UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

JAN 10 2011

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: SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT for Issuance of Modifications to Scientific Research Permits Nos. 1578-00 and 1595-03 to Conduct Scientific Research on Protected Shortnose Sturgeon in the Gulf of Maine

LOCATION: Netting would take place within the Penobscot River, Kennebec Complex, Saco River, and respective estuaries in the Gulf of Maine (GOM). Researchers would also travel by boat to receivers in the passive telemetry array positioned in river and marine locations.

SUMMARY: The current SEA analyzed the effects of shortnose sturgeon research on the environment within rivers and estuaries in the GOM. The Permit modifications addressed in this SEA are for Permit No. 1578-00 issued to the Maine Division of Marine Resources (MDMR) in 2006, and Permit No. 1595-03 issued to Michael Hastings of the University of Maine (UM) in 2009.

Permit No. 1578 currently authorizes research focusing on the location of spawning habitat, feeding habitat and migratory pathways of shortnose sturgeon (*Acipenser brevirostrum*) in the Kennebec River, between Augusta and Waterville, Maine. The proposed modification (File 1578-01) would change research objectives, as well as expand the geographic scope of the research, increasing numbers of sturgeon sampled, acoustic tags deployed, and new research methods including: borescoping, Floy anchor tagging, blood collection, gastric lavage, electronarcosis and scute sampling.

Permit 1595-03 currently assesses the distribution, abundance, movements and spawning of shortnose sturgeon in the lower Penobscot River and Estuary. The objectives and action area of new research would not be changed in the proposed modification (File 1595-04); however, it proposes increased numbers of sturgeon captured, lower water temperatures for sampling adults and juvenile sturgeon, and new research methods including: scute sampling, Floy anchor tagging, fall egg and larvae sampling, electronarcosis and gastric lavage. Both permit modifications would assist researchers in the future development of collaborative research programs in the GOM determining the number and size of extant populations of shortnose sturgeon and the rate of exchange between coastal river systems.

The proposed action analyzed in the SEA 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 SEA is enclosed for your information.

Although NOAA is not soliciting comments on this completed SEA/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,

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

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JAN 4 2011

SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
For Issuance of Modifications to Scientific Research Permits Nos. 1578-00 and 1595-03 to Conduct Scientific Research on Protected Shortnose Sturgeon in the Gulf of Maine

January 2011

Lead Agency:	U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service, Office of Protected Resources
Responsible Official	James H. Lecky, Director, Office of Protected Resources
For Further Information Contact:	Office of Protected Resources National Marine Fisheries Service 1315 East West Highway Silver Spring, MD 20910 (301) 713-2289
NEPA Documents Supplemented:	(File 1578) Environmental Assessment of Issuance of a Scientific Research Permit to the Maine Department of Marine Resources (Gail Wippelhauser, Principal Investigator) (File No. 1578) to Conduct Research on Endangered Shortnose Sturgeon (File 1595-02) Supplemental Environmental Assessment on the Issuance of a Modification to Scientific Research Permit No. 1595-01 [Michael Hastings, University of Maine] for Shortnose Sturgeon Research in the Penobscot River System, Maine, May 2008

Abstract: The National Marine Fisheries Service (NMFS), Office of Protected Resources, proposes to issue modifications to two scientific research permits for takes of shortnose sturgeon in the wild, 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). The Permit modifications addressed in this SEA are for Permit No. 1578-00 issued to the Maine Division of Marine Resources (MDMR) in 2006, and Permit No. 1595-03 issued to Michael Hastings of the University of Maine (UM) in 2009. This SEA, therefore, supplements the prior respective EA and SEA, and all other minor permit modifications.

Permit No. 1578 currently authorizes research focusing on the location of spawning habitat, feeding habitat, and migratory pathways of shortnose sturgeon (*Acipenser brevirostrum*) in the Kennebec River, between Augusta and Waterville, Maine. The proposed modification (File 1578-01) would change research objectives, as well as expand the geographic scope of the research, increasing numbers of sturgeon sampled, acoustic tags deployed, and new research methods including: borescoping, Floy anchor tagging, blood collection, gastric lavage, electronarcosis and scute sampling.

Permit 1595-03 currently assesses the distribution, abundance, movements and spawning of shortnose sturgeon in the lower Penobscot River and Estuary. The objectives and action area of research would not be changed in the proposed modification (File 1595-04); however, it proposes increased numbers of sturgeon captured, lower water temperatures for sampling adults and juvenile sturgeon, and new research methods including: scute sampling, Floy anchor tagging, fall egg and larvae sampling, electronarcosis and gastric lavage.

Both permit modifications would assist researchers in the future development of collaborative research programs in the Gulf of Maine (GOM) determining the number and size of extant populations of shortnose sturgeon in the GOM and the rate of exchange between coastal river systems.

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CHAPTER 1 PURPOSE OF AND NEED FOR ACTION

1.1 DESCRIPTION OF ACTION

The National Marine Fisheries Service (NMFS), Office of Protected Resources (NMFS PR) proposes to issue two permit modifications: one to the Maine Department of Marine Resources (MDMR) (Gail Wippelhauser, Principal Investigator), and the other to Michael Hastings, Permit Holder, University of Maine (UM), under Section 10(a)(1)(A) of the Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531 *et seq*.), and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR 222-226). These modifications would be valid throughout the rest of the permits, expiring in order November 30, 2011 and March 31, 2012.

1.1.1 *Background*

In response to applications for permit modifications received from the Maine Division of Marine Resources (Gail Wippelhauser, Principal Investigator) [File 1578], and from Michael Hastings (Permit Holder) [File 1595], University of Maine, NMFS proposes to issue modifications to scientific research Permit Nos. 1578 and 1595-03 for "takes" of shortnose sturgeon (*Acipenser brevirostrum*) pursuant to the statute and regulations listed above.

This document therefore supplements the original November 13, 2006, environmental assessment (EA) produced for File 1578 entitled "*Environmental Assessment of Issuance of a Scientific Research Permit to the Maine Department of Marine Resources (Gail Wippelhauser, Principal Investigator) (File No. 1578) to Conduct Research on Endangered Shortnose Sturgeon*;" and the latest May 16, 2008 supplemental environmental assessment (SEA) produced for File 1595-02 entitled "*Supplemental Environmental Assessment on the Issuance of a Modification to Scientific Research Permit No. 1595-01 [Michael Hastings, University of Maine] for Shortnose Sturgeon Research in the Penobscot River System, Maine, May 2008*."

File 1578 has not been modified since the original permit was issued; however, File 1595 was modified with one major modification (File 1595-02) for which an SEA was produced in 2008, and also had two other minor modifications (File 1595-01 and File 1595-03) for which no further analysis of environmental effects were necessary because no additional effects on shortnose sturgeon or other parts of the environment had changed since last analyzed.

A new ESA listing for Atlantic salmon in the GOM Distinct Population Segment (DPS) (74 FR 29344; June 19, 2009) has changed the affected environment substantially. The subsequent listing includes an expanded range for the Atlantic salmon GOM DPS co-occurring with the shortnose sturgeon in the planned modifications. Also not yet analyzed are potential environmental effects of a concurrent designation of Critical Habitat throughout the redefined DPS for GOM Atlantic salmon (74 FR 29300; June 19, 2009). Thus, this SEA will discuss any new potential physical and/or biological environmental impacts of sturgeon research on Atlantic salmon.

1.1.1.1 *Descriptions of Existing and Proposed Permits*:

- ***File 1578*:**

Permit No. 1578-00-- (Existing Permit): Permit 1578-00 was issued November 14, 2006, authorizing the Maine Department of Marine Resources (MDMR) (Gail Wippelhauser, Principal Investigator) to conduct research on shortnose sturgeon in the Kennebec River of Maine and is scheduled to expire November 30, 2011. The permit currently annually authorizes capture of up to 500 shortnose sturgeon with gill nets during the upstream spawning migration from mid-April to mid-June, in the Kennebec River between Augusta, ME (44º 19' N, 69º 46' W) and Waterville, ME (44º 25' N, 69º 43' W). The sampled sturgeon may be measured, weighed, tissue sampled, Passive Integrated Transponder (PIT) tagged, and released. A subset of 20 captured sturgeon are annually authorized to be anesthetized and surgically implanted with acoustic tags. Researchers are also permitted to lethally collect up to 30 sturgeon eggs and larvae using submerged D-nets. No incidental mortality of adults or juveniles is authorized. The permit is scheduled to expire November 30, 2011.

File No. 1578-01-- (Proposed Modification): The researcher is now requesting permission to expand the action area of research to sample shortnose sturgeon adults/juveniles in the Kennebec complex and the Saco River, and also place sonic receivers in other coastal rivers to document sturgeon movement and use. Proposed is an increase of non-lethal sampling of 100 shortnose sturgeon adults/juveniles, from 500 to 600 annually. The applicant also requests increasing eggs and larvae sampled in the fall from 30 to 60. The applicant is also requesting new research methods including, borescopic sex identification, Floy anchor tagging (in place of Carlin tags), scute sampling (up to 40), and blood sampling (up to 20). Also, a subset of captured sturgeon would be anesthetized (using either MS-222 or electronarcosis) and implanted with ultrasonic receivers (up to 60), or receive gastric lavage to obtain gut contents (up to 20).

- ***File 1595*:**

Permit No. 1595-03-- (Existing Permit): Permit 1595-03 (issued March 3, 2009) is the latest modification authorizing Michael Hastings, Permit Holder (University of Maine) to conduct research on shortnose sturgeon in the Penobscot River, Maine, and is scheduled to expire March 31, 2012. The Permit Holder is currently authorized to non-lethally sample up to 200 shortnose sturgeon annually with gill nets in waters ranging in temperature from 7°C to 25°C. All fish are measured (length, weight, photos), genetic sampled, PIT and Carlin tagged, and sexed using a borescope. A subset of up to 30 adult or sub-adult sturgeon are also authorized to be anesthetized with MS-222 and implanted with internal or external sonic tags and blood sampled each year. The use of D-nets and artificial substrates are permitted as methods of collecting up to 50 egg and larvae annually from April – June in water temperatures ranging from 7°C to 25°C (or until spawning is documented). Finally, up to two unintentional mortalities of shortnose sturgeon is authorized each year.

File 1595-04-- (Proposed Modification): The proposed modification requests authorization to capture an additional 100 shortnose sturgeon (or a total of 300 annually) in the same action area previously considered and during the same sampling period from March to December. The applicant also requests new research methods annually including Floy anchor tags (in place of Carlin tags); electronarcosis as an alternate method for anesthetization; scute sampling for elemental analysis (up to 20); gastric lavage for diet analysis (up to 40); and fall sampling of eggs and larvae (September – December) to document spawning incidence. The applicant also requests 0°C as the lower minimum water temperature to capture shortnose adults and juveniles. Finally, the researcher would like to appoint additional research personnel and remove others.

1.1.2 *Purpose and Need*:

The primary purpose of the original permits is to provide an exemption from the take prohibitions under the ESA allowing "takes". The need for issuance of permits is related to NMFS's mandates under the ESA. 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, with only a few specific exceptions, including for scientific research and enhancement purposes. Permit issuance criteria require research activities are consistent with purposes and policies of the ESA and will not have significant adverse impact on the species or stock. The proposed modifications would allow applicants to better address recovery plan goals (NMFS 1998) providing information on shortnose sturgeon essential to their conservation and management.

1.1.3 *Objectives of Research*:

Under the ESA, NMFS is responsible for the conservation and recovery of most endangered and threatened species. Scientific research is an important means of gathering valuable information about these species and is necessary to conserve them and promote their recovery. The purposes of research activities conducted by each of the applicants are:

Principal Investigators	Proposed Modification File No.	Objectives of Research
Dr. Gail Wippelhauser, PI (Maine Division Marine Resources)	1578-01	The proposed modification changes the objectives of the original research including: 1) estimating the abundance of shortnose sturgeon in the Kennebec complex, the Saco River, and other near-by coastal rivers; 2) documenting the rate of exchange and intersystem movements of sturgeon between Kennebec complex and other coastal rivers in the GOM; 3) identifying spawning and feeding behavior in the Kennebec complex, the Saco River, and other near-by coastal rivers; 4) determining the relative use of known and potential spawning habitat in the Kennebec complex; and 5) characterizing the genetic and 'river of origin' relationships of Maine's coastal river shortnose sturgeon.
Mr. Michael Hastings, Permit Holder (Univ. of Maine)	1595-04	The objectives of the original research would remain the same for this modification, assessing the distribution, movements, abundance and spawning of shortnose sturgeon in the Penobscot River system, ME

1.2 OTHER EA/EIS INFLUENCING THE SCOPE OF THIS SEA

A number of EAs or SEAs have been prepared on the effects of similar research techniques related to the proposed action. Appendix 1 lists ESA permits or modifications currently issued by NMFS for shortnose sturgeon for which EAs or SEAs were prepared. Each of these NEPA documents resulted in a Finding of No Significant Impact (FONSI) determination and has not been controversial.

The applicants for new permit modifications in this SEA have been authorized to conduct similar research in the past. The issuance of the following permits and subsequent amendments were analyzed in one or more NEPA documents as summarized below:

1.2.1 *History of NEPA Documents*:

- ***File 1578***

<u>Permit No. 1578-00—Original Permit</u>: (Gail Wippelhauser-PI)
Environmental Assessment of Issuance of a Scientific Research Permit to the Maine Department of Marine Resources (Gail Wippelhauser, Principal Investigator) (File No. 1578) to Conduct Research on Endangered Shortnose Sturgeon.

This EA evaluated the effects of research capturing up to 500 juvenile or adult shortnose sturgeon in the Kennebec River, Maine, focusing on the location of spawning and foraging habitat, migratory pathways, and effects of river flow on migration and habitat use. A Finding of No Significant Impact (FONSI), signed November 14, 2006, concluded research activities analyzed and issuance of the permits would not significantly impact the quality of the human environment, including the target species, shortnose sturgeon, or any of the non-target species.

- ***File 1595***

<u>Permit No. 1595-00—Original Permit</u> (Michael Hastings, Permit Holder):
Environmental Assessment of Issuance of a Scientific Research Permit to Michael M. Hastings, University of Maine, (File No. 1595) to Conduct Research on Endangered Shortnose Sturgeon.

This EA analyzed the effects of research capturing up to 100 shortnose sturgeon in the Penobscot River, Maine, assessing the distribution, movements, abundance and spawning of shortnose sturgeon. A Finding of No Significant Impact (FONSI), signed April 9, 2007, concluded the research activities analyzed and the issuance of the permits would not significantly impact the quality of the human environment, including the target, shortnose sturgeon, or non-target species.

<u>Permit No. 1595-01—Minor Permit Modification</u>: (Michael Hastings, Permit Holder)
This minor modification, issued June 4, 2007, authorized an increase in the temperature limits targeting adult and juvenile shortnose sturgeon with gill nets. Evidence was documented that no significant change in effects to shortnose sturgeon or other parts of the environment would occur from what was already analyzed for the existing permit, and the permit modification would include conditions ensuring shortnose sturgeon safety while minimizing impact to other bycatch species. Consequently, further analysis on environmental effects was not considered.

Permit No. 1595-02—Major Permit Modification: (Michael Hastings, Permit Holder)
Supplemental Environmental Assessment on the Issuance of a Modification to Scientific Research Permit No. 1595-01 [Michael Hastings, University of Maine] for Shortnose Sturgeon Research in the Penobscot River System, Maine, May 2008.

This SEA evaluated the effects of a permit modification increasing the total annual capture of shortnose sturgeon from 100 to 200, adding research methods of gastric lavage, blood sampling, D-net sampling for egg and larval collection, and appointing and replacing personnel. A Finding of No Significant Impact (FONSI), signed May 16, 2008, concluded the research activities analyzed and the issuance of the permits would not significantly impact the quality of the human environment, including the target species, shortnose sturgeon, or any of the non-target species.

Permit No. 1595-03—Minor Permit Modification: (Michael Hastings, Permit Holder)
This minor modification to the permit, issued March 3, 2009, authorized an increase in the temperature limits of research (from $15^{O}C$ to $25^{O}C$) while targeting early life stages (ELS) with D-nets. Evidence was documented that no significant change in effects to shortnose sturgeon or other parts of the environment would occur from what was already analyzed for the existing permit. Consequently, further analysis on environmental effects was not considered.

In each of the original EAs prepared for Permit Nos. 1578-00 and 1595-00, and the SEA prepared for Permit No. 1595-02, there were two alternatives: (1) the Proposed Action alternative (i.e., approving the authorizations requested); and (2) the No Action alternative (i.e., not approving the requested permit). The Proposed Action, issuing the specific scientific research permits, was in each case the preferred alternative. The No Action alternative was in each case not the preferred alternative because the opportunity to provide NMFS beneficial information for managing shortnose sturgeon would be lost. Further, each proposed action was found to help conserve, manage, and recover shortnose sturgeon as required by the ESA and implementing regulations.

1.3 SCOPING SUMMARY

1.3.1 *Public and Other Comments*

The purpose of scoping is to identify issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues not significant or those previously 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 SEA 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 (September 24, 2010; 75 FR 58350) announcing the availability of the modification applications and related documents for public comments (File No 1578-01 and File No. 1595-04). However, no comments were received from the public regarding these applications. Comments from NMFS Northeast Regional Office were also solicited and appropriately addressed within the SEA with respect to how the modifications would authorize standard, well known and non-controversial research techniques.

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

This section summarizes federal, state, and local permits, licenses, approvals, and consultation constraints needed to implement the planned action, as well as personal responsibility 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.

1.4.1 *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).

NOAA 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, otherwise categorically excluded, is (1) the subject of public controversy based on potential environmental consequences; (2) has uncertain environmental impacts or unknown risks; (3) establishes a precedent or decision in principle about future proposals, may result in cumulatively significant impacts; or (4) 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 accordance with NEPA, and NAO 216-6.NAO 216-6, NMFS is preparing an SEA for this action to provide a more detailed analysis of effects to ESA-listed species.

1.4.2 *Endangered Species Act*

Section 9 of the ESA, as amended, and Federal regulations pursuant to section 4(d) of the ESA prohibit 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 prescribing 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 for NMFS to issue permits under section 10(a)(1)(A) of the ESA, the Agency must find 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 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 appropriate steps achieving purposes of the treaties and conventions 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 and threatened species and shall utilize their authorities to further 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 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 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 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).

1.4.3 *Magnuson-Stevens Fishery Conservation and Management Act*

Under the MSFCMA Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the MSFCMA offer means to accomplish the goal of heightened consideration to fish habitat in resource management. NMFS PR is required to consult with NMFS Office of Habitat Conservation for any action it authorizes (e.g., research permits), funds, or undertakes, or proposes to authorize, fund, or undertake that may adversely affect EFH. This includes renewals, reviews or substantial revisions of actions.

CHAPTER 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the alternatives determined reasonable for achieving the stated objectives, as well as alternatives eliminated. This chapter also summarizes the expected outputs and any related mitigation of each alternative for both modifications. One alternative is the No Action alternative where the proposed permit modifications would not be issued. The No Action alternative is the baseline for rest of the analyses. The Proposed Action alternative represents the research planned in the modifications with standard permit terms and conditions specified by NMFS.

2.1 ALTERNATIVE 1 – No Action (Status Quo)
Under the No Action alternative, Permit Nos. 1578-01 and 1595-04 would not be issued. This alternative would be the Status Quo because the applicants' current permits 1578 and 1595-03 would remain valid and the research would proceed as authorized until expired on November 30, 2011 and March 31, 2012, respectively. No other permits or permit requests would be affected.

2.2 ALTERNATIVE 2 – Proposed Action (*Issuance of Two Permit Modifications with Standard Conditions*)

Under the Proposed Action alternative, modifications to Permit Nos. 1578 and 1595-03 would be issued with permit terms and conditions standard to such permits as issued by NMFS. All authorized activities previously described in other EAs would not be reconsidered in this SEA.

2.3 DESCRIPTION OF THE PROPOSED ACTION

2.3.1 *Map of Action Area*: [1]

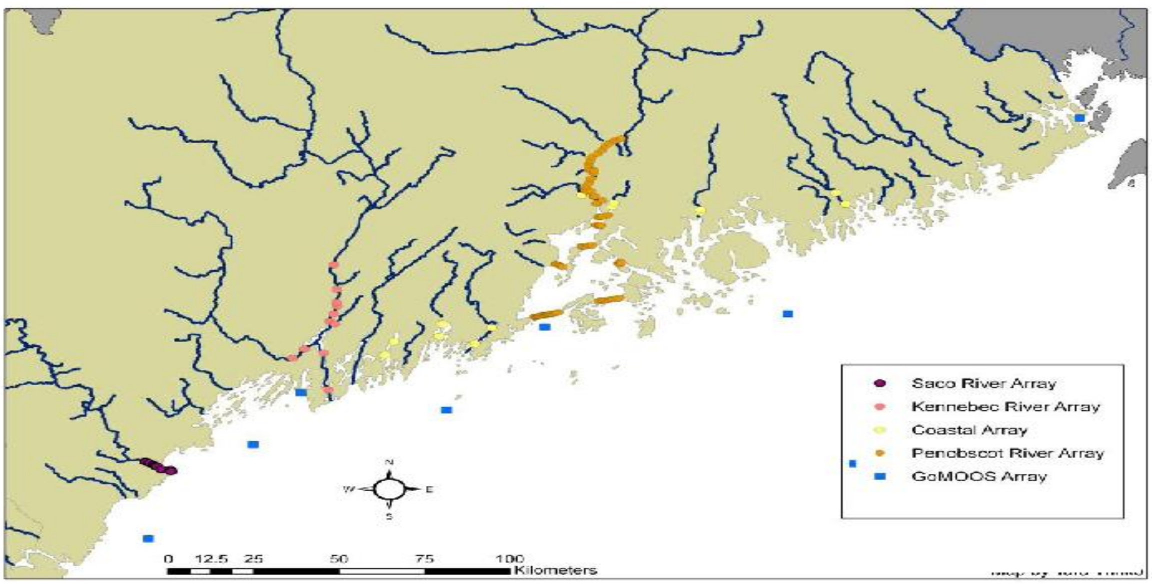

Figure 1: Map illustrating action area and positions of acoustic arrays deployed in the Penobscot River (File 1595), Kennebec complex, Saco River, and coastal monitoring positions (File 1578).

2.3.2 *Research Activities*:

2.3.2.1 *Proposed Modification of Permit No. 1578*:
The proposed modification (Table 1) would annually authorize an **increase in numbers captured** of shortnose sturgeon from 500 to **600** (May 15—**Oct 31**). The sampling area would also include an **expanded action area** comprised of the **Kennebec complex and Saco River**. However, no more than 500 sturgeon would be taken from the Kennebec complex. The use of other river systems by sturgeon in the GOM would be monitored with sonic receivers in mouths of bays and rivers.

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1 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

Table 1. Activities Proposed Under Permit No. 1578-01, annually.						
No	Species	Life Stage	Take Activity	Location	Dates	Notes
Up to 480	shortnose sturgeon *(Acipenser brevirostrum)*	sub-adult, adult	capture*, measure, weigh, **sex ID (borescope)**, photograph, tissue sample, scan for tags, **anchor tag**, PIT tag, recover, release	**Kennebec Complex & Saco River**	**May 15-Oct. 31**	Up to 400 from the Kennebec complex; Up to 80 from the Saco River
Up to 60	shortnose sturgeon *(Acipenser brevirostrum)*	sub-adult, adult	capture*, anesthetize (MS-222 or **electronarcosis**), measure, weigh, **sex ID (borescope)**, photograph, tissue sample, scan for tags, **anchor tag**, PIT tag, internal or external acoustic tags, recover, release	**Kennebec Complex & Saco River**	**May 15-Oct. 31**	Up to 50 from the Kennebec complex; Up to 10 from the Saco River
Up to 40	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, measure, weigh, **sex (borescope), photograph,** tissue sample, scan for tags, **anchor tag**, PIT tag, **scute sample**, recover, release	**Kennebec Complex & Saco River**	**May 15-Oct. 31**	Up to 33 from the Kennebec complex; Up to 7 from the Saco River
Up to 20	shortnose sturgeon *(Acipenser brevirostrum)*	sub-adult, adult	capture*, anesthetize (MS-222 or **electronarcosis)**, measure, weigh, **sex (borescope), photograph,** tissue sample, **blood sample**, scan for tags, **anchor tag**, PIT tag, **gastric lavage**, recover, release	**Kennebec Complex & Saco River**	**May 15-Oct. 31**	Up to 17 from the Kennebec complex; Up to 3 from the Saco River
Up to 60	shortnose sturgeon (*Acipenser brevirostrum*)	eggs, larvae	lethal take**	**Kennebec Complex & Saco River**	April 15-**Oct. 31**	Up to 50 from the Kennebec complex; Up to 10 from the Saco River

*Capture methods – gill nets from **0^{O}C** to 26^{O}C.
Collection method –D-nets until **0^{O}C to 25^{O}C for up to 3 hr duration.

In addition to currently authorized research, other increased take would include **increased numbers of ELS sampling until October 31**(up to 60 annually), and **increased numbers of acoustic tags** (up to 60 annually). New research methods would include: use of **Floy anchor tags** (replacing Carlin tags); (4) use of **borescope for sexing**; (5) **blood sampling** (up to 20); (6) **gastric lavage** (up to 20); (7) **scute sampling** (up to 40); and (8) **electronarcosis** for optional anesthetization (up to 80).

- *Request for Expanded Research Action Area*:[2]

The applicant is requesting to expand the geographic sampling area, allowing more intensive netting in other rivers, and also further monitoring of reciprocal movements between systems. A major objective of the MDMR is to determine the size of Maine's shortnose sturgeon populations and the relationship between them. Historically, evidence has shown shortnose sturgeon occurring only in the Kennebec, Androscoggin, and Sheepscot estuarine complex ("Kennebec complex") and in the Penobscot River. However, recent monitoring has documented high rates of exchange between the Kennebec and the Penobscot River, and also the presence of sturgeon in two new rivers in southern Maine, the Presumpscot and Saco (Fernandes et al. 2008; G. Zydlewski, M. Kinnison & P. Dionne, pers. comm.; and J. Sulikowski, pers. comm.). Thus, because current estimates and natal relationships of sturgeon between Maine's rivers are now considered preliminary, an effort between state agencies and universities examining the GOM sturgeon population and movement is proposed. The following section describes the boundaries of the proposed action area.

__**Sampling Coordinates Requested in the Kennebec Complex and Saco River**__: The researcher is requesting the action area sampled to include the Kennebec River complex and Saco River including: (1) the Kennebec River mouth (43º 44.86' N, 69º 46.32' W) to Lockwood Dam (43º 32.71' N, 69º 37.67' W); (2) the Androscoggin River mouth (43º 57.29' N, 69º 52.65' W) to Brunswick Dam (43º 55.22' N, 69º 58.00' W); (3) the Sheepscot River mouth (43º 47.18' N, 69º 41.46' W) to Reversing Falls (44º 2.89' N, 69º 36.98' W); (4) the Sasanoa River, the Back River, and Sagadahoc Bay (entrance at 43º 45.20' N, 69º46.15' W); (5) and Tottman Cove (43º 44.34' N, 69º 51.27'W), and also would include the lower Saco River and Estuary from its mouth (43º 27.71' N, 70º 22.71' W) to the Cataract Project dams (43º 29.70' N, 70º 26.72'W).

