMAN ALLEN: Does anybody have any comments or thoughts on that? I attended that workshop, also. It was very informative. It was nice to see industry and the scientific community getting together to discuss issues that we really need to discuss. Seeing no comments or questions; I will again turn it over to Kate to talk about advisory panel membership.

REVIEW AND POPULATE THE ADVISORY PANEL MEMBERSHIP

MS. TAYLOR: There has been a request from the state of New Jersey to add Michael Doebley, a recreational fisherman, to the Sturgeon Advisory Panel. Additionally, the Atlantic Sturgeon AP has not met now for over a decade. States are requested to review their current representation and update it as necessary.

The current AP list was included in the briefing material, and it is available on our website as well. It is anticipated that the AP will meet more frequently as the commission develops the upcoming benchmark stock assessment and considers possible management responses. Thank you, Mr. Chair.

MR. ROY MILLER: One quick correction; I believe Michael Doebley is a Delaware resident.

CHAIRMAN ALLEN: Yes, he is. He used to be in New Jersey, though. Bill.

MR. WILLIAM A. ADLER: There are these other advisory panel nomination forms. What are they; are they people that have already come in? I've got a couple here. Is it all for Michael Doebley of are there other names here? Is that the only one?

MS. TAYLOR: Yes, that is the only one.

MR. AUGUSTINE: Are you ready for a motion?

CHAIRMAN ALLEN: Let's see what Rob has to say first.

MR. ROB O'REILLY: I just wanted to follow up on the process for the advisory panel. What is the timeframe for submitting additional members' names and how should we do that?

MS. TINA BERGER: Well, I'm assuming that the board may meet in May. If they do, that would be a good opportunity to have the board review submitted nominations. Anytime between now and a couple of weeks prior to the May meeting so we can get it on the CD should be sufficient.

CHAIRMAN ALLEN: Seeing nothing else; Pat.

MR. AUGUSTINE: **I move that we appoint Michael Doebley and accept his appointment to the advisory panel.**

CHAIRMAN ALLEN: Second from John Clark. Is there any discussion? Is there any need to vote on this; any abstentions? Seeing none; **the motion is approved**.

ADJOURNMENT

Is there anything else to come before this board today? Seeing nothing; we are adjourned.

(Whereupon, the meeting was adjourned at 3:45 o'clock p.m., February 19, 2013.)

Northeast Fisheries Science Center Reference Document 13-06

An Atlantic Sturgeon Population Index for ESA Management Analysis

by John Kocik, Christine Lipsky, Tim Miller, Paul Rago, and Gary Shepherd

April 2013

Northeast Fisheries Science Center Reference Document 13-06

An Atlantic Sturgeon Population Index for ESA Management Analysis

by J. Kocik[1], C. Lipsky[1], T. Miller[2], P. Rago[2], and G. Shepherd[2]
(listed alphabetically)

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

April 2013

Northeast Fisheries Science Center Reference Documents

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Information Quality Act Compliance: In accordance with section 515 of Public Law 106-554, the Northeast Fisheries Science Center completed both technical and policy reviews for this report. These predissemination reviews are on file at the NEFSC Editorial Office.

This document may be cited as:

Kocik J, Lipsky C, Miller T, Rago P, Shepherd G. 2013. An Atlantic Sturgeon Population Index for ESA Management Analysis. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-06; 36 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

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ABSTRACT

The listing in 2012 of Atlantic sturgeon (*Acipenser oxyrinchus*) under the Endangered Species Act identified four Distinct Population Segments (DPSs) as endangered and one as threatened. We developed an index of population abundance for Atlantic sturgeon in the Northeast to aid managers to evaluate potential threats to these stocks. The index uses fishery bycatch estimates, data from the USFWS Atlantic Coast Sturgeon Tagging Database, and published values of Atlantic sturgeon life history parameters. Estimates of total Atlantic sturgeon bycatch were derived from data collected on observed commercial fishing trips monitored by the Northeast Fisheries Observer Program (NEFOP). We evaluated uncertainty in the index input data with a risk analysis model that used a parametric bootstrapping approach. Based on our index, the mean abundance of Atlantic sturgeon in oceanic waters off the Northeast coast of the US during 2006-2011 was 417,934 fish, with a 95% confidence interval of 165,381 to 744,597 fish. This estimate does not include Atlantic sturgeon that may reside year-round in rivers and estuaries. Our abundance estimates are consistent with annual swept area abundance estimates of Atlantic sturgeon in nearshore areas derived from Northeast Area Monitoring and Assessment Program surveys conducted during 2007-2012.

INTRODUCTION

Problem and Scope

To evaluate impacts of human activities on threatened and endangered Atlantic sturgeon Distinct Population Segments (DPSs), an index of population abundance is desirable. This index can then be used to evaluate the impact of projected or actual Atlantic sturgeon fisheries-related incidental mortality (*i.e.,* unintended bycatch). This paper describes the development of an Atlantic Sturgeon Population Index (ASPI). The ASPI was derived from a conceptual model that interprets annual bycatch in terms of Atlantic sturgeon population dynamics and the probability of encountering sturgeon in commercial fisheries. The ASPI provides an annual estimate of the abundance of Atlantic sturgeon in the areas where sturgeon bycatch estimates are available. Atlantic sturgeon that occur in estuaries or rivers—and also north of the Gulf of Maine or south of Cape Hatteras—are not included in the ASPI. Uncertainty in the bycatch data and in the other input parameters was evaluated using a parametric bootstrap approach. The ASPI population estimates were then partitioned across five DPSs and Canada based on genetic assignment analysis of fishery-sampled individuals. The resulting DPS abundance estimates and their confidence intervals provide baseline data to evaluate risk thresholds for expected bycatches of Atlantic sturgeon.

Background

In 2010, NOAA's National Marine Fisheries Service was petitioned to list Atlantic sturgeon under the Endangered Species Act (ESA). In 2012, five distinct population segments (DPSs) were listed; four DPSs were listed as Endangered (New York Bight, Chesapeake Bay, Carolina, and South Atlantic) and one as Threatened (Gulf of Maine). At the time of listing, however, only limited analyses had been conducted of (a) tag-return information in a long-term USFWS Atlantic sturgeon tagging database; (b) recent commercial fishery Atlantic sturgeon bycatch estimates; and (c) abundance indices of Atlantic sturgeon in the Northeast Area Monitoring and Assessment Program (NEAMAP) inshore surveys.

This report summarizes work that the Northeast Fisheries Science Center has conducted to develop abundance estimates consistent with the new data. The approaches described in the work introduce a new method for population estimation, an instantaneous rates model for tagging data, an improved model-based estimator of bycatch, methods for characterizing the uncertainty of population estimates, and comparisons with swept area estimates. We recognize that efforts are underway by the Atlantic States Marine Fisheries Commission to formally assess Atlantic sturgeon populations. The analyses and results presented in this paper should be useful in the ASMFC assessments.

METHODS

Conceptual Bycatch Model

Our Atlantic sturgeon population estimates are based on a conceptual model that interprets a series of annual bycatch estimates in terms of recruitment, capture mortality, inter-annual natural mortality, and the probability of incidentally capturing sturgeon in various commercial fisheries. Our conceptual model was constructed as follows:

Consider a series of total bycatch estimates by year (c_t). If we assume that every sturgeon incidentally captured (a) survives the capture process (no bycatch mortality); (b) does not suffer any other source of mortality; and (c) is never seen again, the total minimum population size of Atlantic sturgeon off the Northeast coast of the US would be the sum of the discards between 2006 and 2010. A simple mass balance approach that relaxes these assumptions can be used to describe the observed catches. The minimum population size in year *t* can then be defined as

$$n_t = c_t(1 - \theta)\, e^{-M} \qquad (1)$$

where n_t is the minimum number of fish at the end of year *t*, c_t is the number of fish bycaught alive during year *t*, θ is the fraction of fish that die during capture, and *M* is the natural mortality rate from all other causes. This approach assumes that the magnitude of natural mortality that occurs in the capture period is negligible such that fishing mortality and natural mortality can be approximated. If *M* and θ equal 0, then n_t is equal to c_t as noted above.

The bycatches that occur in year *t*+1 represent both new fish never seen before R_{t+1}, and recaptures of the surviving fish from previous years $n_t\mu_{t+1}$ where μ_{t+1} is the encounter rate in year $t+1$. Given the total incidental captures during year $t+1$, the new captures are $R_{t+1} = c_{t+1} - n_t\mu_{t+1}$. The minimum population alive at the end of year *t*+1 can be written as a function of those fish that were alive at the end of year *t* but not seen in year *t*+1 and those that were seen in year *t*+1 as bycatch c_{t+1}. We define μ_{t+1} as the fraction of fish alive in year *t* observed in year *t*+1 as bycatch. The observed bycatch in year *t*+1 therefore consists of fish not observed before plus some fraction observed as bycatch before and alive at the end of year *t*. These concepts can be expressed as

$$n_{t+1} = \{(1 - \mu_{t+1})n_t + (c_{t+1} - \mu_{t+1}n_t)(1 - \theta)\}e^{-M} \qquad (2)$$

The first term within brackets on the right hand side of Eq. 2 [i.e., $(1- u_{t+1})\, n_t$] is the population not observed in year *t*+1. The second term within brackets expresses the new captures in year *t*+1 (R_{t+1}) surviving the capture process (i.e., 1-θ). The number of new and previously observed fish is then reduced by the probability of survival (non-capture effects) [i.e., e^{-M}] outside of the brackets.

The population model makes no explicit assumption about recruitment of new individuals to the population. Thus, minimum population size is defined by a recursive equation that converges to a long-term-value defined by (a) the encounter probability μ; (b) the probability of surviving capture (1-θ); (c) the natural mortality rate *M*; and (d) the number of fish observed as bycatch in year *t*. If the parameters μ, θ, and *M* are constant, the minimum population converges to an equilibrium value defined by the average rate of observed bycatch. Note that the population will increase only when there are new captures ($c_{t+1} - \mu_{t+1}n_t$ is greater than zero). In practical terms, the population estimates derived using Eq. 2 will not decrease with additional years of data unless the natural mortality or encounter probabilities have been underestimated. Conversely, if the fraction of fish that die after capture is actually greater than observed, the population estimates will increase. This occurs because a greater number of new fish enter the population each year.

Recursive application of Eq. 2 defines a minimum population of sturgeon observed as bycatch in previous years. However, total population size is estimated using the estimated probability of incidentally capturing sturgeon in the fisheries. This quantity is defined by the fishing mortality rate and the interplay with non-fishing mortality. Using the Baranov catch equation, the probability of encountering a sturgeon is the exploitation rate μ, which is a function of the instantaneous rates of fishing mortality F and non-fishing mortality M, viz.

$$\mu_t = \frac{F_t}{F_t + M}\left(1 - e^{-(F_t + M)}\right) \qquad (3)$$

The exploitation rate μ is equal to the tag recovery probability (when accounting for non-reporting of tags and also for tags loss). Thus tag-recovery data—and the model described in the next section— can be used to obtain estimates of the encounter probability.

The total population size, denoted as N_t, is minimum population size n_t, raised by the encounter probability. This minimal estimate is the Atlantic Sturgeon Population Index (ASPI):

$$N_t = \frac{n_t}{\mu} \qquad (4)$$

The data to estimate the parameters in Eq. 1 to 4 were derived from various sources. Because data were available by type of fishing gear and by size of sturgeon, we modeled the population component-wise by gear type and size group. The gear and size-specific bycatch model (Eq. 2) can be written as

$$n_{g,s,t+1} = \left\{\left(1 - \mu_{s,t+1}\right)n_{g,s,t} + \left(c_{g,s,t+1} - \mu_{s,t+1}n_{g,s,t}\right)\left(1 - \theta_g\right)\right\}e^{-M_s} \qquad (5)$$

Gear type, denoted by the subscript g, refers to gillnets and otter trawls. Sturgeon size classes, denoted by the subscript s, are defined as subadults (< 150 cm) and adults (≥150 cm). The total population size can then be estimated from Eq. 4 as

$$N_t = \sum_s \sum_g \frac{n_{g,s,t}}{\mu_{s,t}}. \qquad (6)$$

Model for Exploitation and Survival Rates from Tag-recovery Data

The USFWS sturgeon tagging database (USFWS 2012) includes releases and recaptures of Atlantic sturgeon since 1989. Tag release information is submitted by state and federal researchers. Recoveries are from three sources: commercial fishermen handling their own tagged fish; independent researchers (including researchers operating independently or contracted commercial fishing vessels targeting sturgeon for researchers); and commercial vessels operating in their specific fisheries and where the tagged fish are handled by researchers or fishery observers (termed "report," "independent," and "dependent," respectively). For our analysis work, we were provided with a subset of the database by the USFWS (S. Eyler, USFWS, pers. comm.). From this subset, we excluded "independent" recoveries because research-based encounter rates are unlikely to be the same as commercial encounter rates. We also excluded recoveries of sturgeons other than Atlantic sturgeon, and excluded recoveries that were either re-released or recaptured fish possessing no external tags. To make these results applicable to the areas where discard estimates were available, we further excluded releases from the Southeast region (south of Cape Hatteras) and Canada, and any releases prior to 1993. Finally, the releases and recoveries were separated into two size groups: (1) fish less than 150 cm (subadults); and (2) fish greater than 150 cm (adults) (Tables 2 to 6).

The "dependent" recoveries were far more numerous than the number of sturgeon recorded by observers as bycatch associated with commercial fishing activities. Therefore, we used the ratio of the total number of tag recoveries by observers between 1993 and 2011 (n=15) to the total "dependent" recoveries (n=267) to scale down the matrix of "dependent" recoveries (Tables 5 and 6). No multiple recaptures occurred in the "dependent" or "report" categories of recoveries.

A model parameterized with instantaneous rates of mortality and tag shedding was used to derive estimates of exploitation rates for the ASPI model (previous section). The expected number of recoveries from Y_r releases in group r (defined by size class of releases s, a and year of release t_r) in fisheries with a researcher during time $t = t_r, \ldots, 2011$ is

$$E(R_{r,1,t}) = Y_r \pi_{r,1,t} = Y_r e^{-\sum_{i=t_r-1}^{t-1} Z_{r,i}} \frac{\rho F_t}{Z_{r,t}} (1 - e^{-Z_{r,t}})$$

where ρ is the fraction of recoveries from effort with researchers. The expected number of recoveries in fisheries without a researcher during time t is

$$E(R_{r,2,t}) = Y_r \pi_{r,2,t} = Y_r e^{-\sum_{i=t_r-1}^{t-1} Z_{r,i}} \frac{\lambda(1-\rho) F_t}{Z_{r,t}} (1 - e^{-Z_{r,t}})$$

where λ is the probability of reporting tags. The expected number of unrecovered tags is

$$E(U_{r,u}) = \left[Y_r - \sum_{t=t_r}^{T} (R_{r,1,t} + R_{r,2,t}) \right] \left[1 - \sum_{t=t_r}^{T} (\pi_{r,1,t} + \pi_{r,2,t}) \right].$$

We accounted for shedding of tags (L) by comparing recoveries of sturgeon that were doubled-tagged with a conventional and a PIT tag. Shedding rate was greater in the first year after release than later, so we used different values for these two intervals (Figure 2). Given a 0.7 probability of retention one year after release and a 0.5 probability of retention five years after release, the shedding rate for the first year was calculated as $L_1 = -\log(0.7) \approx 0.357$. The shedding rate in the second and all subsequent years after release was calculated as $L_2 = -\log(0.5/0.7)/4 \approx 0.084$. We assumed $M_s = 0.125$ for fish less than 150 cm and $M_a = 0.07$ for all fish greater than 150 cm (Kahnle et al. 2007). Thus for tag-recoveries, $Z_{r,t} = F_t + M_r + L$ for $t \geq t_r$ and $Z_{r,t_r-1} = 0$.

We used annual values of ρ, calculated as the ratio of observer trips to those in the Vessel Trip Report (VTR) database from years 1994 to 2011 (Table 7). The criteria for including trips from the Northeast Fisheries Observer Program (NEFOP) and VTR databases were identical to those used to estimate discards for 2006-2011. For 1993, we used the same ratio as for 1994.

The parameters to be estimated were annual fishing mortality rates (1993-2011) and the reporting rate of tags in the unobserved component of the fishery. We assumed that the number of recoveries in each component of the fishery during each interval in a given release group (by size class and year) were multinomial distributed. We then fit the model using an AD Model

Builder (Fournier et al. 2012) program that provided estimates and standard errors of the logit of the annual exploitation rates

$$\mu_{r,t} = \frac{F_t}{F_t + M_r}\left(1 - e^{-(F_t+M_r}\right)$$

and also the annual survival rates

$$S_{r,t} = e^{-(F_t+M_r)}.$$

We calculated approximate standard errors using the delta method and 95% confidence intervals as

$$CI\left(\frac{1}{1+e^{-X}}\right) = \frac{1}{1+e^{-X \pm Z_{0.975}SE(X)}}$$

where X is the logit of survival or exploitation rate and $Z_{0.975}$ is the quantile of the standard normal distribution associated with 0.975 cumulative probability.

Exploitation and survival rate estimates

Estimated exploitation rates were generally higher prior to 2001 (0.05 to 0.12) than afterward (0.002 to 0.05), and were similar between the two size classes of released sturgeon (Figure 3 and Table 8). For releases less than 150 cm in length, annual probabilities of survival exceeded 0.75 and exceeded 0.8 after 1998 (Figure 4 and Table 9). For releases greater than 150 cm, survival was slightly higher due to the lower natural mortality rate. The reporting rate for recoveries from unobserved fishing trips was estimated to be 0.295 (SE = 0.076).

The Risk Analysis Framework in @RISK

The overall uncertainty in the Atlantic sturgeon population estimates are a function of the uncertainty in the estimates from the discard and tagging data, and the uncertainty in the natural mortality and post-capture mortality rates. The joint effects of uncertainty in the estimates from the ASPI model were calculated in a Microsoft Excel workbook using the @RISK software package (Palisade Corporation, 2012). Probability density functions were assumed for each of the ASPI inputs and parameterized by the estimated means and variances.

The @RISK software creates multiple realizations of a stochastic process using parametric Monte Carlo simulations. Each realization of the stochastic process is created by randomly sampling from the corresponding assumed probability distribution of each ASPI model input. Sampling distributions of model outputs were based on 22,500 iterations. The number of stochastic realizations was based on convergence criteria that required less than a 1% change in the mean between successive realizations, and a confidence level of 95% (the mean of each output simulated had to be accurate 95% of the time)

The ASPI estimate (N_t) was then partitioned across the Distinct Population Segments using a Mixed Stock Analysis (MSA; Wirgin, personal communication 12 June 2012). This analysis was based on genetic data from 173 Atlantic sturgeon taken as bycatch in US Atlantic coast commercial fisheries, and sampled as part of the NEFOP. The MSA results, depicted as DPS point estimates in Figure 3 of Damon-Randall et al. (2012), were given as: 2% Canada, 11% Gulf of Maine, 49% New York Bight, 14% Chesapeake Bay, 4% Carolina, and 20% South

Atlantic[1]. Because the MSA sample size is a small, albeit spatially diverse sample, the partitioning of the ASPI estimate was done solely using point estimates without taking account of any variance associated with the genetic assignments (Figure 1). To illustrate the variance around the samples, the Carolina DPS point estimate of 0.04 has a mean of 0.042 with a 95% confidence limit of (0.008 - 0.092). Future ASPI estimates and stock assessments could include these variances in the DPS partitioning exercise, but it would be prudent to wait until samples sizes increase. The population estimates for each DPS were then used to derive the ratio of bycatch mortalities in 2011 to the estimated abundance of sub-adult and adult sturgeon.

Distributions for ASPI model inputs

The key model inputs and assumed distributions used for the Monte Carlo simulation are provided in Table 10.

We assumed normal distributions for the logit annual encounter rates, with mean and standard deviations provided by the estimates and standard error from the tag-recovery model (e.g., Figure 5). We assembled the 10,000 simulations in each year 2006-2009 (corresponding to the bycatch estimates) into one data field (40,000 in total) and transformed them using the inverse of the logit. By doing so, we obtained values on the probability scale for the distribution of average exploitation (or encounter) rates during 2006 to 2009.

Means and standard errors for adult and subadult natural mortality were provided by Kahnle *et al*. (2007). For subadult mortality, M ranged from 0.09 to 0.16 for fish aged 2-10 (<150 cm). This variability in subadult M was best described using a mean of 0.125 and a standard deviation of 0.024 (Figure 6a). For adult mortality, Kahnle *et al*. (2007) reported an M of 0.07. We added a minimal standard deviation of 0.001 (Figure 6b) to provide some variance, and also incorporated a variance threshold as a placeholder so that information of adult M from future studies could be included. We further assumed that a negligible fraction of the sturgeon in the sub-adult group grow into the adult group.

We used bycatch estimates and standard errors for 2006 to 2010 provided in Miller and Shepherd (2011, see also Appendix A). These represent dead encounters and apply only to the Fishery Management Plans (FMPs) that will be included in the Northeast Regional Office (NERO)'s batched consultation (Table 1a). We used a left-truncated normal distribution with mean and standard deviations provided by the annual bycatch estimates and their standard errors (Table 1). The values used for the left-truncation were the annual minima determined from the actual numbers of sturgeon in the Northeast Fisheries Observer Program (NEFOP) database by year and gear type. We partitioned the total estimated bycatch into subadult and adult components by applying the annual proportion of measured lengths less or greater than 150 cm. In Figure 7, an example is given of the distribution of estimated gillnet bycatches of Atlantic sturgeon in 2006 The NEFOP reports the fraction of sturgeon dead at the time of capture. The average survival rate for 2006-2010 was used to estimate θ. Based on Miller and Shepherd (2011), we assumed an observed average bycatch mortality of 5% for trawl-caught sturgeon and 20% for sturgeon taken in gillnets.

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[1] In the final stages of this report these percentages were modified slightly (T. King, USFWS, pers. comm.) The new percentages are: Canada, 1%; Gulf of Maine, 11%; New York Bight, 51%; Chesapeake Bay, 13%; Carolina, 2%, and South Atlantic (SA) 22%. The revised estimates were not used in this report. See Damon-Randall, K, Colligan, M, and Crocker, J 2013. Composition of Atlantic sturgeon in rivers, estuaries, and in marine waters (White paper). NOAA/NMFS, Gloucester, MA: Protected Resources Division.

RESULTS

ASPI Model Results

Based on the ASPI index, the mean abundance of Atlantic sturgeon in oceanic waters off the Northeast coast of the US and Canada during 2006-2011 was 417,934 fish, with a 95% confidence interval of 165,381 to 744,597 fish (Figure 8; Table 11). The values pertaining to the five USA DPSs represent 98% of the total (i.e., 409,575 fish with a 95% confidence interval of 162,074 to 729,705 fish). There is less than a 1% probability that the abundance of sturgeon is lower than 118,393 fish (Table 12). The relative impact of recent annual bycatches of Atlantic sturgeon in US fisheries was examined by allocating the average bycatch mortality during 2006-2010 (314.8 individuals) to each DPS using the genetic assignment ratios. The average bycatch to population ratio across DPSs was 0.09% (Table 11).

Sensitivity Analyses

We also explored the sensitivity of the model to directional changes in key parameters by varying each parameter one at a time about the mean estimate (Table 13). Changes to the exploitation rate had the greatest affect on abundance, as this parameter appears in the denominator of the abundance equation (Eq. 6). Percentage changes in the total discard estimates, natural mortality rates, and the discard mortality rates all generated proportional changes in total abundance. Increases in natural mortality rates and discard mortality rates resulted in reduced population sizes. Changes to sub adult natural mortality (M) were about five times as important as changes in adult M. Changes in the discard mortality rate of sturgeons caught in gillnets had about four times the influence of changes in the discard mortality rates in trawls. Increases in the numbers of discards of adult and sub adult sturgeons in gillnets and trawls resulted in increased estimates of population size. Population size increased about 1.4% for a 10% change in discards of adult sturgeon in gillnets; for subadults, the comparable change was 3.2%. For adult sturgeon caught in trawls, abundance increased by 1.2% for a 10% change in the discard mortality rate and increased by 4.1% for sub adults. The functional responses of abundance to changes in the parameter values are characteristic of the model (Eq. 1-6), but the magnitude of these changes depends upon the relative values of other parameters and data in the model. For example, the percentage rate of change in population size as a function of the percentage rate of change in natural mortality is expected to be linear - but the magnitude of the slope depends upon the overall level of exploitation, total discards, and other model parameters.

The conceptual model (Eq. 1-6) assumes that not all sturgeon die after incidental capture. The estimate of bycatch mortality is based on reports by observers of the number of sturgeon dead at capture. Additional mortality after capture is assumed to be zero. As an exploratory exercise, we used the bycatch estimates to derive annual population abundance estimates by dividing the bycatch by the exploitation rate (Table 14). This variation in model formulation is less realistic than the ASPI approach because it fails to account for the accumulation of fish implied by the survival of fish after capture.

In Table 14, the variability (CV = 124%) associated with the mean abundance estimate in the first scenario (i.e., annual discards/annual exploitation rate during 2006-2009) is greater than expected given biologically feasible recruitment, growth, and migration dynamics of Atlantic sturgeon. However, under all three scenarios, the abundance estimates from annual discards suggest oceanic population sizes in excess of 100,000 sturgeon.

NEAMAP Alternative for Tuning

We conducted one final analysis to determine how our average estimated population size compared to a population estimate derived from the Northeast Area Monitoring and Assessment Program (NEAMAP). The NEAMAP surveys are conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths to 18.3 m. The surveys, conducted during the fall since 2007 and during the spring since 2008, use a spatially stratified random design with a total of 35 strata and 150 stations per survey. The calculation method used to determine the swept area of the survey is provided in Appendix B.

Atlantic sturgeon are frequently sampled during the NEAMAP survey. Minimum swept area population estimates of Atlantic sturgeon from the fall survey range from 6,980 to 42,160 fish with CVs between 0.02 and 0.57. Minimum swept area abundance estimates from the spring surveys range from 25,540 to 52,990 fish with CVs between 0.27 and 0.65 (Table 15). The survey estimates are considered minimum values because these they are based on the unlikely assumptions that (a) the survey gear captures 100% of the sturgeon that occur within the path of the survey tows, and (b) all of the sturgeon in the population exist in the areas sampled by the survey. We define catchability as the product of the probability of capture given encounter (i.e. net efficiency) and the fraction of the population within the sampling domain (availability). Catchabilities less than 100% result in population size estimates greater than the minimum swept area abundance. The true catchability depends on many things including the availability of the species to the survey and the behavior of the species with respect to the gear. True efficiencies less than 100% are common for most species. The average ASPI estimate of 417,934 fish implies a catchability of between 6 and 13% for the spring NEAMAP survey, and a catchability of between 2 and 10% for the fall NEAMAP survey. If the availability of Atlantic sturgeon in the areas sampled by the spring NEAMAP survey were say 50%, then the implied range of net efficiencies for this survey would double to 12 and 26%. The ratio of total sturgeon habitat to area sampled by the NEAMAP survey is unknown, but is certainly greater than one. Abundance estimates derived from the 2007-2012 NEAMAP surveys, by season and year, are presented in Table 16 for survey catchabilities from 5 to 100%.

DISCUSSION

The population abundance estimates developed using the ASPI model are based on estimated discards in coastal commercial fisheries between North Carolina and the U.S.-Canada border. However, since Atlantic sturgeon are anadromous, a part of their life history also involves a residency period in rivers and estuaries, beyond the area of inference of the coastal discard estimates. Mature sturgeon move into rivers during spring for spawning, although not necessarily on an annual basis. Females return to coastal waters following spawning while male sturgeon may remain in the estuaries until fall. Juveniles inhabit estuaries for several years before moving to the marine environment where they participate in extensive coastal migrations (Atlantic Sturgeon Status Review Team, 2007). Although the fishery encounter rates used in the ASPI model encompass both coastal and estuarine areas, the discard estimates do not account for the seasonal availability of sturgeon to the coastal fisheries and thus the resulting ASPI abundance estimates are biased low.

Under the assumption that tags were removed from all recovered sturgeon, annual exploitation rates from the tag-recovery model are approximately analogous to the encounter rates used in the ASPI model when population size is large or encounter rates are low. Estimates of the annual probability of survival derived from the tag-recovery model include fishing mortality, and therefore represent the lower bound on the true survival rate because there is a high probability of surviving the capture process. The currently available tagging data are insufficient to detect fine-scale movement patterns, but other data from acoustic tags may be sufficient to discern relationships between inshore and ocean abundance estimates. The discrete time instantaneous rates model used in our analyses is more realistic than a Brownie-type band recovery model because it incorporates tag shedding and external estimates of natural mortality. However, like the Brownie model, our model does not account for recoveries that are not terminal encounters. Although a cursory examination of the tagging data suggests that multiple recaptures are uncommon, this may reflect a high tag shedding rate and the removal of tags from captured fish.

The abundance estimates from the ASPI model are sensitive to the encounter rates and also to the natural mortality rates. The estimates of bycatch for each gear type and year have less impact because each is part of a cumulative sum (Eq. 2). Although the scaled recoveries in the "dependent" category are non-integer values and therefore not ideal for the multinomial model (which, in theory, is based on counts of discrete outcomes), we could not use the tag-recoveries in the NEFOP database directly because the release year in which they originated was unknown.

Pollock et al. (2002) used a similar approach in modeling recoveries in observed and unobserved components of fisheries. They used binomial models for the number of fish caught in each component, conditioned on the total number caught. In our study, we did not know the total numbers of fish caught in either component. Rather than include further binomial likelihood components we used the proportions of observed trips directly (i.e., the binomial MLEs) which excluded some uncertainty in the estimated quantities. However, the number of trips observed annually was extremely large (1,075-2,716) implying that our proportion estimates were extremely precise using the binomial model (SEs between 0.0006 and 0.0013).

The range of estimated catchabilities for Atlantic sturgeon in the NEAMAP survey is highly plausible given that significant portions of the population are unavailable to the survey because these components reside in unsampled estuaries, freshwater areas, and to some extent, marine depths greater than 18.3m. Therefore, the NEAMAP survey estimates appear to corroborate the ASPI estimates.

The goal of our analyses was to develop an Atlantic sturgeon abundance index for use by managers prior to completion of comprehensive stock assessments. The ASPI is intended to represent abundance in the geographic area where Atlantic sturgeon are caught in sink gill nets and trawls and monitored by NEFSC fishery observers. The ASPI model was designed to: (1) use previous estimates of sturgeon captured in commercial fisheries; (2) capture heterogeneity of rates over time; (3) use an appropriate range of variability associated with key parameters; and (4) produce a population index that adequately reflected the considerable uncertainty in several of the model parameters. Our analyses are intended to abet more thorough stock assessments of Atlantic sturgeon. A more complete examination of the tagging data and further work on the model-based estimates of discards should lead to improved inferences about Atlantic sturgeon abundance.

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Table 1. (A) Estimated dead encounters by gear and year, based on Miller and Shepherd (2011), only for FMPs that will be included in NERO's batched consultation; (B) Bycatch estimates, standard errors, and minimum bycatch. Bycatch estimates are normally distributed, with the lower bound truncated by the observed number of discards, labeled as Minimum. Note that Minimum is not a whole number because of partitioning a whole number by the proportion of adults and subadults in each fishery.

A

	Estimated Dead Encounters	
Year	Sink Gillnet	Otter Trawl
2006	234.4	76.5
2007	344.8	70.7
2008	137.3	60.8
2009	319.9	57.9
2010	191.0	69.4
average	247.7	67.1

B

	Adults				Sub Adults		
Gear/Year	Mean	Standard Error	Minimum		Mean	Standard Error	Minimum
Gillnet							
2006	446.0	170.6	33.5		1,166.0	104.8	87.5
2007	613.2	234.6	30.2		1,602.9	144.9	78.8
2008	237.5	90.8	11.9		620.7	87.7	31.1
2009	568.2	217.4	27.9		1,485.2	131.2	73.1
2010	306.6	117.3	13.8		801.4	99.6	36.2
Trawl							
2006	368.4	95.2	5.8		1,425.3	181.4	22.2
2007	338.1	87.4	11.9		1,307.8	162.0	46.1
2008	285.9	73.9	5.8		1,106.1	135.9	22.2
2009	274.9	71.0	9.9		1,063.3	128.5	38.1
2010	322.5	83.4	21.6		1,247.8	161.3	83.4

Table 2. Annual releases of tags on sturgeon less than (N_s) or greater than (N_l) 150 cm.

	N_s	N_l
1993	460	16
1994	286	45
1995	171	34
1996	1099	30
1997	285	38
1998	390	75
1999	256	7
2000	295	3
2001	267	15
2002	92	12
2003	152	12
2004	353	7
2005	585	13
2006	1171	74
2007	951	80
2008	763	70
2009	535	98
2010	375	143
2011	652	327

Table 3. Recoveries of releases less than 150 cm in size from unobserved fishing effort ("report" category).

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1993	9	10	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994		5	5	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1995			0	4	3	2	0	0	0	0	0	0	0	1	0	0	0	0	0
1996				9	24	6	3	4	0	0	0	0	0	0	0	0	0	0	0
1997					6	9	3	0	0	1	0	0	0	0	0	0	1	0	0
1998						15	10	4	2	0	0	0	0	0	0	0	0	0	0
1999							4	12	1	0	1	0	0	0	0	0	0	0	0
2000								5	8	0	0	1	0	1	0	0	0	0	0
2001									9	4	1	0	0	1	0	0	0	0	0
2002										1	1	0	0	0	0	0	0	0	0
2003											2	3	0	0	0	0	0	0	0
2004												2	2	0	1	0	0	0	0
2005													4	4	1	0	0	0	1
2006														21	10	3	1	0	1
2007															2	3	1	0	3
2008																6	9	2	1
2009																	2	0	1
2010																		0	1
2011																			5

Table 4. Recoveries of releases greater than 150 cm in size from unobserved fishing effort ("report" category).

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1993	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995			1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996				1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997					1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998						1	0	0	0	0	0	0	0	0	0	0	0	0	0
1999							0	0	0	0	0	0	0	0	0	0	0	0	0
2000								0	0	0	0	0	1	0	0	0	0	0	0
2001									0	0	0	0	0	0	0	0	0	0	0
2002										0	0	0	0	1	0	0	0	0	0
2003											1	0	0	0	0	0	0	0	0
2004												0	0	0	0	0	0	0	0
2005													0	0	0	0	0	0	0
2006														1	0	0	0	0	0
2007															0	0	0	0	0
2008																0	0	0	0
2009																	0	0	0
2010																		0	0
2011																			0

Table 5. Unscaled recoveries of releases less than 150 cm in size from fishing effort categorized as "dependent."

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1993	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996				6	98	15	0	1	0	0	0	0	0	0	0	0	0	0	0
1997					8	3	2	0	0	0	0	0	0	0	0	0	0	0	0
1998						11	3	0	0	0	0	0	0	0	0	0	0	0	0
1999							7	0	0	0	0	0	0	0	0	0	0	0	0
2000								1	1	0	0	0	0	0	0	0	0	0	0
2001									4	0	0	0	0	0	0	0	0	0	0
2002										1	0	0	0	0	0	0	0	0	0
2003											1	0	2	0	0	0	0	0	0
2004												0	1	0	0	0	0	0	0
2005													10	4	0	0	0	0	0
2006														24	8	4	0	0	0
2007															17	7	0	0	0
2008																18	1	0	0
2009																	0	0	0
2010																		0	0
2011																			0

Table 6. Unscaled recoveries of releases greater than 150 cm in size from fishing effort categorized as "dependent."

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998						0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999							0	0	0	0	0	0	0	0	0	0	0	0	0
2000								0	0	0	0	0	0	0	0	0	0	0	0
2001									0	0	0	0	0	0	0	0	0	0	0
2002										0	0	0	0	0	0	0	0	0	0
2003											0	0	0	0	0	0	0	0	0
2004												0	0	0	0	0	0	0	0
2005													0	0	0	0	0	0	0
2006														0	0	0	0	0	0
2007															1	0	0	0	0
2008																0	0	0	0
2009																	0	0	0
2010																		0	0
2011																			0

Table 7. Annual proportion of observed commercial fishing effort, ρ, calculated as the ratio of observed trips to VTR trips in the same areas and gear types used for the bycatch estimates in Miller and Shepherd (2011).

	ρ
1993	0.042
1994	0.042
1995	0.033
1996	0.027
1997	0.028
1998	0.031
1999	0.028
2000	0.030
2001	0.027
2002	0.023
2003	0.031
2004	0.056
2005	0.057
2006	0.037
2007	0.043
2008	0.035
2009	0.047
2010	0.049
2011	0.047

Table 8. Estimated annual exploitation rates and standard errors for fish less than ($\hat{\mu}_{s,t}$) and greater than ($\hat{\mu}_{l,t}$) 150 cm.

	$\hat{\mu}_{s,t}$	$\widehat{SE}(\hat{\mu}_{s,t})$	$\hat{\mu}_{l,t}$	$\widehat{SE}(\hat{\mu}_{l,t})$
1993	0.073	0.030	0.075	0.03
1994	0.109	0.038	0.111	0.039
1995	0.092	0.036	0.094	0.037
1996	0.045	0.017	0.046	0.017
1997	0.119	0.039	0.122	0.040
1998	0.099	0.034	0.102	0.035
1999	0.065	0.025	0.067	0.026
2000	0.081	0.030	0.083	0.031
2001	0.068	0.027	0.070	0.027
2002	0.025	0.013	0.026	0.014
2003	0.026	0.013	0.026	0.014
2004	0.021	0.010	0.021	0.011
2005	0.020	0.009	0.021	0.009
2006	0.051	0.016	0.052	0.016
2007	0.021	0.008	0.022	0.008
2008	0.018	0.007	0.018	0.007
2009	0.018	0.006	0.018	0.007
2010	0.003	0.002	0.003	0.002
2011	0.015	0.005	0.015	0.006

Table 9. Estimated annual survival rates and standard errors for fish less than ($\hat{S}_{s,t}$) and greater than ($\hat{S}_{a,t}$) 150 cm.

	$\hat{S}_{s,t}$	$\widehat{SE}(\hat{S}_{s,t})$	$\hat{S}_{a,t}$	$\widehat{SE}(\hat{S}_{a,t})$
1993	0.814	0.028	0.855	0.029
1994	0.781	0.036	0.821	0.037
1995	0.797	0.034	0.837	0.035
1996	0.840	0.016	0.883	0.016
1997	0.771	0.037	0.810	0.039
1998	0.789	0.032	0.830	0.034
1999	0.821	0.024	0.863	0.025
2000	0.807	0.028	0.848	0.030
2001	0.818	0.025	0.860	0.026
2002	0.859	0.013	0.903	0.013
2003	0.858	0.013	0.902	0.013
2004	0.863	0.010	0.907	0.010
2005	0.864	0.008	0.908	0.009
2006	0.835	0.015	0.877	0.016
2007	0.862	0.007	0.907	0.008
2008	0.866	0.006	0.910	0.006
2009	0.866	0.006	0.910	0.006
2010	0.880	0.002	0.925	0.002
2011	0.868	0.005	0.913	0.005

Table 10. Values for ASPI model inputs.

Input	Description		Distribution	Mean	Standard Deviation
θ_g	capture mortality	gillnets		0.20	-
θ_t	capture mortality	trawl		0.05	-
M_s	other mortality	subadults	normal distribution	0.125	0.024
M_a	other mortality	adults	normal distribution	0.070	0.001
$c_{s,g}$	subadult bycatch	gillnets	normal distribution	See Table 1	See Table 1
$c_{s,t}$	subadult bycatch	trawl	normal distribution	See Table 1	See Table 1
$c_{a,g}$	adult bycatch	gillnets	normal distribution	See Table 1	See Table 1
$c_{a,t}$	adult bycatch	trawl	normal distribution	See Table 1	See Table 1
$\text{logit}(\mu_{s,2006})$	logit of encounter rate	subadults	normal distribution	-2.9217	0.32534
$\text{logit}(\mu_{a,2006})$	logit of encounter rate	adults	normal distribution	-2.8961	0.32569
$\text{logit}(\mu_{s,2007})$	logit of encounter rate	subadults	normal distribution	-3.8272	0.36501
$\text{logit}(\mu_{a,2007})$	logit of encounter rate	adults	normal distribution	-3.8022	0.36517
$\text{logit}(\mu_{s,2008})$	logit of encounter rate	subadults	normal distribution	-4.0164	0.37575
$\text{logit}(\mu_{a,2008})$	logit of encounter rate	adults	normal distribution	-3.9914	0.37589
$\text{logit}(\mu_{s,2009})$	logit of encounter rate	subadults	normal distribution	-3.9997	0.36716
$\text{logit}(\mu_{a,2009})$	logit of encounter rate	adults	normal distribution	-3.9747	0.36729

Table 11. Estimated ASPI ocean populations (numbers of fish) with 95% lower and upper bounds for five Atlantic sturgeon DPSs and Canada based on Monte Carlo simulations of a conceptual bycatch with a comparison to observed averaged batched ocean mortalities (2006-2010).

DPS	Proportion of Total Ocean Population	Estimated Ocean Population (95% lower)	Estimated Ocean Population (Mean)	Estimated Ocean Population (95% upper)	Batched Ocean Mortalities	Average Batch/Population Ratio
GOM	11%	18,192	45,973	81,906	34.6	
NYB	49%	81,037	204,788	364,853	154.3	
CB	14%	23,153	58,511	104,244	44.1	
Carolina	4%	6,615	16,717	29,784	12.6	
SA	20%	33,076	83,587	148,920	63.0	
Canada	2%	3,308	8,359	14,892	6.3	
US Totals	98%	162,074	409,575	729,705	314.8	0.09%
Totals	100%	165,381	417,934	744,597		

Table 12. Quantiles of the distribution of ASPI in Figure 8.

Probability	Quantile of ASPI
0.01	118,393
0.05	165,442
0.10	201,538
0.15	230,603
0.20	257,065
0.25	282,611
0.30	307,566
0.35	330,820
0.40	352,980
0.45	376,188
0.50	398,346
0.55	421,252
0.60	445,377
0.65	470,015
0.70	497,026
0.75	525,548
0.80	558,552
0.85	600,233
0.90	654,272
0.95	742,954
0.99	940,575

Table 13. Summary of sensitivity analyses applied to model parameters and input data. Entries in columns 2 and 3 represent the ratio of predicted population size to the mean estimate when the model inputs are multiplied by 0.25 (i.e., 75% decline) and 1.75 (i.e., 75% increase). The slope estimate gives the percentage change in population abundance per percentage change in the model inputs.

	Adjustment Factor Applied			
Parameter	0.25	1.75	Slope	Response
Probability of Encounter	4.333	0.528	negative	Power function: Pop=0.988 Prob Encounter^-1.083
Natural Mortality of Sub Adults	1.224	0.839	-0.2463	Linear
Natural Mortality of Adults	1.044	0.963	-0.0541	Linear
Discards of Adult sturgeon in gill nets	0.892	1.108	0.1439	Linear
Discards of Sub Adult sturgeon in gill nets	0.761	1.239	0.3192	Linear
Discards of adult sturgeon in trawls	0.907	1.093	0.1242	Linear
Discards of Sub Adult sturgeon in trawls	0.691	1.309	0.4126	Linear
Discard mortality in gill nets	1.082	0.916	-0.1104	Linear
Discard mortality in trawls	1.020	0.980	-0.0268	Linear

Table 14. Estimated mean sturgeon abundance (number of fish) based on dividing observed total discards by the exploitation rate derived from the tagging model. The coefficient of variation (CV) is based on the variance of estimates across years.

Scenario	Mean Abundance	CV Abundance
Annual discards/annual exploitation rate (2006-9)	312,562	124%
Annual discards/3-yr moving average of exploitation	139,051	39%
Annual discards/5 year average exploitation	139,935	21%

Table 15. Annual minimum swept area abundance estimates (number of fish) and CVs for Atlantic sturgeon during the spring and fall from the Northeast Area Monitoring and Assessment Program survey. Estimates provided by Dr. Chris Bonzek, Virginia Institute of Marine Science.

	Fall		Spring	
Year	Number	CV	Number	CV
2007	6,981	0.015		
2008	33,949	0.322	25,541	0.391
2009	32,227	0.316	41,196	0.353
2010	42,164	0.566	52,992	0.265
2011	22,932	0.399	52,840	0.48
2012			28,060	0.652

Table 16. Summary of estimated sturgeon abundance based on alternative estimates of catchability. Catchability is defined as the product of gear efficiency and availability.

	Fall Survey					Spring Survey					Statistics of Annual Estimates		
Catchability	2007	2008	2009	2010	2011	2008	2009	2010	2011	2012	Min	Mean	Max
0.05	139,620	678,980	644,540	843,280	458,640	510,820	823,920	1,059,840	1,056,800	561,200	139,620	677,764	1,059,840
0.10	69,810	339,490	322,270	421,640	229,320	255,410	411,960	529,920	528,400	280,600	69,810	338,882	529,920
0.15	46,540	226,327	214,847	281,093	152,880	170,273	274,640	353,280	352,267	187,067	46,540	225,921	353,280
0.20	34,905	169,745	161,135	210,820	114,660	127,705	205,980	264,960	264,200	140,300	34,905	169,441	264,960
0.25	27,924	135,796	128,908	168,656	91,728	102,164	164,784	211,968	211,360	112,240	27,924	135,553	211,968
0.30	23,270	113,163	107,423	140,547	76,440	85,137	137,320	176,640	176,133	93,533	23,270	112,961	176,640
0.35	19,946	96,997	92,077	120,469	65,520	72,974	117,703	151,406	150,971	80,171	19,946	96,823	151,406
0.40	17,453	84,873	80,568	105,410	57,330	63,853	102,990	132,480	132,100	70,150	17,453	84,721	132,480
0.45	15,513	75,442	71,616	93,698	50,960	56,758	91,547	117,760	117,422	62,356	15,513	75,307	117,760
0.50	13,962	67,898	64,454	84,328	45,864	51,082	82,392	105,984	105,680	56,120	13,962	67,776	105,984
0.55	12,693	61,725	58,595	76,662	41,695	46,438	74,902	96,349	96,073	51,018	12,693	61,615	96,349
0.60	11,635	56,582	53,712	70,273	38,220	42,568	68,660	88,320	88,067	46,767	11,635	56,480	88,320
0.65	10,740	52,229	49,580	64,868	35,280	39,294	63,378	81,526	81,292	43,169	10,740	52,136	81,526
0.70	9,973	48,499	46,039	60,234	32,760	36,487	58,851	75,703	75,486	40,086	9,973	48,412	75,703
0.75	9,308	45,265	42,969	56,219	30,576	34,055	54,928	70,656	70,453	37,413	9,308	45,184	70,656
0.80	8,726	42,436	40,284	52,705	28,665	31,926	51,495	66,240	66,050	35,075	8,726	42,360	66,240
0.85	8,213	39,940	37,914	49,605	26,979	30,048	48,466	62,344	62,165	33,012	8,213	39,868	62,344
0.90	7,757	37,721	35,808	46,849	25,480	28,379	45,773	58,880	58,711	31,178	7,757	37,654	58,880
0.95	7,348	35,736	33,923	44,383	24,139	26,885	43,364	55,781	55,621	29,537	7,348	35,672	55,781
1.00	6,981	33,949	32,227	42,164	22,932	25,541	41,196	52,992	52,840	28,060	6,981	33,888	52,992

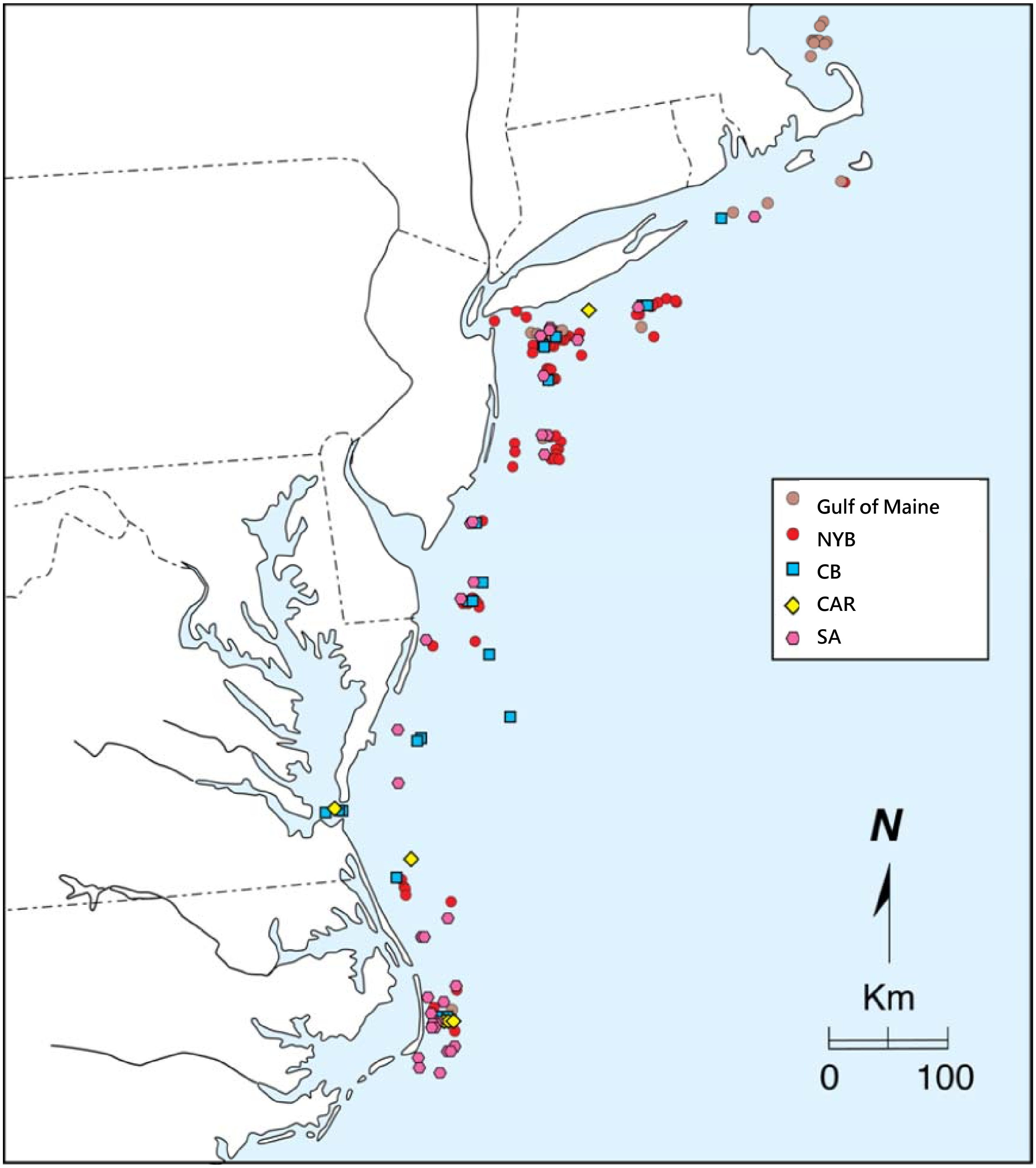


Figure 1. Capture locations and DPS of origin assignments from genetic analysis of NEFOP Atlantic sturgeon specimens (n=173); DPSs are Gulf of Maine, New York Bight (NYB), Chesapeake Bay (CB), Carolina (CAR), and South Atlantic (SA). Map provided by Dr. Isaac Wirgin (New York University).

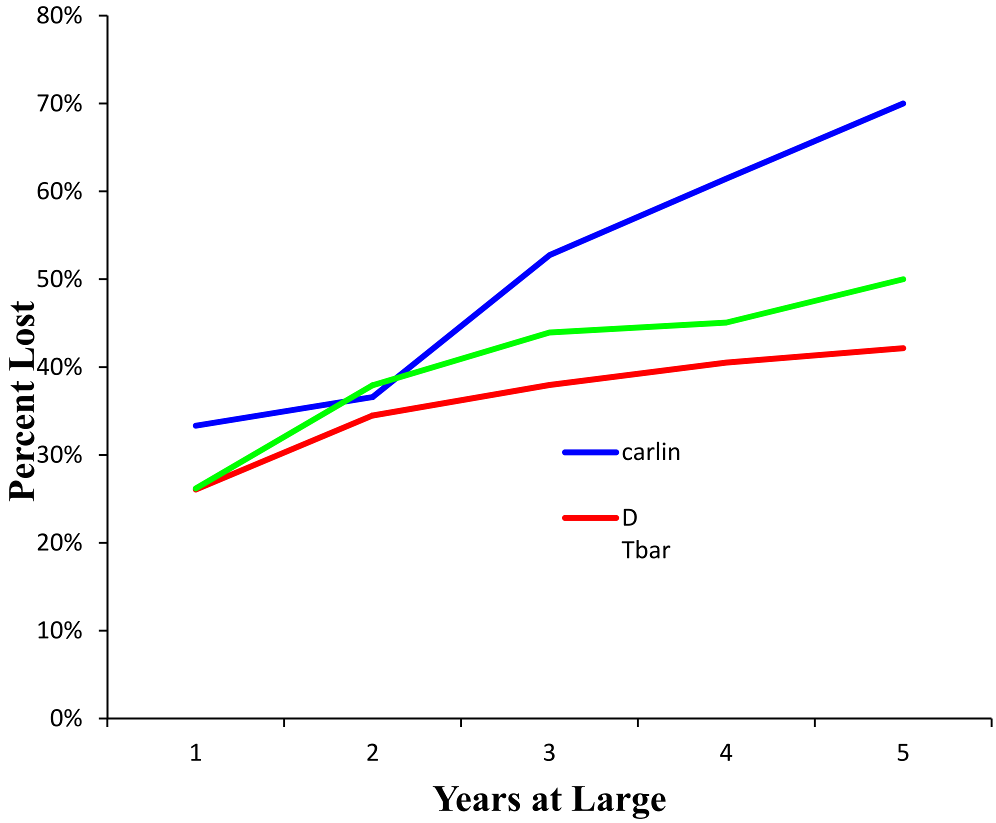


Figure 2. Proportion of Atlantic sturgeon tags shed, by tag type.

