NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT
BIOLOGICAL OPINION

Agency: NOAA's National Marine Fisheries Service
Northeast Fisheries Science Center

Activity Considered: Proposed Funding of Fisheries Sampling in the Penobscot River
F/NER/2008/04730
GARFO-2008-00008

Conducted by: National Marine Fisheries Service
Northeast Region

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INTRODUCTION

This constitutes the biological opinion (Opinion) of NOAA's National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543) on the effects of the NMFS' Northeast Fisheries Science Center (NEFSC) proposes to conduct a fisheries study in the Penobscot River in Maine. This Opinion is based on the following: information provided by the NEFSC in the Biological Assessment (BA) submitted to NMFS' Northeast Regional Office (NER) on July 25, 2008, correspondence between the NEFSC and NER, and other available sources of information. NEFSC's request for formal consultation was received on July 25, 2008 and formal consultation was initiated on July 25, 2008. A complete administrative record of this consultation will be kept on file at the NER.

CONSULTATION HISTORY

On July 25, 2008 NMFS Protected Resources Division received a request from the NEFSC for formal Section 7 consultation regarding the effects of the proposed fisheries study in the Penobscot River. The July 25, 2008 letter contained a Biological Assessment prepared by NEFSC concerning the effects of the project on listed Atlantic salmon and shortnose sturgeon. As the submission from NEFSC contained all of the information necessary to conduct Section 7 consultation, the date that the letter was received (July 25, 2008) serves as the date of initiation of consultation.

DESCRIPTION OF THE PROPOSED ACTION

As part of the Penobscot River Restoration Project (PRRT), two mainstem hydroelectric facilities on the Penobscot River (Veazie and Great Works Projects) are proposed for removal, and fish passage is proposed for a third (Howland Project). Depending upon the Federal Energy Regulatory Commission's (FERC) review and approval, the PRRT could be implemented as early as 2011. If these dams are removed, impounded habitats will revert to more historic lotic (i.e., free flowing water) conditions and both native and invasive species are expected to respond to new habitats and reduced migration barriers accordingly. These dam removals are expected to result in re-structuring of riverine fish communities because of shifts in mesohabitat structure, habitat connectivity, predator-prey relations (Hoagstrom et al. 2007), and influx of marine nutrients (Saunders et al. 2006). These changes are anticipated to: 1) increase the abundance of diadromous species within both the dam removal sites but also in other reaches where diadromous spawning and nursery habitats exist throughout the watershed (Lenhart 2003); 2) increase productivity in formerly-impounded river reaches (Halls and Welcomme 2004) and upstream areas affected by newly-established fish runs (Scheuerell et al. 2007); and 3) shift the resident fish fauna away from a lentic (i.e., still water) assemblage toward a fluvial assemblage (Bushaw-Newton et al. 2002).

In order to evaluate the outcome of this large-scale river restoration project, NOAA's Northeast Fisheries Science Center (NEFSC) is proposing to fund a study to collect pre-and post-dam removal fisheries data in the Penobscot River. In general, few river restoration efforts have been monitored for success (Bernhardt et al. 2005) and the proposed work on the Penobscot River provides a unique opportunity to assess and guide a major river restoration project. The goals of the fisheries study are to assess the magnitude of biotic community change and predict subsequent effects cascading throughout the ecosystem.

The NEFSC proposes to conduct sampling in the Penobscot River consistent with the Index of Biotic Integrity (IBI) approach, which is intended to gauge aquatic biotic responses to water quality and habitat changes. The IBI approach uses a standardized quantitative sampling methodology to generate contemporary baseline data in study areas. Data collected during the proposed study will be used to evaluate reproduction of American shad and distribution of Atlantic salmon and American eel, three key species targeted for restoration by the proposed dam removal action. The currently proposed study only focuses on establishing baseline information on the current status of these fisheries (i.e., pre-dam removal) and does not propose to collect any information beyond the summer of 2009.

The proposed study will follow IBI electrofishing survey protocols established for the Penobscot River (Kulik et al. 2007). Electrofishing entails passing an electric current in the water to capture or control fish. The electric current causes fish within the effective area of the electric field to become temporarily stunned or immobilized (referred to as electrotaxis) to facilitate capture by nets. Single pass boat electro-fishing surveys will be completed along 17 predetermined shoreline transects. The transects will be sampled three times each (late summer 2008, spring 2009 and late summer 2009). The 17 sites are distributed between the mainstem of the Penobscot River (9 sites) and several tributaries (8 sites). With the exception of two transects, all sampling will occur upstream of the Veazie Dam. The two transects below the Veazie Dam are located in freshwater, upstream of the former Bangor Dam (see Figure 1).

An electrofishing boat will make a single pass along each transect, traveling approximately 1 km along the shoreline. Electric currents will be applied to maintain power densities sufficient to generate electrotaxis in targeted fish (i.e., shad, salmon, and eels). Minimum settings will be estimated by measuring water conductivity and evaluating behavioral responses of fish prior to changing settings. Efforts to adjust settings will favor low frequency and pulse width to minimize any injuries to fish. Target electrical currents are 2 to 4 amps, 400 volts, and 60 pulses per second. Based upon these setting, the expected range of electrotaxis for fish in the electric field will be approximately 4.5 meters in diameter down to a depth of approximately 2.5 meters. During sampling the anode and cathode will be held as far apart as practical to generate a more diffuse field in order to minimize the risk of injury to fish. Stunned fish will be captured using hand held nets and removed from the water as rapidly as possible.

Captured fish will be immediately placed in aerated live wells containing ambient river water. Each transects typically takes 45 minutes to complete with an additional 45 minutes to process all of the fish captured. The total time held for each fish will vary; however, as fish are processed after each transect the maximum holding time for any one fish will be 90 minutes. Captured fish will be identified to species, measured, enumerated and released alive. In the event that any shortnose sturgeon are incidentally stunned and collected during sampling, the researchers have stated that sampling will be immediately suspended until sturgeon are processed and released.

Action Area
The action area is defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For purposes of this Section 7 consultation, the action area is defined as all areas where electrofishing sampling has the potential to affected listed species under the jurisdiction of NMFS. As discussed below, listed shortnose sturgeon are known to occur in the lower study area of the proposed study (Figure 1) from the Veazie hydroelectric project downstream to the former Bangor Dam. As explained above, the action will involve running two transects along two 1km reaches of shoreline below Veazie Dam. Each transect will result in an electric field 4.5 meters wide, 2.5 meters deep and 1 km long. Thus, the action area is defined as these two stretches of the Penobscot River between the Veazie Dam and the former Bangor Dam. The proposed action is not expected to have any direct or indirect effects to listed species outside of the two areas where electric current will be experienced. These two areas will be referred to as the Veazie Tailrace – Eddington transect and the Veazie Tailrace – Bangor transect.

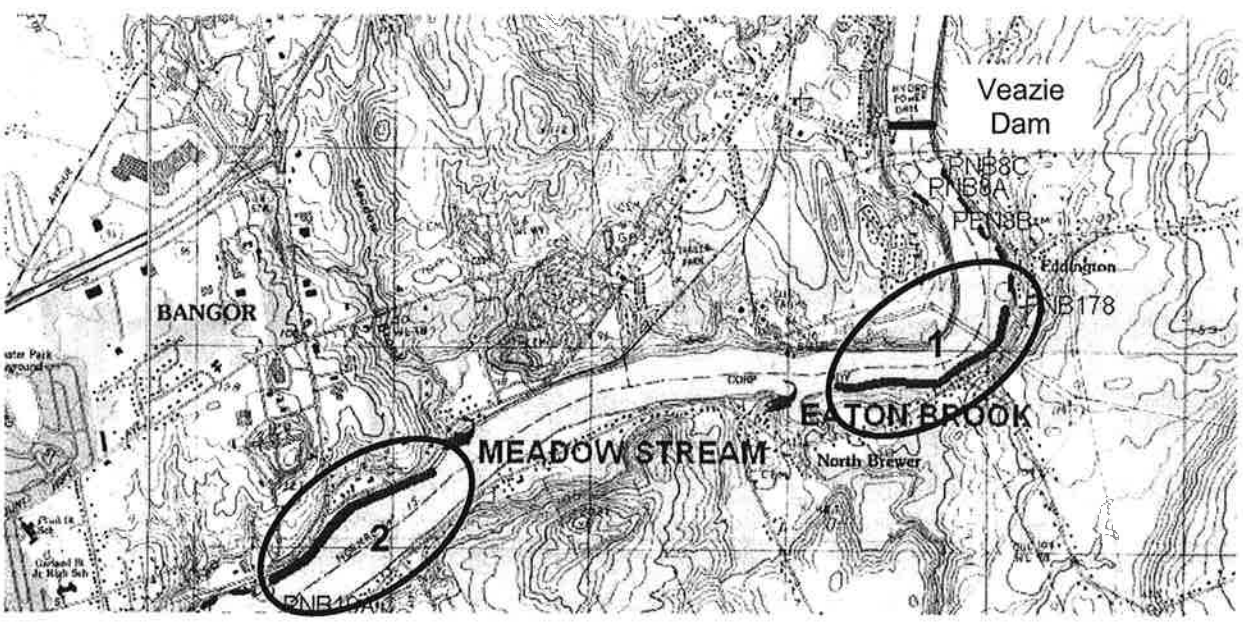

Figure 1. IBI sampling transects below Veazie dam. 1) Veazie tailrace- Eddington; 2) Veazie tailrace- Bangor.