__**Acoustic Monitoring and Proposed VR2 Receivers Locations**__: Acoustic monitoring using 20 Vemco VR2 receivers in the Kennebec complex is proposed. The area extends from near shore waters at the mouths of the Sheepscot and Kennebec Rivers and in Sagadahoc Bay and Tottman Cove to the first dams encountered on the respective streams. Another deployment of receivers is proposed from the mouth of the Saco River to the Cataract dam project. Also, to document movement of sturgeon in intervening river systems, and also south of the Saco River, additional acoustic monitoring is planned with single VR-2 receivers placed these other coastal watersheds, namely the Royal, Presumpscot, Casco Bay, Mousam, York, and Piscataqua Rivers.

Although the researcher's boats would pass through the water column in transit to deploy and collect data from telemetry receivers, netting would not take place at these final deployment locations. The VR-2 units would be attached to stationary structures or anchoring systems, and deployed so the entire width of the river is covered at the freshwater, estuarine, and marine sites. The units would be deployed after ice-out (early April), and inspected and downloaded approximately bi-weekly until the array is removed in late fall. Detection efficiencies would be tested using drones prior to the release of tagged fish. In addition to the anchored array, researchers would search for tagged fish at least once a week with a directional hydrophone and receiver (Vemco VR100) deployed from a boat in order to delineate habitat use on a fine scale.

2
http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

- *Request for Capturing 100 Additional Shortnose Sturgeon*:

In light of new information learned about movement between Maine's coastal rivers, the number of shortnose sturgeon in Maine's waters may be much larger than initially thought and may represent a larger metapopulation (T. King; pers. comm. May 2010). Consequently, to develop a more robust population estimate, characterizing the scope of population exchange between rivers, **the applicant is requesting an increase in allowable take from 500 to 600 adult or sub-adult sturgeon annually**. The total captured from the Kennebec complex would not exceed 500; the remaining 100 shortnose sturgeon takes would be authorized for the Saco River, a system not previously sampled. To accomplish this goal, the applicant is proposing to target shortnose sturgeon during discrete periods of time when exchange between river systems would be generally closed—that is, between May 15 through October 31— and when sturgeon would be foraging at the tidal interface. Subsequently, movement, spawning, and habitat utilization of marked, recaptured, and telemetered animals would be monitored and characterized.

- *Request for Collecting Additional ELS with D-Nets, and Sampling through October 31*:

Within the Kennebec complex, the MDMR has documented past spawning activity in the spring in the Kennebec and Androscoggin Rivers using artificial substrates. **An increase from 30 to 60 ELS captured by D-nets is requested through October 31 each year** by the applicant to better meet research objectives of documenting spawning of sturgeon in all locations of the Kennebec complex and the Saco River. Further, because upstream movement of shortnose sturgeon in the fall has been observed in other rivers (P. Dionne and D. Peterson pers. comm., July 2010), the applicant also proposes to sample ELS in the fall to document fall spawning in Maine's rivers. The selection of habitat, spawning periodicity, and environmental characteristics of spawning shortnose sturgeon would be studied. Once a total of 60 eggs or larvae have been collected (no more than 50 from the Kennebec complex), all egg collecting gear would be removed from rivers until sampling is resumed the following year.

- *Request for Increased Numbers of Internal Acoustic Tags*:

The potentially high rate of exchange between the Kennebec complex, the Penobscot River, and rivers to the south of the Kennebec complex indicates numbers of shortnose sturgeon in Maine's waters may be larger than initially thought, potentially representing a larger metapopulation. In addition to a requested increase in allowable capture of sturgeon over a wider geographical area, **the applicant has proposed an increase of 30 acoustic tags implanted annually.** The applicant makes this request to better assess the rate of exchange, to develop a more robust population estimate, and to better understand the timing and nature of the exchange (permanent or temporary and immigration or emigration). Also, because the study design involves targeting sturgeon when exchange between the river systems is limited, and because the potential migratory distances could exceed 100 miles, they have asked to surgically implant the additional 30 tags.

- *Request Floy Anchor Tags for External Identifying*:

The researcher proposes to tag all shortnose sturgeon ($\geq$ 300 mm) with Floy anchor tags in place of Carlin tags for better retention and less health impact on fish and to incorporate incidental recaptures by commercial or recreational fishermen and other researchers, making it possible for collection of information useful for the assessment of the sturgeon population. In all captured shortnose sturgeon, Floy anchor tags would be anchored in the dorsal fin musculature base, inserted using a 12 gauge needle. The insertion point would be forward and slightly downward from the left side to the right through the dorsal. 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 anchor tag retention and any effects on tagged fish would be documented and reported to NMFS in annual reports.

- *Request for Endoscopic Examination (Borescope)*:

The applicant requests **authorization for borescoping all adult shortnose sturgeon (>69 cm TL) captured, excluding those releasing gametes at time of capture**. Identifying the sex of a sturgeon yields several advantages to the sturgeon researcher, including limiting handling and holding time. Because, early stage shortnose sturgeon females and males are largely not sexually dimorphic for much of the year, borescopic examination, described by Kynard and Kieffer (2002), assists researchers with a minimally invasive procedure to determine the sex of some adults (>69 cm TL) in various stages of sexual maturity. The procedure also gives researchers a means to verify the gamete maturity of females identified by evaluating the stage of eggs.

The endoscopic exam lasts approximately one to two minutes, and is performed without an anesthetic using a flexible fiber optic endocscope (16cm long x 4mm diameter) carefully inserted through the urogenital opening and positioned within the urogenital canal. During the exam, the fish's head, and most of its body, would remain in water. Sampled females would be positively verified by identifying eggs through the urogenital wall, and developed eggs would be staged as either "early stage" or "late stage" for the coming spring by comparing coloration and separation of oocytes viewed through the urogenital wall.

- *Request for Non-Lethal Blood Sampling*:

Understanding the sex ratio of a sturgeon population is essential when estimating the number of individuals likely to spawn. The applicant is therefore requesting to identify sex and maturation of individual sturgeons in different life and reproductive stages by discovering relationships of serum levels of testosterone, estrogen, and vitellogenin collected from blood. **Blood samples would be collected from up to 20 sub-adult or adult shortnose sturgeon.** Samples would be collected from the caudal vein by inserting a needle attached to a Vacutainer tube (containing an anticoagulant) nearly vertically to the ventral midline, immediately behind the anal fin. The needle would be advanced slowly 3-4 millimeters before the Vacutainer tube is attached ensuring the vacuum is not compromised until blood freely flows into the vial. The needle would not be advanced if resistance is encountered to avoid damage to the notochord and associated nervous and vascular tissue. After blood is collected, pressure would be applied to the extraction site to ensure clotting. This procedure would take less than 2 minutes. Fish would be released directly into the river at the site of capture after being allowed to fully recover in a floating net pen. Blood samples would immediately be placed on ice, where they would remain until they could be returned to the lab, refrigerated in a -80^{o}F freezer for future analysis. Training and practice for this procedure would be obtained at the University of Maine prior to the field season.

- *Request for Gastric Lavage for Diet Analysis*:

The Recovery Plan for shortnose sturgeon (NMFS 1998) places priority on determining range-wide foraging habits and ecology of shortnose sturgeon. However, currently little is known about the feeding habits and prey preferences of sturgeon in Maine's rivers, and whether diet preference or abundance would give understanding to potential motivation for observed coastal movements (T. Squires, MDMR, pers. comm., 2010). Consequently, the applicant **requests to assess sturgeon diet in the Kennebec complex and the Saco River, taking 20 samples of stomach contents via gastric lavage** following the protocols of Schuman and Peters (2007) and Collins et al. (2008).

Five individuals per month would be taken during the months of June and July, September, and October. Concurrent habitat availability surveys, using a series of grids to systematically sample the substrate for prey availability, would also be conducted in areas where shortnose sturgeon would be collected or found to be inhabiting through acoustic monitoring. Additionally, lavage would be conducted on various size ranges of sturgeon characterizing diet selection across size ranges.

The method of lavage would include a sedation dose of anesthetic (using 50-100 mg/L of MS-222 or alternately using electronarcosis) to relax the fish's alimentary canal prior to the procedure. Variable sized flexible polyethylene tubes, depending on the size of the sturgeon, would be passed through the sturgeon's alimentary canal and verified to be properly positioned in the stomach by feeling the tubing from fish's ventral surface. Gastric lavage would be then be carried out by gently flooding the stomach cavity with water delivered from a lightly pressurized garden sprayer. To minimize stress, sturgeon between 250 mm and 350 mm (FL) would be lavaged using 1.90 mm outside diameter (O.D.) tubing; sturgeon between 350 mm to 1250 mm, would be lavaged with a 4.06 mm O.D. tube; and sturgeon above 1250 mm would be lavaged with flexible tubing of 10.15 mm O.D. Prey items dislodged from the stomachs of sampled sturgeon would be collected by a 500 micron sieve, preserved (using 95% ethanol), and identified later in the lab. The applicant would then allow fish to recover within a floating net pen alongside the boat prior to release. The entire procedure, including anesthetizing, would last seven to eleven minutes (Collins et al 2008). No other invasive procedure requiring anesthesia would be performed after being lavaged. The applicant has received training in gastric lavage under the supervision of Tom Savoy (Permit # 1516; Connecticut Dept. of Environmental Protection, Fisheries), and further training would be acquired at the University of Maine prior to the first field season.

An index of relative importance (IRI) (Pinkas et al.1971), would be used to rank prey items found. This index would be calculated by summing the numerical and weight percentage values, and then multiplying by the percentage frequency of occurrence. The equation is: IRI = %F (%N+%W), where %N, %W, and %F are the percent contributions of a prey species in terms of number, weight, and frequency of occurrence in the stomachs examined. Capture location of individuals would be recorded and stomach contents would be analyzed to determine location of foraging habitat and dominant prey species in the sample location.

- *Request Scute Sampling for Elemental Analysis*:

The applicant requests to collect and preserve for elemental analysis of the apical hooks of 40 scutes annually. Sampling would involve using an orthopedic bone cutter or small saw to collect 4-10 mm clips of the apical hooks. The scute samples would then be preserved by drying in envelopes. Recent mark-recapture and acoustic telemetry data in Maine has indicated a high rate of exchange of shortnose sturgeon between the Kennebec, Penobscot and other coastal rivers, but little is known about the river of origin. The MDMR proposes, based on wear patterns formed on the apical spines of sturgeon scutes in early life, to study juvenile sturgeon exposure to different water systems to determine the natal source. This proposal is based on sturgeon incorporating trace non-metabolizable rare elements into their hard tissues throughout development. The relative abundances of these elements are often unique to the geology of local watersheds (Kennedy et al. 1997). In some cases, hard tissues like vascular bone or keratinized structures continually resorb or shed during an individual's life span. However, other hard structures, like otoliths (ear bones), teeth or some bone formed in the dermis, are not as metabolically active once formed and can serve as records of past elemental exposure (Campana and Thorrold 2001).

- <u>*Request for Electronarcosis for Anesthesia*</u>:

Electronarcosis is proposed for anesthetizing shortnose sturgeon for surgery while implanting or attaching acoustic tags (up to 60 annually), or while performing gastric lavage (up to 20 annually). As described by Henyey et al. (2002), the researcher would use constant direct current (CDC) voltage to immobilize sturgeon with electronarcosis. In this procedure a single shortnose sturgeon would be placed in a tank, supported with netting allowing only their back or ventral surface out of water. With the sturgeon's head oriented towards the cathode of the device, the voltage would be applied quickly causing the fish to lose equilibrium. The voltage would then be adjusted downward until the fish is relaxed, exhibiting strong opercula movement. In practice, when inducing electronarcosis, if gill ventilation becomes irregular or stops, the electric current is decreased to allow the fish to recover steady ventilation immediately (B. Kynard, USGS, pers. comm., 2010). The amperage would be set for the duration to a minimal level (0.01A), and, depending on the individual sturgeon and water chemistry, about 0.3 to 0.5 volts per centimeter would be used to immobilize sturgeon. Induction and recovery from electronarcosis are both reported as less than 10 seconds. As fish are removed from the electrical current, it is no longer anesthetized (Summerfelt and Smith 1990, Henyey et al. 2002.

2.3.2.2 <u>*Proposed Modification of File No 1595*</u>:

The proposed modification would continue targeting shortnose sturgeon in the same geographic area of the lower Penobscot River, and also during the same netting season (March – December). However, the Permit Holder requests an **increased number of shortnose sturgeon captured** with gill and trammel nets from 200 to **300**. Other research activities include: (1) lowering the **minimum water temperature targeting shortnose sturgeon adults and sub-adults to 0°C**; (2) **Floy anchor tags to externally identify recaptures**; (3) **Electronarcosis for anesthetization**; (4) using **scute sampling** for elemental analysis (up to 20); (5) using **gastric lavage for diet analysis** (up to 40); and (6) using **fall sampling of ELS (September – December)** to document spawning. See Table 2 below illustrating changes in **bold** font to the take table for Permit 1595-04, and also the following narrative summary of the proposed modification.

Table 2. Activities Proposed Under Permit No. 1595-04, annually.					
No.	Species	Life Stage	Take Activity	Location	Dates
200	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, measure, weigh, borescope, photograph, genetic tissue sample, scan for tags, **Floy anchor tag**, PIT tag, recover, release	Penobscot River System, ME	March - December
30	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, anesthetize (MS-222, or **electronarcosis**) measure, weigh, borescope, photograph, genetic tissue sample, scan for tags, **Floy anchor tag**, PIT tag, internal or external sonic transmitter, release, track	Penobscot River System, ME	March - December
20	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, measure, weigh, sex (borescope), photograph, tissue sample, scan for tags, **Floy anchor tag**, PIT tag, **scute sample**,	Penobscot River System, ME	March - December
40	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, anesthetize (MS-222, or **electronarcosis**) measure, weigh, borescope, photograph, genetic tissue sample, blood sample, scan for tags, **Floy anchor tag**, PIT tag, **gastric lavage**, recover, release	Penobscot River System, ME	March - December
10	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	capture*, measure, weigh, borescope, photograph, genetic tissue sample, blood sample, scan for tags, **Floy anchor tag**, PIT tag, recover, release	Penobscot River System, ME	March - December
50	shortnose sturgeon (*Acipenser brevirostrum*)	eggs, larvae	lethal take**	Penobscot River System, ME	March – June & **September -December**
2	shortnose sturgeon (*Acipenser brevirostrum*)	sub-adult, adult	unintentional mortality	Penobscot River System, ME	March - December

* Capture methods — gill and trammel nets from **0^{O}C** to 26^{O}C.
** Collection method — D-nets from **0^{O}C** until 25^{O}C for up to 3 hr duration.

- *Request for Capturing an Additional 100 Shortnose Sturgeon*:

The applicant is **requesting increase in allowable take from 200 to 300 shortnose sturgeon** for a better assessment of the population. The applicant proposes accounting for the scope of population exchange by targeting shortnose sturgeon during discrete periods of time when exchange between river systems is limited, and subsequently examining the relative rate of exchange between rivers in seasonal periods when sturgeon migrate between systems.

The application proposes to document previous research efforts targeting shortnose sturgeon in the Penobscot River. However, past efforts have been complicated by a high degree of variability in catch. For example, in 2008, 185 shortnose sturgeon were captured with conservative netting efforts and no mortality. This included a single day of sampling (~ 2 net hours) where 57 shortnose sturgeon were captured, tagged and released. Similarly in 2009, high encounter rates resulted in over 65% of the total allowable take collected in three sampling events. Also similar netting effort (76 minutes, and 71 minutes with 45.7m, 6 inch stretch gill nets) set in the same area only 2 days apart, yielded one and 18 sturgeon, respectively, illustrating the high degree of variability in the encounter rate and the difficulty of randomizing sampling in a manner providing appropriate sample sizes without exceeding permitted take.

Incorporating data from the 2006 and 2007 field seasons, a Lincoln/Peterson Index calculated the preliminary population estimate for the lower Penobscot River as 1,049 individuals (95% CI: 673 – 6,939). However, a high rate of exchange of tagged fish (10 detected in 2007, representing 40% of active acoustically tagged individuals at the time) was observed (Fernandes 2008) between the Penobscot River system and the Kennebec complex (9488 with a 95% CI of 6942 to 13358) indicating the researchers were potentially sampling a larger population within a meta-population beyond that confined to the Penobscot River.

- *Request for Fall Sampling for ELS (September to December)*:

Although current authorization in Permit No. 1595-03 provides for egg/larvae collection until 25^0C, it does not authorize sampling after June. Consequently, the applicant requests **expanding ELS sampling to fall collection with D-nets and egg mats between September and December).** Once a total of 50 eggs have been collected, all egg collecting gear would be removed from the river until sampling is resumed the following year.

The Permit Holder has not successfully collected ELS from the Penobscot River since first permitted in 2007. While monitoring spawning activity in the Penobscot River, all telemetered sturgeon have been observed moving downstream of the wintering area as spring water flow increased, reaching suitable photoperiod and spawning temperature (P. Dionne, pers. comm., July 2010). However, each fall, upstream movement of tagged sturgeon into likely spawning locations in the Penobscot River was observed, leading researchers to question whether fall water conditions would provide more suitable spawning conditions for shortnose sturgeon.

- *Request for Reducing Minimum Netting Temperature to 0°C Targeting Shortnose Sturgeon*:

The applicant is requesting to **reduce the minimum netting temperature from 7°C to 0°C**, lowering the minimal temperature for capturing sturgeon during the winter period when sturgeon are least likely to be moving between river systems. The applicant holds that the ability to sample and PIT tag as many fish as possible in such "closed" periods is critical to estimate population abundance and migration using models accounting for both closed and open population structure.

- *Request for Floy Anchor Tags for External Identifying*:

The researcher proposes to **tag all shortnose sturgeon (≥ 300 mm) with Floy anchor tags in place of Carlin tags** to incorporate incidental recaptures by commercial or recreational fishermen and other researchers. This change would potentially reduce tagging stress, as well as making it possible for collection of information useful for the assessment of the sturgeon population. In all appropriate sized sturgeon, Floy anchor tags would be anchored in the dorsal fin musculature base and inserted forwardly and slightly downward from the left side to the right through the dorsal pterygiophores with a 12 gauge needle. After removing the injecting needle, the tag would be spun between the fingers and gently tugged ensuring it is locked in place. During the study, the rate of Floy anchor tag retention and any signs of lesions would be documented.

- *Request for Electronarcosis for Anesthesia*:

As described by Henyey et al. (2002), the researcher **requests using constant direct current (CDC) voltage to anesthetize up to 70 shortnose sturgeon annually using electronarcosis**. In this procedure a single shortnose sturgeon would be placed in a tank, supported with netting so that only their back or ventral surface would be emerged from the water before work continued. With the sturgeon's head oriented towards the cathode of the device, the voltage would be applied quickly causing the fish loses equilibrium. The voltage would then be adjusted downward until the fish is relaxed and exhibiting strong opercula movement. In practice, when inducing electronarcosis, if gill ventilation becomes irregular or stops, the electric current is decreased to allow the fish to recover steady ventilation immediately (B. Kynard, USGS, pers. comm., 2010). The amperes would be set for the duration to the minimal level (0.01A), and, depending on the individual sturgeon and water chemistry, about 0.3 to 0.5 volts per centimeter is recommended to immobilize sturgeon. Induction and recovery from electronarcosis are both reported as less than 10 seconds. As fish are removed from the electrical current, it is no longer anesthetized (Summerfelt and Smith 1990, Henyey et al. 2002.

- *Request for Scute Sampling for Elemental Analysis*:

The applicant **requests collection and preservation of the apical hooks of scutes for elemental analysis**. Sampling would involve using an orthopedic bone cutter or small saw to collect 4-10 mm clips of the apical hooks.

Recent mark-recapture and acoustic telemetry data in Maine has indicated a high rate of exchange of shortnose sturgeon between the Kennebec, Penobscot and other coastal rivers, but little is known about the river origins of sturgeon (Fernandes et al. 2008 and P. Dionne, unpublished). The MDMRproposes, based on wear patterns formed on the apical spines on the scutes of sturgeon in early life, to study the juvenile exposure to different water systems in an attempt to determine the natal river source.

This proposal is based on fish incorporating trace amounts of various non-metabolizable rare elements into their hard tissues throughout development. The relative abundances of these elements are often unique to the geology of local watersheds (Kennedy et al. 1997). In some cases, hard tissues like vascular bone or keratinized structures are continually resorbed or shed during an individual's life span. However, other hard structures, like otoliths (ear bones), teeth or some bone formed in the dermis are not as metabolically active once formed and can serve as records of past elemental exposure (Campana and Thorrold 2001).

- *Request for Gastric Lavage for Diet Analysis*:

The Recovery Plan for shortnose sturgeon (NMFS 1998) places high priority on understanding the range-wide foraging habits and ecology of shortnose sturgeon. However, currently little is known about the feeding habits and prey preferences of sturgeon in Maine's rivers and whether diet preference or abundance would give understanding to potential motivation for observed coastal movements (T. Squires, MDMR, pers. comm., 2010). Consequently, to assess feeding in the Kennebec complex and the Saco River, the applicant **requests to sample stomach contents of up to 40 shortnose sturgeon annually using gastric lavage** under light anesthesia following the protocols of Schuman and Peters (2007) and Collins et al. (2008).

Ten fish per month would be taken during the months of June and July, September, and October. Concurrent habitat availability surveys, using a series of grids to systematically sample the substrate for prey availability, would also be conducted in areas where shortnose sturgeon would be collected or found to be inhabiting through acoustic monitoring. Additionally, lavage would be conducted on various size ranges of sturgeon to characterize diet selection across size ranges.

The method of lavage would include a sedation dose of anesthetic (either using 50-100 mg/L of MS-222 or using electronarcosis) to relax the fish's alimentary canal prior to the procedure. Variable sized flexible polyethylene tubes, depending on the size of the sturgeon, would be passed carefully through the sturgeon's alimentary canal and verified to be properly positioned in the stomach by feeling the tubing from fish's ventral surface. Gastric lavage would be then be carried out by gently flooding the stomach cavity with water delivered from a lightly pressurized garden sprayer. To minimize stress, sturgeon between 250 mm and 350 mm (FL) would be lavaged using 1.90 mm outside diameter (O.D.) tubing; sturgeon between 350 mm to 1250 mm, would be lavaged with a 4.06 mm O.D. tube; and sturgeon above 1250 mm would be lavaged with flexible tubing of 10.15 mm O.D. Prey items dislodged from the stomachs of sampled sturgeon would be collected by a 500 micron sieve, preserved (using 95% ethanol), and identified later in the laboratory. The applicant would then allow fish to recover within a floating net pen alongside the boat prior to release back to the river. The entire procedure, including anesthetizing, would take from seven to eleven minutes (Collins et al 2008). No other invasive procedure requiring anesthesia would be performed on fish undergoing gastric lavage. The applicant has received training in the procedure under the supervision of Tom Savoy (Permit #1516; Connecticut Department of Environmental Protection, Fisheries).

An index of relative importance (IRI), (Pinkas et al. 1971), would be used for ranking prey items This index would be calculated by adding the numerical and weight percentage values, and then multiplying by the percentage frequency of occurrence. The equation is: IRI =%F(%N+%W), where %N, %W, and %F are the percent contributions of a prey species in terms of number, weight, and frequency of occurrence in the stomachs examined. Capture location of individuals would be recorded and stomach contents would be analyzed to determine location of foraging habitat and dominant prey species for shortnose sturgeon in the sample location.

CHAPTER 3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The affected environment would include the near shore waters and coastal rivers of the GOM associated with the proposed modifications in the Kennebec complex and Saco River (File 1578), and the lower Penobscot River (File 1595) to the first dam project on each river. Where not previously considered in earlier EAs or SEAs, this SEA evaluates the potential impacts to the human environment —the social and economic, biological and physical resources —resulting from modifying Permit Nos. 1578 and 1595-03. The shortnose sturgeon is the subject of the proposed permit modifications and would be the only target species. All other affected species affected would be incidentally captured during the course of research.

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. Therefore, because 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 supporting 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, this SEA does not include any further analysis of social or economic effects of the proposed action.

3.2 PHYSICAL ENVIRONMENT

Nothing pertaining to the physical environment for File 1595 in the Penobscot River watershed has changed since the 2008 SEA was prepared, with exception of changes occurring in the new designations of the GOM DPS and critical habitat for Atlantic salmon in 2009. This SEA therefore examines primarily the additional potential impacts on the physical environment from the proposed changes in File 1578, considering an expanded sampling area not previously assessed in the 2006 EA, as well as changes in recent designation of the GOM DPS and critical habitat for Atlantic salmon in 2009 for both modifications.

3.2.1 *Description of the Kennebec complex, Saco River and Intervening Rivers*:

Kennebec Complex: The Kennebec complex, consisting of the Androscoggin, Kennebec and Sheepscot Rivers and estuarine complex, supports the second largest population of shortnose sturgeon in the United States, perhaps due to the extensive and relatively accessible spawning, feeding, and overwintering habitat (G. Wippelhauser, pers. comm., 2010). The Kennebec River, at its mouth, drains an area of 24,667 km^2 and contains approximately 11,140 acres of tidal freshwater habitat, most of it occurring between Chops Point, at the outlet of Merrymeeting Bay, Augusta on the Kennebec River and Brunswick Dam on the Androscoggin River. Four smaller drainages of Merrymeeting Bay (Eastern River, Cathance River, Abagadasset River, and Muddy River) are entirely tidal freshwater. Below Chops Point, the Kennebec River becomes increasingly brackish, flowing approximately 20 miles to the Atlantic Ocean. This lower estuarine section of the Kennebec River interconnects with the Sheepscot River estuary by means of the tidal Sasanoa River and Back River.

The removal of Edwards Dam in the fall of 1999, formerly located at the head-of-tide on the Kennebec River at Augusta, Maine, provided 17 more miles of historical habitat accessible to anadromous species. Since this time, the MDMR has detected several acoustically tagged shortnose sturgeon from the Penobscot River in the vicinity of the Lockwood Dam (Wippelhauser, pers. comm., 2010). Seasonal and annual variations in flows in the mainstem Kennebec River above the Lockwood Dam are controlled through upriver storage in the basin at the Flaggstaff, Brassua, and Moosehead Projects, and by minimum flow at the Wyman Project. In dry years, river flows can be controlled by outflow at the Wyman Project.

Saco River: The Saco River watershed is part of southwestern Maine's system of loosely connected estuaries lying either behind barrier beach/salt marsh complexes or areas where rivers discharge into the GOM. This estuarine complex has a watershed area of 4403 sq km (170 sq mi) with an estuarine area of 819 sq km, yielding a ratio of watershed drainage to estuarine of 5.4. The Wells barrier beach system has a 1,200 acre salt marsh system and is home to the Wells National Estuarine Research Reserve and Rachel Carson National Wildlife Refuge to the south (ENSR 2007). Neither of these protected areas would be affected by any proposed boating or netting activities.

