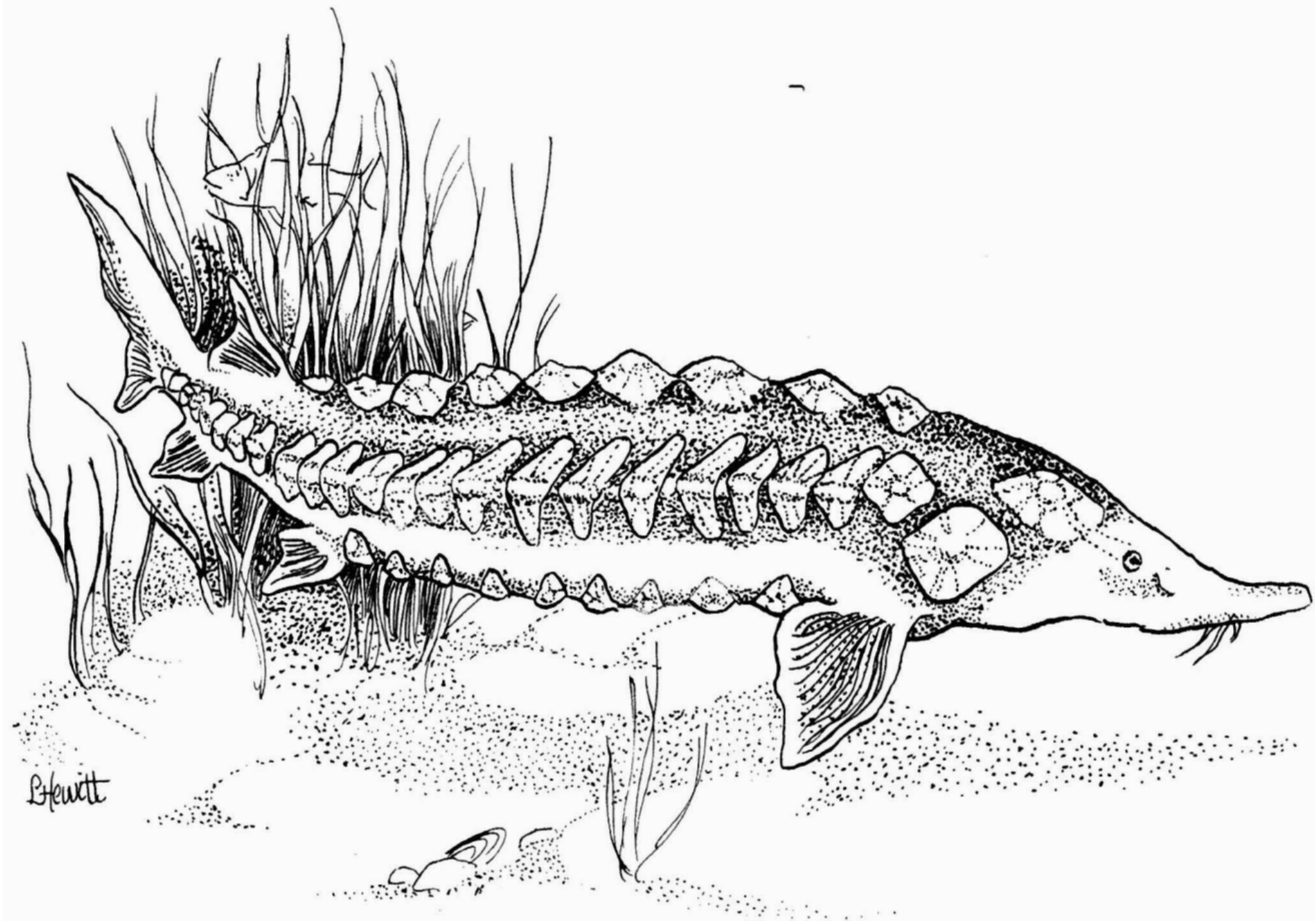
U.S. Fish & Wildlife Service

Atlantic Coast Sturgeon Tagging Database

Maryland Fishery Resources Office
October 2004



Atlantic Coast Sturgeon Tagging Database

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Report Summary:

The Coast-Wide Sturgeon Tagging Program was started in 1992 by the U.S. Fish and Wildlife Service (USFWS) – Maryland Fishery Resources Office. The Program was designed to provide a central repository for sturgeon tagging information on the Atlantic Coast. The database contains information on more than 12,000 sturgeons (5,500 Atlantic and 7,000 shortnose), including recapture information on more than 1,000 fish. The report also provides a description of the two programs that have released hatchery-reared Atlantic sturgeon, tagged with Coded-Wire Tags. Capture and release information is summarized by state, species, and coordinating agency. Tagging programs range from Maine to North Carolina for Atlantic sturgeon and New York to Georgia for shortnose sturgeon. The largest tagging programs for Atlantic sturgeon were in the Hudson River and the Chesapeake Bay and also in the Hudson River for shortnose sturgeon. Both sturgeons are migratory, but shortnose are rarely ever recaptured outside of the waterbody where they were tagged. Conversely, Atlantic sturgeons are more migratory, especially for fish greater than 850mm total length. For fish tagged from North Carolina to Connecticut, recaptures varied greatly, but remained in the coastal range from North Carolina to New Hampshire. Although two-thirds of Atlantic sturgeon recaptures and nearly all of shortnose sturgeon recaptures were reported by researchers working with sturgeon, some fish with external tags were also recaptured by fishermen. Most fishermen that encountered tagged sturgeons were using gillnets and the most common target species was striped bass. The largest number of sturgeon recaptures by fishermen occurred on the Atlantic Coast of Virginia and in the Chesapeake Bay, and most fish were encountered in the winter and spring months. Mortality by fishing gear was reported by the fishermen to be 5.6% (excluding fish that were intentionally harvested prior to the fishery closure). Tag retention was evaluated and the Carlin Dangler tag, Dorsal T-Bar tag, and the Passive Integrated Transponder (PIT) tag appear to have the highest retention. PIT tag retention was high through time (98% from release to 8 years at large). The two external tags had high retention initially, 100% for the first three years of the Carlin Dangler tag and 85% for the first year of the Dorsal-T-Bar tag. The program suggests that all future tagging of sturgeon consist of a PIT tag and a Carlin Dangler or Dorsal T-Bar tag to optimize the amount of data that can be collected by the program. All tags and associated tagging equipment will be provided by the USFWS to sturgeon tagging agencies. Recommendations on required

and optional data fields to be collected have been provided, as well as sample datasheets for data collection. Data from the database can be provided by the USFWS to agencies upon request.

Report Objectives:

The purpose of this report is to 1) provide information on the range and depth of data currently available in the database, 2) make cooperators aware of the types of sturgeon work that has been done and is ongoing in Coastal states and tributaries, 3) standardize tagging methods between sturgeon programs, and 4) standardize data collection formats for input into the central database.

Program Background and General Information:

Since 1992, the U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) has been coordinating a coast-wide sturgeon tagging program as well as serving as a repository for sturgeon capture and tag information for Atlantic and shortnose sturgeon collected on the Atlantic coast and tributaries. The tagging program and database were designed to provide an efficient means of coordination between federal and state agencies and research institutions to ensure consistency between tagging programs and also serve as a central repository for both tagging and capture information for both sturgeon species along the Coast. The current database contains sturgeon capture information dating back to 1988, and tagging information using U.S. Fish and Wildlife Service tags since 1993. Nineteen different agencies and research institutions have participated in the program, ranging on the Atlantic coast from Maine to Georgia.

The database contains capture information on more than 12,000 sturgeons (over 5,500 Atlantic sturgeon and nearly 7,000 shortnose sturgeon). Nearly all of the fish were also tagged prior to release. Of the 5,500 Atlantic sturgeon tagged, nearly 800 have been recaptured at least one time (14% recapture rate), with fish being caught up to four times after their original release. One-third of the recaptures were reported by commercial fishermen and two-thirds of the recaptures were reported by researchers working with sturgeon. Of the 6,650 shortnose sturgeon tagged, nearly 360 have been recaptured (5% recapture rate), with fish being caught up to three times after original release. Nearly all recaptures were reported by researchers with only 13

recaptures reported by fishermen. A general breakdown of agency tagging efforts (Table 1) and recapture range (Table 2) has been provided.

Potential Uses for Current Information:

The database currently contains information on tag retention and movement, as well as target fisheries where sturgeons are incidentally caught. Mapping areas where sturgeon are frequently captured (i.e. Hudson River or Maryland portion of the Chesapeake Bay) may also be used to determine habitat use by sturgeon, although seasonal and temporal fishing pressure must be considered in some of the tagging programs.

The database also has data that can be used to address some of the research needs identified in the ASMFC 2002 FMP for Atlantic Sturgeon, including:

2. Characterize size, condition, and relative abundance of Atlantic sturgeon by gear and season taken as bycatch in various fisheries.

Some limited information is available from commercial recaptures of tagged sturgeon, including size, condition, target species of the fishery, and number of untagged sturgeon captured on the same day that the tagged fish was captured (See Bycatch and Target Species section).

3. Determine the extent to which Atlantic sturgeon are genetically differentiable among rivers.

The USFWS-MFRO, as well as other agencies and research institutions, have collected tissue samples from sturgeon, and some genetic analysis has been completed (King, T.L., B.A. Lubinski, and A.P. Spidle. 2001. Microsatellite DNA variation in Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus) and cross-species amplification in the Acipenseridae. Conservation Genetics 2:103-119). The USFWS-MFRO will coordinate future collection and analysis of tissue samples collected by research agencies.

7. Establish tagging programs to delineate migratory patterns and stock composition and rates of loss to bycatch.

The coast-wide database has been in place since the early 1990's. Migratory patterns can be evaluated through recaptures in the database (Table 2). Some information has also been collected on target species where tagged sturgeons have

been captured as bycatch of other fisheries (see Migration Summary section and Bycatch and Target Species section).

8. Encourage shortnose sturgeon researchers to include Atlantic sturgeon research in their projects.

Many shortnose sturgeon researchers are coordinating with the coast-wide sturgeon tagging program and we can request that they collect information on Atlantic sturgeon while conducting shortnose sturgeon research and tagging.

9. Develop long-term marking/tagging procedures to provide information on individual tagged Atlantic sturgeon for up to 20 years.

This can be accomplished through routinely using passive integrated transponder (PIT) tags in sturgeon and consistently checking for PIT tags while conducting research that encounters sturgeon (see Current Tag Types and Tag Retention section, Tagging Combination Recommendations for Future Tagging section and Appendix 2: Standardized Tagging Methodology for Atlantic Sturgeon).

15. Identify rates of tag loss and tag reporting.

Tag retention has been evaluated with the current data available in the database; no information is available on tag reporting rates (see Current Tag Types and Tag Retention section).

Atlantic Sturgeon Data Summary by State

Maine

Maine Division of Marine Resources (MEDMR) – Contact Person: Tom Squires

MEDMR tagged in 1999 and 2000 in the Kennebec and Sasanoa Rivers. All fish were captured in drift gillnets with 6-12" stretch mesh. All fish were captured and tagged in September and October with the exception of one day in June. Most capture locations include latitude and longitude. 99 Atlantic sturgeons were tagged, nearly all were between 600 and 1200 mm Total Length (TL) at tagging. Weights were taken on most of the fish. No fish were checked for the presence of a coded-wire-tag (CWT). All fish were tagged with a Double Barb tag inserted into the dorsal musculature. To date no fish have been reported to be recaptured.

New Hampshire

No participation in the program.

Massachusetts

No participation in the program.