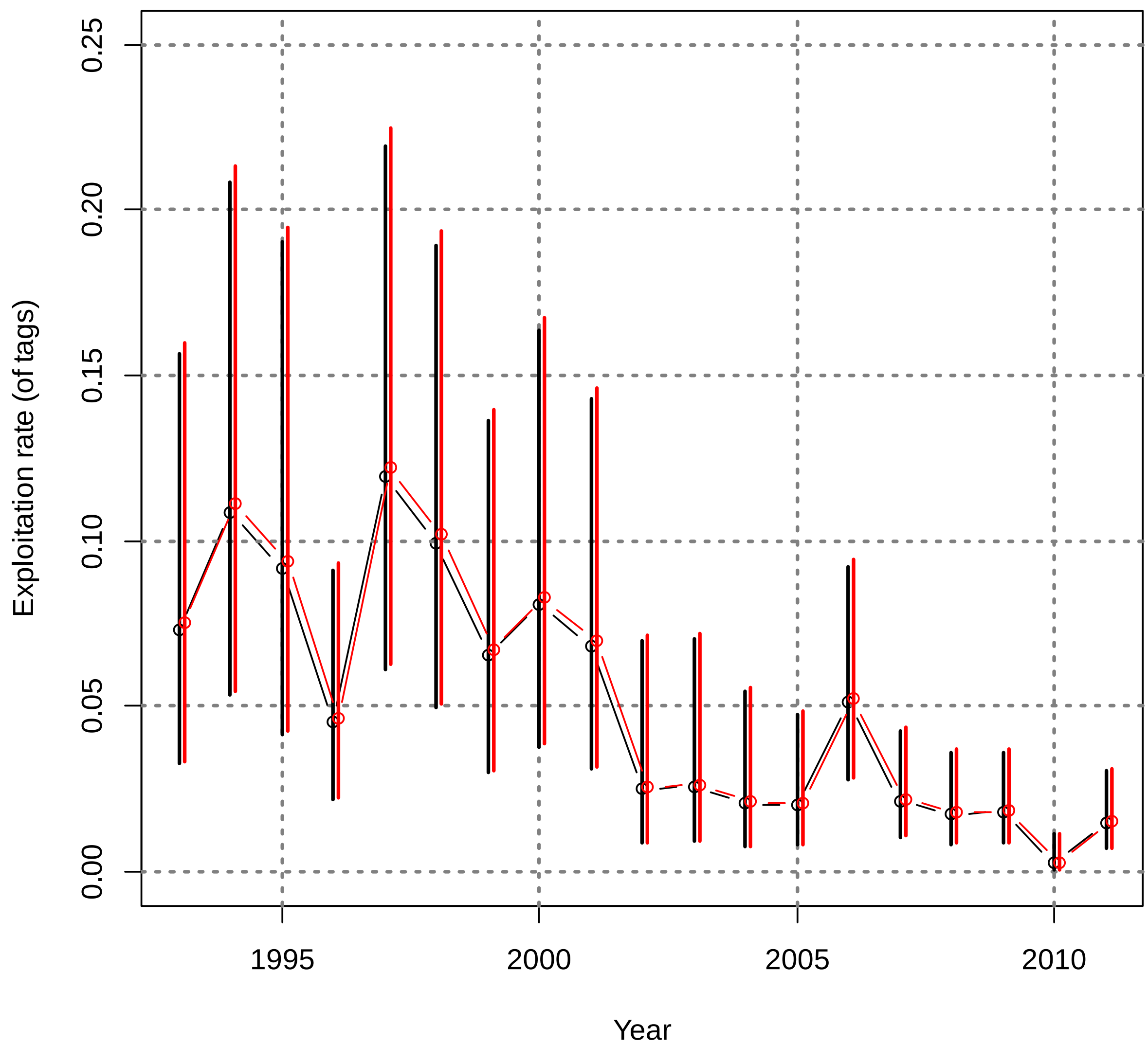


Figure 3. Estimates of annual exploitation rates of Atlantic sturgeon from tag-recovery data for releases of sturgeon less than 150 cm (black) and greater than 150 cm (red). Vertical lines are 95% confidence intervals.

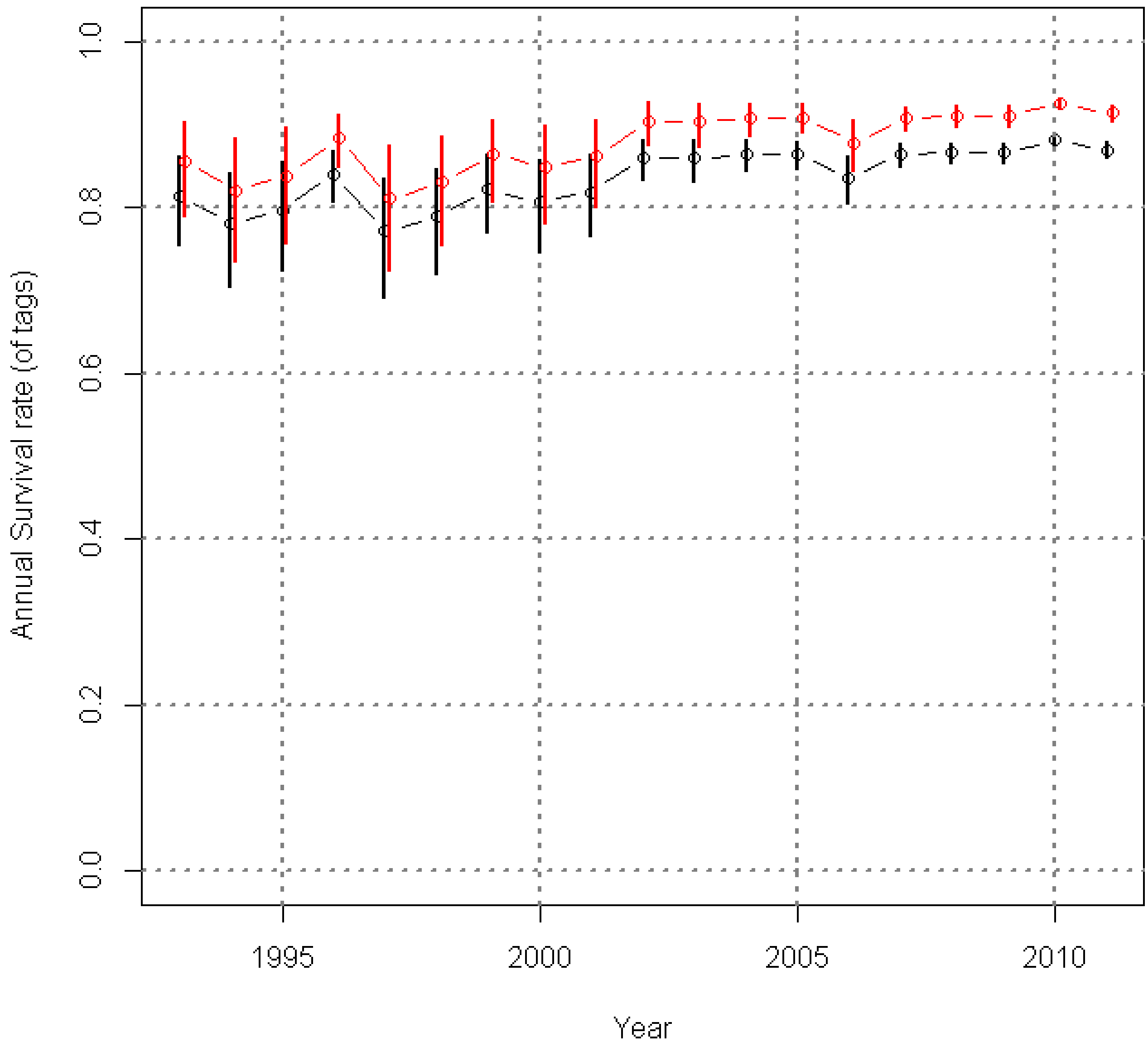


Figure 4. Estimates of annual survival rates of Atlantic sturgeon from tag-recovery data for releases of sturgeon less than 150 cm (black) and greater than 150cm (red). Vertical lines are 95% confidence intervals.

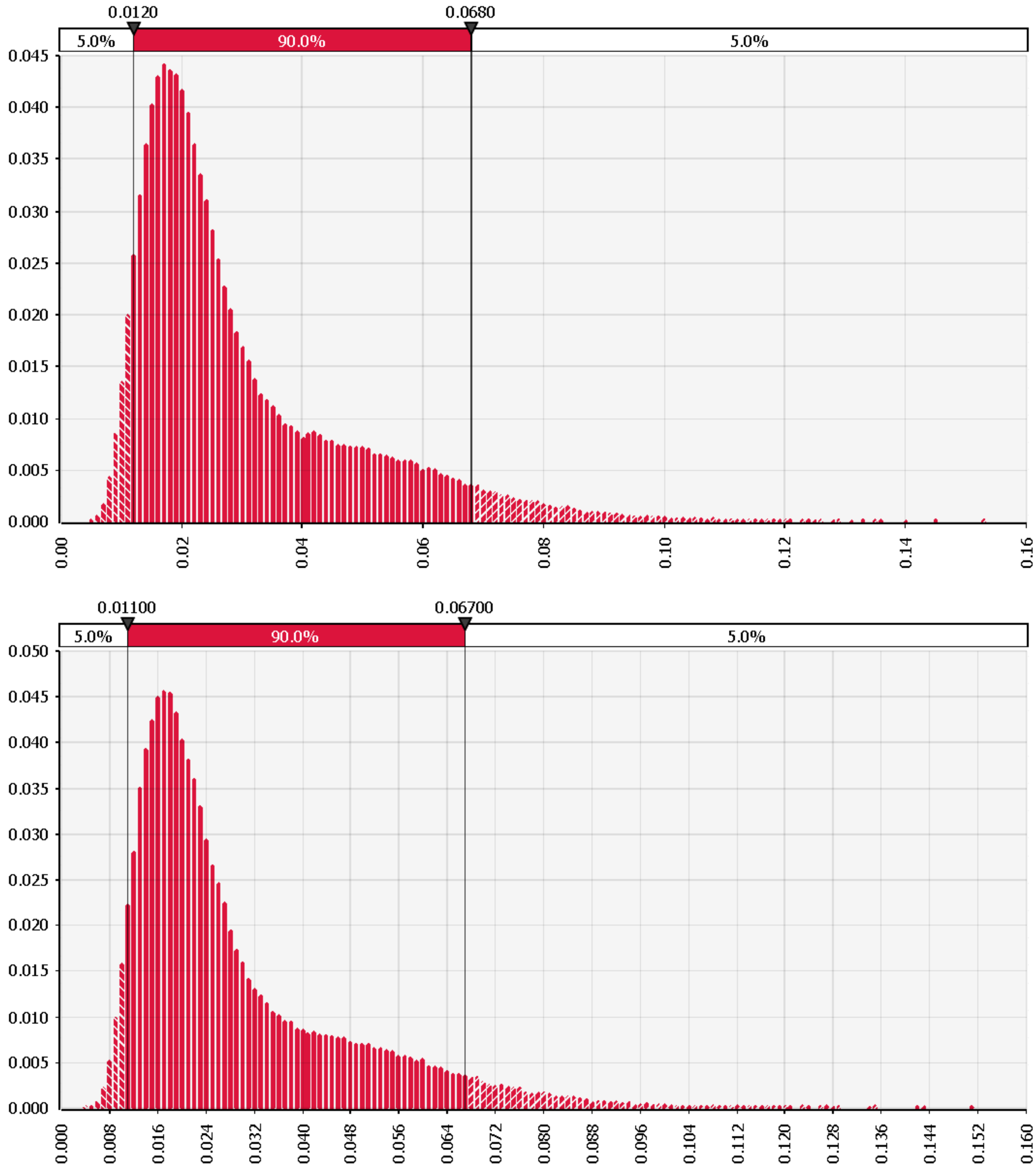
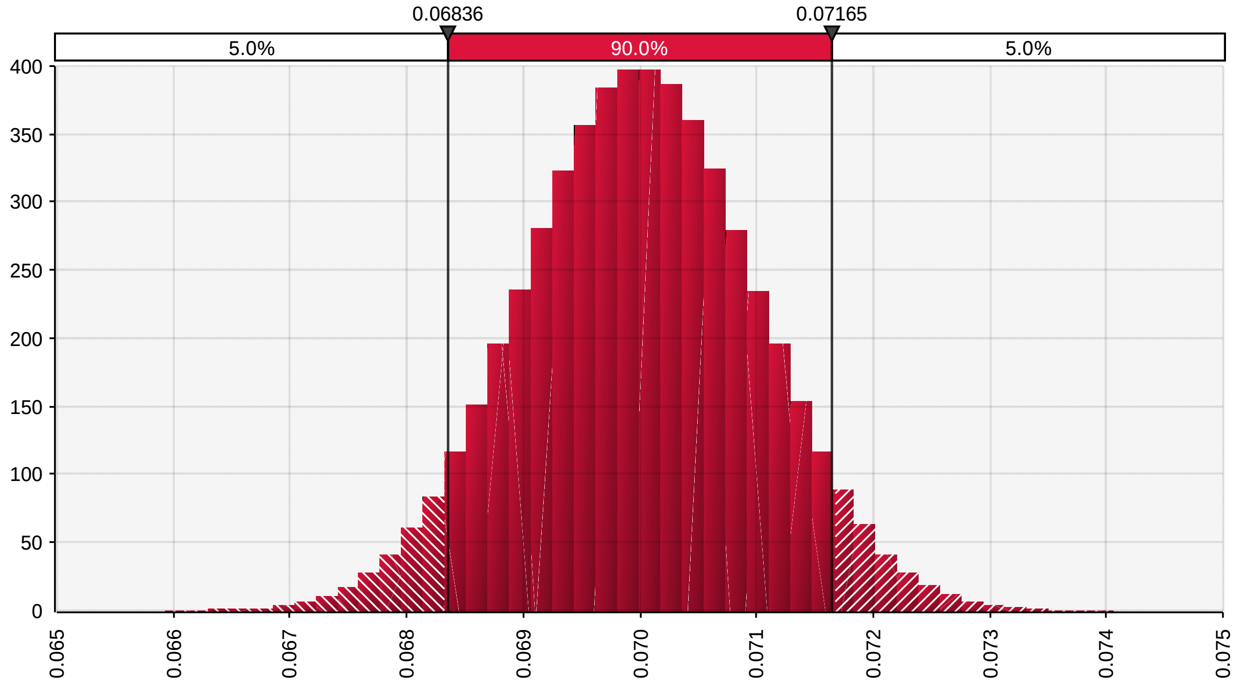


Figure 5. The output distribution of exploitation rates for subadult (sm) and adult (lg) Atlantic sturgeon, with means and standard deviation provided by the estimates and standard errors from the tag-recovery model.

A



B

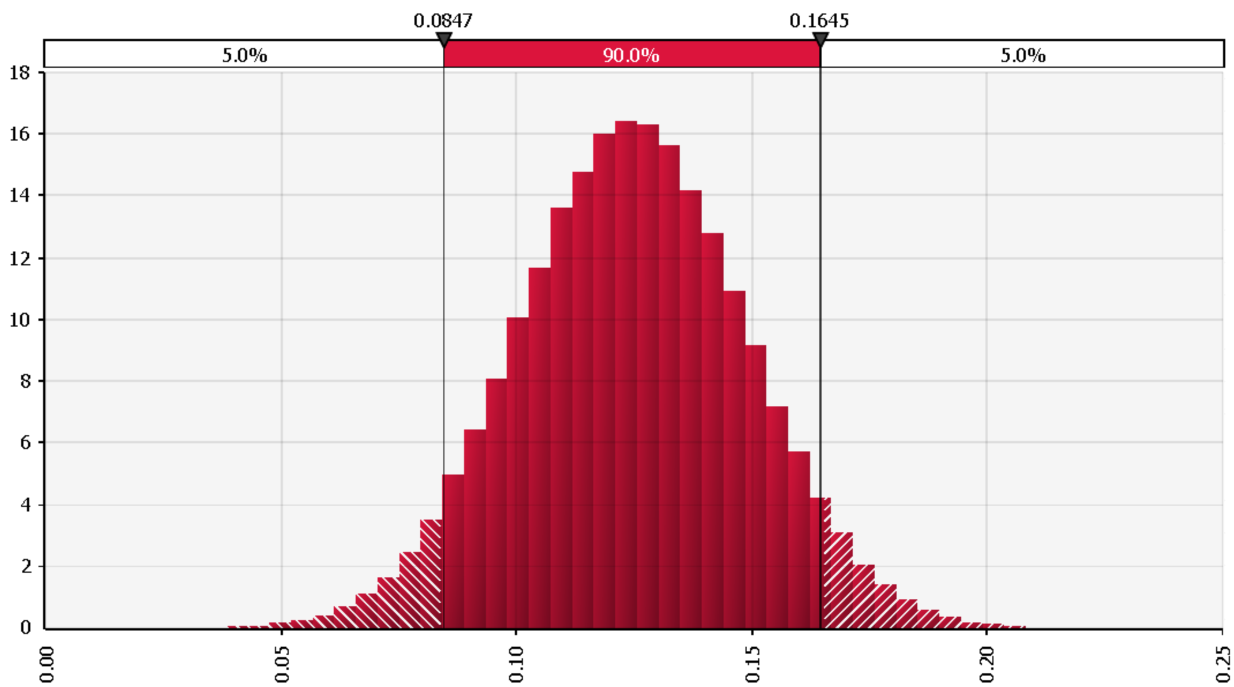


Figure 6. Input distribution for (A) subadult and (B) adult Atlantic sturgeon natural mortality rates (Kahnle *et al*. 2007).

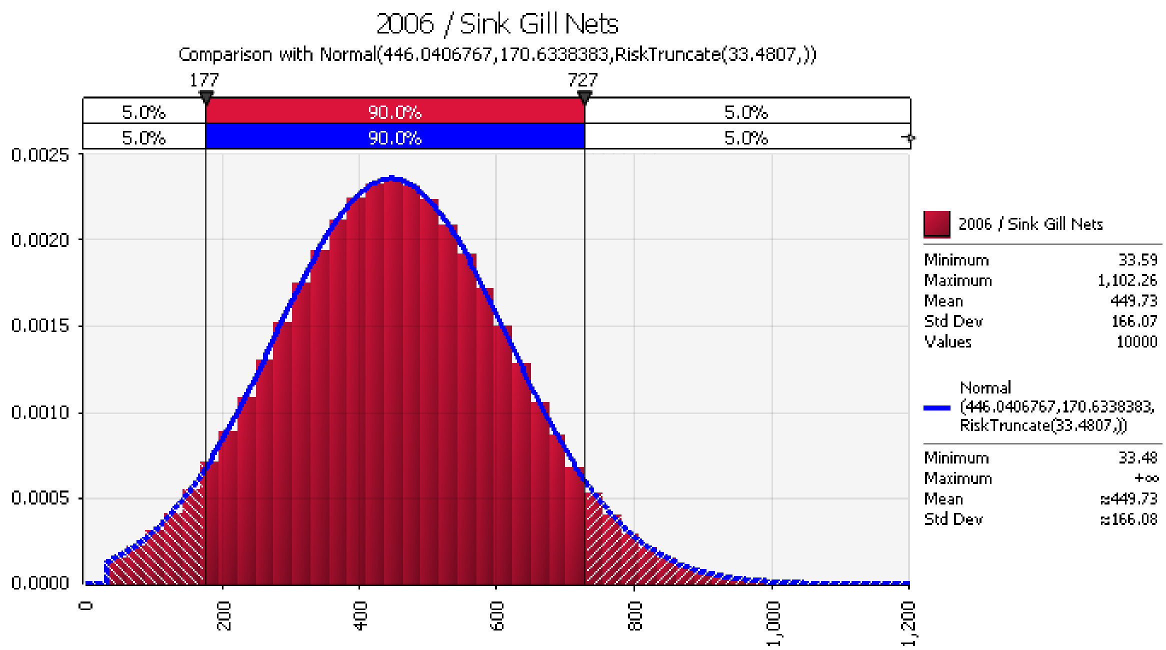


Figure 7. Example uncertainty analyses for estimates of gillnet bycatch of Atlantic sturgeon in 2006. The blue line represents the target distribution which, in this example, is RiskNormal (mean, SD, RiskTruncate(min)) where the mean (446.0) and SD (95.2) are values from Miller and Shepherd (2011) and Table 1. The minimum is truncated (33.6) by observed bycatch as a lower bound.

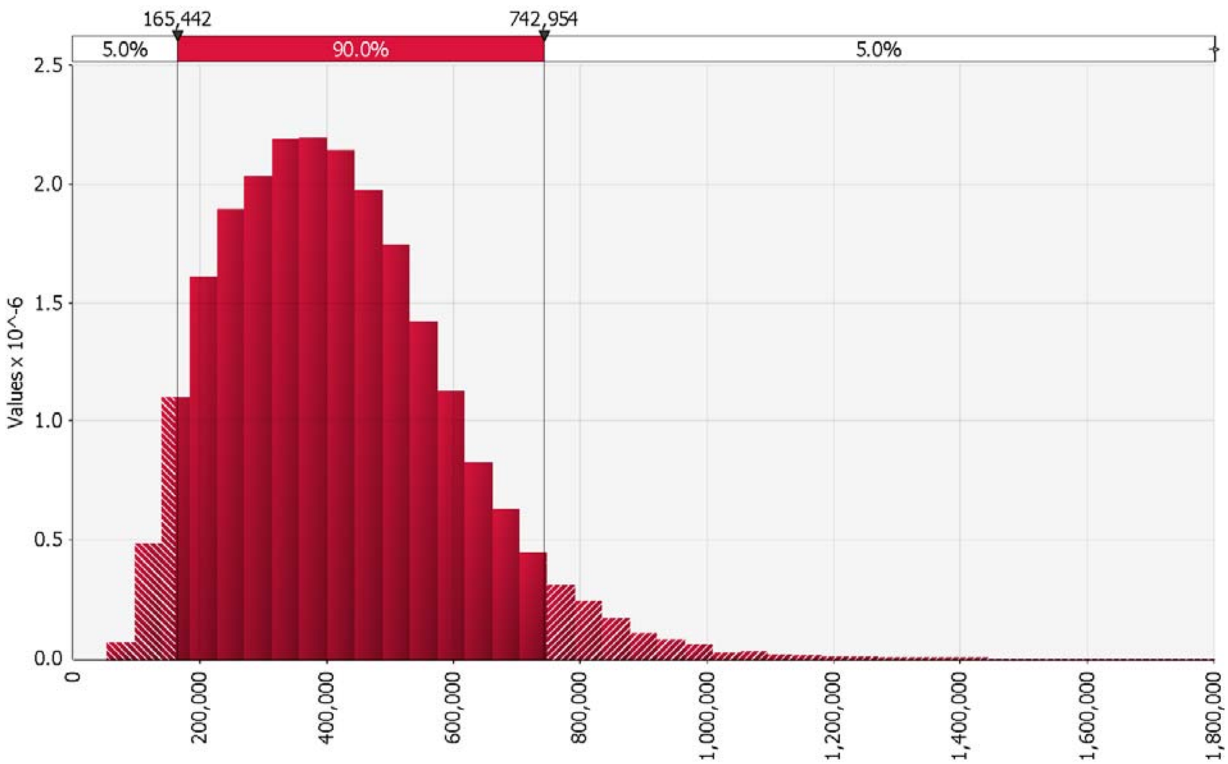


Figure 8. Frequency distribution of the ASPI ocean population of Atlantic sturgeon based on 10,000 simulations of the ASPI model.

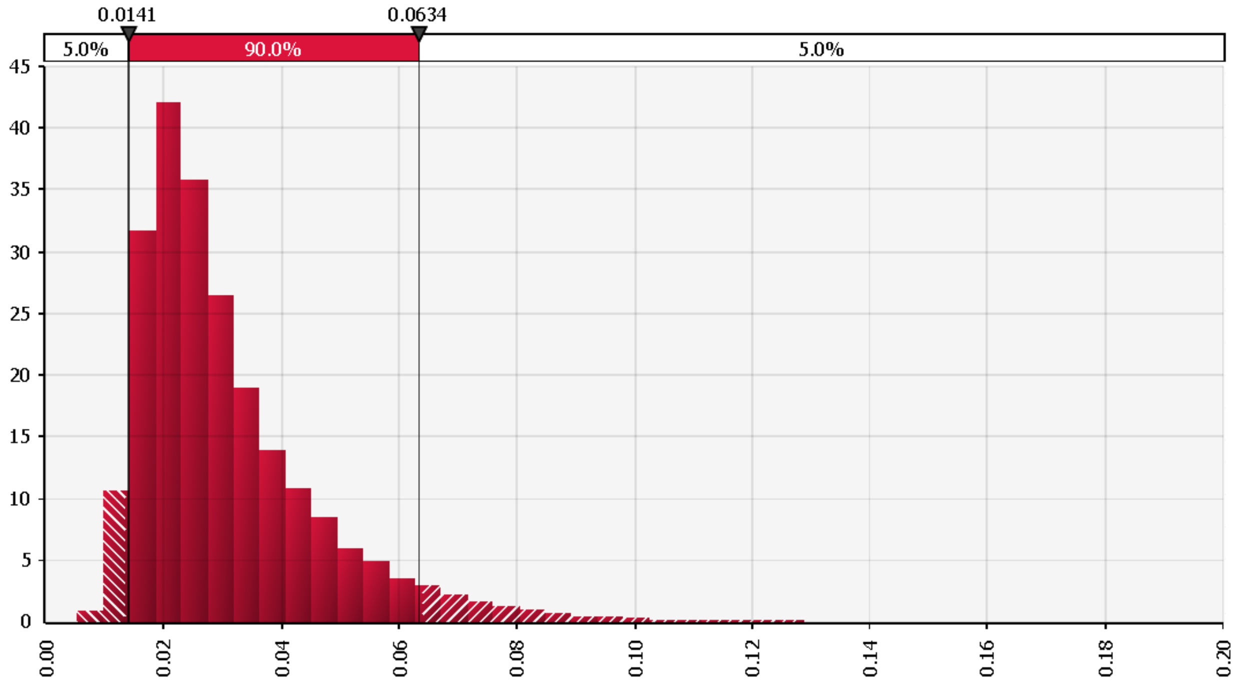


Figure 9. Frequency distribution of ratio of the average batched ocean mortalities (2006-2010) of Atlantic sturgeon to the ASPI ocean population estimate from 10,000 simulations.

APPENDIX A. MODEL-BASED ESTIMATION OF ATLANTIC STURGEON BYCATCH

Here we have provided a portion of the report by Miller and Shepherd (2011) that pertains to estimation of the total discards by trawl and gillnet gear for 2006 – 2009.

Miller and Shepherd (2011) fit a set of quasi-Poisson generalized linear models to observer trip data with number of sturgeon takes as the response and where an FMP was retained, year and quarter were potential explanatory factors. Separate sets of models were fit to trips using gillnet and otter trawl gear. The general model for the log-mean take on trip i is

$$\ln\left(\hat{T}_i\right) = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \cdots + \hat{\beta}_p X_{pi}$$

where $\hat{\beta}$ are the estimated coefficients and $X_{1i}, \ldots, X_{pi}$ are the covariates that represent FMP, year, quarter and any interactions. For gillnet gear, the best performing model of those fitted to the trip specific data based on $QAIC_c$ was a model that allowed yearly effects of the FMPs on sturgeon take. For other trawl gear, the best performing model of those fitted to the trip specific data based on $QAIC_c$ was a model that allowed quarterly effects of the FMPs on sturgeon take.

To predict sturgeon take for all landings, the same covariates on VTR trips were used to make predictions for all VTR trips in a given subset of effort (e.g., year, quarter, gear type). The predictions are made using the anti-log of the same equation above, but where the covariates are for VTR trip i. The total discard estimates are the sum of all the model predictions in year y

$$\hat{T}_y = \sum_{i=1}^{N_y} \hat{T}_{y,i} \ .$$

Variance estimation for total discards

Let $\hat{\boldsymbol{\beta}}$ be the p x1 vector of coefficients estimated from the best fitted model (trawl or gillnet) and $\hat{\mathbf{V}}$ (p x p) be the estimated covariance matrix of the estimated coefficients (p is the number of estimated coefficients). Also, let $\mathbf{X}_y$ be the n_y x p matrix of covariates for the VTR trips in year y where n_y is the number of trips. Then the log estimated predictions for the n_y VTR trips is $\log\left(\hat{\mathbf{T}}_y\right) = \mathbf{X}_y\hat{\boldsymbol{\beta}}$ and the estimated takes are $\hat{\mathbf{T}}_y = e^{\mathbf{X}_y\hat{\boldsymbol{\beta}}}$. The n_y x n_y covariance matrix for the log predictions is

$$\hat{\mathbf{V}}_{\log\left(\hat{\mathbf{T}}_y\right)} = \mathbf{X}_y\hat{\mathbf{V}}\mathbf{X}_y'$$

and the approximate (delta method) covariance matrix for the estimated takes is

$$\hat{\mathbf{V}}_{\hat{\mathbf{T}}_y} = \hat{\mathbf{T}}_y\hat{\mathbf{T}}_y' \circ \hat{\mathbf{V}}_{\log\left(\hat{\mathbf{T}}_y\right)}$$

where $\mathbf{X} \circ \mathbf{Y}$ is the Hadamard (element-wise) product of matrices $\mathbf{X}$ and $\mathbf{Y}$. The variance of the total take estimate for year y is just the sum of all n_y^2 elements of $\hat{\mathbf{V}}_{\hat{\mathbf{T}}_y}$:

$$\hat{V}\left(\hat{T}_y\right) = \mathbf{1}_y'\hat{\mathbf{V}}_{\hat{\mathbf{T}}_y}\mathbf{1}_y \ .$$

where $\mathbf{1}_y$ is a n_y x1 vector of ones. Confidence intervals are based on standard errors (square root of variance) and approximate normality of the point estimates.

APPENDIX B. SWEPT AREA CALCULATION METHOD

(*Information provided by Dr. Chris Bonzek, Virginia Institute of Marine Science).*

The NEAMAP survey uses tow-by-tow net measurements to calculate catch per square meter as the base metric in the calculation. That is, the (tow distance) x(wingspread) measurement on tow X is the denominator for number per unit area on tow X. Tow distance is calculated as a sum from moment-by-moment recordings of location (i.e. not straight-line distance from beginning and ending coordinates). For those tows where either a sensor malfunction or GPS malfunction results in missing data, average figures for the particular cruise are substituted. Swept area abundance is calculated as the sum of abundances in each stratum. Tow and net measurement stats are in the table below. These figures are summarized from 1,520 tows to date. Net height does not (currently) enter into swept-area calculations but is included here to help demonstrate the consistent way in which the net fishes. The total survey area is 12,135.27 square km.

	Tow Distance (m)	Wingspread (m)	Net Height (m)
Mean	1856.1	13.52	5.4
Min	1098.2	11.2	3.2
Max	2585.3	15.24	6.75
Std. Dev.	139.3	0.46	0.26

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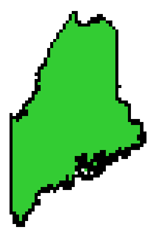


2011 ATLANTIC STURGEON
COMPLIANCE REPORT
TO
THE ATLANTIC STATES MARINE FISHERIES
COMMISSION

Prepared by:
Gail S. Wippelhauser
September 2012

Amendment 1 to the ASMFC Interstate Fisheries Management Plan for Atlantic Sturgeon, approved by the ASMFC in June 1998, requires all Atlantic coast jurisdictions to submit Annual Compliance Reports addressing the issues outlined in Section 5.1.2 of the FMP.

Bycatch monitoring for Atlantic sturgeon in other fisheries

The State of Maine has no active program to monitor bycatch of Atlantic sturgeon in Maine waters. MDMR queried the National Marine Fisheries Service Fishery Observer database for the period 1991 through 2011 for Statistical Areas 511, 512, and 513. However, all Atlantic sturgeon bycatch occurred in Statistical Area 513. The results of this year's query, which were conducted by a senior biologist, should supersede data provided in previous years, which may have contained some errors.

A total of 1,448 pounds of Atlantic sturgeon or sturgeon bycatch was reported for the years 1991-2011 (Appendix 1). Bycatch was greatest in 2000, and was relatively high from 1991-1994 (Figure 1). For all years combined, bycatch was greatest in November and April (Figure 2). Sturgeon were taken by gillnet (1,096 pounds), otter trawl (307 pounds) and purse seine (45 pounds).

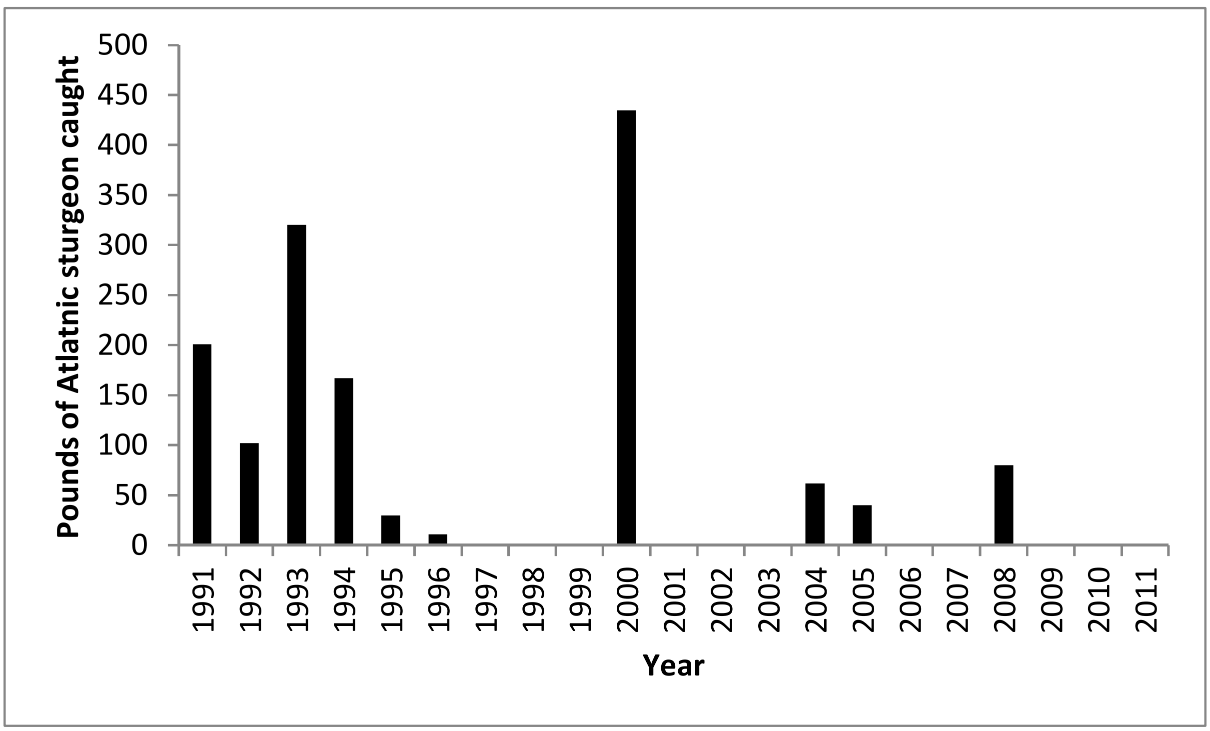


Figure 1. Atlantic sturgeon bycatch in Statistical Area 513 by year.

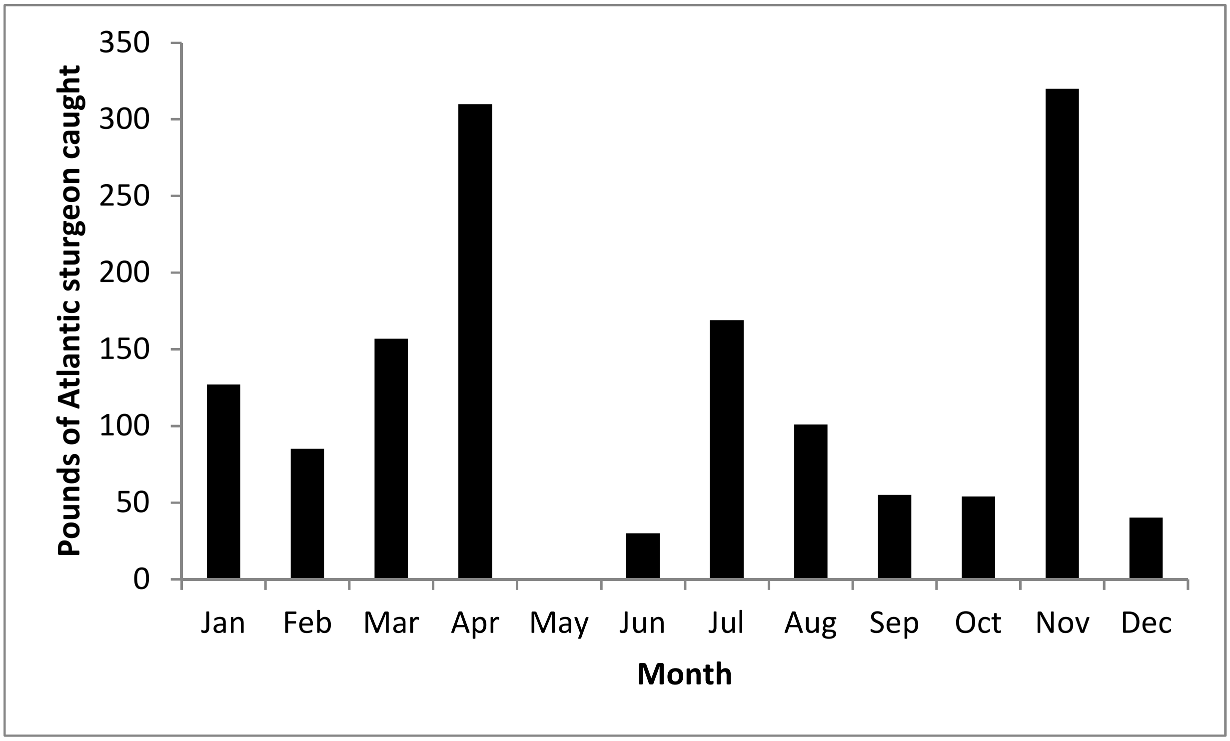


Figure 2. Atlantic sturgeon bycatch in Statistical Area 513 by month.

Monitoring results

1. Studies conducted by the Maine Department of Marine Resources (MDMR) between 1977 and 2000 to estimate the abundance of adult shortnose sturgeon in the Kennebec estuarine complex incidentally captured Atlantic sturgeon. Catch-per-unit-effort (CPUE) for Atlantic sturgeon during the 1998-2000 study was much greater than CPUE during the 1977-1981 study (Table 1). Similar sampling gear (a 90-meter multifilament experimental sinking gill net, 2.4m deep, with three panels of 15.2cm, 17.8cm, and 20.3cm stretch mesh) was used in both studies, but set time in the first study generally was longer (24 hours) than in the second study (3½ - 4 hours). To compare the two time periods a standard net day was defined as a 90m net fished for 24 hours, and the total annual catch was divided by the total net days. Atlantic sturgeon less than 130cm (TL) were arbitrarily classified as sub-adults and those over 130cm as adults.

Table 1. CPUE of subadult Atlantic sturgeon in the Kennebec estuarine complex, Maine.

Year	Number of net days	Total catch	CPUE
1977	38.00	7	0.18
1978	46.00	3	0.07
1979	40.00	25	0.63
1980	34.00	16	0.47
1981	26.00	4	0.15
1989	8.45	122	14.44
1999	13.42	56	4.17
2000	27.82	103	3.70

2. MDMR initiated a study in 2009 to determine the distribution, abundance, movement, and genetic composition of Atlantic sturgeon in the Kennebec complex. The attached report describes the results of the acoustic telemetry portion of the study conducted during the spawning season for the years 2009 through 2011.

3. In 2010 researchers from MDMR, UMaine, and University of New England (UNE) received a Section 6 grant for a study entitled *Connectivity and demographic correspondence among sturgeon stocks in Maine (and Beyond)*. We are using acoustic telemetry and PIT-tagging to study the movements of Atlantic sturgeon among three large rivers (Penobscot , Kennebec, and Saco) in the Gulf of Maine. In 2011, a total of 148 Atlantic sturgeon were caught of which 116 were PIT tagged and 19 acoustically tagged (Table 2).

Table 2. Number of Atlantic sturgeon captured and tagged in the Penobscot, Kennebec, and Saco rivers in 2011.

River	Species	Disposition	2011
Penobscot	Atlantic sturgeon	Caught	15
	Atlantic sturgeon	PIT tagged	12
	Atlantic sturgeon	Acoustic tagged	5
Kennebec	Atlantic sturgeon	Caught	37
	Atlantic sturgeon	PIT tagged	36
	Atlantic sturgeon	Acoustic tagged	11
Saco	Atlantic sturgeon	Caught	96
	Atlantic sturgeon	PIT tagged	68
	Atlantic sturgeon	Acoustic tagged	3

4. In the fall of 2000, Maine and New Hampshire initiated an inshore groundfish trawl survey that is conducted in the spring and fall to provide a fisheries independent assessment of living resources inside ME/NH coastal waters. The assessment is more than a groundfish survey; lobsters, recreational finfish species, and non-commercial species of ecological interest are also being assessed.

The NH/ME coast has been broken into five areas based on geologic, oceanographic, geographic, and biologic factors; in addition, each area has been divided into three depth layers: 5-20, 20-35, and 35-50 fathoms. Stations are located randomly to reflect representative conditions within each of the strata. Up to 100 tows are conducted from New Hampshire through Maine in waters five fathoms (30 feet) to 50 fathoms (300 feet) deep. Gear consists of a modified shrimp net with a two-inch mesh in the wings with a one-half inch mesh liner in the cod end. Foot and head ropes are 50 and 70 feet respectively, with six-inch rubber cookies. The gear was designed to be very light on the bottom to minimize habitat disruption.

Although fishing effort has been similar in each of the regions, 43 of 49 sub-adult Atlantic sturgeon have been captured in Region 2 near the mouth of the Kennebec River (Table 3). In the fall of 2011, an Atlantic sturgeon was captured in Region 4 for the first time.

Table 3: Number of Atlantic sturgeon captured by region, season, and year in the ME/NH Inshore Groundfish Trawl Survey.

	Region 1		Region 2		Region 3		Region 4		Region 5	
	Catch	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	Effort
2000 Fall	0	14	4	16	0	14	0	17	0	17
2001 Spring	0	21	0	23	0	22	0	22	0	23
2001 Fall	0	18	15	18	0	15	0	18	0	6
2002 Spring	0	19	2	20	0	18	0	18	0	19
2002 Fall	0	15	10	17	0	17	0	14	0	18
2003 Spring	1	20	1	21	0	20	0	20	0	20
2003 Fall	0	16	0	15	0	12	0	18	0	17
2004 Spring	0	22	0	23	0	19	0	20	0	19
2004 Fall	0	18	1	20	0	16	0	17	0	16
2005 Spring	0	20	1	22	0	20	0	21	0	21
2005 Fall	0	12	0	14	0	13	0	12	0	3
2006 Spring	2	25	0	22	0	21	0	23	0	18
2006 Fall	0	22	1	18	0	21	0	16	0	8
2007 Spring	0	24	2	21	0	22	0	21	0	20
2007 Fall	0	21	0	18	0	18	0	18	0	12
2008 Spring	0	25	0	21	0	21	0	22	0	23
2008 Fall	1	17	1	17	0	18	0	15	0	12
2009 Spring	0	24	1	23	0	22	0	21	0	22
2009 Fall	0	20	1	19	1	18	0	21	0	14
2010 Spring	0	23	0	24	0	24	0	25	0	21
2010 Fall	0	17	2	21	0	19	0	15	0	13
2011 Spring	0	24	1	24	0	23	0	23	0	22
2011 Fall	0	22	0	15	0	13	1	18	0	16
Total	4	459	43	452	1	426	1	435	0	380

Habitat status

Atkins (1887) reported that Atlantic sturgeon historically were able to ascend the Kennebec River to Taconic Falls at river kilometer (rkm) 102, but the population declined after Edwards Dam was constructed at the head-of-tide (rkm 74) in 1837. In 1999, Edwards Dam was decommissioned and removed, thus allowing sturgeon to access approximately 27 km of spawning and nursery habitat for the first time in 162 years. MDMR conducted limited gill net sampling in the newly accessible habitat in the summers of 2000 and 2001, but did not capture any Atlantic sturgeon. However, in the five years after dam removal, large sturgeon were often seen in the reach between rkm 75 and rkm 102. On June 21, 2005, MDMR captured an Atlantic sturgeon at rkm 102 with a gill net that was set for American shad. Water temp was 17.9 ºC. The sturgeon was measured (149 cm FL; 78 cm TL), tagged with AVID PIT tag, and released in good condition. No additional gill net sampling has been done in the area in the intervening years.

In the Penobscot River, Atlantic sturgeon historically ascended to the falls upon which the Milford Project Dam is located. Three barriers, Great Works Dam constructed just after 1830 at rkm 59, Veazie Dam constructed in 1833 at rkm 47, and Bangor Water Works Dam constructed in 1874 at rkm 42 blocked sturgeon from nearly 20 km of historical habitat for 121 years. Bangor Water Works Dam was removed in 1995. Pursuant to a settlement agreement, Great Works Dam was removed in the summer of 2012 (http://www.maine.gov/dmr/searunfish/programs/greatworksdam/index.htm), and removal of Veazie Dam is expected to begin in 2013.

Aquaculture operations
No Atlantic sturgeon aquaculture operations were authorized during the past year.

APPENDIX 1.

YEAR	MNTH	NEGEAR	GEARNM	TARGSPEC:	OBDBS_OBSPEC_:	AREA	NESPP4	OBDBS_OBSPEC_COMNAME	HAILWT
1991	4	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	10
1991	7	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	19
1991	7	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	7
1991	7	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	15
1991	8	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	11
1991	8	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	13
1991	8	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	10
1991	8	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	12
1991	9	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	45
1991	10	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	19
1991	12	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	40
1992	3	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	45
1992	7	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	20
1992	7	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	28
1992	8	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	9
1993	3	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	10
1993	3	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	10
1993	4	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	150
1993	4	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	150
1994	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4211	STURGEON, NK	1
1994	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4211	STURGEON, NK	1
1994	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4211	STURGEON, NK	1
1994	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4211	STURGEON, NK	1
1994	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	5260	FISH, NK	513	4211	STURGEON, NK	1
1994	3	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	31
1994	11	100	GILL NET, FIXED OR ANCHORED,	5240	GROUNDFISH, NK	513	4200	STURGEON, ATLANTIC	70
1994	3	100	GILL NET, FIXED OR ANCHORED,	5260	FISH, NK	513	4200	STURGEON, ATLANTIC	31
1994	6	100	GILL NET, FIXED OR ANCHORED,	0818	COD, ATLANTIC	513	4200	STURGEON, ATLANTIC	30
1995	7	100	GILL NET, FIXED OR ANCHORED,	1260	FLOUNDER, NK	513	4211	STURGEON, NK	30
1996	8	100	GILL NET, FIXED OR ANCHORED,	3521	DOGFISH, SPINY	513	4200	STURGEON, ATLANTIC	11
2000	1	050	TRAWL,OTTER,BOTTOM,FISH	0818	COD, ATLANTIC	513	4211	STURGEON, NK	100
2000	7	100	GILL NET, FIXED OR ANCHORED,	5240	GROUNDFISH, NK	513	4200	STURGEON, ATLANTIC	50
2000	8	100	GILL NET, FIXED OR ANCHORED,	0124	MONKFISH (GOOSI	513	4211	STURGEON, NK	35
2000	8	100	GILL NET, FIXED OR ANCHORED,	0124	MONKFISH (GOOSI	513	4200	STURGEON, ATLANTIC	
2000	11	100	GILL NET, FIXED OR ANCHORED,	0818	COD, ATLANTIC	513	4211	STURGEON, NK	250
2003	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	7360	SHRIMP, PANDALII	513	4211	STURGEON, NK	0.1
2004	1	058	TRAWL,OTTER,BOTTOM,SHRIMP	7360	SHRIMP, PANDALII	513	4200	STURGEON, ATLANTIC	27
2004	10	121	PURSE SEINE, HERRING	1685	HERRING, ATLANTI	513	4200	STURGEON, ATLANTIC	35
2005	3	058	TRAWL,OTTER,BOTTOM,SHRIMP	7360	SHRIMP, PANDALII	513	4200	STURGEON, ATLANTIC	30
2005	9	121	PURSE SEINE, HERRING	1685	HERRING, ATLANTI	513	4200	STURGEON, ATLANTIC	10
2008	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	7350	SHRIMP, NK	513	4200	STURGEON, ATLANTIC	45
2008	2	058	TRAWL,OTTER,BOTTOM,SHRIMP	7350	SHRIMP, NK	513	4200	STURGEON, ATLANTIC	35
			Total						1448.1

Maine Atlantic sturgeon telemetry study

Gail Wippelhauser, Ph. D.

Introduction

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) currently inhabit the Kennebec complex in Maine, which encompasses three rivers and two connecting passages. Freshwater from the Kennebec and Androscoggin, Maine' s second and third largest rivers, respectively, and three small tributaries combine to form Merrymeeting Bay, below which the Kennebec become increasingly saline as it travels to the Gulf of Maine. The lower part of the Kennebec and Sheepscot rivers are connected by the Sasanoa River (oriented NW to SE) and Back River (oriented SW to NE). The complex has four major habitat zones. The "lower Kennebec" from the river mouth at river kilometer (rkm) 0 to rkm 30 is tidal with salinity ranging from 0-32 ppt, depending on freshwater discharge. "Merrymeeting Bay" from rkm 30-45 is a large, shallow, tidal freshwater embayment. The "upper Kennebec" from rkm 45 to the head-of-tide at rkm 74 is tidal freshwater as is the much shorter "Androscoggin" (approximately 12 KM from head-of-tide to Merrymeeting Bay). The "Sasanoa-Back-Sheepscot" is tidal with salinity rarely below 17 ppt.

Between 1977 and 2000 a total of 461 Atlantic sturgeon were captured in the Kennebec complex as bycatch during sampling for shortnose sturgeon, and an additional 31 were taken by a commercial harvester. Although 272 of the captured Atlantic sturgeon were marked with an external Carlin tag, too few were recaptured to permit a population estimate. Forty-one of the 55 largest Atlantic sturgeon (≥130-cm TL) taken in multiple years (1978, 1980, 1994, 1996, and 1997) were males in spawning condition. These males and most fish ≥130-cm TL were captured in the upper Kennebec between rkm 53-74 in June and July. The area from rkm 17-22 may be an important feeding area as evidenced by high CPUE values from May through October. CPUE declined in November throughout the river, indicating that Atlantic sturgeon leave in late fall to overwinter, although the overwintering site has not yet been identified.

In 2009, MDMR initiated a targeted telemetry study of Atlantic sturgeon to identify critical habitats (spawning, overwintering, feeding) and a mark-recapture study to determine the size of the population. In addition tissue samples are taken for genetic analysis. Behavior of Atlantic sturgeon observed in this telemetry study has been compared to the behavior of Atlantic sturgeon that entered the Kennebec River after being tagged elsewhere.

Methods

Since 2008, MDMR has deployed and maintained an array of moored acoustic receivers (Vemco model VR2W) at 16-20 sites in the Kennebec complex river channels (Figure 1) for approximately seven months during the ice-free period (mid-April to late November) . In 2008 we also placed a receiver in the Sasanoa River (#18), the Back River (#20), the Sheepscot River (#21) and Townsend Gut (#19).

In 2009, 2010, and 2011, pre-spawn Atlantic sturgeon were captured with multifilament gill nets with 12” stretch mesh. Healthy fish were measured, PIT-tagged, fitted with an external acoustic transmitter (Vemco V16-4H), and a DNA sample taken following protocols in Moser (2000).

Results

Freshwater discharge in 2010 and 2011 was at or below the median of <10,000 cfs for most of June and July in the Kennebec River, unlike 2009 when discharge exceeded the 90th percentile of daily flows after June 19 (Figure 2). Average daily water temperature, recorded near the channel bottom, was up to 5ºC cooler in 2009 than in 2010 after June 19 (Figure 2). Temperature data for 2011 are not yet available, but are likely similar to 2010 on the basis of similar discharge.

CPUE for pre-spawning Atlantic sturgeon was low (0.10-0.14 fish per hour soak time) in 2009 and 2010, but increased in 2011 (Table 1). It is likely that we lost fish during each sampling episode. Upon retrieval the gillnets typically had one or more large holes in them, likely made by the sharp scutes of Atlantic sturgeon.

Atlantic sturgeon spawn in the Kennebec complex from mid-June at the earliest to the end of July at the latest. Sturgeon were first seen jumping between rkm 72-84 on June 27, 2009; June 9, 2010; and June 14, 2011. They were first caught between rkm 72-84 July 21, 2009; June 17, 2010; and June 16, 2011. The onset of spawning was likely delayed in 2009 because of high discharge for most of the period.

