



JAN 15 2010

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act (NEPA), an environmental review has been performed on the following action.

TITLE: Environmental Assessment on the Effects of the Issuance of a Scientific Research Permit (File No. 14396) to Conduct Research on Shortnose Sturgeon in the Delaware River.

LOCATION: Netting would take place in the tidally influenced portion of the Delaware River between rkm 119 to 148. Researchers would also travel by boat to receivers in the passive telemetry array between rkm 0 to rkm 215.

SUMMARY: The current EA analyzed the effects of shortnose sturgeon research on the environment in the Delaware River where researchers propose to document the nursery areas, individual movement patterns, seasonal movements, home ranges, and habitat usage of sub-adult and early juvenile shortnose sturgeon (*Acipenser brevirostrum*). To accomplish these goals, the applicant is requesting authorization to annually capture with gill nets up to 100 shortnose sturgeon — but no more than 300 during five years — from May 1 and November 15. Research activities would include handling, weighing, measuring, PIT and Floy tagging, and genetic tissue sampling. Additionally, a subset of 15 juvenile and sub-adult (≤ 500 mm TL) shortnose sturgeon would annually be anesthetized and fitted with internal sonic transmitters — but no more than 45 during five years— to assess juvenile movement and range using a passive telemetry array. One unintended mortality of a shortnose sturgeon is also requested throughout the life of the permit.

The proposed action analyzed in the EA would not have significant environmental effects on the target or non-target species; public health and safety would not be affected; no unique geographic area would be affected; and the effects of this study would not be highly uncertain, nor would they involve unique or unknown risks. Issuance of this permit would not set a precedent for future actions with significant effects, nor would it represent a decision in principle about a future consideration. There would not be individually insignificant but cumulatively significant impacts associated with the proposed action, and there would not be adverse effects on historic resources. The permit would contain mitigating measures to avoid unnecessary stress to the subject animals.

RESPONSIBLE

OFFICIAL: James H. Lecky
Director, Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
(301) 713-2332



The environmental review process led us to conclude this action will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be prepared. A copy of the finding of no significant impact (FONSI) including the supporting EA is enclosed for your information.

Although NOAA is not soliciting comments on this completed EA/FONSI, we will consider any comments submitted assisting us to prepare future NEPA documents. Please submit any written comments to the responsible official named above.

Sincerely,

A handwritten signature in black ink, appearing to read "P. Doremus", written in a cursive style.

for Paul N. Doremus, Ph.D.
NOAA NEPA Coordinator

Enclosure



JAN 11 2010

ENVIRONMENTAL ASSESSMENT
ON THE EFFECTS OF THE ISSUANCE OF A SCIENTIFIC RESEARCH PERMIT
(File No. 14396) TO CONDUCT SCIENTIFIC RESEARCH ON SHORTNOSE STURGEON IN
THE DELAWARE RIVER

January 2010

Lead Agency: USDC, National Oceanic and Atmospheric Administration
National Marine Fisheries Service, Office of Protected
Resources

Responsible Official: James H. Lecky, Director, Office of Protected Resources

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Location: Delaware River and Estuary, Delaware

Abstract: The National Marine Fisheries Service (NMFS) proposes to issue a scientific research permit to the Delaware Department of Natural Resources and Environmental Control-Division of Fish and Wildlife (DNREC-DFW), Dover, Delaware, for takes of shortnose sturgeon (*Acipenser brevirostrum*) in the wild, pursuant to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et seq.*). The primary objective of the proposed research would be to locate and document early juvenile (< 500 mm total length) shortnose sturgeon nursery areas in the Delaware River, and to assess their individual movement patterns, seasonal movements, home ranges, and habitat use through the use of telemetry.

The permit would be valid for five years from the date of issuance and would authorize non-lethal sampling methods on up to 100 shortnose sturgeon annually. Research activities would include gillnetting, temporary holding post-capture, measuring (length, weight, photos), genetic tissue sampling, anesthesia, PIT, Floy and sonic tagging. One incidence of unintentional mortality or serious injury is proposed over the life of the five year permit.

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CHAPTER 1 PURPOSE AND NEED FOR ACTION

1.1 DESCRIPTION OF ACTION

In response to a request from the Delaware Department of Natural Resources and Environmental Control-Division of Fish and Wildlife (DNREC-DFW), Dover, Delaware (File No. 14396), the National Marine Fisheries Service Office of Protected Resources (NMFS-OPR) proposes to issue a scientific research permit authorizing “takes”¹ of shortnose sturgeon (*Acipenser brevirostrum*) in the Delaware River pursuant to the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq.*) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226).

1.1.1 Purpose and Need

The purpose of the aforementioned scientific research would be to gather information used to help inform conservation management decisions to recover shortnose sturgeon in the wild. Section 10(a)(1)(A) of the ESA allows NMFS to issue permits and permit modifications to take ESA-listed shortnose sturgeon. The applicant requires a permit to conduct the proposed research.

The primary purpose of the permit, therefore, is to provide an exemption from the take prohibitions under the ESA to allow “takes” of shortnose sturgeon for bona fide scientific research. The need for issuance of the permit is related to NMFS’s mandates under the ESA. Specifically, NMFS has a responsibility to implement the ESA to protect, conserve, and recover threatened and endangered species under its jurisdiction. The ESA prohibits takes of threatened and endangered species, respectively, with only a few very specific exceptions, including for scientific research and enhancement purposes. Permit issuance criteria require that research activities are consistent with the purposes and policies of these federal laws and will not have a significant adverse impact on the species.

1.1.2 Objectives of the research

The goals of the proposed research are to document the nursery areas, individual movement patterns, seasonal movements, home ranges, and habitats of sub-adult and early juvenile shortnose sturgeon in the Delaware River. To accomplish these goals, the researcher would annually capture up to 100 shortnose sturgeon (no more than 300 over five years) with gill nets from May 1 through November 15. Each fish would be handled, weighed, measured, PIT and Floy tagged, genetic tissue sampled, and allowed to recover prior to release. Additionally, a subset of 15 juvenile and sub-adult (≤ 500 mm total length (TL)) shortnose sturgeon annually (no more than 45 for five years) would be selected to be anesthetized and fitted with internal sonic transmitters to assess juvenile movement and range using a passive telemetry array. A single unintentional mortality of a shortnose sturgeon would be authorized throughout the life of the five year permit if issued.

¹ The ESA defines “take” as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” The term “harm” is further defined by regulations (50 CFR §222.102) as “an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering.”

1.2 SCOPING SUMMARY

The purpose of scoping is to identify the issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes. CEQ regulations implementing the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) do not require that a draft EA be made available for public comment as part of the scoping process. A Notice of Receipt of the application was published in the Federal Register announcing the availability of the permit application and related documents for public comment (File No. 14396; August 25, 2009; 74 FR 42861). No comments were received from the public regarding this application.

1.3 APPLICABLE LAWS AND NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action, as well as who is responsible for obtaining them. Even when it is the applicant's responsibility to obtain such permissions, NMFS is obligated under NEPA to ascertain whether the applicant is seeking other federal, state, or local approvals for their action.

1.3.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was enacted in 1969 and is applicable to all "major" federal actions significantly affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a federal agency. NMFS issuance of permits for research represents approval and regulation of activities. While NEPA does not dictate substantive requirements for permits, licenses, etc., it requires consideration of environmental issues in federal agency planning and decision making. The procedural provisions outlining federal agency responsibilities under NEPA are provided in the Council on Environmental Quality's implementing regulations (40 CFR Parts 1500-1508).

NMFS has, through NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the Council on Environmental Quality. NAO 216-6 specifies that issuance of scientific research permits under the MMPA and ESA is among a category of actions that are generally exempted (categorically excluded) from further environmental review, except under extraordinary circumstances. When a proposed action that would otherwise be categorically excluded is the subject of public controversy based on potential environmental consequences, has uncertain environmental impacts or unknown risks, establishes a precedent or decision in principle about future proposals, may result in cumulatively significant impacts, or may have an adverse effect upon endangered or threatened species or their habitats, preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required.

While issuance of scientific research permits is typically subject to a categorical exclusion, as described in NAO 216-6, NMFS is preparing an EA for this action to provide a more detailed analysis of effects to ESA-listed species. This EA is prepared in accordance with NEPA, its implementing regulations, and NAO 216-6.

1.3.2 *Endangered Species Act*

Section 9 of the ESA, as amended, and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption such as by a permit. Permits to take ESA-listed species for scientific purposes, or for the purpose of enhancing the propagation or survival of the species, may be granted pursuant to Section 10(a)(1)(A) of the ESA.

NMFS has promulgated regulations to implement the permit provisions of the ESA (50 CFR Part 222) and has produced OMB-approved application instructions that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the ESA.

Section 10(d) of the ESA stipulates that, for NMFS to issue permits under section 10(a)(1)(A) of the ESA, the Agency must find that the permit: was applied for in good faith; if granted and exercised will not operate to the disadvantage of the species; and will be consistent with the purposes and policy set forth in Section 2 of the ESA.

Section 2 of the ESA sets forth the purposes and policy of the Act. The purposes of the ESA are to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in section 2(a) of the ESA. It is the policy of the ESA that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA. In consideration of the ESA's definition of conserve, which indicates an ultimate goal of bringing a species to the point where listing under the ESA is no longer necessary for its continued existence (i.e., the species is recovered), exemption permits issued pursuant to section 10 of the ESA are for activities that are likely to further the conservation of the affected species.

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the U.S. Fish and Wildlife Service, (USFWS)) for federal actions that "may affect" a listed species or adversely modify critical habitat. NMFS issuance of a permit affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these Section 7 consultation requirements. Section 7 requires federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. NMFS is further required to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of habitat for such species. Regulations specify the procedural requirements for these consultations (50 Part CFR 402).

CHAPTER 2: ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the range of potential actions (alternatives) determined reasonable with respect to achieving the stated objectives. This chapter also summarizes the expected outputs and any related mitigation of each alternative. Alternative Number 1 is the "No Action" alternative

where the proposed permit would not be issued. The No Action alternative is the baseline for the rest of the analyses. Alternative No. 2 is the “Proposed Action” alternative representing the research proposed in the submitted application for a permit, with standard permit terms and conditions specified by NMFS.

2.1 ALTERNATIVE No. 1: NO ACTION

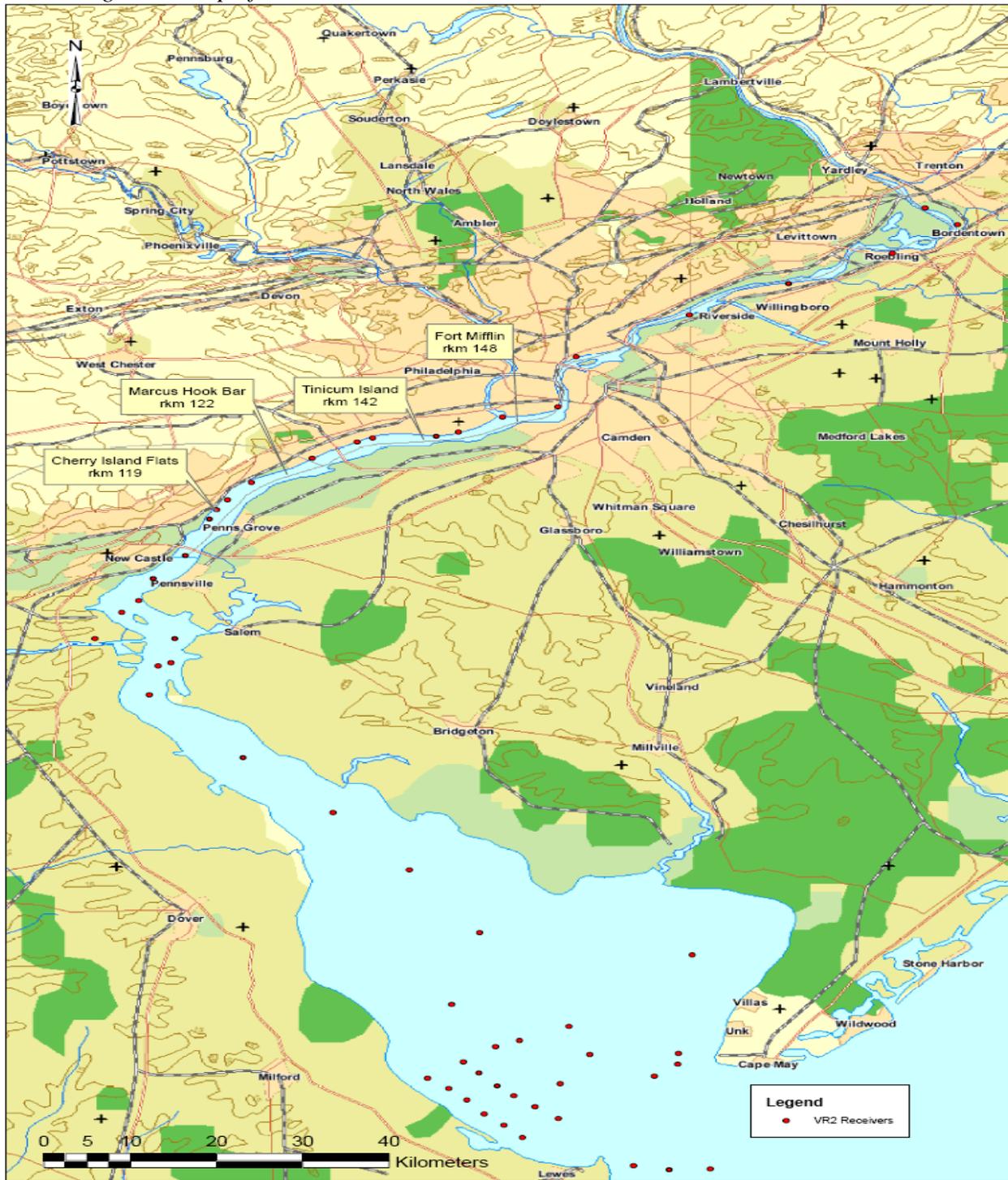
Under this alternative, the No Action alternative, the scientific research permit (File No. 14396) to capture shortnose sturgeon with gill nets, temporarily hold, handle, anesthetize, PIT, Floy and Sonic tag, genetic tissue sample, and release shortnose sturgeon, would not be issued at this time.

2.2 ALTERNATIVE No. 2: PROPOSED ACTION –ISSUANCE OF PERMIT WITH STANDARD CONDITIONS

Under the Proposed Action alternative, a permit would be issued for activities by the applicant, with the permit terms and conditions standard to such permits as issued by NMFS for five years. To accomplish these goals, the researcher proposes to annually capture up to 100 juvenile and adult shortnose sturgeon by gill nets from late May through November. Each fish would be captured, handled, weighed, measured, and PIT and Floy tagged, tissue sampled, allowed to recover and released. Additionally, a subset of 15 juvenile and sub-adult (≤ 500 mm TL) would be selected annually and fitted with internal sonic transmitters to assess juvenile movement and range through telemetry. Lastly, a single unintentional mortality of shortnose sturgeon is requested throughout the life of the permit. The proposed take is summarized in Table 1 following.

