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

Environmental Assessment

on the Effects of Issuing a Permit for Scientific Research on Protected Shortnose Sturgeon in the Gulf of Maine

May 2012

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

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Abstract: The National Marine Fisheries Service (NMFS) proposes to issue Scientific Research Permit No. 16306 pursuant to the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq*.). The permit would exempt the permit holder from takes of shortnose sturgeon under the ESA, by capture, harassment, wounding, and harm. The purpose of the research for Permit No. 16306 is to characterize migration patterns and habitat preferences, generate population estimates, examine age structure and feeding habits, and otherwise gather key life history information for shortnose sturgeon (*Acipenser brevirostrum*) in the Gulf of Maine and its adjoining coastal rivers. The permit would be valid for five years from the date of issuance.

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1.0 PURPOSE OF AND NEED FOR ACTION

Proposed Action: NMFS proposes to issue Scientific Research Permit No. 16306 pursuant to the Endangered Species Act of 1973 as amended (ESA; 16 U.S.C. 1531 et seq.) for "takes"[1] of protected shortnose sturgeon in response to a request from the following applicant:

File No. 16306: Gail Wippelhauser, Ph.D. Maine Division of Marine Fisheries, 21 State House Station, Augusta, Maine 04333

Purpose and Need for Action: The ESA prohibits "takes" of threatened and endangered species with only a few specific exceptions. The applicable exceptions in this case are an exemption for scientific purposes related to species recovery under Section 10(a)(1)(A) of the ESA.

The purpose of the permit is to provide the applicant with an exemption from the take prohibitions under the ESA for harassment of threatened or endangered species, during conduct of research that is consistent with the ESA issuance criteria.

The need for issuance of the permit is related to the purposes and policies of the ESA. NMFS has a responsibility to implement the ESA to protect, conserve, and recover threatened and endangered species under its jurisdiction. Facilitating research about species' basic biology and ecology or that identifies, evaluates, or resolves specific conservation problems informs NMFS management of protected species.

Scope of Environmental Assessment (EA): This assessment is an analysis serving as an EA for File No. 16306. This document focuses primarily on effects on shortnose sturgeon (*Acipenser brevirostrum*), listed as endangered under the ESA. This is the target species of the applicant's research.

The National Oceanic and Atmospheric Administration (NOAA) has, in NOAA Administrative Order 216-6 (NAO 216-6; 1999), listed issuance of permits for research on protected species as categories of actions that "do not individually or cumulatively have a significant effect on the human environment…" and which therefore do not require preparation of an environmental assessment (EA) or environmental impact statement (EIS). A possible exception to the use of these categorical exclusions is when the action may adversely affect species listed as threatened or endangered under the ESA (NAO 216-6 Section 5.05c).

There is no evidence from prior analyses[2] of the effects of permit issuance, or from monitoring reports submitted by permit holders[3], that issuance of research permits for take of shortnose sturgeon listed under the ESA results in adverse effects on stocks or species. Nevertheless, NMFS has

[1] The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

[2] Since 2005, NMFS has prepared over 100 EAs for issuance of permits under the Marine Mammal Protection Act and ESA. In every case, the EA supported a finding of no significant impact regardless of the nature of the permitted take or the status of the species that were the subject of the permit. These EAs were accompanied by Biological Opinions prepared pursuant to interagency consultation under section 7 of the ESA and further document that such permits are not likely to adversely affect listed species. A listing of recently completed EAs is provided in Attachment 1.

[3] All NMFS permits for research on protected species require submission of annual reports, which include information on responses of animals to the permitted takes.

prepared this EA, with a more detailed analysis of the potential for adverse impacts on threatened or endangered species resulting from takes of a specified number of the target shortnose sturgeon, to assist in making the decision about permit issuance under the ESA.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Alternative 1 - No Action: Under the No Action alternative, the requested permit would not be issued and the applicant would not receive an exemption from the ESA prohibition against take.

Alternative 2 - Proposed Permit: Under the Proposed Permit alternative, a permit would be issued to exempt the applicant from the ESA take prohibition during conduct of research that is consistent with the purposes and policies of the ESA and applicable permit issuance criteria.

File No. 16306
The permit applicant proposes to continue to gather information to help inform conservation management decisions to recover shortnose sturgeon (*Acipenser brevirostrum*) in the waters of the Gulf of Maine and several major coastal river systems in the region, including the Penobscot, Kennebec, Saco, and Merrimack rivers. The research project would combine several different existing research projects currently authorized on shortnose sturgeon in the Gulf of Maine under one permit. The applicant's research objectives are to: 1) use mark-recapture techniques to generate population estimates and to define stock structure and distribution 2) determine the degree of demographic correspondence and connectivity of local in-river sturgeon populations, 3) identify habitat use, movement patterns, and life history characteristics of shortnose sturgeon in Maine waters. The permit would contain terms and conditions standard to such permits as issued by NMFS.

Action Area: The proposed research would take place in the waters of the Gulf of Maine, the Penobscot, Kennebec, and Saco Rivers in Maine, the Merrimack River in Massachusetts, and other small coastal rivers of Maine and New Hampshire (see Appendix for maps).

Methods: The research protocols are described in detail in the application on file for this action and are briefly summarized here. The application is on file with NMFS PR and is available on request. The same methodologies would be employed and the same mitigation measures would be in place across all study areas (the Penobscot, Kennebec, Saco, and Merrimack Rivers, and other small coastal rivers of Maine and New Hampshire). Adult and juvenile shortnose sturgeon would be collected using gill nets, trammel nets, beach seines and trawls. Shortnose sturgeon eggs and early life stage (ELS) fish would be lethally collected using egg mats or D-frame nets. All adult and juvenile shortnose sturgeon would be measured, weighed, passive integrated transponder (PIT) tagged, Floy/T-bar tagged, tissue sampled, boroscoped, photographed, and released. Depending on the research objective to be met, several subsets of captured shortnose sturgeon would be assigned different take activities:

1) fitted with an internal or external satellite tag;

2) have an apical spine (or scute) removed;

3) be blood sampled;

4) undergo gastric lavage; or

5) have a fin ray section removed.

As required for the specific procedure, fish would be anesthetized using tricaine methanesulfonate (MS-222) or electronarcosis. The number and procedures to be performed would vary by river; please see Table 1.

Duration: The applicant intends to conduct the research March through November, for five years from the date of issuance.

Target species or stocks: The applicant proposes to take shortnose sturgeon. The proposed annual take for each species is summarized in Table 1.

Table 1: Proposed annual takes of early life stage, juvenile, and adult shortnose sturgeon under Permit No. 16306.