Connecticut

Connecticut Marine Headquarters (CT) – Contact Person: Tom Savoy

Tagged from 1993-2003 (tagging ongoing). Most fish were captured in Long Island Sound, but also some captures in the Connecticut River. Most fish were captured using a trawl, but some in recent years some have been captured using anchored gillnets. Fish were captured and tagged in the summer and fall. Most capture locations include latitude and longitude. 327 Atlantic sturgeons were tagged, and fish ranged in size from 600 to 2150 mm TL at tagging with half the fish being greater than 1200 mm. Weights were taken on most fish. No fish were checked for the presence of a CWT. Tissue samples were taken from some fish. Mouth and orbital widths were also taken on some fish. Water and air temperature, salinity, and soak times for fishing gear were collected for most fish. Most fish were tagged with T-Bar tags through the pectoral fin and the base of the dorsal fin, and recently, fish have also received a passive integrated transponder (PIT) tag. To date, 6 sturgeon have been reported to have been recaptured (1.8% recapture rate), one of those recaptured 3 times. Five of the recapture events were by commercial fishermen, three were by research projects. Recaptures ranged in the Atlantic Ocean from Rye, New Hampshire to Point Pleasant Beach, New Jersey. Tributary recaptures occurred in the Connecticut River and Hudson River. All recaptures were in gillnets and trawls. Of the commercial fishing recaptures, three had target species annotated. The first was gillnetting for Atlantic sturgeon while the fishery was still open, and other two were in gillnet fisheries targeting dogfish.

New York

Cornell University (CORNELL) – Contact Person: Mark Bain

Tagged from 1993-1998 in the Hudson River. All fish were captured using gillnets; the mesh size was recorded for some fish. Most of the sampling was conducted in the summer and fall. Capture locations do not have latitude and longitude, but do have River Mile. 954 Atlantic sturgeon were tagged with fork lengths (FL) ranging from 220 to 2240 mm. Total length and weight were also taken on many fish. 80% of the fish were below 1000mm FL. Sex information was collected on some fish. Fish were evaluated to determine wild or hatchery origin (See Atlantic Sturgeon Hatchery Releases section for more information). From 1993 to 1995, sturgeons were tagged with a dorsal and pectoral T-Bar tag and some also had a PIT tag. In December of 1995, the tagging method was switched to consist of a Carlin tag and a PIT tag, with several fish only receiving a PIT tag. 55 fish have been recaptured (5.8% recapture rate), five fish recaptured twice. Of the recapture events, 34 were collected in gillnets by Cornell, NYDEC or NEFC during their research in the Hudson River. DENREC and CT were other research agencies that encountered sturgeon in the Delaware River near Augustine Beach and near Guilford in Long Island Sound, respectively. Both captures were in July. One fish was collected in 2004 by the Sturgeon Reward Program (see USFWS-MFRO in Maryland section for more information on the Reward Program) in an anchored gillnet in the Potomac River off Sandy Point, VA. Of the 23 recaptures reported by commercial fishermen, they ranged in the Atlantic Ocean from Marshfield, MA to Diamond Shoals (Hatteras), NC. Fish were caught equally in anchored gillnets and trawls. None of those fishermen were reportedly targeting sturgeon. Of the four fishermen that did report a target species, they included monkfish, fluke, smooth dogfish and skates. The smooth dogfish fisherman off Virginia Beach reported also catching about 50 other untagged sturgeon that particular day in May of 2000. None of the other fishermen reported catching untagged sturgeon the day they caught the tagged fish.

Connecticut Marine Headquarters (CT) – Contact Person: Tom Savoy

Tagged in 2001-2003 (tagging ongoing) in Long Island Sound, New York as part of their research in Connecticut. 5 Atlantic sturgeons have been captured and tagged in a trawl.

All fish were greater than 1000mm TL. To date, none have been recaptured. See Connecticut notes for details on research.

U.S. Fish and Wildlife Service, Northeast Fishery Center (NEFC) – Contact Person: John Sweka

Tagged in 1996-1998 and 2003 (tagging ongoing) in the Hudson River. Fish were captured using anchored gillnets in the summer of 1996-1998 and in the fall of 2003. 194 Atlantic sturgeons were captured and 193 were tagged. In 1997, all fish were tagged with dorsal and pectoral T-Bar tags. In addition, some fish collected in 1998 also had a dorsal Double Barb tag applied. In 2003, all fish had a PIT and Carlin tag applied. Fish ranged in size from 415 to 2185 mm TL, fork length was collected for nearly all fish and weight was collected for some fish. It is unknown whether fish were examined to determine hatchery or wild origin. Latitude and longitude were taken for some fish in 1996 and all fish in 2003. Water temperature and air temperature were collected in 1996. Mesh size was collected in 2003. 21 of the fish were recaptured (11% recapture rate), one was recaptured three times. Of the recaptures, 18 were by researchers (one by Cornell, 17 by NEFC) in the Hudson River. Of the four recaptures reported by a commercial fisherman, one was in the Hudson River, one was in the Atlantic Ocean off New York and the last two were caught in Anchored Gillnets off Point Pleasant, NJ.

National Marine Fisheries Service (NMFS) – Contact Person: Peter Chase

One Atlantic sturgeon was tagged by NMFS in New York waters during a trawl survey. The fish was 1100mm TL, tagged off Fire Island in September of 2003. The fish has not been recaptured

New York Department of Environmental Conservation (NYDEC) – Contact Person: Kathy Hattala or Mike Clansy

NYDEC captured and tagged 80 Atlantic sturgeons. 7 were tagged between 1992 and 1999, and remainder in the spring and fall of 2000. All fish were captured in the Hudson River, and tagged with dorsal and pectoral T-Bar tags. Fish ranged in size from 412 to 1100 mm TL. Fork length and weight were collected for all fish. River mile was

collected for capture location, but latitude and longitude were not available. Three fish have been recaptured (3.8% recapture rate), one recaptured twice. Of the recaptures, three were by commercial fishermen (including one in the Sturgeon Reward Program – MFRO) and one by an angler. Recaptures were from: Haverstraw (angling) and Gilgo Beach, NY; Cove Point, Chesapeake Bay, MD; and Virginia Beach. Fishermen reported they were targeting striped bass and weakfish, and did catch 0-10 untagged sturgeon on the same day as the tagged fish. Recaptures occurred in February and June, and the commercial captures occurred in anchored gillnets and pound net.

New Jersey

Army Corps of Engineers (ACEDE) – Contact Person:

ACEDE tagged 7 Atlantic sturgeons in July and August, 1994 in Delaware Bay. Fish were captured in a trawl, and latitude and longitude information is available. All fish were tagged with a dorsal and pectoral T-Bar tag. Water and air temperature were collected for all fish, water depth was collected for most fish. Fish ranged in size from 690-1250 mm TL, fork length and weight also available. To date, no fish have been recaptured.

Delaware Division of Fish and Wildlife (DENREC) – Contact Person: Craig Shirey

DENREC captured 571 Atlantic sturgeons in the summer and fall from 1993-1997. 567 of those fish were tagged using mostly dorsal and pectoral T-Bar tags. 361 of those fish also had a dorsal DENREC dart tag applied. Fish were captured near Artificial Island, NJ in the Delaware River. All fish were caught using anchored gillnets; latitude and longitude information is available for all fish. Fish ranged in size from 515 to 1670 mm TL, with just over half the fish being greater than 1000 mm TL. Fork length and weight are also available for all fish. Barbel (tissue) samples were taken from some fish. Water temperature, stretch mesh size and water depth were recorded for some fish. 47 of those fish have been recaptured (8.3% recapture rate), with two of those being recaptured twice. 17 recaptures occurred by sturgeon researchers and 32 fish were recaptured by commercial fishermen. Of the research recaptures, one was by Cornell in the Hudson River, and the remainders were by DENREC in the Delaware River and Delaware Bay.

DENREC also reported one fish being caught in the Atlantic Ocean south of Oregon Inlet in North Carolina by a research trawl and one caught in the Atlantic Ocean off New Jersey. Of the 32 recapture events by commercial fishermen, one was by trawl, the remainder by anchored gillnet. Recaptures ranged on the Atlantic Coast from Point Judith in Rhode Island Sound to the Atlantic Ocean off Ocean City, Maryland. None of the commercial fishermen reported to be targeting sturgeon, and only one reported that it was a bycatch of a shad fishery in Delaware Bay. One fisherman in Delaware Bay reported to catch two other untagged sturgeon the same day of the tagged fish capture.

New Jersey Bureau of Marine Fisheries (NJ) – Contact Person: Russ Allen

Captured and tagged 390 Atlantic sturgeons from 1992 to 2001. All fish were captured off the Atlantic Coast of New Jersey except for two fish caught in Delaware Bay off Reeds Beach in 2000. Fish ranged in size from 559 to 2149 mm TL, with over half of the fish being larger than 1000mm TL. Fork length and weight information was also collected for many fish. Fish were captured using gillnets and trawls, and most fish have latitude and longitude information available. Water and air temperature, stretch mesh, and gear soak time are available for most fish. Fish were collected and tagged by commercial fishermen as bycatch of other fisheries for the New Jersey program. All fish were tagged using dorsal and pectoral T-Bar tags. 36 fish have been recaptured (6.3% recapture rate), and one of those was recapture twice. Of the recapture events, 7 occurred by New Jersey sturgeon taggers off the Atlantic Coast of New Jersey. One tagged fish was caught by CT in a trawl survey off Long Island Sound near Guilford, CT. DENREC collected a tagged sturgeon off Port Penn in the Delaware River. 28 recapture events occurred by commercial fishermen, ranging from one fish captured in the Atlantic Ocean of New Hampshire, two on the Atlantic Coast of Massachusetts, two on the Atlantic Coast of Rhode Island, two in Narragansett Bay, two fish captured in Long Island Sound, one caught in the Hudson River, two caught on the Atlantic Coast of New York, seven fish caught off the Atlantic Coast of New Jersey, two caught in Delaware Bay, one caught on the Atlantic Coast of Delaware, two fish caught off the Atlantic Coast of Maryland, two off the Atlantic Coast of Virginia, one fish caught in the Chesapeake Bay of Virginia, and one fish caught off Naggs Head, North Carolina.

Delaware

Delaware Division of Fish and Wildlife (DENREC) – Contact Person: Craig Shirey

59 Atlantic sturgeons have been captured and tagged by DENREC in Delaware. 13 of those fish were caught in the summer of 1993 and 1998 in the Delaware River, with no more specific release location available. In 1995 and 2000, three fish were tagged in fall trawl surveys of Delaware Bay. The remainder of the fish were captured by commercial fishermen in the springs of 2002 through 2004 along the Atlantic Coast of Delaware using gillnets. Latitude and longitude and water depth are available for many Atlantic Coast captures. Total lengths of fish ranged from 460 to 1555 mm TL. Fork length and weight are also available for fish captured prior to 2002. Fish were tagged with a dorsal T-Bar tag in 1993, 1998, and 1999. Some fish tagged in 1998 and all fish tagged between 2002 and 2004 were tagged with a Delaware Dart Tag and no USFWS tag. Two of those fish have been recaptured (3.4% recapture rate), both by commercial gillnet fishermen. One fish was captured off Box Iron, Maryland, on the Atlantic Coast. The fisherman was targeting striped bass and caught 3 other untagged sturgeon that day. The second fish was caught off Virginia Beach with no information about target species or untagged sturgeon bycatch.

National Marine Fisheries Service (NMFS) – Contact Person: Pete Chase

Three Atlantic sturgeons have been captured in a trawl and tagged by NMFS. Two of the captures occurred in September 2001 and 2002 in Delaware Bay near Brown Shoal and Prime Hook. The third capture occurred on the Atlantic Coast in September of 1999 near the mouth of Delaware Bay. All fish have latitude and longitude information available. Fish ranged in size from 1760 to 2690 mm TL, with fork length and weight available also. The fish released in 1999 had a dorsal and pectoral T-Bar tag. The fish released in 2000 and 2001 only had a Double Barb tag. To date, no fish have been recaptured.

Maryland

Maryland Department of Natural Resources (MDDNR) – Contact Person: Steve Doctor

Forty Atlantic sturgeons have been tagged by commercial fishermen working with Maryland Department of Natural Resources off Ocean City on the Atlantic Coast. Fish

were captured in trawls in the spring and fall of 1998 and 1999. Fish ranged in size from 812 to 1524 mm TL. All fish were tagged with a Double-Barb tag inserted into the dorsal musculature. Four fish have been recaptured by commercial fishermen (10% recapture rate). Three were caught off the Atlantic Ocean of Virginia and the last was caught by a fisherman in the Chesapeake Bay of Maryland. None of the fishermen were targeting sturgeon, and one was reportedly fishing for striped bass at the time. One of the fishermen caught an untagged sturgeon the same day.

