

U.S. Fish & Wildlife Service

# Atlantic Sturgeon Reward Program for Maryland Waters of the Chesapeake Bay and Tributaries 1996-2006

*Maryland Fishery Resources Office  
November 2007*



# **Atlantic Sturgeon Reward Program for Maryland Waters of the Chesapeake Bay and Tributaries 1996-2006**

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November 2007

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**Report Objectives:**

The purpose of this report is to 1) demonstrate the importance of the Atlantic sturgeon reward program in Maryland 2) report on 11 years of sturgeon captures in Maryland waters of the Chesapeake Bay and 3) Identify trends in captures of sturgeon.

**Program Background:**

Atlantic sturgeon were once plentiful in the Maryland portion of the Chesapeake Bay and Tributaries. Commercial fisheries harvested substantial numbers of sturgeon in the Potomac River in the late 1800's, and spawning populations were known to occur in the Maryland tributaries to the Bay (Hildebrand and Schroeder 1928). Since the early 1900's, commercial landings for sturgeon have dwindled until a complete harvest moratorium was instituted in Maryland and along the coast in 1998 (ASMFC). After the moratorium, few Atlantic sturgeon were reported voluntarily as bycatch in commercial fisheries in Maryland waters of the Chesapeake Bay and tributaries. However, anecdotal information from commercial fishermen indicated that sturgeon were more common in the Chesapeake Bay than bycatch reports showed.

In 1992, at the request of the Atlantic States Marine Fisheries Commission (ASMFC), the U.S. Fish and Wildlife Service (USFWS), Maryland Fishery Resources Office (MFRO) initiated a coast-wide sturgeon tagging program. The coast-wide tagging program coordinates and catalogs sturgeon tagging data from multiple research programs along the Atlantic coast. Through the coast-wide tagging program, a smaller reward program was developed in Maryland specifically to learn more about sturgeon in the Maryland portion of the Chesapeake Bay. The coast-wide sturgeon tagging program initially received financial assistance from the Hudson River Foundation (HRF) and the National Fish and Wildlife Foundation (NFWF). The program is now funded through the USFWS and Coastal Tagging funds from ASMFC. From 1994 to 1996, the MFRO requested commercial fishermen in Maryland to turn over live sturgeon to biologists for tag and release purposes. With no incentive for the fishermen, this request only contributed two sturgeon for tagging and release. In 1996, commercial fishermen were offered \$100.00 for live sturgeon that would be turned over to USFWS biologists for tagging. Information on the reward program was sent to all commercial fishermen via postcard. Funds for this initial reward program were contributed by Chesapeake Bay Foundation (CBF),

Maryland Department of Natural Resources (MDNR), Maryland Port Authority (MPA) and the USFWS. The monetary incentive significantly increased the number of sturgeon supplied to the program by participating commercial fishermen.

In June of 1996, hatchery-reared Atlantic sturgeon were released in the Nanticoke River, a tributary to the Chesapeake Bay. The reward program was then modified to \$100.00 for live wild sturgeon and \$25.00 for hatchery-reared sturgeon, which were identified with a coded wire tag (cwt) (Northwest Marine Technology, Shaw Island, Washington) placed under the 3<sup>rd</sup> anterior dorsal scute. In July 1998, the reward program shut down due to lack of funds, but later reopened December 1998. Besides the short one-time closure, the reward program has been in operation for the most of the past 10 years. Today, the reward program operates from October 1<sup>st</sup> through May 31<sup>st</sup> to avoid sturgeon handling, and the potential resultant increase in mortality, during the warmer summer months. The monetary reward was reduced on October 1<sup>st</sup>, 2006 to \$50.00 for a live sturgeon capture. In order to address concerns about possible under-reporting of dead sturgeon, USFWS and MDNR considered altering the reward program to offer a smaller reward for dead sturgeon in addition to the reward for live sturgeon. This could facilitate accurate assessment of mortality resulting from commercial fishing. However, there are law enforcement ramifications to this policy to consider. The possibility exists that a fisherman, with no intent to report live sturgeon, would keep any sturgeon captured, regardless of its condition at the time of capture. Law enforcement personnel cannot know intent; therefore they would be in a position where they had to allow any fisherman to possess dead sturgeon on their boat. After considering all aspects, the program opted not to offer a reward for dead sturgeon. The program is now currently funded by the MDNR and the USFWS.

### **Program Operation:**

Commercial fishermen have been notified of the program through postcards, advertisements in local and industry newspapers, postings on the MDNR website, directed mailings to announce program changes, outreach events, and word of mouth. The program uses a toll free phone number (1-800-448-8322) for fishermen to call when they capture a sturgeon. The fishermen are required to call to report the capture immediately. Information on capture location and holding site are taken at the time of the call, and the fishermen are given a unique

confirmation number. If stopped by Maryland Natural Resources Police, the confirmation number will let law enforcement know that the fishermen have called to report the sturgeon capture. Either a USFWS or MDNR biologist will report to the fishermen's holding location within 24 hours to tag the sturgeon. The sturgeon are typically held near the boat docking location by various methods, including tail tied, held in crab pots (smaller fish), or in holding tanks. Information on proper handling of live sturgeon is sent to the fishermen as well as posted on the MDNR website. At the holding site, the biologist records total length (TL), fork length (FL), and weight. The sturgeon are examined for any previously applied external tags and scanned for any internal tags including passive integrated transponder (PIT) tags and cwt's. If no tags are present, the biologist will insert a PIT tag (134.2 kHz Biomark, Boise, Idaho) and apply an external t-bar tag (TBA-2, Hallprint, South Australia). A fin clip is also removed from some fish and preserved for later genetic analysis. Immediately after tagging, the fish are released near the holding location.

#### **Program Summary:**

From 1996 through 2006, 260 different fishermen participated in the reward program. In this time period a total of \$137,400 was paid in rewards. There were 1,395 captures of wild Atlantic sturgeon, and 81 of these sturgeon were captured multiple times. There were 566 captures of hatchery-reared Atlantic sturgeon, and 104 of these sturgeon were captured multiple times. There were 75 captures of the endangered shortnose sturgeon and two of the sturgeon were captured multiple times. Nearly all sturgeon captures were reported by commercial fishermen. The sturgeon were caught in various types of gear, including; gill nets, pound nets, hoop nets, fyke nets, eel pots, catfish traps, crab pots, trawls and hook and line. During the 11 years and over two thousand sturgeon reported in the reward program, biologists have only encountered ten Atlantic sturgeon that were deceased upon arrival. The Maryland reward program demonstrates the effectiveness of utilizing commercial fishing effort to collect sturgeon data, especially where sturgeon occurrences in fishing gear are infrequently reported. The methods employed by the Maryland reward program have been successfully used by other jurisdictions with intensive commercial fishing effort to collect information on sturgeon.

## Results

### *Wild Atlantic Sturgeon:*

Atlantic sturgeon were the main focus of the reward program. Before 1996, very little information was known about the abundance or occurrence of Atlantic sturgeon in the Chesapeake Bay. The Maryland reward program collected information on Atlantic sturgeon that would have otherwise not been recorded. The state of Maryland uses the data collected on Atlantic sturgeon in the reward program for reporting compliance with ASMFC requirements. Fishery independent sampling that has taken place during the duration of the reward program has only provided capture data on 13 Atlantic sturgeon.