Number of Shortnose Sturgeon	Life Stage	Collection Method	Take Activity	River System
200	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope	Penobscot
30	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, internal or external satellite tag	Penobscot
20	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, apical spine sample†	Penobscot
10	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, blood sample	Penobscot
40	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, gastric lavage	Penobscot
35	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, fin ray section	Penobscot
25	Juvenile	Gill Net, Trammel Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample	Penobscot

50	ELS	D-frame Net	Intentional Mortality	Penobscot
400	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope	Kennebec
50	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, internal or external satellite tag	Kennebec
33	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, apical spine sample†	Kennebec
10	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, blood sample	Kennebec
40	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, gastric lavage	Kennebec
35	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, fin ray section	Kennebec
25	Juvenile	Gill Net, Trammel Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample	Kennebec
50	ELS	D-frame Net	Intentional Mortality	Kennebec
80	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope	Saco
10	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, internal or external satellite tag	Saco
7	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, apical spine sample†	Saco
5	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, blood sample	Saco

20	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, gastric lavage	Saco
10	Adult	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize, fin ray section	Saco
5	Juvenile	Gill Net, Trammel Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample	Saco
10	ELS	D-frame Net	Intentional Mortality	Saco
200	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope	Small Coastal Rivers ME, NH
80	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope	Small Coastal Rivers ME, NH
20	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, Floy/T-bar tag, tissue sample, boroscope, anesthetize	Small Coastal Rivers ME, NH
185	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope	Merrimack
20	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope, apical spine sample†	Merrimack
25	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope, anesthetize, lavage	Merrimack
10	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope, blood sample	Merrimack
35	Adult/Juvenile	Gill Net	Measure, weigh, photograph, PIT tag, tissue sample, boroscope, anesthetize, fin ray section	Merrimack
100	Juvenile	Trawl Net, Beach Seine, Gill Net, Trammel Net	Measure, weigh, photograph, PIT tag, tissue sample	Merrimack
15	Juvenile	Trawl Net, Beach Seine, Gill Net, Trammel	Measure, weigh, photograph, PIT tag, tissue sample, external acoustic telemetry tag	Merrimack

		Net		
100	ELS	D-frame Net, Egg Mats	Intentional Mortality	Merrimack

† Scute sampling would only occur in the event that the apical spine sampling does not provide sufficient samples for elemental analysis. In that case, the apical spine sampling take would be replaced by scute removal after consultation with NMFS PR.

Juveniles are designated as those fish under 500mm total length (TL), adults as those greater than 500mm (TL).

Mitigation Measures
In addition to the mitigation measures described in the application, the proposed permit would include conditions for minimizing impacts to the target animals and non target species, and prevent impacts to bottom habitat.

3.0 AFFECTED ENVIRONMENT

Location
Research would occur in the waters of the Gulf of Maine, the Penobscot, Saco and Kennebec Rivers, the Merrimack River in Massachusetts, and numerous small coastal rivers of Maine and New Hampshire. See Appendix for maps of the action area.

Status of Target ESA Species

Shortnose sturgeon: Shortnose sturgeon are listed as endangered under the ESA. The following is a brief summary of the status and occurrence of targeted shortnose sturgeon range-wide and in the proposed study area. Further descriptions of the status of these species can be found in the Biological Opinion that accompanies this document as well as NMFS Recovery Plans and other documents at http://www.nmfs.noaa.gov/pr/publications/.

Occurrence of shortnose sturgeon range-wide: Shortnose sturgeon occur along the Atlantic Coast of North America, from the Saint John River in Canada to the Saint Johns River in Florida. The Shortnose Sturgeon Recovery Plan (NMFS 1998) describes 19 shortnose sturgeon populations that are managed separately in the wild. Two additional geographically separated populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams).

At the northern end of its distribution, shortnose sturgeon in the Gulf of Maine have been the focus of much research (see discussion below). Spawning has been documented in the Connecticut River (Taubert 1980; Buckley and Kynard 1985), and foraging habits, stock structure and movement patterns of shortnose sturgeon in Connecticut waters have been studied (Savoy 2004; Savoy and Benway 2004). Research focusing on the Hudson River has shown some scant evidence for a spawning population there (Greely 1937; Dovel et al. 1992); movement patterns (Geoghegan et al. 1992; Woodland and Secor 2007) and foraging behavior (Haley 1998; 1999) have also been examined.

At the geographic center of its range, shortnose sturgeon occur throughout the Delaware River estuary (Brundage and Meadows 1982). Population estimates suggest that the Delaware River adult shortnose sturgeon population is fairly stable, with estimates from studies twenty years apart being similar, ranging from 12,796 (95% CI: 10,228- 16,367) (Hastings et al. 1987) and 12,047 (95% CI: 10,757 – 13,580) (ERC, Inc. 2006). Shortnose sturgeon are known to occur in the Chesapeake Bay, but they may be transients from the Delaware River via the Chesapeake and Delaware Canal (Skjeveland et al. 2000, Welsh et al. 2002) or remnants of a population in the Potomac River.

The United States Geological Survey (USGS) and National Park Service (NPS) conducted a study of shortnose sturgeon in the Potomac River from 2004–2007. Although a total of 5,400 gillnetting hours were conducted during this fishery-independent project, in addition to the continuation of the U.S. Fish and Wildlife Service (USFWS) fishery-dependent reward program, only three individual shortnose sturgeon were captured. These results indicate that a very small number of shortnose sturgeon are present in the Potomac River.

Although shortnose sturgeon have been the subject of research in the southern mid-Atlantic, much remains unknown about the status of the species in this region. Shortnose sturgeon were thought to be extirpated from North Carolina until 1987, when a shortnose sturgeon was collected from the Brunswick River (Ross et al. 1988). Additional sampling in the early 90s established shortnose sturgeon were present but rare within the lower Cape Fear River (Moser and Ross 1995), and only one shortnose sturgeon was captured in Albemarle Sound during state surveys in 1998 (Armstrong and Hightower 1999). No sturgeon were collected in a survey of the Neuse River conducted in 2001-2002 (Oakley and Hightower 2007). Investigations of the status of shortnose sturgeon in North Carolina waters are on-going (File No. 14759).

Historically, the population status of shortnose sturgeon in coastal rivers of South Carolina has not been well documented (NMFS 1998). However, the system believed to have the largest shortnose sturgeon population in South Carolina is the Savannah River, and, while the estimate is not precise, it is believed to be approximately 3,000 (NMFS 2004). A stocking trial in the 80s and 90s was used to evaluate the potential for stock enhancement in the Savannah River. Approximately 97,000 shortnose sturgeon were stocked during this time (Smith et al. 2002), and it is assumed that this has influenced the population size in the river. Spawning adults, as well as juvenile shortnose sturgeon, have been captured in the Savannah River (Hall et al. 1991) and in the Santee-Cooper River system (Collins et al. 2003). There is evidence to suggest that individuals from the Savannah River are populating the nearby Edisto River (McCord 2003).

In Georgia, shortnose sturgeon were first documented in the Altamaha River in the early 1970s (Dadswell et al. 1984) and later by Heidt and Gilbert (1978). Since then, numerous studies have been conducted to evaluate population size and habitat use in the Altamaha system. Population estimates were calculated several times for the shortnose sturgeon in the Altamaha between 1988 and 1993 with abundance ranging between 400 and 2900 fish (Flournoy et al. 1992, Weber 1996). Later, the population estimate of 6,320 individuals (95% CI: 4387-9249) was calculated for the river with a disproportionate number of juveniles (DeVries 2006), suggesting the Altamaha River system shortnose sturgeon population likely is the largest population in the southern mid-Atlantic and may be increasing in size.