While on the spawning ground, all five Atlantic sturgeon tagged in 2009 (Figure 3), seven of 8 tagged in 2010 (Figure 4), and all 3 tagged in 2011 made a series of short upstream and downstream movements between rkm 48-74. In 2011, one fish also moved upstream to rkm 87 where it remained for a week. Individual sturgeon remained on the spawning ground (above rkm 48) for as much as a week in 2009 (Figure 3) and 27 days in 2010 (Figure 4; tag 52191). Tagged fish exhibited a bimodal pattern of detection, and presumably activity, on the spawning ground. Peaks occurred from 0200-0300 and at 1600 in 2009 and at 0400 and 1600 in 2010 (Figure 5).

In 2011 we confirmed that Atlantic sturgeon also spawn in the Androscoggin River. Eight Atlantic sturgeon were caught just downstream of the Brunswick Project dam on June 21, and three were tagged. One of the tagged fish was a male.

After spawning in the upper Kennebec, sturgeon rapidly moved downstream into Merrymeeting Bay (rkm 34) or the lower Kennebec (rkm 16-21) where they were detected through the end of August in 2009 and the beginning of October in 2010 (Figure 3; Figure 4). The 3 Atlantic sturgeon tagged in the Androscoggin remained on the spawning ground for 4-21 days before moving to the lower Kennebec. One sturgeon that had been tagged in 2009 (52185) was detected at rkm 16 for a single day (May 11) in 2010.

In contrast to this movement between major ecological zones, Atlantic sturgeon that entered the Kennebec River after being tagged in the Penobscot River or the Saco River were not detected above rkm 45.

Discussion

This summer and fall up to 20 Atlantic sturgeon will be captured, PIT tagged, and internally tagged with an acoustic transmitter with a tag life of approximately 10 years. Tissue samples will also be taken for genetic analysis. Telemetry data continue to be collected by the receiver array.

References

Moser, M.L., M. Bain, MR Collins, N Haley, B Kynard, JC O'Herron II, G Rodgers, and TS Squiers. 2000. A Protocol for user of shortnose and Atlantic sturgeons. US. Dept. Commerce, NOAA Technical Memorandum NMFS-OPR-18. 18 Pages.

Table 1. Sampling effort, number of Atlantic sturgeon caught, CPUE, and start and end dates of sampling in the Kennebec complex, 2009-2011. Sampling for 2011 is not completed.

Year	Effort (h)	Catch	CPUE	Start date	End date
2009	57.9	8	0.14	6/16	9/14
2010	107.5	11	0.10	6/9	10/29
2011	70.4	23	0.33	6/14	7/11

Figure 1. Map of the Kennebec complex, Maine, and location in river kilometers (rkm) of receivers. Androscoggin receivers were termed rkm 31 and 30 for analysis.

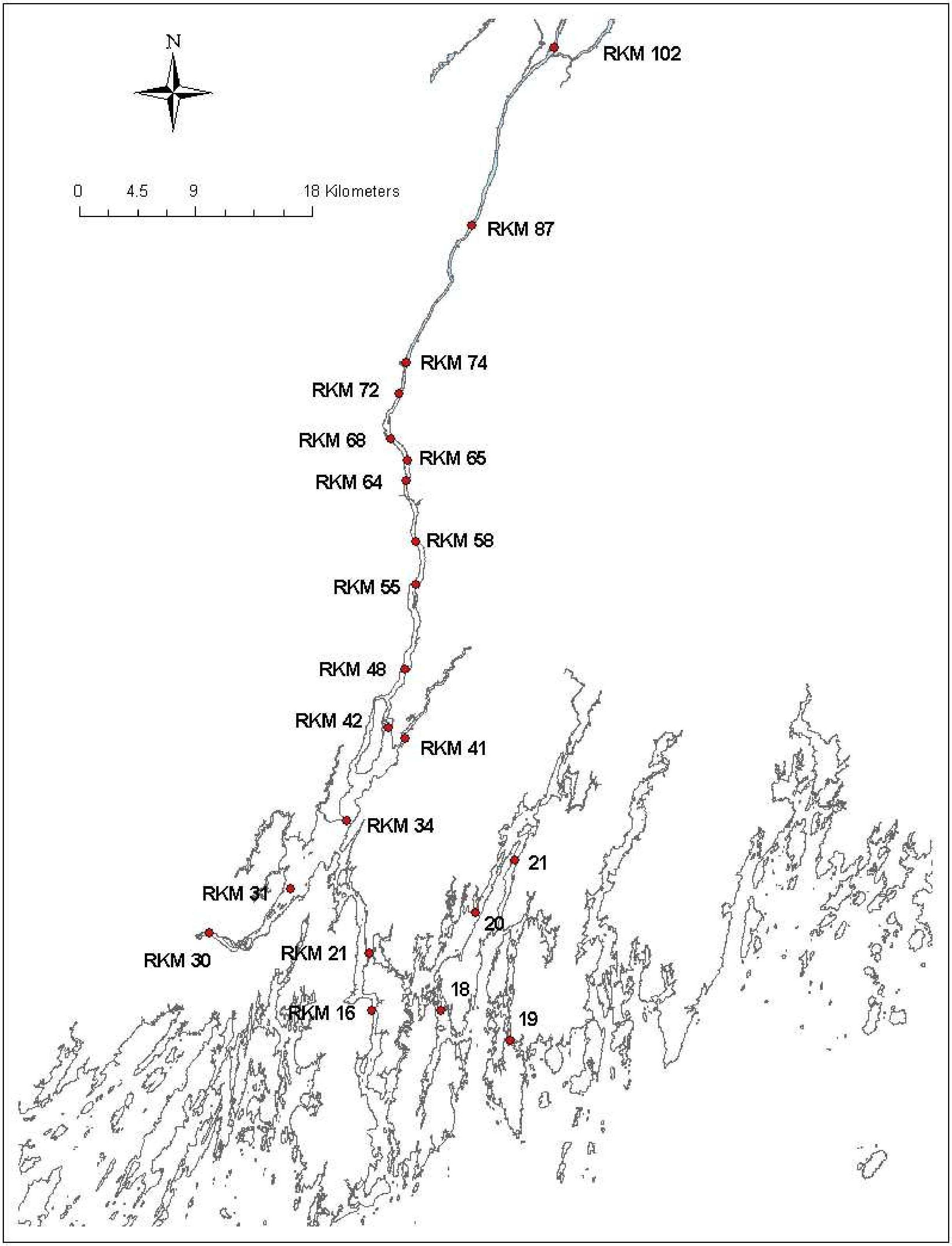
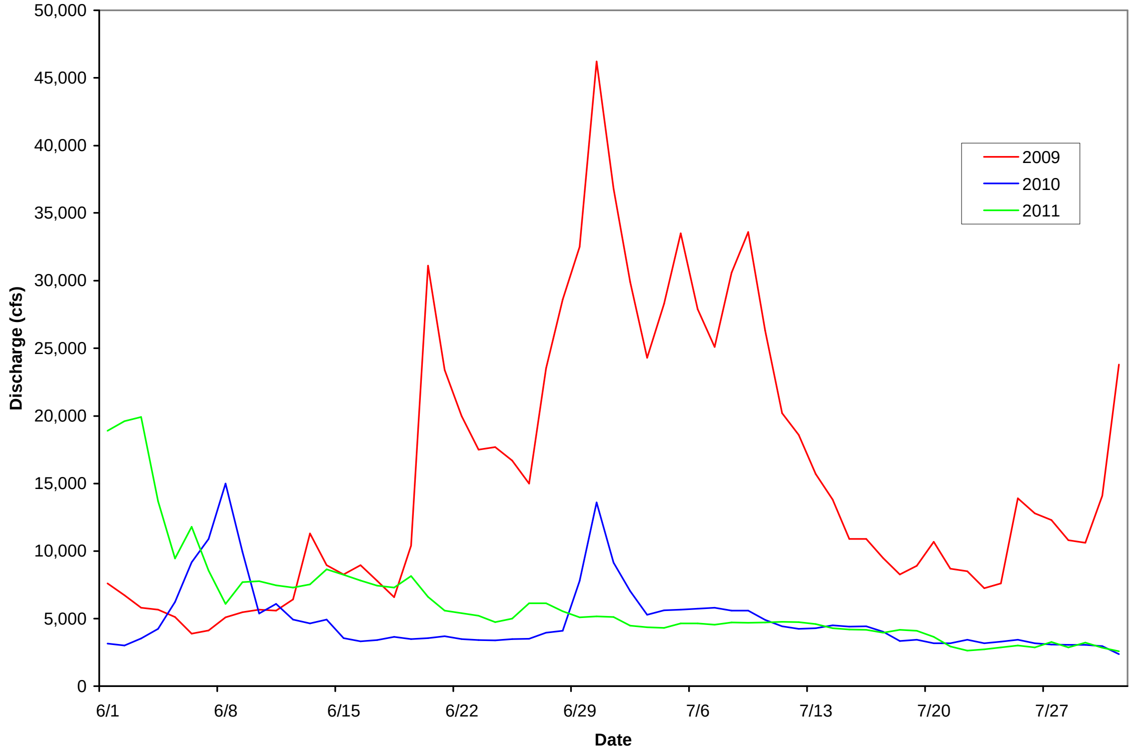


Figure 2. Mean daily freshwater discharge (top panel) at Sidney and water temperature measured 1 m from the bottom at Augusta, Kennebec River.



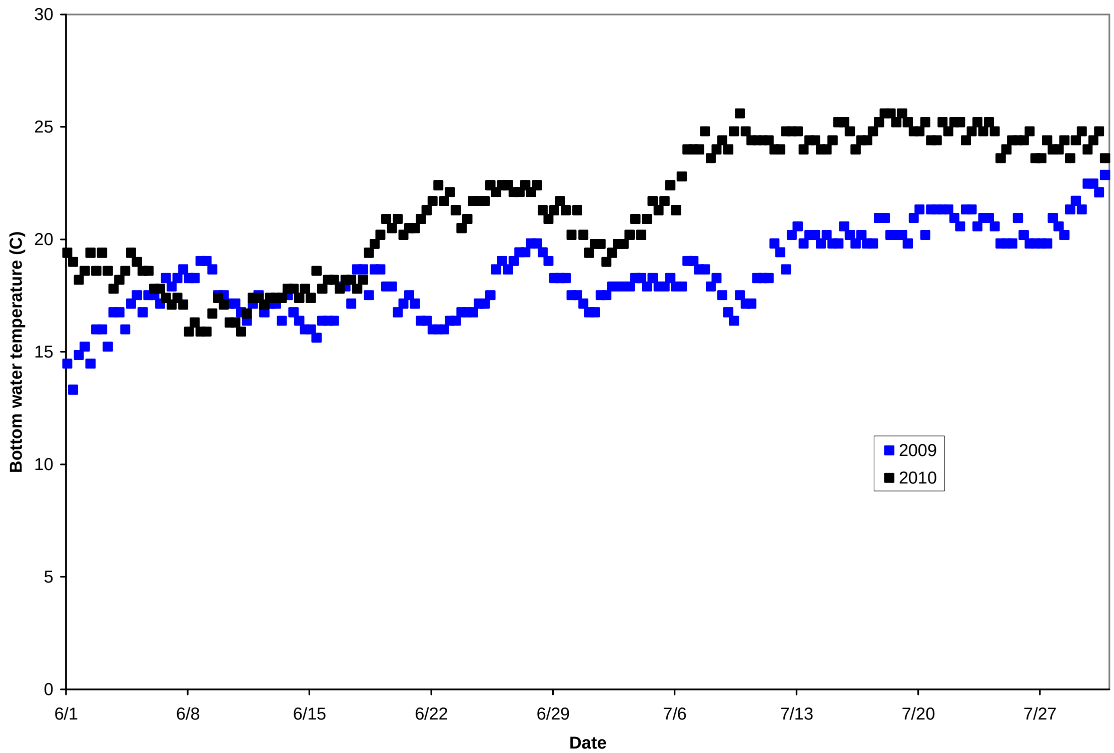


Figure 3. Tracks of Atlantic sturgeon tagged in 2009. Horizontal line at rkm 48 indicates lower limit of spawning area in the upper Kennebec.

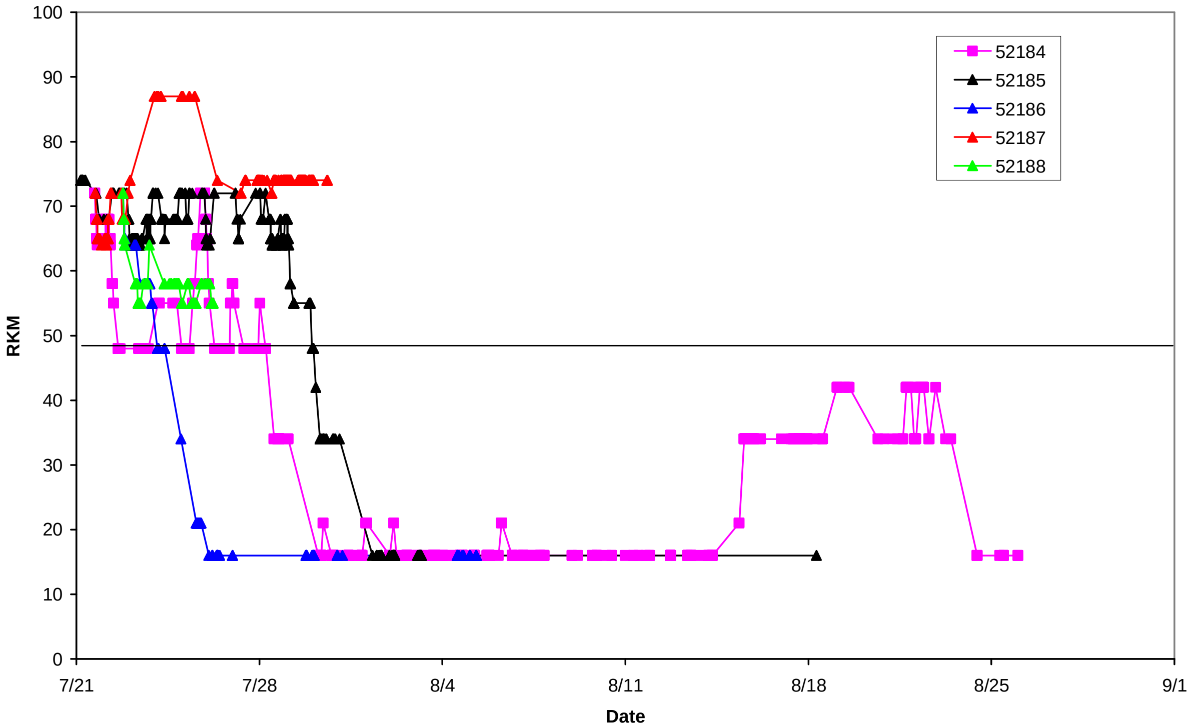


Figure 4. Tracks of Atlantic sturgeon tagged in 2010. Horizontal line at rkm 48 indicates lower limit of spawning area in the upper Kennebec.

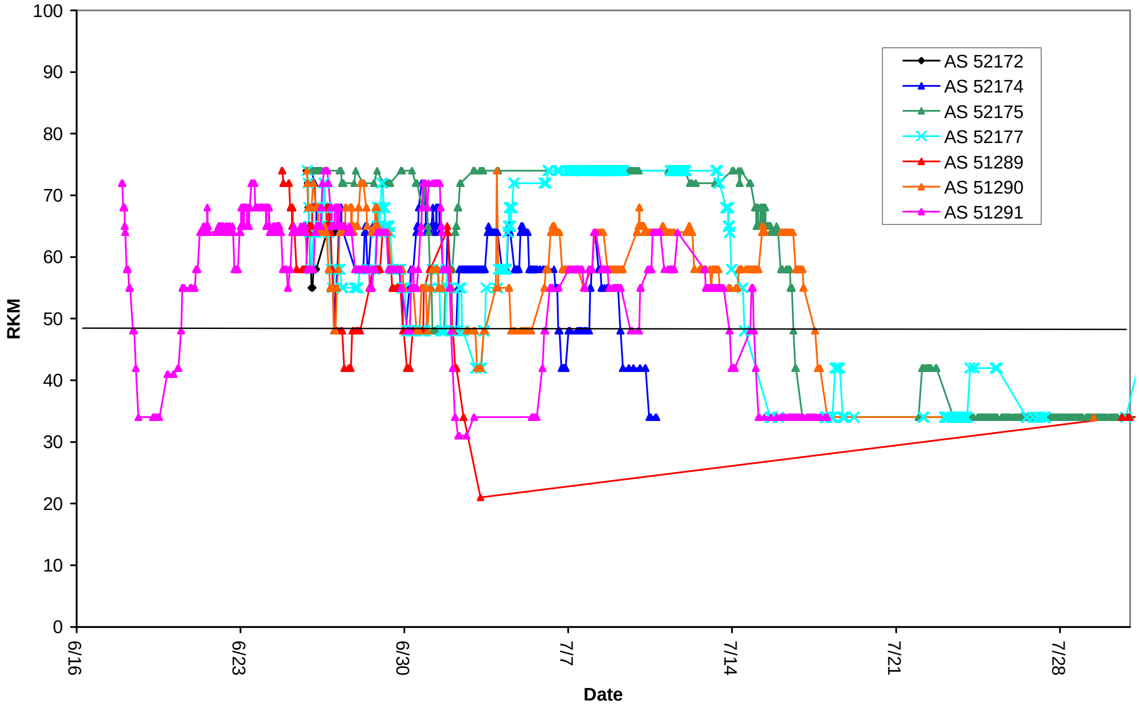
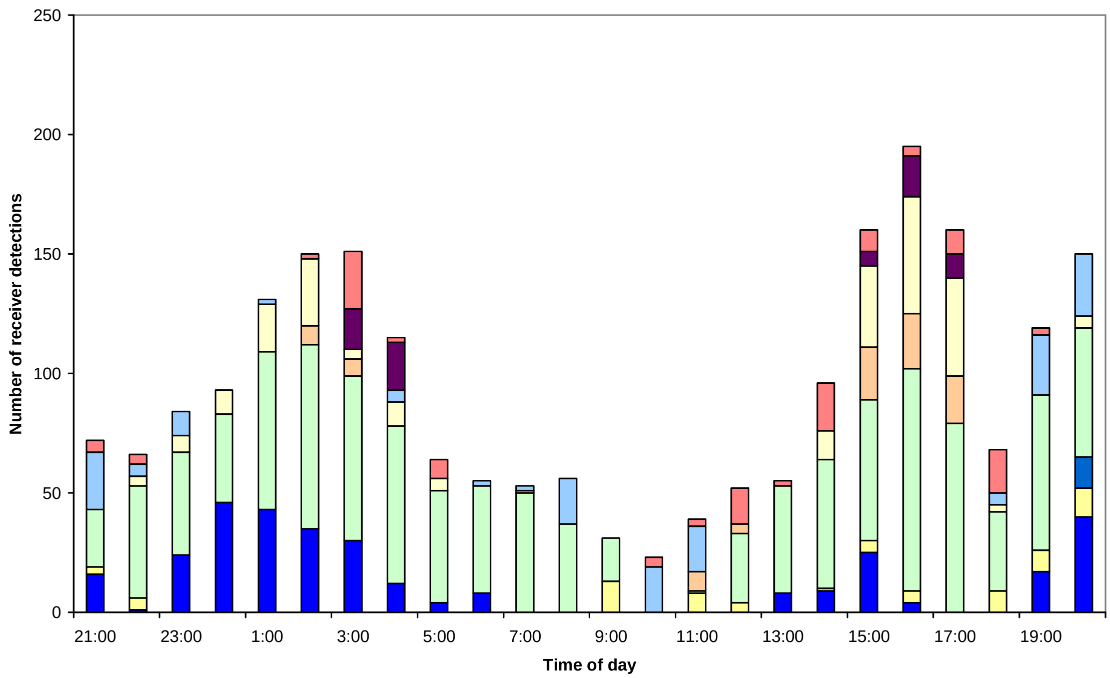
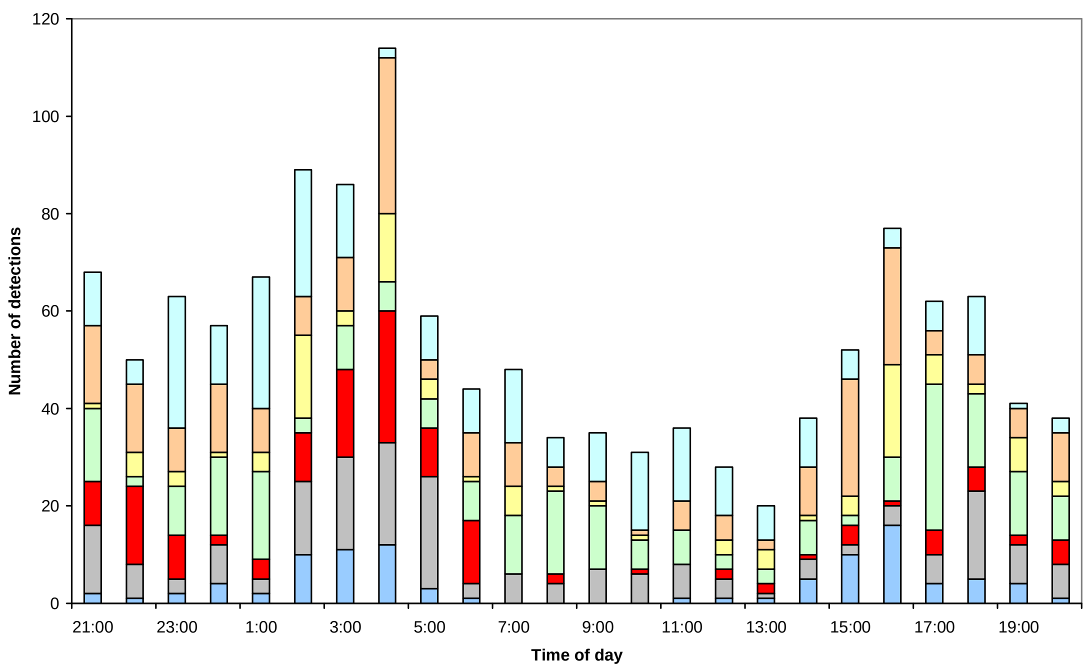


Figure 5. Diel detections of Atlantic sturgeon while spawning in the upper Kennebec in 2009 (upper graph) and 2010 (lower graph).





State of New Hampshire
Annual Compliance Report
for Atlantic Sturgeon - 2011

The following report is submitted as a compliance requirement under Amendment 1 to the Atlantic States Marine Fisheries Commission's Interstate Fisheries Management Plan for Atlantic Sturgeon.

I. <u>Results of By-catch Monitoring for Atlantic Sturgeon in Other Fisheries</u>

The following sources of information were examined for evidence of by-catch of Atlantic sturgeon in other fisheries in New Hampshire during 2011: law enforcement observations, mandatory logbook reports from Coastal Netters permittees*, National Marine Fisheries Service (NMFS) sea sampling for trips originating in New Hampshire, and two fisheries independent surveys conducted in New Hampshire (June to November estuarine seine survey and springtime monitoring of 6 coastal fishways). During 2011, no sturgeons were reported or observed from any of these information sources.

* Permit required to take finfish by seine, net, weir, pot, or trap from coastal and estuarine waters in New Hampshire.

II. <u>Monitoring Results (tagging, five-year juvenile abundance index studies)</u>

The State of New Hampshire has no known reproducing Atlantic sturgeon populations within its jurisdiction, so it is not required to monitor juvenile abundance under the plan. The State cooperates with the National Marine Fisheries Service and US Fish and Wildlife Service tagging program by reporting any tagged Atlantic sturgeon we become aware of. Tagged sturgeon were recorded by receivers in Great Bay and at the Isles of Shoals. The presence of one tagged Atlantic sturgeon was recorded in Great Bay by a University of New Hampshire receiver, and one at the Isles of Shoals by a National Oceanic and Atmospheric Administration receiver. One tagged shortnose sturgeon was recorded in Great Bay by a US Geological Survey in 2011.

III. <u>Habitat Status</u>

Numerous fisheries independent surveys have been conducted in New Hampshire estuarine waters during the past 25 years, including one directed at determining the distribution and abundance of shortnose sturgeon (*Acipenser brevirostrum*). During this time period, the various surveys have encountered only one sub-adult Atlantic sturgeon (June 1981, Oyster River). Also during this period, fisheries dependent data indicated roughly 1,500 lbs. or less of sturgeon landed each year in New Hampshire prior to the implementation of a moratorium on sturgeon landings in 1991. Most of these sturgeons were harvested in the EEZ. From this it has been concluded that there is currently no evidence that Atlantic sturgeon have used New Hampshire estuaries and coastal rivers as spawning and nursery habitat in recent times.

However, many of the habitat conservation measures outlined in Section 4.1 of Amendment 1 to the Atlantic Sturgeon FMP are addressed as a part of the State's work in managing and restoring other anadromous and marine finfish species. These include:

1. Providing written comments concerning fish and wildlife to the State's Department of Environmental Services Water Division who are responsible for reviewing and approving aquatic alteration projects in the State.

2. The New Hampshire Fish and Game Department is represented on the State's Site Evaluation Committee for Power Plants, which must approve all proposed power plants.

3. The State has established (by administrative rule) a dredge window of November 15 to March 15 for dredge and fill projects.

4. The New Hampshire Fish and Game Department regularly works with the US Fish and Wildlife Service and the National Marine Fisheries Service to have Federal Energy Regulatory Commission require appropriate flows and migration routes for anadromous fish species at all coastal hydroelectric operations.

IV. **Aquaculture Operations**

There currently are no aquaculture operations for sturgeons in New Hampshire.

ATLANTIC STATES MARINE FISHERIES COMMISSION
ANNUAL ATLANTIC STURGEON COMPLIANCE REPORT
Reporting Period: October 1, 2011 – September 30, 2012

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February 2013

I. Introduction

The following is the annual compliance report submitted for the Commonwealth of Massachusetts by the Massachusetts Division of Marine Fisheries (*MarineFisheries*) as required by Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon, Section 5.1.2. *This report covers the time period October 1, 2011 through September 30, 2012.*

Massachusetts has no known reproducing populations of Atlantic sturgeon. Regulations have been implemented that prohibit the taking and/or possession of Atlantic sturgeon (Code of Massachusetts Regulations 322 6.16; see Attachment 1). There were no changes in regulations or management of Atlantic sturgeon in Massachusetts during the reporting period.

As outlined in Amendment 1, this compliance report addresses the following: Bycatch monitoring, Monitoring results, Habitat status and Aquaculture operations.

II. Request for *de minimis* status

Not applicable.

III. Previous calendar year's fishery and management program

a. Activity and results of fishery dependent monitoring

MarineFisheries monitors Atlantic sturgeon bycatch in our coastal fisheries through our Fisheries Dependent Investigations project by means of at-sea observers. Fisheries covered include (a) pot fisheries for lobster, sea bass, and scup, (b) trawl fisheries for squid, whiting, and groundfish, (c) hook-fisheries for cod, spiny dogfish, and scup, and (d) gillnet fisheries for groundfish and spiny dogfish. With the exception of the lobster pot sampling, most sea sampling trips are conducted on an ad hoc basis, typically in response to immediate management concerns. Most at-sea observations of gillnet and trawl fisheries in Massachusetts are conducted by the National Marine Fisheries Service (NMFS) observer program. ASMFC is advised to consult the NMFS observer database for documentation of bycatch of Atlantic sturgeon in gillnet and trawl fisheries in Massachusetts waters. Massachusetts state observer data are incorporated into the federal database.

On June 8th 2012, a *MarineFisheries* observer noted the capture and live release of a single Atlantic sturgeon near Gloucester, Massachusetts. The individual weighed 34 lbs and was captured in a sink gill net by a commercial vessel targeting Atlantic cod.

MarineFisheries received no reports of Atlantic sturgeon bycatch in any recreational fishery from October 1, 2011 to September 30, 2012.

b. Activity and results of fishery independent monitoring

The Resource Assessment Project of *MarineFisheries* conducts a fisheries independent trawl survey biannually in spring and fall throughout Massachusetts territorial waters. No Atlantic sturgeon were caught during 2012. No Atlantic sturgeon have been captured in this trawl survey since 1986.

As of November 2011, Micah Kieffer (USGS) ceased tagging Atlantic sturgeon in the Merrimack River. However, he has reported that he continues to record detections within his ultrasonic telemetry array and is currently preparing a report detailing his findings. *MarineFisheries* will continue to work with and support other resource agencies and university scientists in future Atlantic sturgeon distribution and tagging studies.

Within the reporting period, *MarineFisheries* received anecdotal information that multiple sturgeon were seen to breach the water in the Merrimack River, near Plum Island, Massachusetts. The report indicated that dozens of individual breaches were observed and that most fish were between 3 and 4 feet long. Given this report, the observed size of the fish, and previous reports of Atlantic sturgeon in the area, *MarineFisheries* suspects that the breaching sturgeon were probably Atlantic sturgeon.

Two additional sightings of Atlantic sturgeon were reported to *MarineFisheries*. The first occurred in February. A kayaker observed and photographed a sturgeon swimming near the surface in the Charles River, Boston. Based on a photo of the fish, *MarineFisheries* is confident that this individual was an Atlantic sturgeon. The second occurred with the June recovery of a dead Atlantic sturgeon in Hanover. This Atlantic sturgeon was approximately 6 feet long with a weight of about 75 lbs. A necropsy conducted by the New England Aquarium found that the fish was a non ripe female.

No Atlantic sturgeon were observed during the spring and fall 2012 fish lifting activities at the Essex Dam hydroelectric facility on the Merrimack River in Lawrence, Massachusetts. Fish lift activities began on April 16 and continued through July 13, and again from September 15 through November 15. Lifts were conducted hourly in the spring from 8 am to 4 pm. Lifts were conducted four times a day during the fall season. In the 29 year history of lift operation, no Atlantic sturgeon have been observed to utilize the fish lift.

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c. Copy of regulations that were in effect, including a reference to specific compliane criteria as mandated in the FMP

During the reporting period, Atlantic sturgeon were managed under the Code of Massachusetts Regulations 322CMR 6.16, which states:

6.16: Atlantic Sturgeon Prohibition

(1) **Definition**. Atlantic Sturgeon means that species of fish known as *Acipenser oxyrhyncus*

(2) **Purpose**. Massachusetts needs to comply with the Atlantic States Marine Fisheries Commission Atlantic Sturgeon Management Plan that requests states to adopt either an elimination of all sturgeon harvest or a minimum size of seven feet. Since there is no directed fishery for sturgeon in Massachusetts and the state has already declared the sturgeon an endangered species, a prohibition on the landing and possession of sturgeon is appropriate. Now, both the Atlantic sturgeon and the endangered short-nosed sturgeon cannot be landed or possessed.

(3) **Prohibition**. It is prohibited and unlawful for any person to land or possess any Atlantic sturgeon.

This regulation meets the requirements of Amendment 1 to the Interstate Fishery Management

Plan for Atlantic Sturgeon, which closed all commercial Atlantic sturgeon fisheries within the United States.

d. Harvest broken down by commercial, recreational, and non-harvest losses

See Section III.a.

e. Review of progress in implementing habitat recommendations

To enhance protection of Atlantic sturgeon, *MarineFisheries* continues to provide comments for all Army Corps of Engineers, Massachusetts Department of Environmental Protection, and FERC permit applications regarding projects that may impact water quality and fish habitat. During FERC relicensing evaluations, *MarineFisheries* works with the USFWS and the NMFS to provide appropriate recommendations concerning habitat, adequate flow, and fish passage for Atlantic sturgeon. On case-by-case basis, local, state, and federal permitting agencies are provided with resource recommendations, which include appropriate work windows and environmental safeguards for Atlantic sturgeon. During the 2012 reporting period, *Marine Fisheries* provided commentary on Atlantic sturgeon for nine different projects located in four different geographic areas.

Within the Taunton River system, *MarineFisheries* provided commentary for a Massachusetts Department of Transportation bridge improvement and a privately funded pier construction project. In each case, *MarineFisheries* informed relevant parties that Atlantic sturgeon may be present at each site but did not impose specific restrictions.

Additionally, *MarineFisheries* issued a permit to Stantec Consulting Services Inc in August 2012 to allow them to relocate Atlantic sturgeon encountered during the ongoing Berkley-Dighton bridge reconstruction project, which crosses the lower portion of the Taunton River. The permit allowed relevant parties to sweep Atlantic sturgeon out of the construction area with a small mesh seine net.

Within the Buzzards Bay watershed, *MarineFisheries* provided commentary on the Massachusetts Executive Office of Energy and Environmental Affairs' South Terminal project. This project endeavors to create a pier in New Bedford that will facilitate the development of an offshore wind energy farm. Because of concerns over the potential interactions of pier construction with essential Atlantic sturgeon habitat, the project was subjected to a Section 7 consultation under the Endangered Species Act. The results of this consultation indicated that the pier construction project was unlikely to have an adverse impact on Atlantic sturgeon.

In the Boston Harbor area, *MarineFisheries* provided commentary on the LoveJoy Wharf revitalization project. *MarineFisheries* cautioned that because an Atlantic sturgeon was observed in the area that spring that every effort be made to avoid any potential impacts.

Within the Merrimack River, *MarineFisheries* provided commentary regarding Atlantic sturgeon to MassHighway on the Whittier Bridge repair, to the US Army Corps of Engineers (ACOE) on the Bates Bridge replacement, and to the Town of Salisbury on the Town Creek flood hazard mitigation. *MarineFisheries* imposed a time of year restriction on the Whittier Bridge repair and the Town Creek flood hazard mitigation project. In the case of the Bates Bridge replacement, *MarineFisheries* recommended that ACOE consult MassWildlife, NMFS, and Massachusetts Natural Heritage Program.

IV. Planned management programs for the current calendar year

a. Summarize regulations that will be in effect

See Section III.c.

b. Summarize monitoring programs that will be performed

MarineFisheries intends to continue fishery dependent (see Section III.a) and fishery independent (see Section III.b.) monitoring of Atlantic sturgeon. Further, *MarineFisheries* may pursue Federal funding to perform further monitoring, and potentially, remediation, of Atlantic sturgeon interactions that occur within the waters of the Commonwealth.

c. Highlight any changes from previous year

MarineFisheries does not plan any changes to the previous year's monitoring program.

V. Plan specific requirements

h. Atlantic sturgeon

The results of bycatch and scientific monitoring are given in sections III a and b. Information regarding habitat status is given in section III e.

There are no Atlantic sturgeon aquaculture facilities in Massachusetts, nor are any proposed at this time. Under the authority of Massachusetts General Laws Chapter 130, Section 17B, permits are required for aquacultural enterprises. The director may issue aquaculture permits under such terms and conditions as he may impose. The Massachusetts Office of Coastal Zone Management along with the Massachusetts Department of Agricultural Resources, and the Massachusetts Department of Environmental Protection developed a white paper, which serves as the mariculture policy document.

Rhode Island
Department of Environmental Management

DIVISION OF FISH AND WILDLIFE
TEL 401 423-1920
FAX 401 423-1925
3 Fort Wetherill Road
Jamestown, RI 02835

To: Kate Taylor, ASMFC Atlantic Sturgeon FMP Coordinator

From: Eric Schneider, Principal Biologist

Date: March 26, 2013

Subject: Rhode Island Atlantic Sturgeon Compliance Report for the 2011 Fishing Year

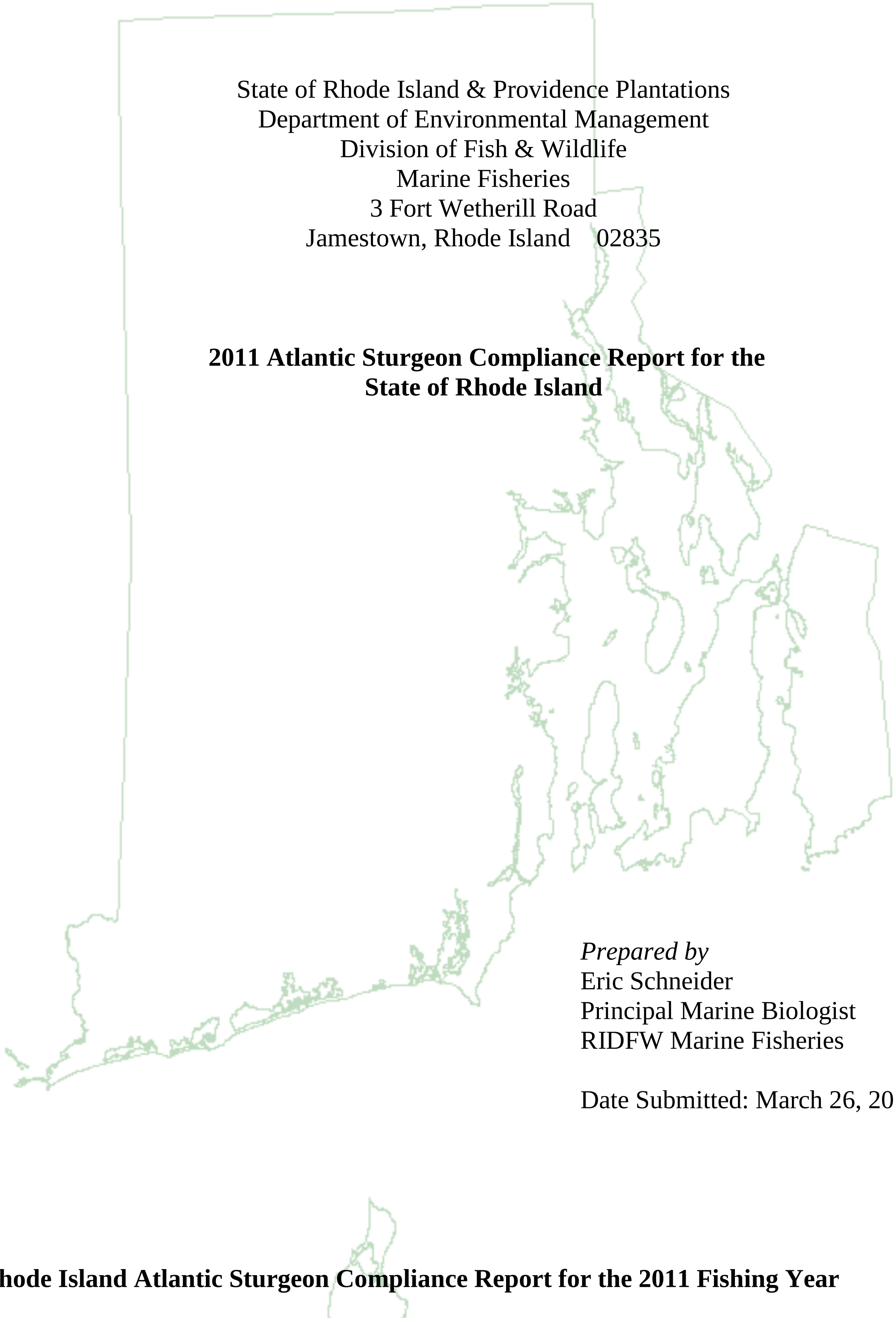
Attached please find Rhode Island's Atlantic Sturgeon compliance report for the 2011 fishing year.

Please contact me at 401.423-1933 or via email at Eric.Schneider@dem.ri.gov if you have questions or need additional information.

Thank you.

cc: J. McNamee

Attachment: RI Atlantic Sturgeon 2011Compliance Report.doc



State of Rhode Island & Providence Plantations
Department of Environmental Management
Division of Fish & Wildlife
Marine Fisheries
3 Fort Wetherill Road
Jamestown, Rhode Island 02835

2011 Atlantic Sturgeon Compliance Report for the State of Rhode Island

Prepared by
Eric Schneider
Principal Marine Biologist
RIDFW Marine Fisheries

Date Submitted: March 26, 2013

Rhode Island Atlantic Sturgeon Compliance Report for the 2011 Fishing Year

I. Bycatch Monitoring

Data collected by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) Northeast Fishery Observer Program (NEFOP) and the At-Sea Monitoring Program (ASM) shows that 17 Atlantic sturgeon were captured in NOAA Fisheries Statistical Reporting Areas 537, 538, 539, 611, and 613 during 2011 (Table 1). It is important to note that despite the 2011 value being the second highest estimate of observed bycatch in the time series, after accounting for the number of hauls observed 2011 was in fact the 12'th lowest year of estimated bycatch of the 18 year time series (Table 1, Figure 1). Also of interest is that only 4 of the 17 observations were from Statistical Reporting Areas 537, 538, and 611, which in part contain RI state waters.

Since 1994 Atlantic sturgeon in Statistical Reporting Areas 537, 538, 539, 611, and 613 have typically been caught in the late spring and late fall; however, catches during the spring of 2011 appear to have occurred slightly earlier than normal (Table 2, Figure 2). During 2011 nine of the 17 Atlantic sturgeon observed as bycatch were caught in gillnets (Table 3). The other 8 sturgeons were evenly split between bottom otter single- and twin-trawl gears (Table 3). None of the sturgeon caught in bottom otter trawls (single or twin) resulted in an observed mortality; however, 8 of the 9 caught in gillnets were dead (Table 3). During 2011 Atlantic sturgeon were most commonly caught when monkfish and Atlantic long-fin squid were the target species (Table 4).

II. Monitoring

No Atlantic sturgeon were caught during routine fish surveys this year by Rhode Island Fish and Wildlife. Since 1979, 42 stations (26 in Narragansett Bay, 10 in Block Island Sound, and 6 in RI Sound) have routinely been sampled each year, by trawl, in the spring and fall. In addition, 13 stations have routinely been monitored by trawl in Narragansett Bay, each month throughout the year, since 1990. Since 1979 only two Atlantic sturgeon have been collected, an 86 cm specimen was caught in Narragansett Bay off Barren Ledge in May 1997 and a 130 cm sturgeon weighing 9.7 kg wascollected in RI Sound in Oct 2005.

III. Habitat Status

Based on the shallow nature of the State's three largest river systems, the Blackstone, Pawtuxet, and Pawcatuck Rivers, it is believed that no suitable Atlantic sturgeon spawning habitat has ever existed in RI.

IV. Regulatory Changes

There were no regulatory changes during 2011. Regulations that were in place from January 1 through December 31, 2011 are as follows:

7.6 Minimum sizes, other species -- Except as specifically noted, no person shall possess or take any of the following species which are less than the following minimum size

ATLANTIC STURGEON: Commercial and Recreational - no possession

IV. Regulatory Changes (Regulations from Jan 1 - Dec 31, 2011 - Continued…)

7.13Atlantic Sturgeon - Moratorium on Harvest
-- No harvest or possession of Atlantic Sturgeon will be permitted within the territorial waters of the State of Rhode Island until further notice.

Table 1. Atlantic Sturgeon bycatch from observed trips during 2011 by NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613. Lengths and weights represent data from all gear types and when available actual and estimated measurements were combined .

Year	Number Collected	Number of Hauls	% of Observed Hauls with Sturgeon	Rank of % of Observed Hauls with Sturgeon	Fork Length (cm)	Weight (lb)
1994	2	1,030	0.19%	15	83	10-49
1995	7	1,720	0.41%	10	84-128	10-47
1996	4	2,621	0.15%	17	170	30-280
1997	3	1,702	0.18%	16	122-183	35-60
1998	4	772	0.52%	6	105-220	40-210
1999	5	875	0.57%	4	80-180	5-150
2000	5	844	0.59%	3	90-188	15-75
2001	8	781	1.02%	1	125-225	40-120
2002	3	573	0.52%	5	130-200	100-200
2003	3	1,430	0.21%	14	90-183	50-150
2004	20	2,925	0.68%	2	60-146	4-100
2005	14	3,435	0.41%	9	60-183	5-150
2006	10	2,448	0.41%	8	89-197	7-150
2007	10	1,947	0.51%	7	63-213	10-150
2008	5	1,700	0.29%	13	91-137	19-45
2009	9	2,324	0.39%	11	70-169	20-100
2010	5	4,759	0.11%	18	70-133	8-40
2011	17	5,058	0.34%	12	90-187	10-240
Total No.	134	36,944				

Table 2. The number of Atlantic sturgeon caught as bycatch, by month and by gear type, observed during trips by the NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613 from 1994 to 2011.

	Month												Gear Type		
													Sinking gillnet		Trawl
Year	1	2	3	4	5	6	7	8	9	10	11	12	Drift	Anchored	
1994											1	1		2	
1995					4	2	1							5	2
1996					1	3								1	3
1997											3			3	
1998						1				1		2		4	
1999	1	1									2	1		5	
2000					1						1	3		5	
2001						6				1	1			2	6
2002					3									3	
2003										1	2		1	2	
2004	1			2	3	3	2	1			7	1		9	11
2005					4	2				2	2	4		11	3
2006				1	5	1					3			7	3
2007					7					1	1	1		8	2
2008	1			1							3			4	1
2009			1		3		2			1	2			7	2
2010					1	2					1	1		2	3
2011	0	1	0	6	3	2	1	0	1	0	1	2		9	8
Total caught	3	1	1	4	32	20	5	1	0	7	26	14	1	89	44

Table 3. The percent of hauls with observed Atlantic sturgeon bycatch, by gear type, during trips by the NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613 for 2011.

Statistical Area	Fishing Gear	Hauls	Sturgeon Observed	% of Observed Hauls with Sturgeon	Status Alive	Status Dead	Observed Mortality Rate
537	Gill Net, Fixed or Anchored, Sink	776	7	0.902%	1	6	86%
537	Other Gear Types	1431	0	-	-	-	-
537 Total	All Gear Types	2207	7	0.317%	-	-	-
538 Total	All Gear Types	65	0	0.000%	-	-	-
539	Gill Net, Fixed or Anchored, Sink	53	1	1.887%	0	1	100%
539	Other Gear Types	942	0	-	-	-	-
539 Total	All Gear Types	995	1	0.101%	-	-	-
611	Trawl,Otter, Bottom	398	3	0.754%	3	0	0%
611	Other Gear Types	5	0	-	-	-	-
611 Total	All Gear Types	403	3	0.744%	-	-	-
613	Gill Net, Fixed or Anchored, Sink	29	1	3.448%	0	1	100%
613	Trawl,Otter, Bottom	183	1	0.546%	1	0	0%
613	Trawl,Otter, Bottom, Twin	7	4	57.143%	4	0	0%
613	Other Gear Types	1169	0	-	-	-	-
613 Total	All Gear Types	1388	6	0.432%	-	-	-
2011 Total	Gill Net, Fixed or Anchored, Sink	858	9	1.049%	1	8	89%
2011 Total	Trawl,Otter, Bottom	581	4	0.688%	4	0	0%
2011 Total	Trawl,Otter, Bottom, Twin	7	4	57.143%	4	0	0%
2011 Total	Other Gear Types	3547	0	0.000%	-	-	0%
2011 Total	Total Huals (All Gear Types)	4993	17	0.340%	9	8	47%

Table 4. The gear type and species targeted on sets that resulted in Atlantic sturgeon caught as bycatch during trips by the NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613 for 2011. The End Status was presumed by the observer at the time of release or discard.

		End Status	
Gear	Haul Target	Alive	Dead
Bottom Trawl	Flounder, Summer (Fluke)	1	0
Bottom Trawl	Skate, Little	1	0
Bottom Trawl	Squid, Atl Long-fin	2	0
Twin Trawl	Squid, Atl Long-fin	4	0
Gillnet	Monkfish (Goosefish)	1	7
Gillnet	Skate, Winter (Big)	0	1
Total		9	8

Figure 1. The number of Atlantic Sturgeon caught as bycatch and the annual percent of observed hauls with sturgeon as bycatch from 1994 to 2011. This information is based on observed trips made by the NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613.

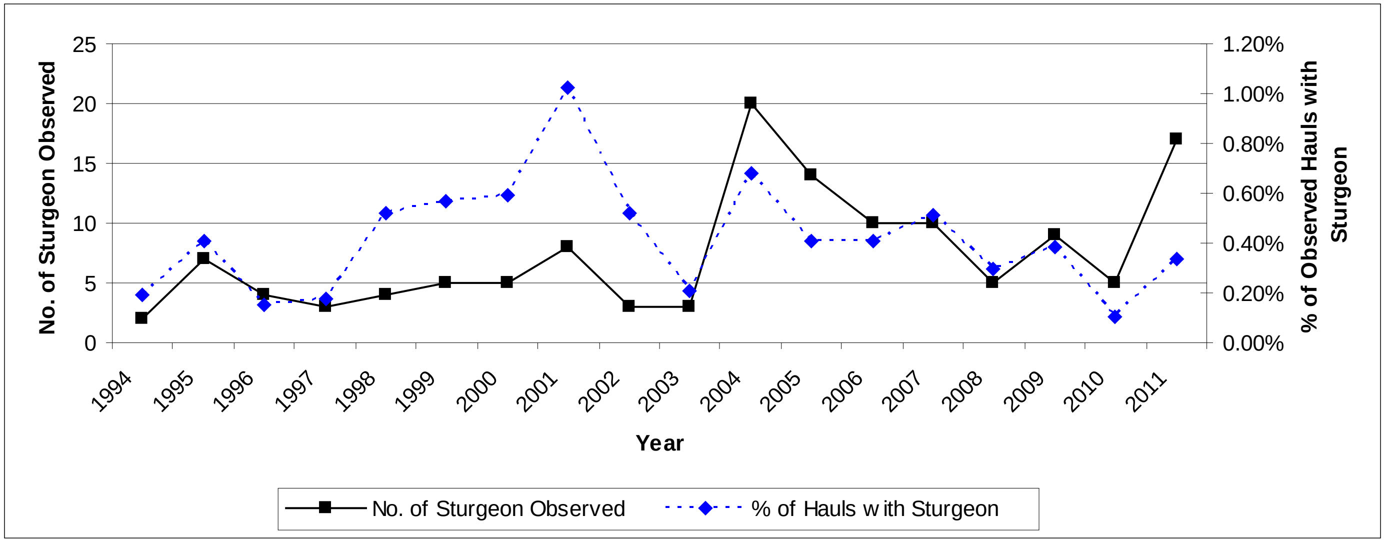
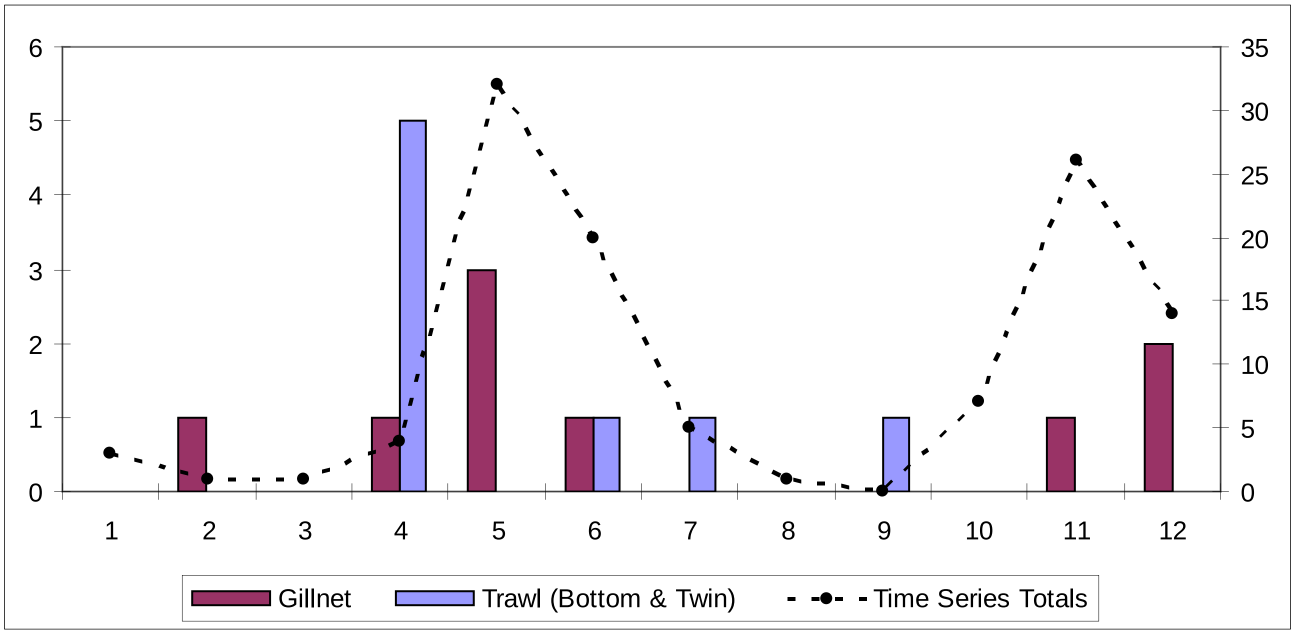


Figure 2. The number of Atlantic sturgeon caught as bycatch by month per general gear types for 2011 and for all gears combined for the time series from 1994 to 2011 (see Table 2 for details). This data is from observed trips made by the NMFS Sea Sampling & Observer Program for Statistical Areas 537, 538, 539, 611, 613 from 1994 to 2011.



Connecticut
Atlantic Sturgeon Compliance Report for 2011

Annual Compliance Report to the Atlantic States Marine Fisheries Commission

By Tom Savoy
Connecticut Department of Energy and Environmental Protection
Marine Fisheries Division

September 25, 2012

I. Introduction

Atlantic sturgeon are present seasonally in Connecticut waters. A State Wildlife Grant study to investigate the abundance and distribution of Atlantic sturgeon in Connecticut waters was conducted from 2006 through 2010. These directed efforts collected a total of 738 Atlantic sturgeon over the course of the study. Connecticut partnered with several other entities for a NMFS funded Section 6 study through the State of Delaware on 'Sturgeons in the mid-Atlantic region: a multi-state collaboration or research and conservation.' from 2010 through 2013.