Atlantic sturgeon captures were reported throughout the Maryland portion of the Chesapeake Bay from the MD/VA line north to the Susquehanna Flats, including Bay tributaries (Figure 1). The captures of sturgeon and the resulting distribution map are entirely dependent on commercial fishing effort. Captures varied by season and year based upon weather, fishing gear and gear location. The majority of captures occurred during the spring months of April, May and June (Figure 2). This time period corresponds to commercial pound net activity in the Chesapeake Bay. Commercial pound nets accounted for the majority of wild Atlantic sturgeon captures (58.9%, n=822) followed by gill nets (40.7%, n=568), with very few fish captured in fyke nets, trawls and crab pots (Figure 3). Captures of wild Atlantic sturgeon were the highest in years 1998, 2005 and 2006 with over 200 individuals captured each year (Figure 4). Average lengths for captured sturgeon were calculated for each year, with the smallest average lengths occurring in years 1998, 2005 and 2006 (Figure 5). In these years the average lengths did not exceed 750mm, (727mm, 739mm, and 694mm respectively). During these years of lower average lengths, capture reports were at the highest (Figure 6). The data indicates that in 1998, and in the two-year period of 2005-06, there were two separate cohorts of sturgeon foraging in the bay that were captured as bycatch in the commercial fishery. This could correspond to a successful sturgeon spawning event approximately two to three years previous to the 1998 and 2005-06 captures in Maryland. As cohorts progress through the reward program (i.e., 1998 cohort), the average size of collected sturgeon increases and the number of captures decreases each year. This data indicates that the cohort is growing and recruiting to the coastal population.

The same relationship was found with hatchery fish. In 2005-06, a second cohort was also recruited to the commercial fishery. The sturgeon captures in the reward program have been dominated by juveniles, with over 75% measuring less than 850mm (Figure 7). During the eleven years of the reward program there have been only eight reported sturgeon that exceeded 1850mm TL with the largest measuring 2420mm.

### ***Hatchery-Reared Atlantic Sturgeon:***

In July of 1996, MDNR, USFWS, University of MD (Chesapeake Biological Laboratory) and Potomac Electric Power Company (PEPCO, now Mirant), joined efforts in a pilot study for the release of 3,300 one year old, hatchery-reared Atlantic sturgeon in the Nanticoke River, Chesapeake Bay, MD. The released sturgeon were progeny of Hudson River adults. There were two different size classes released: a group of 2,409 individuals with a mean total length of 156mm reared at 10°C at the USFWS Northeast Fishery Center and a group of 929 individuals with a mean total length of 323mm reared at 17°C (Welsh et al. 2002) at PEPCO and the MDNR Manning Hatchery. All sturgeon were marked with an internal coded wire tag placed under the anterior portion of the third dorsal scute. The 929 larger individuals were also marked with a yellow Hallprint t-bar tag attached at the base of the dorsal fin on the left side. With the release of the hatchery-reared sturgeon, the reward program was then modified to \$100 for a wild sturgeon and \$25 for a hatchery-reared sturgeon.

Of the initial 3,300 released, there were 462 fish recaptured, with 79 of them recaptured twice, 23 recaptured three times and two recaptured four times. There was a 14% recapture rate of the hatchery-reared sturgeon. The primary commercial fishing gears that encountered hatchery-reared sturgeon were gill nets (n=380) and pound nets (n=183) (Figure 8). Hatchery-reared sturgeon were recaptured in locations (Figure 9) similar to the wild Atlantic sturgeon captures (Figure 1); from the mouth of the Potomac River up to Aberdeen, MD and including tributaries. Similar to the wild sturgeon, captures of the hatchery-reared sturgeon varied by season and year based upon weather, commercial fishing gear type and location. In 1997 the capture reports of hatchery-reared sturgeon peaked at 328 individuals, followed by 154 in 1998 (Figure 10). In 1999 the capture reports decreased to 14 and in the following seven years there were only four captures of hatchery-reared sturgeon in the Chesapeake Bay. In 1997 the average capture size was 705mm TL. Size increased in each consecutive year to 875mm mean TL in

1998, 992mm in 1999, and 1111mm in 2000. After the high number of captures in 1997, the capture reports decreased as the average size of captured sturgeon increased (Figure 11). This indicates that the hatchery-reared sturgeon were successfully growing and began recruiting to the Atlantic Ocean, following a similar pattern to fish of wild origin.

### ***Shortnose Sturgeon:***

As the reward program focused on Atlantic sturgeon, biologists began encountering shortnose sturgeon, which were mistaken for Atlantic sturgeon and turned in for the reward. The shortnose sturgeon is on the Endangered Species List and was thought to be extirpated from the Chesapeake Bay. In April of 1996, a commercial fishermen, while fishing his pound nets in the Upper Chesapeake Bay in the Susquehanna Flats area, captured and reported three sturgeon. It was determined by USFWS biologists that these were shortnose sturgeon. These were the first confirmed captures of shortnose sturgeon in the Chesapeake Bay since 1986. In all, from 1996-2006, there were 73 captures of shortnose sturgeon, including two fish that were captured twice. The majority of captures were located in the Upper Chesapeake Bay above the Bay Bridge (n=51). Below the Chesapeake Bay Bridge there were (n=22) captures, extending down to the mouth of the Potomac as well as mid-way up the Potomac River (Figure 12). The captures are based upon commercial fishing activity. Even though shortnose sturgeon are considered an estuarine species, unlike the primarily marine Atlantic sturgeon, there were captures of shortnose sturgeon in higher salinity waters from the mouth of the Potomac River up to and around Hoopers Island with mean salinity ranges of 9-13ppt. Shortnose sturgeon were captured in various types of fishing gear including pound nets (n=28), gill nets (n=23), fyke nets (n=12) and catfish traps (n=9) (Figure 13). The average TL of captured shortnose sturgeon was 747mm (n=47). The reason for the smaller sample size of sturgeon measured versus caught is due to permitting issues with the state of Maryland and the National Marine Fisheries Service (NMFS). For this reason, sturgeon captured after May of 2002 have not been measured (n=26), weighed or tagged. Until permitting issues are resolved, handling of shortnose sturgeon captured through the reward program is not permitted. Shortnose sturgeon reported to the reward program are immediately released by biologists after they are identified.

From 1997 through 1999, USFWS biologists inserted sonic tracking tags (Sonotronics Tucson, AZ) into 13 shortnose sturgeon in the Upper Chesapeake Bay and 26 in the Delaware

River and tracked their movements. Three of the 13 shortnose that were tagged in the Chesapeake Bay were detected in either the Chesapeake & Delaware (C&D) Canal or in the Delaware River (Welsh et. al. 2002). There were no movements of tagged sturgeon from the Delaware River moving to the Chesapeake Bay. This study determined that the C&D Canal is used by shortnose sturgeon for travel between the two waterbodies.