Rogers and Weber (1995), Kahnle et al. (1998), and Collins et al. (2000) concluded that shortnose sturgeon are extirpated in the Saint Johns River in Florida and also possibly in the Saint Marys River bordering Georgia and Florida. In 2002, a shortnose sturgeon was captured in the Saint Johns River,

in Florida (FFWCC 2007), suggesting either immigration of transient fish or a small remnant population.

Occurrence of shortnose sturgeon in the Gulf of Maine: Shortnose sturgeon in the Gulf of Maine have been studied by the University of Maine (UM) (File No. 1595-04) and the Maine Division of Marine Resources (MDMR) (File No. 1578-01) for several years, generating abundance estimates, examining movement patterns, and documenting spawning. The proposed action would combine the efforts of these research groups under one permit and more closely examine topics with a paucity of data to provide managers with more information to make better decisions.

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). The estimated size of the adult population (>50cm TL), based data from 1977 through 1981, was 7,200 (95% CI: 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). In a later study for the same area, a Schnabel model generated a population estimate of 9,488 (95% CI: 6,942-13,358) (Squiers 2003).

The University of Maine (UM) conducted a mark-recapture study to generate population estimates of shortnose sturgeon in the Penobscot River. Using data from 2006 and 2007, UM researchers used two methods to generate population estimates. The Lincoln/Peterson method provided an estimate of 1,049 fish (95% CI: 673-6,939); a Schnabel model calculated an estimate of 1,710 shortnose sturgeon (Fernandes et al. 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 (Fernandes 2008). 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.

Spawning: The Kennebec River has provided evidence for a shortnose sturgeon spawning population. 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. MDMR conducted an ichthyoplankton survey from 1997 through 2001 to monitor the recolonization of habitat above the Edwards Dam (removed in 1999). Small numbers of shortnose sturgeon eggs and/or larvae were collected at sites located 9km below the site of the Edwards Dam each year (rkm 61-70). No shortnose sturgeon eggs or larvae were collected above the former Edwards Dam in 2000 or 2001 (Squires 2003). Shortnose sturgeon early life stages (ELS) were collected in the Kennebec River in 2009, with 23 larvae captured in the same region as found during the MDMR sampling from 1997-2001. Shortnose sturgeon embryos were also collected in the Kennebec River in 2010 (G. Wippelhauser, pers. comm. 2011); however, no spawning activity was observed in the Merrimack River that year. In the Androscoggin River, a system near the Kennebec, researchers have also observed male sturgeon expressing milt, as well as ripe female sturgeon (Squiers 1983) in late April through mid-May. No recent spawning activity in the Penobscot River has been observed, although suitable spawning areas exist (Zydlewski 2009a).

Foraging: Foraging habits of shortnose sturgeon in the Gulf of Maine are not well known; gastric lavage has only recently been authorized for shortnose sturgeon in the Gulf of Maine under the applicant's current permit, modified in January 2011 (File Nos. 1578-01 and 1595-04).

Movement and Migration: Telemetry studies indicate that 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. For instance, from mid-October to mid-April, most tagged shortnose sturgeon concentrate in a relatively small section of the Penobscot River near Bangor (rkm 48). After overwintering there, they move downstream into the estuary until returning upstream in summer during low flows.

Many tagging and telemetry studies in rivers throughout the species' range indicate shortnose sturgeon remain in their natal river or that 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. Telemetry studies documented shortnose sturgeon tagged in the Penobscot travelling to the Kennebec River, 70km away (Fernandes 2008). Using its array of passive receivers, MDMR detected five adult shortnose sturgeon overwintering in the Kennebec River (near Merrymeeting Bay, rkm 38) in February 2008. These fish had been initially tagged in the Bangor/Brewer area of the Penobscot River in late September 2007 (Fernandes et. al. 2008). 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 UM researchers.

Prior to the capture of shortnose sturgeon within the Saco River in 2009, it was believed that this species was absent from the waters of southern Maine. Shortnose sturgeon were thought unable to use the numerous small coastal rivers due to dams blocking access to freshwater areas. Shortnose sturgeon have also been documented transiently using small coastal rivers in Maine like the Medomak, St. George, and Damariscotta rivers (G. Zydlewski et al., unpublished), suggesting that shortnose sturgeon make use of these systems during their forays between larger drainage systems that might support reproduction.

In April 2010, USGS researchers reported telemetry tagged late-stage females captured in 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), some using the Saco River during their transit. This indicates a much larger coastal migration of the endangered shortnose than previously understood, emphasizing the importance of Maine's southern rivers in terms of stock connectivity and demographic correspondence.

Habitat Preference

In areas where shortnose sturgeon typically occur, the substrate consists of mud, silt or sand (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).

For further information (biology, status, trends) about this species please refer to the attached Biological Opinion issued for the proposed action.

Non-Target Marine Animals

In addition to the shortnose sturgeon that are the subject of the permit, an assortment of sea birds, marine mammals, fish and invertebrates may be found in the action area. The permit would only authorize takes of the target shortnose sturgeon. The applicants have reported past bycatch 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 included American eel elvers, herring eggs, smallmouth bass juveniles, smelt eggs and larvae, and small catfish. However, because nets would be checked at short intervals, it is believed virtually all bycatch would be released alive.

Aquatic nuisance species are also present within the action area. Because the proposed research activities have the potential to spread such aquatic nuisance species to other watersheds, measures proposed by NMFS would be implemented as standard research protocol.

For Permit No. 16306, there is the potential for the proposed action to impact other protected species such as marine mammals, sea turtles, Atlantic salmon (*Salmo salar*) and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Takes of Atlantic sturgeon within the Action Area by the applicant would be authorized under Atlantic sturgeon research Permit No. 16526, currently held by the applicant.

Marine Mammals and Sea Turtles: There is the potential for marine mammal interaction with the proposed research activities, as the action area encompasses the range of marine mammals such as harbor seals, gray seals and others. Harbor seals and gray seals occurring in the Gulf of Maine are the most likely species of marine mammal potentially affected by the proposed action due to their abundance in the area. 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 Gulf of Maine at an annual rate of 6.6% yielding abundance estimate of 99,340 (Gilbert et al. 2005). Harp seals and hooded seals are rarely present in the Gulf of Maine, and are considered extralimital, occurring in the action area from January–May (Harris et al. 2002). Harbor porpoises are prevalent in the Gulf of Maine and are most commonly seen in deeper waters over the continental shelf (Read and Westgate 1997). Based on the applicant's past experience, and the standard mitigation conditions in the permit, the proposed research is not likely to affect marine mammals. Effects on marine mammals are not considered further.

The only sea turtle species likely to be present in the Gulf of Maine is the leatherback sea turtle. Because leatherbacks are a pelagic species, and the proposed research would take place in coastal waters, it is not likely that the activities would interact with this species. Thus, the effects on sea turtles are not considered further.