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

608 Atlantic sturgeon have been caught between 1993 and 2004 (tagging ongoing) in the Maryland waters of the Chesapeake Bay and tributaries. 13 fish were caught in directed research studies on sturgeon, and the remainder of fish were collected by commercial fishermen participating in a Reward Program for sturgeon. In the Reward Program, fishermen are given a monetary incentive to transport and temporarily hold live sturgeon bycatch at a shore location so USFWS-MFRO staff could tag and release the fish. Fish are collected year-round, primarily in gillnets and pound nets. Capture and release latitude and longitude are available for all fish. Although most fish are tagged and released, in recent years 28 fish have been kept by the Maryland Department of Natural Resources to conduct studies on sturgeon and initiate a broodstock program. All fish were evaluated to determine hatchery or wild origin, many hatchery sturgeon released in Maryland were recaptured, and five fish were captured that appeared to be of hatchery origin from the Hudson River (see Hatchery Releases section). Fish ranged in size from 445 to 2420 mm TL. Less than 10% of the fish were greater than 1200 mm TL. Fork length and weight are also available. Tissue samples were taken from many of the fish. 555 fish have been tagged and released in the program, most tagged with dorsal and pectoral T-Bar tags. Some larger fish have received a Double-Barb tag in the dorsal musculature, and more recently, fish have been tagged using PIT tags. 69 fish have been recaptured (12.4% recapture rate), 8 of those were recaptured twice, and two of those were recaptured three times. Recaptures have occurred along the coast and tributaries from Long Island Sound, Connecticut, to Roanoke and Albemarle Sound, North Carolina.

20 recapture events occurred outside of the Chesapeake Bay and tributaries, and half of those were on the Atlantic Coast of Virginia. Other recapture locations, besides the north and south ranges listed above were along the Atlantic Coast including points around Long Island in New York, and Sandy Hook, New Jersey. 37 recapture events occurred by research organizations (35 by USFWS-MFRO in the reward program, one by CT, and one by USFWS-VA) and 42 recapture events occurred by commercial fishermen not through the Reward Program. Primary recapture gears were gillnets and pound nets. None of the commercial fishermen were targeting sturgeon. Target species included striped bass, smooth dogfish, weakfish, bluefish, shad, fluke, and croaker. 15 of 34 fishermen reported catching other untagged sturgeon while fishing that day, with numbers ranging form 1 to 75 fish.

Virginia

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

10 Atlantic sturgeon have been caught between 2001 and 2004 (tagging ongoing) in the Virginia portion of the Potomac River. The fish were collected by commercial fishermen participating in a Reward Program for sturgeon (see description above). Fish were collected in gillnets except for one pound net capture. Capture and release latitude and longitude are available for all fish. All fish were evaluated for hatchery or wild origin. Fish ranged in size from 651 to 1778 mm TL. Fork length and weight are also available. Tissue samples were taken from many of the fish. All fish were tagged with dorsal and pectoral T-Bar tag. Larger fish have received a Double-Barb tag in the dorsal musculature and recent captures also received a PIT tag. One fish has been recaptured (10% recapture rate) by a commercial fisherman in the Potomac River who was not participating in the reward program.

U.S. Fish and Wildlife Service, Virginia Fisheries Coordinator (USFWS-VA) – Contact Person: Albert Spells

257 Atlantic sturgeons were tagged and released in 1997 and February of 1998 in the James, York and Rappahannock Rivers. Fish were collected by commercial fishermen as

part of a monetary Reward Program similar to the one conducted by USFWS-MFRO (see above). Latitude and longitude are available for all capture locations. Fish ranged in size from 260 to 1799 mm TL, with almost half the fish being less than 500 mm TL. Fork length and weight are also available. All fish were evaluated to determine hatchery or wild origin, and tissue samples were taken from all wild fish. Fish were tagged with a dorsal and pectoral T-Bar tag. 36 of those fish were recaptured (14% recapture rate), four of those were recaptured twice, and two of those were recaptured three times. 16 of the recapture events were in the reward programs by USFWS-VA and USFWS-MFRO in the Chesapeake Bay area. Of the 26 recapture events reported by commercial fishermen, 22 were reported from Virginia, 14 from the James River alone, one in the Potomac River and the remainder on the Atlantic Coast of Virginia. Two other recaptures occurred near Hatteras, North Carolina (one Atlantic Ocean and one Pamlico Sound), one off Ocean City, Maryland, and one off Hancocks Bridge, New Jersey in the Delaware River. Fishermen were using primarily gillnets for recapture. No fishermen were reportedly targeting sturgeon, but did report targeting striped bass, white perch, croaker, menhaden, flounder, and trout.

Virginia Marine Resources Commission (VMRC) – Contact Person: Unknown
Six Atlantic sturgeons were tagged and released in April 1996 off Wachapreague, Virginia on the Atlantic Coast. Fish were captured in an anchored gillnet, and latitude and longitude are available. Water and air temperature, water depth, and gear soak time are also available. Fish ranged in size from 786-965 mm TL. Fish were tagged with a dorsal T-Bar tag. To date, none have been recaptured.

National Marine Fisheries Service (NMFS) – Contact Person: Pete Chase
Three Atlantic sturgeons have been captured and tagged during a trawl survey off the Atlantic coast of Virginia in 2000 and 2003. Water temperature, capture latitude and longitude are available. Fish ranged in size from 980 to 1480 mm TL, with fork length and weight also available. Two fish were tagged with a Double-Barb tag inserted into the dorsal musculature, and one fish was tagged with a dorsal and pectoral T-Bar tag. To date, no fish have been recaptured.

North Carolina

North Carolina Cooperative Fish and Wildlife Research Unit (NCCOOP) – Contact Person: Joe Hightower

Collected and tagged 36 Atlantic sturgeons from Albemarle Sound in the summer of 1998 and two from the Neuse River in 2002. All fish had capture latitude and longitude, water depth, water temperature, salinity, and stretch mesh information available. Fish ranged in size from 286 to 585 mm FL in Albemarle Sound, and 639 and 992 mm FL in the Neuse River. Interorbital width, outer mouth width, inner mouth width and snout length as well as weight were collected for each fish. Fish were tagged with a dorsal and pectoral T-Bar tag and many fish also received a PIT tag. Seven of those fish were recaptured (18% recapture rate), and one was recaptured twice. Four recaptures came from the sampling conducted by NCCOOP in Albemarle Sound in the summer of 1998. The other four recaptures were by commercial fishermen in Albemarle Sound in the fall of 1998 and spring of 1999.

North Carolina Cooperative SEAMAP Tagging Cruise (NCCRUISE) – Contact Person: Mike Mangold or Wilson Laney

Collected and tagged 116 Atlantic sturgeons off the Atlantic Coast of North Carolina. Fish were collected in a trawl survey in the winter from 1988 to 2004 (tagging ongoing). Latitude and longitude information as well as water and air temperature, water depth, and gear soak time is available for nearly all fish. Water depth and salinity are available for most fish. Fish ranged in size from 577 to 1517 mm TL. Fork length is also available. Tissue samples were taken from many of the fish. Prior to 1994, fish received a dorsal Monel Strap Tag. Since 1994, most fish received dorsal and pectoral T-Bar tags, but some fish also received a PIT tag, and some fish only received a Double Barb tag. Three of those fish have been recaptured (2.6% recapture rate), and one of those recaptured three times. Two of the recaptures came from off the Atlantic Coast of North Carolina. One fish was caught in the Potomac River in Maryland. One fish was caught twice in New York, in the Hudson River near Con Hook and at Fire Island Inlet. The three fish captured by commercial fishermen were reportedly caught as bycatch of seatrout (NY)

and spiny dogfish (NC), with fishermen reporting catching more untagged sturgeon the same day.

North Carolina Division of Marine Fisheries (NCDMF) – Contact Person: Jason Dilday
NCDMF tagged 310 Atlantic sturgeons in 1998, 2003, and 2004. All captures occurred in anchored gillnets. 285 of the captures occurred in Albemarle Sound and tributaries during the fall and winter and 25 captures (in 2003 and 2004) were in the Cape Fear River system. Latitude and longitude are available for some of the Cape Fear River fish. Total lengths ranged from 269 to 1170 mm TL. Fork length is available for all fish and weight is available for few fish. Water and air temperature, salinity, stretch mesh and gear soak time are available for some fish. Fish were tagged with dorsal and pectoral T-Bar tags. 37 of these fish have been recaptured (12% recapture rate), two have been recaptured twice. 10 of the recaptures were taken by NCDMF in Albemarle Sound, and the remainders were taken by commercial fishermen. All recaptures were in North Carolina in the Albemarle Sound and surrounding waterbodies. All recaptures occurred in gillnets, except for three in flounder nets. None of the fishermen were targeting sturgeon, and targeted species included flounder, mullet, shad, striped bass, and white perch. 12 of the fishermen reported catching anywhere from 1 to 50 other untagged sturgeon that day.

National Marine Fisheries Service (NMFS) – Contact Person: Pete Chase
One Atlantic sturgeon was captured and tagged in a trawl survey in March 1999 off the coast of North Carolina near Hatteras. The sturgeon was 720 mm FL and was tagged with a dorsal and pectoral T-Bar tag. The fish has not been recaptured.

University of North Carolina – Wilmington (UNC) – Contact Person: Mary Moser
55 Atlantic sturgeons were tagged between 1996 and 2002 off the Atlantic Coast, mostly in the vicinity of Holden Beach. Nearly all fish were caught in anchored gillnets, and latitude and longitude information is available for fish caught since 1998. Fish ranged in size from 546 to 1287 mm TL. Fork length is also available. Tissue samples were taken from some of the fish. Most fish were tagged with dorsal and pectoral T-Bar tags,

although some fish only had a dorsal T-Bar tag, and others only had a Double-Barb tag inserted through the dorsal musculature. Many of the fish also received a UNC green T-Bar tag also. Two of the fish have been recaptured (3.6% recapture rate), one by NCDMF in the Cape Fear River during their sturgeon study. The second fish was captured by a commercial fisherman using anchored gillnets targeting flounder in the New River, North Carolina. Water and air temperature and gear soak time are available for all fish.

South Carolina

No participation in the program.

Georgia

No participation in the program.

Florida

No participation in the program.

Shortnose Sturgeon Data Summary by State

New York

Cornell University (CORNELL) – Contact Person: Mark Bain

Tagged from 1993-1998 in the Hudson River. All fish were captured using gillnets. Most of the sampling was conducted in the summer and fall. Capture locations do not have latitude and longitude, but do have River Mile. 6,297 shortnose sturgeons were tagged, 370 to 990 mm FL, total lengths and weights were also taken on many fish. Tissue samples were taken from some fish. Shortnose sturgeons were tagged with a dorsal and pectoral T-bar in 1993. In 1994, a PIT tag was also added to the combination, with some fish only receiving a PIT tag, and some fish not receiving a PIT tag at all. Fish tagged from late March 1995 to 1997 received only a PIT tag and no external tags. 41 of those fish that were considered a first time capture in the database actually had Dovel tags present upon capture. Besides the Dovel recaptures, 344 of the fish were recaptured (5.4%), 22 of those were recaptured twice, and two of those were recaptured three times.

365 of the recapture events were reported by Cornell and CT. The two CT recaptures occurred by gillnet in the Connecticut River. Three recaptures were reported by fishermen, two commercial (using trawl and gillnet) and one angler. All of those recaptures occurred in the Hudson River in May and June.

U.S. Fish and Wildlife Service, Northeast Fishery Center (NEFC) – Contact Person: John Sweka

Tagged in the fall of 2003 in the Hudson River. Fish were captured using anchored gillnet. 41 shortnose sturgeons were captured and tagged. All fish were tagged with a PIT and Carlin tag. Fish ranged in size from 474 to 858 mm TL, fork length and weight were also collected for each fish. Latitude and longitude were taken for all fish in 2003. Gillnet mesh size was recorded for all captures. To date, none of those fish have been recaptured.