The Saco River estuary is 6 miles in length, emptying into the GOM at Saco Bay with the head of the estuary occurring at the Cataract Dam between the towns of Saco and Biddeford, Maine. There are 11 dams on the Saco River between Saco Bay and Fryeburg, ME, having impacts on sturgeon and other anadromous fish species (river herring, Atlantic sturgeon, eels, etc.). Although the first two dams, the Cataract project and Skelton Dam have fish passageways, they are not usable by sturgeon. The estuary is characterized by sand and rock bottoms, and little vegetation. It ranges between 200 and 350 meters in width and averages five meters in depth. Under normal conditions, the estuary's salinity is stratified by salt wedge presence, experiencing a mean tidal range of 2.7 meters (8.6 ft). The daily freshwater discharge is 22 cu ft/sec developing a tidal freshwater volume (mixing zone) of 0.6 billion cu ft in the estuary, while the seawater volume is 14.4 billion cu ft. The portions of the estuary complex receiving riverine input is highly stratified during peak flow periods and during the summer with a short flushing time of about eight days (ENSR 2007).

Other Coastal Rivers South of the Kennebec Complex Monitored for Shortnose Sturgeon Use*:* The mouths of river estuaries and corridors south of the Kennebec complex — Royal, Presumpscot, Casco Bay, Mousam, York, and Piscataqua Rivers — are currently believed used by shortnose sturgeon for foraging and transiting to other river systems (G. Wipplehauser, pers. comm. May 2010). These river systems once supported populations of migratory and residential fish; however, pollution and the presence of dams, providing no fish passage and having no environmental restrictions, were the cause of the abandonment by migrating sturgeon. VR2 acoustic receivers would be placed in the mouths of these basins to monitor sturgeon usage. These areas are characterized by narrow brackish water river channels, extensive mudflats at low tide, fringing spartina salt marshs, and steep, forested slopes (ENSR 2007). Head of tide often ranges only a few miles upriver until the first water control structure is encountered.

3.2.2 *Essential Fish Habitat (EFH)*:

Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act offer resource managers means to accomplish the goal of giving heightened consideration to fish habitat in resource management.

EFH has been designated for federally managed fisheries and occurs in the near shore waters, the tidally mixed areas and freshwater areas of the proposed research for File 1578 and 1595. Details of the designations and descriptions of the habitats within the action area are detailed at: http://www.nero.noaa.gov/hcd/index2a.htm, and http://www.nero.noaa.gov/hcd/salmon.pdf.

NMFS PR considered the potential for adverse impacts on EFH in these two modifications would be defined by proposed boating and netting activities while sampling shortnose sturgeon. Additionally, because the tidally mixed area of the rivers coinciding with the netting activities has designated EFH for life stages of species outlined online, potential bycatch of these species in nets might directly or indirectly adversely affect EFH. For example, because anadromous fish (striped bass, American shad, alewife, blueback herring etc) use sections of these rivers for spawning, nursery, and migratory pathway, and because juvenile anadromous fish are a food source for the managed bluefish species, any impact to these species would also be considered an adverse effect on EFH based upon the EFH rules[3].

The Office of Habitat Conservation was originally consulted on File 1595-00, and it was determined via email (February 20, 2007) that the action, as the researcher' activities were conditioned, would not significantly impact EFH. Consequently, because the proposed modification for File 1595-04 is no different than the original action, no further consultation was necessary with Office of Habitat Conservation.

With respect to File 1578, although the researcher's boats would pass through and over the water column while in transit to collect data from telemetry receivers and netting locations, NMFS concludes this activity would not adversely impact the physical environment, including any portion considered EFH. Similarly, NMFS concludes, because nets would be anchored in position on the bottom of rocky or sandy substrate, resulting in very little bottom drag or disturbance of benthic organisms or bottom habitat, the effects on EFH caused by gill nets (and anchors) would be very limited. Lastly, based on the limited amount of recorded by-catch of the above anadromous species captured by the researchers when netting for shortnose sturgeon, and the fact that virtually all of the by-catch has been reported released alive during sampling, there would be minimal impacts to managed species relying on the early life stages as part of their food supply in the freshwater and estuarine essential habitat.

NMFS, Northeast Office of Habitat Conservation was contacted by email on October 22, 2010 asking whether the proposed netting and boating activity would have adverse impacts on the designated EFH in the GOM rivers and near shore waters in File 1578. The results of this informal consultation appear in Section 4.3.2 of this SEA.

3.2.3 *Protected Areas*:

There are no National Marine Sanctuaries located in the action area where planned boating and netting activities would take place in either of the permit modification's activities. Nor would the research involve any sites listed in or eligible for the National Register of Historic Places or any cultural or historic resources.

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3 The EFH final rule at 50 CFR Section 600.810 defines an adverse effect on EFH as "any impact which reduces the quality and/or quantity of EFH." The rule further states: "An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

3.2.4 *Critical habitat*:

Critical habitat is defined in section 3(5)(A) of the ESA as: (i.) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features; (ii.) essential to the conservation of the species; (iii.) that may require special management considerations or protection; and (iv.) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

3.2.4.1 Shortnose sturgeon Critical Habitat:

Critical habitat has not yet been designated for shortnose sturgeon. Therefore, no discussion of critical habitat for the target species is essential in this analysis.

3.2.4.2 Atlantic salmon Critical Habitat:

Concurrent with a new June 19, 2009 endangered ESA listing for GOM DPS Atlantic salmon, NMFS and the USFWS designated critical habitat (74 FR 29300; June 19, 2009). The new listing was expanded to include all anadromous Atlantic salmon streams whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast northeastward to the Dennys River, and wherever these fish occur in the estuarine and marine environment. (For a full description of the Atlantic salmon critical habitat, refer online at: http://www.nero.noaa.gov/prot_res/altsalmon/4%28b%29%282%29%20Report%20Final.pdf).

Therefore, proposed research in both the Kennebec complex (File 1578) and Penobscot River (File 1595) would occur in newly delineated Atlantic salmon critical habitat. However, none of the planned netting and boating south of the Kennebec complex (i.e., Saco River and intervening rivers) would occur within the boundaries of the GOM DPS, and thus would also not affect critical habitat in rivers south of the Kennebec complex. The potential impact of the proposed research modifications on Atlantic salmon critical habitat is discussed in Section 4.2.3 of this SEA.

3.3 BIOLOGICAL ENVIRONMENT

This section discusses changes proposed by the modifications of File 1578 and File 1595 affecting the biological environment not considered in previous EAs or SEAs.

The planned modification for File 1578 includes an expanded action area, including areas where increased sampling and new methods are proposed in both marine coastal environments and riverine waters of the Kennebec complex and the Saco River.[4] Additionally, because the GOM DPS for Atlantic salmon was relisted and boundaries expanded on June 19, 2009, the biological impacts from newly proposed research methods on shortnose sturgeon are updated for both File 1578 and 1595.

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4 http://maps.google.com/maps/ms?source=s_q&hl=en&geocode=&ie=UTF8&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

3.3.1 ESA Species and Protected Marine Mammals:

- *Targeted ESA Listed Species Affected:* Shortnose sturgeon (*Acipenser brevirostrum*)

- *Non-targeted ESA Listed Species Affected:* Atlantic salmon (*Salmo salar*)

- *Non-targeted ESA and/or MMPA Listed Species Not Affected by the Proposed Actions*:

Loggerhead sea turtle	(*Caretta caretta*)
Kemps's ridley sea turtle	(*Lepidochelys kempi*)
Leatherback sea turtle	(*Dermochelys coriacea*)
Green sea turtle	(*Chelonia mydas*)
Northern Right whale	(*Eubalaena glacialis*)
Fin whale	(*Balaenoptera physalus*)
Humpback whale	(*Megaptera novaeangliae*)
Sei whale	(*Balaenoptera borealis*)
Sperm whale	(*Physter \macrocephalus*)

- *MMPA Protected Species in GOM Waters*:

Harbor porpoise	(*Phocoena phocoena*)
Harp seal	(*Phoca groenlandica*)
Hooded seal	(*Cystophora cristata*)
Gray seal	(*Halichoerus grypus*)
Harbor seal	(*Phoca vitulina*)

3.3.1.1. Targeted ESA Listed Species Affected:

- ***Shortnose sturgeon*** (*Acipenser brevirostrum*) –

The shortnose sturgeon was listed as an "endangered species threatened with extinction" under the Endangered Species Act on March 11, 1967. As noted previously, critical habitat for the species has not been designated. The scientific name for the shortnose sturgeon is *Acipenser brevirostrum*. *Acipenser* is Latin for sturgeon and *brevirostrum* means short snout. LeSueur originally described the species from a specimen taken from the Delaware River (Dadswell et al. 1984).

Range-wide Distribution of Shortnose Sturgeon:
Shortnose sturgeon occur on east coast North American 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, 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 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). Magnin (1963) theorized the species was primarily found in freshwater on the basis of growth to smaller sizes. However, in recent years, telemetry data and genetic analyses have demonstrated coastal migrations of shortnose sturgeon between adjacent rivers are relatively common in some areas (S. Fernandes, 2008; and D. Peterson, pers. comm., 2010).

<u>*Life History of Shortnose Sturgeon*</u>:

Age, Growth and Mortality: Shortnose sturgeon are benthic fish that are primarily found in the deep channel sections of large rivers. They feed on a variety of benthic and epibenthic invertebrates including molluscs, crustaceans (amphipods, chironomids, isopods), and oligochaete worms (Vladykov and Greeley 1963; and NMFS 1998). Shortnose sturgeon have similar lengths at maturity (45-55 cm fork length) throughout their range, but, because sturgeon in southern rivers grow faster than those in northern rivers, southern sturgeon mature at younger ages (Dadswell et al. 1984; and D. Peterson pers. comm. 2010).

Shortnose sturgeon are long-lived (30-40 years) and, particularly in the northern extent of their range, mature at late ages. In the north, males reach maturity at 5 to 10 years, while females mature between 7 and 13 years. Based on limited data, females spawn every three to five years while males spawn approximately every two years. The spawning period is estimated to last from a few days to several weeks.

Total instantaneous mortality rates (Z) are available for the Saint John River (0.12 - 0.15; ages 14-55; Dadswell 1979), Upper Connecticut River (0.12; Taubert 1980b), and Pee Dee-Winyah River (0.08-0.12; Dadswell et al. 1984). Total instantaneous natural mortality (M) for shortnose sturgeon in the lower Connecticut River was estimated to be 0.13 (T. Savoy, Connecticut Department of Environmental Protection, pers. comm.). There is limited recruitment information available for shortnose sturgeon. Estimates of annual egg production for this species are difficult to calculate because females do not spawn every year (Dadswell et al. 1984). Further, females may abort spawning attempts, possibly due to interrupted migrations or unsuitable environmental conditions (NMFS 1998). Thus, annual egg production is likely to vary greatly in this species. Fecundity estimates have been made and range from 27,000 to 208,000 eggs/female (Dadswell et al. 1984).

Spawning: Shortnose sturgeon are believed to spawn at discrete sites within rivers (Kieffer and Kynard 1993). In the Merrimack River, males returned to only one reach during a four year telemetry study (Kieffer and Kynard 1993). Squiers et al. (1982) found over three years in the Androscoggin River, adults returned to a 1-km reach; and Kieffer and Kynard (1993) found adults spawned within a 2-km reach in the Connecticut River for three consecutive years. Spawning occurs over gravel, rubble, or rock-cobble substrates (Dadswell et al. 1984; NMFS 1998). Additional environmental conditions linked to spawning activity include decreasing river discharge following the peak spring freshet, water temperatures between 8-12º C, and bottom water velocities of 0.4 to 0.7 m/sec (Dadswell et al. 1984; NMFS 1998). For northern shortnose sturgeon, the temperature range for spawning is 6.5-18.0ºC (Kieffer and Kynard in press). The eggs are separate when spawned but become adhesive within approximately 20 minutes of fertilization (Dadswell et al. 1984). Between 8º and 12°C, eggs generally hatch after approximately 13 days. The larvae are photonegative, remaining on the bottom for several days.

Buckley and Kynard (1981) found week-old larvae to be photonegative and form aggregations with other larvae in concealment.

Larval and Juvenile Development: At hatching, shortnose sturgeon are blackish-colored, 7-11 mm long, resembling tadpoles (Buckley and Kynard 1981). At 9-12 days, the yolk sac is absorbed as sturgeon develop into larvae growing to 15mm total length (TL; Buckley and Kynard 1981). Sturgeon larvae are believed to begin downstream migrations at about 20mm TL in a 2-step migration, the first a 2 to 3-day migration of larvae followed by a residency period by young of year (YOY). Later sturgeon yearlings resume migration in the second summer of life (Kynard 1997). Juvenile shortnose sturgeon (3-10 years old) reside in the interface of saltwater and freshwater in most rivers (NMFS 1998). In populations having free access to the total length of a river, spawning areas are typically located at near the farthest upstream reach of the river (NMFS 1998).

Movement Patterns: Adult shortnose sturgeon typically leave the spawning grounds soon after spawning. Non-spawning movements include rapid, directed post-spawning movements to downstream feeding areas in spring and localized, wandering movements in summer and winter (Dadswell et al. 1984; Buckley and Kynard 1985; O'Herron et al. 1993). Kieffer and Kynard (1993) reported post-spawning migrations were correlated with photoperiod, increasing spring water temperature and river discharge. Young-of-the-year shortnose sturgeon are believed to move downstream after hatching (Dovel 1981) but remain within freshwater habitats. Older juveniles tend to move downstream in fall and winter as water temperatures decline and the salt wedge recedes. Juveniles move upstream in spring and feed mostly in freshwater reaches during summer.

In the northern extent of their range, shortnose sturgeon exhibit three distinct movement patterns. These migratory movements are associated with spawning, feeding, and overwintering activities. In spring, as water temperatures rise above 8ºC, pre-spawning shortnose sturgeon move from overwintering grounds to spawning areas. Spawning occurs from mid/late March to mid/late May depending upon location and water temperature. Sturgeon spawn in upper, freshwater areas and feed and overwinter in both fresh and saline habitats. Shortnose sturgeon spawning migrations are characterized by rapid, directed and often extensive upstream movement (NMFS 1998).

Juvenile shortnose sturgeon migrate upstream in spring in Maine and move back downstream in fall and winter; however, these movements usually occur in the region above the saltwater/freshwater interface (Dadswell et al. 1984; Hall et al. 1991). Adult sturgeon occurring in freshwater or freshwater/tidal reaches of rivers in summer and winter often occupy only a few short reaches of the total length (Buckley and Kynard 1985). Summer concentration areas in southern rivers are cool, deep, thermal refugia, where adult and juvenile shortnose sturgeon congregate (Flourney et al. 1992; Rogers and Weber 1994; Rogers and Weber 1995; Weber 1996). Limited information is currently available on the extent and frequency of coastal migrations made by individual shortnose sturgeon; however, at least some limited coastal migrations between adjacent rivers occur.

Environmental Tolerances: The temperature tolerance for shortnose sturgeon is not well known (Dadswell et al. 1984) but shortnose sturgeon have been found in waters with temperatures as low as 2 to 3ºC (Dadswell et al. 1984) and as high as 34ºC (Heidt and Gilbert 1978). However, temperatures above 28ºC are thought to adversely affect shortnose sturgeon. In the Altamaha River, temperatures of 28-30ºC during summer months create unsuitable conditions and shortnose sturgeon are found in deep cool water refuges. Shortnose sturgeon are known to occur at a wide range of depths. A minimum depth of 0.6m is necessary for the unimpeded swimming by adults. Shortnose sturgeon are known to occur at depths of up to 30m but are generally found in waters less than 20m (Dadswell et al. 1984; Dadswell 1979). However, in general, shortnose sturgeon typically occur in the deepest parts of rivers or estuaries where suitable oxygen and salinity are present (Gilbert 1989).
Shortnose sturgeon have also demonstrated tolerance to a wide range of salinities. Shortnose sturgeon have been documented in freshwater (Taubert 1980; Taubert and Dadswell 1980) and in waters with salinity of 30 parts-per-thousand (ppt) (Holland and Yeverton 1973). Mcleave et al. (1977) reported adults moving freely through a wide range of salinities, crossing waters with differences of up to 10ppt within a two hour period. The tolerance of shortnose sturgeon to increasing salinity is thought to increase with age (Kynard 1996).

Status of Shortnose Sturgeon in the Action Areas:

- ***File 1578*:**[5]

Kennebec Complex:

Abundance Estimates: MDMR has conducted studies determining distribution and abundance of shortnose sturgeon in the estuarine complex of the Kennebec, Androscoggin and Sheepscot rivers (Squiers and Smith, 1979, Squiers et al. 1982). Additional studies were conducted determining the timing of spawning run and location of spawning areas in the tidal section of the Androscoggin River (Squiers et al. 1982; Squiers 1983; Squiers et al., 1993). The estimated size of the adult population (>50cm TL), based on a tagging and recapture study done from 1977 through 1981, was 7,200 with a 95% C.I. of 5,000 - 10,800 (Squiers et al., 1982). The average density of shortnose sturgeon in the estuarine complex of the Kennebec River was the second highest of any population studied through 1983 (Dadswell et al., 1984). Another population study was conducted from 1998 through 2000. The Schnabel estimate using the tagging and recapture data from 1998, 1999, and 2000 was 9,488 with a 95% confidence interval of 6,942 to 13,358 (Squiers 2003).

Spawning: Suspected spawning areas on the Androscoggin and Kennebec rivers were identified in gillnet studies conducted from 1977 through 1981 (Squiers et al. 1981; Squiers et al., 1982).

Androscoggin River: According to Squires (1983) large catches of shortnose sturgeon were made on the Androscoggin River about 400 m downstream of the Route 201 bridge between Brunswick and Topsham from late April through mid-May. This site is approximately 44 km upriver from the

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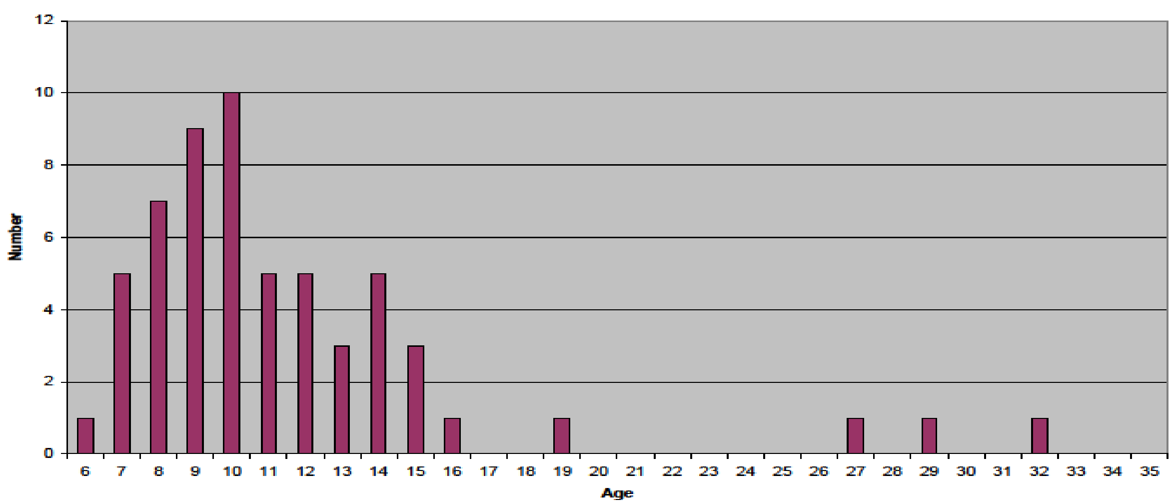
http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

mouth of the Kennebec River in the direction of Brunswick through Merrymeeting Bay. Temperatures ranged from 8.5°C to 14.5°C during the time of these large catches. Many of the male sturgeon captured each year were freely expressing milt. During 1983, a few female sturgeon were so ripe that eggs were extruded as they were retrieved from the nets Squires (1983). The substrate at the sampling site graduated from ledge, boulders, cobbles, pebbles, and gravel on the Brunswick shore to sand in the middle to silt on the Topsham shore. The maximum depth at low tide was 6.7 m, with an average depth of 3 m. Water velocities measured along a transect from the Brunswick shore to the Topsham shore during an outgoing tide ranged from 32cm/sec. to 60cm/sec. A follow-up study (Squires et al., 1993) was conducted in 1993 using radio telemetry, artificial substrate, and bottom set plankton nets. Ripe shortnose sturgeon were concentrated for a distance of about 500 m below the Brunswick Hydroelectric dam approximately 100 m upriver of the Route 201 bridge (rkm 44). Shortnose sturgeon eggs were collected using artificial substrate and plankton nets. The spawning migration extended from the end of April to the last week in May. Spawning occurred from at least May 7 through May 19 based on the presence of eggs on the artificial substrate. The temperature from late April through the end of May ranged from 7°C to 17°C. Gillnet catches and radio telemetry indicated that the peak spawning occurred from May 8 to May 10 at a water temperature of 14°C.

Figure 2 below illustrates a mean age of 12 years (median 10 yr) determined for 58 shortnose sturgeon adults collected on the spawning run in the Androscoggin River in 1981 (Squiers et al. 1982). The lengths ranged from 52.5 cm FL to 90.0 cm FL with the average fork length of 68.9; however, sex was undetermined.

Figure 2: Age of shortnose sturgeon captured in the Androscoggin River, ME during the 1981 spawning run.



Kennebec River: Spawning site(s) on the Kennebec River are not as well delineated as the site(s) on the Androscoggin River (T. Squires, pers. comm.2008). Squiers et al. (1982) suspected a site to occur 11 km below the former Edwards Dam (rkm 59) where males extruding milt were collected in 1980 and 1981. Additional sampling occurred on May 11, 1999 approximately 10 km below the former Edwards Dam (rkm 60) to collect tissue samples. During this sampling, 135 adults were captured in an overnight set. The water temperature was 14 °C and it is assumed that these sturgeon were on the spawning run (Squires 2003).

MDMR also conducted an ichthyoplankton survey from 1997 through 2001 monitoring the recolonization of the habitat above the Edwards Dam removed in 1999. In the results summarized by Squires (2003), 12 sampling sites were established above the former dam site and thirteen sites were established below the former dam site. Surface tows with one-meter plankton nets (800 microns) or stationary sets of one-half meter D-shaped plankton nets (1600 microns) were made at each station. Small numbers of shortnose sturgeon eggs and/or larvae were collected at sites located in the first nine kilometers below the former Edwards Dam each year (rkm 61-70). However, no shortnose sturgeon eggs or larvae were collected above the former Edwards Dam site in 2000 or 2001 (Squires, 2003). The latest collection of ELS on the Kennebec River occurred in 2009 when 23 larvae were captured at rkm 64 with D-nets (G. Wippelhauser, pers. comm. 2010).

While there have not been any directed studies determining if shortnose sturgeon are utilizing potential spawning habitat above the former Edwards Dam, several shortnose sturgeon have been captured incidental to other studies in Waterville, 27 km above the former Edwards Dam, since its removal (G. Wippelhauser, pers. comm. 2009).

Foraging: Tracking data and gillnet studies indicate the majority of shortnose sturgeon feed in the Bath region of the Kennebec River (rkm 16 – rkm 29) from mid April through early December, then migrate upriver to overwinter in Merrymeeting Bay (T. Squires pers. comm.,2008). Although the major concentrations of shortnose sturgeon are found in the Bath region, including the Sasanoa River, shortnose sturgeon are also found in Monstweag Bay in the lower Sheepscot River and in Merrymeeting Bay (rkm 29 to rkm 42). Based on limited gillnetting and telemetry data it appears shortnose sturgeon occasionally make forays upriver to the Augusta/Gardiner (rkm 59-70) area during summer months (T. Squires pers. comm.,2008).

Salinities in the main foraging area in the Bath Region range from 0 to 21ppt from May through November. There is very little stratification during most of this time period and the difference in salinities from the surface to the bottom are usually less than 1 ppt. The temperature ranges from 4°C in April to over 24°C in July, to around 5°C in late November. Dissolved oxygen levels are almost always near 100% saturation (T. Squires pers. comm. ,2008). Some shortnose sturgeon also utilize Montsweag Bay, a part of the Sheepscot River, as a foraging area. The Sheepscot is interconnected with the Kennebec River through the Sasanoa River and Hockomock Bay. Salinities ranged from 12 to 28 ppt and temperatures ranged from 12 to 22°C in June and July in Montsweag Bay during an ultrasonic telemetry study (McCleave et. al. 1977).

Stomach contents of shortnose sturgeon captured in Montsweag Bay were examined by McCleave et al. (1977). The most common food items were crangon shrimp (*Crangon septemspinosous*); clams (*Mya arenaria*); and small winter flounder (*Pseudopleuronectes americanus*). No food habit studies have been conducted for shortnose sturgeon in the Kennebec River (T. Squires pers. comm.,2008).

Tracking studies indicate shortnose sturgeon make use of two large marshes in the Bath area; Hanson Bay (Pleasant Cove; rkm 21) in the Sasanoa River and Winnegance Cove (rkm 17) in the Kennebec River. A Wetland Functional Assessment was conducted by Bath Iron Works (BIW) as part of the review of impacts of the proposed expansion of the shipyard into wetlands habitat (Normandeau, 1998). The benthic community in Winnegance Creek was assessed as part of this study and the benthic assemblage in Winnegance Creek (rkm 17) contained no mollusks, a preferred food of adult shortnose sturgeon in other rivers (Dadswell, 1979, Dadswell et. al., 1984). One of the dominant available species in Winnegance Creek, however, was the sabellid polychaete (*Maranzariella viridis)*, found in stomachs of shortnose sturgeon in the Saint John River, but not preferred there.

No sampling for epibenthic invertebrates was done in the BIW Wetland Functional Assessment. On numerous occasions, however, gammarid amphipods were observed on the nets when sampling for sturgeon in the summer foraging area (T. Squires pers. comm., 2008). In an earlier study on the food habits of smelt in the lower reaches of the Kennebec River, the dominant food item was gammarids, particularly *Gammarus oceanicus* (Flagg, 1974). Although, the stomach contents of shortnose sturgeon were not sampled in this part of the Kennebec complex, shortnose sturgeon consumed gammarid amphipods and polychaete worms in the estuary of the Connecticut River (Savoy and Benway, 2004), in the Hudson River (Haley, 1999), and on the Edisto and Savannah River (Collins 2008); and it is thus likely, shortnose sturgeon in the Kennebec complex would also prefer the same food item.

Overwintering/Resting Areas: No studies had been done to locate the overwintering sites of adult shortnose sturgeon in the Kennebec River prior to 1996. Based on catch per unit effort from gillnet sets in the lower Kennebec River, it was thought the likely overwintering sites in the estuarial complex was in the deep saline region of the lower river (below Bluff Head, rkm 15) and possibly in the adjacent estuary of the Sheepscot River (Squiers et al., 1982). It was also known some shortnose sturgeon overwintered in the tidal freshwater sections of the Eastern and Cathance rivers; both are tributaries to Merrymeeting Bay (Squiers et al., 1982). MDMR attempted to identify shortnose sturgeon overwintering sites in the Kennebec in 1996. A total of fifteen shortnose sturgeon were outfitted with sonic transmitters in October and November 1996 in order to track them to their overwintering habitat. Initial capture locations of the sturgeon varied within the Kennebec System. Eight individuals were captured, tagged and released in Pleasant Cove (rkm 21) on the Sasanoa River which joins the Kennebec River in Bath just a short distance downriver of the Carlton bridge; five were captured, tagged and released in Winnegance Cove (rkm 17), located approximately 2700 m below the Carlton Bridge on the Kennebec River, and two were captured in Merrymeeting Bay (rkm 38) and released at the Richmond town landing in channel west of Swan Island (rkm 40.5) (T. Squires, pers. comm. 2008).