STATUS OF AFFECTED SPECIES

NMFS has determined that the action being considered in this biological opinion may affect the endangered shortnose sturgeon (*Acipenser brevirostrum*). No critical habitat has been designated for shortnose sturgeon. While listed Gulf of Maine (GOM) Distinct Population Segment (DPS) of Atlantic salmon occur in the Penobscot River, they do not occur in the action area. This section will focus on the status of shortnose sturgeon within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

Shortnose Sturgeon

Shortnose Sturgeon Life History

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; Dadswell 1979 in 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). 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. Spawning begins from late winter/early spring (southern rivers) to mid to late spring (northern rivers) when the freshwater temperatures increase to 8-9°C. Several published reports have presented the problems facing long-lived species that delay sexual maturity (Crouse et al. 1987; Crowder et al. 1994; Crouse 1999). In general, these reports concluded that animals that delay sexual maturity and reproduction must have high annual survival as juveniles through adults to ensure that enough juveniles survive to reproductive maturity and then reproduce enough times to maintain stable population sizes.

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, personal communication). There is no recruitment information available for shortnose sturgeon because there are no commercial fisheries for the species. 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).

At hatching, shortnose sturgeon are blackish-colored, 7-11mm long and resemble tadpoles (Buckley and Kynard 1981). In 9-12 days, the yolk sac is absorbed and the sturgeon develop into larvae which are about 15mm total length (TL; Buckley and Kynard 1981). Sturgeon larvae are believed to begin downstream migrations at about 20mm TL. Laboratory studies suggest that young sturgeon move downstream in a 2-step migration: a 2 to 3-day migration by larvae followed by a residency period by young of the year (YOY), then a resumption of migration by yearlings in the second summer of life (Kynard 1997). Juvenile shortnose sturgeon (3-10 years old) reside in the interface between saltwater and freshwater in most rivers (NMFS 1998).

In populations that have free access to the total length of a river (*e.g.*, no dams within the species' range in a river: Saint John, Kennebec, Altamaha, Savannah, Delaware and Merrimack Rivers), spawning areas are located at the farthest upstream reach of the river (NMFS 1998). 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 8°C, 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).

Shortnose sturgeon are believed to spawn at discrete sites within a river (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 that during the three years of the study in the Androscoggin River, adults returned to a 1-km reach below the Brunswick Dam and Kieffer and Kynard (1993) found that adults spawned within a 2-km reach in the Connecticut River for three consecutive years. Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (Dadswell et al. 1984; NMFS 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 8-12° 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 6.5-18.0°C (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 8° 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.

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 that post-spawning migrations were correlated with 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.

Juvenile shortnose sturgeon generally move upstream in spring and summer 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). While shortnose sturgeon are occasionally collected near the mouths of rivers and often spend time in estuaries, they are not known to participate in coastal migrations and are rarely documented in their non-natal river.

The temperature preference for shortnose sturgeon is not known (Dadswell et al. 1984) but shortnose sturgeon have been found in waters with temperatures as low as 2 to 3°C (Dadswell et al. 1984) and as high as 34°C (Heidt and Gilbert 1978). However, temperatures above 28°C are thought to adversely affect shortnose sturgeon. In the Altamaha River, temperatures of 28-30°C 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). 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; Saunders and Smith 1978). 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). Shortnose sturgeon typically occur in the deepest parts of rivers or estuaries where suitable oxygen and salinity are present (Gilbert 1989).

Status and Trends of Shortnose Sturgeon Rangewide

Shortnose sturgeon were listed as endangered on March 11, 1967 (32 FR 4001), and the species remained on the endangered species list with the enactment of the ESA in 1973. Although the original listing notice did not cite reasons for listing the species, a 1973 Resource Publication, issued by the US Department of the Interior, stated that shortnose sturgeon were "in peril…gone in most of the rivers of its former range [but] probably not as yet extinct" (USDOI 1973). Pollution and overfishing, including bycatch in the shad fishery, were listed as principal reasons for the species' decline. In the late nineteenth and early twentieth centuries, shortnose sturgeon commonly were taken in a commercial fishery for the closely related and commercially valuable Atlantic sturgeon. More than a century of extensive fishing for sturgeon contributed to the decline of shortnose sturgeon along the east coast. Heavy industrial development during the twentieth century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery; possibly resulting in substantially reduced abundance of shortnose sturgeon populations within portions of the species' ranges (e.g., southernmost rivers of the species range: Santilla, St. Marys and St. Johns Rivers). A shortnose sturgeon recovery plan was published in December 1998 to promote the conservation and recovery of the species (see NMFS 1998). Shortnose sturgeon are listed as "vulnerable" on the IUCN Red List.

Although shortnose sturgeon are listed as endangered range-wide, the final recovery plan recognizes 19 spawning populations occurring throughout the range of the species. These populations are in New Brunswick Canada (1); Maine (2); Massachusetts (1); Connecticut (1); New York (1); New Jersey/Delaware (1); Maryland and Virginia (1); North Carolina (1); South Carolina (4); Georgia (4); and Florida (2). NMFS has not formally recognized distinct population segments (DPS)[1] of shortnose sturgeon under the ESA. Although genetic information within and among shortnose sturgeon occurring in different river systems is largely unknown, life history studies indicate that shortnose sturgeon populations from different river systems are substantially reproductively isolated (Kynard 1998) and, therefore, should be considered discrete. The 1998 Recovery Plan indicates that while genetic information may reveal that interbreeding does not occur between rivers that drain into a common estuary, at this time, such river systems are considered a single population compromised of breeding subpopulations (NMFS 1998).

Studies conducted since the issuance of the Recovery Plan have provided evidence that suggests that years of isolation between populations of shortnose sturgeon have led to morphological and genetic variation. Walsh et al. (2001) examined morphological and genetic variation of shortnose sturgeon in three rivers (Kennebec, Androscoggin, and Hudson). The study found that the Hudson River shortnose sturgeon population differed markedly from the other two rivers for most morphological features (total length, fork length, head and snout length, mouth width, interorbital width and dorsal scute count, left lateral scute count, right ventral scute count). Significant differences were found between fish from Androscoggin and Kennebec rivers for interorbital width and lateral scute counts which suggests that even though the Androscoggin and Kennebec rivers drain into a common estuary, these rivers support largely discrete populations of shortnose sturgeon. The study also found significant genetic differences among all three populations indicating substantial reproductive isolation among them and that the observed morphological differences may be partly or wholly genetic.

Grunwald et al. (2002) examined mitochondrial DNA (mtDNA) from shortnose sturgeon in eleven river populations. The analysis demonstrated that all shortnose sturgeon populations examined showed moderate to high levels of genetic diversity as measured by haplotypic diversity indices. The limited sharing of haplotypes and the high number of private haplotypes are indicative of high homing fidelity and low gene flow. The researchers determined that glaciation in the Pleistocene Era was likely the most significant factor in shaping the phylogeographic pattern of mtDNA diversity and population structure of shortnose sturgeon. The Northern glaciated region extended south to the Hudson River while the southern non-glaciated region begins with the Delaware River. There is a high prevalence of haplotypes restricted to either of these two regions and relatively few are shared; this represents a historical subdivision that is tied to an important geological phenomenon that reflects historical isolation. Analyses of haplotype frequencies at the level of individual rivers showed significant differences among all systems in which reproduction is known to occur. This implies that although higher level genetic stock relationships exist (i.e., southern vs. northern and other regional subdivisions), shortnose sturgeon appear to be discrete stocks, and low gene flow exists between

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1 The definition of species under the ESA includes any subspecies of fish, wildlife, or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature. To be considered a DPS, a population segment must meet two criteria under NMFS policy. First, it must be discrete, or separated, from other populations of its species or subspecies. Second, it must be significant, or essential, to the long-term conservation status of its species or subspecies. This formal legal procedure to designate DPSs for shortnose sturgeon has not been undertaken.

the majority of populations.

Waldman et al. (2002) also conducted mtDNA analysis on shortnose sturgeon from 11 river systems and identified 29 haplotypes. Of these haplotypes, 11 were unique to northern, glaciated systems and 13 were unique to the southern non-glaciated systems. Only 5 were shared between them. This analysis suggests that shortnose sturgeon show high structuring and discreteness and that low gene flow rates indicated strong homing fidelity.

Wirgin et al. (2005) also conducted mtDNA analysis on shortnose sturgeon from 12 rivers (St. John, Kennebec, Androscoggin, Upper Connecticut, Lower Connecticut, Hudson, Delaware, Chesapeake Bay, Cooper, Peedee, Savannah, Ogeechee and Altamaha). This analysis suggested that most population segments are independent and that genetic variation among groups was high.

The best available information demonstrates differences in life history and habitat preferences between northern and southern river systems and given the species' anadromous breeding habits, the rare occurrence of migration between river systems, and the documented genetic differences between river populations, it is unlikely that populations in adjacent river systems interbreed with any regularity. This likely accounts for the failure of shortnose sturgeon to repopulate river systems from which they have been extirpated, despite the geographic closeness of persisting populations. This characteristic of shortnose sturgeon also complicates recovery and persistence of this species in the future because, if a river population is extirpated in the future, it is unlikely that this river will be recolonized. Consequently, this Opinion will treat the nineteen separate populations of shortnose sturgeon as subpopulations (one of which occurs in the action area) for the purposes of this analysis.