Table 1: Activities proposed to be authorized for endangered shortnose sturgeon (<i>Acipenser brevirostrum</i>) research in the Delaware River, DE under Permit No. 14396.								
Species	Life Stage	Sex	Expected Annual Take	No. of Takes per Individual	Take Action	Transport	Location	Time Period
Shortnose sturgeon	Post-spawning adult, non-spawning adult, & juvenile	Both	Up to 85 Annually (Total 255 over 5 Yrs)	1	Gill net capture, holding, measure, weigh, photograph, fin clip, tag (Floy and PIT), & release	Transfer of genetic fin clips	Delaware River (Primary Sampling Area=rkm 119-148; Secondary Area= rkm 0-216)	May 1 to Nov 15
Shortnose sturgeon	Juvenile	Both	Up to 15 Annually (Total of 45 over 5 Yrs)	1	Gill net capture, holding, anesthesia, surgically implant sonic tag, measure, weigh, photograph, fin clip, tag (Floy and PIT) & release	Transfer of genetic fin clips	Delaware River (Primary Sampling Area=rkm 119-148; Secondary Area= rkm 0-216)	May 1 to Nov 15
Shortnose sturgeon	Post-spawning adult, non-spawning adult, & juvenile	Both	1 (Unplanned lethal take or serious injury over 5 yrs)	1	Unintentional mortality in gill nets, storage, measure, weigh, photograph, fin clip, frozen, transport arrangements made with NMFS for further sampling and disposal	Transfer of dead fish and biological samples	Delaware River (Primary Sampling Area=rkm 119-148; Secondary Area= rkm 0-216)	May 1 to Nov 15

2.2.1 Figure 1: Map of Action Area*



*Sampling sites for shortnose sturgeon by the DE-DFW denoted by yellow boxes between rkm 119 and 148 and telemetry array receivers (Vemco VR-2) between rkm 0 and 216 denoted by red dots.

2.2.2 Description of Action Area

Project sampling would take place annually in the Delaware River Estuary (Figure 1) from May 1 until November 15. Sampling sites would be located in the tidally influenced portion of the lower Delaware River from rkm 119 to 148 in four separate locations identified in Figure 1. The passive sonic telemetry array, maintained from the lower estuary (rkm 0) to near Trenton, New Jersey (rkm 216), would define the effective range of the study area where boats would also travel to download data from receivers. Sampling with gill nets would be based on the ability to use active drift gillnets (McCord et al. 2007) on flat bottom sites, free of snags, away from heavy ship traffic, and out of the main channel (3 - 8 m depth). Where sampling is not possible, either through loss of gear or having extensive bottom structure, those sites would be eliminated from sampling.

2.2.3 Research Activities

Attempts would be made to capture up to a total of 100 shortnose sturgeon annually fishing monofilament nylon drift gill nets four times a month from May 1 to November 15. The sampling effort would be conducted primarily during summer when the population would be most likely congregated in deepwater areas (holes) near the fresh-saltwater interface.

2.2.3.1 Gill netting:

Drift gillnets would be set and marked with GPS coordinates during early stage flood tide (slack) perpendicular to the tidal current and tended closely by researchers until high tide. To maximize chances of catching sturgeon, 92-meter nets would be configured to make contact with the bottom and would have small mesh (6, 9 or 10 cm stretch mesh) on the bottom two meters (McCord et al. 2007). Flat bottom locations free of snags near the freshwater-brackish water interface would be preferred for each set. Researchers would expect a variety of size and age classes captured in these net sets including non-spawning adults, late stage juveniles and early stage juveniles.

The following net-set protocol summarized below in Table 2 would be adhered to by researchers. All gill nets would be attended during daylight hours to avoid marine mammal and sea turtle interactions, and in waters having minimum dissolved oxygen (D.O.) concentrations no less than 5.0 mg/L, with one exception (i.e., net-set duration would be reduced to the next lower duration when D.O. measured between 4 and 5 mg/L). Netting would cease above 28 °C water temperature until consulting with NMFS-OPR.

Table 2: Summary of Gill Netting Conditions

Water Temperature (°C)	Minimum D.O. Level (mg/L)*	Maximum Net Set Duration (hr)
≤ 15	5	10
15 ≤ 20	5	4
20 ≤ 28	5	2
>28		Cease netting until consulting with NMFS

* If DO concentration is between 4 and 5 mg/L at any temperature range, netting may occur, but only at the next lower net set duration indicated.

2.2.3.2 General Handling (e.g., holding, measuring, weighing):

Once captured, sturgeon would be held temporarily in boat-side net pens measuring approximately 200 cm long x 150 cm wide x 200 cm deep. Additional net pens would be onboard to accommodate excess holding of sturgeon and/or bycatch. Handling of fish would be kept to a minimum and fish would not be held longer than two hours after freeing from capture gear, typically less than 30 minutes.

Once recovered, sturgeon would be transferred to an onboard processing station and holding tanks for weighing, measuring, and further processing. To minimize handling, sturgeon would be moved and handled by researchers using latex gloves and, when in onboard holding tanks, sturgeon would be immersed in a continuous stream of water supplied by a pump-hose assembly mounted over the side of the research vessel. Dissolved oxygen (D.O.) would be supplemented with compressed oxygen to ensure the D.O. concentration does not fall below saturation. Sturgeon would be weighed on a platform scale fitted with a small waterproof cushion attached to the surface of weighing platform. Total length of each sturgeon would be measured a standard measuring board, and using calipers mouth width and interorbital width would be measured to confirm species (Moser et al. 2000).

The time required to complete routine, non-invasive methods (*i.e.*, PIT tagging, measuring, weighing) would be less than one minute per fish. The cumulative time required for procedures such as anesthetizing, telemetry tagging, and genetic tissue sampling would vary, but would average less than 15 minutes per fish. Following processing, all fish would be treated with slime coat restorative and, if anesthetized or otherwise necessary, placed in a separate net pen to ensure full recovery prior to release.

2.2.3.3 Genetic Tissue Sampling:

Genetic information would be obtained from tissue samples of sturgeon to help characterize the genetic “uniqueness” of the Delaware River population and would also help quantify the current level of genetic diversity within the population. Immediately prior to release, a small (1.0 cm²) soft tissue sample would be collected from the trailing margin of the pectoral fin using sharp sterilized scissors. Tissue samples would be preserved in individually labeled vials containing 95% ethanol. The researcher has agreed to provide genetic tissue samples collected from shortnose sturgeon for archival purposes to the NOAA/NOS Tissue Archive in Charleston, South Carolina, or to Co-investigators identified in the permit. Proper certification, identity, and chain of custody of samples would be maintained during transfer of tissue samples.

2.2.3.4 PIT Tagging:

Prior to PIT tagging, the entire dorsal surface of captured sturgeon would be scanned using a PIT tag reader to detect PIT tags of previously captured fish. Unmarked shortnose sturgeon (250 to 400 mm TL) would be tagged using 11 mm x 2.1 mm PIT tags injected using a 12 gauge needle at an angle of 60 to 80° in the dorsal musculature (anterior to the dorsal fin). Sturgeon longer than 400 mm TL would be tagged with 14 mm x 2.1 mm PIT tags. During the study, the rate of PIT tag retention would be documented and reported to NMFS in annual reports. The last step after injecting PIT tags would be to verify and record the PIT tag code with a tag reader.

2.2.3.5 *Floy (T-bar Anchor) Tagging:*

The researcher proposes to tag shortnose sturgeon with Floy (T-bar anchor) tags to incorporate incidental recapture of sturgeon by fishermen or researchers enabling collection of information useful for population assessment. For all captured shortnose sturgeon, Floy tags would be anchored in the dorsal fin base, inserted forwardly and slightly downward from the left side to the right through the dorsal pterygiophores. After removing the injecting needle, the tag would be spun between the fingers and gently tugged to be certain it is locked in place. During the study, the rate of Floy tag retention would be documented and reported to NMFS in annual reports.

2.2.3.6 *Anesthesia and Surgical Implantation of Transmitter Tracking Devices:*

Annually during the study, a maximum of 15 juvenile shortnose sturgeon would be collected for surgical implantation of Vemco V-7 or V-9 sonic transmitters devices limited in size to no more than 2% of a fish's body weight.

Specifications of these transmitters are as follows:

Model	Length	Diameter	Weight (H2O)	Weight (O2)
V7-4L	22.5 mm	7 mm	1.0 g	1.8 g
V9-2H	30 mm	9 mm	2.8 g	5.0 g

The following 3-5 minute transmitter implantation surgery under surgical anesthesia (Coyle *et al.* 2004) would be used.

Shortnose sturgeon selected for transmitter implantation would be netted at temperatures 27 °C or below. Each sturgeon would be anaesthetized using a solution of 100 mg/L of tricaine methane sulfonate (MS-222) buffered to neutral pH with sodium bicarbonate. A low volume pump would deliver the anesthetic over the gills through a tube placed within the sturgeon's mouth until a state of anesthesia is reached (i.e., loss of equilibrium, little reaction to touch stimuli, cessation of movement, except for opercula movement). The anesthetic's induction and recovery time would vary but would be appropriate for shortnose sturgeon under the specific water temperature and oxygen conditions present (Fox *et al.* (2000).

Just prior to the surgical procedure, the tube supplying the anesthetic would be removed and the sturgeon placed on a moist surgery rack. Respiration would be maintained by directing fresh ambient water pumped across the gills with tube inserted in the animals' mouth. The incision site (40 to 60 mm anterior to the pelvic fins, although the specific location would vary with fish size) would be disinfected with Betadyne and a sterile surgical packet, containing all surgical instruments and supplies, would be used to make a 10 mm incision in individual fish selected for surgery. Sterilized sonic transmitters, coated with an inert polymer compound, would be inserted into the surgical openings of sturgeon and the incision closed with resorbable suture, sealed with a layer of surgical glue. A thin layer of petroleum jelly mixed with Betadyne would then be spread over the incision areas to protect against infection (Fox *et al.* 2000). Following processing, all fish would be treated with slime coat restorative and placed in a separate net pen to ensure full recovery prior to release. Any fish not responding readily would be recovered further in the net pen by holding the fish upright and immersed in river water within a net pen and gently moving the fish front to back to

aid freshwater passage over the gills to stimulate the fish. When showing signs of being able to swim away strongly, the fish would be released and a spotter would watch to make sure the fish stays down and fully recovered.

2.2.3.7 Unintentional Mortality of Shortnose Sturgeon:

The researcher has requested one unintended mortality over the life of the permit. This request was based on the cumulative stress estimated from the volume of research activity likely to be required to sample sturgeon and meet the researcher's objectives. An applied rate of mortality of 0.35% was used to estimate mortality. This was based on similar previous research on Atlantic sturgeon where seven mortalities of captured Atlantic sturgeon occurred since 1991 (1,998 Atlantic sturgeon handled). If a greater incidence of mortality or serious injury should occur, research would cease and NMFS-OPR would need to be consulted to determine the cause of mortality and to discuss any remedial changes in research methods before a decision could be made to resume research. The Permits Division could grant authorization to resume permitted activities based on review of the incident depending on the circumstances, or else suspend activities.

Additionally, it is possible research activities (gill netting and handling) could result in unintentional mortality of non-target species. However, from past experience of the researchers and their practice of monitoring nets with short soak-times, NMFS anticipates by-catch mortality would be minimal.

CHAPTER 3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This EA evaluates the potential impacts to the human environment from issuance of the proposed permit and the potential impacts on the social, economic, physical, and biological environment (*i.e.*, targeted shortnose sturgeon), specifically those that may result from the proposed research activities requested.

3.1 SOCIAL AND ECONOMIC ENVIRONMENT

Although economic and social factors are listed in the definition of effects in the NEPA regulations, the definition of human environment states that "economic and social effects are not intended by themselves to require preparation of an EIS." However, an EIS or EA must include a discussion of a proposed action's economic and social effects when these effects are related to effects on the natural or physical environment. The social and economic effects of the proposed action mainly involve the effects on the people involved in the research, as well as any industries that support the research, such as suppliers of equipment needed to accomplish the research. There are no significant social or economic impacts of the proposed action interrelated with significant natural or physical environmental effects. Thus, the EA does not include any further analysis of social or economic effects of the proposed action.

3.2 PHYSICAL ENVIRONMENT

The following section provides a description of the critical resources within the action area.

3.2.1 Description of the Delaware River System

The Delaware River is one of the major rivers of the eastern United States draining an area of 31,000 sq km. Beginning on the western slopes of the Catskill Mountains in eastern New York, the river

consists of two branches: the West Branch, 145 km long, and the East Branch, 121 km long. The West Branch is the chief branch flowing southwest as far as Deposit, New York, and then turning southeast at the confluence at Hancock, New York (rkm 452). From this point, the Delaware, continues flowing southeasterly along the New York-Pennsylvania boundary as far as Port Jervis, New York. There, bordering Pennsylvania and New Jersey, it follows a generally eastward course to its mouth in the Delaware Bay. The last 100 kilometers is bounded by New Jersey to the north and Delaware to the south (DRBC 2009).

The Delaware River is a source of hydroelectric power and is a vital commercial and recreational waterway. It is navigable by large, oceangoing vessels as far inland as Philadelphia, Pennsylvania, and by smaller vessels to Trenton, New Jersey. The Chesapeake and Delaware Canal is navigable by oceangoing vessels, connecting the Delaware River below Wilmington, Delaware, with the Chesapeake Bay. The Delaware River Basin Commission, the federal government, and the four Delaware Basin states—New York, Pennsylvania, New Jersey, and Delaware—jointly manage assets and concerns of the Basin. The U.S. Army, Corps of Engineers has responsibility for maintaining navigation on the river and has historically dredged the Delaware River's federal shipping channel since the late 1800s when the controlling depth of the Delaware River was 18 feet (USACE 2009).

Current channelization plans include appropriated construction funds to deepen and maintain the existing shipping channel from 40 feet to 45 feet from Philadelphia Harbor, Pennsylvania and Beckett Street Terminal, Camden, New Jersey to the mouth of the Delaware Bay. Although this is a total distance of 165 kilometers, the lower portion of the river (53 km), mostly in the Delaware Bay, is already at 45 feet or deeper (USACOE 2009).

The existing authorized widths in the straight portions of the channel, ranging from 400 feet in Philadelphia to 1,000 feet in the bay, would not change. However, 12 of the existing 16 bends in the channel would be widened for safer navigation. In addition, the Marcus Hook area, within the proposed action area of the sturgeon research, would be deepened to 45 feet. Approximately 16.4 million cubic yards of material must be removed to deepen the channel during initial construction phases of the project. Of that amount, approximately 12.3 million cubic yards of sand, silt, and clay would be taken from the river portion of the project — the area from Philadelphia, Pennsylvania, and Camden, New Jersey, to the Upper Delaware Bay. About 77,000 cubic yards of rock would also be removed from the Marcus Hook area of the river. The bulk of dredging will be performed by hopper and hydraulic pipeline dredges with a bucket dredge used for rock removal in the Marcus Hook area (USACOE 2009).