Normandeau Associates (NORMANDEAU) – Contact Person: Mike Ricci or Bill Furman

Tagged between 2000 and 2003 in the Hudson River. Fish were captured mostly using trawls but some using benthic sleds. 168 shortnose sturgeons were captured and 93 of those were tagged using PIT and Carlin tags. They ranged in size from 75 to 1035 mm TL. Weight information was collected on most fish. Interorbital and outer-mouth width were collected on most fish. River Mile and latitude and longitude were collected for all fish. One fish did have an existing Dovel tag upon capture. No fish have been recaptured to date. This agency tagged no Atlantic sturgeon.

New York Department of Environmental Conservation (NYDEC) – Contact Person: Kathy Hattala or Mike Clansy

Tagged 101 fish in the fall 1994 and 1998. Fish were captured in the Hudson River. All fish were tagged with dorsal and pectoral T-Bar tags. Fish ranged in size from 664 to 950 mm TL. Fork length was collected for all and weight was collected for some fish. River Mile was collected for capture location, but latitude and longitude were not available.

One fish has been recaptured (1.0% recapture rate) twice by Cornell in 1996 using gillnets in the Hudson River.

New Jersey

Delaware Division of Fish and Wildlife (DENREC) – Contact Person: Craig Shirey

Tagged 5 shortnose sturgeons in November of 1993 and the summer of 1998. All fish were captured using anchored gillnets in the Delaware River at or above Artificial Island. Total lengths ranged from 768 to 1000 mm TL, fork length and weight were also available for all fish. All fish were tagged with a dorsal T-bar tag, and two fish also received a pectoral T-bar tag. One fish was recaptured (20% recapture rate) by a research agency ERC using anchored gillnets in the Delaware River above Scudder's Falls.

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

Tagged 64 shortnose sturgeon in the Delaware River near Scudder's Falls and Bordentown in March and April 1998 and June 2000. All fish were captured using anchored gillnets, and latitude and longitude data are available for most fish. Shortnose sturgeons ranged in size from 675 to 975 mm TL, with fork length and weight also available for all fish. Water temperature, water depth, salinity, conductivity, stretch mesh and gear soak time were recorded for all fish. Tissue samples were also collected from all fish. Four of the fish had existing Rutgers tags on them at first capture, and three fish had an existing ERC tag at first capture. USFWS-MFRO applied a Carlin tag through the base of the dorsal fin, a T-bar tag through the pectoral fin, and a PIT tag. Four of the USFWS-MFRO tagged fish have been recaptured (6.3% recapture rate). One by a commercial fisherman fishing an anchored gillnet near Bordentown, New Jersey. The other three were caught by ERC while conducting research on shortnose sturgeon in the Delaware River between Bordentown, NJ and the Rt.-I95 Bridge in Pennsylvania.

Delaware

Delaware Division of Fish and Wildlife (DENREC) – Contact Person: Craig Shirey

Four shortnose sturgeons have been captured and tagged in the Delaware River above Oldmans Point in 1998. Total lengths of fish ranged from 910 to 1050 mm TL. Fork length and weight are also available for fish captured. Fish were tagged with a dorsal T-Bar tag. To date, none of these fish have been recaptured.

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

Nine shortnose sturgeon were captured in gillnets in 1998 and 2002 in the Delaware River around Scudder's Falls. Fish ranged in size from 649 to 901 mm TL. Fork length and weight are also available for all fish. All fish were tagged with a dorsal Carlin tag, pectoral T-Bar tag and a PIT tag. No fish have been recaptured to date.

Maryland

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

46 shortnose sturgeon have been caught between 1996 and 2004 (tagging ongoing) in the Maryland waters of the Chesapeake Bay and tributaries. Fish were collected by commercial fishermen participating in a Reward Program for sturgeon. Fishermen are given a monetary incentive to transport and temporarily hold live sturgeon bycatch at a shore location so USFWS-MFRO staff could tag and release the fish. Fish captured in 2003 and 2004 were not tagged. Fish were collected primarily in gill nets, fyke nets, and pound nets and most captures occurred in the spring. Capture and release latitude and longitude are available for all fish. Water depth was also recorded for many of the captures. Fish ranged in size from 284 to 1030 mm TL. Fork length and weight are also available. Tissue samples were taken from many of the fish. 37 of the fish were tagged prior to release, most with a pectoral T-Bar tag, dorsal Carlin tag, and an internal PIT tag. Two of the fish were recaptured (4.3% recapture rate), one of those recaptured twice. Two of the recaptures occurred in the USFWS-MFRO reward program, and one was by a commercial fisherman in Gwynns Island, Virginia in the Chesapeake Bay.

Virginia

U.S. Fish and Wildlife Service – Maryland Fishery Resources Office (USFWS-MFRO) – Contact Person: Mike Mangold

3 shortnose sturgeons have been caught between 2001 and 2002 in the Potomac River. Fish were collected by commercial fishermen participating in a reward program for sturgeon (see description above). Fish were collected primarily in pound nets and a perch net and all captures occurred in March. Capture and release latitude and longitude are available for all fish. Fish ranged in size from 766 to 872 mm TL. Fork length and weight are also available. Fish were tagged prior to release with a pectoral T-Bar tag, dorsal Carlin tag, and a PIT tag. To date, none of the fish have been recaptured.

U.S. Fish and Wildlife Service, Virginia Fisheries Coordinator (USFWS-VA) – Contact Person: Albert Spells

One shortnose sturgeon was tagged and released in May 1997 in the Rappahannock River. The fish was collected by a commercial fishermen as part of a monetary Reward Program similar to the one conducted by USFWS-MFRO (see above). Latitude and longitude are available for the capture location. The fish was 708 mm TL, with fork length and weight also available. It was tagged with a dorsal and pectoral T-Bar tag. A tissue sample was taken from the fish. To date, it has not been recaptured.

Georgia

(GADPW) – Contact Person: Tom Bryce

Six shortnose sturgeons were tagged in the Ogeechee River in August of 2000. River Mile information was collected for each capture. Fish ranged in size from 779 to 905 mm TL with fork length and weight also available. All fish were tagged with a pectoral T-Bar tag and two PIT tags. To date, no fish have been recaptured.

Atlantic Sturgeon Hatchery Releases

New York

U.S. Fish and Wildlife Service, Northeast Fishery Center (NEFC) – Contact Person: Jerre Mohler

Two releases of hatchery reared Atlantic sturgeon have occurred in the Hudson River.

1. About 5,000 fish were released into the Hudson River near Newburg in October 1994. All fish were tagged with a CWT under the first dorsal scute and had the left pelvic fin removed before release. Fish were about 4 months post-hatch (1994 year class) and averaged 103mm TL and 4.1g before released. Five fish have been recaptured, all in the Reward Program for sturgeon in the Maryland waters of the Chesapeake Bay. One of the fish was recaptured a second time by a commercial fisherman on the Atlantic coast of Virginia after being externally tagged by USFWS-MFRO. All recaptures occurred between 1996 and 1999.
2. 124 fish were released into the Hudson River near Ulster Landing in May and June 2004. Fish had a PIT and Carlin tag at release, and 15 of those fish were also released with a Sonic tag. All fish were from 1994, 1995, and 1998 year classes. Additional fish will be released in the fall of 2004. To date, no fish have been recaptured.

Maryland

Maryland Department of Natural Resources (MDDNR) – Contact Person: Brian Richardson

About 3,200 Age 1 Atlantic sturgeons were released into the Nanticoke River in July of 1996. All fish were released with a CWT under the third left dorsal scute, and 920 of the larger fish were also released with a dorsal T-bar tag. 451 of the fish were recaptured at least one time (14% recapture rate), with many fish being recaptured multiple times (maximum of four recapture events). Most recapture events (494) occurred in the Reward Program in Maryland, and nine occurred in the Reward Program in Virginia. The remainders of the recapture events (69) have occurred by commercial fishermen

outside of the Reward Programs. Most fish have been caught in pound nets (181) and gill nets (386). Two fish have been caught angling, two caught in trawls, and one fish was found dead. 562 of the recapture events occurred in Maryland and Virginia. To the north, one fish was recaptured in the Delaware River, one in the Atlantic Ocean off New Jersey, three in the Atlantic Ocean off New York, and the furthest north was in the Atlantic Ocean off Little Compton in Rhode Island. To the south, four fish have been recaptured in North Carolina, with two recaptures on the coast, one recapture in Roanoke Sound, and another recapture in Croatan Sound. Nearly half of the recaptures occurred within the first year of release, and 93% of the recaptures occurred within two years of release. The most recent recapture occurred in 2001 off Rudee Inlet in Virginia.

Migration Summary:

Both sturgeons are migratory, with Atlantic sturgeon undergoing much more extensive coastal movements than the shortnose. Of the shortnose sturgeon, 99% of the recaptures occurred in the same river where the fish was originally tagged. Only two recaptured fish were reported from the rivers different from where they originally tagged. Both of the migrating fish were originally tagged in the Hudson River and were recaptured in the Connecticut River.

Atlantic sturgeons are more migratory than shortnose, and are known to make extensive coastal migrations between tributaries. Recaptures have been reported ranging from the same day of original capture (0 days at large (DAL)) to nearly 7 years after original capture (2498 DAL). An important note to keep in mind is that in more intensive sampling programs (Hudson River or Chesapeake Bay), sturgeon will generally be recaptured in a shorter amount of time after release and have higher recapture rates than in programs that encounter fewer fish. Sturgeon recaptures also rely heavily on the visibility and retention of the tag type used (See Tag Retention Section). Although recapture rates varied between programs, all data are lumped here for the summary of migratory movements. Since there is the potential that hatchery reared fish and wild fish may behave differently in regards to migration, they are evaluated separately in this section.

Wild Atlantic Sturgeon

361 recapture events were reported with wild Atlantic sturgeon. 186 of the recapture events (51%) occurred within the first 6 months after release, 56 recapture events (16%) occurred between 6 and 12 months post release, 76 recapture events (21%) occurred between 1 and 2 years at large, 39 recapture events (11%) occurred between 2 and 5 years at large, and 4 fish (1%) were captured at more than 5 years at large. Fish tended to move away from their tagging waterbodies more frequently as time passed. 14% of fish left within the first 6 months after release, 34% left between 6 and 12 months after release, 46% left between 1 and 2 years after release, 69% left between 2 and 5 years after release, and all fish recaptured more than 5 years at large were recaptured in a different waterbody from where they were originally released.

Migratory patterns of sturgeon are probably related to size as well as time at large after release. Length information was recorded by researchers (commercial fishermen reports were omitted) at recapture for 104 events. Only 1 fish of 40 (2.5%) recaptured under 850mm TL were recaptured outside of their tagging waterbody, and the fish that did leave was captured on the Atlantic Coast of North Carolina but was tagged in Albemarle Sound, North Carolina. Days at large for fish recaptured under 850mm TL ranged from 1 to 622. Of the 21 fish recaptured from 850mm to 1000mm TL, only 3 (14.3%) were captured away from their tagging waterbodies. Two of the migrating fish traveled long distances in less than one year (from the Delaware River to the Coast of North Carolina and from the Hudson River to the Chesapeake Bay). The final fish traveled from the Hudson River to Long Island Sound in just over 2.5 years. Of the fish that stayed, days at large ranged from 2 days to nearly 3 years. 23 fish were recaptured between 1000 and 1600 mm TL and 7 (30.4%) of those migrated from their tagging waterbodies. Time at large for fish that didn't leave ranged from 2 days to nearly 3 years. For the fish that did leave, their time at large ranged from 67 days to over 5.5 years. Migrating fish also traveled long distances including from the Hudson River to the Chesapeake Bay, Hudson River to the Delaware River, Hudson River to the Atlantic Ocean of New Jersey, three from the Atlantic Ocean off New Jersey to the Delaware River, and one from the Atlantic Coast of New Jersey to Long Island Sound. Of the 20 fish larger than 1600mm TL, 19 were tagged and later recaptured in the Hudson River,

with time at large ranging from 1 day to nearly 3 years. The only fish greater than 1600mm TL that was tagged and recaptured was tagged in the Chesapeake Bay and was recaptured in Long Island Sound nearly 6 years after being tagged. Based on our information, it appears that Coastal migration is minimal for fish under 600mm TL, and the same is true for fish greater than 1600mm TL. It is important to note that nearly all fish of the largest size class were captured and recaptured in the Hudson River where there is a spawning population, unlike some other areas where tagging is occurring. Fish between 600mm and 1600mm TL tend to make more extensive movements than larger and smaller fish, some traveling long distances along the Atlantic coast. It appears that coastal movements for fish tagged from North Carolina to Connecticut generally don't travel further south than North Carolina or further north than New Hampshire.