Historically, shortnose sturgeon are believed to have inhabited nearly all major rivers and estuaries along nearly the entire east coast of North America. The range extended from the St John River in New Brunswick, Canada to the Indian River in Florida. Today, only 19 populations remain ranging from the St. Johns River, Florida (possibly extirpated from this system) to the Saint John River in New Brunswick, Canada. Shortnose sturgeon are large, long lived fish species. The present range of shortnose sturgeon is disjunct, with northern populations separated from southern populations by a distance of about 400 km. The species is anadromous in the southern portion of its range (i.e., south of Chesapeake Bay), while northern populations are amphidromous (fish move between fresh and salt water during some part of life cycle, but not for breeding)(NMFS 1998). Population sizes vary across the species' range. From available estimates, the smallest populations occur in the Cape Fear (~8 adults; Moser and Ross 1995) and Merrimack Rivers (~100 adults; M. Kieffer, United States Geological Survey, personal communication), while the largest populations are found in the St John (~100,000; Dadswell 1979) and Hudson Rivers (~61,000; Bain et al. 1998). As indicated in Kynard 1998, adult abundance is less than the minimum estimated viable population abundance of 1000 adults for 5 of 11 surveyed northern populations and all natural southern populations. Kynard 1998 indicates that all aspects of the species' life history indicate that shortnose sturgeon should be abundant in most rivers. As such, the expected abundance of adults in northern and north-central populations should be thousands to tens of thousands of adults. Expected abundance in southern rivers is uncertain, but large rivers should likely have thousands of adults. The only river systems likely supporting populations of these sizes are the St John, Hudson and possibly the Delaware and the Kennebec, making the continued success of shortnose sturgeon in these rivers critical to the species as a whole. While no reliable estimate of the size of either the total species or the shortnose sturgeon population in the Northeastern United States exists, it is clearly below the size that could be supported if the threats to shortnose sturgeon were removed.

Threats to Shortnose Sturgeon Recovery

The Shortnose Sturgeon Recovery Plan (NMFS 1998) identifies habitat degradation or loss (resulting, for example, from dams, bridge construction, channel dredging, and pollutant discharges) and mortality (resulting, for example, from impingement on cooling water intake screens, dredging and incidental capture in other fisheries) as principal threats to the species' survival.

Several natural and anthropogenic factors continue to threaten the recovery of shortnose sturgeon. Shortnose sturgeon continue to be taken incidentally in fisheries along the east coast and are probably targeted by poachers throughout their range (Dadswell 1979; Dovel et al. 1992; Collins et al. 1996). Bridge construction and demolition projects may interfere with normal shortnose sturgeon migratory movements and disturb sturgeon concentration areas. Unless appropriate precautions are made, internal damage and/or death may result from blasting projects with powerful explosives. Hydroelectric dams may affect shortnose sturgeon by restricting habitat, altering river flows or temperatures necessary for successful spawning and/or migration and causing mortalities to fish that become entrained in turbines. Maintenance dredging of Federal navigation channels and other areas can adversely affect shortnose sturgeon populations. Hydraulic dredges can lethally take sturgeon by entraining sturgeon in dredge dragarms and impeller pumps. Mechanical dredges have also been documented to lethally take shortnose sturgeon. In addition to direct effects, dredging operations may also impact shortnose sturgeon by destroying benthic feeding areas, disrupting spawning migrations, and filling spawning habitat with resuspended fine sediments. Shortnose sturgeon are susceptible to impingement on cooling water intake screens at power plants. Electric power and nuclear power generating plants can affect sturgeon by impinging larger fish on cooling water intake screens and entraining larval fish. The operation of power plants can have unforeseen and extremely 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. Decomposing plant material in the tailrace canal coupled with the turbine shut down (allowing no flow of water) triggered a low dissolved oxygen 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 dissolved oxygen event.

Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs) can have substantial deleterious effects on aquatic life including production of acute lesions, growth retardation, and reproductive impairment (Cooper 1989; Sinderman 1994). Ultimately, toxins introduced to the water column become associated with the benthos and can be particularly harmful to benthic organisms (Johnson et al. 1992) like sturgeon. Heavy metals and organochlorine compounds are known to accumulate in fat tissues of sturgeon, but their long term effects are not yet known (Ruelle and

Henry 1992; Ruelle and Kennlyne 1993). Available data suggests that early life stages of fish are more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976).

Several characteristics of shortnose sturgeon life history including long life span, extended residence in estuarine habitats, and being a benthic omnivore, predispose this species to long term, repeated exposure to environmental contaminants and bioaccumulation of toxicants (Dadswell 1979). In the Connecticut River, coal tar leachate was suspected of impairing sturgeon reproductive success. Kocan (1993) conducted a laboratory study to investigate the survival of sturgeon eggs and larvae exposed to PAHs, a by-product of coal distillation. Only approximately 5% of sturgeon embryos and larvae survived after 18 days of exposure to Connecticut River coal-tar (i.e., PAH) demonstrating that contaminated sediment is toxic to shortnose sturgeon embryos and larvae under laboratory exposure conditions (NOAA Fisheries 1998).

Although there is scant information available on the levels of contaminants in shortnose sturgeon tissues, some research on other related species indicates that concern about the effects of contaminants on the health of sturgeon populations is warranted. Detectible levels of chlordane, DDE (1,1-dichloro-2, 2-bis(p-chlorophenyl)ethylene), DDT (dichlorodiphenyl-trichloroethane), and dieldrin, and elevated levels of PCBs, cadmium, mercury, and selenium were found in pallid sturgeon tissue from the Missouri River (Ruelle and Henry 1994). These compounds were found in high enough levels to suggest they may be causing reproductive failure and/or increased physiological stress (Ruelle and Henry 1994). In addition to compiling data on contaminant levels, Ruelle and Henry also determined that heavy metals and organochlorine compounds (*i.e.* PCBs) accumulate in fat tissues. Although the long term effects of the accumulation of contaminants in fat tissues is not yet known, some speculate that lipophilic toxins could be transferred to eggs and potentially inhibit egg viability. In other fish species, reproductive impairment, reduced egg viability, and reduced survival of larval fish are associated with elevated levels of environmental contaminants including chlorinated hydrocarbons. A strong correlation that has been made between fish weight, fish fork length, and DDE concentration in pallid sturgeon livers indicates that DDE increases proportionally with fish size (NMFS 1998).

Contaminant analysis was conducted on two shortnose sturgeon from the Delaware River in the fall of 2002. Muscle, liver, and gonad tissue were analyzed for contaminants (ERC 2002). Sixteen metals, two semivolatile compounds, three organochlorine pesticides, one PCB Aroclor, as well as polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs) were detected in one or more of the tissue samples. Levels of aluminum, cadmium, PCDDs, PCDFs, PCBs, DDE (an organochlorine pesticide) were detected in the "adverse affect" range. It is of particular concern that of the above chemicals, PCDDs, DDE, PCBs and cadmium, were detected as these have been identified as endocrine disrupting chemicals. Contaminant analysis conducted in 2003 of tissues from a shortnose sturgeon from the Kennebec River revealed the presence of fourteen metals, one semivolatile compound, one PCB Aroclor, Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in one or more of the tissue samples. Of these chemicals, cadmium and zinc were detected at concentrations above an adverse effect concentration reported for fish in the literature (ERC 2003). While no directed studies of chemical contamination in shortnose sturgeon have been undertaken, it is evident that the heavy industrialization of the rivers where shortnose sturgeon are found is likely adversely affecting this species.

During summer months, especially in southern areas, shortnose sturgeon must cope with the physiological stress of water temperatures that may exceed 28°C. Flourney et al.(1992) suspected that, during these periods, shortnose sturgeon congregate in river regions which support conditions that relieve physiological stress (i.e., in cool deep thermal refuges). In southern rivers where sturgeon movements have been tracked, sturgeon refrain from moving during warm water conditions and are often captured at release locations during these periods (Flourney et al.1992; Rogers and Weber 1994; Weber 1996). The loss and/or manipulation of these discrete refuge habitats may limit or be limiting population survival, especially in southern river systems.

Pulp mill, silvicultural, agricultural, and sewer discharges, as well as a combination of non-point source discharges, which contain elevated temperatures or high biological demand, can reduce dissolved oxygen levels. Shortnose sturgeon are known to be adversely affected by dissolved oxygen levels below 5 mg/L. Shortnose sturgeon may be less tolerant of low dissolved oxygen levels in high ambient water temperatures and show signs of stress in water temperatures higher than 28°C (Flourney et al. 1992). At these temperatures, concomitant low levels of dissolved oxygen may be lethal.

Status of Shortnose Sturgeon in the Action Area

On June 30, 1978, one shortnose sturgeon was captured in Penobscot Bay during finfish sampling conducted by the MDMR (Squiers and Smith 1979). At the time, it was believed that shortnose sturgeon rarely participated in coastal migrations. Since sturgeon were known to complete their entire life history in their natal river, researchers concluded that this sturgeon was a member of a previously undocumented Penobscot River population of shortnose sturgeon. The river had long been suspected of supporting a shortnose sturgeon population based on anecdotal evidence of shortnose sturgeon capture and observation in combination with archeological data which suggested that sturgeon from the Penobscot River were used by native peoples (Knight 1985 and Petersen and Sanger 1986 in NMFS 1998).

In 1994 and 1995, researchers attempted to document the use of the Penobscot River by shortnose sturgeon. Nets were set near the head of tide in both years with the goal of capturing spawning adults. This was the only area of the river targeted by the researchers. Researchers fished for approximately 409 net hours. No shortnose sturgeon were captured. However, even in rivers with relatively large populations with intense sampling programs (*i.e.*, the Connecticut River), it is not uncommon for there to be a year when no migration to the spawning grounds and subsequently no spawning occurs.