### **Tagging Methods:**

From 1996 through 2006, tagging protocol in the sturgeon reward program has changed. The types of tags and placement location has changed with the advancement of technology and independent testing. The program has used five different types of internal and external tags to mark captured sturgeon. The five types of tags include; 1 mm cwt's, T- Bar Tag, Double Barb Tag (FIM-96, Floy, Seattle, Washington), Carlin Dangler Tag (Floy, Seattle Washington) and PIT (125 kHz, 134.2 kHz, Biomark).

### ***Wild Atlantic Sturgeon***

T-Bar tags have been continuously used in Atlantic sturgeon tagging from 1996 through 2006. The T-Bar tags are inserted into the dorsal musculature on the left side of the sturgeon. From 1996 to 2004, T-Bar tags were also inserted through the pectoral fin. The pectoral tagging location was not used after 2004 due to poor retention (Eyler et al. 2004). From 1996 through spring 2003, Atlantic sturgeon that exceeded 700mm total length were also tagged using Double Barb Tags inserted into the dorsal musculature between the 4<sup>th</sup> and 5<sup>th</sup> (craniocaudal or post cranial) dorsal scutes. These tags were not applied after the spring of 2003 due to tissue damage observed at the tag insertion area in an independent study. It was determined that the wire that connects the streamer to the attachment anchor would rotate during fish movement, eroding a large hole. This resulted in tag loss and tissue damage to the fish. From the fall of 2003 to present, PIT tags were placed in all sturgeon. The Atlantic sturgeon tagging database indicates that this type of internal tag has a high retention rate (98.1%) (Eyler et al. 2004). Older PIT tags used in the Reward Program operated at a frequency of 125kHz. Beginning in 2007, newer model PIT tags with a frequency of 134.2 kHz will be the standardized sturgeon PIT tag. The change was made on the basis of an independent study by the USFWS Warm Springs Technical Center (Fuller et. al. 2007). The 134.2 kHz tags have a greater read depth. Additionally readers

are available that can detect all types of PIT tags that have been used by sturgeon researchers along the eastern seaboard.

### ***Hatchery-Reared Atlantic Sturgeon***

The hatchery-reared Atlantic sturgeon were all marked with cwt's when released, so they could be discriminated from wild sturgeon when recaptured. The larger sized hatchery-reared sturgeon (n=929) were also tagged with a T-Bar tag in the left side dorsal musculature. When hatchery sturgeon were recaptured in the reward program they were also marked with pectoral T-Bar tags and the Double Barb tags. Similar to the wild Atlantic sturgeon, the pectoral tagging location was discontinued and the Double Barb tag was not used after 2003. It is not known whether or not the cwt tag in the hatchery-reared sturgeon can be currently detected based on fish growth and the read depth limitations of cwt detectors. Additionally, most sturgeon researchers do not routinely scan for the presence of cwt's. If any future captures are identified as hatchery-reared fish, they will be PIT tagged and have a t-bar tag placed in the dorsal musculature on the left side of the fish.

### ***Shortnose Sturgeon***

Shortnose sturgeon captured in the reward program were tagged with a PIT tag and a pectoral T-Bar tag from 1996 to the spring of 2002. From the winter of 1998 through the spring of 2002, the sturgeon were also tagged with a Carlin Dangler tag inserted into the dorsal musculature on the left side of the fish through the base of the dorsal fin. After the spring of 2002, tagging of captured shortnose sturgeon in the reward program was terminated due to the aforementioned permitting issues between NMFS and the state of Maryland. A formal document, HCP (Habitat Conservation Plan) will need to be developed in order for the USFWS and MDNR to apply tags to incidentally captured shortnose sturgeon in the reward program.

### **Genetic Sampling**

Tissue samples for genetic analysis of sturgeon collected in the reward program were taken from the caudal fin and stored in 95% ethanol. The majority of Atlantic sturgeon collected in the Reward Program between 1996 and the spring of 2006 had a tissue sample taken for

analysis. After the spring of 2006, tissue samples were taken on sturgeon either less than 400mm or greater than 900mm TL. This protocol change was due to the high number of captures in 2006 and to limit the number of samples taken from each size class.

Tissue samples from all shortnose sturgeon were collected from the winter of 1997 through the spring of 2002. In 1998 there were seven shortnose sturgeon captured in the Bohemia River and in the Chesapeake Bay near Worton Point that averaged 438mm TL. At this size, it was hypothesized that they could have been spawned in the Chesapeake Bay. Dr. Ike Wirgin, New York University (NYU) School of Medicine, analyzed tissue samples collected from shortnose sturgeon in the reward program to determine if they were unique to the Chesapeake Bay or were migrants from the Delaware River (Wirgin et al 2001). The results concluded that the genetic makeup of shortnose sturgeon captured in the Reward Program was similar to that of shortnose sturgeon found in the Delaware River. It was determined that shortnose sturgeon collected in the reward program are most likely migrants from a Delaware River population. There were no unique haplotypes of the Chesapeake shortnose sturgeon to indicate a distinct population spawning in the Chesapeake Bay. However, this does not rule out migrants from the Delaware River moving to the Chesapeake Bay to spawn. Genetic tissue collection from shortnose sturgeon in the reward program ceased after the spring of 2002 due to the aforementioned permitting issues.

In 2001 Tim King (USGS-Leetown Science Center) published genetic information regarding Atlantic sturgeon captured in the reward program. Chesapeake Bay Atlantic sturgeon samples were compared to other samples collected from populations north and south along the east coast. The Chesapeake sub-adult sturgeon were found to be of a mixed population from northern and southern populations along the Atlantic coast (King et al. 2001). The Chesapeake Bay appears to be important foraging grounds for various east coast population of Atlantic sturgeon. Given the genetic results, reproduction in the Bay cannot be ruled out (King et al. 2001).

MDNR recently sent a subset of tissue samples from the years 1998 - 2000, and 2003 - 2006 to the USFWS Northeast Fishery Center Conservation Genetics Lab (NEFC) for further analysis.

**Atlantic Sturgeon Broodstock Program:**

Beginning in January 2000 MDNR began collecting larger wild Atlantic sturgeon captured in the Reward Program and transporting them to the University of Maryland Aquaculture and Restoration Ecology Laboratory (AREL). These sturgeon were collected for use as future broodstock in the event that Maryland initiated a sturgeon stocking program. They were also collected to study sturgeon propagation, including growth and feeding in a hatchery facility.

A report (Bartron, 2005) by the USFWS Northeast Fishery Center Conservation Genetics Lab was submitted to MDNR that examined the genetic characterization of the future captive broodstock population. Results from Bartron's genetic characterization will be used by MDNR for broodstock management and guidance of spawning captive adults.

**Conclusion:**

The MD reward program has been a successful tool in gaining an understanding of sturgeon distribution in the Chesapeake Bay. The cooperation of MD and VA commercial fishermen has played an invaluable role in collecting data on sturgeon in Maryland. A variety of commercial fishing gear is deployed throughout the Chesapeake Bay and tributaries enabling a greater amount of effort by commercial fisheries compared to independent sampling by government agencies. The USFWS and MDNR, in a combined effort to collect sturgeon in MD, would not be able to match the amount of gear deployed by commercial fishermen. Without the reward program we would have little understanding of sturgeon presence in the Bay.