The eight shortnose sturgeon captured in Pleasant Cove and the five captured in Winnegance Cove were all relocated. Eleven of the thirteen were relocated in Merrymeeting Bay. The first two sturgeon tagged in Pleasant Cove (code #338 and 356) were never found in Merrymeeting Bay. Sturgeon # 338 did move from Pleasant Cove to Winnegance Cove and back, and sturgeon # 356 moved to Days Ferry (rkm 24) and back. (T. Squires, pers. comm. 2008). Both sturgeons were last found in Pleasant Cove (rkm 21) on November 13, 1996. After November 13, 1996 sturgeon with transmitters were only found in upper Merrymeeting Bay on the east side of Swan Island (rkm 38). Eleven individual sturgeon were identified in this area. It became impossible to separate signals as the sturgeon grouped together. Multiple signals were found at the suspected overwintering site near Swan Island in Merrymeeting Bay on every occasion it was checked. Poor ice conditions made it difficult to cover large areas in Merrymeeting Bay and its tributaries so it was possible that not all sturgeon overwintered at the suspected overwintering site but no other signals were received at other sites which included smelt camp colonies on the Kennebec, Eastern, Cathance and Abagadasset rivers (T. Squires, pers. comm. 2008).

Movement and Migration: Additionally, in October and November of 2007, MDMR using its passive array of receivers, detected five pre-spawning adult shortnose sturgeon overwintering in the Kennebec River having been initially captured and ultrasonically tagged in the Bangor/Brewer overwintering area of the Penobscot River in late September 2007 (Fernandes et. al. 2008) Four of these individuals were subsequently relocated in the Kennebec River overwintering area (Merrymeeting Bay) near rkm 38 in February 2008. These sturgeon were located between rkm 37.25 to 39.25. This stretch of river is tidally influenced freshwater and the depths are approximately 4.5 to 6.0 m with a predominant sand substrate.

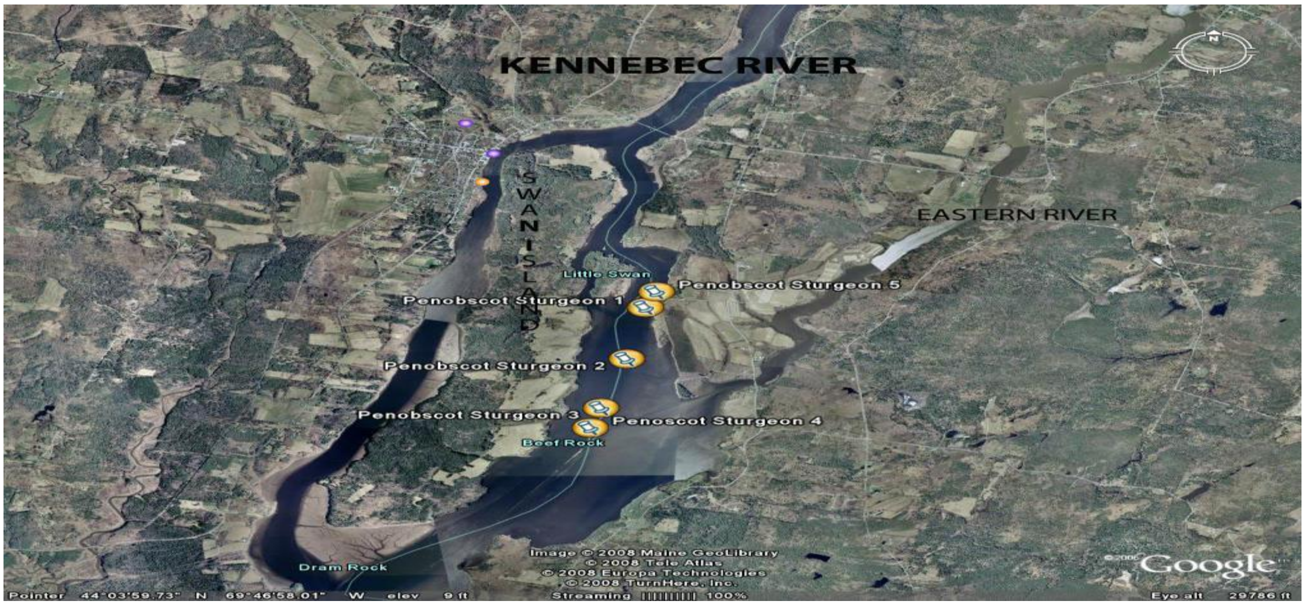


Figure 3: Location of shortnose sturgeon captured from the Penobscot River overwintering in the Kennebec River (February 2008).

Saco River and Other Maine Rivers South of the Kennebec Complex:
A recent discovery of shortnose sturgeon within the Saco River has complicated the understanding of shortnose sturgeon in Maine waters. Prior to capture of two shortnose sturgeon from this watershed in 2009, it was previously believed this species was absent from southern Maine, because shortnose sturgeon were not considered able to make use of the numerous smaller river systems along Maine's coast due to dams blocking access of sturgeon to freshwater areas.

Atlantic sturgeon have been documented in the Saco (Sulikowski, unpublished), and shortnose sturgeon have also been documented transiently using the Medomak, St. George, and Damariscotta Rivers (G. Zydlewski et al. unpublished). Further, recent ultrasonic tracking data now suggest shortnose sturgeon make use of these systems during their forays between the larger drainage systems that might support reproduction.

In early April 2010, researchers from the USGS reported a high percentage of late-stage females captured in the fall and winter of 2009 from the Merrimack River (MA), migrated to known or suspected spawning sites in the Kennebec River (a distance of 285km) (M. Kieffer pers. comm. 2010). Of 26 late-stage shortnose sturgeon females captured in the Merrimack River near Haverill, MA, six were acoustically tagged. And of these fish, five (83%) were later detected in

April 2010 in the Kennebec River. Interestingly, two of these same fish were also detected in the Saco River during their transit, signifying a much larger coastal migration of the endangered shortnose than previously understood and also indicating the importance of Maine's southern rivers in terms of stock connectivity (i.e., immigration and emigration) and demographic correspondence (i.e., similar or unique aspects of population dynamics, reproduction, life history traits and behaviors), all factors critical to status assessment and management of these species.

- ***File 1595*:**[6]

Penobscot River:

Abundance Estimates: In May 2006, the University of Maine (UM), in conjunction with NMFS and the U.S. Geological Survey (USGS), began a study of the distribution, abundance, and movements of adult and sub-adult Atlantic sturgeon in the Penobscot River. These research efforts confirmed the presence of shortnose sturgeon in the river. In 2006, 62 shortnose sturgeon were captured by UM in the Penobscot River from Frankfort upstream to Bangor. Between May 21, 2007 and September 10, 2007, an additional 99 individual shortnose sturgeon were captured and tagged in the river. A total of 185 shortnose sturgeon were captured in the river in 2008 and 221 in 2009. All sturgeon captured during the study were adults or large juveniles, as the type of gear used for sampling (large mesh gill nets of 6" and 12" stretch) were not designed to capture sturgeon less than 2 feet in length.

Using the 2006 and 2007 mark-recapture data, UM researchers used two different calculation methods to obtain a preliminary population estimate for the Penobscot River (Fernandes et al. 2008). Using a Lincoln/Peterson Index, an estimate of 1,049 fish was calculated (95% confidence interval of 673 and 6,939). A Schnabel estimate was also calculated yielding an estimate of 1,710 shortnose sturgeon. It must be noted that both models assume a closed population (no mortality, birth or migration takes place). Fernandes (2008) used capture data from 2006 and 2007 to calculate Peterson and Schnabel estimates of population size. The Peterson estimate of shortnose sturgeon abundance was 1,425 with a confidence interval of 203-2647. The Schnabel estimate was 1,531 with a confidence interval of 885-5681. As reported by Fernandes (2008), these two methods require a large number of recaptures for a precise estimate of abundance, and were likely affected by the low number of recaptures in this study. Additionally, several of the assumptions of these tests were violated, including the lack of a closed population and random sampling. However, researchers believe that these estimates, particularly the Lincoln/Peterson Index, are a reasonable first attempt at an estimate. Researchers are currently exploring other open and closed model assumptions related to when fish are non-transient.

Habitat: In 2009, spawning mats and ichthyoplankton nets were used to detect potential spawning below Veazie Dam (Zydlewski 2009a). While no actual spawning activity was detected, suitable spawning areas were described, using data on bathymetry, water temperature and velocity (Zydlewski 2009a). Sturgeon movement into and out of the Penobscot River estuary also was documented, including immigration into the Kennebec River estuary (Fernandes 2008).

6 http://maps.google.com/maps/ms?source=s_q&hl=en&geocode=&ie=UTF8&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

Telemetry studies indicate while shortnose sturgeon are present in the river and estuary throughout the year, their movements vary by season in response to water temperature and flow. From mid-October to mid-April most tagged shortnose sturgeon concentrate in a relatively small section of river near Bangor. Following overwintering they move downstream into the estuary until returning upstream in summer during low flows. Tagged fish were observed upstream 2 km below the Veazie Dam by August. At the end of summer, shortnose sturgeon moved downstream to the location of the overwintering site in the Bangor area (Fernandes 2008, Zydlewski 2009b). The preliminary telemetry data collected by UM suggests that sub-adult and adult shortnose sturgeon move extensively within the river system during spring and early summer and often can be found over mudflats outside the main river channel (Fernandes et al. 2006). Spawning areas have not yet been identified. However, researchers suspect, based on the literature, spawning would likely take place as far upriver as sturgeon can migrate, allowing larvae and juveniles the most freshwater habitat downriver before entering estuarine conditions. This location would be consistent with just downstream of the Veazie Dam, at water temperatures and depths between 8 and 18°C and 1-5m, respectively, at water velocity between 50-125 cm/s, and on cobble/rubble substrate 101-300 mm diameter available at the site.

Outside of spawning, shortnose sturgeon typically occur over soft substrates consisting of mud, silt or sand, and commonly in deeper channels or over tidal mud flats (NMFS 1998). Such habitat is extensive in the Penobscot River from the estuary upstream to the area around Bangor and Brewer (Fernendes 2008, Zydlewski 2009a, Zydlewski 2009b). Much of this soft sediment consists of bark, sawdust or wood chips, which were deposited as a result of log-driving and operation of saw mills and pulp and paper operations on the river. These soft sediment areas were found to be used by shortnose sturgeon throughout the year in recent University of Maine studies (Fernendes 2008; Dionne, pers. comm., 2010).

Movement and Migration: Many tagging and telemetry studies in rivers throughout the species' range indicate shortnose sturgeon remain in their natal river or the river's estuary (Dadswell et al. 1984, NMFS 1998). However, recent data collected by UM and MDMR indicate migration between river systems is more extensive than was previously thought. Sonic transmitters were implanted in a total of thirty-nine shortnose sturgeon from June 14, 2006 through September 27, 2007 in the Penobscot River by UMaine; (S. Fernandes, UMaine, pers. comm. 2008). Eleven of these sturgeon have been subsequently detected in the Kennebec River by MDMR with its passive array of receivers. It is approximately 70 km between the mouth of the Kennebec River and the mouth of the Penobscot River; however, one tracked individual traveled 230 km from its tagging site in Bangor on the Penobscot River to upper Kennebec River (S. Fernandes, UMaine, pers. comm. 2007;. Additionally, movement from the Kennebec to the Penobscot was documented when two shortnose sturgeon PIT tagged by MDMR in the Kennebec River in 1998 and 1999 were recaptured in the Penobscot River in 2006 by UMaine researchers

Five pre-spawning shortnose sturgeon sonic tagged in late September 2007 in the Bangor overwintering area on the Penobscot River (S. Fernandes, UMaine, pers. comm. 2007, T. Squires, pers. comm. 2008) were detected by the MDMR with its passive array of receivers in the Kennebec River in October and November 2007. Four of these five sturgeon were subsequently relocated in the Kennebec River overwintering area near rkm 38 in February 2008. In addition, the fifth shortnose sturgeon implanted with a transmitter during the same time period and area and was subsequently relocated in the Kennebec River overwintering area.

In the following year (2008) MDMR deployed its passive array of receivers to document movement of the five overwintering sturgeon in the Kennebec, and four of the five on the overwintering grounds in February 2008 were tracked. These four were females with late stage eggs. One migrated upriver to the Farmingdale/Hallowell (rkm 61) reach in the Kennebec River which had been previously identified by MDMR as a spawning area. Another migrated to Waterville (rkm 97), the upstream limit of sturgeon habitat made accessible with the removal of the Edwards Dam in 1999. A third migrated to the known spawning area on the Androscoggin River near Brunswick, ME (rkm 44). These three moved rapidly downriver after a few days and are presumed to have left the Kennebec River system. The fourth sturgeon with late stage eggs migrated to the mouth of the Androscoggin and was last relocated in Merrymeeting Bay on May 12, 2008. Its signal was not picked up on any of the downriver receivers.

Based on a model developed by the University of Maine for coastal immigration and emigration of Penobscot River sturgeon (See Figure 3 below), the stock structure is thought to be relatively stable with minimal immigration and emigration occurring in the winter and summer months. Conversely, migration into and out of the system is believed to occur in two distinct periods of time—after spawning and prior to overwintering. Movements of sturgeon captured during the congregated periods would enable researchers to later assess seasonal movements and migrations of sturgeon stocks between rivers using telemetry and mark and recapture open population models.

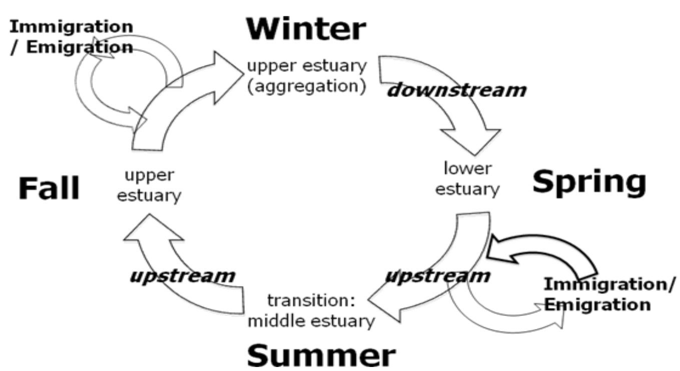


Figure 4: Seasonal movement patterns of SNS in the Penobscot River (adapted from Fernandes 2008). (*Beginning in winter, adult SNS aggregate from November to April in a distinct section of river; when water temperatures and discharge rise in the spring they move to the lower estuary. Later in the spring/early summer some of these individuals leave the river (emigration) and others return (immigration). Those staying in the river system move upstream to the middle estuary in mid-summer and again further upstream in the fall. In late fall/early winter another set of individuals immigrates and emigrates from the river before the wintering aggregation forms in November*).

3.3.1.2. <u>Non-targeted ESA Listed Species Affected</u>:

- ***<u>Atlantic salmon</u>*** (*Salmo salar*) **–**

Atlantic salmon are anadromous fish spending most of its adult life in the ocean, returning to freshwater to reproduce. The Atlantic salmon is native to the basin of the North Atlantic Ocean, from the Arctic Circle to Portugal in the eastern Atlantic, from Iceland and southern Greenland, and from the Ungava region of northern Quebec south to the Connecticut River (Scott and Crossman 1973). In the United States, Atlantic salmon historically ranged from Maine south to

Long Island Sound. However, the Central New England DPS and Long Island Sound DPS have both been extirpated (65 FR 69459; Nov. 17, 2000), and now only the Gulf of Main (GOM) DPS is extant.

GOM Listing Status: The GOM DPS of anadromous Atlantic salmon was initially listed by the USFWS and NMFS (collectively, the Services) as endangered on November 17, 2000 (65 FR 69459) encompassing all naturally reproducing remnant populations of Atlantic salmon from the Kennebec River downstream of the former Edwards Dam site, northward to the mouth of the St. Croix River. The Androscoggin River was not listed. The Penobscot and its tributaries were only included downstream from the former site of the Bangor Dam in the initial listing. The river specific hatchery reared fish were also included as part of the DPS. However, these hatchery fish did not count toward a delisting until naturally spawning in the wild.

The most recent listing by the Services (74 FR 29344; June 19, 2009) relists the GOM DPS of Atlantic salmon as endangered, redefining its range to include all anadromous Atlantic salmon whose freshwater range occurs in the watersheds including the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. Included in the GOM DPS are also all associated conservation hatchery populations used to supplement these natural populations. Excluded from the GOM DPS are landlocked Atlantic salmon and those salmon raised in commercial hatcheries for the aquaculture industry. (See listing online at: http://www.nmfs.noaa.gov/pr/species/fish/atlanticsalmon.htm).

In the Kennebec complex (File 1578) the DPS was expanded upstream from the former Edwards Dam at Augusta, ME to the impassable falls at Grand Falls on the Dead River and the un-named falls (impounded by Indian Pond Dam) immediately above the Kennebec River Gorge in the town of Indian Stream Township on the Kennebec River. The Androscoggin River was included in the new listing extending to Rumford Falls in the town of Rumford on the Androscoggin River, and Snow Falls in the town of West Paris on the Little Androscoggin River. In the Penobscot Basin (File 1595), the range was extended upstream from the dam at Bangor, ME to Big Niagara Falls on Nesowadnehunk Stream; to Grand Pitch on Webster Brook in Trout Brook Township; and Grand Falls on the Passadumkeag River in Grand Falls Township. The marine range of the GOM DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland.

Species Description: The average size of an adult Atlantic salmon is 28-30 inches (71-76 cm) long and 8-12 pounds (3.6-5.4 kg) after two years at sea. Although uncommon, adults can grow to be as large as 30 pounds (13.6 kg). Atlantic salmon have a relatively complex life history including spawning, juvenile rearing in rivers, and extensive feeding migrations on the high seas. As a result, Atlantic salmon go through several distinct phases identified by specific changes in behavior, physiology, and habitat needs. Juvenile salmon feed and grow in rivers for one to three years before undergoing "smoltification" and migrating to the ocean. Atlantic salmon of U.S. origin are highly migratory, undertaking long marine migrations between the mouths of U.S. rivers and the northwest Atlantic Ocean where they are widely distributed seasonally over much of the region. Most Atlantic salmon of U.S. origin spend two winters in the ocean before returning to freshwater to spawn. Those returning after only one year are called grilse. In the United States, most adult Atlantic salmon ascend the rivers of New England beginning in spring and continuing through the fall, with migration peaking in June.

Habitat: Atlantic salmon are anadromous, typically spending 2-3 years in freshwater, migrating to the ocean as smolts, spending 2-3 years, then returning natal rivers to spawn. Suitable spawning habitat consists of gravel or rubble in areas of moving water. Eggs hatch in March or April becoming fry. Fry remain buried in the gravel for about six weeks, emerging about mid-May to start feeding on plankton and small invertebrates. Emergent fry quickly disperse from nests (called redds) within the gravel, soon developing camouflaging stripes along their sides, and enter what is termed the parr stage.

Parr habitat, often called "nursery habitat," is typically riffle areas characterized by adequate cover, shallow water depth, and moderate to fast flowing water. Salmon parr spend 2-3 years in freshwater finally undergoing a physiological transformation called smoltification. This process prepares them for life in a marine habitat.

Atlantic salmon smolt leave Maine rivers in the spring, migrating to Newfoundland and Labrador by mid-summer. They spend their first winter at sea south of Greenland after which a small percentage return to Maine while the majority spend a second year at sea, feeding off the southwest or, to a much lesser extent, the southeast coast of Greenland. Some Maine salmon are also found in waters along the Labrador coast. After a second winter in the Labrador Sea, most Maine salmon return to rivers in Maine, with a small number returning the following year as what is referred to as *three sea* winter fish.

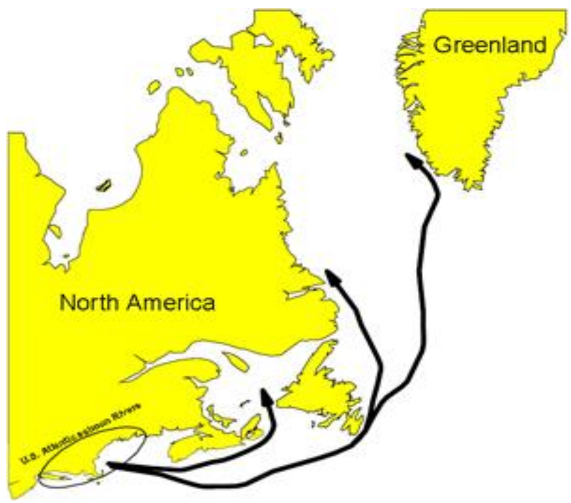


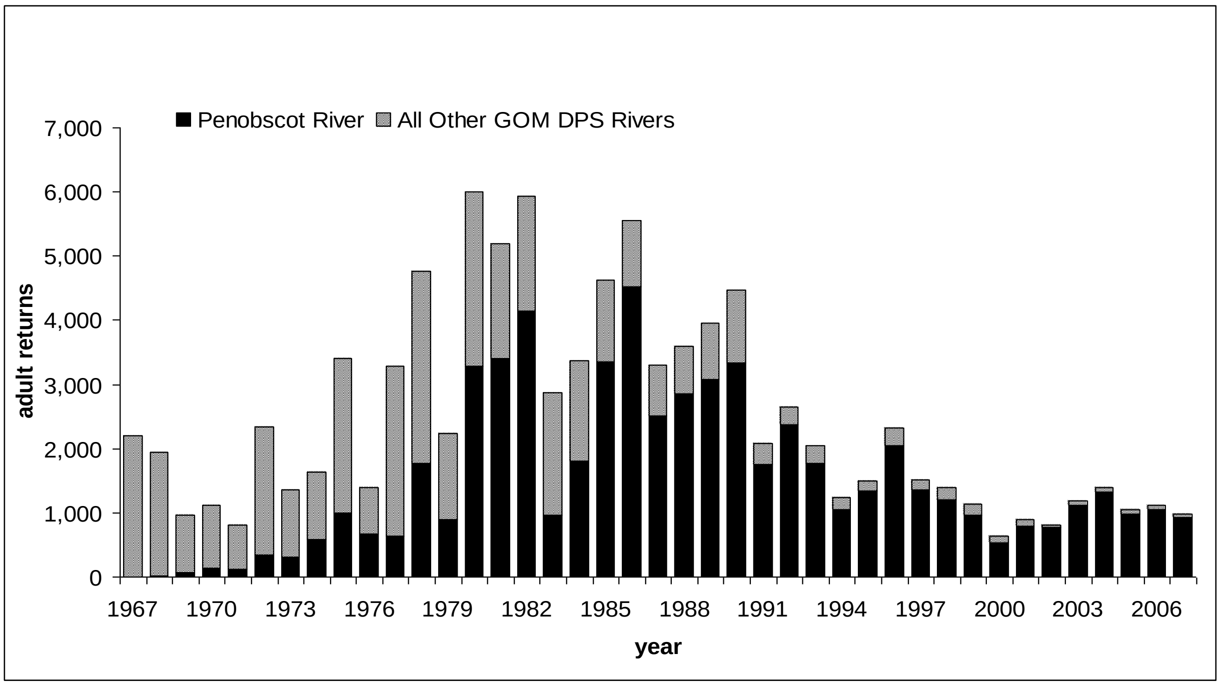
Figure 5: Migration of Atlantic salmon from the GOM to the marine environment

Status and Trends of GOM Atlantic Salmon: The abundance of Atlantic salmon within the range of the GOM DPS has been generally declining since the 1800s (Fay et al. 2006). Data sets tracking adult abundance are not available throughout this entire time period; however, Fay et al. (2006) present a time series of adult returns to the GOM DPS dating back to 1967. It is important to note that contemporary abundance levels of Atlantic salmon within the GOM DPS are several orders of magnitude lower than historical abundance estimates. For example, Foster and Atkins (1869) estimated that roughly 100,000 adult salmon returned to the Penobscot River alone before the river was dammed, whereas contemporary estimates of abundance for the entire GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay et al. 2006).

Contemporary abundance estimates are informative in considering the conservation status of the GOM DPS today. After a period of population growth in the 1970s, adult returns of salmon in the GOM DPS have been steadily declining since the early 1980s and appear to have stabilized at very low levels since 2000 (Figure 6). Population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from Green Lake National Fish Hatchery (GLNFH) constructed in 1974. Marine survival remained relatively high throughout the 1980s, and salmon populations remained relatively stable until the early 1990s. In the early 1990s marine survival rates decreased, leading to declining trends in adult abundance throughout 1990s. Poor marine survival persists in the GOM DPS to date.

Adult returns to the GOM DPS have been low for many years and remain extremely low in terms of adult abundance in the wild. Further, the majority of adults in the GOM DPS return to a single river, the Penobscot, which accounted for 91 percent of all adult returns to the GOM DPS in 2007 (USASAC 2008). Of the 1044 adult returns to the Penobscot in 2006, 996 were the result of smolt stocking, and only the remaining 48 were naturally-reared. A total of 916 and 2,117 adult salmon returned to the Penobscot River in 2007 and 2008, respectively. Most of these returns were also of hatchery origin (USASAC 2008). The term naturally-reared includes fish originating from natural spawning and from hatchery fry (USASAC 2008). Hatchery fry are included as naturally-reared because hatchery fry are not marked; therefore, they are not distinguished from fish naturally spawned. Because of the extensive amount of fry stocking taking place in an effort to recover the GOM DPS, it is possible that a substantial number of fish counted as naturally-reared were actually stocked as fry.

Figure 6: Adult returns to the GOM DPS 1967-2007.



Low abundances of both hatchery-origin and naturally-reared adult salmon returns to Maine demonstrate continued poor marine survival. Declines in hatchery-origin adult returns are less sharp because of the ongoing effects of hatcheries. In short, hatchery production over this time period has been relatively constant, generally fluctuating around 550,000 smolts per year (USASAC 2008). In contrast, the number of naturally reared smolts emigrating each year is likely to decline following poor returns of adults (three years prior). Thus, wild smolt production would suffer three years after a year with low adult returns, because the progeny of adult returns typically emigrate three years after their parents return. The relatively constant inputs from smolt stocking, coupled with the declining trend of naturally reared adults, result in the apparent stabilization of hatchery-origin salmon and the continuing decline of naturally reared components of the GOM DPS observed over the last two decades (USASAC 2008).

Adult returns for the GOM DPS remain well below conservation spawning escapement (CSE) goals widely used (ICES 2005) to describe the status of individual Atlantic salmon populations. When CSE goals are met, Atlantic salmon populations are generally self-sustaining. When CSE goals are not met (i.e., less than 100 percent), populations are not reaching full potential; and this can be indicative of a population decline. For all GOM DPS rivers in Maine, current Atlantic salmon populations (including hatchery contributions) are well below CSE levels required to sustain themselves (Fay et al. 2006), which is further indication of their poor population status.