Hatchery Atlantic Sturgeon

Hudson River Release (October 1994): The six recaptures events occurred between 2 to 5 years at large. All of the recaptures occurred outside of the Hudson River, 5 in the Chesapeake Bay and 1 on the Atlantic Coast off Virginia. Although fish averaged 103 mm TL at release, recaptured fish ranged in size from 530 to 1092 mm TL. Since these fish were only tagged with a coded wire tag (CWT), recaptures were only expected from agencies that were scanning for those tags. Through the Reward Program in the Maryland waters of the Chesapeake Bay, captured sturgeon were being scanned for the presence of a CWT, resulting in the recaptures for the Chesapeake Bay. The fish captured on the coast of Virginia was externally tagged in the Chesapeake Bay before it was captured in Virginia.

Nanticoke River Release (July 1996): Of the 3,200 fish released, 571 recapture events occurred between three months and just over 4.5 years at large. 14 recaptures (2%) occurred within 6 months of release, all of those recaptures occurred in the Chesapeake Bay and tributaries. 246 recaptures (43%) occurred between 6 and 12 months after release and all but two (1%) of these recaptures occurred in the Chesapeake Bay and tributaries. Both fish that were captured outside of the Chesapeake Bay were in North Carolina waters, one in the Atlantic and one in Roanoke Sound. 272 recaptures (48%) occurred between 1 and 2 years after release, and all but four (1%) of these

occurred within the Chesapeake Bay and tributaries. The captures outside of the Chesapeake Bay occurred in the Atlantic Ocean, one in Virginia, two in North Carolina, and one in New York. 27 recaptures (5%) occurred between two and three years at large. Three (11%) of those occurred outside of the Chesapeake Bay, all in the Atlantic Ocean of Virginia, New Jersey, and New York. Of the 12 remaining fish (2%) recaptured more than 3 years after release, 9 (75%) were captured outside of the Chesapeake. The recaptures outside of the Chesapeake were in the Atlantic Ocean in Virginia, New York, and Rhode Island, and one in the Delaware River. All 8 fish recaptured after 3.5 years after release were recaptured outside of the Chesapeake. All fish captured after 3.5 years at large were about 1,000mm TL. As with the Hudson River fish, most Chesapeake Bay fish were released with only a CWT. Subsequent recaptures in the Reward Program led to a larger number of fish being tagged with additional external tags. Fish recaptured outside of the Chesapeake Bay (Maryland and Virginia Reward Programs) were reported on the basis of having an external tag present.

Bycatch and Target Species:

When tagged fish are reported to the USFWS via the toll-free phone number, most are being reported by commercial fishermen. To understand more about target fisheries where sturgeons are captured as bycatch, many fishermen are asked information about gear and target species. Through tag return phone calls, over 250 commercial fishermen were interviewed regarding target species and sturgeon bycatch they had encountered while they were reporting capturing a tagged sturgeon. Overall, the main gear that sturgeon are collected in as bycatch are gillnets (85%), with anchored gillnets being the most popular (Table 3). Target species varied, but the most common reported was striped bass (46%) followed by flounder (14%). Although sturgeon are migratory, recaptures generally occur within a short amount of time after release (see next section on Current Tag Types and Tag Retention) and therefore, recaptures may be more common in the vicinity of tagging programs that have marked large numbers of fish. Most of the tagged sturgeons taken as bycatch were caught in the Chesapeake Bay and the Atlantic Ocean off Virginia (47%) (Figure 1 and Table 4). When fishermen were asked how many untagged sturgeon they captured the day of the tagged sturgeon, the largest numbers of untagged sturgeons occurred off the coast of Virginia, followed by Albemarle Sound and the Chesapeake

Bay (Table 5). Seasonal captures were highest for fish caught in the spring (37%) and winter (30%) months (Table 6).

Sturgeons are encountered as bycatch of other fisheries and mortality is a question of concern. Since the sturgeon fishery was officially closed in 1998, recapture information from fisheries regarding mortality and target species were also divided to pre-1998 and post-1998, to account for sturgeon that may have been targeted for harvest pre-1998. None of the fish were examined by biological staff to verify reports of mortality, so the report is based solely on the reports by the fishermen.

Pre-1998: Of the reports taken in before 1998, 101 reported whether or not they were targeting sturgeon. Ten of the fishermen did report targeting sturgeon (10%) and the remainder of the fishermen reported targeting other species besides sturgeon. Half of the fishermen who reported target species other than sturgeon provided the names of the species they were targeting. The most common target species was striped bass (36% of reports); followed by shad (13%), white perch (10%) and dogfish (10%). Other target species mentioned included croaker, menhaden, flounder, monkfish, seabass, seatrout, and skate. 92 of the fishermen reported whether they had encountered other untagged sturgeon on the day they captured the tagged fish, with 39% of the fishermen encountering other untagged sturgeon the day the tagged sturgeon was captured. The number of untagged sturgeon ranged from 1 to 15, with half reporting only capturing one to three other untagged fish. Most of the tagged sturgeon recaptures occurred in the Atlantic Ocean (36%) (Massachusetts to North Carolina, most in New Jersey (n=15)), the Chesapeake Bay (28%), the Hudson River (14%) and Delaware Bay and River (11%). Of the 108 reports taken before 1998 regarding bycatch mortality, 13 Atlantic sturgeons were reported dead at capture (12% mortality). Of those reported dead, 12 were caught in anchored gillnets and one in a drift gillnet. Six of the 13 fishermen reported their target species; three were targeting striped bass, two targeting dogfish, and one targeting mullet. Before 1998, an additional 5 tagged fish were reported to be harvested, 8 fish were found dead on shore (not captured in a fishing gear).

1998 to present: Only one of the 147 reporting fishermen stated that he was targeting sturgeon (Delaware River in 1999, a commercial fisherman tagging sturgeon for DENREC). 78% of the fishermen did report what fish species they were targeting when they caught the tagged sturgeon. Most common target species included striped bass (39%), flounder (12%),

dogfish (6%), and shad (6%). Other target species included catfish, white perch, weakfish, mackerel, bluefish, shark, mullet, monkfish, menhaden, butterfish, seatrout, croaker and horseshoe crabs. Of the 120 of the fishermen who reported whether they had captured other untagged sturgeon the same day they had captured tagged sturgeon, 41% had stated they caught other untagged sturgeon. The number of untagged sturgeon ranged from 1 to 75, with 69% capturing 10 or less, 15% capturing between 10 and 25, and 13% capturing between 25 and 75. Most of the recaptures of tagged sturgeons occurred in the Atlantic Ocean (39%) (New Hampshire to North Carolina with most in Virginia (n=35)), the Chesapeake Bay (31%), and interior waters of North Carolina (22%). Only one fish captured after the sturgeon fishery closure in 1998 was reported dead (1% mortality), which was captured in an anchored gillnet with no target species mentioned.

Current Tag Types and Tag Retention:

Recapture rates, migration, and bycatch data rely heavily on retention of tags used in the program. This section evaluates the retention of the current tag types used by the USFWS and discusses strengths and short comings for each tag type and placement. For our tag retention evaluation, only the 5,731 fish that were released with more than one tag were considered. Of the fish released with multiple tags, only 872 were recaptured. Tag retention was evaluated separately for both shortnose and Atlantic sturgeon, but the differences between species did not appear to be substantial, so tag retention data was combined for both species. Generally, tag retention for external tagging methods (Carlin, Double Barb and T-Bar) is relatively high initially (> 80% for most tags in first year after release), but decreases substantially as time passes. For recaptures occurring more than one year after tagging, external tag loss ranges from 25% to 100%. Although we only had a limited number of PIT tag recapture data available, retention appeared to remain high through time, and this appears to be a viable tool for long-term tagging of sturgeon, especially since two-thirds of Atlantic sturgeon recaptures and nearly all shortnose sturgeon recaptures are reported by tagging agencies that can scan for internal tags. Tag description and retention information for each tag type and placement follows. The following section (Tagging Combination Recommendations for Future Tagging) makes recommendations for standardizing future tagging to maximize the amount of data that can be generated from this tagging program.

Carlin Dangler Tag

The Carlin Dangler Tag is manufactured by Floy, Inc. The disc portion of the tag measures 3/8" x 1 1/8" and is attached to the fish with stainless steel wire. Two strands of wire are attached by a ring to another section of wire which is attached to the tag. This allows the tag to spin and "dangle" while the fish is moving. The tag is attached to the fish by placing the two free strands of wire through hypodermic needles that are inserted through the flesh at the base of the dorsal fin and twisted together on the opposite side of the fish. The disc portion of the tag is red with black lettering, and contains an identification number for the fish, the U.S. Fish and Wildlife Service name, and a toll-free phone number to report tagged fish.

In our tag retention evaluation, 893 fish were released with Carlin tags and 26 of those fish were recaptured (2.9%). Of the fish recaptured, 24 of the fish were recaptured within three years after release, and all tags were retained (Table 7). Tag loss was only noted for two fish, one recaptured between 3 and 4 years at large, and one recaptured between 5 and 6 years at large. The longest time a tag was retained was between two and three years. No Carlin tags were initially retained and then lost on subsequent recaptures.

Although we have the least amount of retention data for Carlin tags, in comparison to other external tagging types, Carlin tags appear to have the best retention over time. Carlin tags are relatively fast and easy to use, requiring only the needle apparatus to apply the tag. The text on the tag is easy to read and they are readily visible to commercial fishermen who may be encountering tagged fish. We recommend that this be the standardized tagging method used in external tagging of sturgeon.

T-Bar Tag- Dorsal Placement

The T-Bar Tag is manufactured by Hallprint. The tag is type TBA-2 Anchor T-Bar Tag, and measures 3 1/4" long and has a 3/8" T-bar. The tag is attached to the fish by using a specialized tag application gun with a hypodermic needle that inserts the plastic "T" anchor of the tag into the body of the fish. The dorsal application of the T-Bar tag is through the left side of the fish at the base of the dorsal fin, and the "T" anchor is retained in the flesh beneath the dorsal fin (not inserted all the way through the base of the dorsal fin and out on the other side of the body). The tags are yellow with black

lettering, which contains an identification number for the fish, the U.S. Fish and Wildlife Service name, and a toll-free phone number to report tagged fish.

In our tag retention evaluation, 4,754 fish were released with dorsally applied T-Bar Tags and 595 of those fish were recaptured (12.5%). Of the fish recaptured, 367 of the fish were recaptured within one year after release, and 85.3% of the tags were retained (Table 8). Tag loss increased as time passed, with retention dropping to 60.7% retention between the first and second year at large, and 52.8% for fish recaptured more than two years after release. The longest time a tag was retained was between six and seven years. Twelve of the dorsal T-Bar tags were initially recaptured with the tag in place and later recaptured with the tag lost. Of the 12 recaptures, the initial recapture occurred within the first 1.5 years. The subsequent recapture with the tag loss occurred again in the first year for seven of the fish and between the 1st and 3rd year for the remaining 5 of the fish. This information further supports that tag retention drops dramatically after the first year after release.

We have the most retention data for the T-Bar tags, in comparison to other external tagging types, but their retention appears to drop substantially as time passes, and by two years after release, half of the tags have been lost. T-Bar tags are fast and easy to use, but do require a special application gun to apply the tag. Another problem that can be encountered for tags that are applied to immature fish is that the flesh of the fish may over-grow the tag in time, making it difficult to identify by non-researchers that may encounter the tagged fish. We recommend that this be the first alternative tag type used if an agency chooses not to use the Carlin tag for externally tagging sturgeon.

T-Bar Tag - Pectoral Placement

This is the same tag type as used in the dorsal application. The pectoral application of the T-Bar tag is through the pectoral fin on the left side of the body near the pectoral fin joint. The "T" anchor is inserted all the way through the pectoral fin with the tag extending from the top of the fin and the "T" anchor exposed beneath the fin.