From information collected, it appears that there have been two separate cohorts of wild Atlantic sturgeon foraging in the Chesapeake Bay, one beginning in 1998 and the other in 2005-06. Those cohorts appeared to arrive into the Bay at approximately 700 mm total length and departed the bay at approximately 900 mm total length. These captures were not young-of-year fish, but based on their size and the current knowledge of sturgeon behavior, we can assume that they originated from a system nearby or contiguous to Maryland's portion of the Chesapeake Bay. Both cohorts increased in size as time progressed and it appears that they migrated out of the Maryland portion of the Bay, presumably to the Atlantic Ocean.

The reward program also allowed for monitoring of the hatchery-reared sturgeon that were stocked into the Chesapeake Bay. Based on growth and recapture rates collected through

the reward program, it was evident that the released sturgeons were growing and adapting well. The recapture rate of the hatchery-reared sturgeon was extraordinarily high at 14 percent, indicating that sturgeon may easily be captured.

The reward program was responsible for documenting that endangered shortnose sturgeon are present in the Chesapeake Bay. Their re-discovery in 1996 has led to research projects involving identification of shortnose sturgeon habitat and possible spawning grounds.

Atlantic sturgeon are a highly migratory species of fish. Fish tagged in our program have been encountered in other monitoring studies along the coast and vice versa. Biologists working with sturgeon use different types of tags as well as tagging locations. The ASMFC Atlantic sturgeon management board recommended that the USFWS institute standardized tagging methodologies for sturgeon. The proposed standardized tagging methodology (Eyler et al., 2004), will assist biologists coast wide in better management and data collection for the benefit of the species.

By taking advantage of the efforts of the commercial fishing industry, the USFWS and MDNR have gathered far more information on sturgeon in the Bay in eleven years by providing rewards to fishermen, compared to spending those funds on independent research that would have provided far less information.

## **Acknowledgements**

We would like to thank the following Atlantic sturgeon reward program cooperators; Maryland Department of Natural Resources, USFWS (Maryland Fishery Resource Office) biologists, USFWS (Chesapeake Bay Field Office) biologists, University of Maryland (AREL), Mirant Corporation (Chalk Point Facility), USFWS (Northeast Fishery Center), USGS (Leetown Science Center), U.S. Army Corps of Engineers, Chesapeake Bay Foundation, Maryland Port Administration, and Dr. Ike Wirgin (NYU Medical Center)

## References

- Bartron, M.L., 2005. Evaluation of genetic diversity and relatedness for Atlantic sturgeon (*Acipenser Oxyrinchus*) sampled by Maryland DNR in 2005. U.S. Fish and Wildlife Service, Northeast Fishery Center, Conservation Genetics Lab.
- Eyler, S.M., M.F. Mangold, S.P. Minkinen, 2004. A report on the Atlantic Coast Sturgeon Tagging Database. U.S. Fish and Wildlife Service, Maryland Fishery Resources Office, Annapolis, Maryland 50 pages.
- Fuller, S.A., J.P. Henne, V.A. Mudrak, and J. Seals. 2007. Performance of commercially available passive integrated transponder (PIT) tag systems used for fish identification and interjurisdictional fisheries management. North American Journal of Fisheries Management. *In Prep.*
- Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. U.S. Bureau of Fisheries Bulletin.
- King, T.L., B.A. Lubinski, A.P. Spidle, 2001. Microsatellite DNA variation in Atlantic sturgeon (*Acipenser oxyrinchus*) and cross-species amplification in the Acipenseridae. *Conservation Genetics* 2: 103-119.
- Welsh, S.A., S.M. Eyler, M.F. Mangold, A.J. Spells, 2002. Capture Locations and Growth Rates of Atlantic Sturgeon in the Chesapeake Bay. American Fisheries Society Symposium 28:183-194.
- Wirgin, I., C. Grunwald, E. Carlson, J. Stabile, J. Waldman. 2001. Range-Wide Population Structure of Shortnose Sturgeon (*Acipenser brevirostrum*) Using Mitochondrial DNA Control Region Sequence Analysis.

Figure 1. Capture locations of wild Atlantic sturgeon reported through the reward program by commercial fishermen (1996-2006).

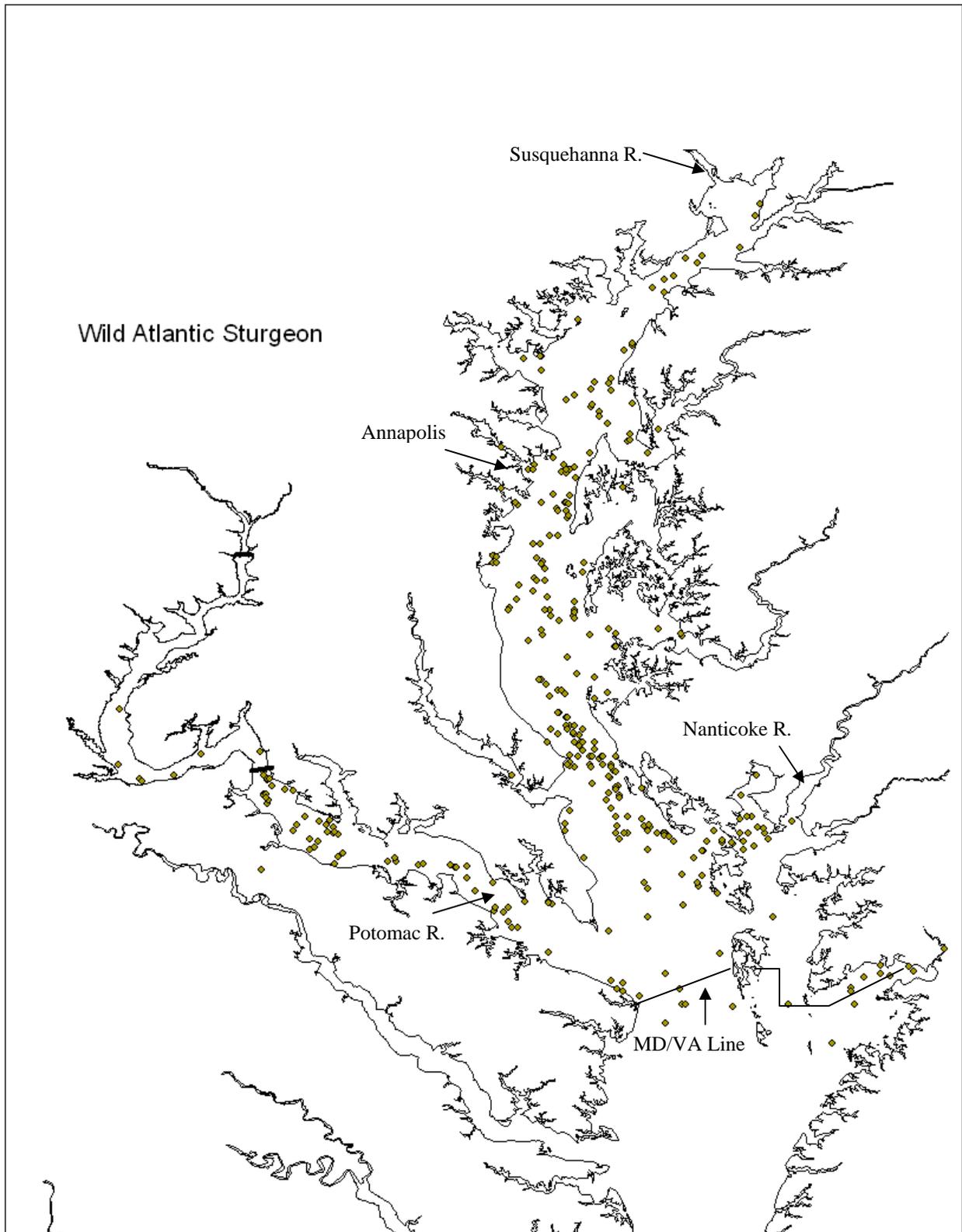


Figure 2. Atlantic sturgeon caught by month in the Chesapeake Bay (1996-2006).