Management: With the listing of Atlantic sturgeon from the New York Bight DPS as US Federally Endangered, State listing of Atlantic sturgeon in Connecticut was changed from State Threatened in freshwaters to state Endangered. Take and possession of both Atlantic and shortnose sturgeon is prohibited in Connecticut.

II. Request for *de minimis* – Not Applicable

III. Previous Calendar Year's Fishery and Management Program

a. **Fishery dependent monitoring –**Connecticut marine and inland waters are closed to all fishing for Atlantic sturgeon. Historic commercial landings of Atlantic sturgeon in Connecticut from 1989 to 1995 are presented in Table 1.

b. **Fishery independent monitoring –** Atlantic sturgeon are collected in the Department's annual Long Island Sound multi-species trawl survey (1984-2011). Results of these efforts are presented in Table 1, however, low catch rates for this rare species render the survey indices of abundance unreliable for monitoring trends in abundance. Atlantic sturgeon were also collected in the Connecticut River and in Long Island Sound during sturgeon research efforts (1988-2011). These efforts were variable over time, consequently the numbers of sturgeon collected should not be utilized as an index of abundance.

   Connecticut participates in the U.S. Fish and Wildlife Service Coastwide cooperative tagging effort. All Atlantic sturgeon captured receive USF&WS t-bar tags and a PIT tag when possible and information is placed into the national database.

c. **Copies of regulations in effect –** See Appendix 1.

d. **Harvest broken down by commercial and recreational and non-harvest losses-** Commercial harvest of Atlantic sturgeon from the marine waters of the State has been prohibited by regulation since September 24, 1997. Estimates of non-harvest losses are not available.

e. **Review of progress in implementing habitat recommendations.** Not applicable.

IV Planned Management Programs for the Current Calendar Year – No change to the current management programs are planned.

a. Summarize regulations that will be in effect. The taking of sturgeon (Acipenser spp.) is prohibited in inland waters of the state. In Marine waters no person shall take, possess, sell, exchange or offer for sale or exchange any Atlantic or shortnose sturgeon.

b. Summarize monitoring programs that will be performed. See III d above. No changes from previous monitoring activities are planned.

c. Highlight any changes from the previous year. No changes.

V. Plan Specific Requirements

a. Bycatch monitoring - Taking of sturgeon both Atlantic and shortnose has been prohibited in inland waters since the mid-1980s. A total of 16 sturgeon were reported captured and released as bycatch in the Connecticut River shad gillnet fishery for April, May and June of 2011. Mortality rates and true species composition are unknown but mortalities are thought to be rare since the nets are actively fished, have relatively short soak times and water temperatures are cool.

b. Review of Progress in implementing habitat recommendations - Threats to the habitat of Atlantic sturgeon in Connecticut are minimized through the regulatory processes that govern permitted activities. All proposed regulated activities are reviewed for possible impacts of the structures and/or activities on Atlantic sturgeon. Atlantic sturgeon have *Threatened Status* in the freshwaters of the State and are thus afforded an extra level of protection, particularly in the Department's permitting process.

c. Aquaculture operations, status of regulations, disease-free certification - No aquaculture activities have been permitted in Connecticut for Atlantic sturgeon.

Table 1. The number of Atlantic sturgeon collected in the CT River and in directed research collections by year and location, commercial landings, reported bycatch in the American shad fishery, and annual catch in Long Island Sound from the CT Long Island Sound Trawl survey (LIST) with geometric means abundance indicies from the spring and fall.

YEAR	CT RIVER	Directed Collections	Landings (lbs)	Reported Bycatch	LIST	LISTS SPRING	LISTS FALL
1988	24				5	0.01	0.00
1989	6		1445[1]		13	0.01	0.02
1990	8		1585		8	0.01	0.02
1991	31	8	2205		3	0.01	0.01
1992	5		160[2]		30	0.03	0.08
1993	2		182		60	0.02	0.08
1994	2		310		60	0.03	0.06
1995	2		126		6	0.01	0.02
1996	2	59			3	0.01	0.01
1997	2				6	0.01	0.02
1998	1				17	0.05	0.02
1999	5				39	0.04	0.07
2000	3				7	0.02	0.03
2001	2	40			18	0.01	0.08
2002	12				17	0.05	0.05
2003	4				29	0.00	0.10
2004	1	48			8	0.00	0.04
2005	19	61		19	8	0.02	0.03
2006	13	64		21	20	0.05	0.10
2007	36	125		21	13	0.02	0.05
2008	11	174		50	7	0.01	0.06
2009	13	152		22	18	0.01	0.10
2010	58	88		17	1[4]	0.01	-
2011	44	91		16	5	0.10	0.02

NS = Not Sampled
1. Prior to 1989, Atlantic sturgeon did not have a species code for CT Commercial Catch Reports.
2. Increase in Minimum length from 48” to 84”.
3. Spring and Fall indices do not reflect the total number of sturgeon caught, only those taken in regular survey were used for index values.
4. Mechanical problems prevented LISTs survey from being conducted after May 30th.

APPENDIX 1. Connecticut Regulations Regarding Atlantic Sturgeon

26-142a-8a. Species restrictions

(a) Blue Crabs. No person shall take or attempt to take any blue crabs in any waters of this state except by scoop or scap net, handline or manually operated and personally attended devices described below:

(b) Minimum Legal Length. No person shall possess any fish taken by any commercial fishing gear or for commercial purposes less than the lengths specified below measured from the tip of the snout to the end of the tail and, notwithstanding section 26-159a-4 of the Regulations of Connecticut State Agencies, no person shall buy, sell, offer for sale or possess in a place where fish are offered for sale, any of said species less than the minimum legal length stated herein.

(c) Sturgeon

(1) No person shall take, possess, sell, exchange, or offer for sale or exchange in Connecticut any Atlantic sturgeon (Acipenser oxyrinchus) or shortnose sturgeon (Acipenser brevirostrum).

(2) Any sturgeon taken contrary to the provisions of this subsection shall be immediately returned, without avoidable injury, to the waters from which it was taken.

Orig. 12/15/00

New York State's
Atlantic Sturgeon Annual Report for 2011 and 2012
to the
Atlantic States Marine Fisheries Commission

Prepared by:
Hudson River Fisheries Unit
Bureau of Marine Resources
New York State Department of Environmental Conservation

1. Bycatch Monitoring - Fishery dependent data

1.1. Hudson River Estuary

The American shad fishery was closed in 2010. Bycatch of juvenile Atlantic sturgeon no longer occurs (Table 1).

1.2 Atlantic Ocean and Long Island Sound

Data on ocean bycatch were not obtained for 2011-12. NYSDEC anticipates obtaining future bycatch data through the ACCSP bycatch module or by state funded sea sampling.

2. Monitoring results- Fishery independent data

2.1 Juvenile abundance

2.1.1 Methods

Hudson Generators Fall Shoals Survey

Fishery independent data on relative abundance of juvenile Atlantic sturgeon prior to emigration from the Hudson River Estuary have been collected annually by contractors to Hudson River power generators (HRG) and other researchers since 1974. The most extensive HRG time series of data were obtained by one-meter epibenthic sled in a weekly spring-summer ichthyoplankton survey and a bi-weekly three-meter beam trawl in a fall shoals survey (FSS). To calculate annual abundance indices from these data, we subset each data series to the time period of highest catches and most consistent sampling. Resulting data from the epibenthic sled and three-meter beam trawl were from May-July and July-October, respectively. Abundance indices were calculated as total catch/total samples. Data from the three-meter beam trawl appear to be more useful for tracking relative annual abundance of juveniles because the gear is larger and catches of sturgeon are higher in the beam trawl than in the epibenthic sled. Data reported for the HRG surveys are still draft, based on monthly field reports sent to the DEC.

This program suffered a major loss of data in 2012 as the HRG did not possess a NMFS endangered species permit when the Atlantic sturgeon were listed. HRG obtained their permit by late August. Bottom sampling with a beam trawl resumed in September; sampling was limited by water temperature and dissolved oxygen restrictions listed in the NMFS permit. We will examine the data in the future stock assessment as to how this affected the annual index from this survey.

NYSDEC Juvenile Relative Abundance Survey

Although the HRG data are extensive, the sample programs do not target Atlantic sturgeon. Therefore, NYSDEC conducted exploratory sampling by gill net in the spring and fall of 2000 to locate times and locations for optimal catches of juvenile sturgeon prior to age of emigration from the estuary. The USFWS Northeast Fisheries Center under contract to NYSDEC conducted seasonal (spring and fall) sampling from fall 2003 through fall 2005. Sampling focused on Newburgh (rkm 90-105) and Haverstraw (rkm 55-65) Bays. Resulting recommendations were to make at least 100 net sets in spring after water temperatures had risen above 4 C and to focus sampling in soft deep habitat of Haverstraw Bay (Sweka et al. 2007). NYSDEC has sampled annually since 2006 as recommended.

In all sampling, we used anchored gill nets of 7.6, 10.2, and 12.7 cm stretch mesh, 61 m long and 2.4 m deep. Nets were set perpendicular to shore and fished for approximately two hours through all tide stages. All sturgeon collected were measured for total length, fork length, weighed, and examined for previous marks. A small piece of flesh was taken from the dorsal fin of each fish for genetic analysis, stored in ethanol, and sent to a NOS Marine Forensic Lab in Charleston, South Carolina. Unmarked fish were tagged in the musculature under the dorsal fin with a Biomark PIT tag and in the base of the dorsal fin with an external Dart Tag in accordance with the Atlantic Coast Sturgeon Tagging Database requirements. These tags bear the legend of the USFWS toll free telephone number at the Maryland Fisheries Resources Office for the reporting of recapture information.

In addition, 15 juvenile Atlantic sturgeon were tagged with sonic tags during this survey to study their movement in comparison to co-occurring shortnose sturgeon, 15 of which were also tagged with sonic tags.

Work performed in the study was conducted under ESA section 10A1a permit 16436; effective on April 6, 2012. Atlantic sturgeon were tagged with internal sonic tags prior to the listing date.

New Jersey Trawl Survey

New Jersey Bureau of Marine Fisheries (NJBMF) conducts a finfish survey in near-shore coastal waters along the entire NJ ocean coastline, Sandy Hook to Cape May. Since 1988, NJBMF has sampled annually in January, April, June, August, and October. Samples were randomly taken within three depth strata (Byrne 1994). Highest and most consistent catches of Atlantic sturgeon come from strata inshore of the 20-m isobath and from the tip of Sandy Hook to Ashbury Park, NJ. We used the data from this region and depth to calculate an annual mean catch per trawl (Table 2).

2.1.2 Results

FSS beam trawl data indicates that an increase in abundance is occurring in the Hudson stock since the fishery closure in 1996. Beginning in 1997, the index has varied in a cyclic manner with peaks occurring approximately every five years (Table 2 and Figure 2). The 2012 index was the second highest value in the time series. As there was a gap in data collection for the first part of the survey in 2012 we subset the data to just September and October for comparison purposes. The same trend is evident.

The presence of young fish was verified by the length data; data include all months of the survey (July through November or December in most years). Mean total length was low when peak abundance occurred (Table 3, Figure 3). The length frequency suggests that most of the smaller fish (<300mm) grow quickly into the larger size range over a two year period. After three years, the number of fish from strong cohorts in trawl catches declines as fish grow to greater than 700 mm. This is most likely due to the ability of these large fish to avoid capture by the beam trawl, and / or a change in their distribution in the river.

Atlantic sturgeon taken by the NYSDEC juvenile gill net survey were generally larger than those taken by the FSS (Tables 3, 4, 5, Figure 4). Mean total length of captured varied among years: size increased from 2003 to 2006; declined slightly until 2008, then increased and remained stable to 2012 (Table 3, Figure 4). Mean total length patterns during spring sampling of the gill net survey track closely to those in the beam trawl survey, with a one to two year lag (Figure 5). This pattern illustrates the transition of fish availability from the beam trawl survey to the gill net survey. Although mean total length patterns show a relationship between the two surveys, it is still unclear whether CPUE indices will do the same. When we attempted to calculate the annual gill net survey index we found that survey catches are affected by varying environmental conditions (e.g. salinity, and salt front movement). We are working on standardizing the gill net survey index before meaningful comparisons can be made to the FSS index.

The FSS and gill net surveys complement each other. Because the FSS samples throughout the spawning and early life stage nursery areas, the first indication of year-class production shows up in this gear's data. However, because juvenile sturgeon grow quickly, the beam trawl tends to only sample them for one to two years (estimated Age-0 and Age-1). The gill net survey continues to sample and track the fish for an additional two to four years (Ages 2 to 3+), before they emigrate from the river. The combination of these studies allows for the identification of successful year classes, and documentation of their transition through the juvenile stage.

New Jersey trawl CPUE (Strata 12&13) increased since 2001 to levels observed in the early 1990s (Table 2). CPUE leveled off from 2006 to 2008, but then declined to the present. Fish captured in this gear are post-migrant sub-adults and tend to be larger than those captured in the Hudson River Estuary (Figure 4).

Data collection on sonic tagged fish is ongoing and will be summarized in future reports.

2.2 Adult Sampling

2.2.1 Methods

Spawning stock sampling

NYSDEC began to sample spawning Atlantic sturgeon in 2006. Effort varied among years dependent on staff and project funding. In 2006 through 2008, NYSDEC cooperated in a study with Erickson et al. (2011) where adult fish were tagged with pop-up satellite archival tags (PSAT) to identify ocean migration patterns. Sampling extended from April through June in the attempt to catch fish on their immigration and / or emigration to and from the spawning area. From 2009 to the present, NYSDEC has continued to conduct limited sampling on the spawning stock, usually three weeks during the month of June. The objective is to monitor size and sex composition of the spawning stock. Large mesh gill nets (25.4 cm to 45.7 cm stretch mesh) are set at or near slack tide in selected deepwater areas in upper Newburgh Bay, near Hyde Park, and Catskill NY. All fish are processed as described above for juvenile fish.

Work performed in the study was conducted under ESA section 10A1a permit 16436; effective on April 6, 2012.

Movement and Habitat Use

During the PSAT tagging study, we also tagged adult fish with sonic tags of 100d, 1.5-yr and 5-yr battery life. The objective of the sonic tag program was to identify specific Hudson River habitats used by adult Atlantic sturgeon by matching fish movement and location data with detailed bottom maps (see http://www.dec.ny.gov/lands/33596.html). The long term 5-yr tags also allowed examination of annual rate of return for adult fish. The 2008 tagged fish are expected to return in 2013.

2.2.2. Results

In 2006 to 2008, 31 fish were tagged with a PSAT, 11 of which received 1-yr duration sonic tags and four with a 100-d tag. In addition, 27 adults were tagged with long term 5-yr sonic tags. From 2009 to the present, crews fished to obtain annual biological data on spawning fish. Catches were dominated by males in all years; females occurred sporadically. It is apparent from sampling that females tend to remain separate from the males, being much more elusive to catch. Fish increased slightly in size from 2006 to 2012 (Table 6).

Data from the sonic tag study are still being collected; 2013 is the final year for returning adult fish tagged with 5yr tags. All data will be summarized in a separate detailed report.

3. Tag recaptures

All tag release data for sturgeon tagged in the Hudson River are annually added to the coast-wide database maintained by the USFWS Maryland Fisheries Resource Office.

Wild fish: Since 1992, 1,563 juvenile/sub-adult and 454 adult wild Atlantic sturgeon have been tagged and released in the Hudson River (Table 7). Most in-river recaptures were from special studies conducted in the Hudson by Bain et al. (1998) in the 1990s, 2003-2005 by USFWS and since 2006 by NYSDEC. Most of the recaptures (Table 7) occurred within the Hudson River (311), followed by CT (36), NJ (21), DE (19) and Chesapeake Bay (17 in MD and 11 in VA). In the past, most fish moved south after leaving the Hudson River. Most recently a higher percentage of recaptures, outside of the Hudson, have come from CT and the Long Island Sound trawl survey (Table 7).

Hatchery fish: The first experimental hatchery release for the Hudson occurred in 1994 when approximately 4,925 age-zero fish were released, marked with CWT and a left pelvic fin clip. Many (210) recaptures occurred during a three year study on juvenile fish following release (Bain et al. 1999). These fish have also been caught widely on the coast from VA to CT. In 2009 and 2010, two fish returned as mature adults to the Hudson spawning areas near Hyde Park NY. It is anticipated that more of these fish will begin to return to the Hudson in coming years (Table 7). The six fish recaptured in 2011 were caught off Bethany Beach, DE.

In 2004, a second experimental release occurred when larger, age seven to ten, juveniles, of known Hudson parentage, were released back to the river. Several fish remained in the river for a short period of time as three recaptures occurred in 2004; one fish left and was caught in VA (Table 7). From 2005 to 2007, recaptures of these fish occurred from CT to NC; after 2007 no other recaptures have occurred.

Bycatch fisheries

Details of many potential commercial bycatch recaptures of Hudson River sturgeon in the coast-wide tag database were unclear because of inconsistent data reporting. This was especially true for the sample type recognized as “Reported to USFWS” a fishery dependent data category. Recapture gear is often missing and target species in commercial fisheries are indicated for a portion of these recaptures. We recommend that all recapture data be reviewed to fill the gaps, including follow-ups with the reporting person or agency to clarify missing data where possible.

Fisheries capturing Hudson River Atlantic sturgeon are spread out on the coast from RI to NC (Table 8). Independent sampling recapture reports have increased since 2007, concurrent with the few increased research efforts focused on Atlantic sturgeon. There are far more commercial fisheries operating on the Atlantic coast yet fishery dependent reports are declining indicating the need for better monitoring (Table 9). Fishery dependent reports included pre-moratorium sturgeon fisheries along with monkfish then a variety of other fisheries targeting fluke, striped bass, weakfish, bluefish and blackfish. Anchored gill nets accounted for 37% of all the by-catch reports.

Although the ASMFC (2007) bycatch report focused on ocean bycatch of Atlantic sturgeon, the potential for bycatch remains high in estuarine and riverine fisheries. This is evidenced by the recaptures reported as bycatch in striped bass fisheries along the coast. This fishery is large, often occurs in rivers, and has the potential to capture juvenile sturgeon as they move among east coast estuaries. One hatchery juvenile released in the Hudson (#352040246) was caught three times within two weeks during the striped bass anchored gill net fishery in the Potomac River. Multiple recaptures, such as this, have the potential to add to mortality of the stock

4. Habitat Status

Locations of spawning and nursery areas within the Hudson River Estuary were summarized in ASMFC (1998). There are no known water quality problems within the reach of Estuary used by Atlantic sturgeon. DEC staff routinely comment on permit applications to prevent activities such as dredging during times and at locations that might harm overwintering concentrations of juvenile Atlantic sturgeon or spring spawning aggregations of adults

In 2010, a transmission cable company proposed to lay a high voltage (1000MW) power transmission line down 133 km of the length of the Hudson River from just above Saugerties (km 165) to the Harlem River (km 22) to Astoria, Queens, NY. Only Haverstraw Bay, a known over-wintering area for juvenile sturgeon will be bypassed. Negotiations are ongoing with the company to conduct habitat studies to examine possible effects of the cable and its magnetic field throughout the major spawning area.

5. Aquaculture

There are no aquaculture operations in NY State licensed or authorized to possess or raise Atlantic sturgeon.

6. Status of Regulations

Existing NY State regulations prohibit possession of Atlantic sturgeon. No changes have occurred since they were enacted in 1996.

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Table 1. Bycatch of juvenile Atlantic sturgeon in fishery dependent sampling of the American shad gill net fishery in the Hudson River Estuary.

	NYSDEC				Bycatch reported	
	Fixed Gillnet Fishery Bycatch				by gill net fishers	
Year	N-trips	Effort*	N-fish	c/f*100	Drift	Fixed
1974						
1975						
1976						
1977						
1978						
1979						
1980	14	1108.72	63	56.82		
1981	9	505.89	16	3.16		
1982	18	1583.46	69	4.36		
1983	17	1400.16	7	0.50		
1984	50	3562.18	31	0.87		
1985	42	2701.98	29	1.07		
1986	40	2472.25	9	0.36		
1987	42	5663.48	27	0.48		
1988	30	3619.29	28	0.77		
1989	8	650.90	2	0.31		
1990	23	2241.73	12	0.54		
1991	22	2323.34	6	0.26		
1992	32	3378.08	5	0.15		
1993	8	809.73	0	0.00		
1994	9	823.20	2	0.24		
1995	12	1589.52	1	0.06	0	14
1996	19	1793.75	0	0.00	6	2
1997	**23**	**1626.25**	**9**	**0.55**	**0**	**15**
1998	**17**	**814.32**	**0**	**0.00**	**0**	**13**
1999	**26**	**1010.79**	**7**	**0.69**	**0**	**8**
2000	**16**	**475.17**	**0**	**0.00**	**0**	**0**
2001	**23**	**413.08**	**2**	**0.48**	**0**	**9**
2002	**4**	**43.44**	**0**	**0.00**	**0**	**1**
2003	**1**	**19.25**	**0**	**0.00**	**0**	**0**
2004	**2**	**17.11**	**0**	**0.00**	**0**	**1**
2005	**1**	**3.02**	**0**	**0.00**	**0**	**1**
2006	**2**	**27.64**	**0**	**0.00**	**1**	**2**
2007	**3**	**3.33**	**0**	**0.00**	**0**	**1**
2008	**2**	**9.09**	**0**	**0.00**	**1**	**1**
2009	**0**	**0**	**0**	**0**	**0**	**0**
2010	**American shad fishery closed**					

BOLD = sturgeon fishery closure 1997 to present

* Effort - square-yard-hours*10^-3

Table 2. Incidental catch of juvenile Atlantic sturgeon in fishery independent sampling of the Hudson River Estuary and near-shore ocean. Two times series presented for the FSS survey (see text).

	Hudson River Power Generators Surveys									New Jersey* Ocean trawl		
	Epibenthic Sled			Fall Shoals Survery								
Year	N-hauls	N-fish	c/f*100	N-trawls	N-fish	c/f*100 Jul-Oct	N-trawls	N-fish	c/f*100 Sep-Oct	N-hauls	N-fish	c/f*10
1974	1138	47	4.13									
1975	661	38	5.75									
1976	984	16	1.63									
1977	1058	10	0.95									
1978	983	7	0.71									
1979	1036	14	1.35									
1980	829	5	0.60									
1981	788	4	0.51									
1982	733	5	0.68									
1983	768	9	1.17									
1984	812	19	2.34									
1985	845	8	0.95	1247	94	7.54	59	776	7.60			
1986	896	5	0.56	1302	160	12.29	87	818	10.64			
1987	884	12	1.36	1288	141	10.95	44	648	6.79			
1988	969	10	1.03	1277	117	9.16	40	649	6.16	10	1	1.00
1989	945	0	0.00	1271	52	4.09	20	638	3.13	25	23	9.20
1990	915	2	0.22	1265	6	0.47	2	628	0.32	20	6	3.00
1991	983	6	0.61	1269	10	0.79	4	635	0.63	22	13	5.91
1992	917	0	0.00	1263	11	0.87	6	633	0.95	23	21	9.13
1993	930	0	0.00	1258	7	0.56	4	744	0.54	21	8	3.81
1994	933	2	0.21	1262	16	1.27	9	677	1.33	20	0	0.00
1995	968	1	0.10	1271	15	1.18	9	643	1.40	20	4	2.00
1996	979	0	0.00	1214	8	0.66	4	607	0.66	20	2	1.00
1997	**963**	**0**	**0.00**	**1020**	**37**	**3.63**	**28**	**588**	**4.76**	**20**	12	6.00
1998	**937**	**2**	**0.21**	**1013**	**20**	**1.97**	**16**	**584**	**2.74**	**20**	0	0.00
1999	**922**	**1**	**0.11**	**969**	**16**	**1.65**	**12**	**511**	**2.35**	**20**	5	2.50
2000	**926**	**0**	**0.00**	**1003**	**4**	**0.40**	**2**	**472**	**0.42**	**20**	0	0.00
2001	**948**	**1**	**0.11**	**977**	**20**	**2.05**	**10**	**544**	**1.84**	**20**	0	0.00
2002	**972**	**1**	**0.10**	**1011**	**36**	**3.56**	**23**	**580**	**3.97**	**22**	1	0.45
2003	**948**	**1**	**0.11**	**1013**	**37**	**3.65**	**18**	**581**	**3.10**	**21**	7	3.33
2004	**928**	**2**	**0.22**	**1008**	**22**	**2.18**	**9**	**541**	**1.66**	**20**	13	6.50
2005	**912**	**0**	**0.00**	**1015**	**10**	**0.99**	**3**	**519**	**0.58**	**20**	10	5.00
2006	**932**	**0**	**0.00**	**1013**	**11**	**1.09**	**7**	**475**	**1.47**	**20**	22	11.00
2007	**880**	**1**	**0.11**	**1013**	**28**	**2.76**	**17**	**475**	**3.58**	**20**	14	7.00
2008	**948**	**1**	**0.11**	**1010**	**17**	**1.68**	**7**	**579**	**1.21**	**20**	18	9.00
2009	**948**	**5**	**0.53**	**1013**	**15**	**1.48**	**8**	**574**	**1.39**	**20**	8	4.00
2010	***948***	***3***	***0.32***	***930***	***19***	***2.04***	***11***	***396***	***2.77***	**20**	2	1.00
2011	***948***	***0***	***0.00***	***908***	***19***	***2.09***	***9***	***396***	***2.27***	**20**	0	0.00
2012	***948***	***1***	***0.11***	***476***	***48***	***10.09***	***48***	***476***	***10.09***			

Estimated and/or draft numbers for 2010 to 2012 for the HRG surveys, DEC not in possession of data to verify

* NJ data provided by NJ Div. of Marine Fisheries.

Table 3. Mean total length (mm) of juvenile Atlantic sturgeon caught by beam trawl in the Hudson River Generators Fall Shoals Survey (FSS), by gill net in the NYSDEC-USFWS juvenile abundance sampling in the Hudson River Estuary and by the New Jersey trawl survey off Sandy Hook.

	Fall Shoals Survey					NYSDEC Gill Net Survey					New Jersey Trawl				
Year	N	Max	Min	Mean TL	SD	N	Max	Min	Mean TL	SD	N	Max	Min	Mean TL	SD
1988											1	900	900	900.0	
1989	52	785	110	591.9	100.9						23	1230	700	923.0	123.5
1990	6	686	475	604.7	71.9						6	1330	800	1020.0	231.6
1991	10	865	149	332.5	242.7						13	1310	690	927.7	152.6
1992	11	695	102	487.4	187.8						21	1750	690	980.0	205.1
1993	7	985	147	588.9	254.0						8	1160	970	1055.0	65.9
1994	16	1175	119	329.6	261.9										
1995	15	605	280	420.0	87.5						4	1190	740	967.5	230.3
1996	8	615	85	358.8	219.5						2	750	720	735.0	21.2
1997	40	706	88	260.9	125.3						12	2150	590	950.8	437.0
1998	30	810	207	490.2	127.1										
1999	18	952	450	670.3	128.9						5	1270	880	986.0	166.4
2000	5	720	51	299.8	250.4										
2001	21	570	123	241.1	114.1										
2002	37	607	86	308.8	166.0						1	1040	1040	1040.0	
2003	39	732	134	463.6	126.2	121	905	415	587.9	85.1	7	1230	880	1072.9	116.6
2004	22	722	372	570.7	90.8	217	1230	436	646.5	103.3	13	1220	520	724.6	234.9
2005	12	805	292	649.3	134.3	253	1240	364	714.0	107.3	10	1140	660	843.0	136.1
2006	14	761	192	421.0	154.4	73	970	359	774.1	106.0	22	1080	700	880.0	107.1
2007	35	581	121	297.5	118.5	40	968	295	745.6	161.1	14	1110	830	958.6	93.1
2008	17	679	124	433.6	173.2	67	1125	314	599.8	161.6	18	1280	790	1061.7	131.7
2009	30	860	190	494.0	179.9	195	1025	306	629.2	101.2	8	1070	620	815.0	157.8
2010	19	840	375	547.9	139.5	201	1290	426	703.5	118.1	2	1490	1140	1315.0	247.5
2011	21	740	94	508.6	184.0	162	1114	430	668.7	138.6	0				
2012	60	1081	80	407.8	138.6	258	1228	291	697.8	153.5					

Table 4. Length frequency of juvenile Atlantic sturgeon collected by beam trawl in the Hudson River Power generators Fall Shoals Survey (all months).

TL-mm	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<=100								1	1			1		1									1	1
120	1			1		1																		
140						1			2				3	3	1				2	3				
160			2		1	1		1	1				2	3										
180			1						3				3	3					1					1
200			1			1		1	4				2	9	1			1	4		1			1
220			1						7	1		1	1	1				1	3					3
240			1	1		4		1	5			1	1	1	1			1	2		1			2
260			1			1			7				3					1	6	1	2		2	1
280						2	1		2	2			2						4		2		2	2
300						1				2		1					1		1	1	1			
320																					2		1	
340	1												1						1		1			
360							3								2									
380						1	2		1	1			1		3	1			2			1		1
400							2		1							1			1			2		4
420				1			1		3					1	8			1	3			1		16
440														1	3	1		1		1		1		12
460				1			2	1		2	1			1	4			2	1	1	1	1		8
480		1			1	1				4			1	5	1	1			1	2		2		3
500	1		1	2			1			1				3				2		4		1		1
520	7						1		1	2	1			1	2	1		3	1	2		2	1	1
540	2			1						1				1	1					4	4			
560	5				1		1			5	2			2	4	3				1	3		1	
580	3				1			1		4			1		1	3			1	1	1		4	
600	5	1						1	1	3	1					2	3		1	1	3			
620	9	2	1	1			1	1		1				1	1	3					3	2	5	
640	2										4				3	3								
660	4	1		1		1					1				1	1	2					3	1	1
680	7										1				1		1			2	2	1	1	
700	1	1		2	2												2							
720	2								1		1	1								1			1	
740	1										3				1	2					1		1	
760											1						1				1			1
780																		1						
800	1																							
820										1							2					1		
840																						1		
860																					1			
880			1																					
900																								
920																								
940																								
960											2													
980																								
1000					1																			
>1000						1																		1
TOTAL	52	6	10	11	7	16	15	8	40	30	18	5	21	37	39	22	12	14	35	25	30	19	21	60

Table 5. Length frequency of juvenile Atlantic sturgeon collected by gill net (NYSDEC-USFWS) in the lower Hudson River and by trawl in coastal ocean waters off Sandy Hook (Strata 12 &13 only), New Jersey.

	NYSDECgill net -Hudson River									
TL-mm	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<=100										
120										
140										
160										
180										
200										
220										
240										
260										
280										
300					1					1
320						1	2			3
340						1	1			1
360				1		1				6
380			1			1	1			4
400										7
420	1					3				5
440	3	2				4		1	3	3
460	4	3	1			2	2		2	
480	4	5	1			4			4	
500	7	7	1		2	3	4		10	
520	10	8	1		1	3	5		7	
540	14	16	6	2	4		8	3	13	2
560	8	13	2			2	18	5	11	1
580	10	8	8	2	1	6	21	24	5	3
600	8	7	8	2		6	26	14	5	4
620	2	12	12		1	7	14	15	4	4
640	8	15	14	1		1	18	17	2	12
660	13	17	17	1		4	13	4	12	14
680	13	19	27		1	3	13	2	7	29
700	6	21	19	3	3	1	7	9	13	30
720	8	16	20	6		1	7	12	6	23
740		18	27	4	1	1	7	18	8	17
760		6	15	5	1	1	8	16	8	9
780	1	5	15	7	4	2	5	13	4	10
800		6	14	6	1	1	6	18	6	8
820		6	9	7	4	1	2	9	8	11
840		4	9	7	3		4	3	6	13
860			10	8	2	1		3	6	8
880		1	4	4	3	2		4		9
900		1	2	1	1			3	4	6
920	1		5	2	2	1		2	4	3
940			1	2		1	1			4
960				1	2	1		1		2
980				1	2		1	2	1	2
1000									1	1
>1000		1	4			1	1	3	2	3
TOTAL	121	217	253	73	40	67	195	201	162	258

	New Jersey coastal ocean trawl																						
TL-mm	1988	1989	1990	1991	1992	1993		1995	1996	1997		1999		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<=100																							
120																							
140																							
160																							
180																							
200																							
220																							
240																							
260																							
280																							
300																							
320																							
340																							
360																							
380																							
400																							
420																							
440																							
460																							
480																							
500																							
520																2							
540																1							
560																							
580																							
600										1						2							
620																					1		
640																2							
660																	1						
680										1													
700		1		1	1					1						2		1			1		
720		1							1	2							2	1			1		
740								1													1		
760		1		1					1									1					
780										1						1		3			1		
800			1	1				1		1						1	1			1			
820		1								1							1	1					
840		1	1		2													2	1	1			
860		1			2													2	1				
880		2	1		2							2			1		1	1	1				
900	1	3		3								1					2		3				
920		2			1												1	1	1				
940		1		2	3													1					
960		1		2	1													3	2	1	2		
980		1			1	1				1								2		2			
1000		2	1	1	1	2						1			1				1	2			
>1000	0	5	2	2	7	5		2	0	3		1		1	5	2	1	3	5	12	1	2	0
TOTAL	1	23	6	13	21	8		4	2	12		5		1	7	13	10	22	15	19	8	2	0

Table 6. Adult Atlantic sturgeon collected in the Hudson River Estuary, NY.

Year	Total length (m) Number measured	Total length (m) Mean	Total length (m) SD	Weight (kg) Number measured	Weight (kg) Mean	Weight (kg) SD	Total number caught
	Male						
2006	30	1.88	0.15	1	41		32
2007	21	1.86	0.16	0			21
2008	66	1.89	0.17	51	46.84	13.25	71
2009	42	1.91	0.15	41	51.10	10.85	46
2010	59	1.94	0.29	44	55.57	11.74	59
2011	28	1.93	0.12	28	45.43	12.34	29
2012	73	1.90	0.14	73	42.21	10.26	87
	Female						
2006	3	2.25	0.17	0			3
2007	3	2.21	0.12	0			3
2008	5	2.31	0.08	5	95.00	11.22	6
2009	0						0
2010	1	2.12		1	80.00		1
2011	1	2.51		1	114.00		1
2012	0						0
	All fish						
2006	36	1.88	0.26	1	41.00		45
2007	28	1.82	0.38	0			28
2008	79	1.89	0.27	59	50.07	19.46	110
2009	43	1.91	0.15	41	51.10	10.85	53
2010	60	1.94	0.29	45	56.11	12.16	67
2011	29	1.95	0.16	29	47.79	17.58	35
2012	73	1.90	0.14	73	42.21	10.26	123

Table 7. Release/recapture matrix of all tagged Atlantic sturgeon released in the Hudson River, NY, reported to the USFWS Coastal Cooperative Sturgeon Tagging Database (Updated to Dec 2011, 2012 recapture year not complete)

Juveniles and Sub-Adults																						
Wild Releases		Recapture Year																				
Year	N	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
1992	2																					0
1993	14		1	1	3	3	1															9
1994	4																					0
1995	31					1																1
1996	17					1	1															2
1997	3							1														1
1998	16								1					1								2
1999	1																					0
2000	73										2			1		1						4
2001	0																					0
2002	0																					0
2003	120													4	5	1	2	3	3	1		19
2004	209													5	3	1		1				10
2005	244														1	2	4	2	3			12
2006	71															1				1		2
2007	81																					0
2008	98																		4	4		8
2009	219																			4	1	5
2010	201																					0
2011	159																				2	2
Total	1563	0	1	1	3	5	2	1	1	0	2	0	0	11	9	6	6	6	10	10	3	77
Hatchery Releases*																						
1994	4925					16	89	105	4	1	3		1		1		4	4	5	1	6	240
2004	207													4	14	4	3					25

*USFWS-NEFC Lamar, 1994 age0, 2004 ages4-10

Table 7 Continued.

Adult fish																						
Wild Releases		Recapture Year																				
Year	N	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
1992	0																					0
1993	14			1	3																	4
1994	44			5	1		1	1											1	3		12
1995	35				3	1	2															6
1996	25					1		3														4
1997	29						2	1														3
1998	72							15														15
1999	0																					0
2000	0																					0
2001	0																					0
2002	0																					0
2003	0																					0
2004	0																					0
2005	0																					0
2006	34																	4	2	3		9
2007	25																			1		1
2008	64																	1	3			4
2009	36																		3	2	2	7
2010	49																			1		1
2011	27																				1	1
Total	454	0	0	6	7	2	5	20	0	0	0	0	0	0	0	0	0	5	9	10	3	67

Table 8. Recaptures, by state and water body, of tagged Atlantic sturgeon released in the Hudson River, NY, reported to the USFWS Coastal Cooperative Sturgeon Tagging Database (Updated to Dec 2011, 2012 recapture year not complete)

Capture State	Capture Waterbody	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
MA	Atlantic Ocean								1												1
RI	Block Island Sound														1						1
	Rhode Island Sound																		1		1
CT	Connecticut River																		2		2
	Long Island Sound				1			1						1	1	8	11	8	2		33
	Niantic Bay						1														1
NY	Atlantic Ocean					1	1		1						1	4			1		9
	Hudson River	4	4	6	18	91	129		1				10	8	1		6	13	14	6	311
NJ	Atlantic Ocean		3	1	3		1	2					2	1		3		1			17
	Delaware Bay													2							2
	Hudson River			1																	1
	Raritan Bay									1											1
DE	Atlantic Ocean												1					1	1	6	9
	Delaware Bay		1											2							3
	Delaware River			1		3				2				1							7
MD	Chesapeake Bay					2	1	1		1				5							10
	Choptank River													1							1
	Nanticoke River													1							1
	Pocomoke Sound											1									1
	Potomac River													1	3						4
VA	Atlantic Ocean			1		1		1	1	1											5
	Chesapeake Bay												1								1
	James River													1	2						3
	Potomac River												1		1						2
NC	Albemarle Sound													1							1
	Atlantic Ocean					1												1			2

Table 9. Fishery dependent recaptures by gear or target species of tagged Atlantic sturgeon released in the Hudson River, NY, reported to the USFWS Coastal Cooperative Sturgeon Tagging Database (Dec 2011).

	By Gear								By Target species										
Capture Year	Unknown	Anchored Gillnet	Drift Gillnet	Gillnet	Hook and Line	Pound Net	Trawl	Total	Unknown	Blackfish	Flounder	Fluke	Monkfish	Seabass	Shad	Striped Bass	Sturgeon	Weakfish/ Bluefish/ other	Total
1994		3		1				4	1								3		4
1995	1	3						4	2				1				1		4
1996	1	1		1			1	4	3				1						4
1997	1		1			2	1	5	3					1	1				5
1998		4	1				1	6	3			1	2						6
1999	1		2			1		4	3									1	4
2000		3			1			4	1				1			1		1	4
2001	1	1				1		3	2							1			3
2002								0											0
2003			1					1	1										1
2004	3	3					1	7	5		1							1	7
2005	13	1				2		16	16										16
2006		7						7	4		1					2			7
2007	1						1	2	2										2
2008								0											0
2009			1					1										1	1
2010				2				2		1		1							2
Total								70	46	1	2	2	5	1	1	4	4	4	70

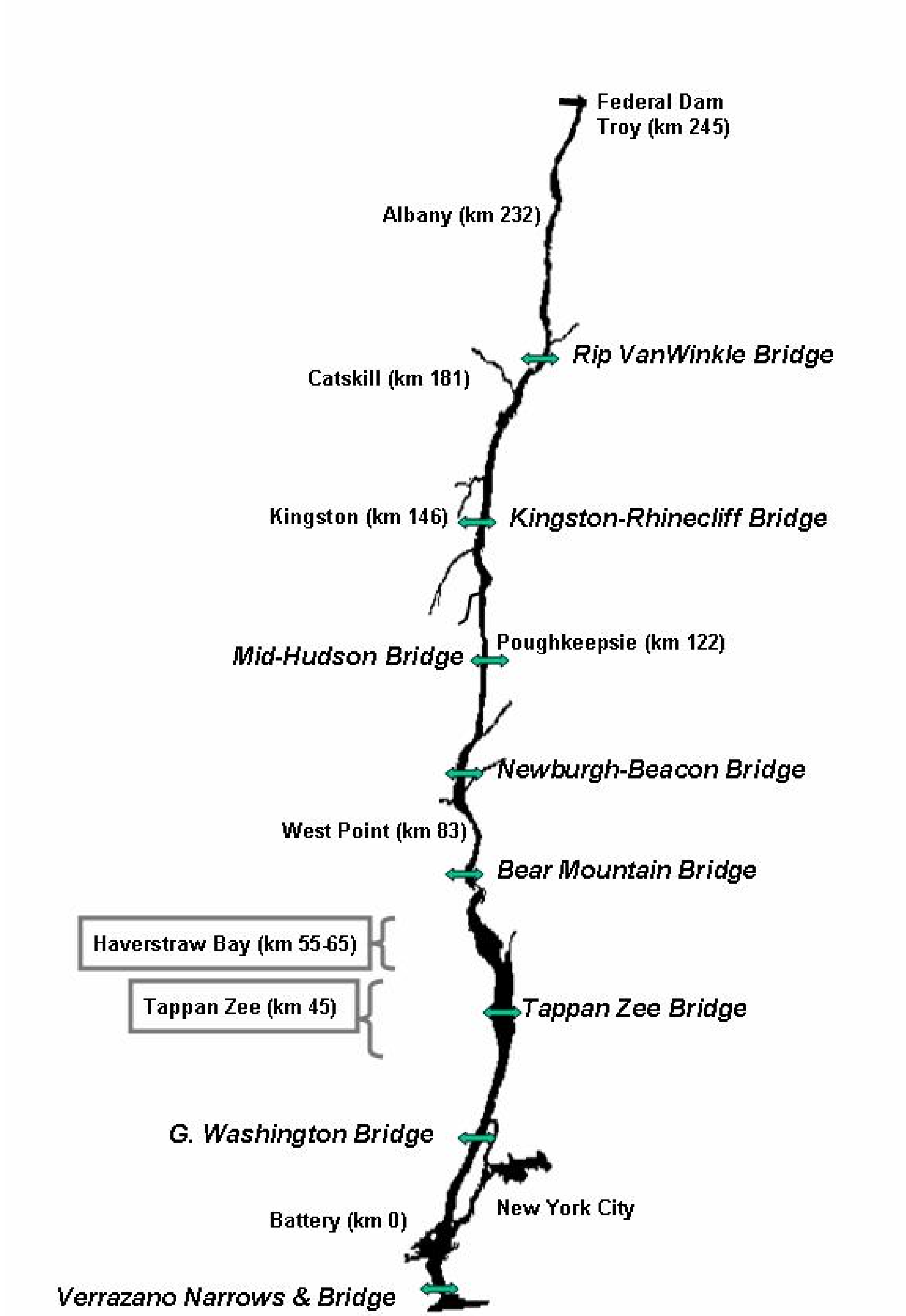

Figure 1. Hudson River Estuary

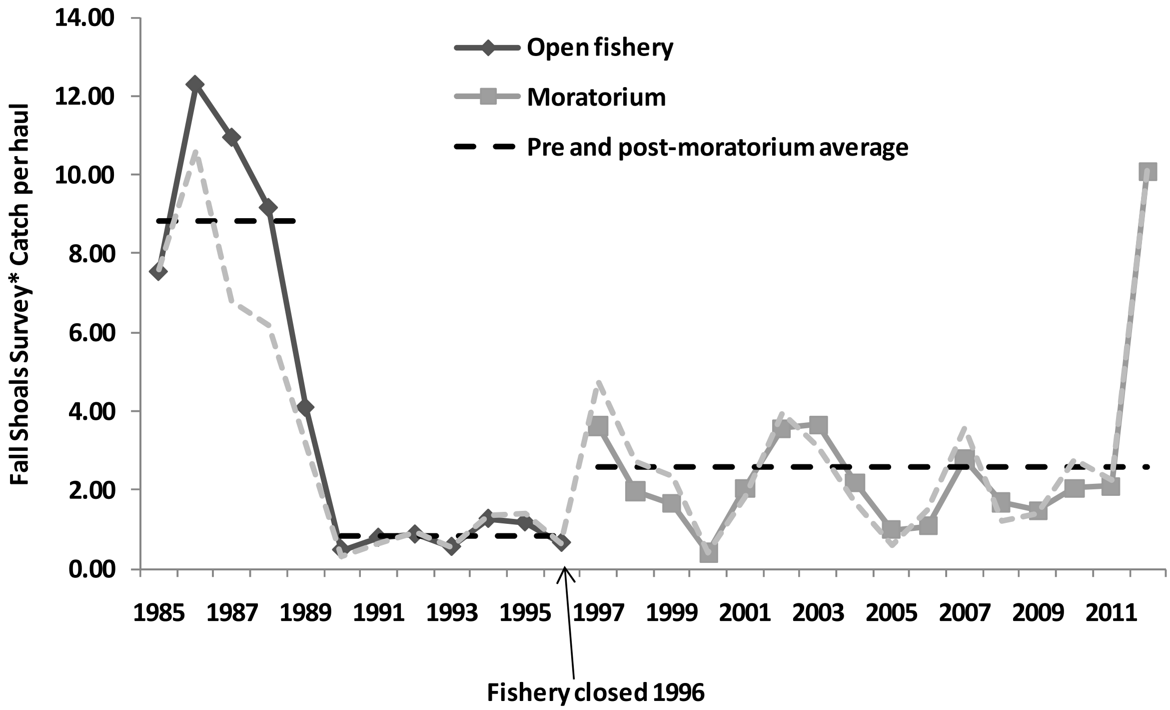

Figure 2. CPUE of juvenile Atlantic sturgeon collected by beam trawl in the Hudson River Power generators Fall Shoals Survey. Solid line= Jul-Oct index, dotted line = Sep Oct index; see text for explanation.

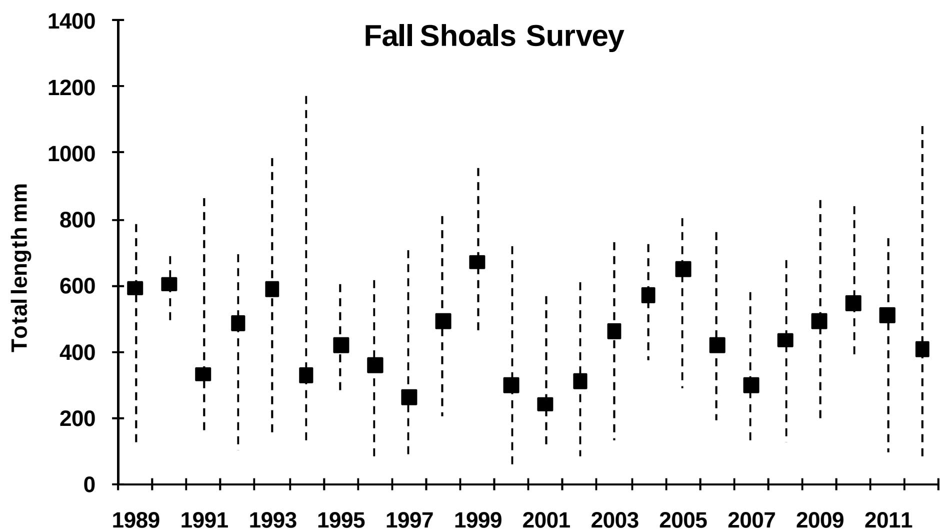

Figure 3. Mean total length (mm – with min-max bars) of juvenile Atlantic sturgeon collected by beam trawl in the Hudson River Power generators Fall Shoals Survey.

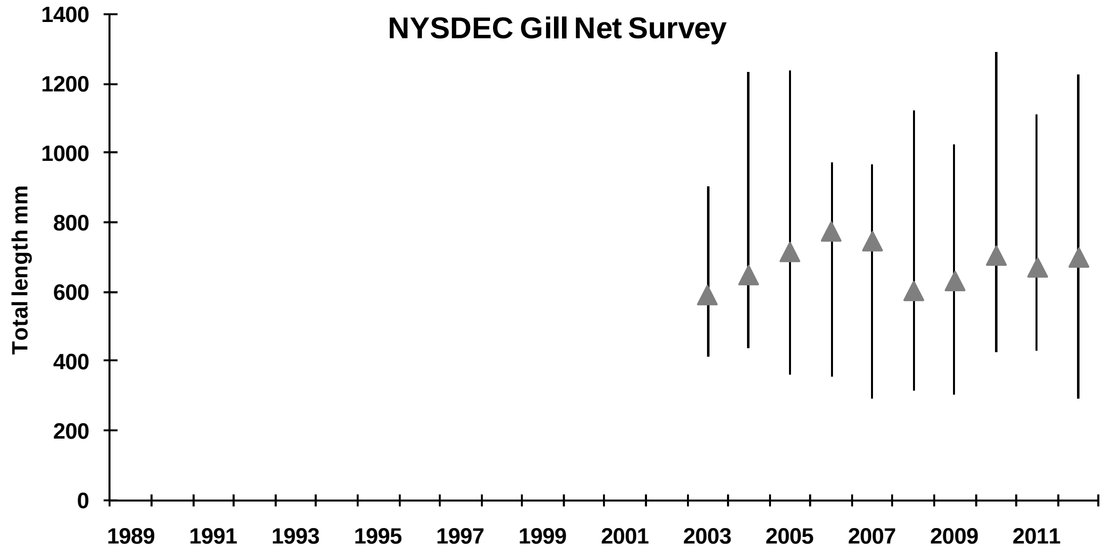

Figure 4. Mean total length (mm – with min-max bars) of juvenile Atlantic sturgeon collected by gill net in the Hudson River gill net survey.

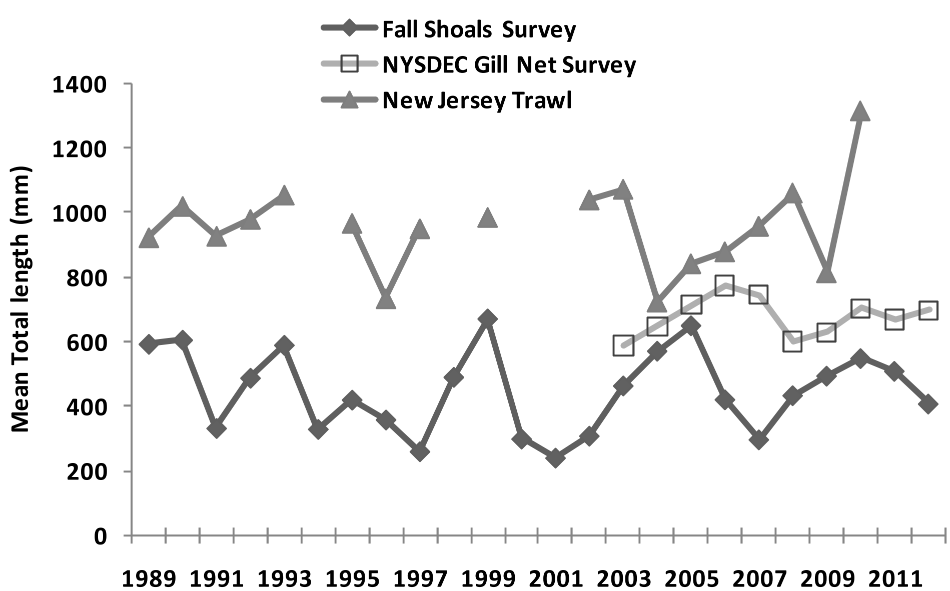

Figure 5. Mean total length (mm) of juvenile Atlantic sturgeon collected by beam trawl and gill net in the Hudson River, and a near shore ocean trawl in coastal New Jersey off Sandy Hook.

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF FISH & WILDLIFE

ANNUAL STATE REPORT FOR ATLANTIC STURGEON: 2011

September 2012

Report By: Heather Corbett
Russ Allen

Submitted to the Atlantic States Marine Fisheries Commission as a requirement to the Interstate Fishery Management Plan for Atlantic Sturgeon

The following addresses Section 5.1.2 of Addendum 1 to the ASMFC Fishery Management Plan (FMP) for Atlantic Sturgeon for an annual compliance report:

Results of By-catch Monitoring for Atlantic Sturgeon in Other Fisheries

Harvest reporting in the American shad gill net fishery was voluntary prior to new regulations that took effect in January 2000. Although shad fishers are required to report shad landings and effort, bycatch reporting of Atlantic sturgeon remains on a voluntary basis. According to logbooks collected from New Jersey commercial shad fishers there was one Atlantic sturgeon caught as bycatch during 2011 in Delaware Bay. This sturgeon was released alive at the time of tending the net.

Permit holders are not required to report Atlantic sturgeon interactions however, so this number may be an underestimate of the total interactions with commercial shad gill netters throughout the state. The accuracy of reported data is also unquantifiable without onboard observers. The data was extrapolated to the entire shad fishery for 2011, based on the number caught by cooperating fishers and effort data from all logbooks. Although the number of interactions is still considered an underestimate, the final reported estimate only increased the catch of one by a decimal (Table 1).

Monitoring Results

The Division's ocean trawl survey, dating back to 1989, has conducted five cruises per year consisting of approximately 39 tows of 20-minute duration per cruise. The survey extends from Sandy Hook to Cape May, NJ and offshore to the 90' isobath. As of December 2011, 310 Atlantic sturgeon were caught by the trawl survey, all were released alive. Table 2 provides Atlantic sturgeon catch data from the Division's coastal trawl survey for 1989 through 2011 including number caught, mean catch per tow, mean length and size range for each year. There were three Atlantic sturgeon caught by the trawl survey during 2011 for an average of 0.016 per haul.