3.2.2 *EFH, Critical Habitat and National Marine Sanctuaries*

There are no National Marine Sanctuaries or designated critical habitat located within the study area for the proposed activities. Additionally, there are no protected areas (e.g., National Estuarine Research Reserves or state protected aquatic areas) present affected by the research activities, nor are there eligible historic resources in the project location.

Designated essential fish habitat (EFH) exists for twenty-six of managed species in the lower Delaware Bay in New Jersey and Delaware waters; however, these occur well downstream of the designated areas for gill netting. Although the researcher's boats would pass through and over the

water column in areas where EFH exists in the Delaware River (when traveling to telemetry receivers to download data), NMFS determined this portion of the researcher's activity would not adversely impact the physical environment (including any portion considered EFH).

The Office of Habitat Conservation was contacted and concurred with OPR's determination (via email, August 11, 2009) that the proposed action, as planned, would have minimal impacts on EFH in the Delaware River. Therefore, no further consultation was necessary and consequently EFH is not further addressed in this analysis.

For further information on the affected physical environment, please refer to the Biological Opinion (January 2010) written for this proposed action.

3.3 BIOLOGICAL ENVIRONMENT

The following is a brief summary of the status and occurrence of targeted shortnose sturgeon range-wide, including the proposed study area. Further descriptions of the status of these species can be found in the Biological Opinion accompanying this document as well as NMFS Recovery Plans and other documents at <http://www.nmfs.noaa.gov/pr/publications/>.

3.3.1 ESA Target Species Under NMFS Jurisdiction

ESA Endangered: Shortnose sturgeon (*Acipenser brevirostrum*)

3.3.1.1 Range-wide Distribution of shortnose sturgeon:

Shortnose sturgeon occur along the east coast of North America in rivers, estuaries and the sea. They were once present in most major rivers systems along the Atlantic coast (Kynard, 1997). Their current distribution extends north to the Saint John River, New Brunswick, Canada, which has the only known population in Canada (Scott and Scott 1988). Their southerly distribution historically extended to the Indian River, Florida (Everman and Bean 1898) but the southern limit of their range is currently believed to be in the Saint Johns River, FL (NMFS 1998). They are sympatric with the Atlantic sturgeon throughout much of their range. However, the Atlantic sturgeon spends more of its life cycle in the open ocean. In rivers, shortnose sturgeon and Atlantic sturgeon may share foraging habitat and resources but shortnose sturgeon generally spawn farther upriver and earlier than Atlantic sturgeon (Kynard 1997, Bain 1997).

Although there is substantial evidence in the literature for shortnose sturgeon occurrence at sea (Vladykov and Greely 1963, Schaefer 1967, Fried and McCleave 1973, Wilk and Silverman 1976, Dadswell 1979, Smith et al. 2002) most researchers believed coastal movements were rare (Dadswell 1984, NMFS 1998) seldom venturing beyond their natal rivers. Magnin (1963) theorized the species was primarily found in freshwater on the basis of growth (i.e., if shortnose sturgeons spent more time in the ocean they would grow to larger sizes). In recent years, telemetry data and genetic analyses have demonstrated coastal migrations of shortnose sturgeon between adjacent rivers may be relatively common in some areas (S. Fenandes, in Maine Rivers, and D. Peterson, in S.E. Rivers, *pers. comm.*, 2008).

3.3.1.2 Shortnose sturgeon in the Delaware River:

Current Distribution and Abundance

Shortnose sturgeon occur throughout the Delaware River estuary and occasionally enter the nearshore ocean off Delaware Bay (Brundage and Meadows 1982). In spring, spawning adults migrate up-river in the non-tidal river in freshwater, and are common at least as far upstream as Scudders Falls (rkm 225). According to Dadswell, et al. (1984), ripe adults have been captured as far upstream as Lambertville (rkm 240). The farthest upstream confirmed account of a shortnose sturgeon in the Delaware River is from 1998. A fish was captured during electrofishing for American shad below the lower tip of Old Sow Island near Raubsville, Pennsylvania (rkm 287) (M. Kaufmann, PA Fish and Boat Commission, *pers. comm.*).

Hastings et al. (1987) estimated a modified Schnabel estimate of adult shortnose sturgeon in the Delaware River at 12,796 (95% confidence interval – 10,228 to 16,367) based on mark recapture data collected during 1981-1984. Environmental Research and Consulting, Inc. (2006b) later estimated the population at 12,047 adult shortnose sturgeon, with a 95% confidence interval of 10,757 – 13,580. A Chapman modification of the Schnabel estimate was used based on mark-recapture data collected from January 1999 through March 2003.

Similarity between the two estimates suggests that the Delaware River shortnose sturgeon population is stable but has not increased in the 20+ years between studies. The recapture of 168 shortnose sturgeon during the later study, tagged as adults by Hastings et al. (1987), suggests that older fish comprise a substantial portion of the Delaware River population (ERC, Inc. 2006b).

Natural History and Habitat Information

Spawning: Delaware River shortnose sturgeon are documented to spawn from late March through early May (H. Brundage, ERC, *pers. comm.* 2008). Spawning occurs primarily between Scudders Falls and the Trenton rapids (rkm approx. 216-223) in Mercer County, although shortnose sturgeon eggs were also collected upstream of Titusville, NJ (rkm 229) in spring 2008. The river in the nontidal area, beginning at the fall line at Trenton Rapids, is relatively shallow (< 3 meters in summer) characterized by pools, riffles and rapids (O'Herron et al. 1993) and the substrate is composed primarily of sand, gravel, and cobble, with soft sediments found in areas of weaker currents. Spawning can occur between 8 and 25^o C, with most spawning occurring within the 10-18^o C range. Recent surveys by ERC, Inc. for early life stages, as well as observations from impingement/entrainment studies, confirm the presence of shortnose sturgeon larvae and/or eggs between Scudders Falls (rkm 223) and Trenton (rkm 216). Larvae collected at a Fairless Hills, Pennsylvania, cogeneration plant (approximately rkm 191) (well south of the spawning/rearing area), may have been carried there during a one day flood event

Foraging: After spawning, most adult shortnose sturgeon spend the summer and early fall foraging throughout the river, between the vicinity of Trenton south to Artificial Island (rkm 79) (J. O'Herron, *pers. comm.* 2008). Some foraging may also occur in winter, though sturgeon are not feeding heavily at this time (J. O'Herron, *pers. comm.* 2008). Predominate substrates in the tidal river include fine grain sediments (silt, sand and clay). Larger substrates ranging from gravel to

bedrock can be found in certain areas, however (ERC, Inc. 2006b). Though gut analysis has not been performed on Delaware River shortnose sturgeon, according to J. O'Herron (pers. comm. 2008), oligochaetes, Asian clams and chironomids were observed over occupied sturgeon habitats during macroinvertebrate sampling conducted in the early 1980's.

Overwintering/resting: Shortnose sturgeon were found to overwinter in the Roebing (rkm 199), Bordentown, (rkm 207) or Trenton reaches from December-March. The channel off Duck Island (rkm 208) is known to be used heavily by overwintering shortnose sturgeon (O'Herron 1993). Recent acoustic tagging studies indicate the existence of an overwintering area in the lower portion of the river, below Wilmington, DE (ERC, Inc. 2006a). Wintering adults are normally observed in tight aggregations and movement at this time appears to be minimal. In addition, results from a preliminary tracking study of juvenile shortnose sturgeon suggest that the entire lower Delaware River from Philadelphia (approx. rkm 161) to below Artificial Island (rkm 79) may be utilized as an overwintering area by juvenile shortnose sturgeon (ERC, Inc. 2007b). According to ERC, Inc. (2007b), juvenile sturgeon in the Delaware River appear to overwinter in a dispersed fashion rather than in dense aggregations like adults.

Migration corridor/seasonal movements: Acoustic tagging studies by ERC, Inc.(2006a) indicate that adult shortnose sturgeon demonstrate one of two generalized movement patterns, either making long excursions from the upper to the lower tidal river (Pattern A) or remaining in and utilizing the upper tidal river (Pattern B) (ERC, Inc. 2006a). Fish with Pattern A movements made long distance excursions, often moving between the upper tidal river and the area of the Chesapeake and Delaware Canal (C&D Canal) (rkm 95) or farther downstream. Movements were often rapid, with one fish swimming 121 kilometers in six days. The long distance excursions often occurred in spring, after the spawning period (likely movement to summer foraging areas), and in early to mid-winter (likely movement to overwintering areas) (ERC, Inc. 2006a). Most of the tagged shortnose sturgeon occupied known overwintering areas in the Roebing, Bordentown and Trenton reaches of the upper tidal river during December through March. Three fish, however, appear to have overwintered in the downriver, below Wilmington (rkm 113). This suggests the existence of an overwintering area in the lower river. Downriver overwintering areas are known to occur in other river systems, but previously there had been no evidence of such in the Delaware River (ERC, Inc. 2006a). Movement patterns observed in the ERC study indicate that some, but not all, of the adult shortnose sturgeon overwintering in the upper tidal Delaware River move to the spawning area in the lower non-tidal river in late March and April (ERC, Inc. 2006a).

Preliminary tracking studies of juvenile shortnose sturgeon showed different patterns of movements in the winter (n=3), indicating that the entire lower Delaware River (Philadelphia to below Artificial Island; approx. rkm 161-79) may be utilized for overwintering (ERC, Inc. 2007b). One fish, whose tag was active in late spring and summer, showed movement spanning approximately 25 kilometers between the Chester and Deepwater Point ranges (rkm 130-101), spending much of its time in the vicinity of Marcus Hook (rkm 128; ERC, Inc. 2007b).

3.3.2 Non Target Species

3.3.2.1 ESA Protected Species Potentially Affected by the Proposed Action:

The researcher's activities would include netting in freshwater-tidally mixed areas between river kilometer 119 to 148, and monitoring by boat the acoustic array receivers established in the Delaware River between river kilometer 0 to 216 (Figure 1).

Highlighted below is a listing of all the non-target ESA-listed species (threatened or endangered) under NMFS or USFWS jurisdiction with habitat occurring in the Delaware Basin states of Delaware, New Jersey and/or Pennsylvania.

In Delaware these species include: (NMFS Jurisdiction) — green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), right whale (*Balaena glacialis*); (USFWS Jurisdiction) — Delmarva Peninsula fox squirrel (*Sciurus niger cinereus*), bog turtle (*Clemmys muhlenbergii*), seabeach amaranth (*Amaranthus pumilus*), Canby's dropwort (*Oxypolis canbyi*), swamp pink (*Helonias bullata*), small whorled pogonia (*Isotria medeoloides*), piping plover (*Charadrius melodus*).

In New Jersey these species include: (Under NMFS Jurisdiction) — hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), right whale (*Balaena glacialis*); (Under USFWS Jurisdiction) — bog turtle (*Clemmys muhlenbergii*), dwarf wedgemussel (*Alasmidonta heterodon*), Knieskern's beaked-rush (*Rhynchospora knieskernii*), American chaffseed, (*Schwalbea americana*), sensitive joint-vetch, (*Aeschynomene virginica*), swamp pink (*Helonias bullata*), small whorled pogonia (*Isotria medeoloides*), seabeach amaranth, (*Amaranthus pumilus*), northeastern beach tiger beetle, (*Cicindela dorsalis dorsalis*), Indiana bat (*Myotis sodalis*), piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii dougallii*).

In Pennsylvania these species include: (USFWS Jurisdiction) — clubshell (*Pleurobema clava*), Pink mucket (*Lampsilis abrupta*), rough pigtoe (*Pleurobema plenum*), orangefoot pimpleback, (*Plethobasus cooperianus*), northern riffleshell, (*Epioblasma torulosa rangiana*), pink ring (*Obovaria retusa*), dwarf wedgemussel (*Alasmidonta heterodon*), bog turtle (*Clemmys muhlenbergii*), northeastern bulrush (*Scirpus ancistrochaetus*), small whorled pogonia (*Isotria medeoloides*), and Indiana bat (*Myotis sodalis*).

Based on the reported ranges found in published records for each of these species, NMFS's determined the researcher's impact in the Delaware River would not likely adversely affect the species recorded in this assessment. To gain concurrence on our opinion, NMFS OPR held informal consultations with the USFWS and other specialists within NMFS OPR divisions. Results of these informal consultations appear in Section 4.3.1 of this EA.

3.3.2.2 *Marine Mammal Protection Act Protected Species (and Other ESA Species) Potentially Affected by the Proposed Action:*

Following is a listing of marine mammals, either protected under the MMPA or ESA, with various sightings documented in the Delaware River estuary with some potential to enter the action of area of the proposed research.

- Harbor seal, *Phoca vitulina* (MMPA, relatively common, lower river)
- Harp seal, *Phoca groenlandica* (MMPA, rare)
- Hooded seal, *Cystophora cristata* (MMPA, rare)
- Gray seal, *Halichoerus grypus* (MMPA, rare)
- Harbor porpoise, *Phocoena phocoena* (MMPA, periodically)
- Bottlenose dolphin (*Tursiops truncatus*) (MMPA, relatively common; lower river)
- Beluga whale (*Delphinapterus leucas*) (ESA, extremely rare occurrence)
- Florida manatee, (*Trichechus manatus latirostris*) (ESA, extremely rare occurrence)

Bottlenose dolphin (*Tursiops truncatus*), harbor seal, and harbor porpoise are the most abundant marine mammal species potentially affected by research netting. However, only occasionally are these reported in upriver locations. Rather, they have been encountered by boaters and researchers more frequently in the lower Delaware Bay and bordering coastal waters of Delaware and New Jersey. In email from NMFS marine mammal specialists in the NE Regional Offices (Amanda Johnson *pers. comm.*, email 9/21/09), the nearest haul out for Harbor seal is located at Great Bay, New Jersey, approximately 17 km north of Atlantic City, New Jersey. The ESA protected Florida manatee (*Trichechus manatus latirostris*), documented only once in the Delaware River in 2008, is considered very rare and outside its known typical range, as was an occurrence of a beluga whale (*Delphinapterus leucas*) sighted near Trenton, NJ in 2005.