The abundance of Atlantic salmon in the GOM DPS has been low and either stable or declining over the past several decades. The proportion of fish of natural origin is very small (approximately 10%) and is continuing to decline. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS.

3.3.1.3. Non-targeted ESA and/or MMPA Listed Species Not Affected:

Sea turtles in northeastern nearshore waters of the GOM are typically small juveniles with the most abundant being the federally endangered leatherbacks followed by the federally threatened loggerhead and endangered Kemp's ridley (NMFS 2007). Loggerhead turtles have been found to be relatively abundant off the Northeast coast (from near Nova Scotia, Canada to Cape Hatteras, North Carolina). Loggerheads and Kemp's ridleys have been documented in waters as cold as 11°C, but generally occur in northern waters when temperatures exceed 16°C (NMFS 2007). These species are typically present in New England waters from June 1st – November 1st and are most common south of Cape Cod Bay. Leatherbacks are located in New England waters during the warmer months as well, but have been sighted in temperatures as low as 0°C in the GOM. While leatherbacks are predominantly pelagic, they may also occur close to shore, especially when pursuing their preferred jellyfish prey. Green sea turtles may also occur sporadically as far north as Massachusetts, but those instances would be rare and are typically storm related. Green sea turtles are not known to occur in Maine waters (NMFS 2007). Thus, while leatherback, loggerhead, and Kemp's ridley sea turtles may be seasonally present in the GOM, these species are not known to occur in the bays and rivers of the GOM where the planned research would occur. As such, NMFS PR has determined sea turtles are not likely to occur in the action area; therefore, effects of the action on listed sea turtles will not be considered further in this SEA.

Federally endangered Northern right whales and humpback whales are found seasonally in Maine waters. Northern right whales have been documented of the coast of Maine from July 15 – October 15. Humpback whales are found off the coast of Maine from April 15 – November 15. Fin, sei and sperm whales are also seasonally present in New England waters but are typically found in deeper offshore waters. Listed whales are not known to occur in the bays and rivers of the GOM where the proposed research would occur (NMFS 2007). As such, NMFS PR has also determined that listed whales are not likely to occur in the action area; therefore, effects of the actions on listed whales will not be considered further in this consultation.

However, in all boating activities — including travel to acoustic receiver arrays — researchers would be advised in permits to keep a close watch for all marine mammals to avoid harassment or adverse interaction, and also advised to review the NMFS Northeast Region Marine Mammal Approach and Viewing Guidelines located online at: http://www.nero.noaa.gov/prot_res/mmv

3.3.1.4. MMPA Protected Species: Marine Mammals in GOM Waters: Harbor seal and gray seal occurring in the GOM are the most abundant species of marine mammal species potentially affected by the applicant's proposed research modification. Maine coast-wide surveys of gray seals conducted in 1993 and 2001 revealed 597 and 1,731 gray seals, respectively (Gilbert et al. 2005). Between 1981 and 2001, the population of harbor seals grew in the GOM at an annual rate of 6.6 percent yielding abundance estimate of 99,340 (Gilbert et al. 2005). Harbor porpoise are also very prevalent in the GOM and they are most commonly seen in deeper waters (>1800 m; Westgate et al. 1998) over the continental shelf. Harp seal and hooded seal are rarely present in the GOM, and are considered extralimital, usually occurring in the action area from January– May (Harris et al. 2002).

File 1595: The 2007 EA prepared for File 1595 discounted potential harassment with marine mammals in the Penobscot River Basin and lower estuary based on limited sightings of seal in the action area and reported locations of haul outs well downstream of the planned netting. Additional precautionary measures in the permit were suggested by the Northeast Offices of Protected Resources and have contributed to zero interaction with marine mammals over the last four years of permitted action. Because no interactions with marine mammals have occurred in sturgeon sampling thus far, similar conditions protecting marine mammals are adopted in the proposed modification.

File 1578: Likewise in File 1578, no interaction with marine mammals in the original 2006 EA was anticipated, and to date none has occurred. However, due to the applicant's latest proposal for netting and boating in near shore estuarine areas, greater potential for interaction with marine mammals would exist. Additionally, in defined locations researchers have identified harbor seal haul outs in one bay in the lower Kennebec complex and in one location in the Saco River.[7] As indicated, minimal sampling for shortnose sturgeon would take place in these locations; however, based on the applicant's past experience of intensive sampling in the presence of these marine mammals with no resulting interaction, the MDMR is requesting no incidental take provisions for marine mammals under the provision of the MMPA.

The applicant suggested the MDMR would seek coverage under the MMPA at a later date; but also suggested they would limit sampling in close proximity (1-km) to known seal haul outs, and would otherwise continue past practices guarding against interaction with marine mammals. Namely, the applicant would: (1) not disturb animals or deploy netting when animals are observed within the vicinity of the research; (2) animals would be allowed to either leave or pass through the area safely before netting is deployed; (3) netting activities would be closely attended and continuously monitored during deployment; (4) nets would be checked every hour or more frequently if it is obvious an animal is caught; (5) netting would cease if a marine mammal is sighted after deployment within a 300 meter radius of the research vessel or net; and (6) netting would only resume after the animal is no longer within this safety zone, or 30 minutes has elapsed since the mammal was last observed within the safety zone.

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7 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

The above voluntary measures would be placed in the modification of File 1578 as mitigating conditions (See Section 4.5.1.13 of this SEA); and NMFS believes these would lessen the probability of interacting with marine mammals during sampling. However, should incidental or adverse harassment of a marine mammal occur during sturgeon sampling, researchers would be required to stop research and contact NMFS PR within two business days.

This ends consideration of marine mammal interaction in both research modifications and will not be considered further in this SEA.

3.3.1.5. *Other ESA Listed Species Under USFWS Jurisdiction* :

There are no other ESA listed species in either action area under USFWS jurisdiction; therefore, consultation with the USFWS was not initiated.

3.3.1.6 *Non-Listed By-catch Species*:

Based on netting history in both action areas, 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*), smallmouth bass (*Micropterus dolomieu*), white perch (*Morone americana*), channel catfish (*Ictalurus punctatus*) could become enmeshed in gill nets. However, nets would typically be checked at short intervals and it is believed virtually all bycatch would be released alive. Non-listed bycatch in D-nets would include American eel elvers (*Anguilla rostrata*), herring eggs, smallmouth bass juveniles, smelt eggs and larvae, and catfish. Additionally, because potential for capturing Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), a NMFS "species of concern," is very likely to occur in various rivers in the GOM, the following discussion on Atlantic sturgeon is highlighted below.

Additionally, because capture of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)— a NMFS managed "species of concern," — is also documented in various rivers in the GOM co-occurring in proposed action areas with shortnose sturgeon, researchers would monitor gill nets closely, using the same netting protocols and standard research conditions found protective for shortnose sturgeon (See also Sections 4.2.4; 4.5.1.12; and 4.5.2.11of this SEA).

3.3.1.7 *Aquatic Nuisance Species*:

The U.S. Geological Survey has documented several aquatic nuisance species (USGS 2010) occurring in GOM watersheds potentially affected by the proposed netting and boating activities in of both researchers including: Asian shore crab (*Hemigrapsus sanguineus)*, green crab, (*Carcinus maenas*); giant snakehead (*Channa micropeltes*); water milfoil (*Myriophyllum heterophyllum*), Eurasian water milfoil (*Myriophyllum spicatum*); hydrilla (*Hydrilla verticillata*); 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 were agreed to by the researcher to be implemented as standard research protocol. (See also Sections 4.2.5; 4.5.1.14; and 4.5.2.13 of this SEA).

For further information on the affected biological environment, please refer to the Biological Opinion (November 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 contained in both research modifications. 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 two permit modifications. This alternative would eliminate any potential risk to all aspects of the environment from the proposed modification of research activities. However, activities currently authorized by Permit No. 1578-00 and 1595-03 would continue under the Status Quo prohibiting researchers from gathering information potentially helping endangered and protected shortnose sturgeon.

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

Any impacts of the proposed actions would be primarily be limited to the biological environment, specifically the animals studied or affected by the research. The type of actions proposed in both permit modifications 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 *Environmental Effects Caused by Research Modification — Shortnose Sturgeon*:

Much of the environmental consequences to the biological environment of the target species–shortnose sturgeon–resulting from the currently authorized research activities in File 1578 (capture with gill nets, handle, weigh, measure, genetic tissue tag, PIT tag, anesthetize with MS-222, sonic tag, and sample for ELS with D-nets); and in File 1595 (capture with gill nets, handle, weigh, measure, genetic tissue sample, blood sample, borescope, PIT tag, anesthetize with MS-222, sonic tag, and sample for ELS with D-nets) have not changed as previously described in NEPA documents prepared for the respective actions. Hence, the following discussion focuses on the effects of the request for an expanded action area (File 1578); the requests for increases in previously authorized activities and numbers of animals (File 1578 & 1595); and the requests for new research methods (File 1578 & 1595).

4.2.1.1 Effects of Research Modification on Shortnose Sturgeon — File 1578:

- *Effects of Expanding Research Action Area*:[8]

In File 1578, the current permit authorizes capture of shortnose sturgeon in the freshwater spawning area of the Kennebec River between Augusta, ME (44º 19' N, 69º 46' W) and Waterville, ME (44º 25' N, 69º 43' W) between mid-April to mid-June. However, the applicant now requests expanding the action area including other rivers of the Kennebec River complex and Saco River including freshwater and marine environments (See coordinates of proposed

8 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

action area in Section 2.2.2.1, and also refer to hyperlink of action area below). Acoustic monitoring is planned where researchers would transit by boat to anchored VR-2 receivers placed at the mouths of Maine's other coastal watersheds to the south of the Kennebec complex, namely the Royal, Presumpscot, Casco Bay, Mousam, York, and Piscataqua Rivers. The units will be deployed after ice-out (early April), and inspected and downloaded approximately bi-weekly until the array is removed in late fall. In addition to the anchored array, researchers will search for tagged fish at least once a week with a directional hydrophone and receiver (Vemco VR100) deployed from a boat in order to delineate habitat use on a fine scale.

There are no new marine sanctuaries, National Wildlife Refuges or other protected areas affected within the proposed expanded geographic range; nor are impacts on EFH anticipated as no change in netting procedures or boating activity is proposed.

In regards to non-target species (listed or non-listed) or listed target species, NMFS concludes research conducted in waters of the Kennebec complex and Saco River would not have different effects than previously analyzed for the original study area. The original EA concluded unintentional mortality or serious injury as a result of the netting and other proposed activities would not be likely, and bycatch would be returned to the river alive. The short-term stresses resulting from research and boating activities are thus expected to continue to be minimal.

- *Effects of Capturing 100 Additional Adult or Sub-adult Shortnose Sturgeon*:

In the first three and one half years of the current permit, netting effort has been minimal; thus, actual take has not approached authorized take. However, the applicant is now requesting an increase of 100 shortnose sturgeon captured (up to 600) to cover an expanded geographical area. Further, the increased take is requested to facilitate coordinated work with other GOM researchers, better assessing the rate of exchange between rivers and developing a more robust GOM population estimate. The apparent high rate of exchange recently documented between the Kennebec complex, the Penobscot River, and Maine's southeastern rivers, indicates the number of shortnose sturgeon in Maine's waters may be much larger than initially thought, and may represent a larger meta-population.

The applicant has reported zero mortality in targeted or non-targeted netting in her current permit, and does not anticipate any incidence of mortality in the proposed research. To further reduce potential for mortality in the future, the applicant proposes more conservative measures, namely: netting activities would be closely attended and continuously monitored during deployment (untended overnight sets would no longer be practiced as previously authorized); deployed nets would be checked every six hours between 0 and 15^{o}C; checked hourly between 15 and 20^{o} C; and every 30 minutes between 20 and 26^{o}C; and sampling would be avoided when water temperatures exceed 18ºC or if percent saturation of dissolved oxygen were less than 55% at any temperature level (See Sections 4.5.1.1 of this SEA).

The increase in authorized take requested would not change the effects of capture to the biological environment originally analyzed in the 2006 EA. There is no mortality authorized, and, although mortality or harm is possible, none is anticipated. The additional capture would result in short-term stress to individuals but would not affect the population at a species level. Moreover, researchers would still be expected to monitor all capture events, following previous permit conditions, as well as any updated measures by NMFS. In light of increased protective measures and the applicant's past record using NMFS guidelines, NMFS does not expect increased take would result in the loss of animals from this population or in reduced reproductive success.

- *Effects of Collecting 30 Additional ELS with D-Nets; and of Sampling until October 31st*

Increased Numbers of ELS Collected: An increase from 30 to 60 ELS captured by D-nets is requested each year by the applicant to better meet research objectives of documenting spawning of sturgeon in locations of both the Kennebec complex and the Saco River. Currently, there is record of adult sturgeon using the Saco River; however, documentation of spawning activity has not been made. An authorized take of up to 10 ELS from the Saco and up to 50 ELS from the Kennebec complex is requested to adequately survey the rivers for spawning activity.

For the Kennebec complex, the latest recognized population estimate (Squiers 2003), using tagging and recapture data from 1998, 1999, and 2000, is 9,488 (95% confidence interval of 6,942 to 13,358). NMFS recognizes each adult female sturgeon can produce between 94,000 and 200,000 eggs every three years (COSEWIC, 2005). Using the most recent population estimate of 9,500 in the Kennebec complex, including large juvenile and adult shortnose sturgeon, and assuming sturgeon only reproduce once every 5 years, and half the population is female, approximately 950 adult females would have the potential of producing over 89 million eggs (950 x 94,000). Using this conservative estimate, the annual take of 50 eggs would be considered a small fraction of the total annual egg production, and would have a negligible additional effect on the Kennebec complex shortnose sturgeon population.

When issuing the original permit for File 1578 in 2006, NMFS described the authorized use of D-nets deployed for 24 hours to capture sturgeon ELS. However, NMFS concludes in the face of the recent listing of Atlantic salmon, 24-hour D-net deployment would be suspended and replaced with 3 hour deployment. Further, once all sturgeon ELS authorized are taken, sampling gear would be required to be removed.

Extended Sampling for ELS until October 31: To date fall spawning has not been documented for shortnose sturgeon. However, it is suspected to occur in other sturgeon species, e.g. Gulf sturgeon, *Acipenser oxyrinchus desotoi* (Sulak and Clugston, 1998) and for Atlantic sturgeon (Peterson, pers. comm. 2009). With this in mind researchers request to expand egg and larval sampling to include both spring and fall. However, NMFS does not believe adverse environmental impacts would result from fall sampling. The same conditions analyzed limiting environmental impacts for spring sampling would apply also to fall sampling efforts. The use of D-nets would continue to typically have a lesser effect than gill nets as analyzed previously; and no adverse impacts to the physical environment including EFH are anticipated. Although sampled eggs or larvae using D-nets are all considered directed take mortality, researchers would check the nets at least every three hours to minimize mortality of both target and non-target species. D-nets would be removed from the river beyond October 31, unless the authorized numbers shortnose sturgeon eggs and/or larvae is collected, or impacts to other listed or non-listed species were elevated due to sampling methods.

- *Effects of Increased Numbers of Internal Acoustic Tags*:

Modification of File No. 1578 would authorize an increase in 30 acoustic tags implanted annually. The action would not change the effects to the biological environment originally analyzed in the 2006 EA. There is no mortality authorized and none is expected. Researchers would still be expected to closely monitor all tracking events and document tag adaptation by manually and passively tracking individual fish (using boats and passive receiver arrays), recording swimming behavior, logging the number of times and the periods between detection, and noting the number of unrelocated individuals. For these reasons NMFS believes the additional tags would result in only short-term stress to individuals and would not affect the population at a species level.

- *Effects of Floy Anchor Tags for External Identifying*:

The applicant proposes to tag all shortnose sturgeon (≥ 300 mm) with external Floy anchor tags in order to more easily incorporate incidental recaptures by other researchers coordinating with the applicant in the GOM-wide research. This additional method would also make it possible for collection of information useful for the assessment of the sturgeon population by alerting commercial or recreational fishermen in the GOM.

Smith et al. (1990) compared the effectiveness of dart tags with nylon Floy 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 anchor tags between fish tagged in freshwater or brackish water. Clugston (1996) also looked at 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 Floy anchor tags inserted in the dorsal fin (as proposed in the current modification), Floy anchor tags implanted abdominally, dart tags attached near the dorsal fin, and disk anchor tags implanted abdominally. They found, long-term, Floy anchor tags were most effective (92%) in the dorsal, but also noted minor, slow-healing lesions at the insertion points.

NMFS concludes the use of Floy anchor tags to externally mark shortnose sturgeon is an acceptable duplicative means to identify recaptured fish externally in certain cases where sturgeon are far ranging. The practice is not expected to significantly impact sturgeon health. To lessen known negative impacts described when using Floy anchor tags—such as small lesions—researchers would use sterile tagging technique and subsequently monitor dorsal fins tag sites of recaptured sturgeon. Also, shed tags would not be considered an adverse impact to the environment, as these tags are small in size and the numbers insignificant. Additionally to gain information on tag retention and fish health, the rate of Floy anchor tag retention and any effects on tagged fish would be documented and reported to NMFS in annual reports, or periodically as requested by NMFS. If impacts of the Floy anchor tags on the health of fish are other than insignificant, NMFS would reevaluate their use.

- *Effects of Endoscopic Examination (Borescope)*:

The applicant requests authorization for borescoping all shortnose sturgeon (>69 cm TL) captured during research efforts. Knowing the sex of a sturgeon yields several advantages to the sturgeon researcher, including limiting handling and holding time. This knowledge also prevents

otherwise more invasive procedures if sex determination is required by the researcher.
The researchers in Kynard and Kieffer (2002) demonstrated no damage is caused while examining sturgeon using a borescope. The procedure as a whole only lasts approximately 1-4 minutes. Due to the minimally invasive nature and the speed and the safety demonstrated while using the procedure, borescope examinations would not be expected to cause harmful effects to sturgeon. Prior to performing the procedure, researchers would receive appropriate training from Michael Kieffer (USGS, Turner Falls, MA) or researchers from University of Maine. For these reasons, NMFS does not expect adverse impacts, other than discomfort to individual sturgeon.

- *Effects of Non-Lethal Blood Sampling*:

Blood samples would be collected from up to 20 sub-adult or adult shortnose sturgeon. Samples would be collected from the caudal vein, inserting a needle attached to a Vacutainer tube (containing an anticoagulant) nearly vertically to the ventral midline and immediately behind the anal fin. Effects of drawing blood samples in the manner described with syringes from the caudal vein could include pain, handling discomfort, possible hemorrhage at the site, or risk of infection. To mitigate these effects, the needle would be slowly advanced while applying gentle negative pressure to the syringe until blood freely flows into the syringe. Once blood is collected, direct pressure would be applied to the site to ensure clotting and prevent subsequent blood hemorrhaging (Stoskopf, 1993). The site would then be disinfected and checked again after recovery prior to release. Additionally, the project staff responsible for obtaining these samples would have received extensive experience in the procedure. Drawing blood in the manner described, appears to have little probability of killing shortnose sturgeon or producing sub-lethal effects.

- *Effects of Gastric Lavage for Diet Analysis*:

The researcher proposes to use methods to gastric lavage up to 20 shortnose sturgeon annually during the remainder of the project. Information on diets and how they relate to seasonal foraging and habitat use has recently benefited from the gastric lavage procedure (Foster 1977; Haley 1998; Murie and Parkyn 2000; Moser et al. 2000 and Collins et al. 2008). Due to the morphology of the gut tract and position of the swim bladder in the shortnose sturgeon, care must be taken in the procedure to not injure sturgeon while inserting the tube into the esophagus and positioning it within the gut. Potential injury to sturgeon could include abrasion of the gut wall near the pyloric caecum, trauma associated with not seating the tubing properly in the gut, and potential negative growth responses of sturgeon (going off-feed) after gastric lavage. The practice of anesthetizing sturgeon with MS-222 prior to gastric lavage relaxes the gut wall, allowing easy penetration of the tubing to the proper position in the gut. The applicant has also reported they will receive training for all field researchers in the procedure on captive shortnose sturgeon prior to using the method.

Savoy (2004) reported results from 246 shortnose sturgeon collected on the Connecticut River between 2000 and 2003. All of the fish tolerated the procedure well and recovered without stress. Between 2004 and 2006 Collins et al (2008) captured and lavaged 256 Atlantic and 47 shortnose sturgeon. All fish recovered rapidly and were released unharmed after the procedure. The lavage technique was successful in evacuating stomach contents effectively of both Atlantic and shortnose sturgeon of all sizes without internal injury. Collins et al. (2008) also demonstrated no damage to internal linings of stomachs of three sacrificed Atlantic sturgeon. Additionally, recaptured sturgeon (lavaged an average of 76 days between recapture), experienced typical interim weight gains indicating that the procedure did not negatively influence sturgeon growth. Based on the reported experience with this procedure, NMFS PR believes sturgeon undergoing gastric lavage as proposed, would experience handling discomfort, but would be exposed to only minimal short-term risk associated with the procedure.

- *Effects of Scute Sampling for Elemental Analysis*:

Sampling would involve using an orthopedic bone cutter or small saw to take a small 4-10 mm clip of the apical hook from a single scute from a subset (n=40) of shortnose sturgeon adults or sub-adults. The purpose would be to determine if unique elemental markers can help researchers better understand the extent of movements between systems and identify natal sources of individuals. NMFS believes the removal of the apical hooks of shortnose sturgeon scutes would likely not have any effect on shortnose sturgeon other than short-term discomfort because the scute material is poorly vascularized and non-innervated, and that the removal of a single apical spine would not likely harm the fish.

- *Effects of Electronarcosis for Anesthesia*:

Electronarcosis is proposed for anesthetizing up to 80 shortnose sturgeon adults or sub-adults for surgery, implanting or attaching acoustic tags (up to 60 annually), and while performing gastric lavage (up to 20 annually).

Electronarcosis (also referred to as electro-anesthesia and galvanarcosis) is a non-chemical method of anesthetization using a low voltage constant direct current (CDC) producing muscle relaxation and immobility, and, as such, does not require FDA approval. Electronarcosis has been used successfully by Boyd Kynard (pers. comm.) anesthetizing shortnose sturgeon since the 1980s. Since 2004, USFWS researchers in Maryland have also followed the Henyey et al. (2002) protocol anesthetizing Atlantic and shortnose sturgeon on the Potomac River and Chesapeake Bay with no adverse affects (Mike Mangold, USFWS, pers. comm.). Researchers in South America following these methods have reported similar success (Alves et al. 2007).

Henyey et al. (2002) described using low voltage CDC to induce electronarcosis in shortnose sturgeon without any changes in swimming or feeding behavior, burns, bruising, or mortality after monitoring the fish for six weeks. All evidence indicates electronarcosis induced by the method described is similar to the condition induced by chemical anesthetics and does not cause adverse effects on sturgeon; nevertheless, more research is needed on the physiological mechanisms by which it works. Reports to NMFS would include experiences and observation using electronarcosis.

4.2.1.2 Effects of Research Modification on Shortnose Sturgeon — File 1595:[9]

- *Effects of Capturing Additional Adult or Sub-adult Shortnose Sturgeon*:

The applicant is requesting an increase in allowable take from 200 to 300 adult or sub-adult shortnose sturgeon, along with previously authorized activities from the Penobscot River. The number of captured shortnose sturgeon authorized in File 1595 (Penobscot River) was originally

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9 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

set low (Permit 1595-00) due to lack of information on the population. Information since provided under Permit Nos. 1595-01, 1595-02, and 1595-03 has suggested a larger but variable population. With 100 sturgeon authorized in the 2006 and 2007 field seasons, the preliminary population estimate for the lower Penobscot River was 1,049 individuals (95% CI: 673 – 6,939). In 2008, a total of 200 sturgeon were authorized to be captured. (Permit 1595-02), and 185 were captured with conservative netting efforts and no mortality. Preliminary 2008 population estimates of sturgeon captured during the summer and fall were 1,739 (95% CI: 847-3653), and 667 (95% CI: 452-1013), respectively. In 2009, high encounter rates resulted in over 65% of the total allowable take collected during only three sampling events. The high degree of variability in catch resulted in difficulty to provide appropriate sampling effort and randomization without exceeding permitted take.

Further, a high rate of exchange indicated between the Penobscot and Kennebec Rivers (n= 9,488 with a 95% CI of 6942 to 13,358) indicates that researchers are potentially sampling a larger population beyond that confined to the Penobscot River. Ten shortnose sturgeon from the Penobscot river were detected in 2007 in the Kennebec River, representing 40% of the active acoustically tagged individuals at the time. In light of these observations, researchers have adjusted goals to characterize the extent of exchange occurring between these coastal systems, describing a more mobile population in a GOM-wide assessment. These goals involve targeting more shortnose sturgeon in the Penobscot River (in cooperation with other researchers in the Kennebec River) during discrete periods of time when exchange between river systems is limited and subsequently tracking individual sturgeon and performing mark-recapture studies in GOM rivers sampled.

The increase in authorized take would not change the effects of capture to the biological environment originally analyzed in the 2007 EA. Based on analyses in previous EAs and SEAs and Biological Opinions for File 1595, NMFS expects any harassment due to increased capture numbers to be minimal and short-term. The additional capture would result in short-term stress and potential mortality to individuals but would not affect the population at a species level. Two incidental mortalities are currently authorized in the current permit, but no increase in mortality has been requested. To date in the current permit authorization, there has been only one recent reported mortality or serious injury of shortnose sturgeon incidental to research activities (Gail Zydlewski; pers. comm.; email 2010). Researchers would continue closely monitoring all capture events, and the researchers would still be bound to conduct their research activities in accordance with the mitigating conditions in their original permit (and any amended by NMFS in the current permit modification) which would reduce the likelihood of serious injury or mortality occurring. Thus, NMFS does not expect that the requested increased take would result in more than two animals from this population annually or reduced reproductive success.

- *Effects of Fall Sampling for ELS (September to December)*:

The current Permit No. 1595-03 provides for ELS collection until 25^0C; however, it does not authorize sampling after June. Accordingly, the applicant proposes to expand ELS sampling with D-nets between September and December.

The Permit Holder has not been successful collecting ELS from the Penobscot River since first permitted in 2007. Although the applicant has reported when suitable conditions for spawning have occurred in the spring in the Penobscot River (optimal photoperiod, water flow and spawning temperature) tagged sturgeon have not moved upstream to suitable spawning substrate in the river. Rather, rather they have instead tracked downstream to foraging areas (P. Dionne, pers. comm., 2010). However, each fall, prior to moving to overwintering locations, sturgeon have been documented moving upstream to likely spawning locations below the Veazie dam, leading researchers to question whether fall water conditions would provide more suitable spawning conditions for shortnose sturgeon.

With respect to the researcher's request to fall sample ELS, NMFS does not anticipate deploying D-nets in the fall would impact the biological or physical environment in the Penobscot River differently than analyzed for spring sampling. Once a total of 50 ELS has been collected, all collecting gear would be removed from the river until sampling is resumed the following year.