Table 3 provides Atlantic sturgeon caught during the Division's Delaware Bay American Shad and Striped Bass Tagging Program from 2000 to 2012. The Delaware Bay Striped Bass Tagging Program began in 1989 and American Shad Program was added in 1995. Sampling is conducted during February to May of each year. Only four Atlantic sturgeon were caught prior to 2000. There has been no significant change in effort during the sampling periods. Staff encountered one sturgeon during 2011 and none during 2012 sampling. Not all fish are brought aboard the sampling vessel, so a size range is not available for most years.

Since mark/recapture is not a mandatory provision of the Atlantic sturgeon FMP, New Jersey discontinued all tagging of Atlantic sturgeon beginning August 2002. Due to the increase in numbers of Atlantic sturgeon in recent years tagging efforts were resumed in 2009 during the Delaware Bay Striped Bass Tagging Program. One Atlantic sturgeon was caught and tagged during 2011 sampling.

Habitat Status

The Division did not conduct studies directed at Atlantic sturgeon habitat identification during the report period.

Aquaculture Operations

The Division was not involved in any Atlantic sturgeon aquaculture operations during the report period.

Table 1. Sturgeon bycatch from the commercial shad fishery: 1999-2011

YEAR	#FISHERMEN	ALIVE	DEAD	TOTAL
1999	3	13	0	13
2000	14	143	1	144
2001	8	73	0	73
2002	9	60	3	63
2003	8	67	0	67
2004	12	147	0	147
2005	6	55	3	58
2006	6	64	10	74
2007	6	84	0	84
2008	4	46	0	46
2009	2	6	0	6
2010	1	2	0	2
2011	1	1	0	1
Total		761	17	778

Table 2. Catch data of Atlantic sturgeon caught during ocean trawl survey sampling in New Jersey's coastal waters: January 1989 – December 2011

Year	# Tows	# Caught	Mean/tow	Mean TL (cm)	Size range (cm)
1989	193	34	0.176	95.13	70-123
1990	171	15	0.088	117.73	80-196
1991	189	16	0.085	99.69	69-205
1992	191	25	0.131	97.65	69-175
1993	187	10	0.053	99.56	75-116
1994	186	0	0.000	0.00	-
1995	188	6	0.032	104.83	74-166
1996	189	3	0.016	86.67	72-113
1997	187	12	0.064	95.08	59-215
1998	188	1	0.005	71.00	71
1999	186	11	0.059	100.50	86-127
2000	187	1	0.005	72.00	72
2001	186	4	0.022	111.75	96-149
2002	188	5	0.027	127.40	104-144
2003	188	16	0.085	125.06	88-189
2004	187	23	0.123	113.14	52-202
2005	186	18	0.097	96.41	66-160
2006	186	35	0.188	107.94	68-248
2007	187	24	0.128	101.13	83-181
2008	186	26	0.140	114.56	79-258
2009	186	12	0.065	88.58	54-132
2010	186	10	0.054	138.3	112-179
2011	186	3	0.016	141.3	122-155

Table 3. Atlantic sturgeon caught in Delaware Bay by gill net during New Jersey American shad and striped bass tagging study: 2000-2012

Year	Number	Size range (cm)
2000	6	69.3 – 83.6
2001	2	N/A
2002	0	
2003	2	104.9 – 175.3
2004	0	
2005	34	N/A
2006	4	N/A
2007	3	97.8 – 170.0
2008	0	
2009	1	76
2010	6	71.8 – 150.2
2011	1	205.0
2012	0	

Annual Report - Atlantic Sturgeon
2011
Pennsylvania

Pennsylvania Fish and Boat Commission
September 13, 2012

Regulations:

Commercial: A commercial fishery does not exist in Pennsylvania.

Recreational: A "no open season" applies to sturgeon in the Delaware River and Estuary.

Overall: The Atlantic sturgeon is on the state list of endangered species. The catching, taking, killing, possessing, importing to or exporting from this Commonwealth, selling, offering for sale or purchasing, of Atlantic sturgeon, alive or dead, or any part thereof, without a special permit from the Executive Director is prohibited.

Monitoring:

Bycatch: None. Pennsylvania does not permit commercial fishing in the Delaware River and Estuary, nor were Atlantic sturgeon taken or observed by staff during sampling efforts for striped bass and American shad.

Other Monitoring: No activity.

Habitat Issues:

No effort was directed at determining/restoring habitat. Agency personnel continued with a best-management practice approach in reviewing and commenting on applications for permits issued by other agencies (e.g., encroachments, Clean Water Act Section 316(b) variances).

Aquaculture:

The Atlantic sturgeon is on the state list of endangered species. Importation, possession, sale, etc. are unlawful without a special permit from the Executive Director. The Atlantic sturgeon is not included on the list of species approved for commercial aquaculture operations as administered by the Pennsylvania Department of Agriculture.

The U.S. Fish and Wildlife Service (USFWS) Northeast Fishery Center at Lamar, Pennsylvania continues to hold a small number of wild Atlantic sturgeon (N = 4) as well as five year classes of hatchery-reared fish (N = 50) for use in research on domestic breeding. The hatchery-reared fish were produced from Hudson River brood stock collected from 1993 to 1998. In 2008, on-going laparoscopic examinations to determine sex and degree of maturity revealed a small number of males approaching reproductive maturity. In June 2008, injection of spawning hormones resulted in the production of milt from two of these fish, representing the first documented milt production from a hatchery-reared Atlantic sturgeon. The University of Maryland is working with USFWS biologists regarding cryo-preservation and extending the viability of fresh milt of wild vs. hatchery-reared sturgeon. Laparoscopic examinations were performed on three of the largest female sturgeon in the spring of 2010 and 2011, and the ovaries were found to be reproductively immature. The oldest female examined was age-19. It will likely be several years before any female sturgeon at Lamar will come into spawning condition.

State of Delaware Annual Compliance Report
for
Atlantic Sturgeon

Submitted to the Atlantic States Marine Fisheries Commission
Atlantic Sturgeon Plan Review Team

D. Raver, U.S. FWS

September 2012

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Introduction

As mandated in the Atlantic States Marine Fisheries Commission (ASMFC) Interstate Fishery Management Plan for Atlantic sturgeon, this report summarizes the State of Delaware's activities regarding Atlantic sturgeon in 2011, including information on by-catch monitoring, ship strike mortalities, tagging and juvenile index of abundance studies, habitat status, and aquaculture operations.

Monitoring programs

Voluntary by-catch logbook program

The Delaware Division of Fish and Wildlife, hereafter referred to as the Division, uses a voluntary logbook program to monitor the by-catch of Atlantic sturgeon in the spring gill net fishery in the Delaware River, Delaware Bay, and near-shore Atlantic Ocean. Logbooks were mailed to all licensed commercial gill net fishermen in February prior to the commencement of the spring gill net fishery which primarily targets striped bass, American shad, and weakfish. Each fisherman was asked to record the date, length, location, and disposition of any Atlantic sturgeon encountered during the spring gill net fishery. In addition, two groups of commercial gill netters were involved with the Division's volunteer tagging program.

A total of 5 Atlantic sturgeon were encountered during the spring gill net fishery in the Delaware River (n = 0) and Delaware Bay (n = 5) in 2011 (Table 1). No mortalities were reported. The proportion of fishermen that responded to the survey was 7% (4 of 59). Dates of capture ranged from April 8 to April 19. Approximate sizes ranged from 91 to 203 cm total length; with two of possible adult size (188, 203 cm). Zero (0) Atlantic sturgeons caught in Delaware Bay during the spring gill net fishery were T-bar tagged prior to release as part of the Division's volunteer tagging program (Table 3, tagging program section).

The logbook data were expanded to reflect Atlantic sturgeon by-catch in the entire spring gill net fishery in the Delaware River and Delaware Bay during the months of March and April when most sturgeon are traditionally encountered. The overall catch rate (sturgeon/net yd. day) of those gill net fishermen that submitted logbooks was extrapolated using the effort (net yd. days) in the entire spring (March-April) gill net fishery (striped bass, American shad, and weakfish), by area, as reported (mandatory reporting) during those months. This estimation procedure assumes that the logbook data submitted was credible, gill net fishermen were using similar gear (e.g., mesh and twine size), and had similar efficiencies. The total estimated by-catch in the spring gill net fishery in the Delaware River (n = 0) and Delaware Bay (n =153) was 145 fish (Table 1). By-catch in the Delaware River fishery in past years has been negligible. The gill net fishery in the Delaware River is strictly a surface drift net fishery by regulation with gill nets typically being set near the edge of the shipping channel thus reducing the chances of catching sturgeon which are typically more bottom oriented. In addition, most juvenile and sub-adult Atlantic sturgeon do not ascend into the Delaware River from Delaware Bay until late May and June based on directed gill net surveys conducted by the Division (Shirey et al. 1999). The higher number of sturgeon encountered in the Delaware Bay fishery was expected considering the distribution of fishing effort and the use of anchored gill nets.

Ship strike mortalities

The Division as well as researchers at Delaware State University (DSU) receives reports of alleged ship strike mortalities each spring and fall. Beginning in 2009, the DFW published a small advertisement in the Delaware Fishing Guide asking for carcasses to be reported via a phone number. The fishing guide is published in April, prior to the start of the carcass season and approximately 100,000 are distributed as a free publication at all in-state fishing license vendors and chambers of commerce. The carcass contact number was also added to a project pamphlet on the DFW website and most commonly used search engines find the contact number when the key words ‘dead’ ‘sturgeon’ ‘Delaware’ are used in combination. These advertisements and the common use of smart phones with the ability to quickly and easily search out information on the internet have increased the number of carcass reports from a mean of 8.2 (2005-2009) to a mean of 17.5 (2010-2011). Advertising has also encouraged prompter reporting which increases ability to ascertain cause of death. In 2005-2009 cause of death was determined to be unknown in 44% of carcasses and since 2010 unknown cause of death has dropped to 28%. The size range of sturgeon reported has ranged from 58 to 229 cm TL. Many of the sturgeon reported have exceeded the size of any sturgeon taken during directed gill net surveys conducted by the Division in the lower Delaware River, which have taken more than 2,000 sturgeon. However, the time of year sampled by the Division does not coincide with the historic spawning season that one would expect to capture adult Atlantic sturgeon. In addition, the mesh and twine size of gill nets used by the Division may be insufficient for capturing large adults. Fifty three percent of reported sturgeon are of adult size (>1500 mm TL) which is a much higher proportion than the number of adults in the population. This may indicate a reporting bias enthusiasm for larger carcasses, a longer persistence time in the environment for larger fish or an increased likelihood of propeller strike mortality based on body size (Dadswell and Rulifson 1994). An investigation into reporting rate such as the one conducted on the James River (Balazik et al. 2012, in review) is needed to assess vessel strike mortality.

Although ship strikes are the likely cause of death for most individuals, the stage of decomposition often makes the cause of death difficult to discern. Most individuals have been severed through the torso region and scute damage is consistent with being struck by the propeller of a large ship (Figure 1) whereas others have had crushed scutes consistent with being struck with a boat or ship hull. The Division has received several anecdotal reports regarding ship/boat strikes. For instance, a commercial crabber reported hitting an adult Atlantic sturgeon with his outboard motor propeller during late spring while moving through a shallow section of the lower Delaware River. In addition, a marine patrol officer encountered an adult-sized Atlantic sturgeon in the Delaware River that floated up behind a large ship navigating upstream in the Delaware River in May 2005. This sturgeon was bleeding and near death from an injury near the dorsal fin described as a probable propeller strike (T. Penuel, DE Division of Fish and Wildlife, pers. comm.).

The Division began tracking Atlantic sturgeon mortalities in 2005. Previous to tracking carcass information in 2005 it is estimated that from 4 to 8 carcasses have been reported each spring. All dead sturgeon reported are measured for total length (or length of portion found), scanned for internal and externals tags, sexed if possible, examined for injuries, documented with a photo, marked with spray paint and buried to eliminate double reporting. In addition, tissue samples are taken for genetic stock analysis and contaminant analysis depending on the stage of decomposition. The Division's Natural Heritage Program has also included Atlantic sturgeon logbooks in their shorebird training guide as part of their monitoring program along Delaware Bay in spring. The shorebird monitoring program covers a large area of Delaware Bay during spring and typically reports several dead Atlantic sturgeon each year. In 2011, 21 Atlantic sturgeon carcasses were reported from the Delaware Estuary of which 17 had external injuries that were most likely the result of being struck by a ship propeller (Table 2). An additional adult sized male Atlantic sturgeon carcass with signs of vessel strike was reported in the Nanticoke. Three shortnose sturgeon carcasses were also reported 2 of which had signs of vessel strike.

Tagging program

Atlantic sturgeon collected by the Division during directed sampling efforts were tagged with USFWS T-bar tags, passive integrated transponders (PIT) and 27 were selected for VEMCO V7 and V9 ultrasonic transmitter tags (Table 3). T-bar tags were inserted in the dorsal musculature just anterior to the dorsal fin. PIT tags were injected below the dorsal sinus in sturgeon >250 mm TL. If total length is < 400 mm, a PIT tag < 11.5 mm is used. Transmitters were surgically implanted near the midline on the ventral side of the fish anterior to the anal vent in sturgeon greater than 250 mm TL. In addition to Atlantic sturgeon tagged by the Division, 1 commercial gill netter voluntarily tagged Atlantic sturgeon that they encountered with USFWS T-bar tags as by-catch from the striped bass fishery in the Delaware Bay. The Division supplied USFWS T-bar tags, instructions and log sheets but no sturgeon were tagged in 2011. Delaware State University tagged Atlantic sturgeon in 2011 as part of their identification of critical habitat and interbasin exchange project. There were a total of 6 recapture events in 2011 including five in-season events (Table 4). An additional 9 Atlantic sturgeon were recaptured from other studies including five from the USFWS 1994 hatchery release experiment on the Hudson River. All tag release information was supplied to the U.S. Fish and Wildlife Service Annapolis, MD field office for inclusion in the tagging database.

The Division's juvenile Atlantic sturgeon survey sampling efforts (*n* = 54) and Delaware State University (n=214) accounted for all 268 tag releases (Table 3). A subset of these sturgeon were also implanted with PIT tags.

Juvenile index of abundance

To assess the abundance of juvenile Atlantic sturgeon in the lower Delaware River, the Division has conducted directed gill net surveys using smaller mesh gill nets. Surveys were conducted in 1991-1998, 2001, 2004, 2007, 2008 and 2009-2011. Beginning in 2009, surveys focused on early stage juveniles, age 0, 1 and 2. Small mesh (51 and 75 mm stretch) gillnets were used exclusively so that early stage juveniles would be more vulnerable to the gear (McCord et al 2007).

Results of the 2011 survey (Table 5) indicate a successful 2011 year class occurred in the Delaware River and that the methods are successful at capturing early stage juveniles. One individual captured (595 mm TL on 9/20) was possibly from the 2010 year class. This was the first potential 2010 year class candidate caught in 2 seasons of effort, which indicates poor year class strength. A total of 54 juveniles were captured (CPUE 3.6) with 3 age-0 recaptures included in the total. Forty-eight individuals were age-0 based on length at time of capture.

2011 was the wettest year on record based on the volume of Delaware River flows at Trenton. After tropical storm Irene in late August, freshwater was reported at the Ship John Lighthouse (rkm 60). Typically the freshwater line is at rkm 120-130 in August. Early season effort (September) focused downstream in areas free of debris that were potential sites based on DFW trawl survey (Pennsville, NJ) and commercial crabber (Hamburg cove, DE) capture reports and produced no sturgeon. As conditions allowed for use of gillnetting gear, effort was focused on areas that produced early stage juveniles in the past. All Atlantic sturgeon age-0 and the one potential age-1 were captured in the Marcus Hook Anchorage area. Two additional juveniles were captured at Cherry Island Flats. The Division is currently in its final year of funding to conduct a habitat and seasonal movements survey using telemetry in 2012 focused on early stage juvenile sturgeon (<500 mm TL).

Previously, Division surveys did not successfully capture young of the year sturgeon. It is unclear if this is due to gear, site selection, unsuccessful year classes or poor survival to recruitment in past surveys. Past surveys occasionally included a portion of small-mesh gillnet and were fished in the areas that produced young of the year in 2009 and 2011. However, early surveys in 1991, 1992, 1993, 1994, 1995 and 1996 focused on the Artificial Island site which has not held young of the year. Surveys from 1997 to 2008 included sampling at sites where young of the year were caught in 2009, but no captures occurred. The DFW trawl survey captured three young of the year sturgeon (1989, 1990, 1993) in locations upriver of Artificial Island (Cherry Island Flats and the western side of Pea Patch Island) but were not able to be identified as Atlantic or shortnose sturgeon. If the trawl captures from 1989, 1990 and 1993 were Atlantic sturgeon, the gillnetting survey may have been focused in areas where capture was less likely. A commonality exists between 1989, 1990, 1993, 2009, and 2011 that conductivity (and its surrogate salinity) were well below average. The surveys after 1996 (1997, 1998, 2001, 2004, 2007, 2008) were years of above average salinity. Salinity may be a factor in producing successful year classes. Another water quality factor driving recruitment may be dissolved oxygen (DO) in the early summer when young of the year are most vulnerable (Kahn and Fisher 2012). A better understanding of environmental drivers of sturgeon recruitment and the tolerances of Atlantic sturgeon <60 days are needed to be able to effectively manage sturgeon populations in the Delaware Estuary.

The Division conducts two trawl surveys in the lower Delaware River and Delaware Bay which provide annual estimates of juvenile abundance for several important fish species. From 1990 to 2011, the trawl program has collected only 30 Atlantic sturgeon (Table 6), generally ranging in size from 700 to 1,500 mm TL. However, in 2011, 8 Atlantic sturgeon were collected in the large trawl and one was collected in the small trawl. The 2011 catch is a record threefold greater than the previous high in 1996 and is likely due to the extremely wet year pushing the freshwater zone downstream and temporarily pushing sturgeon distribution into a much greater portion of the trawling stations in the Estuary.

Habitat status

Information on habitat of Atlantic sturgeon in the Delaware Estuary for all life stages remains limited. Division biologists conducted ultrasonic telemetry studies from 1996 to 1998 and 2007 to 2008 in an attempt to discern movement patterns and important summer habitats of late stage juvenile Atlantic sturgeon in the lower Delaware River (Fisher 2009). In 2009 -2011 telemetry studies focused on early stage river resident juveniles.

Early stage juvenile habitat

Locations are mapped along with the 2009 locations (Figure 2) for comparison purposes between the 2009 and 2011 year classes. The Marcus Hook anchorage, an area adjacent to Tinicum Island, and Mifflin (Mantua Creek) anchorage were the primary locations with the majority of detections occurring at the release site (Marcus Hook Anchorage). These locations are the same areas as 2009 except for the absence of any locations downriver of Marcus Hook Anchorage. In the fall of 2011, hydraulic dredging activities (conducted by the U.S. Army Corps of Engineers) downriver of the anchorage in the Cherry Island to Bellevue Range areas made manual tracking difficult and underwater noise likely interfered with detection.

Hatin et al. 2007 documented habitat preferences for age-2 Atlantic sturgeon in the St. Lawrence as 6 to 10 meters of depth in freshwater (<0.5 ppt), a bottom current velocity of 0.26-0.50 m/s and a dominate substrate of silty clay. Overwintering (YoY to age-1) Delaware River Atlantic sturgeon were located over the most available substrate type (silt to medium sand) (Table 7). Sturgeon were located in the Federal Channel (12%), anchorage (80%), and other deepwater habitat (8%) at depths of 8.5-13.4 m. All sturgeon locations were near the freshwater interface (<0.5ppt) and found at 0% salinity.

The passive receiver array system maintained by the Division, DSU and Environmental Research Consultants, Inc (ERC) (Hal Brundage) is made up of over 70 receivers in various locations throughout the Delaware Bay, Delaware River, Chesapeake and Delaware Canal and the coast of Delaware and New Jersey. The array has produced information on seasonal individual movement and behavior patterns (Figure 3) of juvenile sturgeons, believed to be of the 2011 year class. Detections ranged from where the river meets the bay at Liston Point (rkm 77) to Roebling, NJ (rkm 198) with individual movements of over 30 rkm per day. Some sturgeon remained within a confined home range in the Marcus Hook Anchorage, Bar and Range (rkm 122-133). It should be noted that the cooperation between researchers and compatibility of technology made this possible and is essential for understanding the movements of this species.

Adult spawning habitat

During this time period a total of 215 Atlantic sturgeon were landed over 27 sampling days and 101 gillnet sets. All Atlantic sturgeon were processed using standardized protocols (NOAA-NMFS-Damon-Randall et al. 2010) which included PIT tagging, external tags, measurements, and collection of genetic samples. A total of 84 acoustic transmitters were implanted in a subsample of Atlantic sturgeon collections including all of the USFWS Hudson River experimental individuals. Muscle tissue and parasite collections were made on subsamples of collected Atlantic sturgeon and were provided to collaborating researchers at the University of Maryland, University of Prince Edward Island, and Virginia Commonwealth University. In an attempt to understand the impact of gillnet configuration on Atlantic sturgeon landings, gillnets with alternating panels were deployed which were either tied-down to mimic the monkfish fishery or standup (no tie downs). A total of 115 Atlantic sturgeon were captured in the tie-down nets with 94 landed in the standup gear.

Spawning Site Identification

During the likely period of spawning in 2011 six adult Atlantic sturgeon deemed likely in spawning condition, from directed sampling efforts, were detected in the Delaware River (Table 8). Two of these six were individuals that had entered the Delaware River in 2009 and 2010 (DSU1052433 and DSU1052442). One had entered the Delaware River in 2010 (DSU1084965) and the other 3 were tagged in 2010 (DSU1084956, DSU1084958, and DSU1084980) but were not previously detected in the Delaware River. Atlantic sturgeon # DSU1052433 (male, ROO Delaware) entered the river on May 6 (15.9 ^{o}C) and departed on June 8 (23.1 ^{o}C), Atlantic sturgeon # DSU1052442 (male, ROO Delaware) entered the river on May 5 (16.2 ^{o}C) and departed on June 3 (22.3 ^{o}C); both sturgeon were detected in the same areas as in 2009 and 2010 entering as far upstream as river kilometer (rkm) 135 and 122 respectively. Atlantic sturgeon # DSU1084965 (male, ROO James), entered the river on May 13 (17.2 ^{o}C) and departed on May 30 (21.0 ^{o}C) reaching a maximum upstream extent of rkm 190. Atlantic sturgeon # DSU1084956 (male, ROO Kennebec), entered the Delaware River on May 8 (15.8 ^{o}C) and departed on June 8 (23.1 ^{o}C) reaching a maximum upstream extent of rkm 201. Two females with ROO being the Delaware were detected in the Delaware River in 2011. Both of these females had gonads with mid-vitellogenic ovarian follicles at time of capture in 2010 and were likely in spawning condition in 2011 (Joel Van Eenennaam, pers com). While these individuals did not go upstream as far as the 2 males, they did occupy areas deemed to have suitable habitat, i.e. flowing freshwater and hard bottom substrate (Sommerfield and Madson 2003, and Simpson 2008). Atlantic sturgeon # DSU 1084958 entered the river on May 7 (15.9 ^{o}C) and remained in the river for 9 days before leaving on May 18 (18.1 ^{o}C) traveling as far upstream as rkm 135. When captured in 2010 this female was 196cm FL and weighed 79 kg. Atlantic sturgeon # 108490 went slightly further upstream (rkm 148) and remained in the river for a much longer period of time, entering the river on May 21 (18.4 ^{o}C) and remained in the river until July 30 (28.9 ^{o}C). This female was 206cm FL and weighted 84kg in 2010.

The movements of all six adult Atlantic sturgeon were monitored via both passive and manual telemetry in an attempt to ascertain if they were moving into areas similar to that of known spawning habitat in other rivers or areas previously identified as potential spawning areas, i.e. high freshwater flows and hard bottom (Sommerfield and Madson 2003, and Simpson 2008). Utilizing the locations of these individuals, attempts were made to collect fertilized eggs on cobble/gravel substrates in two areas in the Delaware River. The first area is a section of the river between Tinicum Island and Marcus Hook, PA (rkm 120-150). The second area is much further upriver between the northern edge of the city of Philadelphia and Burlington, NJ (rkm 170-190). We deployed 248 eggs mats for 2 days each for a total of approximately 12,000 egg-mat/hours, but no Atlantic sturgeon eggs were collected.

Aquaculture operations

The Division does not sponsor any aquaculture programs for Atlantic sturgeon, but has cooperated with the neighboring State of Maryland in previous years by collecting low numbers of sub-adult Atlantic sturgeon from the lower Delaware River. These fish were transported to the Maryland hatchery complex for grow-out and will form part of the broodstock necessary to initiate Atlantic sturgeon restoration activities in the Chesapeake Bay upon reaching maturity. No sturgeon were collected for this program in 2011.

TABLE 1. Summary of Atlantic sturgeon by-catch reported in the spring (March-April) gill net fishery (striped bass, American shad, and weakfish) in the Delaware River, Delaware Bay, and near-shore Atlantic Ocean (ocean fishery closed January 1, 2005) from 1999-2011. Total by-catch was estimated using the catch rate of Atlantic sturgeon (fish/net yd. day) reported by commercial gill netters that submitted voluntary by-catch logbooks. This catch rate was expanded to the entire spring gill net fishery in the Delaware River and Bay using the total effort (net yd. days) in the fishery to estimate total sturgeon by-catch.

Location	Active gill netters	Logbooks submitted	Gill netter response	Gill netter effort (net yd. days)	Atlantic sturgeon reported	Total effort in spring gill net fishery (net yd. days)	Total estimated Atl. sturgeon bycatch
				1999			
Delaware Estuary	77[1]	8	18%	-	43	-	-
				2000			
Delaware River	10	4	40%	19,233	2	37,433	4
Delaware Bay	75	14	19%	133,885	51	511,215	195
Atlantic Ocean[2]	7	2	29%	29,695	6	185,245	37
Overall	92	20	22%	182,813	59	733,893	236
				2001			
Delaware River	9	1	11%	17,500	0	78,100	0
Delaware Bay	67	13	19%	145,459	30	583,039	120
Atlantic Ocean[2]	9	2	22%	48,500	11	135,140	31
Overall	85	16	19%	211,459	41	796,279	154
				2002			
Delaware River	7	2	29%	7,800	1	21,500	3
Delaware Bay	55	12	22%	165,625	14	457,740	39
Atlantic Ocean[2]	6	3	50%	62,100	16	114,300	29
Overall	68	19	28%	235,525	31	593,540	71
				2003			
Delaware River	9	0	0%	-	0	35,783	0
Delaware Bay	51	6	12%	26,730	8	259,747	78
Atlantic Ocean[2]	4	3	75%	53,900	7	85,300	11
Overall	64	9	14%	80,630	15	380,830	89
				2004			
Delaware River	10	2	20%	15,200	2	33,760	4
Delaware Bay	51	6	12%	98,800	38	392,457	151
Atlantic Ocean[2]	4	2	50%	28,600	25	60,800	53
Overall	65	10	15%	142,600	65	487,017	208
				2005			
Delaware River	6	2	33%	5,200	0	16,000	0
Delaware Bay[2]	59	13	22%	202,090	29	566,093	81
Overall	65	15	23%	207,290	29	582,093	81

[1] Only 45 of the 77 active gillnetters were mailed by-catch logbooks.
[2] Included commercial gill net fishermen in Indian River and/or Rehoboth Bay.

TABLE 1. (*continued*) Summary of Atlantic sturgeon by-catch reported in the spring (March-April) gill net fishery (striped bass, American shad, and weakfish) in the Delaware River, Delaware Bay, and near-shore Atlantic Ocean (ocean fishery closed January 1, 2005) from 1999-2011. Total by-catch was estimated using the catch rate of Atlantic sturgeon (fish/net yd. day) reported by commercial gill netters that submitted voluntary by-catch logbooks. This catch rate was expanded to the entire spring gill net fishery in the Delaware River and Bay using the total effort (net yd. days) in the fishery to estimate total sturgeon by-catch.

				2006			
Delaware River	6	1	17%	6,600	1	22,400	3
Delaware Bay[2]	55	17	31%	210,650	101	518,315	248
Overall	61	18	30%	217,250	102	540,715	251
				2007			
Delaware River	14	3	21%	10,500	4	33,085	13
Delaware Bay[2]	60	16	27%	134,985	118	405,870	355
Overall	74	19	26%	145,485	122	438,955	368
				2008			
Delaware River	10	1	10%	400	0	16,050	0
Delaware Bay[2]	50	9	18%	31,444	7	179,305	38
Overall	60	10	17%	31,844	7	195,355	38
				2009			
Delaware River	8	3	38%	3,900	1	13,250	3
Delaware Bay[2]	55	4	8%	4,120	4	171,935	167
Overall	63	7	11%	8,020	5	185,185	170
				2010			
Delaware River	7	1	14%	10,500	0	27,650	0
Delaware Bay[2]	49	6	13%	13,340	9	276,635	172
Overall	56	7	13%	23,840	9	304,285	115
				2011			
Delaware River	5	0	0%	0	0	11,900	0
Delaware Bay[2]	54	4	7%	7,960	5	231,040	145
Overall	59	4	7%	7,960	5	242,940	153

TABLE 2. Summary of Atlantic sturgeon mortalities (n=11) reported in the Delaware Estuary in 2011. One mortality from Nanticoke R. (Chesapeake Bay) is included in the table. Adults were classified as sturgeon likely exceeding 1500 mm TL.

Date	Location	Size	Sex	Injuries
5/8/2011	Fortescue, NJ	Juvenile		Unknown
5/11/2011	Port Mahon, DE	Juvenile		Head cut off
5/16/2011	Indian River Inlet, DE	Adult		Head injury
5/16/2011	Kitts Hummock, DE	Adult		Tail injury
5/16/2011	Kitts Hummock, DE	Juvenile		Dorsal gash and head cut off
5/21/2011	Augustine Beach, DE	Juvenile		Head injury
5/23/2011	New Castle, DE	Adult		Tail cut off behind dorsal fin
5/26/2011	Chester, PA	Juvenile		Unknown
6/3/2011	Offshore of Woodland Beach, DE	Adult		Lacerations on top of head
6/8/2011	Dewey Beach, DE	Juvenile		Head cut off
6/12/2011	Ship John Light, DE	Adult		Anterior half cut off
6/19/2011	C + D Canal, DE	Adult	Male	Lacerations on head
7/1/2011	Indian River Inlet, DE	Adult		Blunt force trauma to head
7/6/2011	Oakwood Beach, NJ	Juvenile		Unknown
7/9/2011	Augustine Beach, DE	Adult		Head and tail missing
7/12/2011	Salem, NJ	Adult		Dorsal mid-body laceration
7/26/2011	Pea Patch Island, DE	Adult	Female	Blunt force trauma, 6th dorsal scute
8/3/2011	Cedar Swamp WA, DE	Juvenile		Gash on 3rd dorsal scute
9/1/2011	Artificial Island, NJ	Juvenile		Tail cut off
9/13/2011	Seaford, DE (Nanticoke R. Drainage)	Adult	Male	Laceration to head
10/5/2011	Reeds Beach, NJ	Juvenile		Unknown
10/24/2011	Broadkill Beach, DE	Adult		Head and tail missing with cut scute

TABLE 3. Atlantic sturgeon tagged with Delaware Division of Fish and Wildlife and USFWS T-bar tags or PIT tags in the lower Delaware River and Delaware Bay by the Division's Atlantic sturgeon juvenile survey, Delaware State University, and commercial gill net fishermen cooperating with the voluntary tagging program 2011.

Date	Location	TL (mm)	FL (mm)	WT (kg)	T-bar no.	PIT no.	comments
			DFW Atlantic sturgeon juvenile survey				
9/16/2011	Cherry Island flats	771	656	2.53	44186	985121014382437	
9/19/2011	Cherry Island flats	789	677	2.6	44187	985121014382422	
9/30/2011	Marcus Hook anchorage	254	218	0.061	44188		
9/30/2011	Marcus Hook anchorage	595	524	1.075	44189	985121014382411	
10/3/2011	Marcus Hook anchorage	246	208	0.061	44190		
10/3/2011	Marcus Hook anchorage	257	217	0.06	44191	985121018605114	
10/3/2011	Marcus Hook anchorage	255	219	0.066	44192	985121018577438	
10/3/2011	Marcus Hook anchorage	249	215	0.064	44193	985121018570930	
10/3/2011	Marcus Hook anchorage	250	213	0.065	44194	985121018570692	
10/3/2011	Marcus Hook anchorage	250	217	0.059	44195	985121018569813	
10/3/2011	Marcus Hook anchorage	257	223	0.072	44196	985121018569035	
10/3/2011	Marcus Hook anchorage	283	248	0.095	44197	985121018567609	
10/17/2011	Marcus Hook anchorage	273	237	0.087	44193	985121018570930	recap
10/17/2011	Marcus Hook anchorage	321	274	0.135		985121018567314	
10/17/2011	Marcus Hook anchorage	307	264	0.116		985121018564951	
10/17/2011	Marcus Hook anchorage	291	247	0.108		985121018563653	
10/17/2011	Marcus Hook anchorage	296	252	0.98		985121018562920	
10/17/2011	Marcus Hook anchorage	280	238	0.94		985121018562274	
10/17/2011	Marcus Hook anchorage	294	254	0.109		985121018561149	
10/17/2011	Marcus Hook anchorage	303	265	0.113		985121018560778	
10/17/2011	Marcus Hook anchorage	295	254	0.116		985121018560700	
10/18/2011	Marcus Hook anchorage	278	245	0.092	45651	985121018560144	
10/18/2011	Marcus Hook anchorage	245	214	0.061	45652	985121018559459	
10/18/2011	Marcus Hook anchorage	303	262	0.1223	45653	985121018556002	
10/18/2011	Marcus Hook anchorage	263	225	0.074	45654	985121018555453	
10/18/2011	Marcus Hook anchorage	283	248	0.093	45655	985121018554977	
10/18/2011	Marcus Hook anchorage	283	240	0.089	45656	985121018554512	
10/18/2011	Marcus Hook anchorage	235	206	0.057	45657		
10/18/2011	Marcus Hook anchorage	297	256	0.113	45658	985121018553544	
10/18/2011	Marcus Hook anchorage	277	240	0.096	45659	985121018552819	
10/18/2011	Marcus Hook anchorage	272	232	0.082	45660	985121018552446	
10/18/2011	Marcus Hook anchorage	272	236	0.088	45661	985121018552437	
10/18/2011	Marcus Hook anchorage	277	238	0.096	45662	985121018550722	
10/18/2011	Marcus Hook anchorage	272	234	0.085	45663	985121018550712	
10/28/2011	Marcus Hook anchorage	359	305	0.2	45665	985121018550132	
10/31/2011	Marcus Hook anchorage	342	289	0.162	45666	985121018549232	

10/31/2011	Marcus Hook anchorage	280	242	0.099	45667	985121018547281	
10/31/2011	Marcus Hook anchorage	283	247	0.102	45668	985121018544169	
10/31/2011	Marcus Hook anchorage	287	247	0.104	45669	985121018544149	
10/31/2011	Marcus Hook anchorage	300	259	0.115	45670	985121019102847	
10/31/2011	Marcus Hook anchorage	281	245	0.094	45671	985121019100302	
10/31/2011	Marcus Hook anchorage	287	251	0.111	45672	985121019117896	
10/31/2011	Marcus Hook anchorage	335	291	0.165	45673	985121019122616	
10/31/2011	Marcus Hook anchorage	293	255	0.123	45674	985121019098459	
11/1/2011	Marcus Hook anchorage	328	284	0.153	45675	985121019098397	
11/1/2011	Marcus Hook anchorage	309	262	0.124	44190	985121019052201	recap
11/1/2011	Marcus Hook anchorage	293	255	0.105	45655		recap
11/1/2011	Marcus Hook anchorage	311	270	0.146	45676	985121019061747	
11/1/2011	Marcus Hook anchorage	335	288	0.174	45677	985121019092353	
11/1/2011	Marcus Hook anchorage	338	295	0.15	45678	985121019102663	
11/1/2011	Marcus Hook anchorage	363	311	0.197	45679	985121019077955	
11/1/2011	Marcus Hook anchorage	262	226	0.077	45680	985121018603264	
11/1/2011	Marcus Hook anchorage	360	307	0.208	45681	985121019120081	
11/1/2011	Marcus Hook anchorage	308	263	0.115	45682	985121019100298	

Volunteer Tagging Program

No sturgeon tagged in 2011

Delaware State University

Fish ID	Date	Fork Length (cm)	Total Length (cm)	Weight (kg)	Sex	Acoustic Transmitter	Recapture	Net Type
DSU AS 2011-1	4/2/2011	208	230	83	Female	Yes		Stand Up
DSU AS 2011-2	4/2/2011	114	125	15	Unknown	No		Tie Down
DSU AS 2011-3	4/2/2011	189	214	65	Female	Yes		Tie Down
DSU AS 2011-4	4/3/2011	170	192	46	Male	Yes		Tie Down
DSU AS 2011-5	4/3/2011	141	162	27	Unknown	No		Stand Up
DSU AS 2011-6	4/3/2011	167	190	43	Male	Yes		Tie Down
DSU AS 2011-7	4/3/2011	167	190	45	Male	Yes		Stand Up
DSU AS 2011-8	4/3/2011	173	198	45	Male	Yes		Stand Up
DSU AS 2011-9	4/6/2011	186	208	56	Unknown	No		Tie Down
DSU AS 2011-10	4/7/2011	161	178	41	Unknown	Yes		Stand Up
DSU AS 2011-11	4/10/2011	158	178	36	Unknown	No		Stand Up
DSU AS 2011-12	4/10/2011	139	155	21	Unknown	No		Tie Down
DSU AS 2011-13	4/10/2011	134	152	22	Unknown	Yes		Stand Up
DSU AS 2011-14	4/13/2011	189	206	64	Male	Yes		Tie Down
DSU AS 2011-15	4/13/2011	183	207	58	Unknown	Yes		Stand Up
DSU AS 2011-16	4/14/2011	121	134	20	Unknown	Yes		Tie Down
DSU AS 2011-17	4/14/2011	158	179	43	Unknown	Yes		Stand Up

DSU AS 2011-18	4/14/2011	136	153	29	Unknown	No		Tie Down
DSU AS 2011-19	4/14/2011	126	138	21	Unknown	No		Stand Up
DSU AS 2011-20	4/14/2011	137	160	22	Unknown	No		Tie Down
DSU AS 2011-21	4/17/2011	181	193	54	Female	Yes		Stand Up
DSU AS 2011-22	4/17/2011	185	206	55	Female	Yes		Tie Down
DSU AS 2011-23	4/17/2011	155	172	33	Unknown	No		Tie Down
DSU AS 2011-24	4/17/2011	148	166	26	Unknown	No		Stand Up
DSU AS 2011-25	4/17/2011	160	176	45	Male	Yes		Tie Down
DSU AS 2011-26	4/17/2011	178	203	56	Unknown	Yes		Stand Up
DSU AS 2011-27	4/17/2011	148	163	33	Unknown	No		Stand Up
DSU AS 2011-28	4/17/2011	122	136	16	Unknown	No		Stand Up
DSU AS 2011-29	4/18/2011	208	230	70	Female	Yes		Tie Down
DSU AS 2011-30	4/18/2011	138	162	28	Unknown	No		Tie Down
DSU AS 2011-31	4/18/2011	144	160		Unknown	No		Stand Up
DSU AS 2011-32	4/18/2011	173	196	46	Male	Yes		Stand Up
DSU AS 2011-33	4/18/2011	136	152	25	Unknown	No		Tie Down
DSU AS 2011-34	4/18/2011	166	188	47	Female	Yes		Stand Up
DSU AS 2011-35	4/18/2011	157	175	38	Unknown	No		Stand Up
DSU AS 2011-36	4/19/2011	211	237	95	Female	Yes		Tie Down
DSU AS 2011-37	4/19/2011	148	175	37	Unknown	Yes		Tie Down
DSU AS 2011-38	4/19/2011	159	175	43	Male	Yes		Stand Up
DSU AS 2011-39	4/19/2011	153	171	39	Unknown	No		Stand Up
DSU AS 2011-40	4/19/2011	150	168	36	Unknown	No		Stand Up
DSU AS 2011-41	4/19/2011	144	167	36	Unknown	No		Tie Down
DSU AS 2011-42	4/19/2011	129	143	24	Unknown	No		Tie Down
DSU AS 2011-43	4/19/2011	121	134	17	Unknown	No		Tie Down
DSU AS 2011-44	4/19/2011	147	166	34	Unknown	No		Tie Down
DSU AS 2011-45	4/20/2011	177	198	43	Male	Yes	Yes	Stand Up
DSU AS 2011-46	4/20/2011	171	192	43	Female	Yes		Stand Up
DSU AS 2011-47	4/20/2011	147	164	30	Unknown	No		Tie Down
DSU AS 2011-48	4/20/2011	170	188	45	Unknown	Yes		Stand Up
DSU AS 2011-49	4/20/2011	165	187	44	Unknown	No	Yes	Tie Down
DSU AS 2011-50	4/21/2011	183	206	60	Unknown	Yes		Stand Up
DSU AS 2011-51	4/21/2011	119	137	18	Unknown	No		Stand Up
DSU AS 2011-52	4/21/2011	171	181	40	Unknown	Yes	Yes	Stand Up
DSU AS 2011-53	4/21/2011	174	195	62	Female	Yes		Stand Up
DSU AS 2011-54	4/21/2011	177	200	65	Female	Yes		Tie Down
DSU AS 2011-55	4/21/2011	215	237	98	Female	Yes		Tie Down
DSU AS 2011-56	4/21/2011	181	203	63	Unknown	Yes		Tie Down
DSU AS 2011-57	4/21/2011	165	183	51	Unknown	Yes		Stand Up
DSU AS 2011-58	4/21/2011	145	163		Unknown	No		Tie Down
DSU AS 2011-59	4/21/2011	149	178	34	Unknown	No		Tie Down
DSU AS 2011-60	4/21/2011	192	215	65	Unknown	Yes		Tie Down

DSU AS 2011-61	4/21/2011	153	170		Unknown	No		Tie Down
DSU AS 2011-62	4/21/2011	146	167		Unknown	No		Stand Up
DSU AS 2011-63	4/25/2011	140	155	26	Unknown	No	Yes	Tie Down
DSU AS 2011-64	4/25/2011	123	140	19	Unknown	No		Tie Down
DSU AS 2011-65	4/25/2011	170	196	51	Unknown	No		Stand Up
DSU AS 2011-66	4/25/2011	151	170	31	Unknown	No		Tie Down
DSU AS 2011-67	4/25/2011	150	169	40	Unknown	No		Stand Up
DSU AS 2011-68	4/25/2011	156	177	36	Unknown	No		Stand Up
DSU AS 2011-69	4/25/2011	144	163	30	Unknown	No		Tie Down
DSU AS 2011-70	4/25/2011	152	167	33	Unknown	No		Stand Up
DSU AS 2011-71	4/25/2011	128	148	20	Unknown	No		Tie Down
DSU AS 2011-72	4/25/2011	169	193	43	Unknown	No		Stand Up
DSU AS 2011-73	4/25/2011	139	163	27	Unknown	No		Stand Up
DSU AS 2011-74	4/25/2011	142	164	29	Unknown	No		Stand Up
DSU AS 2011-75	4/25/2011	173	195	44	Unknown	No		Tie Down
DSU AS 2011-76	4/25/2011	179	201	56	Unknown	No		Tie Down
DSU AS 2011-77	4/25/2011	176	203	54	Unknown	Yes		Tie Down
DSU AS 2011-78	4/25/2011	186	211	66	Unknown	Yes		Stand Up
DSU AS 2011-79	4/25/2011	187	210	62	Female	Yes		Tie Down
DSU AS 2011-80	4/25/2011	189	213	65	Female	Yes		Stand Up
DSU AS 2011-81	4/25/2011	150	169		Unknown	No		Tie Down
DSU AS 2011-82	4/25/2011	154	182	38	Unknown	No		Stand Up
DSU AS 2011-83	4/26/2011	176	201	53	Unknown	Yes		Stand Up
DSU AS 2011-84	4/26/2011	169	199	49	Unknown	Yes		Tie Down
DSU AS 2011-85	4/26/2011	172	198	54	Unknown	No		Tie Down
DSU AS 2011-86	4/26/2011	145	163	28	Unknown	No		Tie Down
DSU AS 2011-87	4/26/2011	178	198	46	Unknown	No		Tie Down
DSU AS 2011-88	4/26/2011	150	168	32	Unknown	No		Stand Up
DSU AS 2011-89	4/26/2011	137	157		Unknown	No	Yes	Stand Up
DSU AS 2011-90	4/26/2011	140	162	31	Unknown	No		Stand Up
DSU AS 2011-91	4/26/2011	142	161	31	Unknown	No		Stand Up
DSU AS 2011-92	4/26/2011	186	213	63	Unknown	Yes		Stand Up
DSU AS 2011-93	4/26/2011	182	204	63	Unknown	Yes		Stand Up
DSU AS 2011-100	4/27/2011	115	130	14	Unknown	Yes		Tie Down
DSU AS 2011-94	4/27/2011	179	204	55	Unknown	Yes	Yes	Tie Down
DSU AS 2011-95	4/27/2011	177	202	55	Female	Yes		Stand Up
DSU AS 2011-96	4/27/2011	145	168	30	Unknown	No		Tie Down
DSU AS 2011-97	4/27/2011	165	189	48	Unknown	No		Stand Up
DSU AS 2011-98	4/27/2011	143	162	29	Unknown	No		Tie Down
DSU AS 2011-99	4/27/2011	168	190	48	Unknown	No		Stand Up
DSU AS 2011-101	4/29/2011	150	170	32	Unknown	No		Tie Down
DSU AS 2011-102	4/29/2011	182	205	56	Female	Yes		Tie Down
DSU AS 2011-103	4/29/2011	109	129	14	Unknown	Yes		Stand Up

DSU AS 2011-104	4/29/2011	133	155	24	Unknown	No		Tie Down
DSU AS 2011-105	4/30/2011	130	147	23	Unknown	No		Tie Down
DSU AS 2011-106	4/30/2011	109	129	14	Unknown	No		Stand Up
DSU AS 2011-107	4/30/2011	145	161	30	Unknown	No		Stand Up
DSU AS 2011-108	5/1/2011	185	204	50	Unknown	Yes		Stand Up
DSU AS 2011-109	5/1/2011	137	158	23	Unknown	No		Stand Up
DSU AS 2011-110	5/1/2011	160	177	41	Unknown	No		Tie Down
DSU AS 2011-111	5/1/2011	128	147	17	Unknown	Yes		N/A
DSU AS 2011-112	5/1/2011	128	150	20	Unknown	No		N/A
DSU AS 2011-113	5/1/2011	107	125	12	Unknown	Yes		N/A
DSU AS 2011-114	5/1/2011	125	142	14	Unknown	Yes		N/A
DSU AS 2011-115	5/2/2011	192	213	66	Female	Yes		Stand Up
DSU AS 2011-116	5/2/2011	165	189	44	Female	Yes		Stand Up
DSU AS 2011-117	5/2/2011	134	154	19	Unknown	Yes		Stand Up
DSU AS 2011-118	5/2/2011	162	182	36	Unknown	Yes	Yes	Stand Up
DSU AS 2011-119	5/2/2011	131	149	19	Unknown	No		Tie Down
DSU AS 2011-120	5/2/2011	205	221	68	Female	Yes		Tie Down
DSU AS 2011-121	5/2/2011	153	175	38	Unknown	No		Tie Down
DSU AS 2011-122	5/2/2011	186	210	70	Female	Yes		Tie Down
DSU AS 2011-123	5/2/2011	169	190	40	Unknown	No		Tie Down
DSU AS 2011-124	5/2/2011	126	145	17	Unknown	No		Tie Down
DSU AS 2011-125	5/2/2011	173	195	48	Unknown	No		Stand Up
DSU AS 2011-126	5/2/2011	126	149	17	Unknown	Yes		Tie Down
DSU AS 2011-127	5/2/2011	130	142	42	Unknown	Yes		Tie Down
DSU AS 2011-128	5/3/2011	123	139	16	Unknown	Yes		Tie Down
DSU AS 2011-129	5/3/2011	180	203	55	Female	Yes		Stand Up
DSU AS 2011-130	5/3/2011	176	195	45	Unknown	Yes		Stand Up
DSU AS 2011-131	5/3/2011	148	170	30	Unknown	No		Stand Up
DSU AS 2011-132	5/3/2011	170	191	46	Unknown	No		Tie Down
DSU AS 2011-133	5/3/2011	195	218	72	Female	Yes		Tie Down
DSU AS 2011-134	5/3/2011	166	183	48	Unknown	Yes		Tie Down
DSU AS 2011-135	5/3/2011	160	184	37	Unknown	Yes	Yes	Tie Down
DSU AS 2011-136	5/3/2011	150	172	32	Unknown	No		Tie Down
DSU AS 2011-137	5/3/2011	167	190	40	Unknown	No		Stand Up
DSU AS 2011-138	5/3/2011	140	165	27	Unknown	No		Tie Down
DSU AS 2011-139	5/3/2011	169	186	45	Unknown	No		Stand Up
DSU AS 2011-140	5/3/2011	155	180	41	Unknown	No		Stand Up
DSU AS 2011-141	5/3/2011	164	190	42	Unknown	No		Tie Down
DSU AS 2011-142	5/4/2011	155	180	38	Unknown	No		Stand Up
DSU AS 2011-143	5/4/2011	154	177	40	Unknown	No		Tie Down
DSU AS 2011-144	5/4/2011	154	177	38	Unknown	No		Tie Down
DSU AS 2011-145	5/4/2011	150	169	33	Unknown	No		Stand Up
DSU AS 2011-146	5/4/2011	129	144	17	Unknown	Yes		Tie Down

DSU AS 2011-147	5/4/2011	129	130	19	Unknown	Yes		Tie Down
DSU AS 2011-148	5/4/2011	150	172	32	Unknown	No		Stand Up
DSU AS 2011-149	5/4/2011	160	182	40	Unknown	No		Stand Up
DSU AS 2011-150	5/4/2011	137	161	28	Unknown	No		Tie Down
DSU AS 2011-151	5/4/2011	149	172	33	Unknown	No		Tie Down
DSU AS 2011-152	5/5/2011	152	170	33	Unknown	No		Tie Down
DSU AS 2011-153	5/5/2011	147	166	30	Unknown	No	Yes	Stand Up
DSU AS 2011-154	5/5/2011	178	204	55	Unknown	Yes		Stand Up
DSU AS 2011-155	5/5/2011	138	157	25	Unknown	No		Stand Up
DSU AS 2011-156	5/5/2011	172	196	43	Unknown	No		Stand Up
DSU AS 2011-157	5/5/2011	172	194	55	Unknown	Yes		Stand Up
DSU AS 2011-158	5/5/2011	114	131	15	Unknown	Yes		Tie Down
DSU AS 2011-159	5/5/2011	115	133	16	Unknown	Yes		Tie Down
DSU AS 2011-160	5/5/2011	133	150	28	Unknown	No		Tie Down
DSU AS 2011-161	5/5/2011	130	152	25	Unknown	No		Tie Down
DSU AS 2011-162	5/5/2011	144	165	29	Unknown	No		Tie Down
DSU AS 2011-163	5/5/2011	178	198	54	Unknown	No		Stand Up
DSU AS 2011-164	5/6/2011	63	71	2	Unknown	Yes		N/A
DSU AS 2011-165	5/6/2011	152	175	39	Unknown	Yes		Tie Down
DSU AS 2011-166	5/6/2011	157	183	43	Unknown	Yes		Tie Down
DSU AS 2011-167	5/6/2011	158	175	45	Unknown	Yes		Tie Down
DSU AS 2011-168	5/6/2011				Unknown	No	Yes	Stand Up
DSU AS 2011-169	5/6/2011	149	167	36	Unknown	No		Tie Down
DSU AS 2011-170	5/6/2011	157	181	36	Unknown	No		Tie Down
DSU AS 2011-171	5/6/2011	149	169	33	Unknown	No		Stand Up
DSU AS 2011-172	5/6/2011	170	194	50	Unknown	Yes		Tie Down
DSU AS 2011-173	5/7/2011	142	162	29	Unknown	No		Tie Down
DSU AS 2011-174	5/7/2011	169	183		Unknown	No		Tie Down
DSU AS 2011-175	5/7/2011	155	177	41	Unknown	No		Tie Down
DSU AS 2011-176	5/7/2011	146	164	31	Unknown	No		Tie Down
DSU AS 2011-177	5/7/2011	143	161	31	Unknown	No		Tie Down
DSU AS 2011-178	5/7/2011	157	174		Unknown	No	Yes	Stand Up
DSU AS 2011-179	5/7/2011	182	206	54	Unknown	No		Tie Down
DSU AS 2011-180	5/7/2011	135	155	26	Unknown	No		Tie Down
DSU AS 2011-181	5/7/2011	170	191		Unknown	No		Tie Down
DSU AS 2011-182	5/7/2011	137	156	30	Unknown	No		Tie Down
DSU AS 2011-183	5/7/2011	189	219	60	Unknown	No		Tie Down
DSU AS 2011-184	5/7/2011	170	196	58	Unknown	No		Stand Up
DSU AS 2011-185	5/9/2011	158	178	45	Unknown	No		Tie Down
DSU AS 2011-186	5/9/2011	170	186	56	Female	Yes		Stand Up
DSU AS 2011-187	5/9/2011	202	232	72	Unknown	Yes		Stand Up
DSU AS 2011-188	5/9/2011	170	189	50	Unknown	No		Tie Down
DSU AS 2011-189	5/9/2011	125	145	18	Unknown	Yes		Tie Down

DSU AS 2011-190	5/9/2011	164	189	37	Unknown	Yes	Yes	Tie Down
DSU AS 2011-191	5/9/2011	162	188	41	Unknown	No		Stand Up
DSU AS 2011-192	5/9/2011	165	192	40	Unknown	No		Stand Up
DSU AS 2011-193	5/9/2011	154	175	36	Unknown	No		Stand Up
DSU AS 2011-194	5/9/2011	139	158	28	Unknown	No		Stand Up
DSU AS 2011-195	5/9/2011	140	158	30	Unknown	No		Tie Down
DSU AS 2011-196	5/10/2011	119	135	17	Unknown	Yes		Tie Down
DSU AS 2011-197	5/10/2011	186	218	68	Unknown	No		Stand Up
DSU AS 2011-198	5/10/2011	160	186	45	Unknown	No		Tie Down
DSU AS 2011-199	5/10/2011	170	195	50	Unknown	No		Stand Up
DSU AS 2011-200	5/11/2011	128	142	16	Unknown	No		Tie Down
DSU AS 2011-201	5/11/2011	111	127	10	Unknown	Yes		Tie Down
DSU AS 2011-202	5/11/2011	152	174	40	Unknown	No		Tie Down
DSU AS 2011-203	5/12/2011	172	195	51	Unknown	No		Tie Down
DSU AS 2011-204	5/12/2011	142	162	27	Unknown	No		Tie Down
DSU AS 2011-205	5/12/2011	161	180	42	Unknown	No		Stand Up
DSU AS 2011-206	5/12/2011	198	221	71	Female	Yes		Tie Down
DSU AS 2011-207	5/12/2011	148	166		Unknown	No		Stand Up
DSU AS 2011-208	5/12/2011	158	183		Unknown	No		Stand Up
DSU AS 2011-209	5/12/2011	156	178	36	Unknown	No		Tie Down
DSU AS 2011-210	5/12/2011	141	159	30	Unknown	No		Tie Down
DSU AS 2011-211	5/12/2011	135	153	22	Unknown	Yes		Tie Down
DSU AS 2011-212	5/12/2011	133	150	22	Unknown	Yes		Stand Up
DSU AS 2011-213	5/13/2011	165	189	45	Unknown	No		Stand Up
DSU AS 2011-214	5/13/2011	158	183	38	Unknown	No		Tie Down

TABLE 4. Summary of Atlantic sturgeon tagged in the lower Delaware River and Bay and near-shore Atlantic Ocean off Delaware from 1991 to 2011 and recaptured in 2011. Also included is a 2010 recapture that was not included in the previous report.