Staff members from the NMFS Northeast Regional Office reviewed the potential effects on protected marine mammal and sea turtle species. They agreed with NMFS OPR that sampling sites detailed in Figure 1 would be located far enough north of Delaware Bay that interactions with these species would not be expected. However, it is possible, as is noted within the researcher's application, marine mammals of certain species may occasionally be sighted during research activities on the Delaware River. Consequently, as advised by the NMFS Regional Office of Protected Resources, measures to minimize interaction would be placed in the permit. Namely, all netting would be continuously attended; nets would not be deployed when animals are observed within the vicinity of the research; and animals would be allowed to either leave or pass through the area safely before net setting is initiated. Additionally, in all boating activities (including travel to acoustic receiver arrays outside of the netting area) a close watch would be made for marine mammals to avoid harassment or interaction. Researchers would be advised to also review the NMFS Northeast Region Marine Mammal Approach and Viewing Guidelines located online at http://www.nero.noaa.gov/prot_res/mmv/ (See also Section 4.5.5 of this EA).

3.3.2.3 *Non-Listed By-catch Species:*

Due to the nature of netting, researchers would expect some other non-target species such as American shad (*Alosa sapidissima*), Atlantic menhaden (*Brevoortia tyrannus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), striped bass (*Morone saxatilis*), white perch (*Morone americana*), channel catfish (*Ictalurus punctatus*), and white catfish (*Ameiurus catus*)

would become enmeshed. However, nets would typically be checked at short intervals and it is believed virtually all bycatch would be released alive. Because potential for capturing Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), a NMFS species of concern, is very likely in the Delaware River, the following discussion on Atlantic sturgeon is highlighted below.

- Atlantic sturgeon: Atlantic sturgeon is considered a “species of concern” under NMFS jurisdiction co-occurring in the Delaware River study area with shortnose sturgeon. Thus, there is potential for Atlantic sturgeon to be caught during research activities. NMFS and USFWS received a petition to list Atlantic sturgeon as endangered (reviewed in 1998). The endangered status was denied but the species remained a ‘species of concern’ under NMFS’s jurisdiction. However, since 2006, another status review for the Atlantic sturgeon began and is currently ongoing. NMFS has considered should a subsequent listing of Atlantic sturgeon occur coinciding with the proposed research activities, the effects of researcher’s actions on Atlantic sturgeon would be analyzed at that time. Appropriately, the researcher would monitor gill nets closely, and if an Atlantic sturgeon were captured prior to its listing, measures would be taken to ensure its survival (See Section 4.5.6 of this EA).

3.3.2.4 Aquatic Nuisance Species:

The U.S. Geological Survey has documented several aquatic nuisance species (USGS 2009) occurring in the Delaware River watershed potentially in the action area of researchers including: bowfin (*Amia calva*); flathead catfish (*Pylodictis olivaris*); Asian clam (*Corbicula fluminea*); water hyacinth (*Eichhornia crassipes*); hydrilla (*Hydrilla verticillata*); parrot feather (*Myriophyllum aquaticum*); Eurasian water milfoil (*Myriophyllum spicatum*) and water chestnut (*Trapa natans*). Because the proposed research activities have the potential to spread such aquatic nuisance species to other watersheds, measures proposed by NMFS, outlined in Section 4.5.7 of this EA, were agreed to by the researcher to be implemented as standard research protocol.

For further information on the affected biological environment, please refer to the Biological Opinion (January 2010) written for this proposed action.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter represents the scientific and analytic basis for comparison of the direct, indirect, and cumulative effects of the alternatives. Regulations for implementing the provisions of NEPA require consideration of both the context and intensity of a proposed action (40 CFR Parts 1500-1508).

4.1 EFFECTS OF ALTERNATIVE 1: NO ACTION

An alternative to the proposed action is no action, i.e., denial of the permit request. This alternative would eliminate any potential risk to all aspects of the environment from the proposed research activities. However, it would also prohibit researchers from gathering information that could help endangered and protected shortnose sturgeon.

4.2 EFFECTS OF PROPOSED ALTERNATIVE 2: ISSUANCE OF PERMIT WITH STANDARD CONDITIONS

Any impacts of the proposed action would be limited primarily to the biological environment, specifically the animals that would be studied or affected by the research. The type of action proposed in the permit request would minimally affect the physical environment and would be unlikely to affect the socioeconomic environment or pose a risk to public health and safety.

4.2.1 Effects of Research Activities

4.2.1.1 Gill netting:

The applicant proposes to use drift gill nets to capture up to 100 shortnose sturgeon annually, targeting juvenile shortnose sturgeon (≤ 500 mm). Entanglement in gill nets could result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations of sturgeon (Moser and Ross 1995, Collins et al. 2000, Moser et al. 2000). Historically, the majority of shortnose sturgeon mortality during scientific investigations has been related to such factors as water temperature, low D.O concentration, netting duration, mesh size, net composition, and netting experience of the researcher.

To illustrate, shortnose sturgeon mortality resulting from six similar scientific research permits is summarized in Table 3 below. Mortality rates due to the netting activities ranged from 0 to 1.22%. Of the total 5,911 shortnose sturgeon captured by gill nets or trammel nets, only 23 died, yielding an average incidental mortality rate of 0.39%. However, all of the mortalities associated with these permits were due to high water temperature and low D.O. concentrations. Moser and Ross (1995) reported gill net mortalities approached 25% when water temperatures exceeded 28°C even though soak times were often less than 4 hours.

Table 3: Number and percentage of shortnose sturgeon killed by gill nets or trammel nets associated with existing scientific research permits.

	Permit Number					
	1051	1174	1189	1226	1239	1247
Time Interval	1997, 1999 – 2004	1999 – 2004	1999, 2001 – 2004	2003 – 2004	2000 – 2004	1988 – 2004
No. sturgeon captured	126	3262	113	134	1206	1068
No. sturgeon died in gill nets	1	7	0	0	5	13
Percentage	0.79	0.22	0	0	0.41	1.22

Under separate NMFS Permit No. 1247, between 4 and 7% of the shortnose sturgeon captured died in gill nets prior to 1999, whereas between 1999 and 2005, none of the more than 600 shortnose sturgeon gill netted died as a result of their capture. Also, in five years, under Permit Number 1189, none of the sturgeon captured died. Under Permit Number 1174, all seven of the reported shortnose sturgeon mortalities occurred during one sampling event. Since 2006 more conservative mitigation measures implemented by NMFS and researchers (e.g., reduced soak times at warmer temperatures or lower D.O. concentrations, minimal holding or handling time), have reduced the effects of capture by gill netting on sturgeon significantly with no documented mortalities.

To limit stress and mortality of sturgeon due to gillnetting, the researchers in the proposed research would adopt these more conservative mitigation measures for gill netting (See Section 4.5.1). This analysis indicates that, if done in accordance with the NMFS's sturgeon protocols, gill netting for shortnose sturgeon could be done very safely and with little risk of direct mortality.

4.2.1.2 Effects of General Handling (e.g., holding, measuring, weighing):

Sturgeon are a hardy species, but sensitive to handling stress when water temperatures are high or D.O. is low. Handling stress can escalate if sturgeon are held for long periods after capture; and conversely, stress is reduced the sooner fish are returned to their natural environment to recover (D. Peterson, *pers. comm.* November 2008). Signs of handling stress are redness around the neck and fins and soft fleshy areas, excess mucus production on the skin, and a rapid flaring of the gills. Additionally, sturgeon tend to inflate their swim bladder when stressed and when handled in air (Moser *et al.* 2000). If not returned to neutral buoyancy prior to release, sturgeon tend to float and would be susceptible to sunburn and bird attacks. In some cases, if pre-spawning adults are captured and handled, it is possible that they would interrupt or abandon their spawning migrations after being handled (Moser and Ross 1995).

Although sturgeon are sensitive to handling stress, the proposed methods of handling fish described in the application are consistent with the best management practices recommended by Moser *et al.* (2000) and endorsed by NMFS and, as such, should minimize the potential handling stress and therefore minimize indirect effects resulting from handling in the proposed research. Moreover, with conservative permit conditions in place (see Section 4.5.1 of this EA), the likelihood of harm or mortality due to handling and restraint is expected to be minimal.

4.2.1.3 Effects of PIT Tagging:

PIT tags would be used as a means of permanently marking and identifying individual fish by injecting the tags intramuscularly anterior to the dorsal fin. These biologically inert tags have been shown not to cause problems associated with some methods of tagging fish, that is, scarring and damaging tissue or otherwise adversely affecting growth or survival (Brännäs *et al.* 1994). As such, the proposed tagging of shortnose sturgeon with PIT tags is unlikely to have significant impact on the reproduction, numbers, or distribution of shortnose sturgeon. However, there is one record of young fish mortality within the first 24-48 hours of PIT tag insertion as a result of the tags being inserted too deeply. Henne *et al.* (*in press*) found 14 mm tags injected into shortnose sturgeon less than 330 mm caused 40% mortality after 48 hours; however, no additional mortalities occurred after 28 days. Henne *et al.* (2003) also showed that no mortality in sturgeon less than 330 mm would occur after 28 days if 11.5 mm PIT tags were used.

To address these concerns, the applicant would not use PIT tags larger than 11.5 mm x 2.1 mm on juvenile shortnose sturgeon less than 400 mm in length; and no sturgeon less than 250 mm (10 in TL) would be PIT tagged or have other surgical procedures performed. On sturgeon above 400 mm (TL), the researcher proposes to use 14 mm PIT tags. And to avoid duplicate tagging, all sturgeon would be scanned with a PIT tag reader prior to the insertion of a PIT tag. Additionally, results will be recorded for PIT tag retention.

4.2.1.4 Effects of Floy (T-bar Anchor) Tagging:

The applicant requested an additional externally identifiable tagging method using Floy tags during the study. They hold the additional information gained from visible tags is important for managing the resource in their state because a sizable percentage of sturgeon recaptures are reported by the public (or non-scientific community). To support their request for double tagging, researchers detailed thirty-nine percent (109 out of 283) of recaptures of Atlantic sturgeon in the Delaware were from commercial and recreational fisherman between 1991 and 2006 (M. Fisher, *pers. comm.* in email, July 2009). The remainder were from scientific collections.

Smith *et al.* (1990) compared the effectiveness of dart tags with nylon T-bars, anchor tags, and Carlin tags in shortnose and Atlantic sturgeon. Carlin tags applied at the dorsal fin and anchor tags in the abdomen showed the best retention, and it was noted that anchor tags resulted in lesions and eventual breakdown of the body wall if fish entered brackish water prior to their wounds healing. However, Collins *et al.* (1994) found no significant difference in healing rates (with T-bar tags) between fish tagged in freshwater or brackish water. Clugston (1996) also looked at T-bar anchor tags placed at the base of the pectoral fins and found that beyond two years, retention rates were about 60%. Collins *et al.* (1994) compared T-bar tags inserted near the dorsal fin, T-anchor tags implanted abdominally, dart tags attached near the dorsal fin, and disk anchor tags implanted abdominally. They found, long-term, T-bar anchor tags were most effective (92%), but also noted that all of the insertion points healed slowly or not at all, and, in many cases, minor lesions developed.

NMFS concluded, although the use of Floy tags to externally mark shortnose sturgeon is a duplicative means of identifying captured fish, the practice is not expected to significantly impact sturgeon health. However, to lessen known negative impacts described above using the Floy tag, researchers would use sterile tagging technique and subsequently monitor dorsal fins tag sites of recaptured sturgeon for any lesions. Additionally, results of tag retention and fish health would be reported to NMFS OPR in annual reports and as requested by NMFS. If impacts of the Floy tags are other than insignificant, NMFS would reevaluate their use in the permit.

4.2.1.5 Effects of Transmitter Implantation:

In each year of the study, the applicant proposes to collect 15 juvenile/sub-adult (≤ 500 mm) shortnose sturgeon to implant light-weight Vemco V-7 or V-9 (69 kHz) internal sonic transmitters using the outlined protocol presented in Section 2.2.3.6 of this EA.

Dr. Collins in South Carolina (M. Collins, *pers. comm.*, November 2006) documented no mortality from surgical implantation of internal transmitters with similar methods proposed by the applicant. Additionally, Kieffer and Kynard (*In press*) reported tag rejection internally was reduced by coating tags with an inert elastomer and by anchoring tags to the body wall with internal sutures. Fish retained tags for their operational life, and in most cases, lasted much longer (mean, 1,370.7 days). Devries (2006) reported movements of 8 male and 4 female (≥ 768 mm TL) shortnose sturgeon internally radio-tagged between November 14, 2004 and January 14, 2005 in the Altamaha River. Eleven of these fish were relocated a total 115 times. Nine of these fish were tracked until the end of 2005. However, the remaining three individuals were censored after movement was not detected, or they were not relocated, after a period of 4 months. Periodic checks for an additional 2 months also

showed no movement. Although there were no known mortalities directly attributable to the implantation procedure, the status of the three unrelocated individuals was unknown (Devries 2006).

To minimize the effects caused by internally implanting transmitter tags, the researcher proposes to use standardized protocols endorsed by NMFS (Moser *et al.* 2000). Researchers would use sterile surgical techniques and tags would be coated with an inert elastomer polymer to avoid tag rejection. Invasive tools used would be sterilized with Nolvasan® between uses on each fish as well as the incision area swabbed with Nolvasan® prior to making the incision. A tissue adhesive would also be used to help keep the wound closed and the sutures in place until healing can occur. After surgery a Vaseline betadyne mixture would be spread over the area to deter bacteria from entering the wound. Moreover, implanting transmitters would only be attempted when fish are in excellent condition and would not be attempted on pre-spawning fish in spring or fish on the spawning ground, nor if the water temperature exceeds 27° C to reduce handling stress, or is less than 7° C as incisions do not heal rapidly in lower water temperatures.

To ensure normal mobility and swimming behavior of the juvenile sturgeon receiving internal transmitters, the total weight of all transmitters and tags would not exceed 2% of the weight of the fish. Additionally, the applicant proposes to document adaptation to these tags by individually monitoring and recording swimming behavior of the tagged sturgeon, logging the number of times each fish is detected, by logging the time periods between detection, and recording the history of unrelocated individuals.

Although more invasive surgical procedures are required for internal implantation, this tagging procedure provides greater retention rates than external attachment. In general, adverse effects of the proposed tagging procedure could include pain, handling discomfort, hemorrhage at the site of incision, risk of infection from surgery, affected swimming ability, and/or abandonment of spawning runs. However, using proper anesthesia, sterilized conditions, and the surgical techniques described above, would minimize or eliminate potential short-term adverse effects from tagging and greatly lower the risk of injury and mortality. NMFS expects the tagging would result in no more than short-term stress to the animal.

Lastly, many fish have sensitivity to sound energy from 200 Hz up to 800 Hz, and some species are able to detect lower frequency sounds (Popper 2005). However, the frequency of the acoustic tags used in the proposed research (69 kHz) is well above the hearing threshold of most fish and would thus be inaudible causing little effect.

4.2.1.6 Effects of Anesthesia:

The researcher proposes to use tricaine methane sulphonate (MS-222) to anesthetize shortnose sturgeon at concentrations up to 100 mg/L to prevent captured sturgeon from stress during surgery. MS-222's mode of action prevents the generation and conduction of nerve impulses directly affecting the central nervous system, cardiovascular system, neuromuscular junctions, and ganglion synapses (Brown 1988). It is rapidly absorbed through the gills; however, because MS-222 is acidic (resulting in a prolonged induction time), sodium bicarbonate (NaHCO₃) would be used to buffer the water.