In our tag retention evaluation, 4,959 fish were released with dorsally applied T-Bar Tags and 525 of those fish were recaptured (10.6%). Of the fish recaptured, 324 of the fish were recaptured within one year after release, and 78.4% of the tags were

retained (Table 9). Tag loss increased as time passed, with retention dropping to 70.1% retention between the first and second year at large, and 56.9% for fish recaptured more than two years after release. The longest time a tag was retained was between eight and nine years. Fifteen of the pectoral T-Bar tags were initially recaptured with the tag in place and later recaptured with the tag lost. Of the 15 recaptures, 14 of the initial recaptures occurred within the first year and the final initial recapture occurred nearly two years after release. The subsequent recapture with the tag loss occurred again in the first year for seven of the fish and between the 1st and 4th year for the remaining 8 of the fish. This information further supports that tag retention drops dramatically after the first year after release.

We have the most amount of retention data for the T-Bar tags, in comparison to other external tagging types, but their retention appears to drop as time passes, and by two years after release, nearly half of the tags have been lost. T-Bar tags are relatively fast and easy to use, but do require a special application gun to apply the tag. A problem unique to the pectoral application of the tag is that sturgeon are bottom dwelling fish that can easily snag the "T" portion of the tag on the bottom and the tag can be easily ripped from the fish. We do not recommend that this be a tag application used for externally tagging sturgeon.

Double-Barb Tag

The Double Barb Tag is manufactured by Floy, Inc., and is a type FIM-96 tag. The tag measures 5 1/4" long with a monofilament line that attaches the tag to the plastic barb portion of the tag (1/2" long x 1/2" wide) that is inserted into the fish. The tag is attached to the fish by inserting the barb portion of the tag into the dorsal musculature of the fish on the left side of the fish mid point between the head and the insertion of the dorsal fin below the dorsal scutes. The tag is applied using a push stick with a nail-type pin that inserts through the barb portion of tag, sometimes assisted by making a small incision through the flesh of the fish with a scalpel. The tags are yellow with black lettering, which contains an identification number for the fish, the U.S. Fish and Wildlife Service name, and a toll-free phone number to report tagged fish.

In our tag retention evaluation, 508 fish were released with Double Barb Tags and 80 of those fish were recaptured (15.7%). Of the fish recaptured, 64 of the fish were recaptured within one year after release, and 84.4% of the tags were retained (Table 10). Tag loss increased as time passed, with retention dropping to 28.6% retention between the first and second year at large, and 40.0% for fish recaptured more than two years after release. The longest time a tag was retained was between five and six years. Three of the Double Barb Tags were initially recaptured with the tag in place and later recaptured with the tag lost. Of the 3 recaptures, the initial recapture occurred within the six months. The subsequent recapture with the tag loss occurred again in the first six months for two of the fish and between the 3rd and 4th year for the last fish. This information suggests that tag retention after the first year is poor.

Although we have less data on the retention of Double Barb Tags compared to T-Bar tags, we feel that this is not an acceptable external tagging method for sturgeon. Poor tag retention is compounded by the physical damage that the tag may cause to the body of the fish even if the tag is retained. The monofilament connection line between the barb anchor and the tag cuts the flesh of the fish as the tag revolves when the fish is swimming. Eventually, the monofilament line can create a large open sore on the side of the fish, potentially increasing the risk of infection or even mortality.

Passive Integrated Transponder (PIT) Tag

The Passive Integrated Transponder (PIT) Tag is manufactured by Biomark. This is the only internal tag considered in the tag retention evaluation. The PIT Tag is a 2.1 x 11mm glass encapsulated tag, 125KHz, model number TX1411L, Destron coded tag. The tag is applied to the fish by placing the tag into the end of a specialized hypodermic needle and inserting the needle into the flesh of the fish and depressing the plunger of the syringe to push the tag into the flesh. PIT tags have been applied in two locations on the fish, but retention is lumped together for both tagging types, because in many cases, the actual tagging location was not noted in the data. The first location where the PIT tag is applied is under the 2nd or 3rd dorsal scute on the left side of the body, and the second location is on the left side of the fish into the flesh at the base of the dorsal fin. The

internal tag can only be identified with specialized scanner to read a unique 10-digit alpha-numeric code for the fish.

In our tag retention evaluation, 2,617 fish were released with PIT tags and 159 of those fish were recaptured (6.1%) by research agencies that were scanning for the tag (non-research recaptures of these tagged fish were omitted since they had no means of locating the PIT tag). Of the fish recaptured, nearly all retained their tags (98.1%). Tag loss was only noted for three fish, one recaptured between 1 and 6 months at large, two recaptured between 1.5 and 3 years at large (Table 11). The longest time a tag was retained was between eight and nine years. No PIT Tags were initially retained and then lost on subsequent recaptures. To further reinforce high tag retention of PIT tags, Maryland Department of Natural Resources PIT tagged juvenile Atlantic sturgeon in 1999 that have been held in captivity since that time. To date, none of the 263 fish tagged have experienced a tag loss or malfunction.

Of all tagging types, PIT tags appear to have the best retention, particularly through time. Unlike external tags, retention does not appear to decrease as time passes. This is a tagging method appropriate for collecting data on a long-lived fish. Application of the tag is relatively easy and fast, but the tag does require a moderately expensive reader (~$300, which can be provided to tagging agencies by USFWS-MFRO) to retrieve the tag number. Another drawback to the tag is the long alpha-numeric tag number, which is more subject to being mis-recorded than shorter numbered numeric-only tags. Since the PIT tag is an internal tag, there are no external signs of the tag, so we can only expect recaptures from research agencies that are scanning for tagged fish. Researchers comprise a large number of the recaptures (2/3 of Atlantic sturgeon recaptures and nearly all of shortnose sturgeon recaptures), so PIT tagging is a viable tagging method to collect recapture data. We recommend that this be the standardized tagging method used in addition to externally tagging sturgeon so that long-term data can be collected (for more information, see Appendix 2).

Tagging Combination Recommendations for Future Tagging:

All internal and external tags, as well as specialized tag related equipment, will be provided to tagging organizations by the U.S. Fish and Wildlife Service – Maryland Fishery Resources Office.

Internal:

All fish should be checked for existing PIT tags under the third dorsal scute and in the dorsal musculature between the base of the dorsal fin and the row of lateral scutes on the left side of the fish. PIT tag readers will be furnished to agencies by the USFWS upon request. If possible, Atlantic sturgeon should be checked for the presence of a CWT under the first and third dorsal scutes to determine hatchery or wild origin. All fish should have a PIT tag placed into the musculature below the base of the dorsal fin and above the row of lateral scutes on the left side of the fish. Destron 125kHz PIT tags are the recommended tag type, and will be provided agencies that are tagging sturgeon.

External:

All fish should be examined for the presence of external tags. Each fish should have a Carlin tag placed through the base of the dorsal fin. The T-Bar tag is an accepted alternative to the Carlin tag, and should be inserted through the base of the dorsal fin.

Data Collection Recommendations:

The current tagging database is in Microsoft Access 2002 format. Data can be accepted and exported in MSAccess or MSExcel format. Existing data are available upon request. Many different data fields can be imported into the sturgeon tagging database. Below are two lists of data fields, one list that is required to be reported, and one list is optional to be reported. Please ensure all required fields are collected while tagging sturgeon. Sample datasheets have been attached (Appendix 1: A or B) with the mandatory data fields included. The USFWS-Maryland Fishery Resources Office will enter tagging data into the database for up to 25 sturgeons per year from tagging agencies. Agencies tagging more than 25 sturgeons per year will be required to provide their data electronically to the USFWS-MFRO for importation into the database.

Required Data Fields

Species
Total Length *(mm)*
Capture Agency
Capture Date *(mm/dd/yyyy)*
Capture Gear
Mesh Size *(in)*
Water Depth *(m)*
Capture Waterbody
Capture Site
Capture State *(2-digit)*
Capture Latitude *(decimal degrees)*
Capture Longitude *(decimal degrees)*
Was the Fish Released *(yes/no)*
Fish Released Without Tags? *(yes/no)*
Release Date *(mm/dd/yyyy)*
Release Waterbody
Release Site
Release State *(2-digit)*
Release Latitude *(decimal degrees)*
Release Longitude *(decimal degrees)*
USFWS Tag Number
USFWS Tag Placement *(dorsal, pectoral)*
USFWS Tag Type *(Carlin, T-Bar, PIT)*
Capture Tag? *(yes/no)*
Release Tag? *(yes/no)*

Optional Data Fields

Fork Length *(mm)*
Weight *(g)*
Hatchery or Wild Origin
Fin Clip? *(yes/no)*
Biological Remarks
Tissue Sample Number
Barbel Sample Number
Spine Sample Number
Sex *(M/F)*
Inter-orbital Width *(mm)*
Outer Mouth Width *(mm)*
Inner Mouth Width *(mm)*
Snout Length *(mm)*
River Mile
Capture Remarks
Water Temperature *(C)*
Air Temperature *(C)*
Salinity
Conductivity *(umhom)*
Gear Soak Time *(hr)*
Non-USFWS Tag Numbers
Sonic Tag Frequency
Tag Remarks

Figure 1. Number locations recaptured tagged Atlantic sturgeon reported by fishermen.

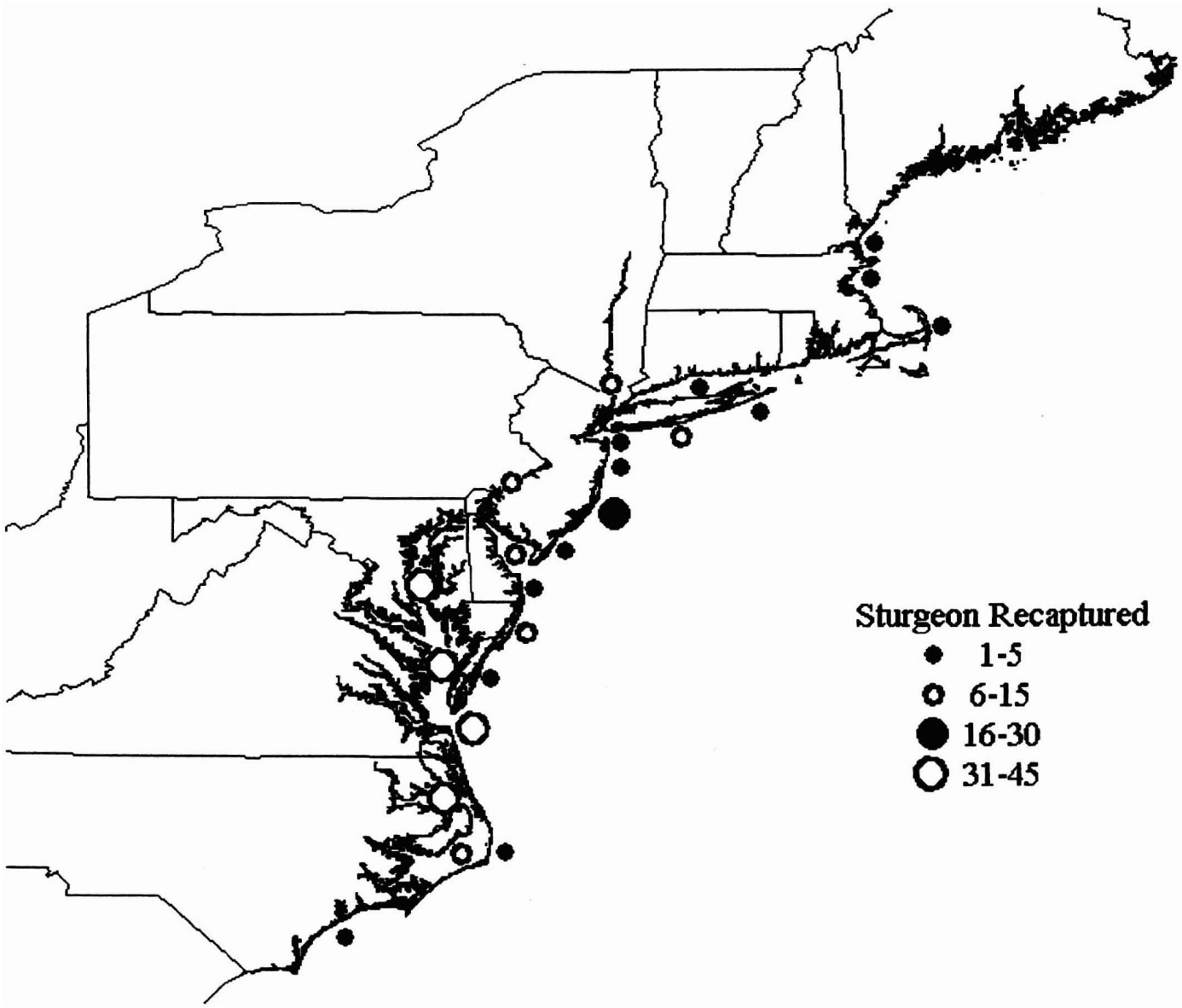

Table 1. Tagging efforts by agency and location for both Atlantic (ATS) and shortnose (SNS) sturgeon.