Date Released	Release TL (mm)	Release Location	Date Recaptured	Recapture TL (mm)	Recapture Gear	Target Species	Recapture Location	Disposition
10/3/2011	249	Marcus Hook, DE	10/17/2011	273	Anchored gillnet	sturgeon	Marcus Hook, DE	Alive
10/3/2011	246	Marcus Hook, DE	11/1/2011	309	Anchored gillnet	sturgeon	Marcus Hook, DE	Alive
10/18/2011	283	Marcus Hook, DE	11/1/2011	293	Anchored gillnet	sturgeon	Marcus Hook, DE	Alive
7/27/2005	1310	East side of Cherry Island, DE	4/27/2011	2040	Anchored gillnet	sturgeon	Atlantic Ocean, Bethany Beach, DE	Alive
4/25/2009	1900	Atlantic Ocean, Bethany Beach, DE	10/14/2010	2000	Anchored gillnet	sturgeon	Long Island Sound, CT	Alive
5/1/2011	1470	Atlantic Ocean, Bethany Beach, DE	6/8/2011	N/A	Trawl	squid	Fire Island, NY	Alive
5/5/2011	1500	Atlantic Ocean, Bethany Beach, DE	5/6/2011	1500	Anchored gillnet	sturgeon	Atlantic Ocean, Bethany Beach, DE	Alive

TABLE 5. Annual catch rates of Atlantic sturgeon taken in the lower Delaware River from 1991 to 2011 by the Delaware Division of Fish and Wildlife.

Year	No. Taken	Days Sampled	Net Hours	N/hr
1991	565	26	17.5	32.2
1992	501	26	29.5	17.0
1993	222	24	26.2	8.0
1994	220	26	21.6	10.2
1995	111	18	21.6	5.1
1996	43	14	17.5	2.5
1997	57	17	17.2	3.2
1998	14	13	10.3	1.4
2001	27	14	15.5	1.7
2004	31	21	19.1	1.6
2007	42	22	22.6	1.9
2008	9	11	11.3	0.8

[1]In 2008, additional sites at Marcus Hook (rkm 127) and Bombay Hook (rkm 63) were utilized. Marcus Hook sampling was based on anticipated summer site fidelity from the 2007 manual tracking results. Manual tracking of individuals prior to setting the net was also used to adjust the location and orientation of the net set to provide a gear efficiency advantage.
[2]Additional sites as well as exclusive use of small mesh (5.1 and 7.6 cm stretch) were utilized to target age-0,1,2 Atlantic sturgeon
Due to changes in sampling methods and locations the 2008 – 2011 CPUE below should be considered separately from the 1991-2008 CPUE above when drawing conclusions about Delaware Estuary juvenile population trends. The 2008 CPUE above only includes sampling days in similar locations with similar methods and can be used for trend comparison purposes with CPUE from 1991 to 2007.

Year	No. Taken	Days Sampled	Net Hours	N/hr
2008[1]	134	18	21.1	6.3
2009[2]	55	28	31.5	1.8
2010[2]	11	13	13.5	0.8
2011[2]	54	17	15.1	3.6

TABLE 6. Number of Atlantic sturgeon taken by the Delaware Division of Fish and Wildlife trawl survey in the lower Delaware River and Delaware Bay from 1990-2011.

Year	30-ft Trawl	16-ft Trawl
1990	3	1
1991	1	0
1992	0	0
1993	0	1
1994	1	0
1995	2	1
1996	3	0
1997	0	0
1998	0	0
1999	1	0
2000	2	0
2001	1	0
2002	0	0
2003	0	0
2004	0	0
2005	0	0
2006	1	1
2007	0	0
2008	1	0
2009	0	0
2010	0	1
2011	8	1
Total	24	6

Table 7. Location habitat of overwintering Delaware River resident juvenile sturgeon in 2011-2012.

Date	Time	ID	Lat.	Long.	Water Temp. (°C)	Conduc-tivity (μ/cm)	Salinity (ppt)	Bottom substrate type (Benthic Mapping Program, DNREC)	Depth	Federal channel (F), anchorage (A), other (O)
11/15/2011	1:39:51 PM	58627	39.79667	-75.42102	10.3	177	0	fine to medium sand	12.8	A
11/15/2011	1:38:36 PM	2050	39.79803	-75.42244	10.3	177	0	fine to medium sand	12.5	A
11/15/2011	1:57:36 PM	1765	39.80351	-75.40781	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	1:57:51 PM	1767	39.80353	-75.40775	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	12:58:06 PM	2056	39.80371	-75.40697	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	2:00:15 PM	1771	39.80372	-75.40664	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	2:00:37 PM	2057	39.80376	-75.40645	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	2:01:11 PM	2049	39.80381	-75.40616	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	1:01:00 PM	1774	39.80399	-75.40612	10.3	177	0	fine to medium sand	12.2	A
11/15/2011	1:54:34 PM	2053	39.80485	-75.40772	10.3	177	0	fine to medium sand	12.8	A
11/15/2011	1:31:20 PM	1770	39.80513	-75.40187	10.3	177	0	fine to medium sand	13.1	A
11/18/2011	12:14:09 PM	1771	39.80079	-75.41413	9.5	195	0	fine to medium sand	13.4	A
11/18/2011	11:26:05 AM	2056	39.80353	-75.40619	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:25:10 AM	1773	39.80368	-75.40603	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:55:29 AM	1774	39.80368	-75.41086	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:33:28 AM	1766	39.80373	-75.40747	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:24:42 AM	1770	39.80381	-75.4059	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:51:22 AM	2053	39.80459	-75.40986	9.5	195	0	fine to medium sand	12.5	A
11/18/2011	11:20:36 AM	2049	39.80466	-75.4051	9.5	195	0	fine to medium sand	12.2	A
11/18/2011	11:13:04 AM	1767	39.80501	-75.40323	9.5	195	0	fine to medium sand	12.8	A
11/18/2011	2:36:05 PM	2058	39.8581	-75.23642	9.5	195	0	N/A	11.6	O
11/18/2011	2:50:31 PM	1769	39.85969	-75.22973	9.5	195	0	N/A	12.2	F
11/18/2011	2:46:07 PM	1769	39.8604	-75.23195	9.5	195	0	N/A	12.2	F
11/28/2011	11:39:21 AM	1774	39.79912	-75.41932	9.7	152	0	fine to medium sand	12.5	A
11/28/2011	11:49:04 AM	1770	39.80169	-75.41459	9.7	152	0	fine to medium sand	12.2	A
11/28/2011	1:01:36 PM	2050	39.80977	-75.39656	9.7	152	0	fine to medium sand	12.2	A
12/2/2011	2:33:32 PM	1769	39.85953	-75.23265	9.4	180	0	N/A	12.2	F
12/2/2011	1:22:44 PM	1765	39.87177	-75.20541	9.4	180	0	N/A	12.2	A
12/20/2011	12:17:08 PM	1774	39.80242	-75.40731	5.6	114	0	fine to medium sand	12.2	A
12/20/2011	12:13:40 PM	1770	39.80337	-75.40566	5.6	114	0	fine to medium sand	12.2	A
12/20/2011	11:47:01 AM	1771	39.80341	-75.40915	5.6	114	0	fine to medium sand	12.2	A
12/20/2011	11:45:40 AM	2091	39.80367	-75.40839	5.6	114	0	fine to medium sand	12.2	A
12/20/2011	11:21:24 AM	58628	39.81334	-75.39792	5.6	114	0	silt	13.7	F
1/6/2012	11:15:17 AM	2050	39.84756	-75.27694	4.2	149	0	N/A	14.0	F
1/20/2012	2:19:32 PM	1771	39.84549	-75.27823	3.3	136	0	N/A	9.1	O
1/26/2012	11:47:32 AM	58627	39.80168	-75.41449	3.3	140	0	fine to medium sand	13.4	A
1/26/2012	12:56:11 PM	1769	39.81091	-75.39407	3.3	140	0	fine to medium sand	12.5	A
1/26/2012	12:51:21 PM	1766	39.8129	-75.39301	3.3	140	0	silt	13.7	A
2/8/2012	12:47:13 PM	2050	39.84489	-75.27829	4.7	147	0	N/A	8.5	O
2/8/2012	1:25:52 PM	1771	39.86274	-75.22098	4.7	147	0	N/A	12.2	A
2/10/2012	10:24:00 AM	1765	39.814	-75.38845	4.9	152	0	fine to medium sand	12.8	A

Table 8. River of Origin (ROO), Sex, Arrival, Departure and Maximum upstream extent (rkm) for each Atlantic sturgeon in likely spawning condition that entered the Delaware River in 2011.

Atlantic sturgeon ID	ROO	Sex	Arrival		Departure		Maximum rkm
			Date	Temperature (°C)	Date	Temperature (°C)	
1052433	Delaware	Male	6-May	15.9	8-Jun	23.1	135
1052442	Delaware	Male	5-May	16.2	3-Jun	22.3	122
1084965	James	Male	13-May	17.2	30-May	21	190
1084956	Kennebec	Male	8-May	15.8	8-Jun	23.1	201
1084958	Delaware	Female	7-May	15.9	18-May	18.1	135
1084980	Delaware	Female	21-May	18.4	30-Jul	28.9	148

FIGURE 1. Adult sized sturgeon (estimated live length of 1830 mm TL), recovered at Broadkill Beach, DE on October 24, 2011 (top panel). Although this carcass was in a state of advanced decomposition, autopsy revealed that the sturgeon was cut dorsally behind the head (note the clean cut scute in bottom left and bottom right panel). Therefore, vessel strike was determined to be the likely cause of death. A genetic sample recovered from this individual was provided to I. Wirgin (NYU). Mitochondrial DNA analysis determined it was an E haplotype that is most commonly found in the Altamaha R., GA but also appears in the Edisto, Combahee, and Savannah Rivers (I. Wirgin, pers. com).

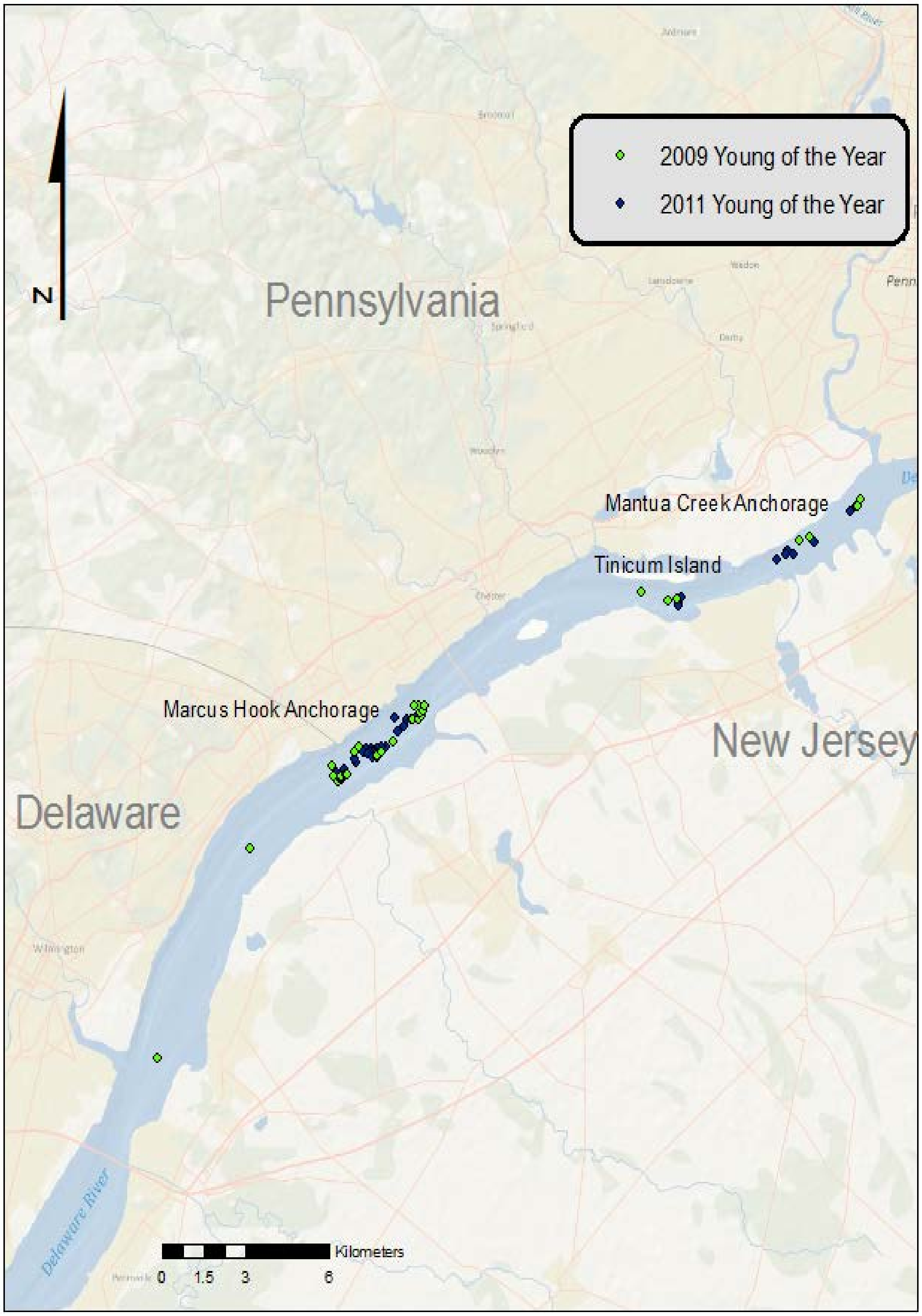

FIGURE 2. Manual tracking locations of transmitter (VEMCO) implanted young-of-the-year (254-363 mm TL) Atlantic sturgeon from October 26th to December 15th, 2009 and November 15th 2011 to February 8th, 2012. Weekly tracking ranged from the Delaware Memorial Bridge to the Walt Whitman Bridge (off map). During the tracking period several individuals moved up river out of tracking range and attempts to locate them manually were unsuccessful. All fish were released at the Marcus Hook anchorage from September 24th to November 9th, 2009 and September 30th to November 1st, 2011.

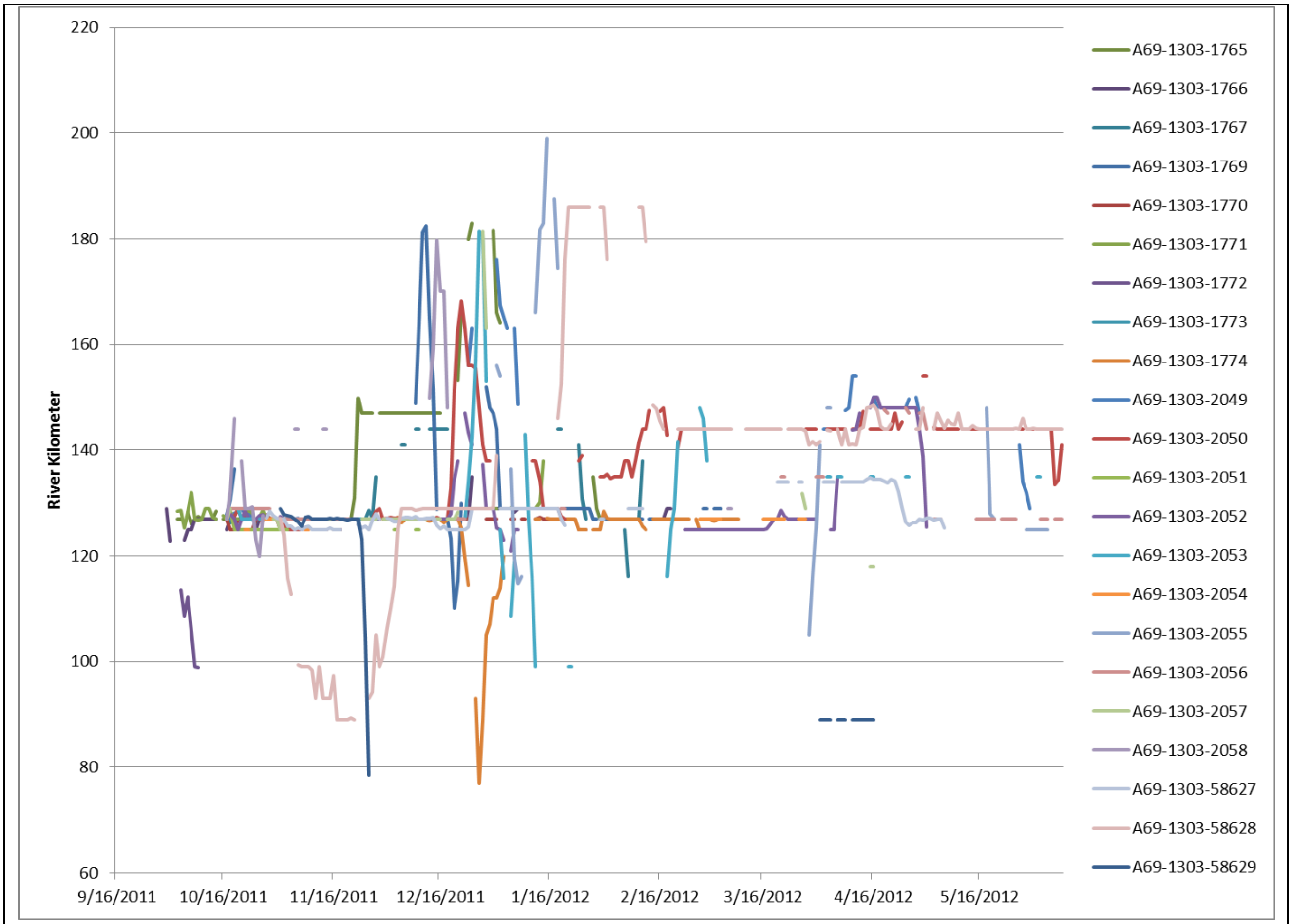

Figure 3. Passive array detections of Atlantic sturgeon young of the year, tagged from September 30th to November 1st, 2011.

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Maryland 2012 Atlantic sturgeon *Acipenser oxyrinchus* compliance report

Submitted to
Atlantic States Marine Fisheries Commission

Reporting period through December 31, 2011 unless otherwise noted

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Introduction:

Atlantic sturgeon (*Acipenser oxyrinchus*) were an important species to early settlers throughout the Chesapeake Bay region. High exploitation rates during the late 1800s and the building of stream blockages significantly reduced the Atlantic sturgeon population in the Chesapeake Bay. By 1928, Atlantic sturgeon were rarely caught north of the Potomac River (Merritt 1992). The Atlantic sturgeon fishery in Maryland waters was closed in 1994. Speir and O'Connell (1996) reviewed Maryland research records and concluded that the stock was not adequate to sustain meaningful reproduction. Atlantic sturgeon were considered biologically extirpated, or below minimum viable population size in the Chesapeake Bay by the late 1990s (Secor et al. 2000).

A joint Maryland Department of Natural Resources (DNR), University of Maryland, and U.S. Fish and Wildlife Service (USFWS) Atlantic sturgeon stocking project conducted in 1996 (Secor et al. 2000) and a subsequent Maryland Sturgeon Reward Program (Welsh et al. 1999) have provided important information on Atlantic sturgeon movement, distribution, growth, habitat, bycatch, feasibility of restoration stocking and survivability in commercial gear. The stocking project placed 3,275 marked, hatchery-origin juveniles into the Nanticoke River.

DNR maintains a captive brood stock population that could be utilized to conduct future hatchery-based restoration under the guidance of an approved recovery plan for Maryland. In addition to providing a future source of eggs and larvae, these fish are a valuable research tool and used to investigate gamete maturation, spawning physiology, sex identification, fish health and pathology, gamete cryopreservation, population genetics, nutrition, culture, and marking techniques. Surplus fish provide excellent outreach and education opportunities.

Bycatch Monitoring:

Maryland's commercial sturgeon fishery was closed in 1994. As recently as 1993, more than 5,000 pounds were reported landed in state waters. DNR conducts several fishery dependent and fishery independent surveys that provide the opportunity to observe live or dead sturgeon encountered as bycatch (Table 1). When DNR biologists observe sturgeon in commercial gear, watermen are generally aware of the Maryland Sturgeon Reward Program and will report these catches.

Since 1996, Maryland watermen have voluntarily reported their live catches of sturgeon to the USFWS Maryland Fishery Resources Office (USFWS-MFRO), who respond to measure, tag and release these fish. A $50.00 reward is offered for each live sturgeon (<1.828 m TL) turned into the program. A $250.00 reward is offered for any live Atlantic sturgeon measuring more than 1.828 m TL (six feet). Atlantic sturgeon larger than 1.828 m TL are presumed to be mature adults. The additional reward is offered to increase reporting for spawning stock assessment. During this sixteen-year period (1996-2011), Maryland watermen reported 2,269 live Atlantic sturgeon caught in commercial gear (567 hatchery-origin, 1,702 wild fish). Of the 567 hatchery fish reported recaptured, 463 were captured once (14% recapture rate), 79 were captured twice, 23 were captured three times and two fish were captured four times. All fish are tagged with coast-wide standardized PIT tags and an external T-bar tag prior to release.

Since 1996, commercial pound nets, fyke nets and gill nets have accounted for all but two of the sturgeon reported to the reward program as bycatch in Maryland. Figure 1 shows the annual reports of Atlantic sturgeon in the Maryland portion of the Chesapeake Bay from pound nets and gill nets over time. CPUE of Atlantic sturgeon reported through the reward program was estimated for pound nets and is equal to the annual catch divided by the annual summation of the number of pound nets set per month. CPUE for gill nets is equal to the annual number of Atlantic sturgeon reported through the reward program divided by the number of annual gill net license holders reporting catch of any species in Maryland (Figure 2).

DNR also conducts a monthly observer program in the Atlantic Ocean where onboard DNR biologists subsample the catch of the trawl fishery. The number of Atlantic sturgeon observations is variable from year to year (Table 2). No CPUE from these data was estimated because sample size and gear were not standardized.

There were no reports of sturgeon observations in any other surveys.

Monitoring results:

Reward Program

The Maryland Sturgeon Reward Program pays commercial fishermen for each live sturgeon reported to the program. Due to a record number of reported Atlantic sturgeon captures from October 2005 through May 2006, the reward level was reduced from $100.00 to $50.00 in October 2006. A $250.00 reward for larger fish (> 1.828 m TL) was instituted beginning December 1, 2007. Reward payments were maintained at this level through December 31, 2011. The reward program is operational from October 1 through May 31. Watermen must contact USFWS at 1-800-448-8322 to obtain a confirmation number prior to transporting any sturgeon. If the capture is outside of normal business hours (7:30-4:00 Monday-Friday), an alternative contact number is provided to the caller. Transport of Atlantic sturgeon without a confirmation number or scientific collection permit is prohibited. Participants are provided with handling instructions to ensure that fish are retained in conditions that will minimize stress and injury.

Experimental hatchery stocking

During the summer of 1996, 3,275 age one hatchery-origin Atlantic sturgeon were released in the Nanticoke River. These fish were produced at USFWS Northeast Fishery Center (USFWS-NFC) in Lamar, PA. During the fall of 1996, hatchery-produced Atlantic sturgeon were captured by commercial fishermen in the lower Nanticoke River as they moved into the Chesapeake Bay. They were caught throughout the Bay by winter of 1996. By the spring of 1997, these fish were dispersed throughout the main Bay and tributaries of Maryland and Virginia. Recaptures occurred in the Atlantic Ocean by October 1998, as they became ocean migrants. The long-term recapture rates within the Chesapeake Bay continued to decline due to ocean emigration and since 2002, only one hatchery reared Atlantic sturgeon has been reported (Figure 3). These fish are now at the age at which we could expect them to return to the Chesapeake Bay if they successfully imprinted to the stocking tributary. Since these fish were tagged with CWT, there is little chance that they will be identified by most sampling programs since the majority of researchers do not scan for CWT. The Maryland Sturgeon Reward Program does screen for CWT and PIT prior to tagging any captured sturgeon. There have been multiple, unconfirmed reports of large sturgeon observed in the Nanticoke River over the past several years. DNR and USFWS staff will respond to any sturgeon carcass reports or live catches to scan for CWT.

Monitoring of wild stocks

There were 1,579 wild, first-time Atlantic sturgeon captures reported from gill and pound nets between February 1996 and December 2011. These fish ranged from 405 mm TL to 2,420 mm TL. No young-of-year (YOY) fish were reported during this time. Several mature adults have been reported but none of these captures were in spawning habitats. Therefore, no confirmation of spawning has been observed in Maryland waters since the start of the reward program.

A subsample of tissues collected from these fish was submitted to USFWS-NFC Population Ecology Branch (Richardson et al, 2007) for genetic analysis. Origin assignments were generated by Tim King, USGS (Table 3). This analysis indicated that the majority of the fish originated from the James River and Hudson River populations (46% and 39%, respectively). The reward program encountered fish that originated as far south as Georgia and as far north as Canada, indicating that Maryland's Chesapeake Bay waters serve as habitat for all coastal populations (Richardson et al. 2007).

Reward program reports for calendar year 2011 totaled 28 gill net captures, and seven pound net captures. Length ranged from 510-1910 mm TL. All of these fish were first time captures. Capture rates for wild Atlantic sturgeon from all gears in the Chesapeake Bay are extremely variable from year to year (Figure 3). Length-frequencies of captured wild Atlantic sturgeon for selected years are presented in Figure 4.

An increase in the relative abundance of Atlantic sturgeon in 2005 and 2006 captured in pound nets and gill nets may be partially attributed to increased reporting rates by commercial fishermen due to a reward program reminder that was distributed to commercial watermen in

January 2005 (Figure 2). In addition, the apparent increase in abundance of Atlantic sturgeon using the Chesapeake Bay as a nursery or staging area may be attributed to recruitment from the James River and Hudson River since origin assignment indicates that these tributaries are major contributors to the Maryland migrant stock (85% combined). Migrant sub-adult Atlantic sturgeon appear in Maryland's portion of the Chesapeake Bay at approximately 500 mm TL and are subsequently captured in large numbers over a two-year period until they migrate back to the coastal population. The observed increase in relative abundance is therefore not indicative of increasing populations in Maryland.

Habitat:

Spawning habitat

Since no wild YOY Atlantic sturgeon have been detected in the Maryland portion of the Chesapeake Bay by fishery dependent or fishery independent sampling, defining spawning habitat is difficult. Self-sustaining populations of Atlantic sturgeon did exist in Maryland prior to 1900. Historic landings records indicate that spawning populations existed in the Patuxent River, Potomac River, Choptank River, Nanticoke River and Pocomoke River (Secor 2002).

Spawning occurs in fresh or brackish waters of estuaries (Smith 1985) and presumably occurred historically in all major Chesapeake Bay tributaries (ASMFC 1998). One factor that may limit spawning in the Chesapeake Bay is the loss of hard substrate to sedimentation (Secor et al. 2000, NMFS 1998). Secor also hypothesizes that increasing water temperatures and hypoxia will continue to restrict Atlantic sturgeon in the Chesapeake Bay (Secor and Niklitschek 2001).

Another limiting factor that affects spawning in some watersheds is stream blockages. The 1987 Chesapeake Bay Agreement committed to reopening access to historic habitat through fish passage and removal of blockages. The Fish Passage Workgroup of the Chesapeake Bay Program's Living Resources Subcommittee was charged with reopening blocked tributaries in Chesapeake Bay. Their ten-year goal was to reopen 1,357 miles of streams. That goal has since been increased to 2,807 miles for the Chesapeake Bay watershed. This is a cooperative effort between Virginia, Maryland, Pennsylvania and the District of Columbia. As of September 2011, 471 miles of Maryland streams have been reopened since 1988. (Jim Thompson DNR, pers. comm.). This was accomplished through the construction of fish passage facilities, dam removals and altering blockages with breeches or notches. The workgroup recently developed a new mapping tool to prioritize fish passage projects. The tool uses more than one dozen habitat and biological metrics to rank blockages across the entire Chesapeake Bay watershed. The tool can be accessed at http://maps.tnc.org/EROF_ChesapeakeFPP/ . There are currently no blockages to historic Atlantic sturgeon spawning habitat in Maryland since all remaining impediments to migration are upstream of the fall line.

YOY habitat

There has been no evidence of successful spawning in Maryland tributaries for at least 40 years and no mature adults have been observed during spawning season in spawning tributaries since the early 1970s. Therefore, it is unknown if Maryland tributaries will support successful larval survival, growth and dispersal. Presumably, increased sedimentation and hypoxia could limit the available nursery habitat for larval sturgeon. Experimental stocking trials could provide this necessary assessment.

Juvenile habitat

Experimental stocking of yearling Atlantic sturgeon in the Nanticoke River demonstrated that there is sufficient available habitat to support that life stage within Maryland's Chesapeake Bay. Stocked fish exhibited excellent survival, dispersal and growth up to one year after stocking (Secor et al. 2000). These fish continued to appear in reward program collections as they moved out into the main stem Chesapeake Bay and eventually migrated to the coastal stocks over the following several years.

The reward program has documented sub-adult sturgeon catches throughout Maryland waters since 1996 (Figure 5). Multiple recaptures indicate good survival and growth (Maryland Sturgeon Reward Program data). This is a fishery dependent survey and data is influenced by gear location.

Annual capture data has provided information on Atlantic sturgeon distribution, growth and habitat utilization within the Chesapeake Bay. Based on data collected through the Maryland Sturgeon Reward Program and the experimental stocking trial in 1996, Maryland's Chesapeake Bay appears to provide adequate nursery habitat for yearling sturgeon and forage habitat for migratory sub-adults. Mature adults have also been documented in the main stem Chesapeake Bay. Further investigation into identification and assessment of available spawning habitat and larval nursery habitat is necessary to completely evaluate the potential for Atlantic sturgeon conservation in Maryland. Test releases of larval sturgeon could verify habitat availability in target tributaries.

Aquaculture:

DNR Fisheries Service sturgeon conservation partnership, in cooperation with GenOn Energy (formerly Mirant Corporation) and the University of Maryland, is currently rearing 94 sub-adult and adult Atlantic sturgeon at GenOn's Chalk Point power plant property (Patuxent River), the University of Maryland's Center for Environmental Science Aquatic and Restoration Ecology Laboratory at Horn Point (AREL, Choptank River), DNR's Joseph Manning Hatchery and the Cooperative Oxford Laboratory. The purpose of these fish is captive brood stock development and research. These fish originated as either hatchery progeny of Hudson River brood stock spawned at USFWS-NFC between 1992 and 1998 or wild migrants collected from the Chesapeake Bay.

The large, wild-origin sturgeon are cultured for future use as captive brood stock. The domestic Hudson River origin sturgeon are cultured for research on reproductive physiology, spawning techniques and culture methodologies.

A small number of fertilized eggs and/or yolk sac larvae (~7,500) are imported each year from the Acadian Sturgeon and Caviar Company (St. John, New Brunswick, Canada) for research purposes. Research is primarily focused on improvement of culture techniques, larval and juvenile nutrition, marking and streamside culture to address imprinting issues. As these fish mature, they are also useful to investigate recirculating aquaculture system designs, fish health, reproductive physiology and adult nutrition. Surplus fish are utilized in education and outreach activities. These fish are tracked through a chain of custody procedure according to a plan presented to the ASMFC Atlantic Sturgeon Technical Committee and will not be released into surface waters. Canadian-origin sturgeon are currently housed at AREL, Chalk Point, DNR

Joseph Manning Fish Hatchery, DNR Cooperative Oxford Laboratory and an experimental streamside culture facility at GenOn Potomac River Generating Station in Alexandria, Virginia.

A summary of current sturgeon inventories is included in Table 4. Fish culture and husbandry methodologies are based on those described by Mohler (2004). All Atlantic sturgeon of suitable size are PIT tagged for individual identification and tissue samples from wild fish are archived for genetic analyses. Captive brood stock or any other sturgeon products are not subject to sale.

Facility descriptions

The GenOn Chalk Point facility is located on the Patuxent River in Aquasco, Maryland. It consists of an intensive culture building, containing flow-through culture tanks 6.1 m in diameter and earthen holding ponds with no drains or catch boxes. There is no filtration other than screened intakes. In a catastrophic event, ponds would overflow into a cooling channel, which is blocked off by netting.

AREL is located adjacent to the Choptank River in Cambridge, Maryland. This facility cultures Atlantic sturgeon in indoor culture tanks (2.4-3.7 m diameter) for training to commercial diets. Tanks can operate on either flow-through or recirculating supply. Discharge from this facility is strictly controlled and includes screens, filters and chemical treatment. Some sturgeon are also cultured in lined, earthen ponds. These ponds have no direct discharge to surface waters.

Manning Hatchery (Brandywine, Maryland) consists of indoor tank-culture facilities and earthen ponds with catch boxes and drains. Currently, sturgeon are not regularly cultured in ponds. Tanks range from 2.4-6.7 m in diameter. Water supply can operate under either recirculating or flow-through conditions. This facility discharges into a drainage pipe/ditch system so there is no direct discharge to surface waters. All outflows are screened to prevent escapement. Earthen ponds are used to hold excess sturgeon intermittently. Outflow is securely screened and ultimately flows to a drainage ditch so there is no direct discharge to surface waters.

GenOn Potomac River Generating Station (Alexandria, Virginia) cultures sturgeon in flow-through culture tanks. All larval tank outflows are securely screened with 100-micron mesh and juvenile culture tanks are fitted with double standpipes to prevent escapement. Discharge is to the power plant screen house intake.

Cooperative Oxford Laboratory (Oxford, Maryland) is a research laboratory that is jointly operated by Maryland DNR and National Oceanic and Atmospheric Administration. All culture tanks on site are supplied by flow-through river water. All tank outflows are securely screened and no escapement is possible through the external standpipe drain system. Drains empty into a tidal settling pond, which drains to the Choptank River. No fish are cultured in ponds.

To date, no escapement has been documented at any facility dating back to the inception of the project in 1996.

There are currently no certifications or authorizations relating to the health of the captive broodstock. Captive fish usually experience some parasite infestations of *Argulus sp* (“fish lice” or “sea lice”) during summer and high water temperatures. A variety of isolated health ailments have been documented over the duration of the project including parasites, bacterial infections, and fungal infections.

Current funding is from the DNR Fisheries Service operating budget and in-kind contributions from GenOn.

Disposition of surplus Canadian-origin juveniles

Surplus Canadian-origin hatchery fish are provided to any suitable facility for research, outreach or education purposes. Participating institutions include universities, school programs, environmental educators, and other state and federal agencies. DNR maintains a permit system to evaluate applicants and maintain written records for sturgeon transfers. The applicant must demonstrate suitable experience and facility resources in order to culture sturgeon for an extended time period. They must also agree not to release any fish into surface waters. Applicants agree to obtain required permits from state and federal regulatory agencies and will not transfer fish without written approval from DNR. All fish are tagged with PIT for permanent identification and records are maintained by Chuck Stence (DNR, 410.643.6788 x2114) in Stevensville, MD.

Transfers of surplus fish have been of great benefit to researchers and educators and serve to raise the profile of Atlantic sturgeon and promote stewardship for the resource. There are currently 8 institutions participating in the program and they care for 405 animals as of December 2011 (2005-11 year classes). A “sturgeon in schools” classroom program was terminated in 2011, resulting in a drop from 37 participating institutions.

Spawning and experimental stocking rationale

Captive brood stock should ultimately produce progeny that could be utilized in stocking trials. Proposed experimental stocking is one component of a larger sturgeon conservation project conducted by DNR, USFWS, the University of Maryland and GenOn. The overall goal of the conservation effort is to support spawning populations of Atlantic sturgeon Maryland's Chesapeake Bay tributaries. Experimental stocking is one strategy that could be employed to produce several outputs and outcomes.

The intended objective of captive Atlantic sturgeon spawning and experimental stocking is to monitor survival, growth and movement of stocked fish. Successful spawning and subsequent experimental stocking could produce important benefits including:

1. Further refine culture techniques
2. Assess efficacy of cryopreserved Atlantic sturgeon sperm
3. Evaluate marking techniques
4. Estimate survival and juvenile abundance of stocked sturgeon
5. Investigate imprinting and stream fidelity
6. Develop streamside culture facilities
7. Assess target tributaries and related habitat suitability

Experimental stocking is an objective of our conservation effort and would evaluate several aspects of the project. Stocking trials would utilize the guidance documents from the Atlantic States Marine Fisheries Commission Guidelines for Stocking Cultured Atlantic Sturgeon for Supplementation or Reintroduction (ASMFC)**.**

A summary of a proposed experimental stocking plan was presented to the ASMFC Atlantic Sturgeon Technical Meeting in Manchester, New Hampshire on July 25, 2007. DNR solicited peer review from committee members on the proposed experimental stocking project in the event that a spawning opportunity arises. If such an opportunity does occur, we would likely propose experimental stocking with the support of the Technical Committee.

Streamside culture

Genetic analysis indicates low gene flow from riverine sub-populations (Wirgin et al. 2000; King et al. 2001) strongly suggesting that Atlantic sturgeon return to their river of origin to spawn. The mechanism of imprinting and homing in Atlantic sturgeon is undetermined. In order to address imprinting concerns, fish cultured streamside to the target tributary could be a valuable restoration technique. If chemical imprinting is the mechanism for stream fidelity, streamside culture should improve homing for fish stocked as juveniles since they will have been grown in water sourced from the target tributary. Experimental stocking trials could also provide some insight into the timing of imprinting. A cooperative fish culture facility at the GenOn Potomac River Generating Station in Alexandria, Virginia has already been constructed for this purpose. This facility has successfully cultured yolk-sac larvae to juvenile size and successful growout for a period of one year. GenOn has committed to funding the project through 2012. Technical problems such as episodic high sediment loading and high larval culture water temperatures are under investigation.

Conservation target tributaries

Potential target tributaries are being evaluated. Several factors dictate the decision process:

1. Historical records
2. Habitat and hydrology similar to other mid-Atlantic tributaries that currently support spawning populations of Atlantic sturgeon
3. Indications of shortnose sturgeon spawning
4. Feasibility to conduct appropriate monitoring
5. Ability to conduct streamside culture

Atlantic sturgeon historically spawned in the larger tributaries of the Chesapeake Bay (Secor et al. 2000, ASMFC 1998). At this time, the most likely suitable Maryland tributaries for targeted evaluation and conservation efforts are the Potomac River, Pocomoke River and Choptank River. Historical records indicate that these tributaries supported spawning populations of Atlantic sturgeon. Existing sampling programs, in addition to commercial fisheries, closely monitor these rivers. USFWS-MFRO is currently tracking shortnose sturgeon in the Potomac River and mature fish have migrated to historic spawning sites during the spawning season. This could indicate potential spawning habitat, although no direct evidence of successful spawning activity (eggs or larvae) has been observed. Finally, DNR and GenOn Potomac River Generating Station collaborated on development of a streamside sturgeon culture facility at their Alexandria power plant. GenOn provides physical plant space and significant financial support to enable larval and juvenile culture to take place utilizing water drawn directly from the Potomac River. The Choptank River and Pocomoke River have potential sites that would be appropriate for streamside culture facility construction.

Conservation

Research will continue in order to improve culture, spawning and marking techniques for Atlantic sturgeon. Captive brood stock will be managed to improve genetic diversity and increase the number of potential spawners originating from adjacent riverine populations. Funding for fishery independent surveys will be pursued to document the presence or absence of spawning populations in potential target tributaries. Identification of potential spawning and larval nursery habitat is also a research priority in Maryland.

2011 research

Spermiation trials-Laparoscopic evaluation determined that eleven male sturgeon from the captive brood stock at AREL and CPGS were mature (white and enlarged testes). A 1.0 cc syringe was used to inject the males with LHRHa at a rate of 30.0 µg/kg body weight. Males were examined 24 hours post-injection and an average of 98 ml of sperm was collected from each fish. A 30.0 ml sperm sub-sample from each fish was sent to Dr. Curry Woods (University of Maryland) for analysis. University of Maryland partners compared sperm quality from captive fish to samples collected from wild sturgeon (Dr. Curry Woods, pers. comm.). Sperm was analyzed for pH, osmolality, density, viability and motility. Sperm motility from the males ranged from 0 to 90%.

Laparoscopic evaluations-Each year, DNR biologists perform laparoscopic evaluations on captive females to determine their level of sexual maturity. In this process, an endoscope is inserted through a small incision in the body cavity. This minimally invasive procedure monitors the progress of sexual maturity without imparting undue stress to the animal. Perfecting the laparoscopic surgery procedures used to determine sex and fertility is one goal of the Maryland Atlantic Sturgeon Restoration Program. Several females exhibit numerous white oocytes attached to the ovaries, but no females were found to be sexually mature in 2011.

Sea lice infestation -Sea lice *Argulus sp*. are external parasites that infect a variety of freshwater fish species. Environmental conditions such as temperature change and high organic loading from feed may increase the incidence of external parasites. Captive sturgeon brood stock are cultured at the GenOn Chalk Point aquaculture facility in Aquasco, MD. Sturgeon are cultured in four 6.1 meter circular flow through tanks. River water is supplied and filtered by 100 micron screening installed on the water inlet. As water temperatures rise in June, *Argulus sp.* egg clusters begin to appear on the walls and bottom of the tanks. Most sturgeon are infected with *Argulus sp.* by mid July. Infestations cause substantial redness and swelling of the integument. The subsequent lesions present a pathway for opportunistic pathogens to infect the captive populations. Stress and bacterial infection result in poor fish condition and mortality. There are no chemicals currently labeled for use to eradicate sea lice on Atlantic sturgeon. Hydrogen peroxide and formalin are viable alternatives, however H_2O_2 becomes lethal to sturgeon when administered at water temperatures above 25˚C and formalin can have environmental impacts. Emamectin benzoate is potentially effective to treat sea lice and is the active ingredient in SLICE®. It was originally developed for the food crop industry but has been incorporated into the Investigational New Animal Drug (INAD) program. This joint program is operated by the US Food & Drug Administration and the USFWS Aquatic Animal Drug Approval Partnership (AADAP) to collect data that supports label use approval for aquaculture drugs. SLICE® is top coated to fish feed. When ingested, SLICE® is distributed throughout the fish tissues. The louse dies by paralysis resulting from the disruption of nerve impulses. (USFWS Study Protocol INAD

11-370). Emamectin benzoate is slowly metabolized by the sturgeon, resulting in an extended period of protection. SLICE® treatments are currently only authorized for use under the AADAP program but in the future, this extended protection could be used as a prophylactic treatment to eliminate these infestations. In 2011, 103 sub-adult and adult sturgeon were treated for seven days with SLICE®. Treated feed was offered during the initial feeding of the day to assure SLICE® would be ingested. These treatments have been very successful. Trial success could not be quantified, as there were too many lice on each fish to accurately count without undue stress to the fish. Each fish was examined at ten days post-treatment and all of the fish appeared in good health. Their abdomens were white and no redness or swelling was observed. Few *Argulus sp*. were still present on the sturgeon even though post-treatment inspections revealed *Argulus sp*. egg clusters on many of the tank walls. Isolated *Argulus sp*. were also observed on a few of the fish. The absence of redness and swelling on these fish suggest that SLICE® is an effective treatment for *Argulus sp*. Photographs and a grading system will be used in 2012 to qualify the severity and subsequent recovery of infected sturgeon.

Analysis of the effects of various prepared diets on gonadal development and sex steroid levels of Atlantic sturgeon - Long-term absence of essential fatty acids (EFA) in fish diets can lead to reduced growth, increased mortality and reduced reproductive potential (Tocher 2008). Cooperative partner UMCES AREL designed a study to examine effects to Atlantic sturgeon. Summary text below is excerpted from <u>Analysis of the effects of various prepared diets on gonadal development and sex steroid levels of Atlantic sturgeon</u> (Lazur and Ryder 2011). This is an unpublished progress report to MD DNR. Request for a copy of the full report or questions regarding this research can be addressed to Erin Markin eryder@hpl.umces.edu or 410.221.8326.

Objective and Methods

We developed a study to determine the effect of varied prepared diets on gonadal development and sex steroid levels in juvenile Atlantic sturgeon. 2008 year class (YC) juvenile sturgeon (avg wt 0.544kg) were acquired from Acadian Sturgeon and Caviar Inc, Saint John, NB, Canada. Three diet treatments were developed and evaluated: 1) a specialty diet containing 25 g/kg fish oil and 25 g/kg flaxseed oil (FO+FSO); 2) a specialty diet containing flaxseed oil at 50 g/kg of diet dry weight (FSO); and 3) a control diet containing fish oil at 50 g/kg of diet dry weight (FO). Seven fish were exposed to each treatment for one year (n=21). Gonads and blood samples were collected at the start and end of the study. Sex and stage of maturity were determined from gonad samples. Blood samples were collected for analysis of plasma testosterone and estradiol concentrations.

Results

The fish oil (FO) and fish oil+flaxseed oil (FO+FSO) contain higher levels of DHA (C22:6) and EPA (C20:5). The flaxseed oil diet (FSO) contains higher levels of α-linoleic acid + oleic/elaidic acid (C18:3+C18:1Δ9) and linoleic acid (C18:2). CHN (carbon:hydrogen:nitrogen) for each specialty diet was also performed. There was no statistical difference in growth between treatments ($p = 0.1470$). An increase in sex steroid levels within sexes after one year of the study is evident. There was no statistical difference in initial estradiol levels between sexes ($p=0.3161$). However, after one year, there was a statistical difference in estradiol levels between female and male Atlantic sturgeon ($p<0.0001$) with higher estradiol levels found in female Atlantic sturgeon. There was statistical differences in initial testosterone levels between sexes ($p<0.0001$) with male Atlantic sturgeon have significantly higher testosterone levels. This held true after one year with male Atlantic sturgeon having statistically higher testosterone levels than female Atlantic sturgeon ($p<0.0001$). Two stage I females were determined to be stage II after year one. One stage I male was determined to be stage II after year one. There were no significant differences in sex steroid levels between diet treatments. The only male in the FO+FSO treatment died so no data exists for males in that diet treatment. Sexes were analyzed separately as significant differences in sex steroid levels exist between sexes.

Discussion

Sex steroids levels, estradiol and testosterone, increased in both male and female Atlantic sturgeon after year one of the study. Estradiol levels increased almost 6-fold in female Atlantic sturgeon. The highest estradiol level observed was 2320.5 pg/ml. The highest testosterone level observed was 8793.6 pg/ml. In a study using 11-yr old male sturgeon hybrid, bester, serum testosterone levels ranged from 13 ng/ml (13,000 pg/ml) to 28 ng/ml (28,000 pg/ml) (Amiri et al. 1996a).   In a study using female sturgeon hybrid, bester, immature females had serum estradiol levels <0.6 ng/ml (600 pg/ml) and testosterone levels between 5-15 ng/ml (500-1500 pg/ml). The immature Atlantic sturgeon females in our study had higher levels of estradiol than reported for sturgeon hybrid, bester. In a study by Barannikova et al. (2004), they found female Russian sturgeon, Acipenser gueldenstaedtii, with stage II gonadal development had estradiol levels 0.019 ng/ml (19 pg/ml) and testosterone levels of 11.5 ng/ml (11,500 pg/ml). Male Russian sturgeon with stage II gonadal development had 12.8 ng/ml (12,800 pg/ml) testosterone levels (Barannikova et al. 2004). Female giant sturgeon, Huso huso, with stage II gonads had estradiol levels of 0.196 ng/ml (196 pg/ml) and testosterone levels of 0.3 ng/ml (300 pg/ml) (Barannikova et al. 2004). Male giant sturgeon with stage II gonads had testosterone levels of 0.7 ng/ml (700 pg/ml) (Barannikova et al. 2004). The female stellate sturgeon, Acipenser stellatus, with stage II gonadal development had estradiol levels of 0.024 ng/ml (24 pg/ml) and testosterone levels of 9.4 ng/ml (9,400 pg/ml) and males with stage II gonads had testosterone levels of 13.5 ng/ml

(13,500 pg/ml) (Barannikova et al. 2004). All the Atlantic sturgeon females in our study (stage I and II) had higher levels of estradiol after the first year of the study. Their testosterone levels were much lower than found by Barannikova et al. (2004). The male Atlantic sturgeon in our study (stage I and II) had lower testosterone levels than the stellate and Russian sturgeon but had higher levels than the giant sturgeon in the Barannikova et al. (2004) study.

We do not know if the diet is influencing the increase in sex steroid levels since gonadal development only advanced in a few Atlantic sturgeon during the study. This project is being carried on for another year. If possible, tissue samples will be collected to determine fatty acid profiles of the sturgeon from each diet which may tell us how much or which fatty acids were incorporated into the sturgeon and if conversion of fatty acids occurred. The additional year may also provide time to see differences occur in sex steroid levels between diet treatments.

Amiri BM, Maebayashi M, Adachi S, Yamauchi K (1996a) Testicular devlopment and serum sex steroid profiles during the annual sexual cycle of the male sturgeon hybrid, bester. J Fish Biol 48:1039-1050.

Barannikova IA, Bayunova LV, Semenkova TB (2004) Serum levels of testosterone, 11-ketotestosterone and oestradiol-17B in three species of sturgeon during gonandal development and final maturation induced by hormonal treatment. J Fish Biol 64:1330-1338.

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Feed Training-In 2011, AREL received thirty-eight Atlantic sturgeon through the Maryland Sturgeon Reward Program. Fish arriving at AREL were weighed, measured, PIT tagged, and a DNA sample was taken. The fish were then examined for external parasites and general health observations were noted. Some fish had minor skin lesions, abrasions and or injuries and were treated with either formalin or potassium permanganate. Since these fish could be potentially held for years as captive brood stock, it is necessary to transition the sturgeon to a commercial diet. This can be challenging, especially for older and larger specimens that tend to be difficult to train to pelletized diets. Initially, sturgeon were offered pieces of shrimp daily until staff biologists observed feeding behavior. This can take from several weeks to months. Once the fish were feeding on shrimp, a gel diet (the Maymont diet) consisting of gelatin, ground commercial fish pellets, spinach, carrots, shrimp, squid, fish fillets and spirulina (algae flakes) was offered along with the cut shrimp. This feeding regimen continued until the sturgeon were eating 100% gel diet. Once the gel diet was accepted, the process was repeated with the gel diet and commercial pellets. Eleven fish were successfully trained onto commercial pellets (Zeigler Brood Stock Diet, Gardners, PA or Nelson and Sons Silver Cup, Tooele, UT). Three fish were received in poor condition and died shortly after arrival. It is unusual to observe fish from the reward program in poor condition so it is likely that these fish were in poor health prior to capture. Two sturgeon could not be trained to feed and were released in good condition. Typically, sturgeon that are captured and delivered to AREL readily accept natural food within the first month. If they fail to take natural foods, they are released before weight loss exceeds 25% of body weight. Three fish died during the course of the year long trial. One sturgeon that was successfully trained to commercial feed died unexpectedly. Necropsies performed on fish mortalities were indeterminate. Renewed focus will be placed on captive sturgeon mortalities. Fish that are not taking any food will be evaluated at 15-20% body weight loss. If fish condition looks compromised, they will be released. Any fish that loses 25% body weight will be released regardless of fish condition.