Risks associated with MS-222 to anesthetize shortnose sturgeon would be overdosing to lethal or harmful levels due to inexperience at recognizing the proper stage of surgical anesthesia (Coyle *et al.* 2004). MS-222 is one of the most broadly used anesthetic and tranquilizing agents for poikilotherms and is recommended as safe by Moser *et al.* (2000). The proposed rate of 100 mg/L dose is considered a moderate rate and the induction time would be approximately five minutes; complete recovery times would range from five to six minutes (Brown 1988). The researchers are experienced in using MS-222, having performed surgical procedure over 100 times in Atlantic sturgeon research over the past five years. Fish would be monitored closely during induction to determine when the proper surgical stage of narcosis is reached. When recovering from anesthesia, sturgeon would be placed in boat-side net pens prior to release. Therefore, NMFS believes that sturgeon anesthetized in this manner would not be at risk, and long term effects to the fish and the environment would be minimal.

An existing FDA 21 day withdrawal period for MS-222 applied to food fish would not be applicable to endangered shortnose sturgeon because they are a protected species with prohibitions against take. Thus there would not be a legitimate health risk by accidental consumption by humans (F. Pell, FDA *pers. comm.*, email; 2/24/2009). Moreover, MS-222 has been documented to be excreted from fish urine within 24 hours and tissue levels decline to near zero in the same amount of time (Coyle *et al.* 2004).

4.2.1.7 Effects of Genetic Tissue Sampling:

The applicant proposes to take small (1 cm²), non-deleterious tissue samples, clipped with surgical scissors from sections of soft pectoral fin rays of sturgeon captured. Tissue sampling does not appear to impair the sturgeon's ability to swim and is not thought to have any long-term adverse impact (Wydoski and Emery 1983). Many researchers, including the applicant, have reported removing tissue samples according to this same protocol with no adverse effects; therefore, NMFS does not anticipate any long-term adverse effects to sturgeon from this activity.

4.2.1.8 Effects of Incidental Mortality (or Serious Harm):

The permit would authorize research related mortality (or serious harm) to one shortnose sturgeon over the five-year permitting period. The researcher has maintained a record of verifiable mortality in other authorized research with Atlantic sturgeon in the same action area and he anticipates at least one shortnose sturgeon mortality from his proposed research (capture, handling, tagging, and anesthesia) objectives over the five year term.

Because the Delaware River population of shortnose sturgeon is estimated as one of the larger stable stocks within its range, having an estimated spawning population of 12,000 adults (Brundage 2003), the anticipated impact of one sturgeon mortality (or serious harm) on the population would be small, or 0.008% based on the abundance estimate.

4.3 SUMMARY OF COMPLIANCE WITH APPLICABLE LAWS, NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

4.3.1 Compliance with Endangered Species Act (ESA)

To comply with Section 7 of the regulations (50 CFR 402.14(c)), a Section 7 consultations were initiated by NMFS-OPR under the ESA. In accordance with Section 7 of the ESA of 1973, as

amended (16 U.S.C. 1531 *et seq.*), a Biological Opinion (January 2010) was prepared for this proposed action. It concluded, after reviewing the current status of shortnose sturgeon, the environmental baseline for the action areas, the effects of the take authorized in the permits, and the probable cumulative effects of the proposed permit, would not likely jeopardize the continued existence of shortnose sturgeon or any other NMFS ESA-listed species, nor would it likely destroy or adversely modify designated critical habitat.

Likewise communication with NMFS Northeast Region specialists indicated interactions with ESA protected sea turtles were not anticipated from proposed netting activities (Carrie Upite, *pers. comm.*, by email 8/31/09). However, because there have been reports of sea turtle being sited as far up-river as Artificial Island, NJ (rkm 79), the same additional safeguards outlined in Section 4.5.5 of this EA would be used to limit interactions with sea turtles, as they would be for whales potentially entering the Delaware Bay and lower river.

The USFWS was contacted by email with regard to potential impacts of the proposed activity on listed species (and/or habitats) under the USFWS's jurisdiction. USFWS biologist Pamela Shellenberger (ES Field Office, State College, PA) concurred by email dated August 18, 2009 with NMFS OPR findings that the researcher's activity in the Delaware River would not likely adversely affect the listed non-target species identified in Section 3.3.2.2 of this EA.

These communications concluded NMFS OPR's consideration of the effects on ESA listed target and non-target species.

4.4 COMPARISON OF ALTERNATIVES

While the "no action" alternative would have no environmental effects, the opportunity to conduct this particular research would be lost. Initiation of this research is important to collect information that would contribute to better understanding of shortnose sturgeon and to provide information to NMFS that would be needed to implement NMFS management activities if shortnose sturgeon are present in these river systems. This is important information that would help conserve and manage shortnose sturgeon as required by the ESA and implementing regulations.

The environmental effects of the preferred alternative would mainly be limited to individual shortnose sturgeon. However, effects would be minimal and this alternative would allow collection of valuable information assisting NMFS' efforts to recover shortnose sturgeon. Neither option is expected to have adverse population nor stock-level effects on shortnose sturgeon. Given the preferred option's minimal impact to the environment and the potential positive benefits of the research, NMFS believes the information gained would outweigh any likely negative affect to the target species.

4.5 MITIGATION MEASURES

4.5.1 Netting, Holding, and Handling Conditions

- The Permit Holder must take all necessary precautions to ensure sturgeon are not harmed during capture, including use of appropriate net mesh size and twine preventing shutting gill opercula, restricting gill netting activities and decreasing the time of net sets.

- Location (GPS), temperature, dissolved oxygen., gear used (e.g., mesh size, trawl, gillnet, trammel), soak time, species captured, and any mortalities should be measured and recorded (at the depth fished) each time nets are set to ensure appropriate values according to the conditions below. This data must be made available to NMFS in annual reports or upon request.
- After removal from capture gear, researchers must hold sturgeon in floating net pens or in onboard live cars while shielding them from direct sunlight.
- Researchers must carry a second net pen in the research vessel to accommodate larger catches; overcrowded fish must be transferred to the spare net pen or else released.
- Any sturgeon overly stressed from capture, must be resuscitated and/or allowed to recover inside a net pen and released without further handling.
- During lower water temperatures ($< 15^{\circ}\text{C}$), soak times of gill nets must not exceed 10 hours; at water temperatures between 15°C and 20°C , net sets must not exceed 4 hours; at water temperatures between 20°C and 28°C ; soak times of gill nets must not exceed 2 hours. Netting activities must cease at 28°C or higher until consulting with NMFS-OPR.
- Gear may be deployed only in waters with D.O. levels ≥ 5 mg/L at the deepest depth sampled by the gear for the entire duration of deployment, with one exception; that is, if D.O. is between 4 – 5 mg/L, netting may still occur, but at the next lower net set duration.
- If water temperature exceeds 27°C or is lower than 7°C research procedures on shortnose sturgeon must be limited to non-invasive procedures only such as PIT and Floy tagging, measuring, weighing, and genetic tissue clipping.
- The total holding time of shortnose sturgeon, after removal from the capture gear, must not exceed two hours, unless the fish has not recovered from anesthesia.
- During processing, the total handling time (outside of net pen or live well) must not exceed 15 minutes.
- When fish are onboard for processing, they must be placed in an aerated flow-through holding tank (live well) allowing for total replacement of water volume every 10-15 minutes. Backup oxygenation of holding tanks with compressed oxygen is necessary to ensure sturgeon are not stressed onboard and D.O. levels remain above 5 mg/L.
- Fish must be handled with care and kept in water to the maximum extent possible during processing procedures.
- For weight measurements, sturgeon must be supported using a sling or net, and handling should be minimized throughout the procedure.
- Smooth rubber gloves must be worn to reduce abrasion of skin and removal of mucus.

- Shortnose sturgeon (or bycatch) must be allowed to recover before they are released to ensure full recovery, and they must be treated with an electrolyte bath prior to release to help reduce stress and restore slime coat.
- Sturgeon are extremely sensitive to chlorine; therefore, thorough flushing of holding tanks sterilized with bleach would be required between sampling periods.

4.5.2 *Tagging Conditions*

- PIT tags must be used to individually identify all captured fish not previously tagged. Prior to placement of PIT tags, the entire dorsal surface of each fish must be scanned with a waterproof PIT tag reader and visually inspected to ensure detection of fish tagged in other studies. Previously PIT-tagged fish must not be retagged.
- PIT tags must be injected in dorsal musculature anterior to the dorsal fin with the copper antenna oriented up for maximum signal strength and scanned after implantation to ensure proper tag function.
- The rate of PIT tag and Floy tag retention and the condition of fish at the site of tag injection must be documented during the study and results reported to NMFS in annual and final reports.
- Researchers must not use PIT tags larger than 11.5 mm x 2.1 mm on juvenile shortnose sturgeon less than 400 mm in length; and no sturgeon less than 250 mm (10 in TL) should be PIT tagged or have other surgical procedures performed.
- Surgical implantation of ultrasonic transmitters must only be attempted on fish in excellent condition, and must not be attempted on pre-spawning fish in spring, or on fish at the spawning ground.
- During surgical procedures to tag fish, instruments must be sterilized or changed between uses.
- To ensure proper closure of surgical incisions, a single interrupted suturing technique must be applied. Surgical glue should also be placed over incision sites to aid in wound closure and to secure the tag in place until the wound heals.
- The total weight of tags must not exceed 2% of the sturgeon's total body weight unless otherwise authorized by NMFS-OPR.

4.5.3 *Tissue Sampling*

- Care must be used when collecting genetic tissue samples (soft fin tissue clips). Instruments should be changed/disinfected and gloves changed between each fish sampled to avoid possible disease transmission or cross contamination of genetic material.
- Submission and archival of genetic tissue samples must be coordinated with Julie Carter at the NOAA-NOS tissue archive in Charleston, SC (843)762-8547. Samples must be submitted between six and twelve months after collection. Samples may only be used by other researchers with written permission signed by the Permit Holder and NMFS/OPR for submitting genetic samples.
- The Permit Holder may not transfer biological samples to anyone not listed in the application without obtaining prior written approval from NMFS. Any such transfer will be subject to such conditions as NMFS deems appropriate.
- The terms and conditions concerning samples collected under this authorization will remain in effect as long as the material taken is maintained under the authority and responsibility of the Permit Holder.

4.5.4 *Anesthesia*

- Researchers performing anesthesia on shortnose sturgeon must first receive supervised training on shortnose sturgeon or another surrogate species. The Responsible Party or PI must report this training to NMFS prior to the activity.
- Researchers may use MS-222 for anesthetizing shortnose sturgeon at concentrations up to 150 mg/L; such solutions should be made fresh daily.
- Prior to anesthetizing shortnose sturgeon with MS-222, researchers must saturate the solution with dissolved oxygen and buffer it to a neutral pH with sodium bicarbonate.
- To avoid injury to anesthetized sturgeon, researchers must use restraint in containers preventing the animals from jumping or falling out.
- When anesthetizing shortnose sturgeon, researchers must observe fish at all times to establish the proper level of anesthesia has been reached.
- During surgical procedures requiring anesthetization, researchers must irrigate the gills of sturgeon with ample oxygenated water flow to ensure respiration.
- Researchers must observe shortnose sturgeon during anesthetic recovery in a boat-side net pen prior to release to their environment.
- All researchers are required to wear protective clothing, gloves, and goggles when handling MS-222 powder.
- Unused MS-222 solution must be disposed of by using state adopted procedures.

4.5.5 *Marine Mammal and Sea Turtle Interaction*

- In all boating and research activities within the study area, a close watch must be made for marine mammals and sea turtles to avoid interaction and harassment. Researchers are advised to review the marine mammal approach and viewing guidelines online at http://www.nero.noaa.gov/prot_res/mmv/
- The nets must be observed at all times; — “net observing” defined as continual, complete, and thorough visual check of nets at all times while set — and all netting shall be restricted between 30 minutes after sunrise to 30 minutes before sunset.
- Nets may only be set in daylight hours and must not be deployed if animals are sighted within the action area unless they are on seen on a path away from the action area.
- In the unlikely event a marine mammal or sea turtle is captured, the animal must be assessed and if possible, and if safe for the researchers and animal, the animal must be supported to prevent it from drowning. The NOAA Northeast Region Marine Mammal and Sea Turtle Stranding and Entanglement Hotline must be immediately contacted at 978-281-9351 as well as the New Jersey Marine Mammal Stranding Center at (609) 266-0538 (in New Jersey waters) and/or the Marine Education Research and Rehabilitation Institute at (302) 228-5029 (in Delaware waters).
- In the unlikely event a captured marine mammal or sea turtle dies or is severely injured, all permitted activities must cease and researchers must contact the NOAA Northeast Region Marine Mammal and Sea Turtle Stranding and Entanglement Hotline at 978-281-9351, as well as the Chief, Permits Division and/or the permit analyst at (301) 713-2289.

4.5.6 *Atlantic Sturgeon Interaction*

- If an Atlantic sturgeon is incidentally captured, NMFS requests that it minimally be PIT tagged, genetically sampled, and released.
- NMFS requests reports of any Atlantic sturgeon interactions to Kim Damon-Randall, NMFS OPR at 978-281-9300 x 6535; (Kimberly.Damon-Randall@noaa.gov). This report should contain the description of the take including lethal take, location, and final disposition of the sturgeon. Specimens or body parts of dead Atlantic sturgeon should be preserved (preferably on ice or refrigeration) until sampling and disposal procedures are discussed with NMFS.

4.5.7 *Aquatic Nuisance Species*

- To prevent potential spread of aquatic nuisance species identified in the watershed, all equipment assigned to the research should not be reassigned to other watersheds until the research is completed or is suspended.
- If the research has been completed or is suspended, all gear and equipment used should be bleached, washed and air dried before being redeployed to another location.

4.5.8 *Other Mitigation Measures*

- Environmental sampling data (e.g., dissolved oxygen, temperature, net set duration, and other data associated with capture) must be recorded (Appendix 4) and be made available to NMFS in annual reports, or when requested periodically.
- Careful and detailed records should be kept on the time of recovery and other responses from anesthesia, handling, tissue sampling, fin-ray removal as well the condition and health and tag retention of any recaptured shortnose sturgeon. This information must be reported to NMFS in annual reports.

4.6 UNAVOIDABLE ADVERSE EFFECTS

The research activities would cause unavoidable disturbance, stress, and injury to the captured shortnose sturgeon and other non-target species (temporarily interrupting normal activities such as feeding). The proposed research could also have some incidental lethal effects on some individuals based on planned invasive surgery. Risk from capture, the effect on the animals and the removal of a limited number of eggs/larvae is not expected to have an adverse or long-term effect on target or non-target individuals or populations.