The 1978 capture in conjunction with historical and anecdotal evidence and the habitat characteristics of the river led NMFS to conclude that it is reasonably likely that a small persistent population of shortnose sturgeon exists in the Penobscot River (NMFS 1998). In the spring of 2004, NMFS biologists observed two approximately 36"-long sturgeon leaping out of the river near Bangor. Water temperatures at the time of this observation were consistent with the preferred temperatures for shortnose sturgeon spawning and this is the area of the river where spawning likely occurs (*i.e.*, 8-15°C). Also in the spring of 2004, NMFS biologists reported that three small sturgeon were observed by others working in the river in the Bangor area. One Atlantic sturgeon was captured by an angler in the river in the spring of 2005 which indicates that the river may also support a population of Atlantic sturgeon; however, adult Atlantic sturgeon are much larger than adult shortnose sturgeon and the size of the other observed fish is consistent with the size of adult shortnose sturgeon. Additionally, the location of the observed sturgeon was upstream of where juvenile Atlantic sturgeon (which may be the same size as adult shortnose sturgeon) are likely to be found in the river. Based on these captures and observations, NMFS concluded it was reasonably likely that there were at least several adult shortnose sturgeon in the Penobscot River.

In May 2006, the University of Maine (UM), in conjunction with NMFS and 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 individual shortnose sturgeon were captured by UM in the Penobscot River from Frankfort upstream to Bangor. This research was continued in 2007. In 2007, an additional 88 individual shortnose sturgeon were captured and tagged in the river. During 2007, eleven shortnose sturgeon were recaptured, with three of the recaptures being fish that were captured and tagged in 2006. All of the sturgeon captured during the study were adults (i.e., greater than 50cm in length). The type of gear used for sampling (large mesh gill nets of 6" and 12" stretch) is not designed to capture sturgeon less than 2 feet in length; therefore, juveniles were not expected to be caught. No sampling targeting early life stages or juvenile shortnose sturgeon has been conducted to date.

Using the 2006 and 2007 mark-recapture data, UM researchers have 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 1710 shortnose sturgeon. It must be noted that both models assume a closed population (no mortality, birth or migration takes place). As this is likely not the case for the Penobscot River (see below), these assumptions are likely violated in the Penobscot River. However, researchers believe that these estimates, particularly the Lincoln/Peterson Index, is a reasonable first attempt at an estimate and represents the best available information at this time. Researchers are currently exploring other models that do not have assumptions related to closed populations; however, other population estimates are not currently available.

Information on the habitat use of shortnose sturgeon in the Penobscot River is available from the UM tagging and tracking data. Shortnose sturgeon were tracked by UM throughout the lower Penobscot River from the estuary upstream to the vicinity of the Veazie Dam. 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). For the majority of the year, most tagged fish moved between river kilometers 10 and 45.

UM researchers have identified what is believed to be the main overwintering site for adult shortnose sturgeon in the river. UM researchers captured 17 shortnose sturgeon the reach of the Penobscot River between Sedgeunkedunk Stream (river mile 36.4) and an asphalt plant in

Bangor (river mile 38.5) from September 28 to October 19, 2006. Additionally in 2006, 12 of 14 (86%) shortnose sturgeon tagged with hydroacoustic transmitters were detected during the winter months in an approximately 7,500 foot section of the Penobscot River from the confluence of Sedgeunkedunk Stream upstream to the City of Bangor's waste water treatment facility. Tracking data indicate that sturgeon begin moving into this reach of the Penobscot River in October and depart in early spring (April). Following movements downstream in the spring, some adults start moving back into the vicinity of this area in June while others remained in the downstream area until the fall. This information indicates that the area between the Bangor water treatment facility and Sedgeunkedunk Stream is likely used as an overwintering area for shortnose sturgeon. These movements are consistent with movements of shortnose sturgeon in other river systems, including the Delaware and Kennebec Rivers. In these river systems, the majority of shortnose sturgeon have moved to the overwintering area by the time water temperatures reach 10°C in the fall, although some move to the overwintering area much sooner and others do not appear to move to the main overwintering area at all. In the Penobscot, 86% of tagged fish were detected at the overwintering site. For the winter of 2006-2007, the fish varied in their arrival times to the overwintering site, but all fish were present by November 2006 and all fish had departed by April 19, 2007 (Fernandes et al. 2008).

In some river systems (Hudson, Connecticut), overwintering areas are segregated between spawners and non-spawners. In the Penobscot River, the distance to be traveled to the spawning grounds is relatively short and there may only be one overwintering area as is seen in other rivers with small amounts of available habitat (*e.g.*, the Merrimack River). After leaving the overwintering area, adults disperse to the spawning grounds or to foraging grounds located downstream. Adults may also briefly visit more saline reaches of the estuary as is seen in the Connecticut and Merrimack Rivers. UM researchers have documented adults moving far downstream into the lower estuary and bay, but only for short periods of time during May and October (Fernandes et al. 2008).

UM also documented coastal migrations of shortnose sturgeon between the Penobscot River and Kennebec River. Nine shortnose sturgeon captured and acoustically tagged in the Penobscot River were detected by a new acoustic receiver array deployed in the Kennebec River this year. The movement from the Penobscot to the Kennebec exceeded 230 km. Additionally, two shortnose sturgeon captured in the Penobscot in 2007 were found to have PIT tags that were inserted in the Kennebec River in 1999 and 2000. As long distance movements through fully marine environments have rarely been documented previously, the significance of these movements are unknown. The only other documented movements of shortnose sturgeon between river systems has been the capture of two shortnose sturgeon in the Connecticut River that were tagged in the Hudson River and the tracking of shortnose sturgeon moving from the Upper Chesapeake Bay to the lower Delaware River through the man-made Chesapeake and Delaware Canal (Kynard 1998; O'Herron et al. 1993).

Research on shortnose sturgeon indicates that this species typically spawns just below the limit of upstream passage. In unimpeded rivers systems spawning typically occurs 200km or more upstream and in dammed rivers, spawning often occurs at the base of the first dam (Kynard 1997). A multi-year spawning study in the Connecticut River, perhaps the most comprehensive study of natural shortnose sturgeon spawning, indicates that spawning occurred at daily mean temperatures of 6.5-14.7°C. Females spawned in water depths of 1-5m with a peak at 1.5-1.9m. Bottom water velocity at the spawning site was a mean of 70cm/s with the greatest usage of 75-125 cm/s. The only substrate type females used was cobble/rubble (101-300 mm diameter). Substrate and flow are consistent in all areas where shortnose sturgeon spawning has been confirmed.

Extensive analyses of potential spawning habitat in the Penobscot River have not been completed. However, there is hard bottom substrate with depths and velocities consistent with shortnose sturgeon spawning habitat within the Penobscot River. The presence of suitable habitat combined with the capture of gravid females in the Penobscot River suggests that spawning may occur in this river. However, more research is needed to determine where in the river spawning occurs and the number of adults involved in spawning each year.

Eggs and larvae are likely concentrated near the spawning area for up to 4 weeks post-spawning, after which larvae disperse into downstream into the tidal river. Based on water temperature data, shortnose sturgeon spawning is likely to occur during the month of May in the Penobscot River. As such, larvae are likely to have dispersed into the river by the end of June. As juvenile sturgeon are believed to remain upstream of the salt wedge until they are about 45 cm long (Crance 1986), it is likely that juvenile sturgeon occur in the Penobscot River from the Veazie Dam downstream to the Town of Hampden.

Research has been conducted by the NYU School of Medicine involving mitochondrial DNA (mtDNA) analysis of shortnose sturgeon populations, including fish caught in the Penobscot River (Wirgin et al. in progress). Information available to date for the Penobscot samples indicates that haplotype frequencies in this population were almost identical to that in the Kennebec River system. Additionally, the Penobscot River samples did not exhibit any haplotypes that were not seen elsewhere. It is unknown at this time whether shortnose sturgeon in the Penobscot River are the descendants of recent migrants from the Kennebec River, migrants themselves or whether they represent a remnant naturally reproducing Penobscot River population. It is possible that the adults captured to date are representatives of all three scenarios. The most recent estimate of the number of shortnose sturgeon in the Kennebec complex is 9888 and successful spawning has been confirmed in both the Kennebec and Androscoggin Rivers.

As the sample size is very small and as mtDNA represents only a fraction (less than 1%) of the genetic material and is maternally inherited, it is difficult to make conclusive statements regarding the potential for fish in the Penobscot River to be genetically distinct from other fish in the Kennebec complex. However, as there were no unique haplotypes in the Penobscot River fish and unique haplotypes are seen in almost every other population, the best available information suggests that fish occurring in the Penobscot River are not genetically unique and are not genetically distinct from other fish in the Kennebec River. Nuclear DNA analysis is currently ongoing on the Penobscot River samples; however, no results are available to report at this time.

As noted above, the Lincoln/Peterson Index estimate of 1,049 adult shortnose sturgeon (Fernandes et al. 2008) is the best available estimate of the number of shortnose sturgeon present in the Penobscot River at a given time. Tracking data has shown that there is at least limited exchange between the Penobscot River and the Kennebec River. The most recent estimate of the number of shortnose sturgeon in the Kennebec complex is a Schnabel estimate of 9888 adults (Squiers 2003). Based on comparison to older population estimates, NMFS believes that the Kennebec River population is increasing slightly or is stable. Without historical data to compare to the current Penobscot River population estimate, it is not possible to assess the population trend.

ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this biological opinion includes the effects of several activities that may affect the survival and recovery of the endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include: dredging operations, water quality impacts, scientific research, commercial and recreational fisheries, and recovery activities associated with reducing those impacts.