- *Effects of Reducing Minimum Netting Temperature to 0°C when Targeting Adult and Sub-adult Shortnose Sturgeon*:

The applicant in File 1595 is requesting to reduce the permitted minimum netting temperature from 7°C to 0°C when targeting adults and sub-adult shortnose sturgeon, thus expanding the minimal temperature during the overwintering period when sturgeon are least likely to be moving between river systems. The applicant's experience with Didson sonar equipment has demonstrated sturgeon are active below 4°C when aggregated on overwintering grounds, and do not experience adverse effects when netting at lower temperatures (G. Zydlewski; pers. comm. 2010). Because NMFS has discovered no clear evidence suggesting minimum water temperatures negatively affect sturgeon when captured beyond the early life stages, NMFS concludes netting at 0°C would not cause harm to adult and sub-adult shortnose sturgeon. However, when air temperatures are below freezing, researchers would be required to stop netting, preventing exposure of a sturgeon's skin to below freezing temperatures.

- *Effects of Floy Anchor Tags for External Identifying*:

The applicant proposes to tag all shortnose sturgeon ($\geq$ 300 mm) captured from the Penobscot River system with external Floy anchor tags, removing the previously authorized Carlin tag as an external identifier tag.

Smith et al. (1990) compared the effectiveness of dart tags with nylon Floy anchor tags, and Carlin tags in shortnose and Atlantic sturgeon. Carlin tags applied at the dorsal fin and anchor tags in the abdomen showed good 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 Floy anchor tags between fish tagged in freshwater or brackish water. Clugston (1996) also looked at 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 Floy anchor tags inserted in the dorsal fin (as proposed in the current modification) implanted abdominally, dart tags attached near the dorsal fin, and disk anchor tags implanted abdominally. They found, long-term, anchor tags were most effective (92%) in the dorsal, but also noted minor, slow-healing lesions at the insertion points.

NMFS concludes the use of Floy anchor tags to externally mark shortnose sturgeon is an acceptable duplicative means to identify recaptured fish externally in certain cases where sturgeon are far ranging. The practice is not expected to significantly impact sturgeon health. To lessen known negative impacts described when using Floy anchor tags—such as small lesions—researchers would use sterile tagging technique and subsequently monitoring dorsal fins tag sites of recaptured sturgeon. Also, should a tag shed, it would not be considered an adverse impact to the environment, as these tags are small and the numbers insignificant. Further, to gain information on tag retention and fish health, the rate of Floy anchor tag retention and any effects on tagged fish would be documented and reported to NMFS in annual reports, or periodically as requested by NMFS. If impacts of the Floy anchor tags on the health of fish are found other than insignificant, NMFS would reevaluate their use.

- *Effects of Electronarcosis for Anesthesia*:

Electronarcosis is a non-chemical method of anesthetization. It utilizes a low voltage constant direct current (CDC) producing muscle relaxation and immobility, and, as such, does not require FDA approval. Electronarcosis is proposed for anesthetizing up to 70 shortnose sturgeon adults or sub-adults from the Penobscot River for surgical implantation of acoustic tags (up to 30 annually) and performing gastric lavage (up to 40 annually).

Electronarcosis has been used successfully by Dr. Boyd Kynard (pers. comm.) who has been anesthetizing shortnose sturgeon since the 1980s. Since 2004, USFWS researchers in Maryland have also followed the Henyey et al. (2002) protocol anesthetizing Atlantic and shortnose sturgeon on the Potomac River and Chesapeake Bay with no adverse affects (Mike Mangold, USFWS, pers. comm.). Researchers in South America following these methods have reported similar success (Alves et al. 2007).

Henyey et al. (2002) described using low voltage CDC to induce electronarcosis in shortnose sturgeon without any changes in swimming or feeding behavior, burns, bruising, or mortality after monitoring the fish for six weeks. All evidence indicates electronarcosis induced by the method described is similar to the condition induced by chemical anesthetics and does not cause adverse effects on sturgeon; nevertheless, more research is needed on the physiological mechanisms by which it works. Reports to NMFS would include experiences with electronarcosis.

- *Effects of Scute Sampling for Elemental Analysis*:

Sampling would involve using an orthopedic bone cutter or small saw to take a small 4-10 mm clip of the apical hook from a single scute from a subset (n=20) of shortnose sturgeon adults or sub-adults from the Penobscot River. The purpose would be to determine if unique elemental markers can help researchers better understand the extent of movements between systems and identify natal sources of individuals. NMFS believes the removal of the apical hooks of shortnose sturgeon scutes would likely not have any effect on shortnose sturgeon other than short-term discomfort because the scute material is poorly vascularized and non-innervated, and that the removal of a single apical spine would not likely harm the fish.

- *Effects of Gastric Lavage for Diet Analysis*:

The researcher proposes to use methods to gastric lavage up to 40 shortnose sturgeon annually during the remainder of the project. Information on diets and how they relate to seasonal foraging and habitat use has recently benefited from the gastric lavage procedure (Foster 1977; Haley 1998; Murie and Parkyn 2000; Moser et al. 2000 and Collins et al. 2008). Due to the morphology of the gut tract and position of the swim bladder in the shortnose sturgeon, care must be taken in the procedure to not injure sturgeon while inserting the tube into the esophagus and positioning it within the gut. Potential injury to sturgeon could include abrasion of the gut wall near the pyloric caecum, trauma associated with not seating the tubing properly in the gut, and potential negative growth responses of sturgeon (going off-feed) after gastric lavage. The practice of anesthetizing sturgeon with MS-222 prior to gastric lavage relaxes the gut wall, allowing easy penetration of the tubing to the proper position in the gut. The applicant has also reported they will receive training for all field researchers in the procedure on captive shortnose sturgeon prior to using the method.

Savoy (2004) reported results from 246 shortnose sturgeon collected on the Connecticut River between 2000 and 2003. All of the fish tolerated the procedure well and recovered without stress. Between 2004 and 2006 Collins et al. (2006 and 2008) captured and lavaged 256 Atlantic and 47 shortnose sturgeon. All fish recovered rapidly and were released unharmed after the procedure. The lavage technique was successful in evacuating stomach contents effectively of both Atlantic and shortnose sturgeon of all sizes without internal injury. Collins et al. (2006 and 2008) also demonstrated no damage to internal linings of stomachs of three sacrificed Atlantic sturgeon. Additionally, recaptured sturgeon (lavaged an average of 76 days between recapture), experienced typical interim weight gains indicating the procedure did not negatively influence sturgeon growth. Based on reported experience with this procedure, NMFS PR believes sturgeon undergoing gastric lavage as proposed would experience handling discomfort, but would be exposed to only minimal short-term risk associated with the procedure.

4.2.1.3 *Summary of Research Effects on Shortnose Sturgeon*:
Any effects of the increased action area in File 1578, or the increased numbers of authorized take and authorization of newly proposed research activities in both File 1578 and File 1595, are not expected to adversely affect the survival, longevity, or lifetime reproductive success of the target species, shortnose sturgeon.

4.2.2 *Environmental Effects Caused by Research Modification — Atlantic Salmon*:
The following sections analyze effects on Atlantic salmon from both proposed research modifications in File 1578 and 1595. Although the effects of research on salmon in File 1595 were previously analyzed, and conditions were added successfully minimizing further interaction with Atlantic salmon, effects of the proposed modification for File 1595 are reconsidered in this SEA due to the relisting of the species 2009 with the concurrent designation of critical habitat. The applicant in File 1595 is not anticipating interacting with salmon and no authorization for incidental take of salmon would be authorized in the new permit.

4.2.2.1 *Effects of Research Modification on Atlantic Salmon — File 1578*:
The MMDR state in their application there is limited potential for Atlantic salmon appearing as bycatch in gillnet samples as nets would be deployed in river channels in deeper water locations and other areas where Atlantic salmon would not be anticipated. Evidence from telemetry studies indicates adult salmon tend to swim in the upper water column at mean depths 3.7–4.0 m, (Gowans et al. 1999; and Sturlaugsson 1995). Further, the applicant stated, between 1977 and 2009, the MDMR had made 945 directed sets for shortnose and Atlantic sturgeon throughout the

Kennebec complex using similar gill netting methods and have netted only three Atlantic salmon with no mortalities. Two salmon were netted at the Sand Island location occurring on 8/9/1978 and 7/25/1979; and the other salmon was taken at Pine Island on 6/25/1980.[10] Another Atlantic salmon was recorded captured in a gill net set for American shad just downstream of Lockwood Dam on the Kennebec River. This fish was also released alive within a few minutes of capture.

Based on the applicant's past netting record with limited Atlantic salmon interaction, NMFS anticipates no Atlantic salmon would be captured during proposed sturgeon netting; thus, no authorized capture or mortality for Atlantic salmon would be issued for File 1578.

To minimize any capture of Atlantic salmon in the action area, researchers would not fish in areas where they had encountered them in the past. Moreover, all nets would be fished in deeper channel waters (20 foot depths at low tide) and in areas off the main channel having muddy bottoms in less than 10 feet of water at low tide. The researchers would follow NMFS's netting guidelines protective of sturgeon; however, they would also continuously monitor nets, limiting net sets typically to one hour before checking. Should an Atlantic salmon be captured, the fish would be released alive immediately, cutting it from the net without handling.

NMFS believes Atlantic salmon captured in gillnets during sturgeon research would suffer short-term stresses posing a potential risk to the salmon; however, it would not likely result in serious injury or mortality. However, in the event that a salmon were caught, the researchers would suspend sampling immediately and consult with NMFS PR within 48 hours.

4.2.2.2 Effects of Research Modification on Atlantic Salmon — File 1595:
In May 2006, UM, in conjunction with NMFS and the U.S. Geological Survey (USGS), began a study of the distribution, abundance, and movements of Atlantic sturgeon in the Penobscot River. This research confirmed the presence of shortnose sturgeon in the river; however, exceeding the ITS provisions accompanying the Biological Opinion issued in April 2006. Additionally, in 576 hours of fishing, two Atlantic salmon were captured (with one mortality) in waters where the Biological Opinion did not anticipate. Research was suspended until a scientific research permit could be issued eliminating take prohibitions on shortnose sturgeon and Atlantic salmon.

Researchers at the University of Maine were issued a scientific research permit (File 1595-00) NMFS in 2007 authorizing capture of up to 100 shortnose sturgeon and 4 conservation hatchery Atlantic salmon annually in the Penobscot from 2007-2012. This permit has been modified several times, most recently on March 2, 2009, and currently does not authorize any lethal take of listed Atlantic salmon. However, using measures in the new permit, the researchers have avoided further takes of any Atlantic salmon in four years.

In the modified permit proposal, no take of any salmon is proposed. Moreover, researchers have agreed to ongoing measures, as well as more conservative measures protective of salmon than recommended by NMFS in previous permits. The ongoing permit conditions limiting interaction with salmon would continue to include: (1) researchers would not set nets within 0.5 miles of the confluences of the Penobscot River with rivers with known migrations of salmon (i.e., Cove

10 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

Brook, Kenduskeag River or Ducktrap Rivers); (2) only 12 inch nets would be set from the Waterworks at the site of the former Bangor Dam upstream to the Veazie Dam; (3) researchers would not fish in areas where they had encountered salmon in the past; and (4) all nets would be fished in deeper river channel waters (20 foot at low tide) or in areas with a muddy bottom, off the main channel, where the measured water depth would be less than 10 feet at low tide.

The more conservative measures protective of salmon in the new modification are to: constantly monitor nets, fishing no more than six hours when water temperatures are less than 15^{o}C; using three hour intervals when water temperatures are between 15 and 20 ^{o}C; checking nets every hour at water temperatures between 20 and 26 ^{o}C. In the unlikely event an Atlantic salmon is captured, it would be released alive immediately, cutting it from the net without handling.

However, in the event a salmon is caught, the researchers would be required to suspend sampling immediately and consult with NMFS PR within 48 hours. If an Atlantic salmon is captured in gillnets during sturgeon research, NMFS concludes it would suffer short-term stresses posing a potential risk to the salmon; however, it would not likely result in serious injury or mortality. Because researchers have avoided takes of Atlantic salmon in their current permit, they are not requesting permitted take of Atlantic salmon. NMFS believes adherence to the above measures would minimize potential for salmon interactions.

4.2.3 *Effects of Research Modifications on Atlantic Salmon Critical Habitat*:
As stated previously, critical habitat is defined as specific areas containing physical and biological features essential to the conservation of the species. Primary Constituent Elements (PCE's) for critical habitat identified in the GOM DPS Atlantic salmon include factors essential for the conservation of the species. Within the occupied range of the Gulf of Maine DPS, Atlantic salmon PCEs are regarded as providing: sites for spawning and incubation, sites for juvenile rearing, and sites for unobstructed migration. A detailed review of the physical and biological features required by Atlantic salmon is provided in Kircheis and Liebich (2007). The description of Atlantic salmon critical habitat is online at http://www.nmfs.noaa.gov/pr/species/fish/atlanticsalmon.htm.

The critical habitat PCE relevant to the proposals within Files 1578 and 1595 focuses on providing unobstructed migratory pathways for Atlantic salmon adults and smolts. Thus, NMFS PR identifies specific PCE factors and conclusions potentially impacting critical habitat for salmon as follows:

(1) Freshwater and estuary migratory sites free from physical and biological barriers delaying or preventing access of adult salmon seeking spawning grounds needed to support recovered populations: This factor is related to adult Atlantic salmon returning to their natal rivers or streams requiring migration sites free from barriers obstructing or delaying passage to reach their spawning grounds at the proper time for effective spawning (Bjornn and Reiser, 1991). Migration sites free from physical and biological barriers are essential to the conservation of the species because without them, adult Atlantic salmon adults would not be able to access spawning grounds needed for egg deposition and embryo development. The extent adult salmon migration would be blocked by the proposed fisheries research proposals is relevant to the impacts on critical habitat.

This analysis examined the potential for the research obstructing migratory pathways between adjacent riverine and estuarine critical habitat units. NMFS PR concludes the research nets present a small barrier in place relative to the size of the area available for salmon migration. Additionally nets are checked at minimum each hour when in use, or immediately, if an animal is captured, and is therefore not a permanent structure. Moreover, gill netting employed by researchers has been conditioned in current permits to successfully limit interaction within the Atlantic salmon migratory pathways as evidenced by the small numbers of salmon netted historically. Consequently, NMFS does not believe proposed netting in either of the project modifications would affect the ability of the critical habitat to provide unobstructed migratory pathways for adult Atlantic salmon.

(2) **Freshwater and estuary migration sites free from physical and biological barriers delaying or preventing emigration of smolts to the marine environment:** This feature is essential to the conservation of the species because Atlantic salmon smolts require an open migration corridor from their juvenile rearing habitat to the marine environment.

In earlier NEPA documents, the use of D-shaped ichthyoplankton nets (D-nets) were described as gear for collecting shortnose sturgeon eggs and larvae in potential sturgeon spawning areas in the Kennebec, Androscoggin and Penobscot River systems (Kieffer & Kynard 1996). D-nets measuring approximately 1 meter in diameter, 3 meters long, with a mesh size of 1-2 mm, could potentially serve as a physical barrier for the emigration of Atlantic salmon smolt. In the proposed research, up to three D-nets would be deployed and anchored in a row along the deepest channel bottoms near spawning sites 100 to 300 meters downstream of known or suspected sturgeon spawning areas. These nets would soak for no more than 3 hours at a time before being raised and examined for eggs or larvae before being re-deployed. However, because D-nets would be anchored to the river bottom, drifting smolt near the surface would not be exposed to likely capture. Moreover, as there have been no smolts captured in the Kennebec and Penobscot Rivers while using D-nets, NMFS concludes D-nets would not affect the ability of the critical habitat to provide an unobstructed downstream migratory pathway for Atlantic salmon smolts.

(3) **Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation:** Atlantic salmon adult and smolts interact with other diadromous species indirectly while migrating. Migration through the estuary often coincides with the presence of alewives (*Alosa* spp.), American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), and striped bass (*Morone saxatilis*). The abundance of diadromous species present during adult migration may serve as an alternative prey source for seals, porpoises and otters (Saunders et al., 2006). For example, as smolts pass through the estuary during migration from their freshwater rearing sites to the marine environment, they experience high levels of predation. These features are essential to the conservation of the species because without highly prolific abundant alternate prey species such as alewives and shad, the less prolific Atlantic salmon would likely become a preferred prey species.

NMFS PR examined if proposed research activities would appreciably reduce the abundance of riverine or estuarine “buffer” prey for Atlantic salmon adults or smolts within the migratory critical habitat. NMFS examined whether prey species structure in action area would be affected by the proposed action, but concluded, based on the limited amount of by-catch of the above species captured by researchers in the past, and the fact that virtually all of the by-catch reported has been reported released during sampling, there would be minimal impacts to associated buffer prey organisms in the freshwater and estuarine critical habitat. Thus, NMFS concludes the ability of the critical habitat providing fish communities as protective buffers against predation, does not obstruct migratory pathways for adult or juvenile Atlantic salmon in either action.

4.2.4 *Effects of Research Modifications on Non-Listed By-catch Species*:
The applicants in File 1578 and 1595 have reported past catches using gillnets of non-target species, such as American shad, Atlantic menhaden, blueback herring, alewife, striped bass, smallmouth bass, white perch, channel catfish. Non-listed bycatch in D-nets have also include American eel elvers (*Anguilla rostrata*), herring eggs, smallmouth bass juveniles, smelt eggs and larvae, and small catfish. However, because nets would typically be checked at short intervals and it is believed virtually all bycatch would be released alive.

Atlantic sturgeon: Atlantic sturgeon is currently a "candidate species" under NMFS jurisdiction, co-occurring with shortnose sturgeon. Thus, there is potential for Atlantic sturgeon to be captured during shortnose sturgeon research. Reviewed in 1998, NMFS and USFWS received a petition to list Atlantic sturgeon as endangered. Although a protective ESA status was denied at that time, the species remained a 'species of concern' under NMFS's jurisdiction. In 2007, NMFS completed a second status review for this species and again accepted a petition evaluating whether the species warrants listing under the ESA in 2009. NMFS responded with a proposed listing of Atlantic sturgeon as endangered in four defined DPSs and as threatened in one DPS. Currently, the species does not currently receive protections under the ESA until a final rule becomes effective. Consequently, NMFS considers when a final rule and subsequent listing of Atlantic sturgeon occurs coinciding with the applicants' research activities, the effects on Atlantic sturgeon would be analyzed at that time. Appropriately, the researcher would monitor gill nets closely, and if an Atlantic sturgeon were captured, NMFS would request the same netting protocols and standard research conditions protective for shortnose sturgeon are used to ensure Atlantic sturgeon survival (See Sections 4.5.1.12 and 4.5.2.11 of this SEA). [11]

4.2.5 Effects of Research Modifications from Aquatic Nuisance Species:
Because nets would be deployed in watersheds in both action areas where aquatic nuisance species are potentially present, such as Asian shore crab, green crab, Giant snakehead, water milfoil, Eurasian water milfoil, hydrilla, and water chestnut, the possibility exists for spreading such aquatic nuisance species to other watersheds. Transfer of these species to other watersheds on equipment would be minimized by both applicants, agreeing to the mitigation measures outlined in this SEA (See Sections 4.5.1.14 and 4.5.2.13).

4.2.6 *Summary of Proposed Research Effects*:
It is possible that interactions with the newly proposed methods in File 1578 (i.e., borescope, anchor tagging, electronarcosis, scute sampling, blood sampling, and gastric lavage) and in File 1595 (i.e., anchor tagging, electronarcosis, scute sample, and gastric lavage), as well as other

11 ***"A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons"***
http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf

increased scope of research activities (i.e., increased action area for 1578 and increased numbers authorized, as well as changing the timing of sampling in both modifications) could result in some infrequent mortality, fewer adults reaching spawning grounds, or a greater overall reduction in recruitment potential. Further, NMFS PR concludes each of these proposed modifications could introduce pain, stress, handling discomfort, possible hemorrhage at the site, or risk of infection. However, as mitigated in Section 4.5 of this SEA, NMFS considers these interactions would only present short term impacts to sturgeon captured in ether modified permit. Additionally, NMFS concludes Atlantic salmon or its critical habitat would not be impacted by the proposed modifications. For further information on the affected biological environment, please refer to the Biological Opinion (November 2010) written for these proposed actions.

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 governing takes of shortnose sturgeon (50 CFR 402.14(c)), a Section 7 consultation was initiated by the NMFS, Permits, Conservation and Education Division, Office of Protected Resources 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 (November 2010) was prepared for the proposed actions by the NMFS' Endangered Species Division, Office of Protected Resources. It concluded, after reviewing the current status of shortnose sturgeon and Atlantic salmon, 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 Atlantic salmon (or any other NMFS ESA-listed species); nor would it likely destroy or adversely modify designated critical habitat for Atlantic salmon. No coordination under Section 7 of the Endangered Species Act with the USFWS was required, as research is conducted in waters affected by tidal influences.

4.3.2 *Compliance with the Magnuson-Stevens Fishery Conservation & Management Act*:
As stated previously, there are no changes to update for File 1595 with respect to EFH. However, NMFS determined the applicant's proposed netting and boating activity in new areas of research proposed for File 1578 would occur within designated EFH zones not previously considered for managed species. NMFS also concluded the impacts on EFH of boating and netting activity, and possible direct and indirect effects of managed species from by-catch would likely only have minimal impacts. NMFS PR contacted the Northeast Office of Habitat Conservation, who reviewed the proposed action and responded by email November 1, 2010 citing that they had no EFH conservation recommendations to provide pursuant to Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act. Thus, no formal consultation was necessary and no consultation was initiated.

The proposed issuance of both permit modifications was published in the Federal Register on September 24, 2010; however, no public comments requesting additional review were received.

4.4 COMPARISON OF ALTERNATIVES

While the "no action" alternatives for each of the permit modifications in File 1578 and 1595 would have no additional environmental effects beyond those already authorized if the permits were not issued, the opportunity to conduct proposed research would be lost. Initiation of these research projects would be important to collect information contributing to a better understanding of shortnose sturgeon and providing information to NMFS needed to implement NMFS management activities. This would be important information for the conservation and management of 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 to assist recovery of 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 likely impacts to the target species.

4.5 MITIGATION MEASURES

The modifications in Files 1578 and 1595, would still require the applicants to adhere to previous permitted conditions authorized in previous permits and modifications, as well as new permit conditions designed to minimize impacts to the environment from newly proposed research. Further, because former methods in some instances have been modified by the applicants to more conservative standards, some of the former conditions have been changed. Lastly, in consultation with the applicants, NMFS has added or modified conditions to previously authorized methods based on new information about minimizing adverse effects; ensuring methods do not operate to the disadvantage of the listed species. Consequently, the following conditions are those measures newly required for each of the permit modifications:

4.5.1 *Additional Mitigation Measures for File 1578-01*: (Changes highlighted in **bold**)

4.5.1.1 Authorized Changes in File 1578-01 for Netting with Gillnets:

In General:

- The Permit Holder must take necessary precautions ensuring sturgeon are not harmed during captures, including using appropriate gill net mesh sizes and twine types, restricting gill netting activities by decreasing net set durations as water temperature increases and dissolved oxygen concentration decreases, and following other measures outlined in ***"A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons"*** **http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf**

Specific Netting Conditions Include:

- **Gill nets must not be set within 0.5 miles upstream or downstream of the confluences of the Kennebec River and Bond Brook, and 0.5 miles below Lockwood Dam;**

- **Researchers must avoid documented locations of the Kennebec complex where Atlantic salmon have been encountered in the past (i.e., Sand Island @ < 43.914465,-69.727821>; Pine Island @ < 43.914465,-69.727821>; and Fort Halifax Park @ <44.54482,-9.627271>).**

- **Six inch gillnets may be fished in main channels of rivers and bays of the research area at depths greater than 20 feet at low tide. Nets may also be fished in areas characterized as "mudflats," off main channels in waters less than 10 feet at low tide;**

- **A sounding device and Global Positioning System (GPS) is optionally recommended used for monitoring and marking bottom characteristics before netting to limit snags and resulting stress on fish.**

- **If a net becomes snagged on bottom substrate or debris, it must be untangled immediately while attempting to reduce stress on captured animals;** and

- **Nets may be fished at water temperatures between 0°C and 26°C and at dissolved oxygen concentrations of 4.5 mg/l (or 55% saturation) or greater during deployment. See summary of environmental conditions below.**

Summary of Authorized Netting Conditions for Permit 1578-01

Water Temperature (ºC)	Minimum D.O. Level (mg/L)	Minimum D.O. Saturation Level (%)	Maximum Net Set Duration (hrs)
0 < 15	**4.5**	**55**	**6**
15 < 20	**4.5**	**55**	**1**
20 ≤ 26	**4.5**	**55**	**0.5**
> 26	**N.A.**	**N.A.**	**Cease Netting**

4.5.1.2 Authorized Changes in File 1578-01 for Collecting ELS with Artificial Substrates or D-nets:

- Deployment of D-nets for 3 hour intervals is authorized for collecting up to 60 shortnose sturgeon eggs and larvae in the Kennebec complex **and Saco River between April 15 and October 31**, **the optimal timing for deployment determined by researchers. A subset of these (determined by the researcher) may be transported back to the lab for species verification and preservation in 95% ETOH; the remainder must be returned to the river at the site of collection.**

- **D-nets must be removed from rivers once water temperature exceeds 25ºC, reaches 0ºC, or the authorized numbers of shortnose sturgeon eggs and/or larvae have been collected, whichever comes first.**

4.5.1.3 Authorized Changes in File 1578-01 for Holding Shortnose Sturgeon:

- After removal from capture gear, sturgeon should be recovered in floating net pens or onboard live wells **while shielding animals from direct sunlight. Researchers should accommodate larger catches, carrying secondary net pen(s) to avoid overcrowding. Else, researchers must release any excess catch after PIT and Floy anchor tagging;**

- **Any shortnose sturgeon showing signs of being overly stressed from capture or otherwise, must be resuscitated and allowed to recover inside a net pen or live well. Once recovered, it may only be PIT and Floy anchored tagged prior to release;**

- The total holding time of shortnose sturgeon after removal from capture gear must not exceed two hours **unless fish have not yet recovered from anesthesia;**

- When fish are held onboard a research vessel, they must be placed in flow-through tanks allowing for total replacement of water volume every 15-20 minutes. Dissolved oxygen levels in holding tanks must be maintained at or above **4.5** mg/l; and

4.5.1.4 Authorized Changes in File 1578 for Handling Shortnose Sturgeon:

- Handling of shortnose sturgeon for biological sampling **(i.e., measuring, weighing, PIT and Floy anchor tagging and tissue sampling)** must not exceed 15 minutes;

- **While being transferred for sampling, sturgeon should be moved rapidly and supported in sling or net to prevent struggle. During transfer they should also be kept shaded and in water to the maximum extent possible;**

- **Prior to release, sturgeon should be examined and, if necessary, recovered by holding fish upright and immersed in river water, gently moving the fish front to back, aiding freshwater passage over the gills to stimulate it. The fish should be released only when showing signs of vigor and able to swim away under its own power. A spotter should watch the fish, making sure it stays submerged and does not need additional recovery.**

4.5.1.5 *Authorized Changes in File 1578-01for Anesthesia*:

- **NMFS authorizes electronarcosis for inducing anesthesia on 80 shortnose sturgeon using low voltage direct current as described by Henyey et al. (2002). NMFS requests results in annual reports;**