The measures required by permit conditions are intended to reduce, to the maximum extent practical, the potential for adverse effects of the research on all species. However, because the research involves wild animals not accustomed to being captured, the research activities would unavoidably result in harassment.

4.7 CUMULATIVE EFFECTS

In addition to the direct and indirect effects assessed above, in accordance with NEPA, this EA considers the potential for cumulative effects. Cumulative effects are those that result from incremental impacts of a proposed action which when added to other past, present, and reasonably foreseeable future threats or actions, regardless of which agency (federal or nonfederal) or person(s) undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time. For shortnose sturgeon range-wide, these effects include: research, bycatch, poaching, artificial propagation, dams, dredging, blasting, water quality and contaminants.

4.7.1 Other Shortnose Sturgeon Research Permits

Shortnose sturgeon have been the focus of field studies since the 1970's. The primary purpose of this research is for monitoring populations and gathering data for physiological, behavioral and ecological studies. Over time, NMFS has issued dozens of permits for takes of shortnose sturgeon within its range for a variety of activities including capture, handling, lavage, laparoscopy, bloodwork, habitat, spawning verification, genetics, aging, and tracking. Research on shortnose sturgeon in the U.S. is carefully controlled and managed so it does not operate to the disadvantage of the species. As such, all scientific research permits are also conditioned with mitigation measures to ensure that the research impacts target and non-target species as minimally as possible.

Range wide, there are currently 16 active scientific research permits targeting shortnose sturgeon with similar research objectives as is proposed in the current application in the Delaware River (See Appendix 1). Current shortnose sturgeon research in the Delaware River is associated with Permit No. 1486 focusing on industrial development and current plans for dredging by the US Army, Corps

of Engineers. Various other researchers studying the closely related Atlantic sturgeon also impact shortnose sturgeon and its habitat to some extent.

A Biological Opinion was issued for each of the permits, including the requirement for consideration of cumulative effects to the species (as defined for ESA). For each permit, the Biological Opinion concluded that issuance, as proposed, was not likely to jeopardize the continued existence of the shortnose sturgeon, either individually or cumulatively.

4.7.2 *Bycatch and Poaching*

4.7.2.1: *Bycatch*

Directed harvest of both shortnose and Atlantic sturgeon is prohibited. As stated earlier, shortnose sturgeon are listed as endangered under the ESA and therefore prohibited from take. In 1998, the Atlantic States Marine Fisheries Commission (ASMFC) imposed a coast-wide fishing moratorium on Atlantic sturgeon until 20 year classes of adult females could be established (ASMFC 1998). NMFS followed this action by closing the Exclusive Economic Zone (EEZ) to Atlantic sturgeon take in 1999. Shortnose sturgeon has likely benefited from this closure as any bycatch in the fishery targeting Atlantic sturgeon (primarily for meat since the 1950s) has been eliminated.

Although directed harvest of shortnose sturgeons has been prohibited since 1967, bycatch of this species has been documented in other fisheries throughout its range. Adults are believed to be especially vulnerable to fishing gears for other anadromous species (such as shad, striped bass and herring) during times of extensive migration – particularly the spawning migration upstream, followed by movement back downstream (Litwiler 2001). Additionally, bycatch in the southern trawl fishery for shrimp *Penaeus* spp. was estimated at 8% in one study (Collins *et al.* 1996).

The 1998 Recovery Plan for shortnose sturgeon lists commercial and recreational shad fisheries as a source of shortnose bycatch. Although shortnose sturgeon are primarily captured in gillnets, they have also been documented in the following gears: pound nets, fyke/hoop nets, catfish traps, shrimp trawls and hook and line fisheries (recreational angling).

Bycatch in the gillnet fisheries can be quite substantial and is believed a significant threat to the species. The catch rates in drift gillnets are believed to be lower than for fixed nets; longer soak times of the fixed nets appear to be correlated with higher rates of mortalities. In an American shad gillnet fishery in South Carolina, of 51 fish caught, 16% were bycatch mortality and another 20% of the fish were visibly injured (Collins *et al.* 1996).

4.7.2.2: *Poaching*

There is evidence of shortnose sturgeon targeted by poachers throughout their range, and particularly where they appear in abundance (such as on the spawning grounds) but the extent this is occurring is difficult to assess (Dadswell 1979, Dovel *et al.* 1992, Collins *et al.* 1996). There have been several documented cases of shortnose sturgeon caught by recreational anglers. One shortnose sturgeon illegally taken on the Delaware River was documented by a NJ DFW conservation officer in Trenton New Jersey (NJCOA 2006). Additionally, citations have been issued for illegal recreational fishing of shortnose in the vicinity of Troy, New York on the Hudson River and on the Cooper River in South Carolina.

Poaching has also been documented for other sturgeon species in the United States. Cohen (1997) documented poaching of Columbia River white sturgeon sold to buyers on the U.S. east coast. Poaching of Atlantic sturgeon has also been documented by law enforcement agencies in Virginia, South Carolina and New York and is considered a potentially significant threat to the species, but the present extent and magnitude is largely unknown (ASPR T 2008).

4.7.3 *Artificial Propagation*

Since there are aquaculture or research facilities currently raising captive shortnose sturgeon on watersheds of native shortnose sturgeon, there is a potential for escapement and impact to the wild population. Potential threats from aquaculture escapement include the genetic alterations to native populations and potential competition for space and resources between hatchery-reared and wild fish. Further, since most sturgeon diseases have been documented in captive-reared fish, there is also the chance that escapees could spread pathogens and disease. To date, there have been no reports of escapees from the two facilities in Canada or from the USFWS facilities in South Carolina and Georgia. However, on the Connecticut River six fish artificially spawned from adults captured at Holyoke were released with radio tags upstream of the Holyoke Dam in 1989 and 1990 and they were subsequently never recovered. Additionally, several juveniles were accidentally released in 2006 and unrecovered.

There are currently two private companies producing shortnose sturgeon in Canada. Both are located on the Saint John River and one is currently operating at a commercial scale. In the United States, the USFWS has been raising shortnose sturgeon (NMFS Permit No. 1604) for approximately 22 years. Until recently Bears Bluff National Fish Hatchery located on Wadmalaw Island in South Carolina raised the bulk of these fish while some fish were also reared at the USFWS' Warm Springs, GA and Orangeburg, SC hatcheries. Propagation of shortnose sturgeon at the Bears Bluff facility ended in the spring of 2008 but a subset of the broodstock and offspring are still maintained at Warm Springs and Orangeburg.

Captive shortnose sturgeon are also maintained by the USGS at the Conte Anadromous Fish Research Center (Permit No. 1549) located on the Connecticut River. These stocks are held in quarantine and are primarily used as test animals for upstream and downstream fish passage studies, but some progeny are also made available to other research facilities and educational display aquaria when requested. The F-1 progeny are produced periodically using wild native fish from the Connecticut River in a *living stream* natural spawning environment; however, hatchery protocol is not a research objective at the facility.

4.7.4 *Dams*

Dams are used to impound water for water resource projects such as hydropower generation, irrigation, navigation, flood control, industrial and municipal water supply, and recreation. Dams can have profound effects on diadromous fish species by fragmenting populations, eliminating or impeding access to historic habitat, modifying free-flowing rivers to reservoirs and altering downstream flows and water temperatures. Direct physical damage and mortality can occur to diadromous fish that migrate through the turbines of traditional hydropower facilities or as they attempt to move upstream using fish passage devices.

In addition to dams impeding anadromous fish migration and associated mortalities, Hill (1996) identified the following potential impacts from hydropower plants: altered DO concentrations; artificial destratification; water withdrawal; changed sediment load and channel morphology; accelerated eutrophication and change in nutrient cycling; and contamination of water and sediment. Furthermore, activities associated with dam maintenance, such as dredging and minor excavations along the shore, can release silt and other fine river sediments that can be deposited in nearby spawning habitat. Dams can also reduce habitat diversity by forming a series of homogeneous reservoirs; these changes generally favor different predators, competitors and prey, than were historically present in the system (Auer 1996a).

The effects of dams on populations of shortnose sturgeon are generally well documented (Kynard 1998, Cooke *et al.* 2004). However, there may be some rivers where shortnose sturgeon have been extirpated almost without notice due to the construction of impassable dams. In these rivers historical presence of shortnose sturgeon was likely but unknown; there are historical accounts of sturgeon but it is unclear if both Atlantic and shortnose sturgeon used the river and if the river supported spawning of either species. For example, the Susquehanna River is the second largest river on the east coast of the U.S. and there are historical and anecdotal accounts of plentiful “sturgeon” upriver. Currently the Susquehanna has four mainstem dams, the lowermost of which is at approximately rkm 16. The dam has a fish lift but it is not used by shortnose sturgeon. If the Susquehanna River once supported a population of shortnose sturgeon, it is no longer available to them.

Perhaps the biggest impact dams have on shortnose sturgeon is the loss of upriver spawning and rearing habitat. Migrations of shortnose sturgeon in rivers without barriers are wide-ranging with total distances exceeding 200 km or more depending on the river system (Kynard 1997). The construction of dams has blocked upriver passage for the majority of the shortnose sturgeon populations. Dams have restricted spawning activities to areas below the impoundment, often in close proximity to the dam (Kynard 1997, Cooke *et al.* 2004). The suitability of riverine habitat for shortnose sturgeon spawning and rearing depends on annual fluctuations in flow, which can be greatly altered or reduced by the presence and operation of dams (Cooke *et al.* 2004). Effects on spawning and rearing may be most dramatic in hydropower facilities that operate in peaking mode (Auer 1996a). Daily peaking operations store water above the dam when demand is low and release water for electricity generation when demand is high, creating substantial, daily fluctuations in flow and temperature regimes. Kieffer and Kynard (*in press*), have documented that flow fluctuations for hydroelectric power generation affected access to spawning habitat and possibly deterred spawning of shortnose sturgeon on the Connecticut River. Similar results were reported in studies conducted for lake sturgeon *A. fulvescens* in the Sturgeon River, Michigan (Auer 1996b) and white sturgeon *A. transmontanus* in the Columbia River, Oregon and Washington (Parsley and Beckman 1994). Kieffer and Kynard (*in review*), have also observed flow regimes from an upstream hydroelectric facility that were either so forceful that they scoured the shortnose sturgeon rearing shoals or so low that the shoals were dry and exposed. Auer (1996b) demonstrated that there is greater spawning success of lake sturgeon on the Sturgeon River, MI, when facilities operated in the more natural “run-of-the-river” mode.

4.7.5 *Dredging and Blasting*

4.7.5.1: *Dredging*

Many rivers and estuaries are periodically dredged for flood control or to support commercial shipping and recreational boating. Dredging also aids in construction of infrastructure and in marine mining. Dredging may have adverse impacts on aquatic ecosystems including direct removal/burial of organisms; turbidity; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat and actual loss of riparian habitat (Chytalo 1996, Winger *et al.* 2000).

Dredges are generally either mechanical or hydraulic. Mechanical dredges are used to scoop or grab bottom substrate and are capable of removing hard-packed materials and debris. Mechanical dredge types are clamshell buckets; endless bucket conveyor, or single backhoe or scoop bucket types; however, these dredge types often have difficulty retaining fine materials in the buckets and do not dredge continuously. Material excavated from mechanical dredging is often loaded onto barges for transport to a designated placement site (USACOE 2008).

Hydraulic dredges are used principally to dredge silt, sand and small gravel. Hydraulic dredges include cutterhead pipeline dredges and self-propelled hopper dredges. Hydraulic dredges remove material from the bottom by suction, producing slurry of dredged material and water, either pumped directly to a placement site, or in the case of a hopper dredge, into a hopper and later transported to a dredge spoil site. Cutterhead pipeline dredges can excavate most materials including some rock without blasting and can dredge almost continuously (USACOE 2008).

The impacts of dredging operations on sturgeon are often difficult to assess. Hydraulic dredges can lethally take sturgeon by entraining sturgeon in dredge drag arms and impeller pumps (NMFS 1998). Mechanical dredges have also been documented to lethally take shortnose sturgeon (Dickerson 2006). In addition to direct effects, indirect effects from either mechanical or hydraulic dredging include destruction of benthic feeding areas, disruption of spawning migrations, and deposition of resuspended fine sediments in spawning habitat (NMFS 1998).

Another critical impact of dredging is the encroachment of low D.O. and high salinities upriver after channelization (Collins *et al.* 2001). Adult shortnose sturgeon can tolerate at least short periods of low D.O. and high salinities, but juveniles are less tolerant of these conditions in laboratory studies. Collins *et al.* (2001) concluded harbor modifications in the lower Savannah River have altered hydrographic conditions for juvenile sturgeon by extending high salinities and low D.O. upriver.

In addition to the impacts of dredging noted above, Smith and Clugston (1997) reported that dredging and filling eliminates deep holes, and alter rock substrates. Nellis *et al.* (2007) documented that dredge spoil drifted 12 km downstream over a 10 year period in the Saint Lawrence River, and that those spoils have significantly less macrobenthic biomass compared to control sites. Using an acoustic trawl survey, researchers found that Atlantic and lake sturgeon were substrate dependent and avoided spoil dumping grounds (McQuinn and Nellis, 2007). Similarly, Hatin *et al.* (2007) tested whether dredging operations affected Atlantic sturgeon behavior by comparing CPUE before and after dredging events in 1999 and 2000. The authors documented a three to seven-fold reduction in Atlantic sturgeon presence after dredging operations began, indicating that sturgeon avoid these areas during operations.

4.7.5.2 *Blasting:*

Bridge demolition and other projects may include plans for blasting with powerful explosives. Fish are particularly susceptible to effects of underwater explosions and are killed over a greater range than other organisms (Lewis 1996). Unless proper precautions mitigate the damaging effects of shock wave transmission to physostomous fish like shortnose sturgeon, internal damage and/or death may result (NMFS 1998).

A study testing the effects of underwater blasting on juvenile shortnose sturgeon and striped bass was conducted in Wilmington Harbor, NC in December 1998, and January 1999 (Moser 1999). There were seven test runs including 32-33 blasts (3 rows with 10-11 blast holes per row and each hole ~ 10 ft apart) with about 24-28 kg explosives per hole. For each blast 50 hatchery reared shortnose sturgeon and striped bass were placed in cages three feet from the bottom at distances of 35, 70, 140, 280 and 560 ft upstream and downstream of the blast area. A control group of 200 fish was held 0.5 miles from the blast site (Moser 1999). Test blasting was conducted with and without an air curtain in-place 50 ft from the blast site. Survival was similar for both species. External assessments of impacts to the caged fish were conducted immediately after the blasts and 24 h later. After the 24 h period, a subsample of the caged fish, primarily from those cages nearest the blast, at 35 ft and some from 70 ft, were sacrificed for later necropsy.