Effects of Federal Actions that have Undergone Formal or Early Section 7 Consultation

NMFS has undertaken several ESA Section 7 consultations to address the effects of various federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways of reducing the probability of adverse impacts of the action on listed species.

USGS/UMaine Atlantic Sturgeon Survey

On April 20, 2006, NMFS issued a Biological Opinion on the effects of distributing funds to the USGS as part of an interagency agreement to investigate the distribution and abundance of Atlantic sturgeon in the Penobscot River, Maine. Although the Opinion concluded that the issuance of funds to USGS for the proposed Atlantic sturgeon study was not likely to jeopardize the continued existence of any ESA-listed species under NMFS jurisdiction, takes of shortnose sturgeon were expected to occur. NMFS issued an Incidental Take Statement (ITS) to USGS exempting the take of no more than 9 shortnose sturgeon (one lethally) that were likely to be captured incidentally in gill nets set for the project. On June 13, 2006, NMFS reinitiated formal section 7 consultation on the Atlantic sturgeon study since the level of take exempted in the April 2006 Opinion was exceeded and the action resulted in effects to shortnose sturgeon not previously considered. On October 4, 2006, NMFS issued a new Opinion for the Atlantic sturgeon study. The October 2006 Opinion also concluded that the proposed action was not likely to jeopardize the continued existence of any ESA-listed species under NMFS jurisdiction, but exempted that take of up to 215 shortnose sturgeon (10 lethally). This Opinion and Incidental Take Statement have been withdrawn (see "Scientific Research Permits" below).

Scientific Research Permits

Permit No. 1595, issued on April 11, 2007 to Mr. Michael Hastings of the University of Maine. This permit was modified on June 4, 2007 and May 21, 2008. The May 21, 2008 permit authorizes the capture, handling, genetic sampling, and tagging of 200 adult and juvenile shortnose sturgeon annually. Telemetry tagging is authorized for a subset of the captured fish (30). The permit also authorizes the capture of 50 early life stage shortnose sturgeon (i.e., eggs or larvae). Two unintentional mortalities are authorized each year. A Biological Opinion was completed on the issuance of this permit which concluded that this action may adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon. This permit expires on April 11, 2012. During the 2007 sampling season, 99 adult shortnose sturgeon were captured and tagged. No juvenile or early life stages have been captured to date.

In-water construction
NMFS has completed several informal consultations on effects of in-water construction activities in the Potomac River permitted by the US Army Corps of Engineers and the Federal Highway Administration. No interactions with shortnose sturgeon have been reported in association with any of these projects.

On October 24, 2007, NMFS issued an Opinion on the effects of dredging, bulkhead construction, and other instream work for the Brewer Module Facility in Brewer, Maine. The October 24, 2007 Opinion concluded that the proposed action was not likely to jeopardize the continued existence of shortnose sturgeon. The Opinion exempted the incidental take of up to 3 shortnose sturgeon for the project. No interactions with shortnose sturgeon have occurred at the project to-date.

Non-Federally Regulated Actions

Fishery Operations
Unauthorized take of shortnose sturgeon is prohibited by the ESA. However, shortnose sturgeon are taken incidentally in anadromous fisheries along the East Coast and may be targeted by poachers (NMFS 1998). The Penobscot River is an important corridor for migratory movements of various species including alewife (*Alosa pseudohernegus*), American eel (*Anguilla rostrata*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), rainbow smelt (*Osmerus mordax*), striped bass (*Morone saxatilis*) and lobster (*Homarus americanus*). It has been estimated that approximately 20 shortnose sturgeon are killed each year in the commercial shad fishery operating in the Northeast and an additional number are also likely taken in recreational fisheries (T. Savoy pers. comm. in NMFS 1998). However, the incidental take of shortnose sturgeon in the Penobscot River has not been documented due to confusion over distinguishing between Atlantic sturgeon and shortnose sturgeon and likely apprehension to report illegal bycatch to authorities. Due to a lack of reporting, no information on the number of listed shortnose sturgeon caught and released or killed in commercial or recreational fisheries on the Penobscot River is available.

Contaminants and Water Quality
Point source discharges (*i.e.*, municipal wastewater, paper mill effluent, industrial or power plant cooling water or waste water) and compounds associated with discharges (*i.e.*, metals, dioxins, dissolved solids, phenols, and hydrocarbons) contribute to poor water quality and may also impact the health of sturgeon populations. The compounds associated with discharges can alter the chemistry and temperature of receiving waters, which may lead to mortality, changes in fish behavior, deformations, and reduced egg production and survival. Contaminants including heavy

metals, polychlorinated aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs), can have serious, deleterious effects on aquatic life and are associated with the production of acute lesions, growth retardation, and reproductive impairment (Ruelle and Keenlyne 1993). Contaminants introduced into the water column or through the food chain eventually become associated with the benthos where bottom dwelling species like shortnose sturgeon are particularly vulnerable. In 2000, the US Environmental Protection Agency (EPA) delegated authority for the National Pollutant Discharge Elimination System (NPDES) permit program to the State of Maine. NMFS comments on most NPDES issued for discharges to the Penobscot River. By letter dated March 7, 2006, NMFS commented on a proposed Maine Pollutant Discharge Elimination System (MEPDES) permit being issued to Maine Independence Station by the state of Maine. The Maine Independence Station is located in the action area of this consultation. In the March 7, 2008 letter to the Maine Department of Environmental Protection (MDEP), NMFS commented that a lack of information concerning the thermal plume downstream of the station precluded a determination that the proposed MEPDES permit would not have more than a minor detrimental effect of listed shortnose sturgeon. As the proposed action will not alter water quality in the Penobscot River, NMFS does not expect any addition effects to water quality or water temperatures as part of this proposed action.

Several characteristics of shortnose sturgeon life history including long life span, extended residence in estuarine habitats, and being a benthic omnivore, predispose this species to long term, repeated exposure to environmental contaminants and bioaccumulation of toxicants (Dadswell 1979). Contaminant analysis of tissues from a shortnose sturgeon from the Kennebec River (which supports similar industries, such as paper mills, as the Penobscot River) revealed the presence of fourteen metals, one semivolatile compound, one PCB Aroclor, Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in one or more of the tissue samples. Of these chemicals, cadmium and zinc were detected at concentrations above an adverse effect concentration reported for fish in the literature (ERC 2003). Thomas and Khan (1997) demonstrated that exposure to cadmium at concentrations well below the concentration detected in the shortnose sturgeon significantly increased ovarian production of estradiol and testosterone which can adversely affect reproductive function. The concentration of zinc detected in the shortnose sturgeon liver tissue was slightly less than the effect concentration for reduced egg hatchability reported by Holcombe et al. (1979) and exceeded the effect concentration for reduced survival cited in Flos et al. (1979).

Ruelle and Henry (1994) determined that heavy metals and organochlorine compounds (*i.e.*, PCBs) accumulate in fat tissues. Although the long term effects of the accumulation of contaminants in fat tissues are not yet known, some speculate that lipophilic toxins could be transferred to eggs and potentially inhibit egg viability. PCBs may also contribute to a decreased immunity to fin rot. In other fish species, reproductive impairment, reduced egg viability, and reduced survival of larval fish are associated with elevated levels of environmental contaminants including chlorinated hydrocarbons. A strong correlation that has been made between fish weight, fish fork length, and DDE (dichlorodiphenyldichloroethylene) concentration in pallid sturgeon livers indicates that DDE increase proportionally with fish size (NMFS 1998).

Despite improvements to water quality in the Penobscot River, discharges to this system contribute various chemical contaminants as well as heated effluent to the river. While individual discharges likely have only minor detrimental effects on listed species and their habitats, the cumulative effects of these discharges is unknown and may be negatively impacting or delaying the potential for shortnose sturgeon to recover in this system. While no studies of contaminant levels of shortnose sturgeon in the action area have been conducted, shortnose sturgeon in other river systems (Hudson, Delaware and Kennebec) have been demonstrated to carry significant contaminant loads and it likely that shortnose sturgeon occurring in the action area are exposed to contaminants and may be affected by this exposure. It is possible that the presence of contaminants in the action area may have adversely affected shortnose sturgeon abundance, reproductive success and survival.

Hydroelectric facilities
The Penobscot River Basin has been extensively developed for hydroelectric power production. There are 113 dams in the Penobscot River watershed. Twenty of these dams are associated with generating facilities. While the effects of these facilities are largely unknown, they all have the potential to affect flow in the river and may affect shortnose sturgeon habitat and/or migration patterns. The first impediment to upstream passage on the mainstem of the Penobscot River is currently the Veazie Dam. This dam restricts the available habitat for shortnose sturgeon. In rivers where shortnose sturgeon have free access (*i.e.*, there are no dams), the species typically has a 100-200km range. In the Penobscot River, this range is restricted to only 25 miles of mainstem river, with an additional 20 miles of estuary available below the mouth of the river. The Veazie Dam prevents shortnose sturgeon from accessing the majority of their historically available habitat and has likely prevented the species from spawning at their preferred spawning habitat, which is likely located upstream of the Veazie Dam. The lack of availability to their full range has likely had a significant negative effect on shortnose sturgeon in this river system and will continue to delay recovery of this species in the Penobscot River. Since most of the mainstem hydroelectric projects on the Penobscot River operate in a run-of-river mode, any effects to downstream habitats from river flow fluctuations are expected to be minor. As part of the PRRP, the Veazie and Great Works Dams will likely be removed thus providing shortnose sturgeon access to additional habitat in the river.