- **Researchers performing electronarcosis must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must verify such training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training;**

- Researchers may use tricaine methane sulfonate (MS-222) when anesthetizing shortnose sturgeon**, preparing fresh solutions as needed at concentrations up to 150 mg/L;**

- **Prior to anesthetizing shortnose sturgeon with MS-222, researchers must saturate the solution with dissolved oxygen and also buffer it to a neutral pH with equal parts of sodium bicarbonate;**

- **When anesthetizing shortnose sturgeon, researchers must observe animals closely, establishing when the proper level of anesthesia is reached;**

- **Only non-stressed animals in excellent health and vigor may be anesthetized;**

- **Researchers must observe shortnose sturgeon closely during recovery from anesthesia, ensuring full recovery prior to release; and**

- **All researchers should wear protective clothing, gloves, and goggles when handling MS-222 powder; and when disposing of MS-222 solution, researchers should use state adopted procedures.**

4.5.1.6 *Authorized Changes* in *File 1578-01* for *Biological Sampling* (*Genetic, Blood, and Scute Samples)*:

- Genetic tissue samples must be taken from all juvenile and adult shortnose sturgeon collected by removing a small (1.0 cm2) fin-clip from soft pelvic fin tissues using a pair of sharp scissors**. NMFS recommends preserving tissue samples in individually labeled vials containing 95% ethanol;**

- Archiving of genetic tissue samples must be coordinated with the NOAA/NOS Tissue Archive in Charleston, South Carolina (843/ 762-8547**). Samples must be submitted between six and twelve months after collection. Researchers must provide proper certification, identity, and chain of custody maintained during transfer of tissue samples;**

- **Blood samples are authorized on 20 adult/sub-adult shortnose sturgeon and may be sent to the cooperating laboratories listed in the permit;**

- **To sample blood, researchers must first receive supervised training from a properly permitted individual using either wild, captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must report the training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training.**

- **Blood samples may be sent to the cooperating laboratories listed in the permit for analysis.**

- **Blood samples not consumed during testing must be destroyed and properly disposed of immediately after all testing is completed;**

- **Scute samples taken from 40 wild shortnose sturgeon are authorized by removing 4 -10 mm clips of the apical hooks.**

4.5.1.7 *Authorized Changes in File 1578-01 for using PIT Tags and Floy Tags*:

- **Researchers should not insert PIT tags in sturgeon nor perform other surgical procedures on shortnose sturgeon less than 300 mm (TL);**

- **Standard 11.5 mm and 14 mm sized PIT tags (having 134.2 kHz frequency) may be inserted in sturgeon of at least 300 mm and 400 mm (TL), respectively;**

- **PIT tags should be inserted proximal and anterior to the dorsal fin. However, PIT tags may also be inserted at the widest dorsal position just to the left of the 4th dorsal scute, if necessary to ensure tag retention or prevent harm to smaller juvenile sturgeon;**

- **Numbered Floy anchor tags must be anchored in the dorsal fin musculature base of shortnose sturgeon, inserted forward and slightly angled downward from the left to the right side through the dorsal pterygiophores; and**

- **The rate of PIT tag and Floy anchor tag retention and the condition of fish at the site of tag injection should be documented during the study and results reported to NMFS in annual and final reports.**

4.5.1.8 *Authorized Changes in File 1578-01 for Transmitter Tags*:

- **NMFS does not recommend capturing adult sturgeon during upstream spawning migration nor on spawning grounds due to the risks of aborted spawning.**

- **If research objectives are short-term (e.g., 4 -12 mo) for tracking late stage, pre-spawning females, NMFS recommends external attachment[12] of smaller, short term transmitters to the dorsal fin during the preceding fall or winter months;**

- **Surgically implanting larger transmitter tags (e.g., 2-year+ life) in shortnose sturgeon is acceptable when warranted by project objectives and, at water temperatures between 7 and 26°C;**

- The cumulative weight of all transmitters and tags must not exceed 2% (measured in air) **or 1.25% (measured in water)** of the fish's total body weight; and

- **Researchers are asked to document in annual and final reports any information on telemetry tag adaptation by manually or passively tracking individual fish (using boats and passive receiver arrays), recording swimming behavior, periods between detections, and number of un-relocated individuals. Additionally, the healing rates of incisions on recaptured fish should be recorded.**

4.5.1.9 Authorized Changes in File 1578-01 for Borescope Examination:

- **Borescopy for identifying sex/maturity is authorized on adult shortnose sturgeon (≥69 cm TL), specifically those not releasing eggs or sperm while handling, during the foraging season and the overwintering season (May - December**); **and**

- **Prior to an individual researcher performing borescopy, they must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must report individual training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training.**

4.5.1.10 Authorized Changes in File 1578-01 for Gastric Lavage:

- **Gastric lavage for diet analyses is authorized on up to 20 shortnose sturgeon annually;**

- **Individual researchers performing gastric lavage must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon**

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NMFS recommends attaching an external transmitter to the dorsal fin of shortnose sturgeon as highlighted in Kahn and Mohead (2010, p.30) http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf

species. The Responsible Party or PI must report individual training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training;

- **Researchers may carry out gastric lavage via 1.90mm diameter flexible tubing on shortnose sturgeon between 250 mm -350 mm (FL); 4.06 mm diameter flexible tubing may be used on sturgeon between 350 mm-1,250 mm (FL); and 10.15 mm flexible tubing may be used on sturgeon over 1,250 mm (FL);**

- **Prior to gastric lavage, researchers must anesthetize sturgeon allowing relaxation and penetration of the tubing to proper positioning in the gut;**

- **While performing gastric lavage on shortnose sturgeon, researchers must irrigate the sturgeon's gills with ample water flow, insuring respiration.**

4.5.1.11 Authorized Changes in File 1578-01 for Atlantic Sturgeon Interaction:

- If an Atlantic sturgeon is incidentally captured, NMFS requests it minimally be PIT tagged, genetically sampled, and released. **NMFS also requests that all other netting protocols and research conditions protective of shortnose sturgeon also be used by researchers to ensure survival of Atlantic sturgeon during research activities; and**

- **NMFS requests Atlantic sturgeon interactions are reported to Lynn Lankshear, NMFS-PR (lynn.lankshear@noaa.gov) 978-281-9300 x 6535.** The report should describe the take, location, and final disposition of the sturgeon (*i.e.*, released in good health, etc.).

4.5.1.12 Authorized Changes in File 1578-01 for Maine Mammal Interaction:

- **In all boating activities — including travel to acoustic receiver arrays — researchers are advised to keep a close watch for all marine mammals to avoid harassment or adverse interaction, and are also advised to review the NMFS Northeast Region Marine Mammal Approach and Viewing Guidelines located online at: http://www.nero.noaa.gov/prot_res/mmv;**

- **When appropriate, researchers must turn off boat engines or put them in neutral when approaching a marine mammal;**

- **Researchers must attempt to not disturb animals at rest with boating activity, or deploy netting when animals are observed within the vicinity;**

- **If a marine mammal is observed within the vicinity of planned netting activity, it must be allowed to either leave or pass through the area safely before netting is initiated;**

- **Netting activities must be closely attended and continuously monitored during deployment when netting in areas where marine mammals are likely to be encountered;**

- **Should a marine mammal enter a planned research area after nets are deployed, and remain within the vicinity of the research, nets must be removed. Netting may resume only after the animal is no longer within a 100-meter radius safety zone, or 30 minutes has elapsed since the mammal was last observed within the safety zone;**

- **Researchers should report *any* marine mammal interaction within 48 hours to the Chief, Permits Division and/or the permit analyst at 301-713-2289; and**

- **In the unlikely event a marine mammal is captured or harmed, the animal should be assessed, and, if possible, and is safe for the researchers and the animal, the animal should be supported to prevent it from drowning. The NOAA Northeast Region Marine Mammal and Sea Turtle Stranding and Entanglement Hotline should be contacted as soon as possible at (800) 281-9351, as well as the Chief, Permits Division and/or the permit analyst at 301-713-2289; and**

4.5.1.13 Authorized Changes in File 1578-01 for Aquatic Nuisance Species:

- **To prevent potential spreading of aquatic nuisance species identified in the watershed, all equipment assigned to the research must not be reassigned to other watersheds until the research is completed or is suspended.**

- **If the research has been completed or is suspended in one watershed, all gear and equipment used must be bleached, washed and air dried before being redeployed to another location.**

4.5.1.14 Authorized Changes in File 1578-01 for Reporting Mortality:

- **In the event of mortality of shortnose sturgeon, Atlantic sturgeon (or Atlantic salmon) from directed or incidental take (or found opportunistically), NMFS requests that dead specimens or body parts be photographed, measured, and immediately preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS.**

4.5.2 *Additional Mitigation Measures Authorized for File 1595-04 (Changes in **bold**)*:

4.5.2.1 *Authorized Changes in File 1595-04 for Gillnets and Trammel Nets*:

In General:

- The Permit Holder must take necessary precautions ensuring sturgeon are not harmed during captures, including using appropriate gill net mesh sizes and twine types, restricting gill netting activities by decreasing net set durations as water temperature increases and dissolved oxygen concentration decreases, and following other measures outlined in **"A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons" http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf**

Specific Netting Conditions Include:

- **Researchers must avoid fishing in documented locations of the Penobscot River where Atlantic salmon have been encountered in the past (i.e., shallow water (non-channel) locations at Oak Point Cove @44.667005,-68.822994>; and Graham Station @44.821459,-68.708721[13])**

- **Only nets with 12" mesh may be fished from the Waterworks at the site of the former Bangor Dam upstream to the Veazie Dam.**

- **To limit snagging nets on bottom structure, a sounding device and Global Positioning System (GPS) is optionally recommended;**

- **If a net is snagged on bottom substrate or debris, it must be untangled immediately while attempting to reduce stress on captured animals;**

- Nets may be fished at water temperatures between 0°C and 26°C and at dissolved oxygen concentrations **4.5 mg/l (or 55% saturation) or greater** during deployment. See environmental conditions summarized below:

Summary of Proposed Netting Conditions for File 1595-04

Water Temperature (ºC)	Minimum D.O. Level (mg/L)	Minimum D.O. Saturation (%)	Maximum Net Set Duration (hr)
0 < 15	4.5	55	6
15 < 20	4.5	55	3
20 ≤ 26	4.5	55	1
> 26	N.A.	N.A.	Cease Netting

13 http://maps.google.com/maps/ms?ie=UTF8&hl=en&vps=1&jsv=255b&oe=UTF8&msa=0&msid=107419381652978988335.0004898db79ec5c46aa9b

4.5.2.2 *<u>Authorized Changes in File 1595-04 for Collecting ELS with Artificial Substrates or D-nets</u>*:

- Deployment of artificial substrates and D-nets for 3 hours is authorized for collecting shortnose sturgeon eggs and larvae **between March and December and between 0^{O} C and 25 ^{O} C water temperature, the optimal timing for deployment determined by researchers;**

- **Egg mats should be checked at least twice a week, or more frequently if circumstances allow;**

- **No more egg mats should be fished than necessary. If the researcher is unsure of the number of pads required to identify spawning areas and success, no more than 100 to 150 pads should be fished at once across several sites. If it is not necessary to remove the eggs from the mat, the mat can be returned to the river bottom allowing eggs to incubate and hatch before being removed; and**

- All artificial substrates and D-nets must be removed from rivers once water temperatures exceed 25ºC, **reaches 0 ºC**, or the authorized numbers of shortnose sturgeon eggs and/or larvae have been collected, whichever comes first.

4.5.2.3 *<u>Authorized Changes in File 1595-04 for Holding Shortnose Sturgeon</u>*:

- After removal from capture gear, sturgeon should be recovered in floating net pens or onboard live wells**, shielding animals from direct sunlight. Researchers must accommodate larger catches by carrying secondary net pen(s) to avoid overcrowding, or else release the excess catch after only PIT and Floy anchor tagging;**

- **Any shortnose sturgeon showing signs of being overly stressed from capture must be resuscitated and allowed to recover inside a net pen or live well. Once recovered, it may only be PIT and Floy tagged prior to release;**

4.5.2.4 *<u>Authorized Changes in File 1595-04 for Handling Shortnose Sturgeon</u>*:

- Handling of shortnose sturgeon for biological sampling **(i.e., measuring, weighing, PIT and Floy anchor tagging and tissue sampling)** must not exceed 15 minutes;

- **Prior to release, sturgeon should be examined and, if necessary, recovered by holding fish upright and immersed in river water, gently moving the fish front to back, aiding freshwater passage over the gills to stimulate it. The fish should be released only when showing signs of**

vigor and able to swim away under its own power. A spotter should watch the fish, making sure it stays submerged and does not need additional recovery.

4.5.2.5 *Authorized Changes in File 1595-04 for Anesthetizing Shortnose Sturgeon*:

- **NMFS authorizes electronarcosis for inducing anesthesia on 70 shortnose sturgeon using low voltage direct current as described by Henyey et al. (2002);**

- **Researchers performing electronarcosis must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must verify such training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training;**

- **Prior to anesthetizing shortnose sturgeon with MS-222, researchers must saturate the solution with dissolved oxygen and also buffer it to a neutral pH with equal parts of sodium bicarbonate;**

- **When anesthetizing shortnose sturgeon, researchers must observe animals closely, establishing when the proper level of anesthesia is reached;**

- **Only non-stressed animals in excellent health and vigor may be anesthetized;**

- **Researchers must observe shortnose sturgeon closely during recovery from anesthesia, ensuring full recovery prior to release;**

- **All researchers should wear protective clothing, gloves, and goggles when handling MS-222 powder; and**

- **MS-222 solution should be disposed of by using state adopted procedures.**

4.5.2.6 *Authorized Changes in File 1595-04 for Biological Sampling (Genetic and Scute Samples*:

- Archiving of genetic tissue samples must be coordinated with the NOAA/NOS Tissue Archive in Charleston, South Carolina (843/ 762-8547**). Samples must be submitted between six and twelve months after collection. Researchers must provide proper certification, identity, and chain of custody during transfer of tissue samples;**

- **Scute samples taken from 20 wild shortnose sturgeon are authorized by annually removing 4-10 mm clips of the apical hooks.**

4.5.2.7 *<u>Authorized Changes in File 1595-04 for using PIT Tags and Floy Tags</u>:*

- **Researchers must not insert PIT tags nor perform other surgical procedures on shortnose sturgeon less than 300 mm (TL);**

- **Standard 11.5 mm and 14 mm sized PIT tags (having 134.2 kHz frequency) may be inserted in shortnose sturgeon of at least 300 mm and 400 mm (TL), respectively;**

- PIT tags should be inserted proximal and anterior to the dorsal fin. **However, PIT tags may also be inserted at the widest dorsal position just to the left of the 4th dorsal scute if necessary to ensure tag retention or to prevent harm to smaller juvenile sturgeon;**

- **Numbered Floy anchor tags must be anchored in the dorsal fin musculature base, inserted forwardly and slightly downward from the left side to the right through the dorsal pterygiophores; and**

- **The rate of PIT tag and Floy anchor tag retention and the condition of fish at the site of tag injection should be documented during the study and results reported to NMFS in annual and final reports.**

4.5.2.8 *<u>Authorized Changes in File 1595-04 for Using Transmitter Tags</u>*:

- **NMFS does not recommend capturing adult sturgeon during their upstream spawning migration, nor on spawning grounds due to the risks of aborted spawning.**

- **If research objectives are short-term (e.g., 4 -12 mo) for tracking late stage, pre-spawning females, NMFS recommends external attachment[14] of smaller, short term transmitters to the dorsal fin during the preceding fall or winter months;**

- **Surgically implanting larger transmitter tags (e.g., 2-year+ life) in shortnose sturgeon is acceptable when warranted by project objectives, and at water temperatures between 7 and 26° C;**

14
NMFS recommends attaching an external transmitter to the dorsal fin of shortnose sturgeon as highlighted in: Kahn and Mohead (2010, p.30) http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf

- The cumulative weight of all transmitters and tags must not exceed 2% (measured in air) **or 1.25% (measured in water)** of the fish's total body weight.

- **Researchers are asked to document in annual and final reports any information on telemetry tag adaptation by manually and passively tracking individual fish (using boats and passive receiver arrays), recording swimming behavior, periods between detections, and number of unrelocated individuals. Additionally, the healing rate of incisions of recaptured fish should be recorded.**

4.5.2.9 *Authorized Changes in File 1595-04 for Borescopic Endoscopic Examination*:

- **Borescopy for sex/maturity identification is authorized on adult shortnose sturgeon (≥69 cm TL) (those not releasing eggs or sperm while handling) during the foraging season (May-October) and during the overwintering season (November - December); and**

- **Individual researchers performing borescopy must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must report individual training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training.**

4.5.2.10 *Authorized Changes in File 1595-04 for Gastric Lavage (Diet Analysis)*:

- **Gastric lavage for diet analyses is authorized on up to 40 shortnose sturgeon annually;**

- **Individual researchers performing gastric lavage must first receive supervised training from a properly permitted individual using either wild or captive shortnose sturgeon, or another surrogate sturgeon species. The Responsible Party or PI must report individual training to NMFS prior to the activity, and then append a signed letter received from NMFS certifying the training;**

- **Researchers may carry out gastric lavage via 1.90 mm diameter flexible tubing on shortnose sturgeon between 250 mm -350 mm (FL); 4.06 mm diameter flexible tubing may be used on sturgeon between 350 mm-1250 mm; and 10.15 mm flexible tubing may be used on sturgeon over 1250 mm;**

- **Prior to gastric lavage, researchers must anesthetize sturgeon allowing relaxation and penetration of the tubing to proper positioning in the gut;**

- **While performing gastric lavage on shortnose sturgeon, researchers must irrigate the sturgeon's gills with ample water flow, insuring respiration.**

4.5.2.11 *Authorized Changes in File 1595-04 for Atlantic Sturgeon Interaction*:

- If an Atlantic sturgeon is incidentally captured, NMFS requests that it minimally be PIT tagged, genetically sampled, and released. **NMFS also requests that all other netting protocols and research conditions protective of shortnose sturgeon be used by researchers to ensure survival of Atlantic sturgeon during research activities; and**

- **NMFS requests Atlantic sturgeon interactions are reported to Lynn Lankshear, NMFS-PR (lynn.lankshear@noaa.gov) 978-281-9300 x 6535.** The report should contain descriptions of take, including any lethal take, location, and final disposition of the sturgeon (*i.e.*, released in good health, etc.). **Specimens or body parts of dead Atlantic sturgeon are requested to be preserved (on ice or refrigeration) until sampling and disposal procedures are discussed with NMFS.**

4.5.2.12. *Authorized Changes in File 1595-04 for Marine Mammal Interactions*: (Special Netting Conditions applied to all nets set seaward of the bridges at Verona Island, **and, in general, elsewhere to avoid other potential marine mammal interactions).**

- **In all boating activities — including travel to acoustic receiver arrays — researchers are advised to keep a close watch for all marine mammals to avoid harassment or adverse interaction, and are also advised to review the NMFS Northeast Region Marine Mammal Approach and Viewing Guidelines located online at: http://www.nero.noaa.gov/prot_res/mmv;**

- **Researchers must not attempt to disturb marine mammals at rest with boating activity,** or deploy nets when animals are seen within the vicinity;

- Netting activities must be closely attended and continuously monitored during deployment **when netting in areas where marine mammals are likely to be encountered, or immediately if it is obvious an animal is captured;**

- **Although unlikely, should a marine mammal enter a research area after nets are deployed, and remain within the vicinity of the research, nets must be removed. Netting may resume only after the animal is no longer within a 100-meter radius safety zone, or 30 minutes has elapsed since the mammal was last observed within the safety zone;**

- **Researchers must report marine mammal interactions within 48 hours to the Chief, Permits Division and/or the permit analyst at 301-713-2289.**

4.5.2.13. <u>*Authorized Changes in File 1595-04 for Aquatic Nuisance Species*</u>:

- **To prevent potential spreading of aquatic nuisance species identified in the watershed, all equipment assigned to the research must not be reassigned to other watersheds until the research is completed or is suspended.**

- **If the research has been completed or is suspended in one watershed, all gear and equipment used must be bleached, washed and air dried before being redeployed to another location.**

4.6 UNAVOIDABLE ADVERSE EFFECTS

The above measures required by permit conditions in the two amendments 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 some harassment.

The research activities proposed for File 1578 and 1595 would cause unavoidable disturbance, stress, and minor injury to the captured shortnose sturgeon and Atlantic salmon (if captured) other non-target species (temporarily interrupting normal activities such as feeding). The proposed modifications could also have some incidental sub-lethal effects on some individuals based on the increased level of invasive surgery and schedule of netting planned over the remainder of the permit. However, mortality is not anticipated or authorized and these risks are not expected to have long-term effects on target or non-target individuals or populations.

Interactions with marine mammals are not anticipated; however, if such interaction does occur, the researchers would be required to cease research and contact the appropriate NMFS offices(s) listed in the permit.

4.7 CUMULATIVE EFFECTS

In addition to the direct and indirect effects assessed above, in accordance with NEPA, this SEA also updates the potential for cumulative effects experienced by shortnose sturgeon throughout its known range (NMFS, Status Review for Shortnose Sturgeon, in progress) and by Atlantic salmon within the GOM (NMFS 2009b).

Cumulative effects are those resulting from incremental impacts of a proposed action 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 taking place over a period of time.

4.7.1 *Range-wide Cumulative Effects on Shortnose Sturgeon*:

4.7.1.1 Scientific Research:

Shortnose sturgeon have been the focus of field studies since the 1970s under section 10(a)(1)(A) of the Endangered Species Act (ESA; 16 U.S.C. 1531 *et seq*.) for the conservation and recovery of ESA-listed shortnose sturgeon, having authority to issue permits for takes related to research and enhancement otherwise prohibited by section 9 of the ESA. 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, aging, population studies, laparoscopy, blood work, habitat, spawning verification, genetics, and tracking. Shortnose sturgeon research 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 ensuring the research impacts on target and non-target species are minimized.

Range wide, there are 18 active scientific research permits targeting wild shortnose sturgeon populations with similar objectives as proposed by the applicant (See Appendix 1). A Biological Opinion was issued for each of the range-wide permits including the requirement for consideration of cumulative effects to the species (as defined for ESA). For each permit, the Biological Opinion concluded issuance, as conditioned, would not likely jeopardize the continued existence of the shortnose sturgeon, either individually or cumulatively.

Although there are various other researchers studying the unlisted Atlantic sturgeon populations in GOM waters potentially impacting shortnose sturgeon and its habitat to some extent, there are no other current permitted activities sampling shortnose sturgeon in the GOM, other than those in File Nos. 1578 and 1595.

4.7.1.2 Bycatch and Poaching:

Bycatch: Directed harvest of both shortnose and Atlantic sturgeon is prohibited. As stated, 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.

However, 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, sturgeon bycatch in the southern trawl fishery for shrimp *Penaeus* spp. was estimated at 8% in one study (Collins et al. 1996).

The shortnose sturgeon recovery plan (NFMS 1998) lists commercial and recreational shad fisheries as a major source of shortnose bycatch. Although shortnose sturgeon are primarily captured in gill nets, they have also been documented in pound nets, fyke/hoop nets, catfish traps, shrimp trawls and hook and line fisheries (recreational angling).

Bycatch in the gill net fisheries can be quite substantial and is believed a significant threat to the species. The catch rates in drift gill nets 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 gill net fishery in South Carolina, 16 percent of 51 fish caught in gill nets were bycatch mortality, and another 20% of the fish were visibly injured (Collins et al. 1996).

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 New Jersey Department of Fish and Wildlife 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 (ASPRT 1998).

4.7.1.3 Artificial Propagation:

Since there are aquaculture or research facilities currently raising captive shortnose sturgeon on native watersheds, 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 St. 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 23 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.

4.7.1.4 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 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 unusable 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).

On the Kennebec River, construction of Edwards Dam at Augusta, Maine (rkm 71) in 1837 denied sturgeon access to historical habitat in the Kennebec River, until 1999 when it was removed. Since its removal, almost 100% of historic habitat has been opened and shortnose sturgeon. Recently sturgeon have been documented using much of the opened habitat, spawning at the Lockwood Dam (rkm 98) indicating the available habitat is being utilized to a certain level.

On the Penobscot River, there are currently two obstructions to sturgeon historical spawning habitat in the Penobscot River, Maine. In 1833, the Veazie Dam was constructed at rkm 56, and blocked 29 km of habitat that was historically accessible to sturgeon. Just upstream of the Veazie Dam is the Great Works Dam (rkm 41.3; completed in 1887). Five kilometers downstream of the Veazie Dam was the Treats Falls Bangor Dam (completed in 1875) which also impeded migration during the summer months. The Treats Falls Bangor Dam, however, was breached in 1977 and now allows diadromous fish passage. Thus, there are currently 50 km of tidal and freshwater habitat currently available for sturgeon spawning and nursery habitat. Moreover, current plans for the removal of the Veazie and Great Works Dams will restore access to approximately 22 km more shortnose sturgeon habitat.

The restoration of access by dam removal in both the Kennebec and Penobscot Rivers is likely to coincide with that of the historic range. Any increase in carrying capacity and an increase in abundance and distribution of shortnose sturgeon would result from increased availability of spawning, low salinity, and foraging and overwintering habitat, each factor improving the viability of early life stages and juveniles.

4.7.1.5 Dredging and Blasting:

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 while removing hard-packed materials and debris. Mechanical dredge types are clamshell buckets; endless bucket conveyor, or single backhoe or scoop bucket types; however, such dredges have difficulty holding fine materials in the buckets and do not dredge continuously. Material excavated with mechanical dredges 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 impacts of dredging, Smith and Clugston (1997) reported dredging and filling eliminates deep holes, and alter rock substrates. Nellis et al. (2007) documented dredge spoil drifted 12 km downstream over a 10 year period in the Saint Lawrence River, and those spoils have significantly less macrobenthic biomass compared to control sites. Using an acoustic trawl survey, researchers found 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 sturgeon avoid these areas during operations.

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 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%, 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

4.7.1.6 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 7 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 7. 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 VA; southeast region = NC-FL; and the Chesapeake Bay = the central region).

	Region		
Status Index	**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 fairly well in water quality, low D.O. and high temperature may limit available habitat and survival of juveniles. Secor (1995) noted a correlation between low numbers of sturgeon during this century and decreasing water quality caused by increased nutrient loading and increased spatial and temporal frequency of hypoxic water. 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 low D.O. at early life stages and the limited means to escape from hypoxic waters (Secor and Niklitschek 2002).

Niklitschek (2001) modeled suitable habitat availability for juvenile shortnose and Atlantic sturgeon in the Chesapeake Bay using a multivariable bioenergetics and survival model. Results show 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 D.O.-criteria for the Chesapeake Bay (increased from ~2 ppm to 3.5 mg/L) 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, later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web. 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 D.O., 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).

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, pentachlorophenal (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 elutrtraite static renewal (Richland 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.

4.7.2 *GOM-wide Cumulative Impacts on Atlantic salmon*:

The following segments discussing cumulative impacts on GOM Atlantic salmon appear in the biological valuation of Atlantic salmon habitat within the Gulf of Maine Distinct Population Segment (NMFS 2009b).