Externally, shortnose sturgeon and striped bass selected for necropsy all appeared to be in good condition externally and behaviorally after blasts. However, results of necropsies found that many had substantial internal injuries. Moser concluded many of the injuries would have resulted in eventual mortality (Moser 1999). Therefore, based on necropsy results, an apparent estimate of mortality was conducted finding that fish held in cages at 70 ft from blast sites were less seriously impacted by the test blasting than those held at 35 ft. Lastly, it was concluded shortnose sturgeon suffered fewer, less severe internal injuries than striped bass tested. For striped bass and shortnose sturgeon held in cages at 35 ft, approximately 66 and 12 percent, respectively, would have probably not survived the blasts due to their internal injuries. Also there appeared to be no reduction of injury in fish experiencing blasts while air curtains were in place

4.7.6 *Water Quality and Contaminants*

The quality of water in river/estuary systems is affected by human activities conducted in the riparian zone and those conducted more remotely in the upland portion of the watershed. Industrial activities can result in discharges of pollutants, changes in water temperature and levels of D.O., and the addition of nutrients. In addition, forestry and agricultural practices can result in erosion, run-off of fertilizers, herbicides, insecticides or other chemicals, nutrient enrichment and alteration of water flow. Coastal and riparian areas are also heavily impacted by real estate development and urbanization resulting in storm water discharges, non-point source pollution, and erosion.

The water quality over the range of shortnose sturgeon varies by watershed but is notably poorer in the north than in the south. The U.S. Environmental Protection Agency (EPA) published its second edition of the National Coastal Condition Report (NCCR II) in 2005, a “report card” summarizing the status of coastal environments along the coast of the United States (USEPA 2005; See Table 4 below). The report analyzes water quality, sediment, coastal habitat, benthos, and fish contaminant indices to determine status. The Northeast Region and the Chesapeake Bay received grades of F. The Southeast region received an overall grade of B-, the best rating in the nation.

Table 4. Summary of the USEPA National Coastal Condition Report (NCCR II) for the U.S. east coast published by the U.S. Environmental Protection Agency (2005) grading coastal environments. (Northeast Region = ME through DE; Southeast Region = NC-FL; and the Chesapeake Bay = Maryland to Delaware).

Status Index	Region		
	Northeast	Chesapeake Bay	Southeast
Water Quality	D	F	B
Sediment	F	F	B
Coastal Habitat	B	-	C
Benthos	F	F	C
Fish Tissue	F	F	A
Overall	F	F	B-

Areas of concern having poor index scores were: 1) Hudson River – water quality, sediment, and tissue contaminants, 2) Delaware River – water quality and tissue contaminants, 3) Upper Chesapeake Bay – water quality and sediment, 4) Potomac River – sediment, 5) Pamlico Sound – water quality, 6) ACE Basin – water quality, and 7) St. Johns River – sediment. There was also a mixture of poor benthic scores scattered along the Northeast and Southeast region.

Although the south region scored relatively well in terms of water quality, low D.O. and elevated temperatures in the south may limit available habitat and survival of juvenile shortnose sturgeon. Secor (1995) noted a correlation between low abundances of sturgeon during this century and decreasing water quality caused by increased nutrient loading and the increased spatial and temporal frequency of hypoxic conditions. Further, Secor and Gunderson (1998) and Collins *et al* (2001) hypothesized survival of juvenile sturgeon in estuaries may be compromised due to combined effects of increased hypoxia and temperature in nursery areas impacted by human activity. Hypoxia affects sturgeon species more than other fish species due to their limited ability to oxyregulate at low D.O. (Secor and Gunderson 1998, Secor 2002). Sturgeon’s first year of life may leave it particularly susceptible to hypoxia owing to high sensitivities to low D.O. at early life stages and the limited means to escape from hypoxic waters (Secor and Niklitschek 2001).

Niklitschek (2001) modeled suitable habitat availability for juvenile shortnose and Atlantic sturgeon in the Chesapeake Bay using a multivariable bioenergetics and survival model. Results indicated the cumulative stresses of hypoxia, high temperatures and salinity during summer months caused large reductions in potential nursery habitat for both species during 1990-1999 (Niklitschek 2001). The modeling established during dry years, when persistent hypoxia in deeper areas consistently precluded access to thermal refuges, there may little suitable habitat for juvenile sturgeon.

The EPA adjusted open water minimum DO-criteria for the Chesapeake Bay (increased from ~2 ppm to 3.5 ppm) to provide protection specifically for sturgeon species, requiring higher levels of D.O. than other fish species (USEPA 2003). Niklitschek and Secor (2005) modeled the achievement of EPA’s D.O. criteria for Atlantic sturgeon predicting available habitat for Atlantic sturgeon would increase by 13% per year, while an increase of water temperature by 1°C would reduce available habitat by 65%. Similar results may occur for sturgeons in southern rivers where high water temperatures and low D.O. are a common occurrence during the summer months.

Life history of shortnose sturgeon (i.e., long lifespan, extended residence in estuarine habitats, benthic foraging) predispose them to long-term, repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants (Dadswell 1979, NMFS 1998). However, there has been little work on the effects of contaminants on shortnose sturgeon to date.

Chemicals and metals such as chlordane, dichlorodiphenyl dichloroethylene (DDE), DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web (e.g. to sturgeon). Some of these compounds may affect physiological processes and impede a fish's ability to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other physical properties of the water body.

Although there have been very few analyses of shortnose sturgeon tissues for contaminants, shortnose sturgeon collected from the Delaware and Kennebec rivers had total toxicity equivalent concentrations of polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), PCBs, DDE, aluminum, cadmium, and copper above adverse effect concentration levels reported in the literature (ERC 2002, 2003). In the Hudson, six fish have been tested over the past 37 years. Most fish carried very high burden load of PCBs, or one of its derivatives (DDT).

Dioxin and furans were detected in ovarian tissue from shortnose sturgeon caught in the Sampit River/Winyah Bay system (SC). Results showed that four out of seven fish tissues analyzed contained tetrachlorodibenzo-*p*-dioxin (TCDD) concentrations greater than 50 pg/g (parts-per-trillion), a level which can adversely affect the development of sturgeon fry (J. Iliff, NOAA Habitat Restoration Division, Silver Spring, MD, unpublished data).

Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not known (Ruelle and Henry 1992, Ruelle and Keenlyne 1993). High levels of contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Cameron *et al.* 1992, Longwell *et al.* 1992, Hammerschmidt *et al.* 2002, Giesy *et al.* 1986, Mac and Edsall 1991, Matta *et al.* 1998, Billsson *et al.* 1998), reduced survival of larval fish (Berlin *et al.* 1981, Giesy *et al.* 1986), delayed maturity (Jorgensen *et al.* 2003) and posterior malformations (Billsson *et al.* 1998). Pesticide exposure in fish may affect anti-predator and homing behavior, reproductive function, physiological maturity, swimming speed and distance (Beauvais *et al.* 2000, Scholz *et al.* 2000, Moore and Waring 2001, Waring and Moore 2004).

Sensitivity to environmental contaminants also varies by life stage. Early life stages of fish appear to be more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976). Dwyer *et al.* (2005) compared the relative sensitivities of common surrogate species used in contaminant studies to 17 listed species including shortnose and Atlantic sturgeons. The study examined 96-hour acute water exposures using early life stages where mortality is an endpoint. Chemicals tested were carbaryl, copper, 4-nonphenol, pentachlorophenol (PCP) and permethrin. Of the listed species, Atlantic and shortnose sturgeon were ranked the two most sensitive species tested (Dwyer *et al.* 2005). Additionally, a study examining the effects of coal tar, a byproduct of the process of destructive distillation of bituminous coal, indicated that components of coal tar are toxic to shortnose sturgeon embryos and larvae in whole sediment flow-through and coal tar elutriate static renewal (Kocan *et al.* 1993).

Lastly, the operation of power plants can have unforeseen and detrimental impacts to water quality which can affect shortnose sturgeon. For example, the St. Stephen Power Plant near Lake Moultrie, South Carolina was shut down for several days in June 1991 when large mats of aquatic plants entered the plant's intake canal and clogged the cooling water intake gates (Balciunas *et al.* 2002). Decomposing plant material in the tailrace canal coupled with the turbine shut down (allowing no flow of water) triggered a low D.O. water condition downstream and a subsequent fish kill. The South Carolina Wildlife and Marine Resources Department reported that twenty shortnose sturgeon were killed during this low D.O. event.

4.7.7 *Summary of Cumulative Impacts*

Effects of past and ongoing human and natural factors and current threats (fisheries, water quality, dams, existing NMFS research permits, and other actions) are occurring (or have occurred) in or near the action area that have contributed to the current status of the species, are described above, and are also included in the baseline section of the Biological Opinion issued for this proposed research activity. These activities and threats are expected to continue into the future.

Overall, the preferred alternative would not be expected to have more than short-term effects on shortnose sturgeon if sturgeon are present in the research locations. The impacts of the non-lethal research activities are not expected to have more than short-term effects on individual animals and any increase in stress levels from the capture and handling would dissipate rapidly. Even if an animal was exposed to additional capture (e.g., a week later), no significant cumulative effects from the research itself would be expected given the nature of the effects. Based on the analysis in this EA and supported by the Biological Opinion (January 2010) NMFS expects that the proposed authorization of shortnose sturgeon research activities of the preferred alternative would not appreciably reduce the species likelihood of survival and recovery in the wild nor would it adversely affect spawning, mortality rates, or recruitment rates. In particular, NMFS expects the proposed research activities not to affect reproductive adults in a way that appreciably reduces their reproductive success, the survival of young, or the number of young that annually recruit into the breeding populations.

The incremental impact of the proposed research on these animals, when added to other past, present, and reasonably foreseeable future actions discussed here, would not be significant at an individual or a population level. Therefore, no species level events would result from the capture, handling, and release of shortnose sturgeon. The data collected during sampling activities linked with the proposed action would help assess movement and habitat use of juvenile shortnose sturgeon found in the Delaware River action area. The research would provide information helpful in managing, conserving, and recovering this species and would outweigh any adverse impacts.

Moreover, the Biological Opinion prepared for File No. 14396 provides an integration and synthesis of the information about the status of the species, past and present activities affecting the species, possible future actions that might affect the species, and effects of the proposed action to provide a basis for determining the additive effects of the take authorized in this permit on ESA listed sturgeon, in light of their present and anticipated future status. The conclusion of the biological opinion for File No. 14396 was the proposed action would not likely jeopardize the continued existence of the species.

The opinion also indicated that NMFS is not aware of any future State, tribal, local, or private actions in the action area that may have a bearing on the risk assessment, and finds that the issuance of the proposed permit would have only negligible impacts to shortnose sturgeon. The analysis of past, present and reasonably foreseeable actions indicates that no cumulatively significant impacts would occur associated with the proposed action.

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Appendix 1

Existing shortnose sturgeon research permits authorized for wild populations.			
Permit No.	Location	Authorized Take	Research Activity
<u>10115</u> Expires: 8/3/2013	Saltilla & St. Marys Rivers, GA & FL	85 adult/juv 20 ELS	Capture, handle, measure, weigh, PIT tag, tissue sample, collect ELS
<u>14394</u> Expires: 9/30/14	Altamaha River and Estuary, GA	500 adult/juv. (1 lethal), 100 ELS	Capture, handle, weigh, measure, PIT tag, transmitter tag, tissue sample, anesthetize, laparoscopy, blood collection, fin ray section, collect ELS
<u>10037</u> Expires: 4/30/2013	Ogeechee River and Estuary, GA	150 adult/juv. (2 lethal), 40 ELS	Capture, handle, measure, weigh, PIT tag, tissue sample, fin-ray section, anesthetize, laparoscopy, blood collection, radio tag, collect ELS
<u>1447</u> Expires: 2/28/2012	S. Carolina Rivers and Estuaries	100 adult/juv. (2 lethal), 100 ELS	Capture, handle, measure, weigh, PIT and DART tag, transmitter tag, anesthetize, tissue sample, gastric lavage, collect ELS
<u>1505</u> Expires: 5/15/2011	S. Carolina Rivers and Estuaries	98 adult/juv. (2 lethal), 200 ELS	Capture, handle, measure, weigh, PIT and DART tag, transmitter tag, anesthetize, laparoscopy, blood collection, tissue sample, gastric lavage, collect ELS
<u>1542</u> Expires: 7/31/2011	Upper Santee River Basin, SC	5 adult/juv.; 100 ELS	Capture, handle, weigh, measure, PIT and dart tag, tissue sample, ELS collection
<u>1543</u> Expires: 11/30/2011	Upper Santee River Basin, SC	3 adult/juv.	Capture, handle, weigh, measure, tissue sample
<u>1486</u> Expires: 1/31/2010	Delaware River and Estuary NJ & DE	1,750 adult/juv. (10 lethal), 1000 ELS	Capture, handle, measure, weigh, Floy & T-bar tag, PIT tag, tissue sample, anesthetize, ultrasonic tag, laparoscopy, blood collection, collect ELS
<u>1547</u> Expires: 10/31/2011	Hudson River, (Haverstraw & Newburgh), NY	500 adults/juv.	Capture, handle, weigh, measure, PIT & Carlin tag, tissue sample
<u>1575</u> Expires: 11/30/2011	Hudson River (Tappan-Zee), NY	250 adult/juv.	Capture, handle, measure
<u>1580</u> Expires: 3/31/2012	Hudson River and Estuary, NY	82 adult/juv.; 40 ELS	Capture, handle, measure, weigh, PIT tag, Carlin tag, photograph, tissue sample, collect ELS
<u>1449</u> Expires: 3/31/2010	Upper Conn. River, MA	80 adult/juv.; 200 ELS	Capture, handle, measure, weigh, PIT tag, external radio tag, collect ELS
<u>1549</u> Expires: 1/31/2012	Upper Conn. River, MA	673 adult/juv (5 lethal), 1,430 ELS from East Coast rivers	Capture, handle, measure, weigh, anesthetize, PIT tag, TIRIS tag, radio tag, temperature/depth tag, tissue sample, borescope, laboratory tests, photographs, collect ELS
<u>1516</u> Expires: 5/15/2011	Lower Conn. River & Estuary, CT	500 adult/juv (2 lethal); 300 ELS	Capture, handle, measure, weigh, PIT tag, sonic/radio tag, gastric lavage, fin ray section, collect ELS
<u>1578</u> Expires: 11/30/2011	Kennebec River and Estuary, ME	500 adult/juv.; 30 ELS	Capture, handle, measure, weigh, tissue sample, PIT tag, acoustic tag, anesthetize, collect ELS
<u>1595-03</u> Expires: 3/31/2012	Penobscot River and Estuary, ME	200 adult/juv. (2 lethal); 50 ELS	Capture, handle, measure, weigh, borescope, photograph, tissue sample, blood sample, Carlin tag, PIT tag, anesthetize, transmitter tag, collect ELS

Appendix 2



Species Reports

Environmental Conservation Online System

How many listed species currently occur in and are listed in **Delaware?**

Species listed in this state and that occur in this state -- 16 listings

Animals -- 12

<u>Status</u>	<u>Species/Listing Name</u>
T	Plover, piping except Great Lakes watershed (Charadrius melodus)
T	Sea turtle, green except where endangered (Chelonia mydas)
E	Sea turtle, hawksbill (Eretmochelys imbricata)
E	Sea turtle, Kemp's ridley (Lepidochelys kempii)
E	Sea turtle, leatherback (Dermochelys coriacea)
T	Sea turtle, loggerhead (Caretta caretta)
E	Squirrel, Delmarva Peninsula fox Entire, except Sussex Co., DE (Sciurus niger cinereus)
E	Sturgeon, shortnose (Acipenser brevirostrum)
T	Turtle, bog (=Muhlenberg) northern (Clemmys muhlenbergii)
E	Whale, finback (Balaenoptera physalus)
E	Whale, humpback (Megaptera novaeangliae)
E	Whale, right (Balaena glacialis (incl. australis))

Plants -- 4

<u>Status</u>	<u>Species/Listing Name</u>
T	Amaranth, seabeach (Amaranthus pumilus)
E	Dropwort, Canby's (Oxypolis canbyi)
T	Pink, swamp (Helonias bullata)
T	Pogonia, small whorled (Isotria medeoloides)

Last updated: August 13, 2009



Species Reports

Environmental Conservation Online System

How many listed species currently occur in and are listed in New Jersey?