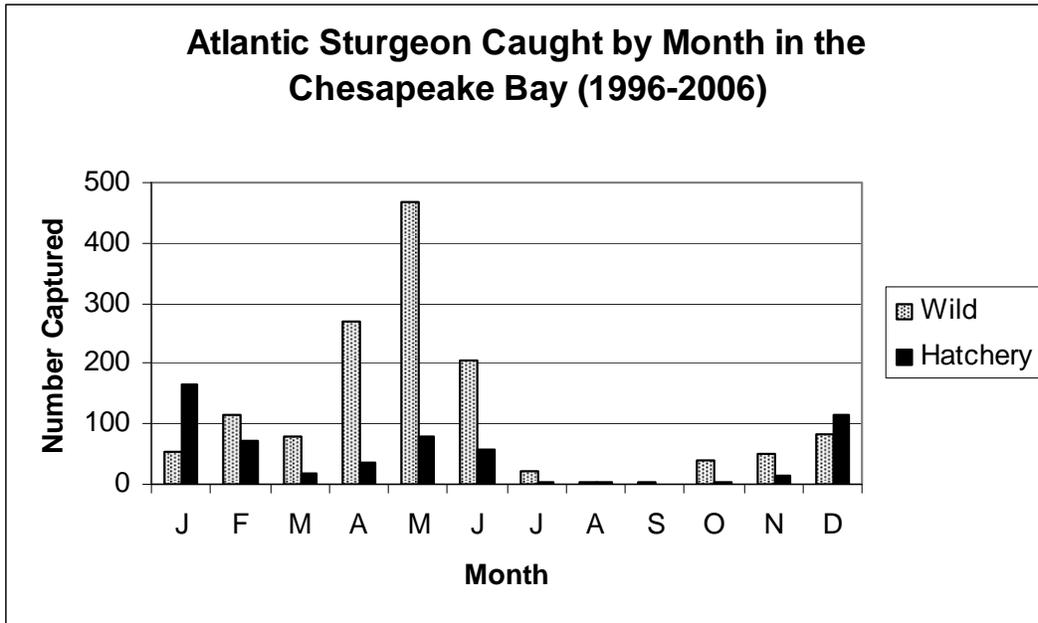


Figure 3. Wild Atlantic sturgeon captured by gear type (1996-2006).

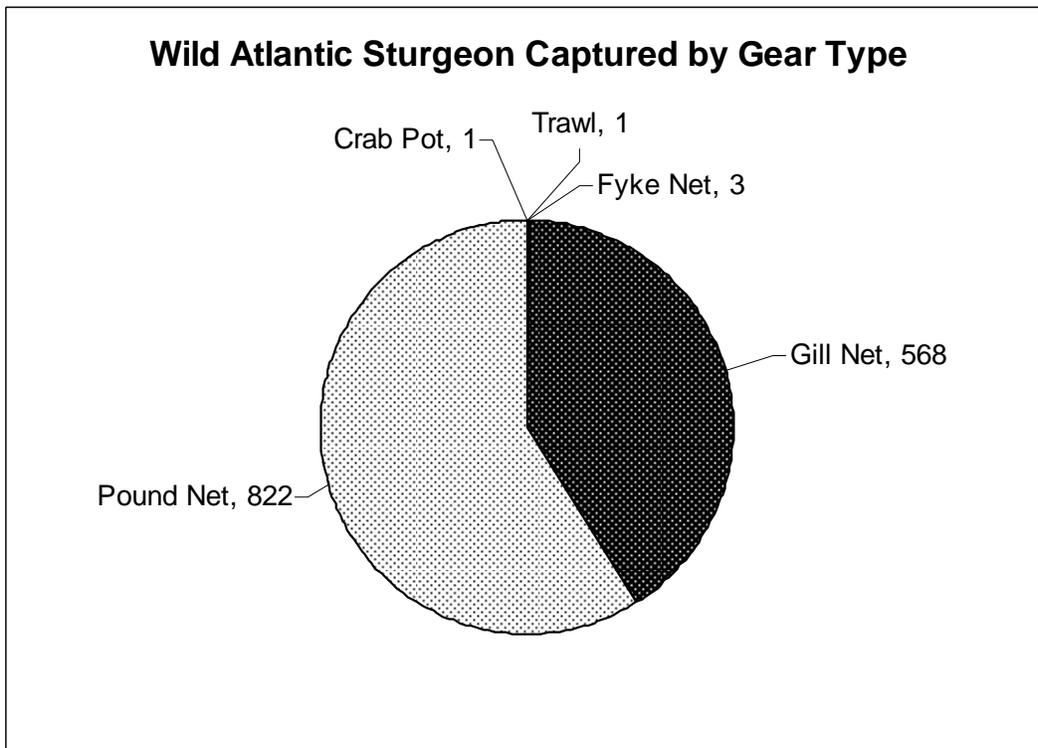


Figure 4. Number of wild Atlantic sturgeon captured by year.

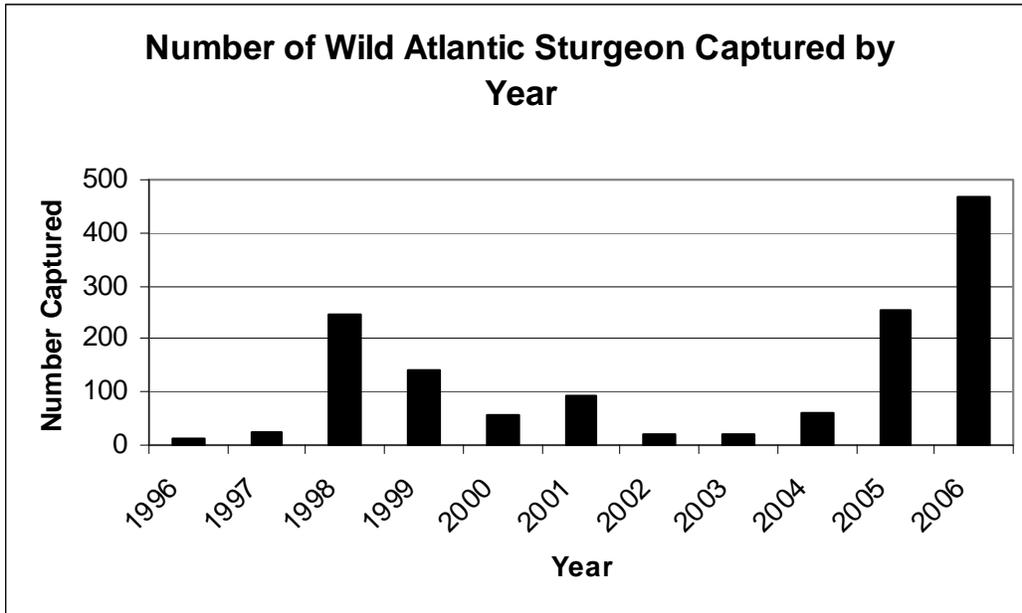


Figure 5. Average length of wild Atlantic sturgeon captured by year.