Agency	Species	Number Tagged	Tagging Years	Release Waterbody	Dorsal T-Bar	Pectoral T-Bar	Double-Barb	Carlin Dangler	PIT	Agency Tag
ACEDE	ATS	7	1994	Delaware Bay	X	X				
CORNELL	ATS	954	1993-1998	Hudson River	X	X		X		
CORNELL	SNS	6,297	1993-1998	Hudson River	X	X			X	
CT	ATS	333	1993-2003	CT R. & L.I. Sound	X	X			X	
DENREC	ATS	626	1993-2004	DE R. & Bay, Atlan. O.	X	X				Red Dart
DENREC	SNS	9	1993-1998	Delaware River	X	X			X	Red Dart
GADPW	SNS	6	2000	Ogeechee River		X			X	
MDDNR-HATCH	ATS	920	1996	Nanticoke River	X					
MDDNR-COAST	ATS	40	1998-1999	Atlantic Ocean			X			
MEDMR	ATS	99	1999-2000	Kennebec & Sasanoa R.			X			
NCCOOP	ATS	38	1998, 2002	Albemarle S., Neuse R.	X	X			X	
NCCRUISE	ATS	116	1988-2004	Atlantic Ocean	X	X	X			Monel Strap
NCDMF	ATS	307	'98, '03-'04	Albm. S., Cape Fear R.	X	X				Unknown
NEFC	ATS	193	'96-'98, '03	Hudson River	X	X	X	X	X	
NEFC-HATCH	ATS	124	2004	Hudson River				X	X	
NEFC	SNS	41	2003	Hudson River				X	X	
NJ	ATS	390	1992-2001	Atlantic Ocean	X	X				
NMFS	ATS	8	1999-2003	Atlantic Coast, NY-NC	X	X	X			
NORMANDEAU	SNS	168	2000-2003	Hudson River				X	X	
NYDEC	ATS	80	1992-2000	Hudson River	X	X				
NYDEC	SNS	101	1994-1998	Hudson River	X	X				
UNC	ATS	55	1996-2002	Atlantic Ocean	X	X	X			Green T-Bar
USFWS-MFRO	ATS	578	1993-2004	Chesapeake Bay	X	X	X			
USFWS-MFRO	SNS	114	1996-2004	Ches. Bay & Del. R.		X		X	X	
USFWS-VA	ATS	257	1997-1998	James, Rapp., York R.	X	X				
USFWS-VA	SNS	1	1997	Rappahannock River	X	X				
VMRC	ATS	6	1996	Atlantic Ocean	X					

Table 2. Recapture range of Atlantic sturgeon listed by release agency.

Agency	Number Marked	Marking Years	Marking Waterbody	Fish Re-Captured	Events by Researchers	Events by Fishermen	North Recapture Range	South Recapture Range
ACEDE	7	1994	Delaware Bay	0				
CORNELL	954	1993-1998	Hudson River	55	37	23	Atlantic O., Marshfield, MA	Atlantic O., Hatteras, NC
CT	333	1993-2003	CT R. & L.I. Sd.	6	3	5	Atlantic O., Rye, NH	Atlantic O., Pt. Pleasant, NJ
DENREC	626	1993-2004	DE R. & Bay, Atlantic O.	47	17	30	Rhode Island Sound, Point Judith, RI	Atlantic O., Oregon Inlet, NC
MDDNR-HA	3,200	1996	Nanticoke River	451	504	69	Atlantic O., RI	Croatan Sound, NC
MDDNR-CS	40	1998-1999	Atlantic Ocean	4	0	4	Atl. O., C. Henry VA	Atlan. O., VA Beach
MEDMR	99	1999-2000	Kennebec/Sasanoa	0				
NCCOOP	38	1998, 2002	Albm. S., Neuse R.	7	4	4	Albemarle S., NC	Albemarle S., NC
NCCRUISE	116	1988-2004	Atlantic Ocean	3	2	3	Hudson R., Con Hook, NY	Atlantic O., NC
NCDMF	307	'98, '03-'04	Alb. S., C. Fear R.	37	10	29	Albemarle S., NC	Currituck S. NC
NEFC	193	'96-'98, '03	Hudson River	21	18	4	Hudson River, NY	Atlantic O., Pt. Pleasant, NJ
NEFC-HATC	5,000	1994	Hudson River	5	5	1	Chesapeake Bay, MD	Atlantic Ocean, VA
NEFC-HATC	124	2004	Hudson River	0				
NJ	390	1992-2001	Atlantic Ocean	36	9	28	Long Island Sound, Guilford, CT	Atlantic O., Naggs Head, NC
NMFS	8	1999-2003	Atlantic O. NY-NC	1		1		
NYDEC	80	1992-2000	Hudson River	3	1	3	Hudson River, NY	Atlan. O., VA Beach
UNC	55	1996-2002	Atlantic Ocean	2	1	1	Cape Fear R., NC	New R., NC
USFWS-MD	578	1993-2004	Ches. Bay, MD	69	37	42	Long Island Sd., CT	Albemarle Sd,. NC
USFWS-VA	257	1997-1998	James, Rapp., York	36	16	26	DE R., Hancocks Bridge, NJ	Atl. O., Hatteras, NC
VMRC	6	1996	Atlantic Ocean	0				

Table 3. Gear types and target species reported by fishermen who captured a tagged Atlantic sturgeon.

Target Species	Anchored Gillnet	Drift Gillnet	Gillnet (unspecified)	Angling	Pound Net	Trawl	Other	*Total*
Bluefish	3	2	0	0	0	1	0	*6*
Butterfish	1	0	0	0	0	0	0	*1*
Catfish	0	0	0	0	1	0	0	*1*
Croaker	1	0	0	0	2	0	0	*3*
Dogfish	12	0	2	0	0	0	0	*14*
Flounder	12	0	4	0	0	3	3	*22*
Horseshoe Crab	0	0	0	0	0	1	0	*1*
Mackerel	1	0	0	0	0	0	0	*1*
Menhaden	3	0	0	0	2	0	0	*5*
Monkfish	4	0	1	0	0	0	0	*5*
Mullett	1	0	2	0	0	0	0	*3*
Seabass	0	0	0	0	0	1	0	*1*
Shad	11	3	0	0	0	0	0	*14*
Skate or Shark	2	0	0	0	0	0	0	*2*
Striped Bass	47	14	10	2	2	0	0	*75*
Sturgeon	4	5	1	0	0	1	0	*11*
Weakfish and Trout	6	3	1	0	0	0	0	*10*
White Perch	3	2	1	0	1	0	0	*7*
No Target Reported	41	8	6	2	0	7	3	*67*
Total Reports	*135*	*35*	*27*	*4*	*10*	*14*	*6*	*231*

Table 4. Gear type and capture location of recaptured tagged Atlantic sturgeon reported by fishermen.

Recapture Waterbody	Recapture State	Anchored Gillnet	Drift Gillnet	Gillnet (unspecified)	Angling	Pound Net	Trawl	Other	*Total*
Gulf of Maine	NH	1	0	0	0	0	0	0	*1*
Atlantic Ocean	NH	0	0	1	0	0	0	0	*1*
Atlantic Ocean	MA	3	0	0	0	0	0	0	*3*
Massachusetts Bay	MA	2	0	0	0	0	0	0	*2*
Atlantic Ocean	RI	3	0	0	0	0	0	0	*3*
Narragansett Bay	RI	0	0	0	0	0	1	1	*2*
Rhode Island Sound	RI	2	0	0	0	0	0	0	*2*
Long Island Sound	CT & NY	0	0	0	0	0	3	0	*3*
Atlantic Ocean	NY	6	2	1	2	0	3	0	*14*
Hudson River	NY	4	0	1	1	0	0	0	*6*
Atlantic Ocean	NJ	15	2	3	0	0	2	0	*22*
Delaware Bay & River	DE & NJ	7	6	1	0	0	0	0	*14*
Atlantic Ocean	DE	1	0	0	0	0	0	0	*1*
Atlantic Ocean	MD	4	1	0	0	0	3	0	*8*
Chesapeake Bay	VA & MD	24	22	9	1	9	0	2	*67*
Atlantic Ocean	VA	34	2	2	0	0	1	0	*39*
Atlantic Ocean	NC	0	0	0	0	0	0	0	*0*
Currituck Sound	NC	1	0	0	0	0	0	1	*2*
Croatan Sound	NC	2	0	0	0	1	0	0	*3*
Alligator River	NC	1	0	1	0	0	0	0	*2*
Pamlico Sound	NC	1	0	0	0	0	0	0	*1*
Roanoke Sound	NC	1	0	1	0	0	0	0	*2*
Albemarle Sound	NC	18	1	5	0	0	0	2	*26*

Table 5. The number of untagged Atlantic sturgeon captured the same day by the fisherman as the reported tagged sturgeon by location of capture.

Recapture Waterbody	Recapture State	0	1	2-5	6-10	11-25	26-50	>50
Gulf of Maine	NH	1	0	0	0	0	0	0
Atlantic Ocean	NH	1	0	0	0	0	0	0
Atlantic Ocean	MA	2	0	0	0	0	0	0
Massachusetts Bay	MA	1	1	0	0	0	0	0
Atlantic Ocean	RI	3	0	0	0	0	0	0
Narragansett Bay	RI	0	1	0	0	0	0	0
Rhode Island Sound	RI	2	0	0	0	0	0	0
Long Island Sound	CT & NY	3	0	0	0	1	0	0
Atlantic Ocean	NY	5	0	0	3	0	0	0
Hudson River	NY	5	0	2	0	0	0	0
Atlantic Ocean	NJ	12	1	3	0	0	0	0
Delaware Bay & River	DE & NJ	6	2	2	2	0	0	0
Atlantic Ocean	DE	1	0	0	0	0	0	0
Atlantic Ocean	MD	2	2	2	0	0	0	0
Chesapeake Bay	VA & MD	51	3	2	0	4	0	0
Atlantic Ocean	VA	16	4	8	2	1	3	2
Atlantic Ocean	NC	0	1	1	0	0	0	0
Currituck Sound	NC	0	1	1	0	0	0	0
Croatan Sound	NC	1	0	0	0	0	0	0
Alligator River	NC	2	0	0	0	0	0	0
Pamlico Sound	NC	0	0	1	0	0	0	0
Roanoke Sound	NC	0	1	1	0	0	0	0
Albemarle Sound	NC	11	2	3	2	3	2	0

Table 6. Seasonal breakdown of recapture location for tagged Atlantic sturgeon reported by fishermen.

Recapture Waterbody	Recapture State	Spring	Summer	Fall	Winter
Gulf of Maine	NH		1		
Atlantic Ocean	NH		1		
Atlantic Ocean	MA		3		
Massachusetts Bay	MA		2		
Atlantic Ocean	RI		4		
Narragansett Bay	RI	1			1
Rhode Island Sound	RI	2			
Long Island Sound	CT & NY	1	2	1	
Atlantic Ocean	NY	1	5	6	2
Hudson River	NY	3	5		
Atlantic Ocean	NJ	11	2	4	6
Delaware Bay & River	DE & NJ	9	4	2	
Atlantic Ocean	DE	1			
Atlantic Ocean	MD	2	1	4	1
Chesapeake Bay	VA & MD	21	10	11	32
Atlantic Ocean	VA	18		2	19
Atlantic Ocean	NC	4			
Currituck Sound	NC		2		
Croatan Sound	NC	1		1	1
Alligator River	NC	1			
Pamlico Sound	NC	1			
Roanoke Sound	NC	2			
Albemarle Sound	NC	11	1	5	10
Total	--	*90*	*43*	*36*	*72*

Table 7. Retention of the Carlin Dangler tag over time.