Species listed in this state and that occur in this state -- 20 listings

Animals -- 14

<u>Status</u>	<u>Species/Listing Name</u>
E	Bat, Indiana (Myotis sodalis)
T	Plover, piping except Great Lakes watershed (Charadrius melodus)
E	Sea turtle, hawksbill (Eretmochelys imbricata)
E	Sea turtle, Kemp's ridley (Lepidochelys kempii)
E	Sea turtle, leatherback (Dermochelys coriacea)
T	Sea turtle, loggerhead (Caretta caretta)
E	Sturgeon, shortnose (Acipenser brevirostrum)
E	Tern, roseate northeast U.S. nesting pop. (Sterna dougallii dougallii)
T	Tiger beetle, northeastern beach (Cicindela dorsalis dorsalis)
T	Turtle, bog (=Muhlenberg) northern (Clemmys muhlenbergii)
E	Wedgemussel, dwarf (Alasmidonta heterodon)
E	Whale, finback (Balaenoptera physalus)
E	Whale, humpback (Megaptera novaeangliae)
E	Whale, right (Balaena glacialis (incl. australis))

Plants -- 6

<u>Status</u>	<u>Species/Listing Name</u>
T	Amaranth, seabeach (Amaranthus pumilus)
T	Beaked-rush, Knieskern's (Rhynchospora knieskernii)
E	Chaffseed, American (Schwalbea americana)
T	Joint-vetch, sensitive (Aeschynomene virginica)
T	Pink, swamp (Helonias bullata)
T	Pogonia, small whorled (Isotria medeoloides)

Last updated: August 13, 2009



Species Reports

Environmental Conservation Online System

How many listed species currently occur in and are listed in **Pennsylvania?**

Species listed in this state and that occur in this state -- 13 listings

Animals -- 10

<u>Status</u>	<u>Species/Listing Name</u>
E	Bat, Indiana (Myotis sodalis)
E	Clubshell Entire Range; Except where listed as Experimental Populations (Pleurobema clava)
E	Mucket, pink (pearlymussel) (Lampsilis abrupta)
E	Pigtoe, rough (Pleurobema plenum)
E	Pimpleback, orangefoot (pearlymussel) (Plethobasus cooperianus)
E	Plover, piping Great Lakes watershed (Charadrius melodus)
E	Riffleshell, northern (Epioblasma torulosa rangiana)
E	Ring pink (mussel) (Obovaria retusa)
T	Turtle, bog (=Muhlenberg) northern (Clemmys muhlenbergii)
E	Wedgemussel, dwarf (Alasmidonta heterodon)

Plants -- 3

<u>Status</u>	<u>Species/Listing Name</u>
E	Bulrush, Northeastern (Scirpus ancistrochaetus)
T	Pogonia, small whorled (Isotria medeoloides)
T	Spiraea, Virginia (Spiraea virginiana)

Last updated: August 13, 2009



JAN 11 2010

Finding of No Significant Impact
For Issuance of a Scientific Research Permit (File No. 14396) to the Delaware
Department of Natural Resources and Environmental Control-Division of Fish and
Wildlife (DNREC-DFW) to Conduct Research on Endangered Shortnose Sturgeon
(*Acipenser brevirostrum*)

National Marine Fisheries Service

On August 18, 2009, the National Marine Fisheries Service, Office of Protected Resources (NMFS PR) received an application (File 14396) from the Delaware Department of Natural Resources and Environmental Control-Division of Fish and Wildlife (DNREC-DFW) (Craig Shirey, Responsible Party) for a permit to conduct shortnose sturgeon research on the Delaware River.

In accordance with the National Environmental Policy Act (NEPA), NMFS prepared an Environmental Assessment (EA) analyzing the impacts on the human environment associated with permit issuance (*Environmental Assessment on the effects of issuance of a scientific research permit (File No. 14396) to conduct research on shortnose sturgeon in the Delaware River, January 2010*). In addition, a Biological Opinion was issued under Section 7 of the Endangered Species Act (ESA) (*Biological Opinion on the Permits, Conservation and Education Division's proposal to issue a Permit (Number 14396) to the Delaware Department of Natural Resources and Environmental Control-Division of Fish and Wildlife (DNREC-DFW) for research on shortnose sturgeon in the Delaware River pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973.*) The analyses in the EA, as informed by the Biological Opinion, support the following findings and determination.

The applicant is requesting authorization to locate and document early juvenile (< 500 mm total length) shortnose sturgeon nursery areas and assess individual movement patterns, seasonal movements, home ranges, and habitat use of shortnose sturgeon in the Delaware River.

The National Oceanic and Atmospheric Administration's Administrative Order 216-6 (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) NEPA implementing regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1. Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat (EFH) as defined under the Magnuson - Stevens Act and identified in Fishery Management Plans?

Response: The proposed netting activity would take place principally in the Middle Delaware River (rkm 119-148), and would not take place in national marine sanctuaries. No coral reef ecosystems occur in the action area and thus none would be affected. Designated essential fish habitat (EFH) exists for twenty-six managed species in the lower Delaware Bay in New Jersey and Delaware waters; however, these occur well downstream of the designated areas for gill netting. Although the researcher's boats would pass through and over the water column in areas where EFH does exist in the Delaware River (when traveling to telemetry receivers to download data), NMFS determined this portion of the researcher's activity would not adversely impact the physical environment, including any portion considered EFH.

The impacts from research activities to the middle Delaware river bottom would be during capture; however, with the mitigation measures set forth in the permit, only minimal disturbance of the benthic organisms/substrate is anticipated. Therefore, no long-term disturbance of habitats is expected.

2. Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: No substantial impact on biodiversity or ecosystem function within the affected area is expected. The bottom substrate of the Delaware River is sandy loam sediment with some rocky substrate in the upper branches of the action area. The impacts to the river bottom would be during capture (gillnet); however, with minimal contact in localized areas of the river in addition to the mitigation measures set forth in the permit, we expect minimal disturbance of the benthic organisms and substrate.

Due to the nature of netting, the researchers would expect that some other non-target species would become enmeshed. Other non-target species collected in the past during gill netting by the applicant include blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), Atlantic menhaden (*Brevoortia tyrannus*), striped bass (*Morone saxatilis*), white perch (*Morone americana*), channel catfish (*Ictalurus punctatus*), and white catfish (*Ameiurus catus*). Non-target fish will be removed from the net and released at the site of capture. However, nets would be checked at short intervals and it is believed that virtually all by-catch would be released alive without long-term effects on predator-prey relationships.

It is also likely that small numbers of subadult Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) will be taken during sampling for shortnose sturgeon. The Atlantic sturgeon is a candidate species being considered for listing under the Endangered Species Act (ESA). Any Atlantic sturgeon captured would be handled using the same procedures as shortnose sturgeon.

3. Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?

Response: This action would involve the use of 95% ethanol pre-measured in vials for preservation, storage, and transportation of tissue samples. MS-222 powder, used for anesthetizing shortnose sturgeon during surgery, will also be transported in premeasured amounts and mixed onboard. The researchers would wear gloves during sampling; therefore, direct contact with the alcohol or MS-222 would be eliminated. Issuance of the permit is not expected to have substantial adverse impacts on public health or safety that could reasonably be expected by the proposed research activities.

4. Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

Response: The proposed new research activities could potentially have adverse effects on individual endangered shortnose sturgeon which could include mortality, but the effects are not expected to be major at the individual or species level.

The permit activities require standard NMFS research and mitigation protocols to minimize stress and harmful effects on the species. In the Biological Opinion produced for this action, NMFS concluded that issuance of the permit would not likely jeopardize the continued existence of the endangered shortnose sturgeon. Critical habitat has yet to be designated for shortnose sturgeon; thus, none would be affected.

Likewise, by-catch would be returned immediately to the water with minimal exposure to handling stress. Because nets would typically be checked at short intervals, NMFS believes that virtually all by-catch would be released alive. Furthermore, Atlantic sturgeon is considered a “species of concern” occurring in the Delaware River in small numbers; hence, there is potential for Atlantic sturgeon to be caught as by-catch during expanded research activities. Accordingly, the researchers would monitor the nets closely and if this sturgeon species is captured, appropriate measures would be taken to ensure its survival. Additionally, should there be a subsequent Federal listing established for Atlantic sturgeon during the permitted time frame, the effects of the proposed research on Atlantic sturgeon would be analyzed at that time.

Also, in the unlikely event marine mammals or sea turtles are encountered while netting, researchers would be directed by permit conditions to avoid contact with the animals. All netting would be continuously attended; nets would not be deployed when animals are observed within the vicinity of the research; and animals would be allowed to either leave or pass through the area safely before net setting is initiated. Additionally, in all boating activities (including travel to acoustic receiver arrays outside of the netting area) a close watch would be made for marine mammals to avoid harassment or interaction. Contact information for the local Marine Mammal Stranding and Entanglement Hotline is provided in the permit to the researcher for assistance.

5. Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: There would be no significant social or economic impacts interrelated with natural or physical environmental effects.

6. Are the effects on the quality of the human environment likely to be highly controversial?

Response: A *Federal Register* notice (74 FR 42861) was published on August 25, 2009, to allow other agencies and the public the opportunity to review and comment on the action. All agency comments were addressed and responses were included in the decision memos for the modified permit. None of the comments were considered controversial and none were received addressing the proposal's potential effects on the quality of the human environment. No comments from the public were received on this application.

7. Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?

Response: The research methods in the proposed permit have been analyzed under the current January 2010 EA. The activities in this proposed permit would not be expected to result in significant impacts to any unique areas mentioned above.

8. Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: The potential risks by proposed research methods are not unique or unknown, nor is there significant uncertainty about the impacts. Monitoring reports from previous permits of a similar nature, and published scientific information on impacts of shortnose sturgeon, indicate the proposed activities are not likely to result in significant adverse impacts to the human environment or the species. There is considerable scientific information available on the likely impacts of such activities.

9. Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: Overall, the proposed action would be expected to have no more than short-term effects on endangered shortnose sturgeon and no effects on other aspects of the environment. The incremental impact of the action when added to other past, present, and reasonably foreseeable future actions discussed in the environmental assessment would be minimal and not significant.

10. Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: The action would not take place in any district, site, highway, structure, or object listed in or eligible for listing in the National Register of Historic Places, thus none would be impacted. The proposed action would also not occur in an area of significant scientific, cultural or historical resources and thus would not cause their loss or destruction.

11. Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

Response: The U.S. Geological Survey has documented several aquatic nuisance species occurring in the Delaware River watershed having potential to be spread by the actions of the proposed research. However, the researcher has agreed to follow current Delaware State boating regulations limiting the spread of aquatic nuisance species, as referenced by NMFS in Section 4.5.9 of the attached EA. Therefore, the proposed research activities would not be expected to result in the introduction or spread of non-indigenous species to other watersheds. The research activities would also not involve bilge water or other issues of concern relative to nonindigenous species.

12. Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

Response: The decision to issue this permit would not be precedent setting and would not affect any future decisions. NMFS has issued numerous scientific research permits to study shortnose sturgeon pursuant to section 10 of the Endangered Species Act, thus this is not the first permit NMFS has issued for this type of research activity. Issuance of a permit or permit modification, to a specific individual or organization for a given research activity, does not in any way guarantee or imply NMFS would authorize other, or the same, individuals or organizations to conduct the same research activity. Any future requests received would be evaluated upon its own merits relative to the criteria established in the MMPA, ESA, and NMFS' implementing regulations.

13. Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: Issuance of the proposed permit is not expected to violate any Federal, State, or local laws for environmental protection. NMFS has sole jurisdiction for issuance of such permits for shortnose sturgeon and has determined the proposed research to be consistent with all applicable provisions of the ESA. The permit currently contains language stating this permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with any other Federal, State, local, or international laws or regulations. This condition would remain in effect.

14. Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: NMFS concluded the proposed procedures would have potential for effects on individual shortnose sturgeon. However, because shortnose sturgeon are a robust species and have responded well to the types of handling in the proposed action, the cumulative effects on the population in the Delaware River are not expected to be long-term or significant on the target species.

Since a new status review for the Atlantic sturgeon has begun, NMFS has considered the potential for cumulative effects on Atlantic sturgeon as bycatch. Accordingly, NMFS established provisions for monitoring interactions with Atlantic sturgeon and placed conditions in the permit stating if an Atlantic sturgeon is incidentally captured, it must be handled with similar protocols authorized for shortnose sturgeon and at least PIT tagged and genetically sampled. NMFS concluded that since researchers would be monitoring the nets closely and if Atlantic sturgeon are captured, appropriate measures would be taken to ensure survival. NMFS also concluded that should there be a subsequent listing of Atlantic sturgeon coinciding with the proposed research activities, the effects of the research on Atlantic sturgeon would be analyzed at that time.

Likewise, NMFS considered impacts upon potential marine mammal interactions during sturgeon research in the Delaware River. Although interactions with marine mammals would be considered rare based on historical records in the river, the permit would be conditioned so that nets would not be set if marine mammals are seen in the vicinity of the research, and also mandate that the animals must be allowed to leave the area before the nets are set.

DETERMINATION

In view of the information presented in this document and the analysis contained in the Environmental Assessment (EA) prepared for Issuance of Permit No. 14396, pursuant to the ESA, and the ESA section 7 Biological Opinion, it is hereby determined the issuance of Permit No. 14396 will not significantly impact the quality of the human environment as described above. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an Environment Impact Statement for this action is not necessary.



James H. Lecky
Director, Office of Protected Resources

JAN 11 2010

Date