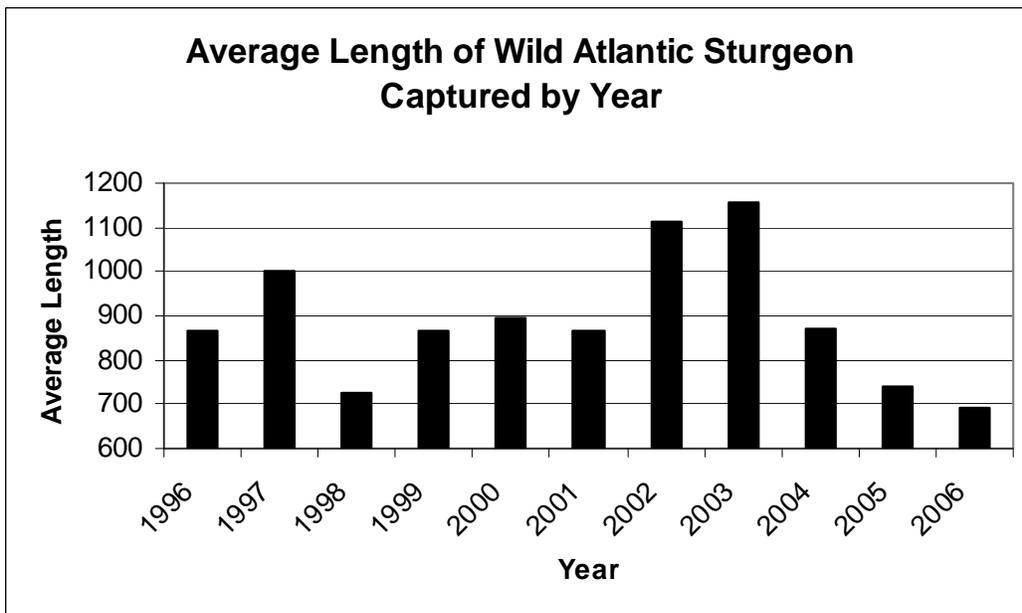


Figure 6. Wild Atlantic sturgeon: length/number captured comparison.

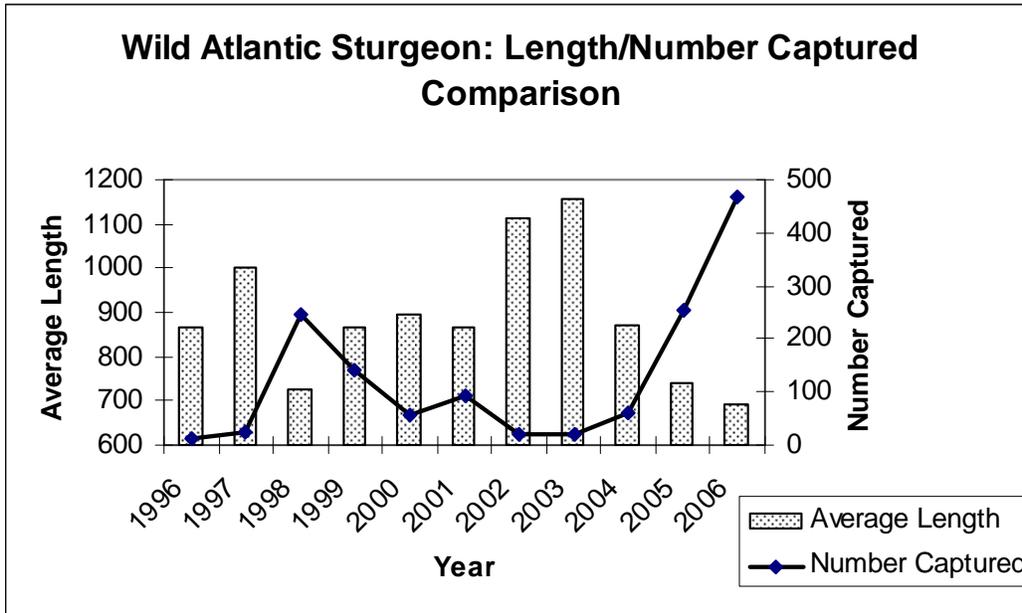


Figure 7. Mid-lengths of wild Atlantic sturgeon caught in Maryland waters of the Chesapeake Bay (1996-2006).

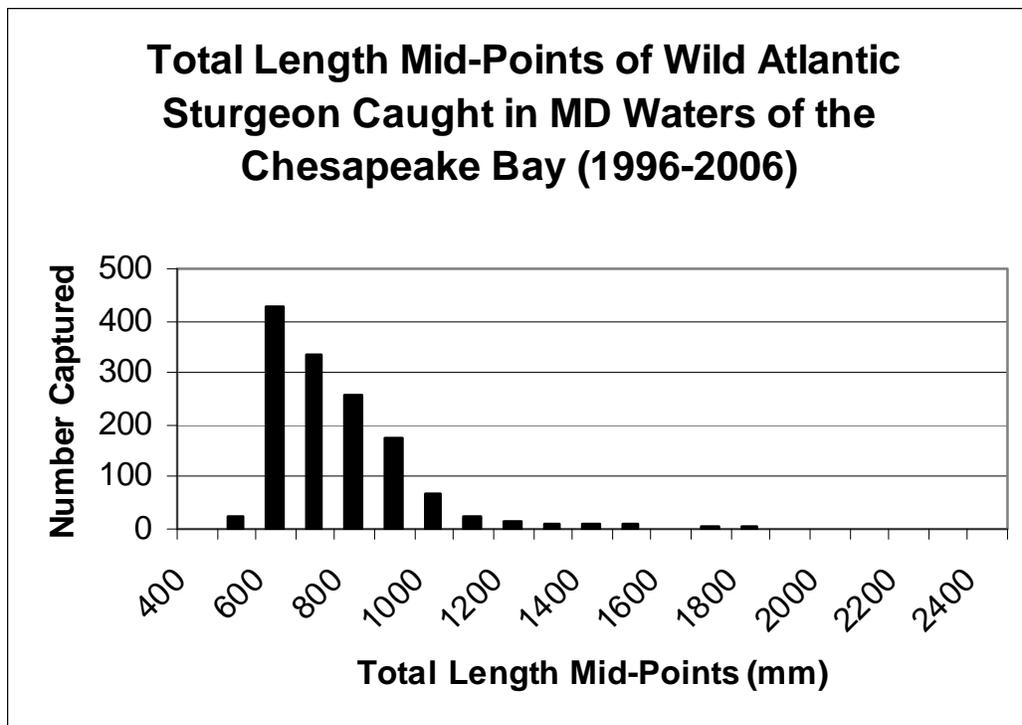


Figure 8. Hatchery-reared Atlantic sturgeon captured by gear type (1996-2006).