Time At Large	Number Retained	Number Lost	Percent Retention
0-1 Month	8	0	100
1-6 Months	3	0	100
6-12 Months	9	0	100
12-18 Months	2	0	100
18-24 Months	1	0	100
2-3 Years	1	0	100
3-4 Years	0	1	0
4-5 Years	--	--	--
5-6 Years	0	1	0
6-7 Years	--	--	--
7-8 Years	--	--	--
8-9 Years	--	--	--

Table 8. Retention of the Dorsal T-Bar tag over time.

Time At Large	Number Retained	Number Lost	Percent Retention
0-1 Month	106	8	93
1-6 Months	95	18	84
6-12 Months	112	28	80
12-18 Months	53	29	65
18-24 Months	49	37	57
2-3 Years	26	20	57
3-4 Years	8	6	57
4-5 Years	3	4	43
5-6 Years	0	2	0
6-7 Years	1	1	50
7-8 Years	--	--	--
8-9 Years	0	1	0

Table 9. Retention of the Pectoral T-Bar tag over time.

Time At Large	Number Retained	Number Lost	Percent Retention
0-1 Month	109	15	88
1-6 Months	90	27	77
6-12 Months	55	28	66
12-18 Months	48	24	67
18-24 Months	53	19	74
2-3 Years	26	20	57
3-4 Years	8	8	50
4-5 Years	4	1	80
5-6 Years	1	1	50
6-7 Years	1	1	50
7-8 Years	--	--	--
8-9 Years	1	0	100

Table 10. Retention of the Double Barb tag over time.

Time At Large	Number Retained	Number Lost	Percent Retention
0-1 Month	28	2	93
1-6 Months	23	2	92
6-12 Months	3	6	33
12-18 Months	3	7	30
18-24 Months	1	3	25
2-3 Years	0	2	0
3-4 Years	1	1	50
4-5 Years	--	--	--
5-6 Years	1	0	100
6-7 Years	--	--	--
7-8 Years	--	--	--
8-9 Years	--	--	--

Table 11. Retention of the Passive Integrated Transponder (PIT) tag over time.

Time At Large	Number Retained	Number Lost	Percent Retention
0-1 Month	29	0	100
1-6 Months	26	1	96
6-12 Months	17	0	100
12-18 Months	23	0	100
18-24 Months	33	1	97
2-3 Years	19	1	95
3-4 Years	7	0	100
4-5 Years	--	--	--
5-6 Years	1	0	100
6-7 Years	--	--	--
7-8 Years	--	--	--
8-9 Years	1	0	100

List of Appendices

Appendix 1: Optional Datasheets.

A. Sturgeon tagging datasheet (for use with tagging multiple sturgeons at one capture location and date), 2 pages.

B. Sturgeon tagging datasheet (for use with tagging single sturgeon at one capture location and date), 1 page.

C. Sturgeon tag return datasheet (for use at the USFWS to collect information on tagged sturgeon that are recaptured and reported via the toll-free phone number).

Appendix 2: Standardized tagging methodology for Atlantic sturgeon.

STURGEON TAGGING DATASHEET

Agency:_____

Capture Information:

Capture Date_____

Waterbody_____ Site_____ State_____

Latitude_____ Longitude_____

Water Depth_____ (___m or ___ft)

Capture Method:

Anchor Gillnet_____ Drift Gillnet_____ Mesh Size:_____ (___in or ___cm)

Pound Net_____ Trawl_____ Other_____

Soak Time (optional)_____ (___min or ___hr)

Physical Data (optional):

Water Temp_____ (___C or ___F) Air Temp_____ (___C or ___F)

Salinity_____ Conductivity_____

Release Information: _____(check if same as Capture Information)

Release Date_____

Waterbody_____ Site_____ State_____

Latitude_____ Longitude_____

Researcher or Fisherman Contact Information:

Name_____ Phone Number_____

Address_____ SSN (MD only)_____

_____

Comments:

Fish Information:

Species (ATS/SNS)	Recapture or Release (RC or RL)	Total Length (mm)	Fork Length (mm)	Weight (__kg __lb)	PIT Tag	Dorsal Tag ___Carlin ___T-Bar	Other Tag Type: _____	Tissue Sample #

STURGEON TAGGING DATASHEET

Agency:_____

Species: Atlantic Sturgeon_____ Shortnose Sturgeon_____

Capture Information:

Capture Date_____ Release_____ Recapture_____

Waterbody_____ Site_____ State_____

Latitude_____ Longitude_____

Water Depth_____ (___m or ___ft)

Capture Method:

Anchor Gillnet_____ Drift Gillnet_____ Mesh Size:_____ (___in or ___cm)

Pound Net_____ Trawl_____ Other_____

Soak Time (optional)_____ (___min or ___hr)

Physical Data (optional):

Water Temp_____ (___C or ___F) Air Temp_____ (___C or ___F)

Salinity_____ Conductivity_____

Release Information: _____(check if same as Capture Information)

Release Date_____

Waterbody_____ Site_____ State_____

Latitude_____ Longitude_____

Fish Information:

Total Length (mm)_____ Fork Length (mm)_____

Weight_____ (___g or ___kg or ___lbs)

PIT Tag #_____

Dorsal Tag #_____ Tag Type: ___Carlin ___T-Bar Other_____

Other Tag #_____ Tag Type: ___Carlin ___T-Bar Other_____

Tissue Sample # (optional)_____

Researcher or Fisherman Contact Information:

Name_____ Phone Number_____

Address_____ SSN (MD only)_____

_____

Comments:

STURGEON TAG RETURN INFORMATION

DATE CALL RECEIVED_____ INTERVIEWER_____

TAG #1_____ REMOVED? ___YES ___NO PLACEMENT_____

TAG #2_____ REMOVED? ___YES ___NO PLACEMENT_____

ANY OTHER TAGS? ___YES ___NO WHAT TYPE?_____ TAG#_____

DATE TAG RECOVERED _____ (_____CAPTURED _____FOUND)

WATERBODY_____ WATER DEPTH_____ (FT OR M)

LATITUDE_____ LONGITUDE_____

NEAREST CITY OR TOWN_____ STATE_____

CAPTURE METHOD _____GILLNET (___ANCHOR ___DRIFT) MESH SIZE____(INCH)

_____POUNDNET _____TRAWL OTHER_____

SPECIES: _____ATLANTIC _____SHORTNOSE ____UNKNOWN

LENGTH_____ TL OR FL WEIGHT_____ LBS OR KG

DISPOSITION: ____RELEASED (___ALIVE ___DEAD) OTHER_____

WHAT KIND OF FISH WERE YOU FISHING FOR_____

WERE OTHER UNTAGGED STURGEON CAUGHT ___YES ___NO HOW MANY?_____

NAME_____

MAILING ADDRESS_____

_____

_____

PHONE NUMBER_____

COMMENTS:

Appendix 2: Standardizing tagging methodology for Atlantic Sturgeon

Current Tagging Methods

Since 1992 Atlantic sturgeon data from tagging surveys along the eastern seaboard has been compiled at the USFWS Maryland Fishery Resources Office (MFRO). Over this time researchers from 17 organizations have tagged over 5,000 sturgeons with external tags. There have been 700 recaptures during this interval. The external tags used include the Carlin, Double Barb, and T-Bar tags which are provided to researchers by the U. S. Fish & Wildlife Service. A few agencies have also applied Dart and T-Bar tags they purchased independently. External tags have been applied in a variety of locations. Carlin tags have been inserted at the base of the dorsal fin. Double-Barb tags were applied in the dorsal musculature. T-Bar tags have been applied to the dorsal fin and the pectoral fin. External tags enable identification by anyone encountering a sturgeon but they have not exhibited consistent, prolonged retention. Most recaptures of external tags have occurred less than two years after release. Limited tag retention rates are a disadvantage in a long-lived fish since they do not allow for data collection throughout its lifespan. Atlantic sturgeon can live for more than sixty years. Coded wire tags (CWT) were utilized on hatchery releases in the Hudson River in 1994 (5,000 sturgeon) and the Chesapeake Bay (3,200 sturgeon) in 1996. CWTs were placed under the first and third dorsal scute respectively in each of these releases. CWT readers are required to scan for these tags. Wire tag readers cost about $7,000 each. Although CWTs are a permanent method of tagging fish, the animal must be sacrificed in order to collect specific tag information. Passive integrated transponders (PIT) have been utilized in a number of sturgeon studies. Initially they have been inserted beneath one of the first few dorsal scutes. More recently they have been inserted at the anterior base of the dorsal fin. This latter location has become somewhat standard for shortnose sturgeon tagging programs. This type of tagging system offers some advantages over other methods. The PIT is permanent, discrete tag data collection is non-lethal and detectors are reasonably priced (about $300 per unit).

PIT Technology

Passive integrated transponder identification chips have been used on many animals. The system provides electronic identification with a reader using common, low-power radio signals. This radio frequency identification (RFID) signal collects ID numbers stored in the tiny electronic circuit of the transponder. The circuit is energized by the low-power radio beam sent by a compatible reading device. The transponder sends the ID number as a radio signal back to the scanner, which then decodes the number and displays it on a small screen similar to that on an electronic calculator. There are several advantages of this type of technology over some other tag types that have been employed. PIT tags are passive so they have no batteries or parts to wear. They consist of a microchip, a capacitor and an antenna coil encased in a cylindrical glass tube. Manufacturers maintain that they should last over 100 years. The tags are implanted with a syringe into the body cavity, under the skin, under cartilage or in muscle. PIT tags are read by scanning for the code on the tag with a compatible ID reading system. Therefore tag specific data can be collected without harming the fish. Northeast Fishery Center and Maryland Department of Natural Resources have been maintaining captive PIT tagged sturgeon for several years. These tags have exhibited extremely high durability and retention rates are close to one hundred percent.

There are two types of PIT tag systems: Trovan and Destron. The two formats are not compatible: Only the Destron system has been used in sturgeon. Three wavelengths of transponders have been employed. These are 400 kHz, 125 kHz and 134.2 kHz. The 400 kHz tags that were the first ones to be produced are not commonly available at this time. The most commonly used wavelength in sturgeon tagging has been the 125 kHz tag. Electronic readers can be manufactured to read any of these wavelengths or to read only specific ones. The frequency of 125 kHz is much lower than the frequencies used in AM medium-wave broadcasting. The power of the radio signal sent by the scanner is less than one one-thousandth of a watt (one milliwatt), which is far less than the power transmitted by a child's two-way radio (walkie-talkie). Scanners are approved to operate as low-power radio-frequency devices by the FCC in the United States and by similar organizations in other countries (PTTs). Scanners do not require site licensing. Scanners are typically able to read tags from a distance of 70 to 300 mm (3-11 inches). Specialized readers can detect tags from greater distances.

Standardized Methods

In order to enhance our knowledge of Atlantic sturgeon and our ability to collect critical stock assessment information, we recommend standardizing tagging methodology along the eastern seaboard. This will allow for improved data collection, considering the multitude of participating researchers and the longevity of the fish. The FWS proposes to provide 125kHz PIT tags and readers to all organizations within the ASMFC region in order to encourage the adoption of this tagging practice. We would then encourage jurisdictions to scan for these tags in monitoring programs where sturgeons are encountered. Tagging location should be standardized to be within 5 cm of the anterior insertion at the base of the dorsal fin (within 4 cm of the midline on the left side). The FWS will continue to provide Carlin and T-Bar tags to jurisdictions that desire external marks in addition to PIT tags. The MFRO will add the PIT tag information to the coastal tagging database. We estimate that implementation of this program will incur an initial expenditure of $14,000 to purchase 1,000 tags, implanters and 30 readers.