Atlantic Salmon: The range of the Atlantic salmon GOM DPS overlaps with the proposed action area. 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 the proposed action. The

permit would contain mitigation measures that minimize the potential for the research to affect Atlantic salmon.

The potential impacts of the activities on Atlantic salmon critical habitat were analyzed in detail in the SEA for the applicant's previous permits (File Nos. 1578-01 and 1595-03) (NMFS 2011) and are incorporated by reference. Areas of specific concern for potential effects to critical habitat were identified as impacts to sites for spawning and incubation, sites for juvenile rearing, sites for unobstructed migration, and effects on prey resources (NMFS 2011). NMFS concluded that the nets and sampling gear used in the research would not represent a significant migratory pathway obstruction for Atlantic salmon during spawning, incubation, or juvenile rearing. Because all by-catch was anticipated to be released alive, the proposed activities were not expected to affect Atlantic salmon prey resources (NMFS 2011a). The same permit mitigation conditions would be in effect for the applicant's proposed activities, and based on the researcher's past experience, it is not likely that the activities would significantly impact Atlantic salmon critical habitat.

Atlantic sturgeon: Atlantic sturgeon were listed as threatened in the Gulf of Maine in February 2012 (77 FR 5880) (effective date April 6, 2012). Atlantic sturgeon in the Gulf of Maine face many of the same threats as shortnose sturgeon, including habitat loss, poor water quality, overfishing and incidental bycatch (ASSRT 2007). Because capture of Atlantic sturgeon is also documented in various rivers in the Gulf of Maine co-occurring in proposed action areas, researchers would monitor nets closely, using the same netting protocols and standard research conditions found protective for shortnose sturgeon (Kahn and Mohead 2010). The applicant for File No. 16306 is also conducting research on Atlantic sturgeon in the same rivers as in the proposed action to monitor the status of Atlantic sturgeon in the Gulf of Maine under Permit No. 16526. Takes of Atlantic sturgeon are authorized under that permit.

This proposed action combines research projects conducted by the University of Maine (File No. 1595-04) and the Maine Division of Marine Resources (File No. 1578-01), and the impacts to non-target marine animals were analyzed in the EAs and SEAs completed for those actions (NMFS 2006 (1578); NMFS 2007 (1595); NMFS 2011 (SEA). As was concluded in the EAs and SEAs for the applicants' previous permits, and in the accompanying Biological Opinions for those actions, this proposed action is not expected to significantly impact any non-target marine animals and they are not considered further in this EA.

Biodiversity and Ecosystem Function

The proposed action is directed at the target shortnose sturgeon and does not interfere with benthic productivity, predator-prey interactions or other biodiversity or ecosystem functions. With the exception of a limited number of ELS directed mortality, shortnose sturgeon will not be removed from the ecosystem or displaced from habitat, nor will the permitted research affect their diet or foraging patterns. (See Chapter 4 for a more detailed discussion on the effects of ELS removal from the system). Further, the proposed action does not involve activities known or likely to result in the introduction or spread of aquatic nuisance species, such as ballast water exchange. Thus, effects on biodiversity and ecosystem function will not be considered further.

Ocean and Coastal Habitats

The proposed action is directed at the target shortnose sturgeon and would not affect habitat. As noted in the EAs and SEAs for the applicant's previous actions, the gill nets, trammel nets, trawls,

D-frame nets, egg mats, and beach seines would have little to no impact to the sediment, critical habitat, or other bottom habitat (NMFS 2006 (1578); NMFS 2007 (1595); NMFS 2011 (1578 and 1595 batched SEA)). Further, research vessels would avoid sensitive habitat areas and researcher would take precautions to avoid trawling over the same area in a 24 hour period. Based on the proposed research methods and mitigating conditions of the permits, the proposed action does not involve substantive alteration of substrate, movement of water or air masses, or other interactions with physical features of ocean and coastal habitat. Thus, effects on habitat will not be considered further.

Unique Areas
If authorized, the research would not take place at any sanctuaries, reserves or conservation areas. No park lands, prime farmlands, wetlands, or wild and scenic rivers are found within the action area. The proposed action is directed at shortnose sturgeon and would not alter or affect habitat, unique areas, including any components of essential fish habitat or Atlantic salmon critical habitat. As noted in the EAs and SEAs for the applicant's previous actions, protected areas, critical habitat, and EFH around the Gulf of Maine and the other rivers of the action area are not likely to be significantly impacted by the proposed action (NMFS 2006 (1578); NMFS 2007 (1595); NMFS 2011 (SEA). Thus, effects on such unique areas will not be considered further.

Historic Places, Scientific, Cultural, and Historical Resources
There are no districts, sites, highways or structures listed in or eligible for listing in the National Register of Historic Places in the action area. The proposed action represents the non-cosumptive use of shortnose sturgeon for scientific research purposes and does not preclude their availability for other scientific, cultural, or historic uses. Thus, effects on such resources will not be considered further.

Social and Economic Resources
The proposed action does not affect distribution of environmental burdens, access to natural or depletable resources or other social or economic concerns. It does not affect traffic and transportation patterns, risk of exposure to hazardous materials or wastes, risk of contracting disease, risk of damages from natural disasters, food safety, or other aspects of public health and safety. Thus, effects on such resources will not be considered further.

4.0 ENVIRONMENTAL CONSEQUENCES

Effects of the No Action Alternative
There are no direct or indirect effects on the environment of not issuing the permits. Under this alternative, the take of shortnose sturgeon resulting from the applicant's research would not be exempted and research would not take place. The No Action alternative would result in the loss of valuable information about the biology and ecology of this species.

Effects of the Proposed Permit Alternative
Effects would occur at the time when the applicant's research results in takes of the target shortnose sturgeon.

Environmental Consequences to the Biological Environment-Shortnose Sturgeon
The applicant has requested authorization to take shortnose sturgeon as described in the table

included in Ch. 2. No mortalities or serious injuries from activities authorized by the permit would be expected. NMFS does not expect the proposed methods for Permit No. 16306 to result in serious injury or mortality of target shortnose sturgeon. The analyses conducted for issuance of prior permits (File Nos. 1595-04 and 1578) to the applicants for similar shortnose sturgeon research activities in the same areas, demonstrated that although individual animals may experience short-lived stress or minimal injury during procedures, they would recover overall within the course of a day (NMFS 2011a). The following summarizes effects on individual sturgeon from the proposed taking during various research procedures.

Effects of Capture

The applicant proposes to use gill nets, trammel nets, beach seines and trawls to capture shortnose sturgeon. Entanglement in nets can result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations of sturgeon (Moser and Ross 1995; Collins et al. 2000; Moser et al. 2000). Historically, the majority of shortnose sturgeon mortality during scientific research has been directly related to capture, as a function of numerous factors including water temperature, low dissolved oxygen concentration, soak time, mesh size, net composition, and netting experience.