Maryland DNR intends to incorporate existing and new data into a Maryland Sturgeon Recovery Plan that will guide future conservation planning.

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Table 1. Summary of statewide sampling programs that could potentially encounter Atlantic sturgeon. Sturgeon are observed frequently in the Maryland Sturgeon Reward Program. The only other program that has encountered sturgeon is the Atlantic Ocean Observer Program. Observations from this survey are variable among years and not common overall.

Area	Gear Type	Target Species	Years	Program Status	Atlantic Sturgeon Captured
Chesapeake Bay and Tributaries	Various commercial gear (Maryland Sturgeon Reward Program)	All commercial species	1996 - present	Ongoing	Yes
Chesapeake Bay and Tributaries	Seine (MDNR Juvenile Finfish Survey)	Juvenile striped bass	1959-present	Ongoing	No
Chesapeake Bay	Bottom trawl (MDNR Blue Crab and Fisheries Service Surveys)	Blue crabs and juvenile finfish	1977-present	Ongoing	No
Conowingo Dam	Fish Lifts (Power company survey)	Anadromous species	1972-present	Ongoing	No
Chesapeake Bay and Tributaries	Experimental gill nets & pound nets (Conducted by MDNR)	Mature striped bass	1982-present	Ongoing	No
Atlantic Ocean	Various commercial gear (Observer program)	All commercial species	1995 - present	Ongoing	Yes

Table 2. Annual catch of Atlantic sturgeon as observed by Maryland Atlantic coast onboard observer program, 1995-2011.

Year	Number of Atlantic sturgeon Captured during the Observer Program
1995	1
1996	0
1997	2
1998	6
1999	1
2000	0
2001	0
2002	0
2003	0
2004	0
2005	27
2006	4
2007	7
2008	0
2009	0
2010	0
2011	1

Table 3. Origin assignments for sub-adult Atlantic sturgeon collected from the Maryland Sturgeon Reward Program. A subsample (N=312) of archived tissue samples originally collected from 1997-2006 was analyzed for origin. Delaware River populations are not included in the baseline data due to low sample size for known origin fish from this tributary. Origin assignments were generated by Tim King, USGS.

Origin assignment population	N	Percent
St. John (New Brunswick, Canada)	5	1.6
Kennebec (Maine, USA)	8	2.6
Hudson (New York, USA)	121	38.8
James (Virginia Chesapeake Bay, USA)	142	45.5
Albermarle (North Carolina, USA)	4	1.3
Savannah (Georgia, USA)	23	7.4
Altamaha (Georgia, USA)	4	1.3
Ogeechee (Georgia, USA)	5	1.6

Table 4. Atlantic sturgeon inventories at five facilities cooperating with the Maryland DNR sturgeon conservation project. Facilities include University of Maryland Aquaculture and Restoration Ecology Laboratory (AREL, Cambridge, MD), Maryland DNR Joseph Manning Hatchery (Brandywine, MD), GenOn Energy Potomac River Generating Station (Alexandria, VA), GenOn Energy Chalk Point Generating Station (Aquasco, MD) and Cooperative Oxford Laboratory (COL, Oxford, MD). All fish are implanted with PIT tags as soon as they reach suitable size (approximately 6-9 months age). YC=year class, H=hatchery origin, W=wild origin.

Facility	YC	Num.	Mean weight (kg)	Origin	Source	Date of inventory
AREL tanks	2008	20	2.84	Canada	H	10/24/12
AREL tanks	2010	75	0.91	Canada	H	10/24/12
AREL tanks	2011	125	0.14	Canada	H	10/24/12
AREL tanks	2012	15	0.048	Canada	H	09/24/12
Manning Hatchery	Various	9	12.06	Chesapeake	W	07/24/12
GenOn Chalk Point	≤ 1998	13	22.44	Hudson	H	07/24/12
GenOn Chalk Point	2005	1	7.76	Canada	H	07/24/12
GenOn Chalk Point	2007	4	2.52	Canada	H	07/24/12
GenOn Chalk Point	2008	53	2.46	Canada	H	07/24/12
GenOn Chalk Point	Various	19	11.05	Chesapeake	W	07/24/12
COL	2005	1	9.72	Canadian	H	07/17/12
COL	2006	4	9.32	Canadian	H	07/17/12
COL	Various	2	33.16	Chesapeake	W	07/17/12

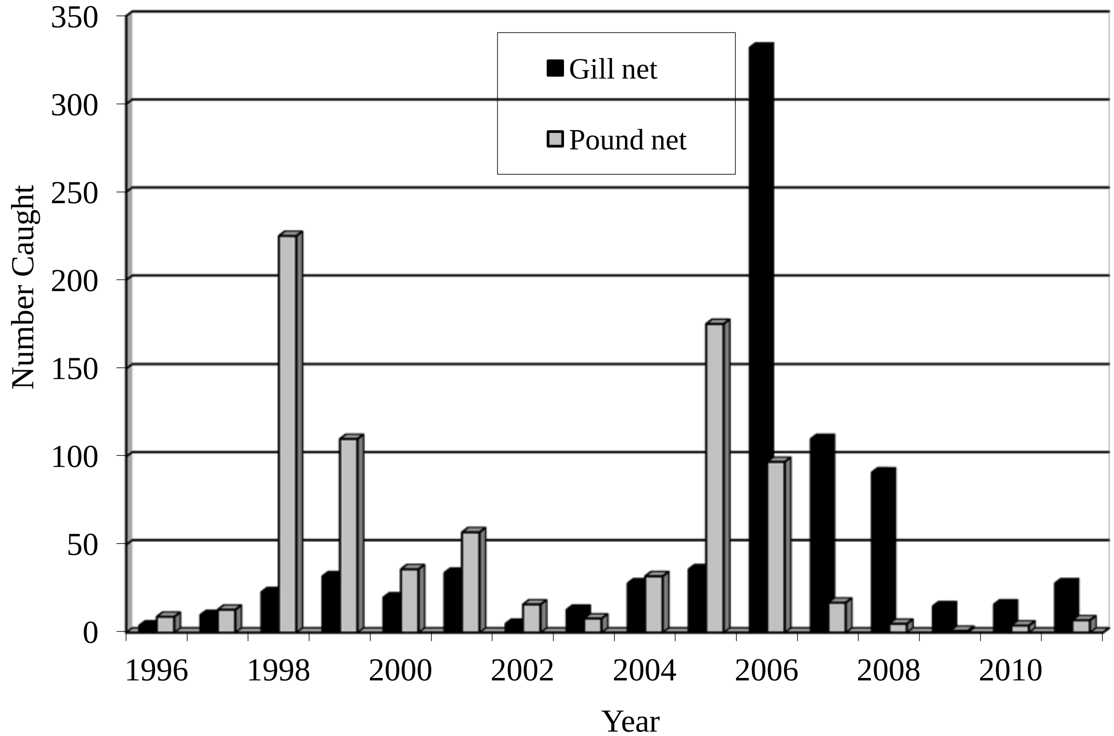

Figure 1. Annual number of Atlantic sturgeon captured by pound and gill nets as reported to the U.S. Fish and Wildlife Service, 1996-2011.

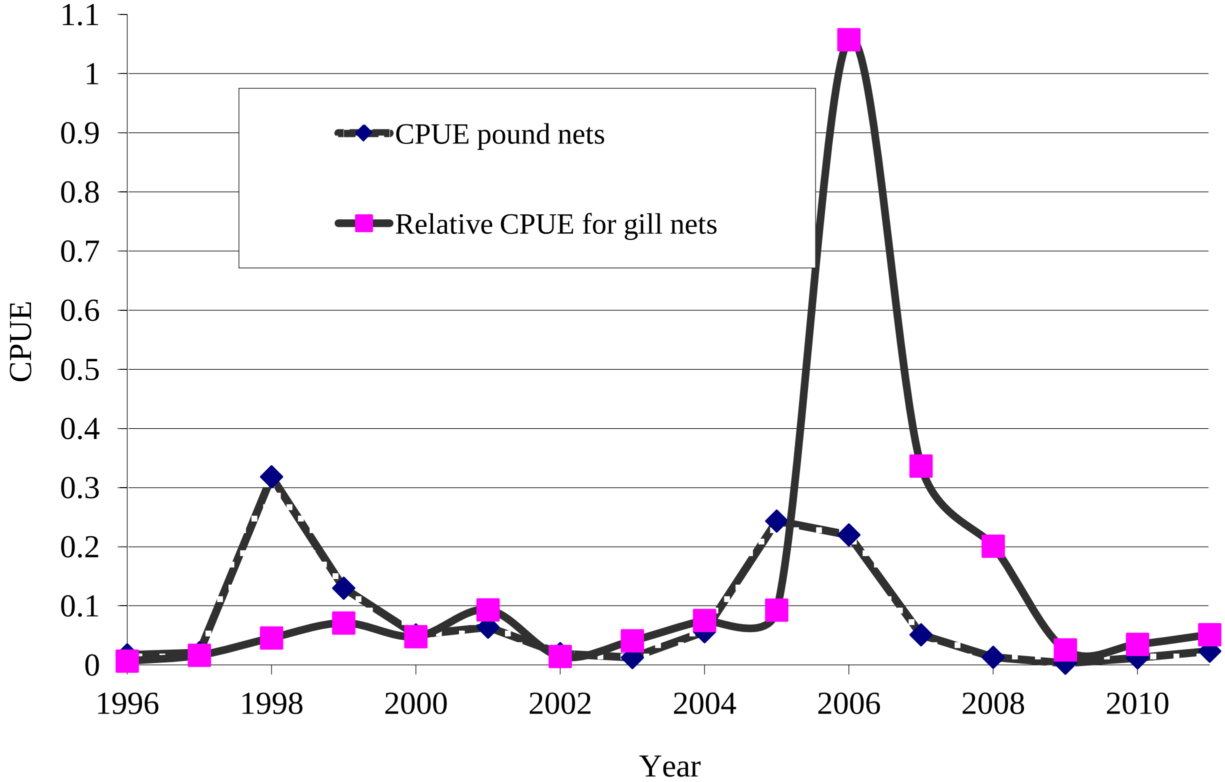

Figure 2. CPUE of pound and gill net Atlantic sturgeon captures from Maryland's portion of the Chesapeake Bay, 1996-2011. Pound net CPUE is the total number of sturgeon reported from pound nets divided by the annual summation of the number of pound nets fished monthly in Maryland. CPUE for gill nets is equal to the annual number of Atlantic sturgeon reported from gill nets through the reward program divided by the number of annual gill net license holders reporting catch of any species in Maryland.

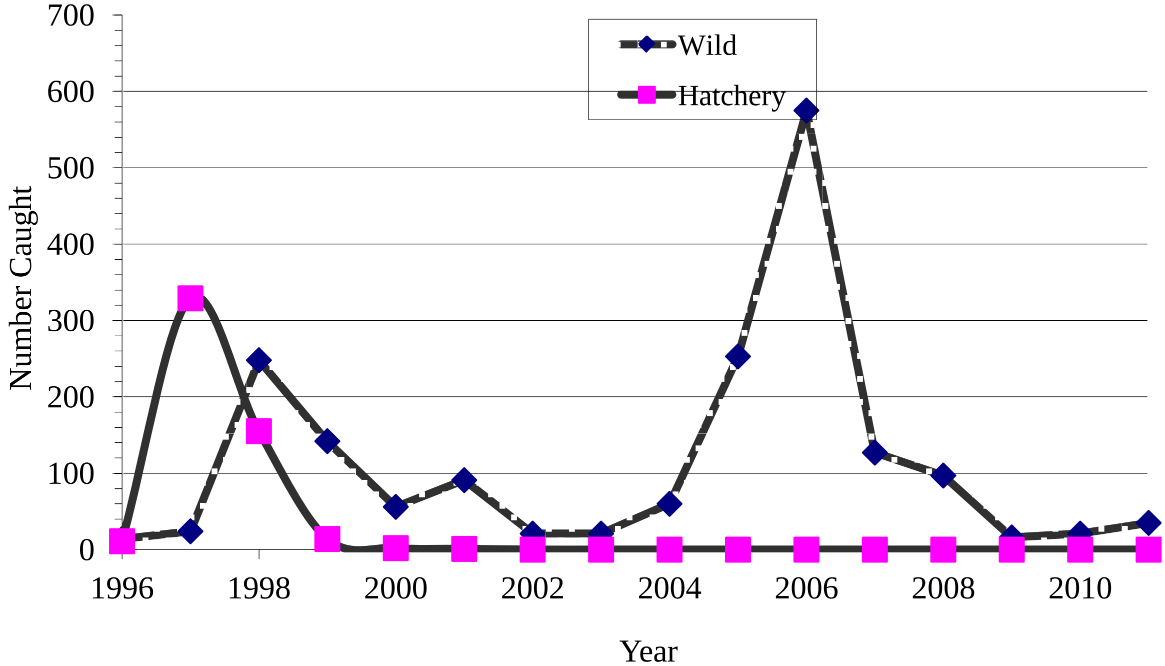

Figure 3. Total annual catch of hatchery and wild Atlantic sturgeon as reported to the U.S. Fish and Wildlife Service, 1996-2011.

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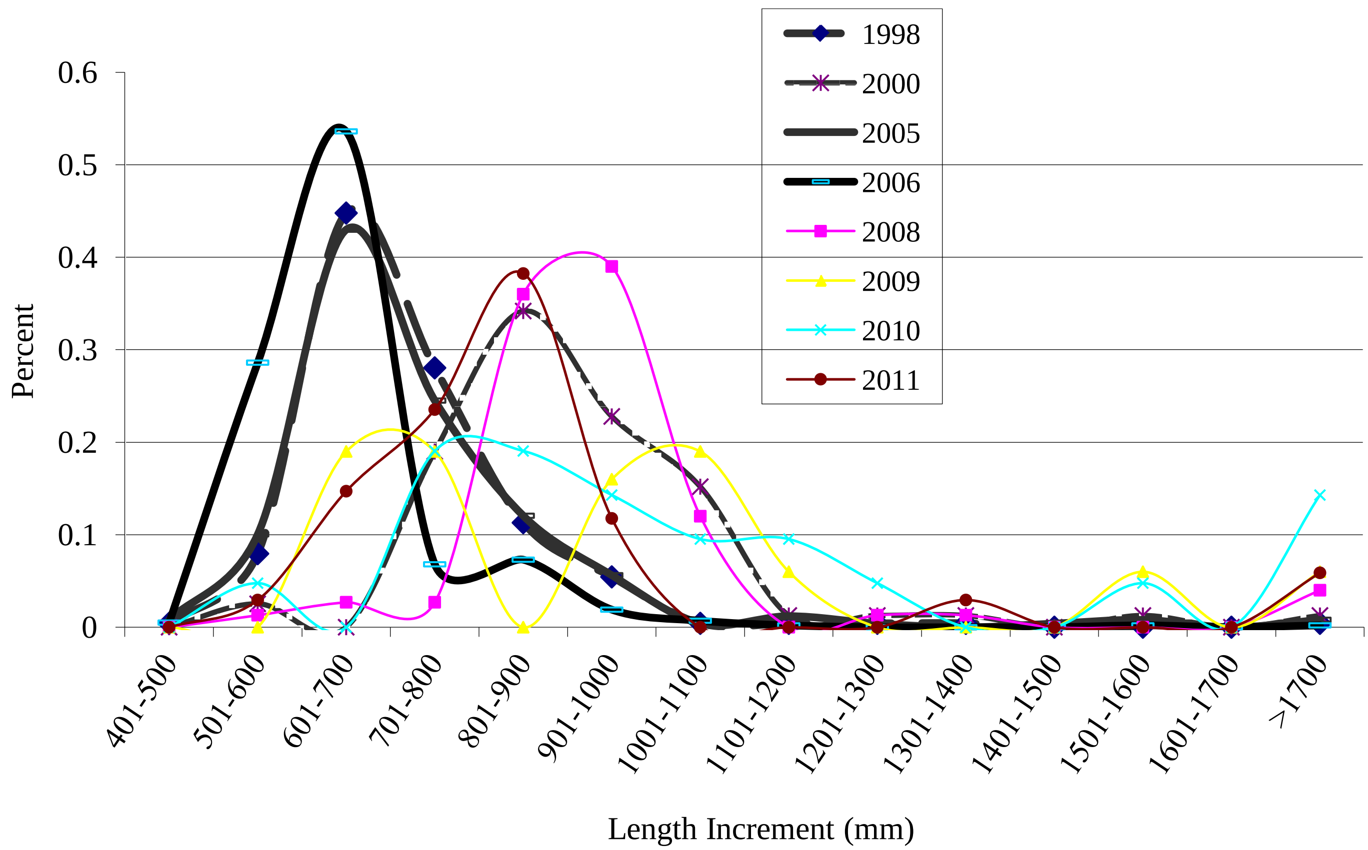


Figure 4. Length-frequencies of wild Atlantic sturgeon reported to the U.S. Fish and Wildlife Service for select years 1998, 2000, 2005, 2006, 2008-11.

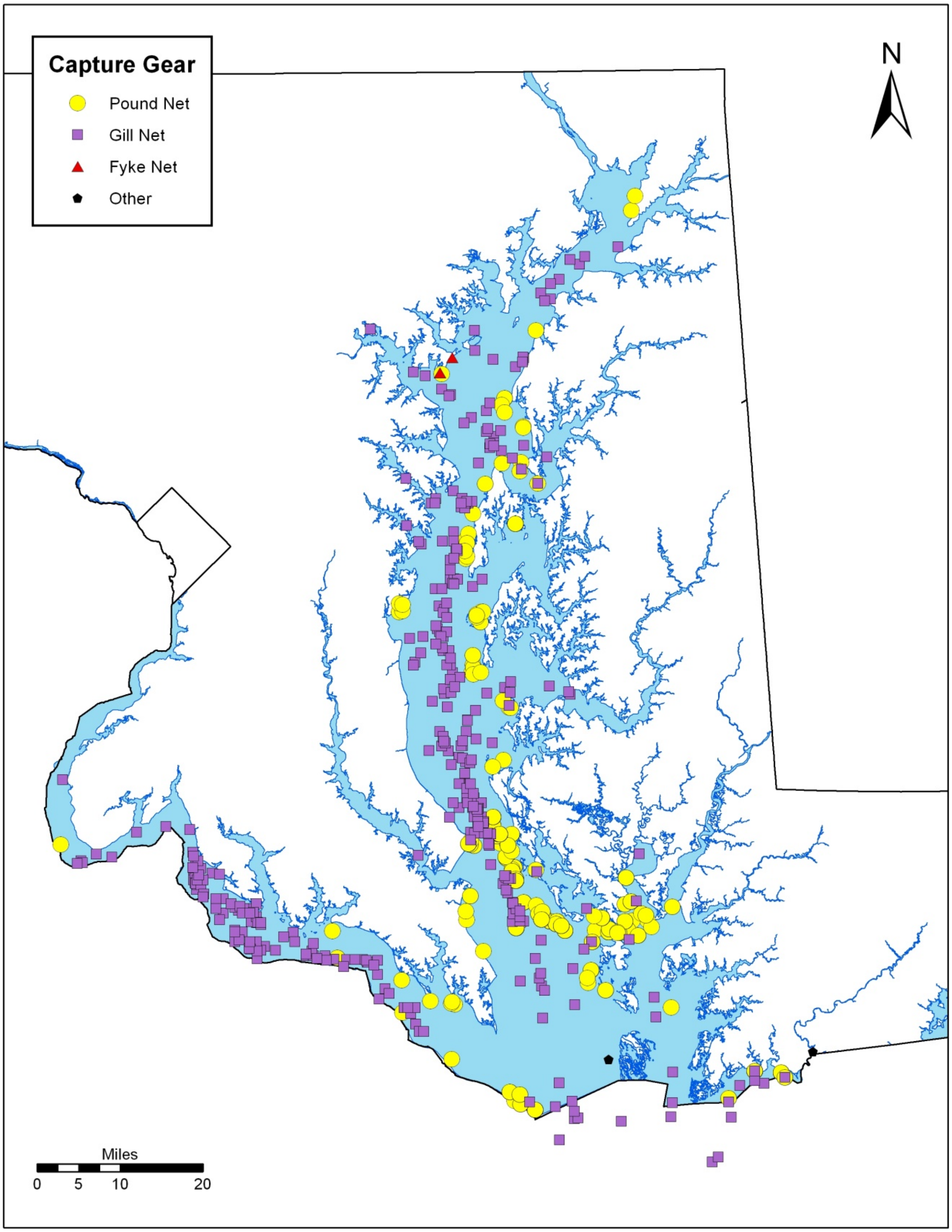


Figure 5. Atlantic sturgeon capture locations reported to the Maryland Sturgeon Reward program from 1996-2011 by gear type. Gear listed as "other" includes crab pots and eel pots. This fishery dependent survey is not a comprehensive indicator of sturgeon habitat preference use since the data is influenced by gear location.

DISTRICT OF COLUMBIA FISHERIES AND WILDLIFE MANAGEMENT DIVISION
2011 ANNUAL STATE COMPLIANCE REPORT FOR ATLANTIC STURGEON

Fisheries Research Branch

Introduction

In the District of Columbia the Potomac River historically supported a good population of Atlantic sturgeon. Due to habitat degradation and over-fishing this species has been nearly decimated from the waters in the District for well over 60 years. With evidence of a tagged sturgeon in D.C. waters as recently as the spring of 2005, interest in restoring the Atlantic sturgeon has peaked. Complying with the Atlantic Sturgeon Management Plan will create the potential for seeing the return of this magnificent fish to the Potomac River.

II. Request for *de minimis,* where applicable.

Not applicable.

III. Previous calendar year's fishery and management program

a. Activity and results of fishery-dependent monitoring (provide general results and references to technical documentation).

Not applicable since no commercial fishery for sturgeon exists in the District of Columbia

b. Activity and results of fishery-independent monitoring (provide general results and references to technical documentation).

There is no monitoring program specifically directed at the capture of sturgeon in the District, and none have been collected during any routine fishery sampling.

c. Copy of regulations that were in effect, including a reference to the specific compliance criteria as mandated in the FMP.

There are no commercial fisheries in the District, and there is currently a moratorium on the recreational catch or possession of sturgeon.

d. Harvest broken down by commercial (by gear type where applicable) and recreational, and non-harvest losses (when available).

No commercial fishery for sturgeon exists in the District of Columbia, and we have no data on recreational by-catch.

e. Review of progress in implementing habitat recommendations.

There is no specific program in the District to modify or enhance Atlantic sturgeon habitat.

IV. Planned management programs for the current calendar year.
There are no planned management programs for sturgeon.

a. Summarize regulations that will be in effect. (Copy of current regulations if different from III c.
There is currently a moratorium on the recreational catch or possession of sturgeon in the District of Columbia.

b. Summarize monitoring programs that will be performed.
While there is no specific sampling targeted at sturgeon, the District's general anadromous and resident fish surveys will continue in 2012. Sampling methodologies for these surveys include electrofishing, seining, push-netting and gillnetting.

c. Highlight any changes from the previous year.
No change.

V. Plan specific requirements

a. Results of bycatch monitoring for Atlantic sturgeon in other fisheries as per Section 3.4 of the FMP.
No commercial fishery for sturgeon exists in the District of Columbia, and we have no data on recreational bycatch.

b. Monitoring results (tagging, five-year juvenile abundance index studies).
There is no monitoring program specifically directed at the capture of sturgeon in the District, and none have been collected during any routine fishery sampling.

c. Habitat status (restoration efforts, FERC relicensing studies, etc.), in accordance with the recommendations in Sections 4.1.1, 4.1.2, and 4.1.4.
There is no specific program in the District to modify or enhance Atlantic sturgeon habitat.

d. Aquaculture operations authorized, status of regulations, disease-free certification status, stocking.
Currently the District of Columbia has no aquaculture operations directed at sturgeon.

MARYLAND - VIRGINIA
"Potomac River Compact of 1958"
Potomac River Fisheries Commission
222 Taylor Street
P.O. BOX 9
Colonial Beach, Virginia 22443
TELEPHONE: (804) 224-7148 · (800) 266-3904 · FAX: (804) 224-2712

Atlantic Sturgeon
2011 Annual State Report
June 1, 2012

I. Introduction

The Potomac River Fisheries Commission maintains a total closure on the possession of Atlantic sturgeon by all gear types and all fisheries. There are no plans to reopen the fishery.

II. Monitoring

Mandatory weekly commercial catch reporting forms are used in the Potomac River, which include information on by-catch for all fisheries. No sturgeon were reported as caught in any gear.

The MDDNR and the U. S. Fish and Wildlife Service operate a $50 per "live" fish reward program in the Potomac and most commercial watermen are aware of this program. The PRFC has a link on their website which provides details of how to participate www.dnr.state.md.us/fisheries/commercial/sturg100.htm . In 2011, there were nine Atlantic sturgeon recorded as captured live in the Potomac River by the USFWS (Table 1).

III. Habitat

The Potomac River Fisheries Commission cooperated in efforts to modify the Little Falls Dam in Washington, DC with an improved fish ladder design (primarily for American Shad). All other habitat issues are functions and responsibilities of Maryland and/or Virginia state agencies.

IV. Aquaculture

No Atlantic sturgeon aquaculture operations are within the Potomac River Fisheries Commission's jurisdiction.

Table 1

*2011 Atlantic Sturgeon Captures in the Potomac River **

Month	Count	Average Total Length of Released Fish (mm)	Disposition
January			
February	3	797	All kept by MdDNR
March	5	902	All kept by MdDNR
April			
May			
June			
July			
August			
September			
October			
November	1	770	Kept by MdDNR
December			
Total	9		

* Data from the USFWS - Maryland Fishery Resources Office

COMMONWEALTH of VIRGINIA

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

Douglas W. Domenech
Secretary of Natural Resources

Jack G. Travelstead
Commissioner

October 1, 2012

MEMORANDUM

TO: Kate Taylor, Atlantic Sturgeon Fishery Management Plan Coordinator
Atlantic States Marine Fisheries Commission

FROM: Adam B. Kenyon, Fisheries Management Specialist
Virginia Marine Resources Commission

SUBJECT: Virginia's 2012 Compliance Report for Atlantic Sturgeon

The attached document describes Virginia's Atlantic sturgeon data and fisheries management program for the 2011 calendar year.

Please contact me at 1-757-247-2243 if you need additional information regarding this report.

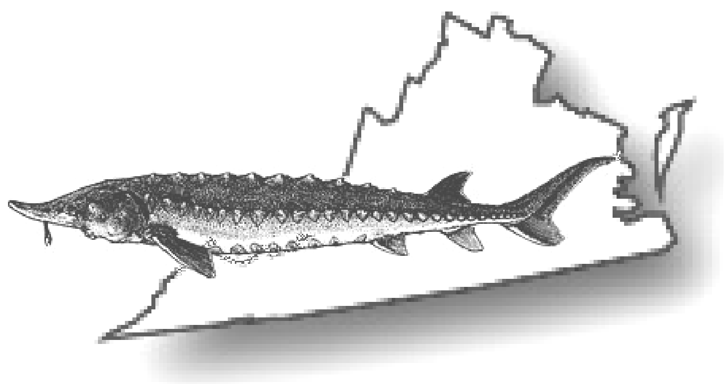
ABK

Attachment

Annual Compliance Report
to the
Atlantic States Marine Fisheries Commission

Atlantic Sturgeon Fisheries and Management in Virginia

Review of 2011



Prepared by:
Adam B. Kenyon
Virginia Marine Resources Commission

September 2012

ATLANTIC STURGEON COMPLIANCE REPORT

I. Introduction

The Atlantic sturgeon is listed on the Virginia Rare Animal List, which is maintained by the Virginia Department of Conservation and Recreation's Division of Natural Heritage (Roble 2010). This list provides information on the rank and the legal and biological status of listed species. Species are assigned both a state and global rank. Atlantic sturgeon have been assigned a state rank of "S2", which is given to those species that are considered very rare and imperiled with 6 to 20 occurrences or few remaining individuals in the state or species that are vulnerable to extirpation in the state. The global rank assigned to Atlantic sturgeon is "G3", which is assigned to species that are very rare and local throughout the entire species range or found locally in a restricted range. A global rank of "G3" may also be assigned to species that are vulnerable to extinction due to other factors.

The Virginia Rare Animal list also gives the state and federal status of listed species (Roble 2010). The Virginia Department of Game and Inland Fisheries (VDGIF) determines the state status of animal species (except insects) that occur in Virginia. The Atlantic sturgeon has been designated a species of special concern within the state, though this is not a legal status (Roble 2010; VDGIF 2009; VFWIS 2009).

Federal status is determined by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS). In February 2007, a status review team convened by NMFS finalized its report on the status of Atlantic sturgeon in the U.S. (NOAA 2007). Atlantic sturgeon in the Chesapeake Bay were identified as one of five distinct population segments (DPS)—discrete population units with distinct physical, genetic, and physiological characteristics—along the east coast. On February 6, 2012 NMFS released its final ruling to list the Chesapeake Bay DPS as an endangered species under the Endangered Species Act (ESA), effective on April 6, 2012. The New York Bight, Carolina, and South Atlantic DPSs were also ruled endangered while the Gulf of Maine DPS was determined to be a threatened species. The ESA defines an endangered species as "any species which is in danger of extinction throughout all or a significant portion of its range" (NOAA 2012). The Chesapeake Bay DPS was found to have (1) declines in population sizes; (2) a limited amount of current spawning; and (3) and has threats that have an will continue to prevent population recovery. These threats include dredging and habitat degradation, poor water quality, vessel strikes, and incidental catch. In order to comply with federal ESA requirements each states including Virginia must submit a Section 10 (a)(1)(b) application for any expected interactions with Atlantic sturgeon.

II. Request for *de minimis*, where applicable

The state of Virginia does not wish to apply for *de minimis* status.

III. Previous calendar year's fishery and management program

A. Activity and results of fishery-dependent monitoring (provide general results and references to technical documentation).

There are currently no fishery-dependent sampling programs in Virginia that target Atlantic sturgeon harvested commercially or landed from state waters because the harvest or landing of Atlantic sturgeon has been prohibited in Virginia since 1974 (Code of Virginia § 28.2-303, Appendix A).

The NMFS Marine Recreational Information Program (MRIP) program routinely samples recreational harvest (Type A+B1) encountered in its angler intercept survey to collect biological data. The MRIP raw intercept files demonstrate that no Atlantic sturgeon have been encountered during interviews of Virginia's recreational anglers over the entire survey time series.

B. Activity and results of fishery-independent monitoring (provide general results and references to technical documentation).

The Virginia Institute of Marine Science (VIMS) Juvenile Fish and Blue Crab Survey monitors the distribution and abundance of important finfish and invertebrate species occurring in the Chesapeake Bay. Since the survey's initiation in 1955, only 46 Atlantic sturgeons have been observed. During mid-March of 2004, a single Atlantic sturgeon was captured in the James River. The small size of that fish**—**170 millimeters in length**—**suggests successful spawning occurred in the James River system. Five Atlantic sturgeons were captured by the trawl survey in 2005 and one was captured in 2006. The survey did not capture any Atlantic sturgeon from 2007 through 2010. On December 1, 2011, one young-of-the-year Atlantic sturgeon (133 mm TL) was captured in the Pamunkey River, indicating that successful spawning occurred in the York River System (Note: three additional young-of-the-year Atlantic sturgeon were captured at the same sampling location in January 2012).

In 2011 a final project report was published which was funded by the Virginia Fishery Resource Grant Program that tested raised footlines in Virginia's striped bass fishery as a gear based method of reducing sturgeon interactions in anchored gill nets. This project was conducted over a period of 39 days using two different net configurations and hanging methods in order to test methodologies to reduce the bycatch of Atlantic Sturgeon while not affecting the striped bass fishery. Nets were hung using conventional methods allowing the net to rest on the bottom of the waters. Experimental nets were also hung to float 3' from the bottom. All nets were hung using mesh sizes ranging from 5.5" to 8". All catch was recorded and compared to determine the effects of the different hanging methods. Upon completion of this project it was concluded that use of floating nets can aid in lowering the Atlantic sturgeon bycatch, often while not greatly affecting the striped bass fishery. Some mesh sizes in float nets only resulted in a reduction of striped bass catch of approximately 10% (VASG, 2011).

C. Copy of regulations that were in effect, including a reference to the specific compliance criteria as mandated in the FMP.

The taking and sale of any sturgeon has been prohibited in Virginia since the 1970s (Code of Virginia § 28.2-303, Appendix A). All vessels landing seafood in Virginia for commercial purposes must possess a Seafood Landing License, unless the vessel owner is a registered Virginia Commercial Fisherman. All registered commercial fishermen and Seafood Landing License holders selling to non-federally permitted dealers are required to report daily harvest from Virginia tidal and federal waters to the Virginia Marine Resources Commission (VMRC) on a monthly basis. The state of Virginia also requires a license to catch finfish for recreational purposes in tidal waters.

D. Harvest broken down by commercial (by gear type where applicable) and recreational, and non-harvest losses (when available)

Virginia established a moratorium on the harvesting of sturgeon in 1974 (see Section III.C.). The VMRC collected voluntary reports of commercial landings from seafood buyers from 1973 to 1992. A mandatory harvester reporting system was initiated in 1993 and collects data on harvest and landings within Virginia waters. Records of fish harvested from federal waters and landed in Virginia have been provided by the NMFS and it's predecessors since 1929. There have been no reports of Atlantic sturgeon harvest or landings in the voluntary or mandatory harvester records.

The MRIP is the primary source of recreational fisheries statistics for Virginia. The MRIP data indicate there has been no harvest or live releases of Atlantic sturgeon by Virginia's recreational anglers from 2004 to 2011.

IV. Planned management programs for the current calendar year

A. Summarize regulations that will be in effect. (copy of current regulations if different from III.C.)

Virginia's ban on the taking, selling, and possession of Atlantic sturgeon will remain in effect (Code of Virginia § 28.2-303, Appendix A).

B. Summarize monitoring programs that will be performed.

The VMRC mandatory harvest reports will continue to be monitored for reports of Atlantic sturgeon. The MRIP angler intercept data will continue to be reviewed for encounters with Atlantic sturgeon. The occurrence of Atlantic sturgeon in fisheries-independent surveys conducted in Virginia will continue to be monitored.

In spring 2008, the Virginia Fishery Resource Grant Program awarded a grant to support the continuation of ongoing research of by-catch in Virginia's commercial white perch gill-net fishery (see Section V. A.). The main purpose of this study was to evaluate white perch fisheries catch and determine the impact on Atlantic sturgeon. If an impact was noted then fisheries techniques would be analyzed to lower by-catch.

C. Highlight any changes from the previous year.

No significant changes in Virginia's fishery management program for Atlantic sturgeon are planned for 2011.

V. Plan Specific Requirements

A. Results of bycatch monitoring for Atlantic sturgeon in other fisheries as per Section 3.4 of the FMP

Atlantic sturgeon is taken as by-catch in the staked gill nets used to monitor abundance of adult American shad in the James, York, and Rappahannock rivers in the VIMS American shad monitoring program. A total of 227 Atlantic sturgeon has been captured and released since 1998, with 184 of them being from the James River (Table 1).

B. Monitoring results (tagging, five-year juvenile abundance index studies).

<u>Tagging</u>

Virginia Commonwealth University (VCU) and its partners, including James River Association, Luck Stone, Vulcan Materials, and the Fish America Foundation, constructed two Atlantic sturgeon spawning reefs in the tidal James River in 2010 and 2011. Reef number 1 is located at the Turkey Island cut and reef number 2 is located at the Jones Neck cut. The VCU has conducted post-construction monitoring of both structures since spring, 2010; monitoring consists of egg-mat deployment during suspected spawning periods, as well as gill-netting and limited telemetry of adult sturgeon in the area.

Although no sturgeon eggs have been collected on the two reefs, VCU has collected a significant number of reproductively-active, adult sturgeon in the vicinity of the lower reef. VCU has documented fertilized eggs of other commercially important fishes, including white perch, blueback herring, and hickory shad on both structures.

<u>Juvenile Abundance</u>

Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon recommends that member jurisdictions with reproducing populations of Atlantic sturgeon should survey abundance and calculate catch-per-unit-effort estimates of juveniles (ASMFC 1998). Virginia has not yet developed a survey that targets juvenile sturgeon. The presence of a spawning population of adult Atlantic sturgeon in Virginia waters, and especially in the James River, has been assumed based on genetic studies and occasional reports of young-of-year individuals, but the size and strength of this population is less clear. The reproductive ecology of this population is currently under study (G. Garman, VCU, pers. comm.). Infrequent occurrences of young-of-year Atlantic sturgeon have been reported from the James and York rivers, with one captured by the VIMS trawl survey in the Pamunkey River in 2011. The VIMS annual seine survey for juvenile striped bass has no record of Atlantic sturgeon.

C. Habitat status (restoration efforts, FERC relicensing studies, etc.), in accordance with the recommendations in Sections 4.1.1, 4.1.2, and 4.1.4 of the FMP

   During 2008, the VIMS Center for Coastal Resources Management (CCRM) continued their project to assess the availability of Atlantic sturgeon spawning habitat in the James and Appomattox rivers (Bilkovic et al. 2009). The project used side-scan sonar to identify viable spawning habitat within the known range of historic spawning areas. The results of the project are intended to support Atlantic sturgeon restoration efforts.

   This study led to a proposal by the James River Association, partnering with Virginia Commonwealth University and Luck Stone, and funded by the National Fish and Wildlife Foundation, to construct an artificial spawning reef for sturgeon (See Section V. B).

D. Aquaculture operations authorized, status of regulations, disease-free certification status, stocking.

   NA

E. See ASMFC Terms, Limitations and Enforcement Document for additional requirements.

   NA

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VFWIS (Virginia Fish and Wildlife Information Service). 2010. Status chapter for sturgeon, Atlantic (010032). *In*: BOVA Species Booklet. Virginia Department of Game and Inland Fisheries, Richmond, VA.
Available: http://vafwis.org/fwis/booklet.html?Menu=_.Status&bova=010032&version=15160 (July 2010)

Table 1. Total number of Atlantic sturgeon captured and released during the VIMS American shad monitoring program from the York, Rappahannock, and James rivers, Virginia, 1998 through 2011.

Year	Number Captured	Number Captured in James River
1998	34	27
1999	24	22
2000	16	15
2001	8	7
2002	1	1
2003	3	2
2004	6	4
2005	26	22
2006	41	31
2007	30	22
2008	9	7
2009	7	6
2010	10	7
2011	12	11
Total	227	184

APPENDIX A. Copy of the Code of Virginia statute prohibiting the taking and sale of sturgeon in Virginia.

Code of Virginia

Title 28.2 - Fisheries and Habitat of the Tidal Waters.

Chapter 3 - Finfish

§ 28.2-303. Taking and sale of sturgeon prohibited; penalty.

Except as otherwise provided by regulation, it shall be unlawful for any person to take, catch or possess any sturgeon. Any sturgeon caught by any person shall be immediately returned to the water.

It shall be unlawful for any dealer or wholesaler of fish for human consumption to buy from others or to otherwise possess for purposes of resale any sturgeon.

A violation of this section is a Class 1 misdemeanor.

ASMFC ATLANTIC STURGEON PLAN – AMENDMENT 1

NORTH CAROLINA ANNUAL ATLANTIC STURGEON COMPLIANCE REPORT 2011

October 2012

NC Department of Environment and Natural Resources

Division of Marine Fisheries

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Morehead City, NC 28557

Section 3.0 Monitoring results

The North Carolina Division of Marine Fisheries (NCDMF) currently has three independent gill net programs that encounter and tag Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus)* (Figures 1, 2, and 3). The Albemarle Sound Independent Gill Net Survey (IGNS) is a stratified random gill net survey that employs gill nets with mesh sizes that range from 2.5 inch stretch mesh (ISM) through 7 ISM (0.5 ISM increments) and 8 ISM and 10 ISM of floating and sinking nets (Figure 1). Gill nets are fished in 40 yard shots totaling 960 yards per set. Each set is fished for approximately 24 hours before retrieval. Nets were fished from January through May, November, and December 2011 totaling 3,740 net days. Forty-seven Atlantic sturgeon were collected. There were two Atlantic sturgeon mortalities and 45 fish were tagged (T-bar, PIT) and released. Lengths ranged from 393 to 1,498 mm fork length (FL) (Table 1)

The Pamlico Sound Independent Gill Net Survey (PSIGNS) is conducted in Pamlico Sound, Pungo, Pamlico, and Neuse rivers, and consists of gill net sets, ranging in mesh size from 3.0 ISM through 6.5 ISM (0.5 ISM increments) and are fished for approximately 12 hours before retrieval (Figure 1). During 2011, approximately 240 yards were fished per sample and 640 samples were completed. The Fisheries Independent Assessment Program (FIAPOG) is modeled after the PSIGNS. The areas fished include the New and Cape Fear rivers (Figure 2). Approximately 240 yards were fished per sample and 120 samples were completed. Trips conducted in the Atlantic Ocean include an additional 2.5 ISM net. The areas fished include the coastal ocean waters off New and Cape Fear rivers (Figure 3). Approximately 270 yards were fished per sample and 24 samples were completed in 2011. Four Atlantic sturgeon were collected in these two surveys during 2011 (Tables 2 and 3). Sturgeon were collected in Neuse River (2,300mm TL), Cape Fear River (765 mm FL), and Atlantic Ocean off Lockwoods Folly Inlet (532, 820 mm FL), all were released alive.

The North Carolina Wildlife Resources Commission (NCWRC) continued a trial sampling survey to capture and tag Atlantic sturgeon in the Roanoke River near Weldon. Two male Atlantic sturgeon were collected, tagged and released through the combined efforts of the NCWRC, NCDMF, U. S. Fish and Wildlife Service, Dominion, NC State University, and the U. S. Geological Survey. Dominion added to the effectiveness of the survey by maintaining low flows from Roanoke Rapids Dam during the period when netting was underway.

The fish were captured using large mesh gill nets set immediately downstream of the first set of rapids at The Weldon Boating Access Point. This site is 220 km from the mouth of the river and over 308 km from the ocean. Atlantic sturgeon were not known to occur this far upstream in summer or fall but reports by a Weldon angler of jumping sturgeon prompted the survey. Four electrofishing boats using low voltage (“catfish”) settings moved downstream toward the nets in an attempt to herd Atlantic sturgeon into the nets. The nets were checked after each pass of the electrofishing boats.

Two Atlantic sturgeon were collected and were 1,680 and 1,350 mm FL and weighed 37 and 27 kg respectively. Both of the fish were males; observed by applying abdominal pressure and observing the presence of milt. The fish were tagged with internal Vemco acoustic transmitters, PIT tags, external T-bar tags, and released.

During 2010, The North Carolina Division of Marine Fisheries joined a multi-state grant entitled “Research and Management of Endangered and Threatened Species in the Southeast: Riverine Movements of Shortnose and Atlantic Sturgeon” cooperating with South Carolina

Department of Natural Resources, The University of Georgia, and North Carolina State University. Funding was provided through the National Marine Fisheries Service (NMFS), Section 6. Obtaining funding, acquiring equipment and hiring staff delayed field work until 2011.

During sampling efforts for 2011, 56 Atlantic sturgeon were collected in the Cape Fear River. The fish ranged in size from 497 mm to 1,620 mm FL. Thirty-five of the sturgeon were implanted with Vemco telemetry tags. The remaining 21 fish were either too small or the condition of the fish was not appropriate for tagging. Nine Atlantic sturgeon were collected and telemetry tagged in the Albemarle Sound during 2011. Lengths ranged from 630 to 1,499 mm FL. A more detailed description of these activities can be found in the progress reports submitted to NMFS.

No shortnose sturgeon were encountered in any of these independent surveys.

Section 3.4 Assessing bycatch fishing mortality

The NCDMF provides at sea observer coverage for the fall flounder fishery as well as other large and small mesh fisheries throughout the state. Staff observed 374 large mesh trips (424,808 yards) and 74 (41,235 yards) small mesh trips during 2011 throughout the estuaries of North Carolina during 2011. Three Atlantic sturgeon were observed during large mesh trips and one Atlantic sturgeon was observed during small mesh trips. No shortnose sturgeon were observed during these trips in 2011.

Fisherman participating in the American shad fishery conducted in the Cape Fear (drift nets) and Brunswick rivers (anchored gill nets) were interviewed for interactions with Atlantic sturgeon during 9 fishing trips. No Atlantic or shortnose sturgeon were reported during 2011.

North Carolina is currently developing a Section 10 Incidental Take Permit for the estuarine waters of NC relative to gill net fishing. Through this process NC is working on a model to estimate bycatch in the gill net fisheries. This model will break down the state estuarine waters into management units and estimate takes (live and dead) within each of these units, by season, and mesh size (large and small). Results from this model will be available during 2012 and will be reported in the 2012 annual compliance report.

Section 4.1.1 Preservation of existing habitat

The NCDMF regularly provides input to federal and state regulatory agencies of the location of habitats used by Atlantic sturgeon. The Division reviews impact statements and permit applications for projects or facilities, which may impact sturgeon spawning or nursery areas and provides appropriate recommendations to minimize impacts or to preserve habitats.

Section 4.1.2 Avoidance of incompatible activities

The NCDMF routinely works with the U.S. Army Corps of Engineers and the NC Department of Transportation on windows of compatibility for activities (dredging, pile driving, bridge replacement) that may adversely affect Atlantic sturgeon. The guidelines for in water construction are a moratorium on activities from February 15th through September 30th; dates may vary depending on location.

Section 4.1.4 Habitat restoration, improvement, and enhancement

The NCDMF and the NCWRC have designated Anadromous Fish Spawning Areas for their respective jurisdictions. Also, the NC Coastal Habitat Protection Plan (CHPP) was adopted in 2005 to reach 4 goals: 1. Improve effectiveness of existing rules and programs protecting coastal fish habitats, 2. Identify, designate, and protect strategic habitat areas, 3. Enhance habitat and protect it from physical impacts and, 4. Enhance and protect water quality, all of which will directly impact habitats utilized by Atlantic sturgeon (Street 2005). The CHPP was updated in 2010, but maintains these same four goals.

The NCDMF approved Strategic Habitat Areas (SHA) for region 1 in North Carolina in January 2009. “Strategic Habitat Areas represent priority habitat areas for protection due to their exceptional condition or imminent threat to their ecological functions supporting estuarine and coastal fish and shellfish species” (NCDMF 2009). The SHA areas will be incorporated into conservation and restoration efforts. SHA #3: Bellows Bay to Knotts Island Bay (28,462 acres) was identified partially due to the near shore ocean areas that are important for Atlantic sturgeon and striped bass (Figure 4). SHA #8: Chowan and Roanoke rivers, and western Albemarle Sound (401,233 acres) was identified and may include one of few Atlantic sturgeon spawning habitats in NC (Figure 4).

The NCDMF has identified approximately 150 SHAs for region 2 and is currently reviewing proposed sites (Figure 5)(NCDMF 2011). Many of the proposed sites include habitats where Atlantic sturgeon have been collected or observed. Important travel routes into and out of Pamlico and Albemarle sounds have been indentified as SHA’s: Oregon Inlet System, Hatteras Inlet System, and Ocracoke Inlet System. Other SHA’s have been identified that potentially include important spawning habitat or forage areas for Atlantic sturgeon in the Tar, Pamlico, and Neuse rivers.

Considerable progress has also been made on the addition of a rock rubble arch ramp at Lock and Dam # 1 on the Cape Fear River. North Carolina Division of Marine Fisheries has detected two striped bass utilizing the ramp to pass the dam, however it is unknown if Atlantic or shortnose sturgeon have. Vemco receivers are in place at the base of the ramp, as well as the top to identify passage of any fish outfitted with a transmitter. The ramp construction is currently not complete.

Aquaculture Operations

In 2005 LaPaz LLC. received approval from the Atlantic States Marine Fisheries Commission (ASMFC) and NCDMF to operate an Atlantic sturgeon aquaculture operation in North Carolina. After experiencing difficulty in acquiring Atlantic sturgeon in the fall of 2005, LaPaz made a request to the NCWRC and the NC Department of Agriculture to allow LaPaz to possess and culture Siberian sturgeon (*Acipencer baerii*). LaPaz imported 2,022 fertilized Atlantic sturgeon eggs from Supreme Sturgeon and Caviar during 2006. An additional 3,861 fertilized Atlantic sturgeon eggs were imported in July 2008, now weighing an estimated 5,161 kg. Recently, the LaPaz facility reduced the number of Atlantic sturgeon being held, nearly all of the 2006 fish have been culled and 435 fish from 2010 were transported to Kenneth J. Semmens, Extension Specialist, University of West Virginia (Hinshaw 2012). Table 4 shows the current inventory of Atlantic sturgeon in the LaPaz LLC facility.

LaPaz is shifting their focus away from Atlantic sturgeon and plans to concentrate on production of other species. During this transition, LaPaz anticipates marketing some meat and potentially some caviar from the remaining Atlantic sturgeon that are on-site, and are of suitable size and quality. Fish that are not mature or large enough for efficient processing will likely be removed from the systems and disposed (composted, buried, or rendered). Much of this transition is planned to be accomplished in 2013 (Hinshaw 2012)

The fish that were transferred (donated 8/11/12) to West Virginia University (WVU) are involved in a research study at one of their facilities evaluating aquaculture potential of reclaimed water from coal mining. The fish were accompanied by copies of the CITES documents and Health Inspection report for this group of fish, as well as a copy of Appendix II from ASMFC, and a letter transferring ownership of these fish to them. West Virginia University received permission from the West Virginia Fish and Game Division allowing possession of the fish at their facility. The contact person for West Virginia University is: Kenneth J. Semmens, Extension Specialist, Aquaculture, P.O. Box 6108, Agricultural Sciences Building, Rm. 1052, Morgantown, WV 26506-6108, (304) 293-2657 - (304) 293-6954 Fax, Ken.Semmens@mail.wvu.edu, Web site: http://www.wvu.edu/~agexten/aquaculture (Hinshaw 2012).

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Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC, 656 pp.

Table 1. Number of Atlantic sturgeon collected and released from the Albemarle Sound Independent Gill Net Survey, Albemarle Sound, NC, 2011.

Month	# Caught	# Tagged	# Released	Mean Size (mm FL)	Minimum Size (mm FL)	Maximum Size (mm FL)
January	2	2	3	446	393	473
February	1	1	1	497	497	497
March	2	2	2	598	496	700
April	1	1	1	530	530	530
May	7	6	6	718	462	1,498
November	19	18	18	646	433	921
December	15	15	15	545	460	754
Total	47	45	46	604	393	1,498

Table 2. Number of Atlantic sturgeon collected and released from the Pamlico Sound Independent Gill Net survey, Pamlico Sound, Pamlico, and Neuse rivers, NC, 2011.

Month	# Caught	# Tagged	# Released	Mean Size (mm TL)	Minimum Size (mm TL)	Maximum Size (mm TL)
February	0	0	0			
March	0	0	0			
April	0	0	0			
May	0	0	0			
June	0	0	0			
July	1	0	1	2,300	2,300	2,300
August	0	0	0			
September	0	0	0			
October	0	0	0			
November	0	0	0			
December	0	0	0			
Total	1	0	1	2,300	2,300	2,300

Table 3. Number of Atlantic sturgeon collected and released from the Fisheries Independent Assessment Program, Cape Fear River and the Atlantic Ocean, NC, 2011.

Month	# Caught	# Tagged	# Released	Mean Size (mm FL)	Minimum Size (mm FL)	Maximum Size (mm FL)
February	0	0	0			
March	1	1	1	532	532	532
April	0	0	0			
May	0	0	0			
June	0	0	0			
July	0	0	0			
August	0	0	0			
September	0	0	0			
October	0	0	0			
November	1	1	1	765	765	765
December	1	1	1	820	820	820
Total	3	3	3	706	532	820

Table 4. Inventory of Atlantic sturgeon located at LaPaz LLC Aquaculture Facility, Lenoir, NC, 2011-2012.

Year Obtained	Year Class	Tank	Number	Weight (kg)
2006	2006	Culled		
2006	2006	Culled		
2007	2000/2002	GO 9	58	963
2007	2000/2002	GO 10	144	2,162
2008	2008	GO 5	548	2,968
2008	2008	GO 6	850	2,193
2003/2006	2003/2006	S3	16	93
2010	2010	Moved to WV	435	952
Total Inventory			1,616	8,379
Total Removed *			1,698	952

- 435 Atlantic sturgeon moved to West Virginia, 1,263 culled and/or used for product development. Nearly all 2006 was culled.