Future state and private activities reasonably certain to continue to occur in the GOM impacting Atlantic salmon are similar to those affecting shortnose sturgeon, these being continuation of dams, bycatch from recreational or conservation fisheries, aquaculture, discharge of pollutants, and development and/or construction activities resulting in excessive water turbidity and habitat degradation.

Atlantic salmon in the GOM DPS currently exhibit critically low spawner abundance, poor marine survival, and are still confronted with a variety of threats. The abundance of Atlantic salmon in the GOM DPS has been low and either stable or declining over the past several decades. The proportion of fish of natural origin is very small (approximately 10%) and is continuing to decline. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS. (NMFS 2009b).

Hatcheries and stocking occurs in all specific areas in the GOM DPS designation and can negatively affect PCE sites for spawning and rearing. Use of hatcheries may be essential to rebuild Atlantic salmon populations; however, without proper adherence to genetic, evolutionary, and ecological principles, the use of hatcheries could have adverse consequences for naturally reproducing fish that may undermine other rehabilitation efforts. Management considerations or protection may include efforts that employ genetic and stock management of Atlantic salmon such that stocked fish do not present a genetic or competitive risk to natural populations, and stocking of other species.

Research activities on both shortnose and Atlantic sturgeon by University of Maine and the MDMDR are also likely to continue and thus each could potentially have impacts on Atlantic salmon. NMFS Permit 1578 and 1595 do not authorize any lethal takes of listed Atlantic salmon in the GOM during research activities. Impacts from these projects are discounted by NMFS through directed fishing practices eliminating take of Atlantic salmon over the last three years; however, should a take occur, researchers would be required to cease their investigations and consult with NMFS.

It is possible occasional recreational fishing for anadromous fish species may result in incidental takes of Atlantic salmon, and thus the operation of recreational fisheries and other fisheries in these waters of the GOM rivers could result in future Atlantic salmon mortality and/or injury. In December 1999, the State of Maine adopted regulations prohibiting all angling for sea-run salmon statewide. However, a limited catch-and-release fall fishery (September 15 to October 15) for Atlantic salmon in the Penobscot River was authorized by the Maine Atlantic Salmon Commission (MASC) in 2007. The fishery was closed prior to the 2009 season. Despite strict state and federal regulations, both juvenile and Atlantic salmon remain vulnerable to injury and mortality due to incidental capture by recreational anglers and as bycatch in commercial fisheries.

The best available information indicates Atlantic salmon are still incidentally caught by recreational anglers. Evidence suggests Atlantic salmon are also targeted by poachers (NMFS 2005). Commercial fisheries for elvers (juvenile eels) and alewives may also capture Atlantic salmon as bycatch. Again, however, no estimate of the numbers of Atlantic salmon caught incidentally in recreational or commercial fisheries exists.

Pollution from point and non-point sources has been a major problem in GOM river systems, which continue to receive pollutant discharges from sewer treatment facilities, paper production facilities (metals, dioxin, dissolved solids, phenols, and hydrocarbons), mining, and agriculture/ silviculture sources. Contaminants introduced into the water column or through the food chain, eventually become associated with the benthos causing long-term impacts to Atlantic salmon in the GOM. Contaminants associated with the action area are directly linked to industrial development along the waterfront. PCBs, heavy metals, and waste associated with point source discharges and refineries are likely to be present in the future due to continued operation of industrial facilities. In addition, many contaminants such as PCBs remain present in the environment for prolonged periods of time and thus would not disappear even if contaminant input were to decrease. It is likely Atlantic salmon will continue to be affected by contaminants in the action area in the future.

Industrialized waterfront development will also continue to impact the water quality in GOM rivers and the action area of the proposed permit modifications. Sewage treatment facilities, manufacturing plants, and other facilities present in the action areas are likely to continue to operate. Excessive water turbidity, water temperature variations and increased shipping traffic are likely with continued future operation of these facilities.

Dams currently obstruct migration of Atlantic salmon in the GOM, delaying or precluding adult salmon access to spawning sites and smolts from access to the marine environment. Dams also preclude or diminish access of co-evolutionary diadromous fish communities, likely serving as buffers from predators of migrating salmon (Saunders et al. 2006). Dams also degrade spawning and rearing sites through alterations of natural hydrologic, geomorphic and thermal regimes (American Rivers et al. 1999; Heinz Center 2002; NRC 2003; Fay et al. 2006 and NMFS 2009a). Dams in the GOM are also the most significant contributing factor to the loss of salmon habitat connectivity within the range of the GOM DPS (Fay et al. 2006) and have been identified as the greatest impediment to self-sustaining Atlantic salmon populations in Maine (NRC 2003).

NMFS considers the proposed removal of the Veazie and Great Works Projects and the surrender of the Howland Project license in the Penobscot River (File 1595) — as well as the 1999 removal of the Edwards Dam on the Kennebec River(File 1578) — will greatly improve upstream and downstream passage for Atlantic salmon (NMFS 2009a). Additionally, these actions have potential to vastly improve several critical habitat features, including migration, spawning and rearing PCEs, but the presence of other dams in the watersheds will likely continue to negatively impact salmon recovery, and therefore may require additional special management considerations or protection through further dam removal or improved fish passage devices (NMFS 2009a).

4.7.3 *Summary of Cumulative Impacts*:

Effects of past and ongoing human and natural factors and current threats are occurring (or have occurred) in or near both of the action areas contributing to the current status of both shortnose sturgeon and Atlantic salmon. These factors are also included in the baseline section of the Biological Opinion issued for this proposed research activity. As noted above, impacts to listed species from all of these factors are not completely known. However, NMFS has no information suggesting the effects of future activities in the action areas would be any different from effects of activities in the past.

Overall, with respect to the preferred alternative proposed for each of the permit modifications, NMFS does not expect the proposed research activities 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 animals were 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 SEA and supported by the Biological Opinion, NMFS expects the proposed authorization of the modified 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.

Additionally, because past practices over the last three years having largely eliminated capture of Atlantic salmon in researcher's sampling efforts, NMFS believes the authorization of the proposed modifications would not impact Atlantic salmon or its critical habitat previously described in the action areas. NMFS does not anticipate significant interaction with Atlantic salmon resulting from the modifications; however, should a take occur, researchers would be required to cease their investigations to consult with NMFS

The Biological Opinion prepared for the modifications of File Nos. 1578 and 1595 provides an integration and synthesis of the above information about the status of the affected species, past and present activities affecting the species, possible future actions potentially affecting the species, and the effects of the proposed action, providing a basis to determine the additive effects of the take authorized in this permit on ESA listed shortnose sturgeon and Atlantic salmon. The conclusion of the Biological Opinion was that the proposed actions would not likely jeopardize the continued existence of either shortnose sturgeon or of Atlantic salmon or its designated critical habitat.

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 that the issuance of the proposed permit modifications would have only negligible impacts. The analysis of past, present and reasonably foreseeable actions indicates no cumulatively significant impacts would occur associated with each of the proposed actions.

CHAPTER 5 LIST OF PREPARERS AND AGENCIES CONSULTED

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Agencies and Personnel Consulted:

Office of Protected Resources National Marine Fisheries Service Endangered Species Division, Silver Spring, MD 20910	Section 7 formal consultations on effects on ESA target species (shortnose sturgeon)
Northeast Office Protected Resources National Marine Fisheries Service Gloucester, MA 01930 & Orono, ME 04473	Informal consultations on effects of proposed research on non-target species (Atlantic, salmon marine mammals, sea turtles and other by-catch)
Habitat Conservation Division Northeast Office Habitat Conservation National Marine Fisheries Service Gloucester, MA 01930	Informal consultations on effects on EFH of federally managed species

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APPENDICES
Appendix 1

Table 1: Existing shortnose sturgeon research permits authorized for wild populations.			
Permit No.	**Location**	**Authorized Take**	**Objectives and Research Activities**
10115 University of Georgia Expires 08/3/2013	Satilla & St. Marys GA & FL	85 adult/juv 20 ELS	**1) Presence /Absence; 2)Genetics:** Capture, handle, measure, weigh, PIT tag, tissue sample, collect ELS
14394 University of Georgia Expires: 9/30/2014	Altamaha River, GA	500 adult/juv. (1 lethal), 20 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Genetics**; and **4) Contaminants:** Capture, handle, weigh, measure, PIT tag, transmitter tag, tissue sample, anesthetize, conduct laparoscopy, blood collection, fin ray section, collect ELS
10037 University of Georgia Expires: 4/30/2013	Ogeechee River, GA	150 adult/juv (2 lethal), 40 ELS	**1) Population Dynamics**; **2) Habitat**; **3)Genetics**; & **4) Contaminants:** Capture, handle, measure, weigh, PIT tag, tissue sample, fin-ray section, anesthetize, laparoscopy, blood collection, radio tag, collect ELS
1447 South Carolina DNR Expires: 2/28/2012	S. Carolina Rivers	100 adult/juv. (2 lethal), 100 ELS	**1) River Survey**; **2) Genetics**; and **3) Diet**: Capture, handle, measure, weigh, PIT and DART tag, transmitter tag, anesthetize, tissue sample, gastric lavage, collect ELS
1505 South Carolina DNR Expires: 5/15/2011	S. Carolina Rivers	98 adult/juv. (2 lethal), 200 ELS	**1) River Survey**; **2) Genetics**; and **3) Contaminants; and 4) Diet**: Capture, handle, measure, weigh, PIT and DART tag, transmitter tag, anesthetize, laparoscopy, blood collection, tissue sample, gastric lavage, collect ELS
1542 SCANA Expires: 7/31/2011	Upper Santee River Basin, SC	5 adult/juv.; 100 ELS	**1) Presence/Absence (FERC Re-licensing)** and **2) Spawning Success**: Capture, handle, weigh, measure, PIT and dart tag, tissue sample, collect ELS
1543 Duke Power Co. Expires:11/30/2011	Upper Santee River Basin, SC	3 adult/juv.	**Presence/Absence (FERC Re-licensing)**: Capture, handle, weigh, measure, tissue sample
14759 Joe Hightower,USGS Expires 8/19/2015	North Carolina Rivers	70 adult/juv	**1) River Survey**; and **2) Genetics, and 3) Acoustics:** Capture, handle, measure, weigh, PIT tag, Carlin tag, Sonic tag; photograph, and tissue sample, Didson/Sidescan Sonar Locating
14176 USFWS Expires 9/30/2015	Potomac River, MD	30 adult/juv 20 ELS	**1) River Survey**; **2) Genetics;** and **3) Spawning Success:** Capture, handle, measure, weigh, PIT tag, T-Bar tag, CART tag, anesthetize, Temperature-depth logger, tissue sample, borescope, collect ELS
14604 ERC, Inc. 4/19/2015	Delaware River NJ & DE	1,000adult/juv . (1 lethal), 300 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Genetics**; **4) Movement; 5) Contaminants; and 6) Spawning Success; 7)Acoustic:** Capture, handle, measure, weigh, Floy & T-bar tag, PIT tag, tissue sample, anesthetize, ultrasonic tag, laparoscopy, blood collection, collect ELS
14396 Delaware DNR Expires 12/31/2014	Delaware River	100 adult/juv. (1 lethal)	**1) Population Dynamics**; **2) Habitat**; **3) Genetics**; **4) Movement:** Capture, handle, measure, weigh, anesthetize, PIT tag, sonic tag; tissue sample, and photographs
1547 New York State Expires:10/31/2011	Hudson River, Haverstraw & Newburgh,NY	500 adults/juv.	**1) River Survey**; and **2) Genetics:** Capture, handle, weigh, measure, PIT & Carlin tag, tissue sample
1575 Earth Tech, Inc. Expires11/30/2011	Hudson River (Tappan-Zee), NY	250 adult/juv.	**1) River Survey:** Capture, handle, measure
1580 Dynegy Expires: 3/31/2012	Hudson River NY	82 adult/juv.; 40 ELS	**1) River Survey**; and **2) Genetics:** Capture, handle, measure, weigh, PIT tag, Carlin tag, photograph, tissue sample, collect ELS

1549 USGS Expires: 1/31/2012	Upper Conn. & Merrimack River, MA & Androscoggin River, ME	673 adult/juv (5 lethal); 1,430 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Genetics**; **4) Dam Passage; 5) Movement;** and **6) Spawning Success**: Capture, handle, measure, weigh, anesthetize, PIT tag, TIRIS tag, radio tag, temperature/depth tag, tissue sample, borescope, laboratory tests, photographs, collect ELS
1516 Connecticut DEP Expires: 5/15/2011	Lower Conn. River, CT + Thames/Housatonic Rivers	500 adult/juv (2 lethal); 300 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Genetics; 4) Movement; 5) Diet** and **6) Spawning Success**: Capture, handle, measure, weigh, PIT tag, sonic/radio tag, gastric lavage, fin ray section, collect ELS
1578-00* Maine DMR Expires: 11/30/2011	Kennebec River, ME	500 adult/juv.; 30 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Movement; 4) Genetics** and **5) Spawning Success:** Capture, handle, measure, weigh, tissue sample, PIT tag, acoustic tag, anesthetize, collect ELS
1595-03* University of Maine Expires: 3/31/2012	Penobscot River, ME	100 adult/juv. (2 lethal); 50 ELS	**1) Population Dynamics**; **2) Habitat**; **3) Movement 4) Contaminants; 5 Genetics;** and **6) Spawning Success:** Capture, handle, measure, weigh, borescope, photograph, tissue sample, blood sample, Carlin tag, PIT tag, anesthetize, transmitter tag, collect ELS

* Existing permit currently being modified

Table 2: Existing shortnose sturgeon research permits authorized for captive populations

Permit	Research Facility	River of Origin	Research Activity Authorized	Inventory
1549 Expires 1/31/12	Conte Research Center, (USGS)Turner Falls, MA	Conn. R. Savannah R.	Fish passage technology; conditioning & propagation, behavior, and tagging studies	F-1 Adult----22 F-1 Juv ------92 F-1 YOY----12 F-2 Juv------110
1574 Expires 8/31/11	University of Florida, Gainesville, FL	Savannah R.	Embryonic & reproductive biology	F-1 Adult------9 F-2 Adult---113 F-3 Juv-------65
1579 Expires 8/1/11	Alden Research Lab Holden, MA		Fish passage technology	Permitted, but no inventory
1604 Expires 5/31/12	Warm Springs Fish Technology Center (FWS) Warm Springs, GA; Charleston, SC; and Orangeburg, SC	Savannah R.	Refugia, conditioning, propagation, nutrition, embryonic, fish health, behavioral, tagging, genetics, & fish culture genetic sampling, and gamete bank	F-1 Adult --25 F-2 Adult---37
14384 Expires 10/31/2014	University of Georgia	Savannah R Conn. R.	Scientific studies include nutrition, tagging, physiology, environmental, tolerance tests, contaminants, fish health, behavioral, tagging, genetics, & fish culture techniques	Adult 59 Juvenile 37
14754 Expires 3/31/2014	NYU Medical School Ike Wirgin	Canadian (St. John River)	Toxicology Lethal Research	ELS 25,000

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JAN 5 - 2011

FINDING OF NO SIGNIFICANT IMPACT
ON THE EFFECTS OF THE ISSUANCE OF MODIFICATIONS TO SCIENTIFIC RESEARCH PERMITS NOS. 1578-00 AND 1595-03 TO CONDUCT SCIENTIFIC RESEARCH ON SHORTNOSE STURGEON IN THE GULF OF MAINE

National Marine Fisheries Service

On November 15, 2009 and June 17, 2010, the National Marine Fisheries Service, Office of Protected Resources (NMFS PR) received two applications to modify File 1595-03 and File 1578-00 respectively from Michael Hastings, University of Maine (Permit Holder) and the Maine Department of Marine Resources (MDMR), to conduct shortnose sturgeon research in Maine rivers entering the Gulf of Maine.

In accordance with the National Environmental Policy Act (NEPA), NMFS prepared a Supplemental Environmental Assessment (SEA) analyzing the impacts on the human environment associated with issuing two permit modifications (*Supplemental Environmental Assessment For Issuance of Modifications to Scientific Research Permits Nos. 1578-00 and 1595-03 to Conduct Scientific Research on Protected on Shortnose Sturgeon in Maine rivers entering the Gulf of Maine*). 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 two Permit Modifications (Numbers 1578-01 and 1595-04) to Michael Hastings, University of Maine (Permit Holder) and the Maine Department of Marine Resources (MDMR), for research on shortnose sturgeon in Maine rivers entering the Gulf of Maine pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973.)* The analyses in the SEA, as informed by the Biological Opinion, support the following findings and determination.

The applicants are requesting authorization to modify their scientific research, assessing presence, abundance, and distribution of shortnose sturgeon within Gulf of Maine river basins, specifically the Penobscot River (File 1595) and the Kennebec complex and Saco Rivers (File 1578) using non-lethal sampling methods.

The National Oceanic and Atmospheric Administration's Administrative Order 216-6 (May 20, 1999) for implementing NEPA, 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 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 actions 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 research activities include boating and netting activity taking place in the Penobscot River and upper estuary (File 1595-04), and also in the Kennebec complex and Saco Rivers (File 1578-01). No coral reef ecosystems occur in the action areas and thus none would be affected. However, designated EFH exists in the proposed areas of research.

   File 1595-04: With respect to the proposed modification in the Penobscot River, there are no changes in research activities impacting EFH, including timing or size of action area, than were previously considered in the original 2007 EA. The Office of Habitat Conservation concurred with NMFS PR at that time the proposed action, as conditioned, would not significantly impact EFH. Therefore, no further consultation is necessary for this modification.

   File 1578-01: Because the proposed modification for the Kennebec and Saco River contains a newly expanded action area not previously considered in the original 2006 EA, NMFS PR again evaluated the potential for adverse impacts on EFH, concluding that the impacts on EFH in the modified action area would be defined by boating and netting activities (with anchored gillnets). The researcher's boats would pass through and over the water column, transiting to collect data from telemetry receivers and to and from netting locations. However, NMFS concludes this activity would not adversely impact the physical environment, including any portion considered EFH. Further, with respect to impacts on EFH from gill netting activity, NMFS PR concludes, because nets would be anchored in position on the bottom of rocky or sandy substrate, this would result in very little bottom drag or disturbance of benthic organisms or bottom habitat, and the effects on EFH would be very limited. Further, because prey of managed species, potentially captured as by-catch in gill nets would be returned unharmed, no indirect impacts are anticipated. NMFS, Northeast Office of Habitat Conservation concurred via email (November 1, 2010) that the proposed action, as it would be conditioned, would not significantly impact EFH. Therefore, no further consultation was necessary.

2. Can the proposed actions 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 impacts on biodiversity or ecosystem function within either of the affected action areas are expected. The bottom substrate of the proposed areas for sampling sturgeon consists of sandy loam sediment, mud flats and some rocky substrate in the upper branches of rivers. Thus, the impacts to bottom substrate would typically be during capture (gillnetting); however, due to the minimal contact by nets in localized areas— in addition to the proposed mitigation measures set forth in the permit—NMFS expects minimal disturbance of the benthic organisms and substrate.

Due to the nature of netting, the researchers would expect some other non-targeted species would become enmeshed. However, non-target fish would be removed from the net and released at the site of capture 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 expected some sub-adult and adult Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) would be taken during sampling for shortnose sturgeon. Atlantic sturgeon is currently a candidate species proposed for listing under NMFS jurisdiction, co-occurring with shortnose sturgeon in the action areas described. In 1998, NMFS and USFWS received a petition to list Atlantic sturgeon as endangered. Although such listing was denied at that time, the species remained a 'species of concern' under NMFS's jurisdiction. In 2007, NMFS completed a second status review for the species and accepted a petition evaluating whether Atlantic sturgeon warrants listing under the ESA. A proposed rule for listing Atlantic sturgeon was published on October 4, 2010; however, the species does not receive protections under the ESA until a final rule becomes effective. Consequently, should a listing of Atlantic sturgeon occur coinciding with the applicants' research activities, the effects on Atlantic sturgeon would be analyzed at that time. The researcher would monitor gill nets closely, and if an Atlantic sturgeon is captured, NMFS requests in the permit that the same netting protocols and standard research conditions for shortnose sturgeon be used to ensure Atlantic sturgeon survival.

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

   Response: Issuance of the permit modifications is not expected to have substantial adverse impacts on public health or safety. These actions 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, would also be transported in premeasured amounts and mixed onboard. The researchers would wear gloves and masks during mixing of the chemical; therefore, direct contact with the alcohol or MS-222 would be eliminated. Additionally, researchers would be advised in the permit to dispose of the chemicals safely following state approved measures.

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

   Response: The proposed research activities could potentially have adverse effects on individual endangered shortnose sturgeon, but the effects are not expected, and have not been shown to be significant at the population or species level. Further, 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 these actions, NMFS concluded issuance of the permit modifications would not likely jeopardize the continued existence of the endangered shortnose sturgeon.

   Additionally, the Biological Opinion analyzed effects on Atlantic salmon from both research modifications (File 1578 and 1595). Significant to the analysis was the 2009 relisting of the GOM Atlantic salmon DPS redefining the boundaries of the DPS. However, based on both applicants' past netting record with limited Atlantic salmon interaction, and the success of mitigation measures put into place to minimize interaction with Atlantic salmon over the past five years, NMFS anticipates no Atlantic salmon would be captured during proposed sturgeon netting; thus, no authorized capture or mortality for Atlantic salmon would be issued for either proposed modifications. However, NMFS believes if an Atlantic salmon were captured in gillnets it would suffer short-term stress posing a potential risk to the salmon; however, it would not likely result in serious injury or mortality. However, in the event that a salmon were caught, the researchers would suspend sampling immediately and consult with NMFS PR within 48 hours.

Critical habitat has yet to be designated for shortnose sturgeon; thus, none would be affected. However, concurrent with the new 2009 endangered ESA listing for GOM DPS Atlantic salmon, NMFS and the USFWS designated critical habitat (74 FR 29300; June 19, 2009). The new listing was expanded to include all anadromous Atlantic salmon streams whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast northeastward to the Dennys River, and wherever these fish occur in the estuarine and marine environment.

Thus, proposed research in both the Kennebec complex (File 1578) and Penobscot River (File 1595) would take place in newly delineated Atlantic salmon critical habitat. However, NMFS PR concludes, based on the analyses contained in the accompanying SEA that: (1) the proposed gill netting in either of the project modifications would not affect the ability of the critical habitat to provide unobstructed migratory pathways for adult Atlantic salmon; (2) D-nets used to capture sturgeon eggs anchored on the bottoms of rivers in either action area would not affect the ability of the critical habitat to provide an unobstructed downstream migratory pathway for Atlantic salmon smolts; and (3) the ability of critical habitat to provide fish communities as protective buffers against predation, would not serve to obstruct migratory pathways for adult or juvenile Atlantic salmon in either of the proposed action areas.

Likewise, NMFS believes any bycatch encountered in both of the studies would be returned immediately to the water with minimal exposure to handling stress. That is, because nets would typically be checked at short intervals, NMFS considers virtually all bycatch would be released alive. Atlantic sturgeon is considered a “species of concern” occurring in action area in small numbers; hence, there is potential for Atlantic sturgeon to be captured as bycatch. Accordingly, the researchers would monitor nets closely and if this sturgeon species is captured, appropriate measures would be taken to ensure its survival. Also, in the event a protected marine mammal or other protected species is encountered while boating or netting, researchers would be directed by permit conditions to avoid contact with the animals.

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

   Response: There are no known social or economic impacts associated with the proposed actions. Therefore, 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 (75 FR 58350) was published on September 24, 2010, allowing other agencies and the public to comment on both actions. No comments from the public were received on these applications. All agency comments were appropriately addressed within the scoping summary of the SEA and responses were included in the decision memos for the permits. None of the comments were controversial and none addressed the proposal's potential effects on the quality of the human environment.

7. Can the proposed actions 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 permits have been analyzed under the current SEA, and the activities would not be expected to result in significant impacts to any unique areas mentioned above. Additionally, with respect to anticipated effects on EFH by gill nets and boating activities, NMFS concluded these would result in minimal disturbance to the physical environment, including the bottom substrate and any portion having EFH.

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

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

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

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

10. Are the proposed actions 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 actions 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 actions would also not occur in an area of significant scientific, cultural or historical resources and would not cause their loss or destruction.

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

    Response: The U.S. Geological Survey has documented several aquatic nuisance species occurring in both proposed research areas having potential to be spread by research. However, the applicants have agreed to follow certain conditions proposed by NMFS (outlined in the accompanying SEA) minimizing the potential spread of these aquatic nuisance species. Therefore, the proposed research activities would not be expected to result in introduction or spread of non-indigenous species to other watersheds. The research activities would also not involve discharging bilge water or other issues of concern relative to non-indigenous species.

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

    Response: The decisions to issue these permit modifications would not be precedent setting nor would they 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 individuals or organizations to conduct the same research activity. Any future request received, including those by the applicants, would be evaluated upon its own merits relative to the criteria established in the ESA and NMFS' implementing regulations.

13. Can the proposed actions 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 modifications 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 activities are consistent with applicable provisions of the ESA. The permit modifications each contain language stating the permits do not relieve the Permit Holder of the responsibility to obtain other permits, or comply with other Federal, State, local, or international laws or regulations.

14. Can the proposed actions 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 adverse effects on individual shortnose sturgeon. However, because shortnose sturgeon are a robust species and respond well to the types of handling proposed, the cumulative effects on the population are not likely long-term or significant to the species. NMFS believes if an Atlantic salmon is captured in gillnets during sturgeon research, it would suffer short-term stress posing potential risk to the salmon; however, as conditioned, salmon would not likely experience serious injury or mortality. However, in the event that a salmon were caught, the researchers would be required to suspend sturgeon sampling immediately and consult with NMFS PR within 48 hours.

Because a new proposed listing was published for the Atlantic sturgeon on October 4, 2010, NMFS PR considered the future potential for cumulative effects on Atlantic sturgeon as bycatch in these studies. Accordingly, NMFS established in the permits provisions for monitoring interactions with Atlantic sturgeon, placing conditions in the permit detailing procedures to be used if an Atlantic sturgeon are incidentally captured. In particular, permits are conditioned stating Atlantic sturgeon should be handled with similar protocols protective for shortnose sturgeon, as well as requesting Atlantic sturgeon are minimally PIT and Floy tagged and also genetically sampled. NMFS concludes since researchers would be monitoring their nets closely, if Atlantic sturgeon or other by-catch were captured, appropriate measures would be in place to ensure survival.

Likewise, NMFS considered potential impacts from marine mammal interactions with researchers when sampling for sturgeon would be rare based on historical records; however, sampling methods used to minimize contact would nevertheless be conditioned in permits to minimize any adverse effects of boating and netting activities of researchers.

DETERMINATION

In view of the information presented in this document and the analyses contained in the SEA prepared for issuance of the permit modifications, pursuant to the ESA, and the ESA section 7 Biological Opinion, it is hereby determined that the issuance of Permit Nos. 1578-01 and 1595-04 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 reaching the conclusion of no significant impacts. Accordingly, preparation of an Environment Impact Statement (EIS) for this action is not necessary.

for James H. Lecky
Director, Office of Protected Resources

1/6/11
Date