To illustrate, of 5,911 shortnose sturgeon captured by gill nets or trammel nets during research authorized by 6 permits (during years 1997-2004), only 23 died, yielding an incidental mortality rate of 0.39%. All of these mortalities were due to high water temperature and low dissolved oxygen (DO) concentrations. Moser and Ross (1995) reported gill net mortalities approached 25% when water temperatures exceeded 28ºC even though soak times were often less than 4 hours. NMFS revised netting protocol based on guidance from researchers (Moser et al. 2000; Kahn and Mohead 2010) and these procedures were implemented in the permit conditions. From 2005-2010, 4,826 shortnose sturgeon were captured during research activities conducted by 17 permits; there were 2 mortalities (0.04% mortality rate). The low mortality rate of more recent research is due to mitigation measures implemented by permit holders (Moser et al. 2000; Kahn and Mohead 2010), such as reduced soak times at warmer temperatures or lower DO levels; as a result, the effects of capture on shortnose sturgeon have been reduced.

To limit stress and mortality of sturgeon due to capture by gill nets or trammel nets, the applicant will adhere to the net set protocols as stated by NMFS PR and conditioned in the permit. Specifically, during lower water temperatures (<15°C), soak times of nets would not exceed 6 hours; at water temperatures between 15°C and 20°C, net sets would not exceed 3 hours; at water temperatures between 20°C and 25°C, net sets would not exceed 1 hours; and netting activities would cease at 26°C or higher. Gear would be deployed only in waters where dissolved oxygen concentrations are at least 4.5 mg/l at the deepest depth sampled for the duration of deployment.

Trawl nets will be used in such a manner as to limit potential impacts to shortnose sturgeon. According to the applicant and in accordance with NMFS recommendations, the gear will be set and hauled by hand (Kahn and Mohead 2010). The trawl will be towed along the bottom at a slow speed (about 2.5 knots) for a short time (5-15 minutes). Other permit holders have utilized trawl nets to capture shortnose sturgeon in the past, and had no mortality or injuries (e.g., File No. 1516). Beach seine use would be limited to the winter in the Merrimack River along sand and gravel shoals, and fish would be handled in the same manner as sturgeon captured using other methods. Based on the applicant's experience and past history, as well as the conditions contained in the permit, NMFS does not anticipate any long-term adverse effects to shortnose sturgeon as a result of the proposed capture methods.

Effects of Handling and Holding
Routine handling and holding can result in raised levels of stressor hormones in shortnose sturgeon. Sturgeon are a hardy species, but sensitive to handling stress when water temperatures are high or dissolved oxygen is low. Additionally, sturgeon tend to inflate their swim bladder when stressed or handled in air (Moser et al. 2000). If they are not returned to neutral buoyancy prior to release, they tend to float and would be susceptible to sunburn and bird attacks. In some cases, if pre-spawning adults are captured and handled, it is possible that they would interrupt or abandon their spawning migrations (Moser and Ross 1995).

To minimize capture and handling stress, researchers would hold shortnose sturgeon in nets pens or in holding tanks (as available), provide fish with a continuous flow of water, and minimize the amount of time the fish would be handled and held. For most procedures planned, the total time required to complete routine handling and tagging would be no more than 15 minutes. Moreover, following processing, sturgeon would be returned to the net pen or holding tank for observation to ensure full recovery prior to release. Shortnose sturgeon would be checked for buoyancy problems and treated with a slimecoat restorant prior to release, as well as monitored for proper swimming behavior after release. Total holding time would be no longer than 60 minutes from capture until release.

The handling, holding, weighing, measuring, and photographing procedures are simple and not invasive. NMFS expects that individual fish would normally experience no more than short-term stresses as a result of these activities. Researchers have taken measurements and weights of thousands of shortnose sturgeon in the proposed manner with no apparent ill effect. No injury would be expected from these activities, and individuals would be worked up as quickly as possible to minimize stress. The applicant would also be required to follow procedures designed to minimize the risk of either introducing a new pathogen into a population or amplifying the rate of transmission from fish to fish of an endemic pathogen during handling. The proposed methods of handling fish described in the application and conditioned in the permit are consistent with the best management practices endorsed by NMFS and, as such, should minimize effects resulting from routine handling and holding.

Effects of PIT Tagging and Floy/T-bar Tagging
PIT Tags: PIT tags insure unique identification upon capture or recapture for population and growth estimates. To avoid duplicate tagging, all sturgeon would be scanned with a PIT tag reader prior to the insertion of a PIT tag. Tagging procedures could result in stress during restraint and minor wounds from insertion. PIT tag use is not known to have any other direct or indirect effects on shortnose sturgeon when tags are appropriately sized and inserted correctly. There has been reported shortnose sturgeon mortality as a result of PIT tags being too large for the fish or inserted too deeply. Henne et al. (2003) found that 14mm tags inserted into shortnose sturgeon <330 mm total length (TL) caused 40% mortality after 48 hours; no mortality in sturgeon 250- 330 mm TL occurred after 28 days using smaller 11.5mm PIT tags. Therefore, to address these concerns, the applicant would not PIT tag sturgeon <300mm TL. As such, the tagging of shortnose sturgeon with PIT tags is unlikely to have significant impact.

Floy/T-bar Tags: NMFS has authorized a variety of external-identifier tag designs and placement sites on shortnose sturgeon including the proposed T-bar tags. Placing an external T-bar tag in the dorsal musculature has shown promise for tag retention with minor impacts to shortnose sturgeon (Moser et al. 2000). Smith et al. (1990) compared the effectiveness of dart tags with nylon T-bars, anchor tags, and Carlin tags in shortnose and Atlantic sturgeon. Carlin tags and dart tags had low retention rates; T-bar anchor tags had the highest. However, it was noted that dart tags caused some tissue damage. Long-term (>2 years) tag retention rates of T-bar anchor tags attached at the base of the pectoral fins was ~60% (Clugston 1996). Collins et al. (1994) compared tag retention rates of several external identifier tags inserted at different locations in shortnose sturgeon and found that T-bar anchor tags were the most effective (92% tag retention rate). However, in terms of healing, he noted that insertion points for all tag types healed slowly or not at all, and, in many cases, small lesions developed. That study found no significant difference in healing rates of fish tagged in freshwater versus brackish water (Collins et al. 1994).

Researchers would only tag sturgeon ≥300mm TL using T-bar anchor tags. To account for concerns about tissue damage and healing, the researchers would use sterile techniques when inserting tags. Tag retention would be monitored by comparing recapture results with PIT tag results on recaptures; and effects of tagging would be measured by examining the tissue or recaptured sturgeon at insertion points. NMFS does not expect any long-term adverse effects to shortnose sturgeon as a result of T-bar tags.

Effects of Tissue Sampling

The applicant proposes to take a small (1 cm^2), non-deleterious tissue sample, clipped with surgical scissors from a section of soft fin rays of captured sturgeon. Tissue sampling does not appear to impair the sturgeon's ability to swim and is not thought to have any long-term adverse impact (Kahn and Mohead 2010). Many researchers, including the applicant, have removed tissue samples according to this same protocol with no adverse effects (Wydoski and Emery 1983); therefore, NMFS does not anticipate any long-term adverse effects to the sturgeon from this activity.