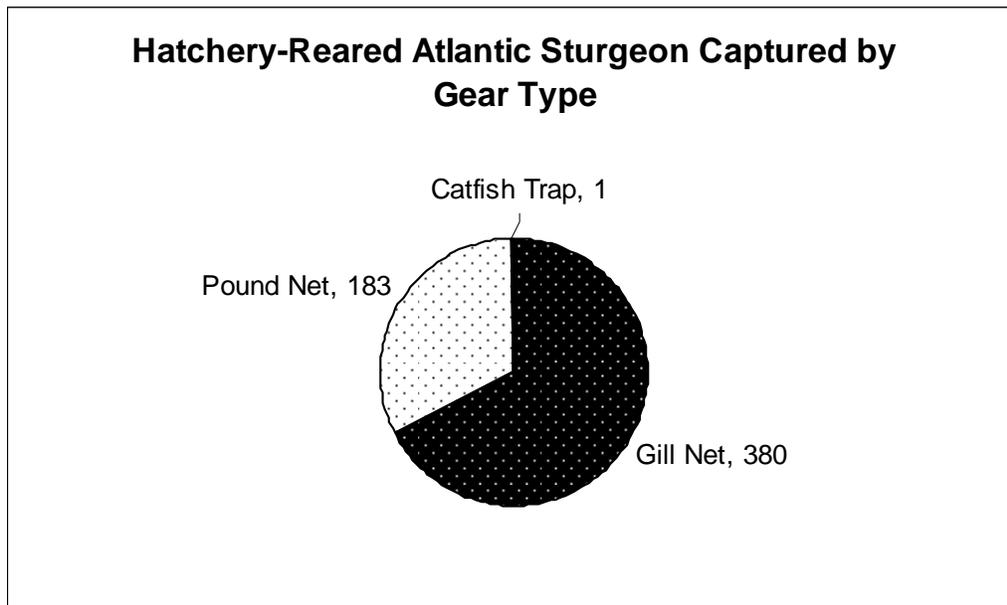


Figure 9. Capture locations of hatchery-reared Atlantic sturgeon reported through the reward program by commercial fishermen (1996-2006).

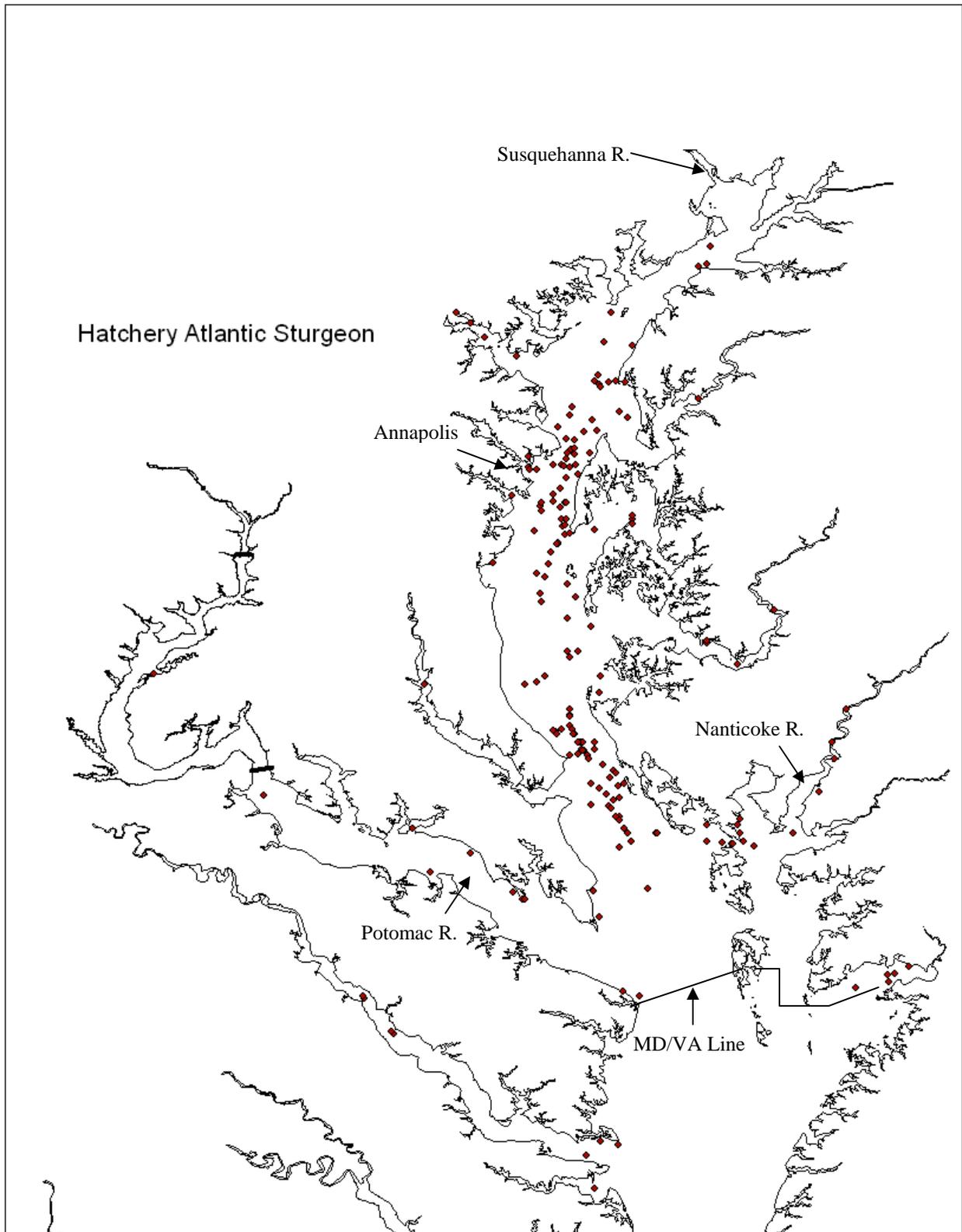


Figure 10. Number of hatchery-reared sturgeon captured by year.