Conservation and Recovery Actions Reducing Threats to Listed Species
In 1998, NMFS issued the Final Recovery Plan for shortnose sturgeon (NMFS 1998). The long-term recovery objective for shortnose sturgeon is to recover all discrete population segments to levels of abundance at which they no longer require protection under the ESA. To achieve and preserve minimum population sizes for each population segment, the final recovery plan recommends identifying and preserving essential habitats and monitoring and minimizing mortality. Other key recovery tasks are to define essential habitat characteristics, assess mortality factors, and protect shortnose sturgeon through applicable federal and state regulations.

Summary and Synthesis of the Status of the Species and Environmental Baseline
Impacts from actions occurring in the Environmental Baseline for the Penobscot River have the potential to impact shortnose sturgeon. Despite improvements in water quality and the elimination of directed fishing for the species, shortnose sturgeon still face numerous threats in this river system. As noted above, the effect of hydroelectric facilities in the Penobscot River Basin is largely unknown; however, it is likely that they affect flow in the River which may affect the habitat and/or migration patterns of shortnose sturgeon.

As explained above, shortnose sturgeon in the Penobscot River may be part of a larger Penobscot River-Kennebec River complex. Within this complex, shortnose sturgeon are assumed to be spawning in at least the Penobscot, Kennebec and Androscoggin Rivers, with some level of current exchange between the Penobscot and Kennebec. Without more information on the status of shortnose sturgeon in the Penobscot River, including information on the origin of fish caught in the river, it is difficult to speculate about the status of the populations. However, the best available information has led NMFS to make the determinations about species status as stated below.

Preliminary population estimates by UM indicate that there are approximately 1,049 adult shortnose sturgeon in the Penobscot River. The particulars of population dynamics and habitat use of the Penobscot River population are currently being studied. Without information on historical abundance it is difficult to make determinations with a high level of confidence regarding the stability of the population or about the long term survival and recovery of this population. However, as it is likely a relatively small population, it may be vulnerable to the effects of catastrophic events (*e.g.*, oil or chemical spill, weather event etc.) that affect habitat quality, prey availability or result in direct mortality of a number of individuals. However, as there are likely several hundred adults in this population and the adults captured so far are likely several decades old, the available information indicates that this population is long lived and relatively unexploited by fisheries. As such, NMFS believes that this population is likely stable but low when compared to historic population levels in the Penobscot River.

While no estimate that has a high level of certainty regarding the size of either the shortnose sturgeon population in the Northeastern US or of the species throughout its range exists, it is clearly below the size that could be supported if the threats to shortnose sturgeon were removed. Based on the number of adults in population for which estimates are available, there are at least 104,662 adult shortnose sturgeon, including 18,000 in the Saint John River in Canada. Based on the best available information, NMFS believes that the status of shortnose sturgeon throughout their range is at best stable (with gains in populations such as the Hudson, Delaware and Kennebec offsetting the continued decline of southern river populations) and at worst declining.

EFFECTS OF THE ACTION

This section of an Opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). This Opinion examines the likely effects (direct and indirect) of the proposed action on shortnose sturgeon in the action area and their habitat within the context of the species' current status, the environmental baseline and cumulative effects.

The NEFSC proposes to sample the lower Penobscot River using electrofishing during three (3) sampling events in the late summer of 2008, the spring of 2009, and in late summer of 2009. The section of the BO analyzes the effects of the proposed sampling events on shortnose sturgeon present within the action area of this consultation.

While specific habitat preferences or feeding areas in the Penobscot River have not been identified to date, the available information, as well as what is known about sturgeon in other river systems, allows NMFS to determine when and where shortnose sturgeon are likely to occur in the Penobscot River system. Based upon data collected by UM, known life history characteristics of shortnose sturgeon, and habitat availability in the Penobscot River, larvae, young-of-year, juvenile, and adult shortnose sturgeon have the potential to occur in the action area at various times of the year. As explained above in the "Description of the Action" section, two of the IBI sampling sites, Veazie tailwater-Eddington and Veazie tailwater-Bangor (Figure 1), occur in areas where shortnose sturgeon have been documented to occur.

As the exact location of spawning is unknown, researchers have agreed that no sampling will occur in the spring when water temperatures are between 8 and 15°C to protect any spawning sturgeon in the action area. As such, it is expected that the spring sampling will occur during the month of June. Based on the telemetry data from UM, no shortnose sturgeon were detected in the action area prior to June 27. As such, the researchers have agreed that the spring sampling will take place after water temperatures reach 15°C but prior to June 27. As such, NMFS does not anticipate that any shortnose sturgeon will be present in the action area during the spring 2009 sampling event. It should be noted that sampling occurred in late June 2008 and no shortnose sturgeon were detected.

Juvenile and adult sturgeon will likely occur in the action area during the late summer sampling events as adults have been documented in the area between Veazie Dam and the former Bangor Dam from June 27 through October (UMaine unpublished data). Based upon data collected by UM, shortnose sturgeon likely move downstream below the Bangor Dam in the late fall to overwinter.

Shortnose sturgeon are considered to remain in the juvenile life stage until they are 45 to 55cm fork length (Dadswell et al. 1984); fish greater than this size will be referred to as the adult lifestage. In northern rivers, this size generally coincides to fish aged five and older being considered adults. Adult shortnose sturgeon have been documented in the lower reaches of the study site up to the Veazie dam from late June until October (Fernandes et al. 2006; 2008). Previous sampling in 2006 and 2007 by UM did not detect spawning adults or juveniles in the action area. However, sampling methods were not designed to capture juvenile sturgeon. As noted above, juvenile shortnose sturgeon are known to concentrate in the freshwater portion of the river. As the action area is within the freshwater portion of the Penobscot River, it is likely that juveniles occur in the action area.

Electrofishing can cause mortality or injury to fish. Fish encountering the electric current typically undertake an involuntary movement toward the positive electrode. Harmful effects to fish during electrofishing can include spinal injuries, bleeding at gills or vent, hemorrhaging, and excessive physiological stress (Snyder 2004). Snyder (2004), however, states that injuries heal and seldom result in delayed mortality if electrofishing is conducted carefully. Handling and anesthesia associated with electrofishing surveys can also cause harm to fish. Snyder (2004), in a review of the effects of electrofishing on fish, notes that electrofishing mortalities related to asphyxiation are often the result of poor handling.

Effects to Adults

Based upon radio telemetry data collected by UM in 2006 and 2007 (Figure 2), between 1 and 10 tagged shortnose sturgeon were present in the area above the Bangor dam on a given sample date. Most shortnose sturgeon were documented above the former Bangor Dam during late summer and fall months. In order to avoid sampling during the period of high shortnose sturgeon densities in the study area above the Bangor dam, the late summer sampling event will be performed prior to September 15 each year. Prior to September 15, up to 2 of 7 (28%) acoustically tagged fish were present in the river in 2006 and up to 3 of 12 (25%) acoustically tagged fish present in this river reach in 2007 (Figure 2). Based upon a preliminary population estimate of 1,049 adults and acoustic telemetry data which documented up to 28% of tagged fish upstream of the former Bangor Dam at any one time prior to September 15, we estimate up to 294 adult shortnose sturgeon (28% of 1,049 adults) would be present between the Veazie Dam and former Bangor Dam during late summer electrofishing sampling during this study.

The approximate river area between the former Bangor dam and the Veazie dam is 1.03 sq. km. Of this area, shoreline electrofishing transects will occur in approximately 0.018 sq. km, or approximately 1.7% of the overall area. Assuming a uniform distribution of sturgeon throughout the Bangor dam to Veazie dam area during sampling activities, it is likely that no more than 5 shortnose sturgeon (1.7% of 294 fish) are likely to occur in the action area (i.e., along the two transects) at any given time during the summer sampling event.

According to University of Maine data from 2006 and 2007, most shortnose sturgeon detected above the Bangor during the period of August to mid September were detected at depths greater than 2.5m (see Figure 3). During this time period in 2006, the mean depth on all detection dates was ≥2.5m (6 out of 6), in 2007 the mean detection depth was ≥2.5m on 35 days (out of 46; 76%). Due to the effective electrofishing depth of 2.5m, it is likely that no more than 2 adult shortnose sturgeon will be affected by the electrofishing current (24% of 5). As two late summer sampling events will take place, NMFS estimates that a total of 4 adult shortnose sturgeon may interact with the electrofishing gear and be subject to stunning.

Effects to juveniles

As no juvenile sturgeon data has been collected in the Penobscot River, it is difficult of estimate the number of juvenile sturgeon that could be in sampling areas upstream of the former Bangor Dam during the late summer sampling event. However, as most of the suitable spawning and rearing habitat available in the Penobscot River occurs in the freshwater reach between the Veazie Dam and former Bangor Dam, we expect that juvenile sturgeon are likely to occur in sampling areas. The number of juveniles in a population is typically greater than the number of adults due to the effects of mortality as a year class ages. However, as shortnose sturgeon are (1) long lived species (i.e., at least 30 years old) where the majority of age classes are adults and (2) experience the greatest level of mortality from age zero to one, it is extremely difficult to estimate the number of juveniles in a population. Additionally, age class strength is extremely variable in shortnose sturgeon and can vary up to 10 fold (Woodland and Secor 2007). Very little research has been done to establish age specific abundance estimates. The only available information on age class abundance was compiled by DeVries (2006) in the Altamaha River in

Georgia. Based on the information presented by DeVries, approximately 37% of the population consisted of juveniles. It should be noted that in southern river systems, shortnose sturgeon are known to grow more quickly, reach maturity sooner and not live as long as shortnose sturgeon in northern river systems. While the age structure of shortnose sturgeon populations in the Altamaha and Penobscot may not be expected to be identical, it is reasonable to expect that they would have similar proportions of juveniles in their populations. As such, for purposes of this consultation, NMFS will assume that 37% of the shortnose sturgeon population in the Penobscot River consists of juveniles. Given that there are approximately 1049 adults, there would be approximately 611 juveniles at any one time.