Effects of Boroscopy

Boroscopy is minimally invasive and it allows researchers determine the sex of a sturgeon without engaging in riskier surgical procedures that would also include greater handling and holding time. Researchers demonstrated that no damage is caused while examining sturgeon using a borescope (Kynard and Kieffer 2002). The procedure as a whole only lasts approximately 1-4 minutes. Borescopic examinations would not be expected to cause harmful effects to sturgeon because of the speed, safety, and minimally invasive nature of the procedure. Prior to performing the procedure, researchers would receive appropriate training. For these reasons, NMFS does not expect adverse impacts, other than discomfort to individual sturgeon.

Effects of Anesthesia

MS-222: The proposed anesthetic concentration of up to 150 mg/L MS-222 is commonly used by sturgeon biologists to induce light to deep planes of anesthesia for invasive procedures (e.g., internal acoustic tagging) (D. Peterson, D. Fox, M. Collins, T. Savoy, *pers. comm*. Nov. 2009) and is the only chemical anesthetic recommended by NMFS (Kahn and Mohead 2010). The induction varies with dosage, temperature and water chemistry; however, typical induction times are from 5-8 minutes. Complete recovery time from the anesthetic averages 4-6 minutes (Brown 1988).

Risks associated with anesthetizing with MS-222 would include hypoxia from overexposure (Coyle et al. 2004), and injury from thrashing during the excited phase of induction. Furthermore, anesthetizing fish in poor health or stressed condition could result in injury or mortality. To reduce such risks, only properly trained staff would use this technique, and only non-stressed animals in good health would be anesthetized. To avoid injury while being anesthetized, sturgeon would be restrained with netting to prevent animals from jumping or falling out the anesthetic bath. Fish would be monitored closely during induction to reach the proper level of anesthesia prior to surgery, and would be observed to ensure proper recovery from anesthetic narcosis prior to release. Also, because MS-222 is an acidifying solution, potentially extending the induction time for narcosis, bath solutions would be buffered to a neutral pH with sodium bicarbonate and oxygenated prior to use.

MS-222 has been found to be excreted in fish urine within 24 hours and tissue levels decline to near zero in the same amount of time (Coyle et al. 2004). Consequently, a sturgeon released after treatment with MS-222 would not present a sizable risk to the environment should a predator consume that sturgeon. Therefore, NMFS considers this anesthetizing protocol to be well established with known risks minimized to produce limited effects on sturgeon and the environment.

Electronarcosis: Electronarcosis is a non-chemical method of anesthetization using a low voltage constant direct current (CDC) producing muscle relaxation and immobility. Electronarcosis has been used successfully by Boyd Kynard (CI) to anesthetize shortnose sturgeon since the 1980s. Since 2004, USFWS researchers in Maryland have 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 using these methods have reported similar success (Alves et al. 2007).

Henyey et al. (2002) used low voltage CDC to induce electronarcosis in shortnose sturgeon and observed no changes in swimming or feeding behavior, no ill effects, and no mortality after 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 descriptions of using electronarcosis and observations of fish reactions.

Effects of Telemetry Tags

External Acoustic Tags: The research would authorize the attachment of external telemetry tags, a minimally invasive procedure which has several advantages over surgical implantation of telemetry tags. Since surgery is not necessary for attachment, external telemetry tags can be used on late-stage females without risk of destroying eggs. Attaching external acoustic tags would be a minimally intrusive way to tag pre-spawning female sturgeon, so as to reduce the likelihood of aborted spawning runs (Kahn and Mohead 2010). This method also allows the researcher more flexibility since external tags can be attached throughout the year, in contrast to internal tags, where surgery can only be performed when water temperatures are appropriate. Further, the external tag is not thought to have adverse effects on sturgeon when installed with neoprene buffer pads as the applicant proposes. While using neoprene buffer pads has not been used by the applicant before, it has been used when attaching external telemetry tags in other fish species (smalltooth sawfish; File No. 13330-01) to reduce irritation to the animal and increase tag retention. There have been no reported adverse effects. Adult and juvenile shortnose sturgeon would be fitted with external acoustic tags, but because of their size, juvenile shortnose sturgeon would only receive external

acoustic tags, and would not undergo surgery for internal tags. The researcher estimates the procedure to attach the external tags would be non-stressful, lasting approximately 2-3 minutes.

Internal Acoustic Tags: Surgery for inserting internal acoustic tags would cause stress during capture and restraint, as well as minor wounds from surgery. The surgical procedures would also cause discomfort to the fish, and carry a risk of infection. To address these concerns, the researchers propose to use the best management practices as endorsed by Moser et al. (2000) and revised by NMFS (Kahn and Mohead 2010). These practices would minimize or eliminate potential short-term adverse effects and reduce the risk of injury and mortality. The fish would also be monitored for infection and treated as needed.

The experience of other researchers using the same methods suggests that these procedures are conducted in a manner which minimizes or eliminates mortality to the fish. Buckley and Kynard (1985) tagged 91 shortnose sturgeon with internal radio tags and 1,442 locations from 82 fish were obtained with no observed mortality. Studies have also shown that radio-tagged fish appear to recover quickly and show no long-term effects from handling; O'Herron et al. (1993) radio-tagged 28 fish, with 26 being relocated as many as 35 times. Shortnose sturgeon were tagged and tracked for up to 3 months by Moser and Ross (1995). Surgical implantation of internal transmitters in fish by Collins in South Carolina (M. Collins, *pers. comm.*, November 2006) has thus far not resulted in a known mortality. Additionally, Kieffer and Kynard (In press) report that tag rejection internally is reduced by coating tags with an inert elastomer. Tags surgically implanted into the body cavity were usually retained for the tag's operational life, and in most cases, for much longer (mean: 1,370.7 day), and poor incision healing was rare (Kieffer and Kynard, in press).

To guard against adverse effects associated with internal acoustic tags, the applicant proposes to use the best management practices as endorsed by NMFS in the sturgeon protocol (Moser et al. 2000; Kahn and Mohead 2010). Surgery would only occur when water temperatures were between 8-25°C in spring and summer, and at temperatures ≥12°C in fall and winter. Additionally, they would seal the tags with an inert elastomer polymer to prevent tag rejection. In general, by using proper sterilized surgical techniques, tagging with internal sonic tags is not expected to have significant impact on the normal behavior, reproduction, or survival of shortnose sturgeon.

Effects of Apical Spine Sampling

Sampling would involve using an orthopedic bone cutter or small saw to take a 4-10 mm clip of the apical hook of a single scute. This sample would be used to determine if unique elemental markers are present to help 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. The scute material is poorly vascularized and non-innervated, and that the removal of a single apical spine would not likely harm the fish.