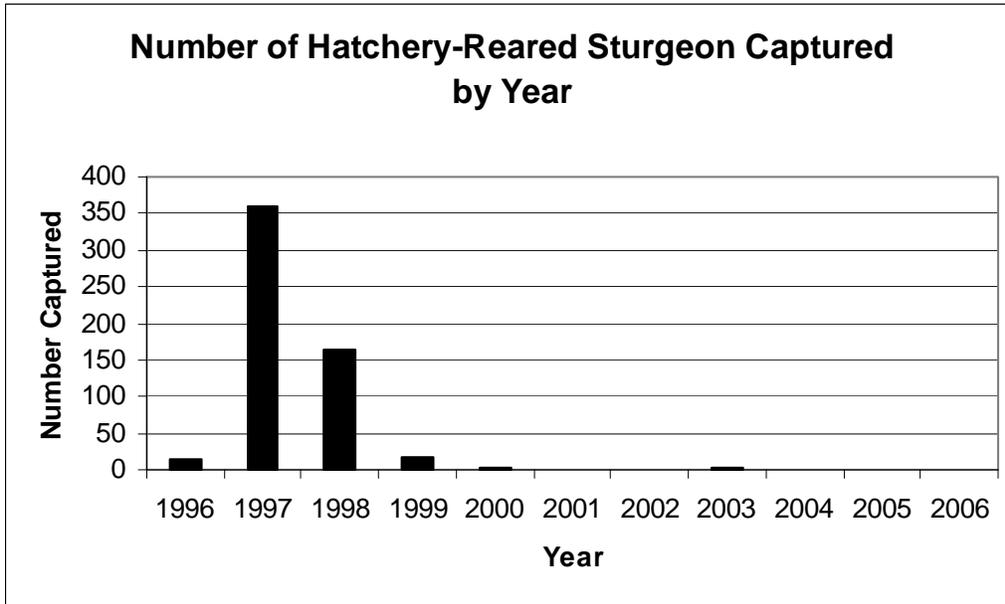


Figure 11. Hatchery-reared sturgeon: length/number captured comparison.

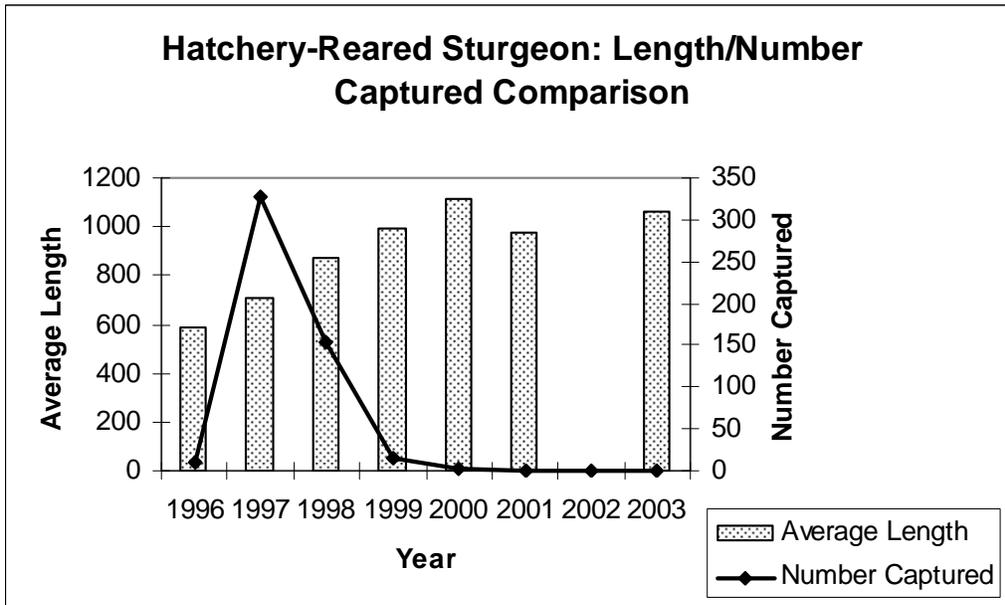


Figure 12. Capture locations of shortnose sturgeon reported through the reward program by commercial fishermen (1996-2006).

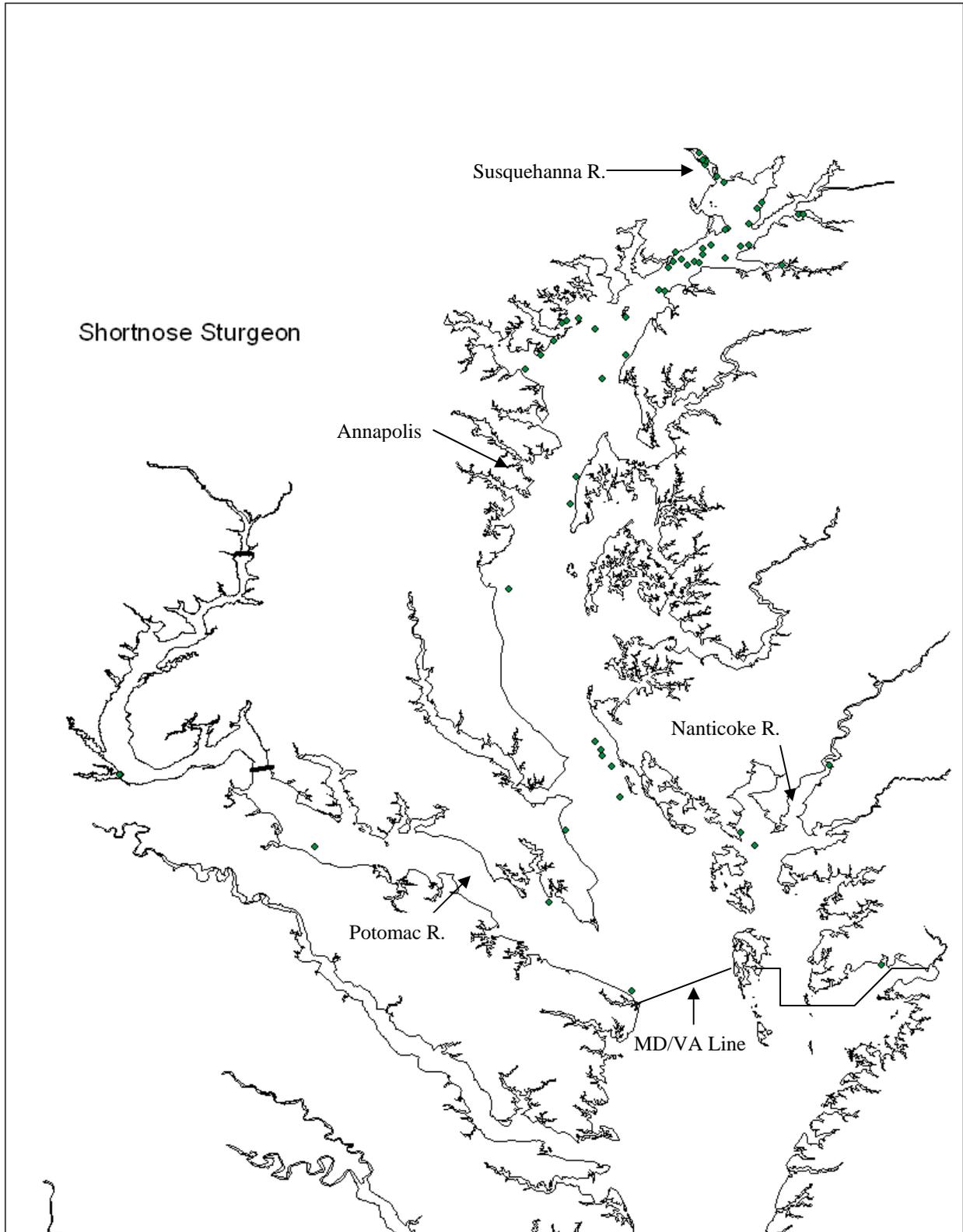


Figure 13. Shortnose sturgeon captured by gear type (1996-2006) where are the geartype headings?