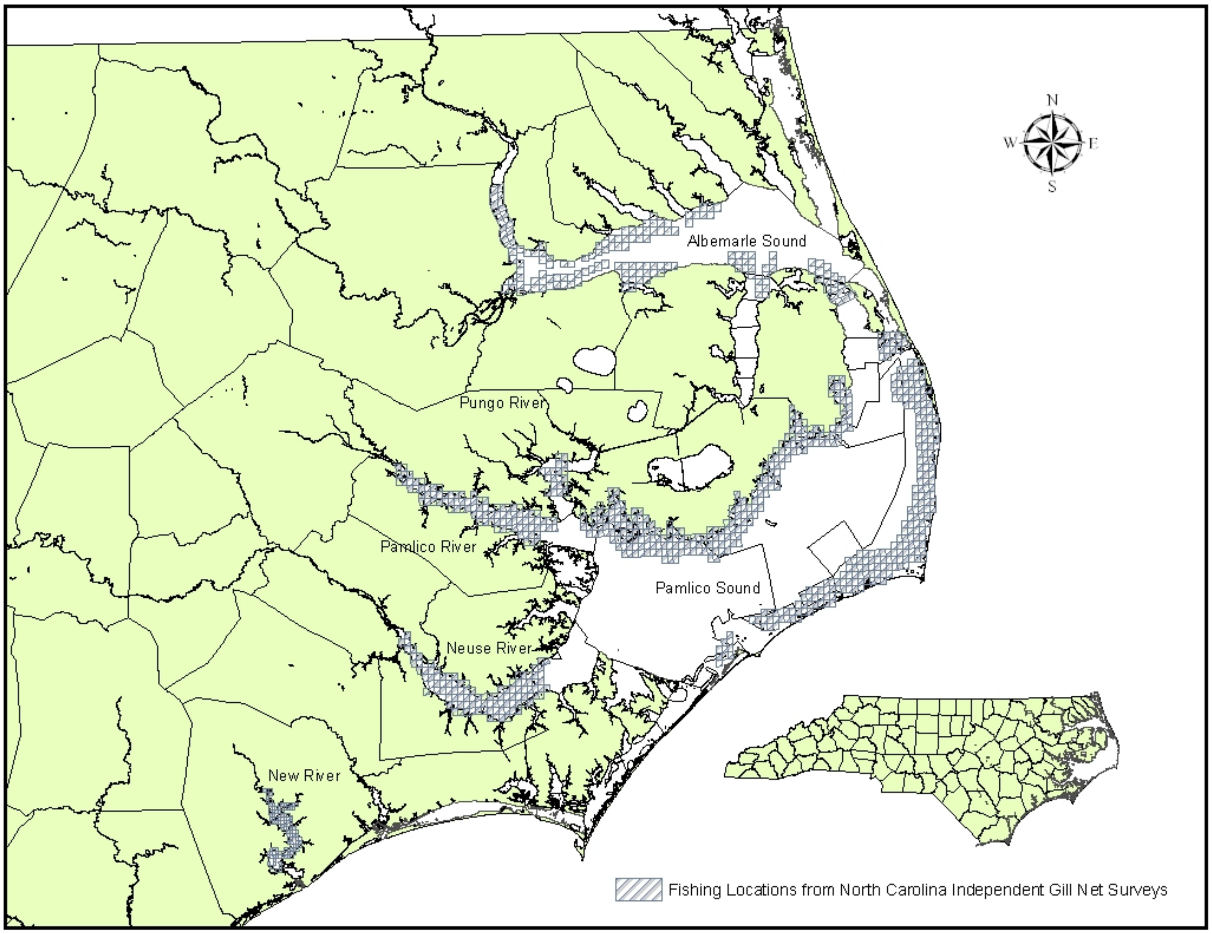


Figure 1. Fishing locations from Independent Gill Net Surveys conducted in Albemarle and Pamlico sounds, and Pungo, Pamlico, Neuse, and New rivers, North Carolina, 2011.

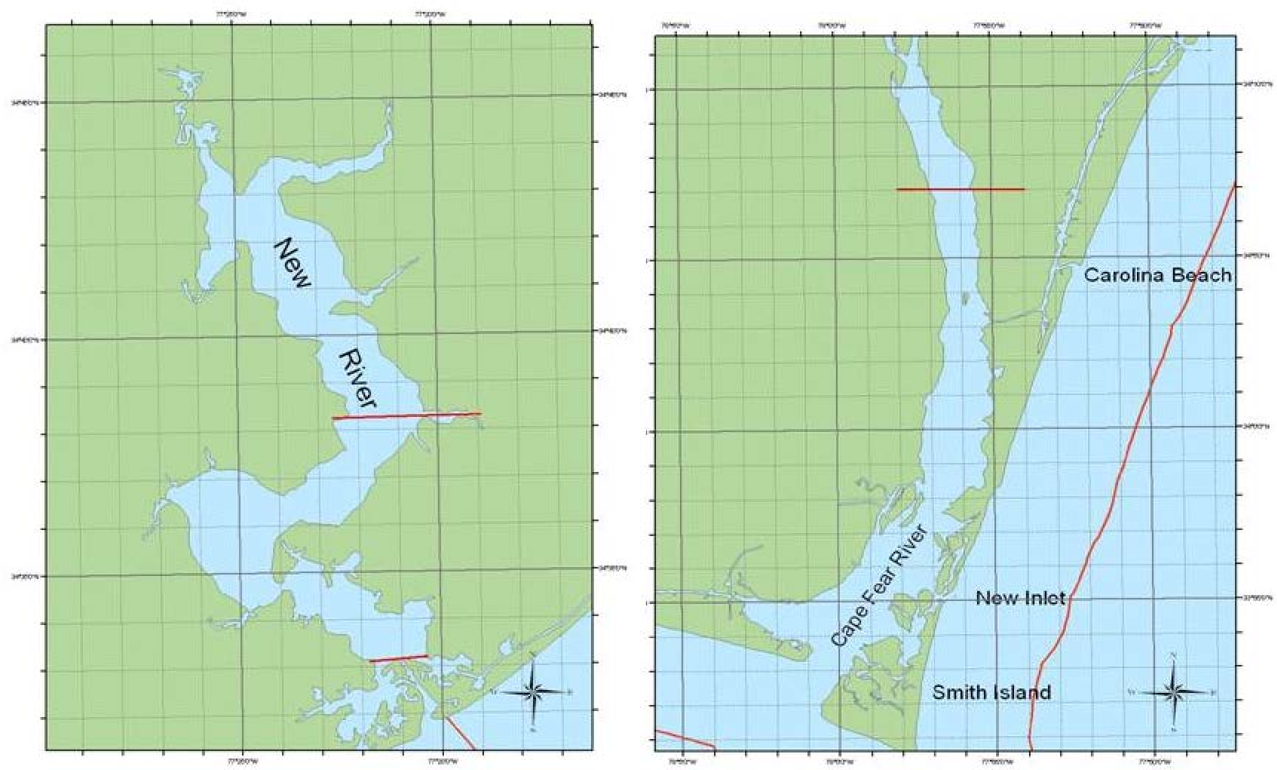


Figure 2. The sample regions and grid system for the Fisheries Independent Assessment Program (New and Cape Fear rivers) of North Carolina during 2011 with areas numbered (New: 1-Upper, 2-Lower; Cape Fear).

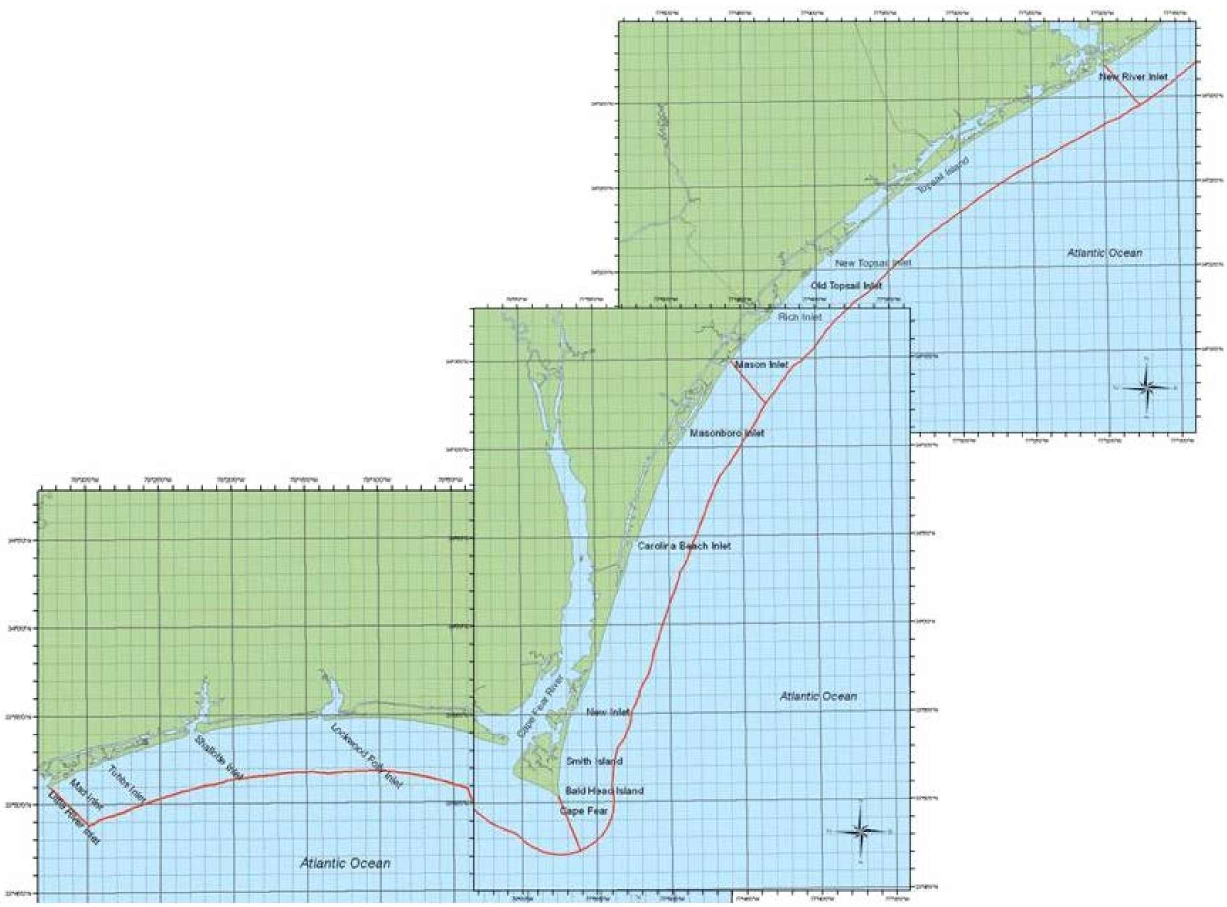


Figure 3. The sample regions and grid system for the Fisheries Independent Assessment Program (Atlantic Ocean) of North Carolina during 2011 including the Topsail, Masonboro, and Brunswick areas.

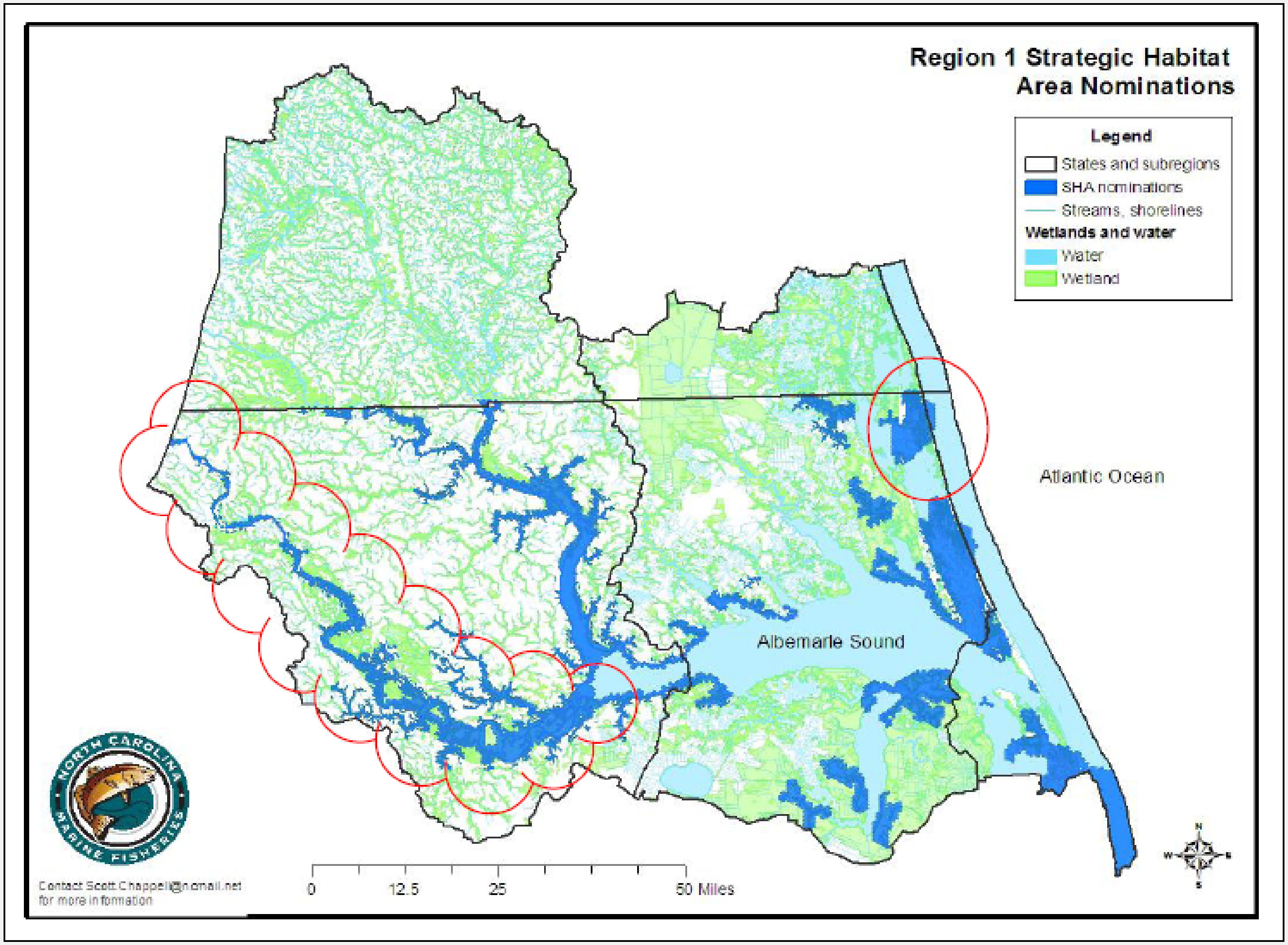


Figure 4. Region 1 Strategic Habitat Area Nominations, North Carolina, 2010.

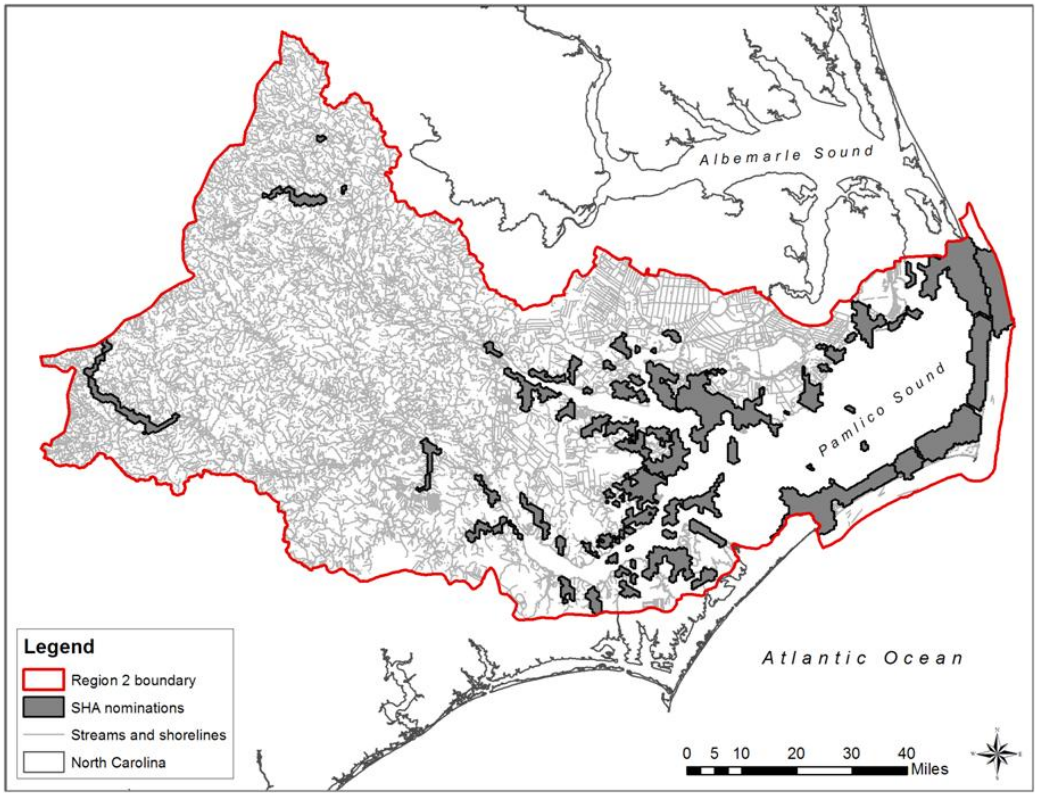


Figure 5. Region 2 Strategic Habitat Area Nominations, North Carolina, 2011 (NCDMF 2011).

South Carolina

Atlantic Sturgeon Management Program

Compliance Report for the Year 2011

DNR

October 1, 2012

Prepared by:

Marine Resources Division &
Freshwater Fisheries Section
South Carolina Department of Natural Resources

I. INTRODUCTION

Harvest of Atlantic sturgeon is not allowed in South Carolina territorial waters. No significant changes to the state-directed monitoring of sturgeon populations or state regulations pertaining to sturgeon were made in 2011.

II. REQUEST FOR *de minimis* - Not applicable.

III. ATLANTIC STURGEON MANAGEMENT PROGRAM

A. Fishery Dependent Monitoring:

Not applicable. No commercial or recreational fishery exists.

B. Fishery Independent Monitoring:

Fishery independent data related to South Carolina's sturgeon populations are acquired through the combined efforts of both the Marine Resources Division and Freshwater Fisheries Section of the SCDNR.

<u>Marine Resources Division Efforts</u>

Assessing Recruitment

Juvenile Atlantic sturgeon sampling is being conducted on the Edisto River and has been since 1994. The sampling in 1994 and 1995 was incidental to tagging studies being conducted on American shad. However, from 1996 through 2011, sampling activities were directed for juvenile sturgeon with gear modified to capture age-1 sturgeon effectively. The sampling period has been standardized as 4 days/month during May-September. The presence of nominal age-1 fish is indicative of an extant spawning population of Atlantic sturgeon in the Edisto River system. In 2011, 81 Atlantic sturgeon were tagged in the Edisto River (307-1,848 mm FL), 0 of which were nominal age-1. There were 13 recaptures. Thus, if this standardized sampling is a valid indicator, annual recruitment of age-1 fish is highly variable, at least in this river system. Zero, nominal age-1 fish may be caused by low flow and high salinity in the sample site.

Table 1: Edisto River captures and recaptures of sturgeon from 2004 through 2011.

	Initial Captures	Recaptures
2004		
Atlantic Sturgeon	214	69
2005		
Atlantic Sturgeon	150	46
2006		
Atlantic Sturgeon	154	39
2007		
Atlantic Sturgeon	34	13
2008		
Atlantic Sturgeon	30	7
2009		
Atlantic Sturgeon	75	6
2010		
Atlantic Sturgeon	76	14
2011		
Atlantic Sturgeon	81	13

In the event a recaptured Atlantic sturgeon had been at liberty for 1 year or more from its original capture, a second spine (right) was removed. Comparison of this spine with a spine taken at a known prior interval will establish the periodicity of annulus formation. Multiple recaptures of individual fish have also provided investigators with valuable growth (both seasonal and long-term) data that will aid in validation of aging techniques. Fin clips were taken for genetic analyses from all fish and were supplied to the NOS laboratory in Charleston where they are archived for future utilization.

Assessing Migration

Juvenile Atlantic sturgeons are being tagged with external tags (Hallprint nylon dart tags) and PIT (passive integrated transponder) tags and acoustic transmitters. Information on migratory activity is supplied to NMFS through annual progress and completion reports. Recapture data have been analyzed to determine movements among estuarine or river systems. Tagged fish have been reported from as far south as St. Augustine, FL and as far north as Delaware. In past years, recaptures of Atlantic sturgeon outside the Edisto River were reported in trawls in the St. Helena Sound or adjacent Atlantic Ocean coastal areas during late fall through early spring. One Atlantic sturgeon (20.95kg) has been reported, captured in a trawl, by SEAMAP just off the South Carolina coast. However, in recent years no recapture events were reported from other sources outside DNR. There is little doubt that trawlers are still capturing Atlantic sturgeon, but unfortunately many commercial fishers (certainly in South Carolina) are now unlikely to report sturgeon captures or tags found in such animals. Thus, other basin transfer observations would likely be unavailable.

Since juvenile Atlantic sturgeon typically move into coastal bays and near shore ocean waters during winter to early spring, it seems very probable that numerous tagged animals have been cumulatively taken over past years in the lower portions of the Santee River, the Winyah Bay complex, the Savannah River, and near shore Atlantic Ocean waters adjacent to these drainage mouths. The statewide reported by-catch of Atlantic sturgeon from the shad gill-net fishery in 2011 was 181 (none were reported from herring fisheries), all but two were from the Winyah Bay System. Twenty-one shortnose sturgeon were reported as incidental catches in 2011. However the potential problem of misidentification should be noted. (SCDNR POC: postb@dnr.sc.gov; collinsm@dnr.sc.gov)

Freshwater Fisheries Section Efforts

In 2011, various sampling efforts designed for shortnose sturgeon, but applicable to Atlantic sturgeon in the freshwater and estuarine rivers, particularly sub-adults, were conducted. These included gillnetting with either 5.5 inch stretched mesh, 5 – 7 – 9 inch stretched mesh alternating panel experimental, and 5.5 inch top panel 2.5 inch bottom panel gill nets. Twenty-one Atlantic Sturgeon were captured in 2011 by the Freshwater Fisheries Section.

C. Atlantic Sturgeon Regulations in Effect:

Harvest Controls

South Carolina Code of Laws

SECTION 50-5-1505. Taking of shad, herring, or sturgeon.

The department must monitor the various drainage basins and water bodies of this State and may promulgate regulations to set seasons, take (catch) and size limits, areas, methods, times, equipment requirements, and catch reporting requirements for taking of shad, herring, and sturgeon as needed for proper management in each basin or water body as a zone. It is unlawful to take or attempt to take shad, herring, or sturgeon except as authorized by this article. It is unlawful to possess more than the legal limit of shad, herring, or sturgeon**.**

SECTION 50-5-1508. Zones, seasons, times, catch limits, size limits, methods and equipment for taking sturgeon.

In addition to other provisions of law, the following provisions govern seasons, times, methods, equipment, size limits, and take limits in fishing for Atlantic sturgeon in the waters of this State:

(a) Territorial sea:
Season: **No open season**.

(b) Internal waters:
Season: **No open season**.

Maximum size limit – Not applicable.

Commercial restrictions – No commercial harvest allowed in South Carolina waters.

D. Atlantic Sturgeon Harvest:

Recreational Harvest Data – Not applicable.

Commercial Harvest Data – Not applicable.

Non-harvest losses – Unknown.

E. Progress Related to Habitat Recommendations:

(See Section V. subsection C. below.)

IV. PLANNED ATLANTIC STURGEON MANAGEMENT PROGRAM

A. Summary of Regulations:

No changes anticipated from 2011.

B. Planned Monitoring Activities:

Fishery dependent and fishery independent sturgeon monitoring activities described will continue in 2012 without significant change.

C. Changes from 2011:

No changes in South Carolina's current overall Atlantic sturgeon management program or strategy are anticipated to occur in 2012.

V. PLAN SPECIFIC REQUIREMENTS

A. By-catch Monitoring

Mandatory catch and effort reports were required from South Carolina shad fishermen in 2011 and included reporting requirements for incidental catches of Atlantic and shortnose sturgeon. The 2011 catch reports had records of 15 Atlantic and 14 shortnose sturgeon (the Atlantics were caught mostly from the Winyah Bay System). No data were available on the mortality associated with these incidental captures. The actual, overall level of by-catch in the shad gillnet fishery is most likely under-reported, and its impact on achieving the goals and objectives of the Atlantic sturgeon FMP is not really known. Better documentation of the by-catch in gillnet and trawl fisheries statewide is certainly desirable. (SCDNR POC: postb@dnr.sc.gov ; collinsm@dnr.sc.gov)

B. Monitoring Results

(See Section III. Subsection B. above.)

C. Habitat Status

Preservation of Existing Habitat

The SCDNR is working closely with federal agencies to identify Atlantic sturgeon and other anadromous fish habitat and the type of threats posed to populations of sturgeon due to habitat alteration. The Edisto River survey (1994-2011) has demonstrated the apparent preference, of age-1 and -2 Atlantic sturgeon to a region of several miles within, and immediately inland of, the zone of movement of the fresh/brackish water interface from late winter through late fall. Fish of these cohorts, and apparently older animals within the river, redistribute themselves seaward and into sounds, bays and near shore ocean waters during the winter period of lowest water temperature. Otherwise, more inland river reaches (not yet delineated) provide essential habitat for some older animals (generally > age 2) that select riverine habitats for summer residency.

SCDNR biologists make recommendations to regulatory agencies that will minimize or eliminate threats to current habitat quantity and quality that may affect stocks of Atlantic sturgeon. Current knowledge of spawning and nursery habitat locations is not sufficient in most cases to provide specific input on habitat areas of particular concern. There is however a generalized commitment to preserve and protect important riverine and associated wetland habitats that are integral to the success of anadromous and other species. Various authorities (e.g., Section 404 of the Clean Water Act, Farm Bill, Fish and Wildlife Coordination Act, FERC relicensing and other dam-related studies) are utilized to review most newly proposed development activities that would adversely affect anadromous fish habitat. SCDNR biologists work closely with staff from USFWS and NMFS in developing recommendations to protect habitat utilized by Atlantic sturgeon.

The lack of adequate data on essential fish habitat for Atlantic sturgeon in most South Carolina riverine systems hampers efforts to designate waters as High Quality Waters or Outstanding Resource Waters relating to sturgeon protection. In the coastal zone, the Outstanding Resource Waters category is most often utilized to protect shellfish resources. Although specific data related to the importance of particular areas to Atlantic sturgeon stocks is often lacking, the SCDNR plays an active role in conjunction with federal agencies in maintaining and improving water quality throughout the state. SCDNR staff work closely with the Department of Health and Environmental Control (DHEC) in providing input on water quality issues that relate to fishery and wildlife needs.

The SCDNR plays a significant role in monitoring and protecting coastal habitats important to sturgeon and other diadromous species. Water quality criteria specific to Atlantic sturgeon spawning and nursery areas have not been established but it is believed that established water quality standards would be adequate for this species. The SCDNR provides input on federal permits and licenses required by the Clean Water Act, Federal Power Act and National Pollutant Discharge Elimination System (NPDES).

Avoidance of Incompatible Activities

The introduction of compounds known to be accumulated in Atlantic sturgeon tissues, and which pose a threat to human or Atlantic sturgeon health, is reduced or eliminated through the previously mentioned water quality monitoring and regulation programs administered by SCDNR, DHEC and federal agencies. The establishment of windows of compatibility for activities adversely affecting Atlantic sturgeon life stages and their habitats is hampered by a scarcity of Atlantic sturgeon specific data regarding habitat utilization and life stage requirements. Activities such as navigational dredging, bridge construction, wetland alterations and dredged material disposal are commented on by state agencies in terms of their effect on the general ecosystem when specific information relative to Atlantic sturgeon is unavailable. The effectiveness of such comments will be greater as more information on habitat utilization and requirements for Atlantic sturgeon becomes available.

Water withdrawals from spawning or nursery habitats for power generation and cooling, irrigation, water supply projects etc., are recognized as posing potential threats to Atlantic sturgeon stocks. Power plant and municipal water supply withdrawals require an Army Corp of Engineers permit for intake structures and SCDNR staff take advantage of the opportunity to comment on possible adverse effects on fishery resources. Removals for irrigation are not adequately monitored or controlled at this time. Recent attention has been focused on maintaining minimum in-stream flows necessary for the health of anadromous fish stocks in dam-controlled rivers. Attention to these factors is particularly important during severe drought cycles that have been periodically experienced in South Carolina and other southeastern states.

Habitat Restoration, Improvement and Enhancement

An interagency team consisting of the USFWS, NMFS and, SCDNR have completed the Santee-Cooper Basin Diadromous Fish Restoration Plan. One objective of this plan is to restore and enhance populations of these species in the Santee-Cooper basin. The intent of the plan is to: restore spawning and maturation habitats, access to these habitats and address required fishery related elements of the Federal Energy Regulatory Commission (FERC) re-licensing process for power generation facilities within the basin. Prospective partners in addition to the SCDNR, the USFWS and NMFS, include the U. S. Army Corps of Engineers, South Carolina Electric and Gas Company, Santee-Cooper, Duke Power Company, Lockhart Power Company and others managing and using the public-owned water resources of the basin. A similar plan is under development for the Savannah River basin where multiple dams are also undergoing the FERC-relicensing process. Also, FERC-relicensing is underway for Blewett Falls Dam, just across the South – North Carolina state line, on the Pee Dee River. Strategies to be employed to effect restoration of diadromous resources include:

1. Identify needs for upstream and downstream passage; instream flows; water quality; and habitat protection.
2. Identify required studies to determine modifications needed at each passage barrier within a particular basin.
3. Submit any such plan to FERC as a Comprehensive Plan under Section10 (a) (2) (a) of the Federal Power Act for consideration during the re-licensing procedure.
4. Participate with state and federal agencies and the ASMFC concerning management of fishing activities.

5. Direct re-licensing studies, enhancement, and restoration efforts as well as potential grant monies, towards identified research needs and fish enhancement or restoration projects.

The provisions of the Santee-Cooper Basin Diadromous Fish Restoration Plan apply to all diadromous species, but several proposed studies are directed at sturgeon. Although the emphasis at this time is on the shortnose sturgeon, it is anticipated that these studies will also collect data on Atlantic sturgeon that are encountered in sampling efforts. Proposed studies will be conducted in a cooperative effort between the Wildlife and Freshwater Fisheries Division and the Marine Resources Division of the SCDNR and possibly by non-government consultants.

Projected benefits of installing or improving fish passage facilities are usually measured in terms of increases in American shad and blueback herring. The upstream passage of adult Atlantic sturgeon may not be accomplished with facilities designed primarily for shad and herring, but additional studies may be conducted to make passage facilities as versatile as possible. Downstream passage facilities may also be a problem for adult Atlantic sturgeon and young of the year moving toward their estuarine over-wintering areas. The scope of restoration plans must be broad enough to consider these aspects of sturgeon restoration work.

At present, passage of both sturgeon species is under consideration for both Pinopolis Dam on Cooper River and Wilson Dam on Santee River. Funding for related studies may be obtained from Santee-Cooper Electric Cooperative as part of the requirements for the FERC-relicensing process.

The SCDNR, USFWS, The Nature Conservancy, the Army Corp of Engineers, and NMFS have discussed fish passage options as recently as 2010 for the Savannah River at the New Savannah Bluff Lock and Dam near Augusta, GA. There was a consensus to construct a passage facility capable of passing adult sturgeon as well as shad and river herring. Fish passage, possibly to include both sturgeons, may be an option at other facilities undergoing FERC-relicensing on the Savannah River. However, New Savannah Lock and Dam is the lowermost dam on the Savannah River, and passage of sturgeons must be accomplished there if these species are to have access to more inland dams.

D. Aquaculture Operations

There are currently no stock enhancement or commercial aquaculture activities involving sturgeon being conducted in South Carolina. There are no permitting procedures in place dealing specifically with sturgeon and any requests for permits would be dealt with on a case-by-case basis. There is no disease free certification procedure in place at the present time. It is anticipated that if commercial aquaculture activity were to be initiated the SCDNR would develop such procedures.

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

Georgia Atlantic Sturgeon Management
Year 2011 Compliance Report
September 27, 2012

In accordance with section 5.1.2 of the Interstate Fishery Management Plan for Atlantic Sturgeon, the State of Georgia submits the following report:

Introduction

Georgia's Atlantic sturgeon fishery has been closed due to a moratorium since February 1997. Current Georgia regulation, Board of Natural Resources Rule 391-2-4-.04 (previously submitted), does not allow the harvest or possession of Atlantic sturgeon and does not provide for an open fishing season in state waters. This rule applies to anyone fishing for Atlantic sturgeon in Georgia waters, or landing, or offering Atlantic sturgeon for sale in Georgia. This moratorium was first implemented through an Emergency Rule effective February 1997 in anticipation of Amendment One to the ASMFC Atlantic Sturgeon Plan (Section 5.1.1.1). A permanent Rule was later adopted and became effective on May 13, 1997.

Request for *de minimis*

Not Applicable.

Previous calendar year's fishery and management program

Georgia's Atlantic sturgeon fishery has been closed due to a moratorium since February 1997. (GA Board of Natural Resources Rule 391-2-4-.04)

Planned management programs for the current calendar year

Georgia's Atlantic sturgeon fishery has been closed and will remain closed due to a moratorium since February 1997. (GA Board of Natural Resources Rule 391-2-4-.04)

Plan Specific Requirements

Results of bycatch monitoring for Atlantic sturgeon in other fisheries as per section 3.4 of the FMP

1. Section 10 Application

During 2011 GA DNR was in active Section 10 consultation with NMFS to address incidental bycatch of shortnose and Atlantic sturgeon in the commercial shad fishery. The Section 10 permit will likely result in some level of monitoring that will include the collection of data on shortnose and Atlantic sturgeon.
Due to the passage of ASMFC Shad and River Herring Amendment 3 and to reduce incidental bycatch of shortnose sturgeon, new commercial shad fishing regulations took effect January 1, 2011. Changes in the

commercial regulations closed the upper portions of Altamaha, Ogeechee, and Savannah rivers to commercial shad fishing gear. These changes reduced areas open to commercial shad fishing by 65%, 66%, and 35% respectively for the Altamaha, Ogeechee, and Savannah rivers. In addition, the Satilla and St. Marys rivers were entirely closed to commercial shad fishing.

2. Shad Survey

During annual Wildlife Resources Division (WRD) fishery-independent monitoring of the adult shad populations in the Altamaha River, a drift gill net with a minimum 4-½ inch stretch mesh was used. In the 2011 shad season, during a total of 16 days, thirteen Atlantic and four shortnose sturgeon were encountered (Table 1). All sturgeon were measured and released alive. No population estimate can be made from this limited effort, but these data will be followed through time as a possible population trend indicator.

Table 1. Altamaha River Sturgeon Caught, Measured, and Released During WRD Shad Monitoring

Date	***Species***	***Length (mm)***	***Water Temp (^oC)***
1/8/2011	Atlantic	468	10.0
1/8/2011	Atlantic	509	10.0
1/15/2011	Shortnose	1194	6.5
1/29/2011	Atlantic	574	9.6
1/29/2011	Atlantic	540	9.6
1/29/2011	Atlantic	535	9.6
1/30/2011	Atlantic	789	10.5
2/12/2011	Atlantic	564	8.8
2/13/2011	Atlantic	542	9.4
3/5/2011	Atlantic	742	17.2
3/5/2011	Atlantic	535	17.2
3/5/2011	Atlantic	515	17.2
3/5/2011	Atlantic	160	17.2
3/12/2011	Shortnose	629	16.3
3/12/2011	Shortnose	667	16.3
3/19/2011	Atlantic	560	18.0
3/19/2011	Shortnose	745	18.0

Year	***Atlantic***	***CPUE***		***Shortnose***	***CPUE***	
2011	13	0.81 / field day	0.10 / hr	4	0.25 / field day	0.03 / hr
2010	1	0.06 / field day	0.007/hr	0	0.00 / field day	0.00 / hr
2009	2	0.11 / field day	0.01 / hr	4	0.21 / field day	0.03 / hr
2008	12	0.71 / field day	0.09 / hr	3	0.17 / field day	0.02 / hr
2007	5	0.25 / field day	0.04 / hr	9	0.45 / field day	0.08 / hr
2006	5	0.29 / field day	0.05 / hr	5	0.29 / field day	0.05 / hr
2005	0			1	0.06 / field day	0.009 / hr
2004	2	0.11 / field day	0.02 / hr	4	0.21 / field day	0.04 / hr
2003	1	0.06 / field day	0.009 / hr	1	0.06 / field day	0.009 / hr
2002	1	0.07 / field day	0.01 / hr	41	2.73 / field day	0.45 / hr
2001	4	0.21 / field day	0.04 / hr	7	0.37 / field day	0.06 / hr
2000	7	0.35 / field day	0.06 / hr	12	0.60 / field day	0.10 / hr
1999	21	1.05 / field day	0.18 / hr	5	0.25 / field day	0.04 / hr
1998		0.08 / field day	0.01 / hr	0		
1997	3	0.27 / field day	0.045 / hr	3	0.27 / field day	0.045 / hr

3. At-Sea Observer Program

Coastal Resources Division (CRD) bycatch observers are available to perform fishery dependent characterization work aboard commercial whelk trawl vessels. Observers recorded information from four tows on one whelk trip taken during the 2011 season. No sturgeon (Atlantic or shortnose) were observed during the 2011 season (Table 2). Though the potential does exists for these anadromous species to occur in this fishery, the use of turtle excluder devices (TEDs) greatly reduces such potential.

4. GADNR Trawl Characterization Cruises

CRD biologists have conducted fisheries-independent monitoring and assessment of Georgia’s commercially important crustaceans on a monthly basis since 1976. In March 2003, the monitoring of all finfish was implemented to provide a comprehensive trawl characterization study. Fifteen-minute tows of a 40’ flat otter trawl are conducted monthly at 42 stations along Georgia’s coast. Between January 1, 2011 and December 31, 2011, 504 tows totaling 127 hours of bottom trawling along Georgia’s beaches, estuaries, rivers and creeks resulted in encounters with one Atlantic sturgeon (Table 2). All captured sturgeons were promptly returned to the water alive.

Table 2. Bycatch Assessment for Georgia Fisheries.

Fishery	Atl. Sturgeon Catch	Number Of Tows	Number of Trawl Hours
Whelk (observation)	0	4	0.93
GADNR Trawl Survey (independent)	1	504	127

5. Marine Sportfish Population Health Project

During 2011, CRD biologists conducted netting surveys designed to provide fisheries independent estimates of relative abundance for recreationally important finfish species. The two primary target species were spotted seatrout and red drum. Sampling gear consisted of 300' x 7' trammel nets (14" stretch outer panels, 2.75" stretch inner panel) and 300' x 9' gill nets (2.5" stretch). Sampling conducted in the Altamaha Sound consisted of 75 trammel and 108 gill net sets, and sampling in the Wassaw Sound consisted of 75 trammel and 108 gill net sets. No Atlantic sturgeon were caught.

6. Recreational Fishery

In 2011, CRD continued to monitor the catch and effort of marine recreational anglers in Georgia through participation in the NMFS marine recreational fishing surveys. CRD conducted a coast-wide creel survey and no Atlantic sturgeon were reported as caught.

Monitoring Results

1. Ogeechee River Monitoring

No additional sampling has been conducted on the Ogeechee in 2011, however, the UGA research team has deployed and maintained an acoustic array consisting of 22 stationary receivers to detect presence and to monitor movements of Atlantic and shortnose sturgeon tagged in other SE rivers (see below, “Riverine Movements of Atlantic and shortnose sturgeon”). The receivers are currently distributed throughout the lower River, from the mouth of Ossabaw Sound, upstream to ~ rkm 100.

2. Altamaha River Monitoring

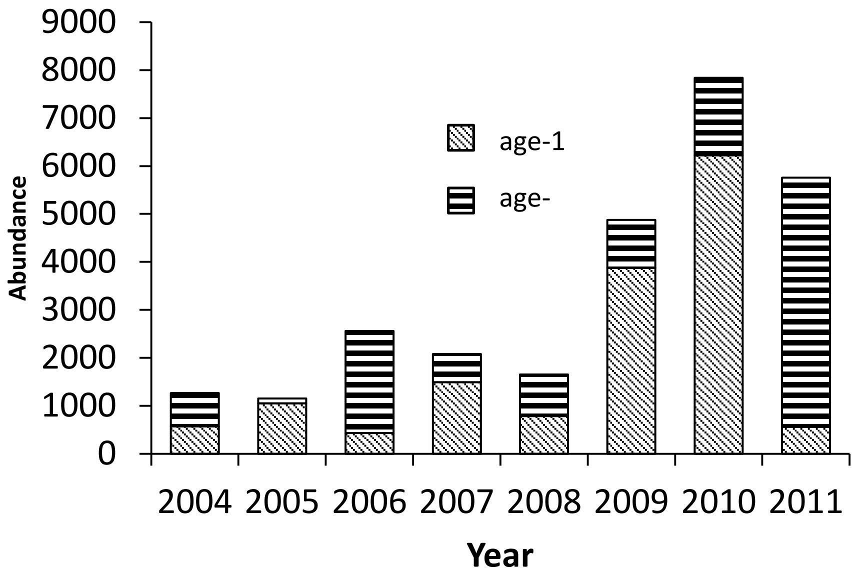
The University of Georgia is currently working on the 10th year of an ongoing study focusing on the Atlantic sturgeon population of the Altamaha River. The primary objectives for this reporting period were to 1) estimate annual abundance of the river resident juvenile population; 2) describe seasonal movements and habitat use, with emphasis on determining when juvenile Atlantic sturgeon leave their natal estuary; 3) evaluate population trends through basic population dynamics modeling.

Researchers are using 91m x 3m set trammel nets and gill nets to capture juvenile Atlantic sturgeon in the lower 40 rkm of the Altamaha River (including the Champney River). These nets were set in various locations throughout this reach and were typically fished for 20-80 min during both running and slack tides. From 2004 - 2011, a total of 1,399 nets have been fished for juvenile Atlantic sturgeon with a total of 1,842 juvenile Atlantic sturgeon captures. All captured Atlantic sturgeon were measured, weighed, and pit-tagged prior to release. Age assignments of juveniles were based on length-frequency histograms and annuli counts of fin rays sections collected from random sub-samples of the catch.

Juvenile Atlantic sturgeon catch data were analyzed using the Huggins closed capture model in Program MARK to estimate abundance of age-1 juvenile cohorts for each summer from 2004-2011. These estimates varied from a low of 333 (246-460) in 2006 to a high of 6225 (5057-7721) in 2010.

Year	# Nets	# Captured	# Recaptured	N Age-1	Lower 95% CI	Upper 95% CI
2004	94	174	16	483	368	643
2005	102	249	32	1345	1077	1697
2006	91	315	20	333	246	460
2007	109	296	25	1318	1053	1668
2008	190	315	25	679	451	1375
2009	277	493	26	3214	2251	5617
2010	344	1283	97	6225	7721	5057
2011	192	855	51	561	870	342

Although age-1 abundance declined in 2011, total juvenile biomass (for age-1 and age-2 cohorts combined) reached the highest point on record in 2011. Subsequent analysis of juvenile growth rates showed that annual growth declined significantly as total juvenile biomass has increased. Although the juvenile carrying capacity of the Altamaha Estuary is uncertain, the density dependent changes in juvenile growth documented in 2010 and 2011, suggest the Altamaha River Atlantic sturgeon population is recovering and annual recruitment may be approaching pre-fishery levels. This project was discontinued in 2012, but will resume in 2013 if funding is available.



<u>Riverine Movements of Atlantic and shortnose sturgeon in GA</u>

A stationary telemetry array consisting of 138 Vemco VR2W acoustic receivers is currently in place across six Georgia rivers: the Altamaha, Ocmulgee, Oconee, Ogeechee, Satilla and St Marys Rivers. Within the Altamaha Drainage (~800 rkm on the Altamaha, Ocmulgee, and Oconee Rivers), the UGA team has deployed and maintained a total of 63 receivers on the Altamaha River, 21 on the Ocmulgee River, and 25 on the Oconee River. To ensure complete documentation of sturgeon movements between the Altamaha River and the Atlantic Ocean, receiver coverage in Altamaha Sound and the lower river are sufficiently dense to permit triangulation (receiver detection ranges are overlapping). Upriver, receivers are strategically located at 10-rkm intervals, except at the confluence, where again, receiver spacing is sufficiently dense to facilitate precise documentation of spawning movements and habitat use. This reach was been previously identified by the UGA team as a primary spawning area for shortnose sturgeon (DeVries and Peterson, 2006).

On the Ocmulgee River, the UGA team has deployed and maintained 21 receivers distributed throughout the lower 300 rkm reach, from the Altamaha Confluence upstream to Milledgeville, GA. The UGA team has deployed and maintained a total of 20 additional receivers at ~10 rkm intervals on the Oconee River, from the Altamaha Confluence upstream to ~ rkm 250.

<u>Acoustic Tagging of SNS and Adult ATS</u>

Since spring 2011, acoustic transmitters have been implanted into 30 shortnose sturgeon and 28 adult Atlantic sturgeon on the Altamaha River. All tagged shortnose sturgeon were captured in March using anchored monofilament gill nets using large mesh sizes (5”-6” stretch) to selectively target adults weighing >1800 g. Adult Atlantic sturgeon were targeted from April through late June using large mesh (10”-16” stretch) multifilament drift nets in Altamaha Sound.

Telemetry data from stationary arrays on the Altamaha River showed that several shortnose tagged in spring 2011, moved 50-100 rkm upstream during Jan and Feb – a clear indication of spawning. These data further corroborate previous findings from the UGA research team studying this population (Devries and Peterson 2006, Bahn et al 2012). Several of these shortnose moved upstream of the Altamaha Confluence (rkm 250) and into the lower Ocmulgee and Oconee Rivers. In January and

February, 2012, one of these fish was detected in the lower Oconee River, but subsequently, returned to the Altamaha before moving ~ 70 rkm into the Ocmulgee River (320 rkm from Altamaha Sound. This individual eventually moved back downstream to the lower Altamaha River in late February, presumably after spawning had concluded. To date, this record represents the most upstream migration of any shortnose in our study and possibly, the longest documented migration of the species. Two other tagged shortnose were detected above the Altamaha confluence in February: one fish was detected on receivers in the Oconee River, while the other was recorded in both the Ocmulgee and Oconee Rivers. Shortnose spawning has not been previously documented in either of these rivers.

Of 17 adult Atlantic sturgeon tagged in spring 2011, telemetry data showed that 15 of these individuals move upstream at least 110 rkm into the Altamaha after their release (Figure 4). Of these 15 individuals, 6 moved all the way up to and past the Altamaha Confluence from Sept-Dec, suggest that the primary spawning period for the Altamaha population occurs in late fall. In fact, most of these fish were detected leaving the system in January 2012, suggesting that they had completed spawning sometime between Oct-November. The last of these fish to leave the system were detected in the lower Altamaha Sound in February. Confirmation of fall spawning is still needed, but to date, our study has shown no evidence of Atlantic sturgeon spawning during any other period in the Altamaha System.

3. Satilla & St. Mary’s River Monitoring

No additional sampling was conducted in either the St. Marys or Satilla Rivers in 2011; however, the UGA team is currently maintaining 3 acoustic receivers in the mouth of the Satilla River and 4 acoustic arrays in the mouth of the St. Marys Rivers as part of their ongoing study or sturgeon movements in Coastal GA rivers. To date, no detections of transmitted Atlantic sturgeon have been detected in either the Satilla or St. Marys.

<u>Habitat Status</u>

The GA DNR has been providing input on the water quality regulations and associated permit applications to promote protection of Atlantic sturgeon habitat. WRD and CRD are on the Corps of Engineers (COE) Public Notice of 404 and Section 10 requests.

<u>Savannah Harbor Deepening</u>

The Port of Savannah continues to be one of the busiest on the East Coast of the United States. For several years, the Georgia Port Authority (GPA) has sought to deepen the harbor from 42 to 47 feet. As a Trustee Agency, DNR is committed to providing oversight to GPA. An interagency fisheries committee has reviewed hydrodynamic models to determine impacts of the deepening project. The models are to demonstrate the changes in water flow and its effect on other areas such as the Savannah River National Wildlife Refuge, which potentially stands to have its freshwater intertidal wetlands (including sturgeon habitat) altered by the deepening. The Final Environmental Impact Statement has been reviewed and GPA has obtained all environmental clearances to go forward with the project. The final Record of Decision (ROD) in expected this fall with construction beginning as soon as summer 2013.

Aquaculture Operations Authorized, Status of Regulations, Disease-Free Certification Status, etc.

Bears Bluff and Warm Springs National Fish Hatcheries

The U. S. Fish and Wildlife Service currently maintain eight adult Atlantic sturgeon at the Bears Bluff National Fish Hatchery in South Carolina. Four fish were acquired during fall of 2008, four were acquired during spring of 2009, and an additional fish was acquired during the spring of 2010. All fish were captured from the Altamaha River population. Unfortunately one fish was lost during routine fish lice treatment in July, 2010 due to an ammonia spike in a re-circulating system. All of the fish have responded well to feeding and a successful protocol has been developed to initiate feeding of wild fish held in captivity. Two fish had released eggs while in captivity, unfortunately both events occurred during the fall and sperm was unavailable. In both cases eggs were slightly over ripe, and it appeared that fall spawning (rather than conventional life-history theory of springtime spawning) might be a real possibility for Atlantic sturgeon.

The Atlantic sturgeon holding regime was adjusted in 2011 to explore the options for fall spawning at Bears Bluff. The sturgeon responded favorably to the environmental conditions, and several animals produced eggs. These progeny hatched the week of Sept 26th, 2011 and will be used to develop reliable/repeatable captive propagation techniques along with feeding, marking and tagging (pit/telemetry) technique development. This research would be useful in preparing for hatchery propagation for a potential (future) reintroduction effort in the St. Marys River system. These fish will not be used for stocking purposes. The captive sturgeon allow biologists to improve methods of maintaining Atlantic sturgeon in captivity, and assist researchers in refinement of techniques needed to measure the success (imprinting, life history, return-to-spawn) of stocking hatchery-reared juvenile sturgeon for future restoration efforts.

As of September 2012, there are 1,425 juvenile sturgeon at Bears Bluff National Fish Hatchery and 15 juvenile fish at the Warm Springs National Fish Hatchery. The 15 juvenile sturgeon were brought to Warm Springs from the Bears Bluff population to compare fish health related differences between progeny retained at Bears Bluff SC and those reared at our hatchery in Warm Springs GA. The mean length and weight of all these one-year old fish are 317 mm and 106 g. respectfully.

The US Fish and Wildlife Service also had one 1998 year-class Atlantic sturgeon in its possession at the Warm Springs National Fish Hatchery in Warm Springs, Georgia, but it was subsequently transferred (June 15, 2006) to the Flint River Aquarium, in Albany, Georgia, for display purposes. This animal was the remnant Atlantic sturgeon received from USFWS Fish Technology Center in Lamar, Pennsylvania, for use in a study comparing growth, survival, and morphometrics of Atlantic sturgeon verses Gulf sturgeon. This fish was offspring from Hudson River stock.

US Fish and Wildlife staff biologists are seasoned veterans in fish handling practices. For example, we have developed standard protocols for conditioning and spawning of shortnose sturgeon (Ware and Echevarria, 1999), and have successfully propagated and maintained captive shortnose sturgeon for 18 years at Bears Bluff NFH. Personnel use proven techniques to culture, handle, and transport fish, and are recognized by the fisheries community as being consistently excellent.

Fish held at both hatcheries undergo an annual health inspection that follows guidelines developed by the National Wildlife Fish Health Survey. The Southeast Region Fish Health Center completed a non-lethal health exam for Atlantic sturgeon in October 2011 and fish at both hatcheries received a clean bill-of-health. This work is fully aligned with federal criteria identified by U.S. Department of the Interior, U.S. Fish and Wildlife Service, and is part of the Strategic Plan for Conserving America's Fisheries (Southeast Region).

Atlantic States Marine Fisheries Commission
Annual Compliance Report:
Florida Fish and Wildlife Conservation Commission:
Atlantic and Shortnose sturgeon

FY 2011-2012
Submitted September 14, 2012

Shortnose sturgeon: *Acipenser brevirostrum*

Reported by-catch: zero
Incidental take: zero
Collected for scientific research: zero
Aquaculture: produced for food production: zero
Aquaculture: produced for restoration/restocking: zero

Atlantic sturgeon: *Acipenser oxyrinchus oxyrinchus*

Reported by-catch: zero
Incidental take: 1
Collected for scientific research: zero
Aquaculture: produced for food production: zero
Aquaculture: produced for restoration/restocking: zero

Commercial producers of non-native sturgeons continue to desire for the Sturgeon Production Working Group of the Florida Department of Agriculture and Consumer Affairs to pursue an ESA exemption (captive stock DPS) for food production of shortnose sturgeon in Florida. While Florida FWC has not established an official position on this issue, the exceedingly low incidence of wild-capture of this species in Florida suggests that minimal genetic risk exists from production aquaculture of shortnose sturgeon.

One juvenile Atlantic sturgeon was caught on hook-and-line in the St. Johns River in January of 2012. The St. Marys River continues to be assessed for water quality by the St. Johns River Water Management District, the Georgia Department of Natural Resources (GaDNR), the USFWS, and the University of Georgia. USGS and USFWS teams have been conducting side-scan sonar assessments of several stretches of the St. Marys River to explore for potential spawning sites and benthic regions needing rehabilitation or dredging to restore natural conditions.

FWC regulations regarding Special Activity Licenses authorizing release of captured-for-monitoring and/or cultured-for-release insure that neither new nor old diseases and parasites, nor genetically inappropriate stocks, are introduced to Florida waters.

In 2011, Florida proposed listing the Atlantic sturgeon as threatened in the St. Marys and St. Johns Rivers; prior to FWC Commission approval this state-listing, in April 2012, NMFS designated the species federally endangered, making Florida's listing moot. FWC is developing a species action plan to conserve the species and its habitat in Florida.

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