Scute removal in sturgeon species has been used in the past in a variety of capacities, primarily as a means of external marking or for age analysis (Rien and Beamesdefer 1994; Ireland et al. 2002). In a mark-recapture study comparing feasibility of different marks in white sturgeon, scute removal had a high retention rate after two years at large; upon examining recaptured fish, researchers surmised that there were no apparent adverse effects as a result of scute removal (Rien et al. 1994). Studies comparing the ageing precision of calcified structures in shovelnose and white sturgeon have shown

that using dorsal scutes for age analysis have yielded less than optimal results than other structures like pectoral fin rays (Brennan and Cailliet 1989; Jackson et al. 2007). Removal of pectoral fin rays for ageing analysis in shortnose sturgeon is considered more reliable and is the technique commonly authorized by NMFS for ageing studies.

While the practice of removing scutes for ageing analysis is no longer common, the applicant wishes to remove scutes for a different purpose. The applicant proposes to remove a small, posterior lateral scute to determine river of origin based on elemental composition. Currently, the applicant is studying the feasibility of using the elemental composition of scutes in determining river origin by using samples obtained from salvaged shortnose sturgeon (File No. 1614). Scute removal would only be carried out as a contingency if apical spine scute sampling was not sufficient to determine the natal river by examining the elemental composition, something which would occur after discussion with NMFS PR. Based on the results of previous studies, scute removal is not expected to have long-term adverse impacts.

Effects of Blood Sampling

Effects of drawing blood could include pain, discomfort, or possible hemorrhage or infection at the site of needle insertion. To mitigate these effects, specific procedures would be followed. 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 prior to release. Additionally, personnel responsible for blood sampling would have received training in the procedure. NMFS expects that drawing blood in the manner described would have little probability of killing shortnose sturgeon or producing sub-lethal effects.

Effects of Gastric Lavage

Due to the morphology of the gut tract and the position of the swim bladder in shortnose sturgeon, care must be taken while inserting the tube into the esophagus and positioning it within the gut for gastric lavage. 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 (i.e., interrupted foraging) after gastric lavage. To mitigate these concerns, the applicant would anesthetize sturgeon to relax the gut wall, allowing easy penetration of the tubing to the proper position in the gut, and use appropriately sized tubing (Kahn and Mohead 2010).

Savoy and Benway (2004) performed gastric lavage on 246 shortnose sturgeon collected on the Connecticut River; all of the fish tolerated the procedure well, recovered rapidly and were released unharmed. The lavage technique was successful in evacuating stomach contents of shortnose sturgeon of all sizes without internal injury; in some cases, recently ingested prey items were still alive after retrieval (Savoy and Benway 2004). Based on the reported evidence, it is believed that sturgeon which undergo gastric lavage as proposed would experience handling discomfort, but would be exposed to only minimal short-term risk associated with the procedure.

Effects of Fin Ray Section

A small section (~1 cm^2) of the pectoral fin ray would be collected from shortnose sturgeon captured for age-determination (Kahn and Mohead 2010). The samples would be collected using sterilized hacksaws and scalpels from a section of the pectoral fin ray while fish are under anesthesia. The

procedure is a common and accepted practice in shortnose sturgeon research and has been shown to not impair the sturgeon's ability to swim or have long-term impacts (Moser et al. 2000).

Effects of ELS Collection

Due to their relatively small size, neither D-frame nets nor egg mats would disrupt water flow or habitat. Therefore, no adverse impacts to the physical environment are anticipated. Drifting or dislodged embryos and larvae would be captured in the nets, identified, and preserved; excess of the authorized take would immediately be returned to the river. Researchers would check nets every 3 hours to be sure that authorized take is not exceeded. Sampling would occur from March to June and September to December. ELS sampling gear would be removed from the river once the water temperature exceeds 25°C or once the amount of authorized shortnose sturgeon eggs and/or larvae has been collected, whichever comes first.

The survival from egg to juvenile is a critical aspect in determining the strength of the year class (COSEWIC 2005); therefore, it is important to be conservative when authorizing ELS sampling. Each adult female sturgeon produces between 94,000 and 200,000 eggs every 3 years (COSEWIC 2005). The proposed directed mortality of shortnose sturgeon eggs varies between rivers (from 10 to 100 annually). So, for example, if only 1 female sturgeon reproduces each year in a river and produces a minimal number of eggs (94,000), this project would collect between 0.01-0.1% of the eggs produced in that year. As such, the proposed take of ELS is not expected to impact the biological environment or the population viability of shortnose sturgeon. In fact, authorizing ELS take in the Gulf of Maine and its coastal rivers would likely result in more timely and conclusive data about shortnose sturgeon spawning, aiding conservation and management decisions.

Effects on Atlantic salmon

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' deep at low tide) and in areas off the main channel having muddy bottoms in (<10' feet deep at low tide). 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 stress; however, it would not likely result in serious injury or mortality. In the event that a salmon was captured, the researchers would suspend sampling immediately and consult with NMFS PR within 48 hours.

Minimally, net checks are performed each hour during use, or immediately, if it is obvious that an animal is captured. Therefore, the nets are not a permanent structure. Moreover, gill net protocol has been conditioned in the permit to effectively limit interaction within the Atlantic salmon migratory pathways. Consequently, NMFS does not believe the proposed netting would impact critical habitat and would not obstruct migratory pathways for adult or juvenile Atlantic salmon. Because D-nets and egg mats would be anchored to the river bottom, Atlantic salmon smolt drifting near the surface would not be exposed to 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 impact critical habitat or obstruct downstream migratory pathway for Atlantic salmon smolts.

Effects on Atlantic sturgeon
If an Atlantic sturgeon is incidentally captured, it will be handled according to the same NMFS protocol established for shortnose sturgeon and subject to the same conditions listed in the permit; thus, no significant impacts on Atlantic sturgeon are expected. The applicant is authorized for takes of Atlantic sturgeon in the Gulf of Maine under Permit No. 16526.

Controversy
Federal agencies are required to consider "the degree to which effects on the quality of the human environment are likely to be highly controversial" when evaluating potential impacts of a proposed action. [40 CFR §1508.27] The applications for the proposed permits were made available for public review and comment for 30 days (76 FR 58471). No public comments were received. All agencies comments were addressed and responses were included in the decision memos for the permit. Given the proposed research methodologies are well known and are expected to have minimal effects, NMFS believes it is not likely to be controversial.

Cumulative Impacts
Summary of Effects from Total Number of Permits: In general, takes of shortnose sturgeon by harassment during permitted research using the proposed methodologies have not been shown to result in long-term or permanent adverse effects on individuals regardless of the number of times the harassment occurs. The frequency and duration of the disturbance under the proposed permit would allow adequate time for animals to recover from adverse effects such that additive or cumulative effects of the action on its own are not expected.

No measurable effects on population demographics are anticipated because any sub-lethal (disturbance) effects are expected to be short-term, with the animals recovering within a day, and the proposed action is not expected to result in unintentional mortality of any animals. There exists the possibility that adverse effects on a species could accrue from the cumulative effects of a large number of permitted takes by harassment relative to the size of the population. However, based upon past reports to NMFS, there is no evidence that current or past levels of permitted takes have resulted in such population or species level effects. The impacts of directed mortality of ELS shortnose sturgeon would be negligible at the population and species level.

Other than the applicants' current permits, File No. 1595-04 (UM) and File No. 1578-01 (MDMR), which the proposed permit would replace, no other NMFS permits authorize takes of the target shortnose sturgeon for research in the action area. One other research permit in nearby regions (File No. 15614 in Connecticut waters) authorize take of this species, but not enough information is known of these populations to determine whether either of these permits would target and therefore affect the same individual animals or populations as the proposed research. Even if the proposed permit is able to target the same animals as other Permit Holders in the region, NMFS would not expect cumulative impacts since effects of research activities would dissipate within a day as previously discussed. Moreover, researchers working under NMFS permits are required to notify the appropriate NMFS Regional Office in advance of field work. The Northeast Regional Office is tasked with coordinating activities under multiple permits for the action area to ensure there is not unnecessary duplication of research.

Summary of Other Actions: The target shortnose sturgeon population may be exposed to other human activities including by-catch in fishing gear, ship strikes, and habitat alteration. Effects of past and ongoing human and natural factors (fisheries, existing NMFS research permits and other activities) occurring in or near the action area that have contributed to the current status of the species are described in the baseline section of the attached biological opinion done for the ESA Section 7 Consultation for this permit. General threats facing shortnose sturgeon range-wide are also discussed in the opinion. These activities and threats are expected to continue into the future.

The conclusion of the biological opinion was that the proposed action would not likely jeopardize the continued existence of any of the species and would not likely destroy or adversely modify designated critical habitat. NMFS expects the proposed research activities not to appreciably reduce the species likelihood of survival and recovery in the wild by adversely affecting their birth, death, or recruitment rates. In particular, NMFS expects the proposed research activities not to affect adult female sturgeon in a way that appreciably reduces the reproductive success of adults, the survival of young, or the number of young that annually recruit into the breeding populations of any of the species.

Summary: Overall, the proposed action would not be expected to have more than short-term effects on endangered shortnose sturgeon. The incremental impact of the action when added to other past, present, and reasonably foreseeable future actions discussed here would be minimal and not significant. The data generated by the research activities associated with the proposed action would help determine the movement, habitat use, and life history characteristics of shortnose sturgeon found in the waters of the action area. The research would provide information that would help manage and recover endangered species and would outweigh any adverse impacts that may occur. The proposed action would not be expected to have any more than short-term effects any marine life species or other portions of the environment and would not result in any cumulatively significant effects.

5.0 LIST OF PREPARERS

This EA was prepared by the National Marine Fisheries Service, Office of Protected Resources in Silver Spring, Maryland.

6.0 APPENDIX

I. Figures

Figure 1: Proposed Action Area for File No. 16306. Sampling would occur in the Penobscot, Kennebec, and Saco Rivers in Maine.

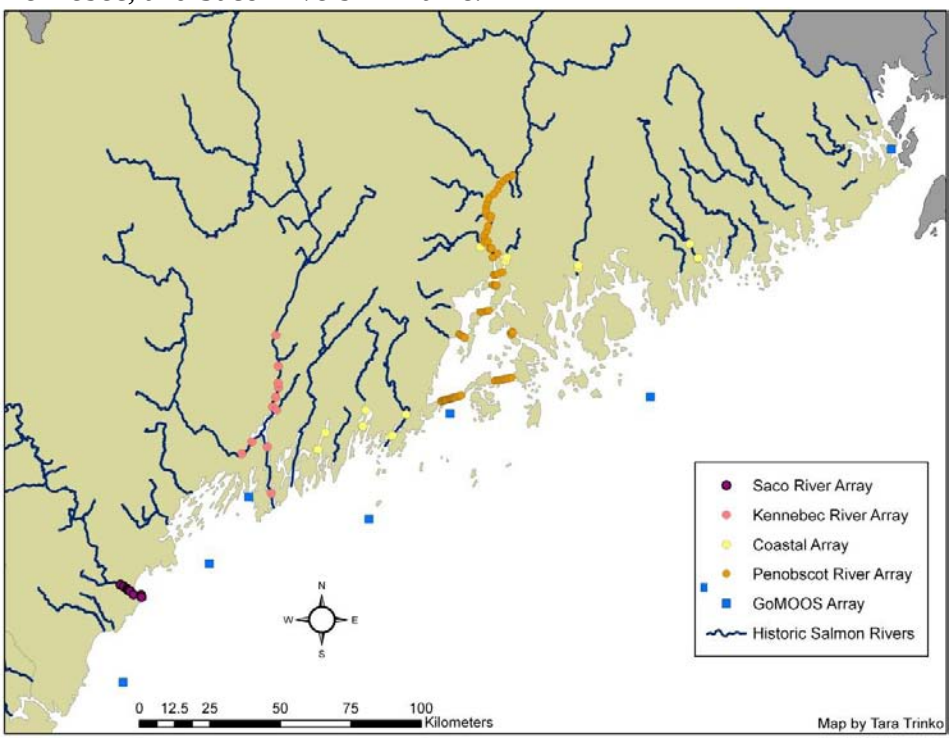

Figure 2: Proposed Action Area for File No. 16306. Sampling would occur in the Merrimack River, Massachusetts.

Figure 3. From Kieffer and Kynard (in press): "Cut-away view of internal tagging procedures used on adult shortnose sturgeon. Tags were inserted through either a ventral incision or a lateral incision as shown in Panel A."

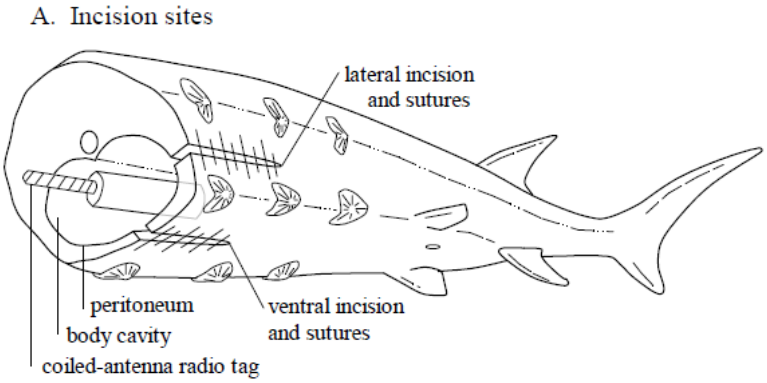

Table I: Proposed Action Area for File No. 16306. Small coastal rivers and waterbodies of ME and NH where Atlantic sturgeon sampling may occur

Waterbody	State
St. Croix River	ME
Dennys River	ME
Narraguagus River	ME
Union River	ME
Passagassawakeag River	ME
St. George River	ME
Medomak River	ME
Damariscotta River	ME
Sheepscot River	ME
Androscoggin River	ME
Royal River	ME
Presumpscot River and inshore Casco Bay	ME
Scarborough River	ME
Mousam River	ME
Webhannet River	ME
York River	ME
Piscataqua River	ME, NH

II. References

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