It is not reasonable to assume that juveniles would be distributed throughout the river in the same way that adults are. Given that shortnose sturgeon juveniles concentrate above the freshwater/saltwater interface, juveniles are expected to be distributed over an approximately 4km stretch of river from the Veazie Dam to Hampden, Maine (approximately 4.5 sq km). As explained above, the shoreline electrofishing transects will occur in approximately 0.018 sq km area (approximately 0.4% of the Veazie to Hampden stretch). Thus, assuming juveniles are evenly distributed throughout the Veazie to Hampden area, approximately 3 (0.4% of 611) juveniles may be present in the action area. As juveniles are also typically found in deepwater channel habitat, NMFS assumes that the depths where adults were found is also representative of juvenile depth distribution. As such, based on the electrofishing gear's effective depth of 2.5m, and the detection of adults at depths of less than 2.5m only 24% of the time, it is reasonable to expect that no more than 1 shortnose sturgeon (24% of 3) is likely to occur within the effective zone of the electrofishing gear. As two late summer sampling events will take place, NMFS estimates that a total of 2 juvenile shortnose sturgeon may interact with the electrofishing gear and be subject to stunning and collection.

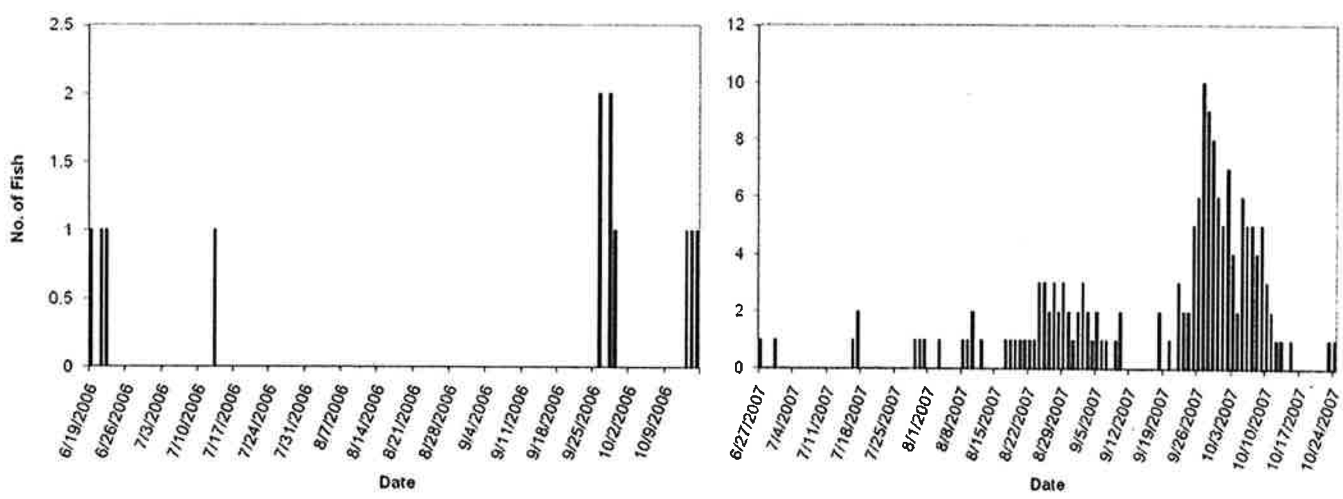

Figure 2. Adult shortnose sturgeon present in the Penobscot River above the Bangor dam during 2006 and 2007.

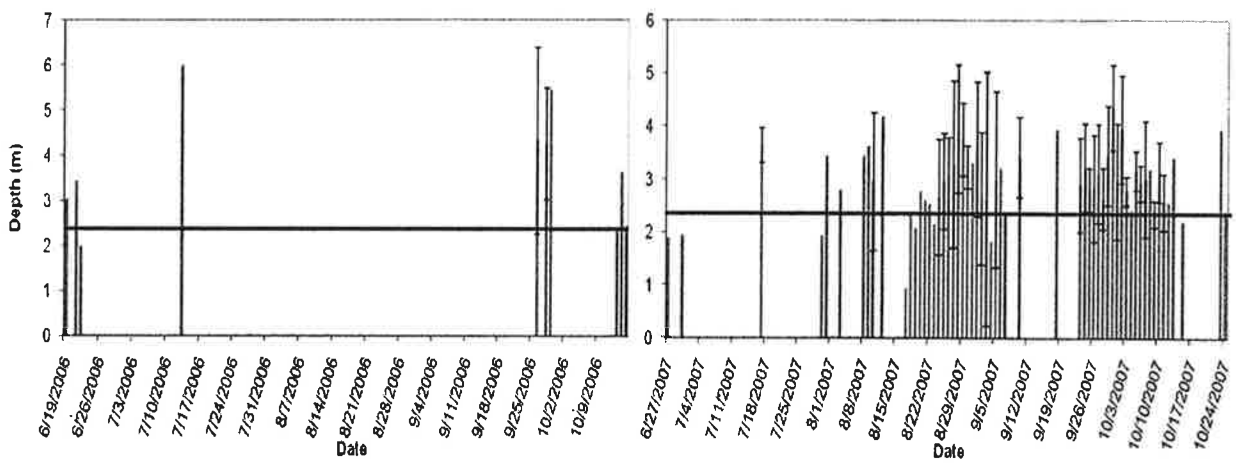

Figure 3. Mean depth of shortnose sturgeon detected above Bangor dam in 2006 and 2007 with effective depth of boat electoshocker (~2.5m).

Electrofishing can cause mortality or injury to fish. Limited information is available regarding effects to shortnose sturgeon. Moser (2000) conducted limited laboratory experiments on the effects of electrofishing on shortnose sturgeon. Shortnose sturgeon were exposed to electrical current for up to 60 seconds at a time, four to five minutes a day. Despite this extensive level of exposure, no mortality occurred. Shortnose sturgeon recovered very quickly from exposures and no difference in growth was seen in control and exposed subjects suggesting that feeding behaviors were not effected. Sturgeon were initially more responsive to the electroshocking treatment than catfish; however, they recovered quickly and moved to avoid the stimulus. More sturgeon than catfish rolled onto their side or completely rolled upside-down within the first 15 seconds. They also exhibited more twitching, rigor and avoidance behaviors than did catfish. But, sturgeon generally recovered immediately after the experiment.
Over 75% of the sturgeon recovered immediately, with maximum recovery times of 5 minutes. Sturgeon were exposed repeatedly over a 32 day period and no long term mortality was seen.

Electrofishing injury rates for shovelnose sturgeon (*Scaphirhynchus platorynchus)* were documented to be 0% according to Snyder (2003). Lab studies conducted on juvenile white sturgeon (*Acipenser transmontanus*) showed higher injury rates for pulsed DC current compared to DC current (68% vs. 10%) with no mortality (Holliman and Reynolds 2002). The available mortality data for shortnose sturgeon indicates that mortality resulting from exposure to electrofishing current is likely to be zero. This is supported by mortality data for other sampling methods as well. Most researchers utilize gill nets to capture shortnose sturgeon as electrofishing is not an effective method for capturing shortnose sturgeon. Gill net mortality rates for adult shortnose sturgeon have been reported to range from 0 to 1.22% (NMFS 2008), and mortality rates for electrofishing can be expected to be much lower than that reported for gill nets.

Based upon this information, of the shortnose sturgeon that are likely to be present within the effective zone for the electrofishing boat (2 adult and one juvenile for each of the two late summer sampling events), none are expected to experience mortality. Exposed sturgeon are likely to be stunned and may roll or twitch. The available information indicates that most shortnose sturgeon will recover immediately, with all exposed sturgeon recovering within 5 minutes. It is likely that most shortnose sturgeon will recover and swim away before they are netted. However, as shortnose sturgeon adults are large fish and may be vulnerable to injury during capture in hand nets, no adult sturgeon will be netted or handled during the study. If encountered, an attempt will be made to net juvenile shortnose sturgeon. These fish will be processed immediately (i.e., measured, weighed, and photographed) and released alive downstream of the sampling area. Use of electro-fishing guidelines established by the DMR and NMFS are expected to reduce the impact of capture on any shortnose sturgeon encountered.

In summary, based on the limited size of the effective area of the electrofishing boat (two separate transects, 1 km long and 4.5 meters wide), the likely distribution of juvenile and adult shortnose sturgeon within the action area, and the limited occurrence of shortnose sturgeon in the top 2.5 meters of the water column where fish will be exposed to the electric current, no more than 2 adult and 1 juvenile shortnose sturgeon is expected to be affected by each late summer sampling event. As explained above, no shortnose sturgeon are likely to occur in the action area during the spring (June) sampling event. Exposed sturgeon may be temporarily stunned and exhibit rolling or twitching behavior, but no injuries or mortalities are expected and any effects will be temporary. As no sampling will occur during shortnose sturgeon spawning activities and any adults encountered during sampling will have months to recover prior to any subsequent spawning activities, no significant effects to spawning shortnose sturgeon are expected. It should be noted that this BO anticipates fewer take of juvenile shortnose sturgeon (2 juveniles total) than the BA prepared by the NEFSC (4 juveniles total). Based upon the best available information, this BO assumes 37% of the shortnose sturgeon population in the Penobscot River would be comprised of juveniles. The NEFSC estimated an equal proportion of juveniles and adults in the Penobscot River which would not be consistent with the best available information on shortnose sturgeon populations.

CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. The following section discusses potential cumulative effects that are reasonably certain to occur to shortnose sturgeon within the action area of this consultation.

The effects of future state and private activities in the action area that are reasonably certain to occur during NEFSC's proposed fisheries sampling in the Penobscot River are recreational fisheries, pollutants, and development and/or construction activities resulting in excessive water turbidity and habitat degradation.

Impacts to shortnose sturgeon from non-federal activities are largely unknown in this river. It is possible that occasional recreational fishing for anadromous fish species may result in incidental takes of shortnose sturgeon. There have been no documented takes of shortnose sturgeon in the action area. One Atlantic sturgeon was captured by an angler in 2005. Thus, the operation of these hook and line fisheries and other fisheries could result in future shortnose sturgeon mortality and/or injury.

Pollution from point and non-point sources has been a major problem in this river system, which continues to receive discharges from sewer treatment facilities and paper production facilities (metals, dioxin, dissolved solids, phenols, and hydrocarbons). Contaminants introduced into the water column or through the food chain, eventually become associated with the benthos where bottom dwelling species like shortnose sturgeon are particularly vulnerable.

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 that shortnose sturgeon will continue to be affected by contaminants in the action area in the future.

Industrialized waterfront development will continue to impact the water quality in and around the action area. Sewage treatment facilities, manufacturing plants, and other facilities present in the action area 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. As a result, shortnose sturgeon foraging and/or distribution in the action area may be adversely affected.

Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from development, groundwater discharges, and industrial development. Chemical contamination may have an effect on listed species reproduction and survival.

As noted above, impacts to listed species from all of these activities are largely unknown. However, NMFS has no information to suggest that the effects of future activities in the action area will be any different from effects of activities that have occurred in the past.

INTEGRATION AND SYNTHESIS OF EFFECTS

Shortnose sturgeon are endangered throughout their entire range. This species exists as nineteen separate populations that show no evidence of interbreeding. The shortnose sturgeon residing in the Penobscot River form one of these nineteen populations.

NMFS has estimated that the proposed action, the funding of a fisheries study in the Penobscot River will result in no mortality of shortnose sturgeon. As explained in the "Effects of the Action" section, the study has the potential to adversely effect up to 3 shortnose sturgeon (2 adult and 1 juvenile) during each of two annual late summer surveys (September 2008 and 2009). As no shortnose sturgeon are expected to occur in the action area when the spring sampling event takes place in 2009, no effects to shortnose sturgeon from the spring sampling are likely.

This action will not reduce reproduction of shortnose sturgeon in the Penobscot River because it will (1) not result in the mortality of any shortnose sturgeon and therefore will not effect any potential reproduction of that individual; (2) not affect any spawning adults; and (3) not affect spawning habitat.

This action will not reduce the numbers of shortnose sturgeon in the Penobscot River because it will not result in the mortality of any shortnose sturgeon.

The proposed action will not reduce distribution because the action will not impede shortnose sturgeon from accessing spawning, foraging or overwintering grounds in the Penobscot River. Further, the action is not expected to reduce the river by river distribution of shortnose sturgeon.

For these reasons, NMFS believes that there is not likely to be any reduction in reproduction, numbers or distribution of shortnose sturgeon in the Penobscot River population or the species as a whole. As there will not be a reduction in reproduction or numbers of shortnose sturgeon in the Penobscot River and no reduction in the rangewide distribution of shortnose sturgeon, this action is not likely to impede the ability of the species to recover. As such, there is not likely to be an appreciable reduction in the likelihood of survival and recovery in the wild of the Penobscot River population or the species as a whole.

CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS' biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon. Because no critical habitat is designated in the action area, none will be affected by the proposed action.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered and threatened species respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. NMFS interprets the term "harm" as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering (50 CFR §222.102). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Incidental Take

The proposed project has the potential to directly affect shortnose sturgeon by causing them to be stunned by the electric current and then be captured and handled. As explained in the "Effects of the Action" section of this consultation, no mortalities are likely and all shortnose sturgeon exposed to the current are expected to recover quickly. While shortnose sturgeon may exhibit behaviors such as rolling or twitching, no injuries are likely to be sustained. Based on available population estimates, the location of tagged fish within the Penobscot River in 2006 and 2007 and the effective range of the electrofishing boat, NMFS has determined that no more than 2 adults and 1 juvenile shortnose sturgeon are likely to be effected by the electrofishing survey each year. As the survey will take place during two consecutive years (2008 and 2009), no more than 6 shortnose sturgeon (4 adults and 2 juveniles) are expected to be effected by the project as a whole. While no injuries or mortalities to any shortnose sturgeon are expected, the anticipated interaction of 6 shortnose sturgeon with sampling gear would be considered harassment under Section 9 of the ESA. Also, the incidental take associated with capturing and handling applies only to juvenile shortnose sturgeon; no adults may be captured or handled as part of this study. NMFS bases this level of incidental take on the seasonal distribution and abundance of shortnose sturgeon in the action area. In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

Reasonable and prudent measures

Reasonable and prudent measures are those measures necessary and appropriate to minimize incidental take of a listed species. NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of the Penobscot River population of shortnose sturgeon:

1. The NEFSC must contact the Protected Resources Division before sampling commences and again upon completion of the sampling activity.
2. The NEFSC must promptly report all interactions with shortnose sturgeon to the Protected Resources Division.

Terms and conditions

In order to be exempt from prohibitions of section 9 of the ESA, NEFSC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, the NEFSC must contact the NER within 24 hours of beginning and ending sampling occurring below the Veazie Dam (Jeff Murphy: by email (Jeff.Murphy@noaa.gov) or phone (207-866-7379) or the Endangered Species Coordinator by phone (978-281-9208) or fax (978-281-9394)). This notification must occur with each spring and late summer sampling event.
2. To implement RPM #2, the NEFSC must contact the NER within 24 hours of any interactions with shortnose sturgeon, including non-lethal and lethal takes (Jeff Murphy: by email (Jeff.Murphy@noaa.gov) or phone (207-866-7379) or the Endangered Species Coordinator by phone (978-281-9208) or fax (978-281-9394)).
3. To implement RPM #2, the NEFSC must not net any adult shortnose sturgeon over 2 feet in length. Any sub-adult sturgeon netted during sampling must be photographed and measured. The corresponding incident report form (Appendix A) must be completed and submitted to NMFS **within 24 hours** by fax (978-281-9394) of any interaction with shortnose sturgeon (juvenile or adult).
4. To implement RPM #2, in the event adult sturgeon come in contact with sampling gear, all electrofishing must cease for 5 minutes or until the fish is observed to recover and leave the sampling area.

5. To implement RPM #2, the NEFSC in the event of any lethal takes, any dead specimens or body parts must be netted, photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS's NER. The Sturgeon Salvage form included as Appendix B must be completed and submitted to NMFS's NER as noted above.

6. To implement RPM #2, the NEFSC if any lethal take occurs, must take fin clips (according to the procedure outlined in Appendix C) to be returned to NMFS's NER for ongoing analysis of the genetic composition of the Penobscot River shortnose sturgeon population.

7. To implement RPM #2, the NEFSC must submit a final report at the end of each calendar year summarizing the results of sampling activities and any takes of listed species to NMFS by mail (to the attention of the Endangered Species Coordinator, NMFS Protected Resources Division, One Blackburn Drive, Gloucester, MA 01930).

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed action. Specifically, these RPMs and Terms and Conditions will keep NMFS informed of when sampling activities are taking place and will require NEFSC to report any take in a reasonable amount of time, as well as avoid additional sources of injury and mortality to adult fish that may result from handling associated with netting. Term and Condition #1, #2 and #6 are specifically designed to monitor take. As shortnose sturgeon adults may be vulnerable to additional injury and/or mortality if captured in a hand held net, Term and Condition #3 is necessary and appropriate to prevent the occurrence of this additional source of injury and mortality. In order to effectively monitor and report the effects of this action, Term and Condition #3 permits collecting data from juvenile shortnose sturgeon. Netting and collecting data from juvenile shortnose sturgeon will enable NMFS to better monitor the take associated with this project. Term and Condition #4 will further reduce any impacts to the species by allowing any adult shortnose sturgeon interacting with sampling gear to recover and move outside of the sampling area. As NMFS does not anticipate any lethal take, the implementation of Term and Condition #5 and #6 are necessary and appropriate to preserve any dead shortnose sturgeon so that they may be salvaged and examined to determine the cause of death. Genetic information is important to document, if possible, whether the fish killed belongs to the Penobscot or the Kennebec population as well as whether the fish contains any unique genetic haplotypes.
If, during the course of the action, the level of incidental take is exceeded, reinitiation of consultation and review of the reasonable and prudent measures are required. NEFSC must immediately provide an explanation of the causes of the taking and review with NMFS the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS has determined that the proposed action is not likely to jeopardize the continued existence of endangered shortnose sturgeon. To further reduce the adverse effects of fisheries sampling on listed species, NMFS recommends that NEFSC implement the following conservation recommendations.

(1) If any lethal take occurs, the NEFSC should arrange for contaminant analysis of the specimen. If this recommendation is to be implemented, the fish should be immediately frozen and NMFS's NER should be contacted within 24 hours to provide instructions on shipping and preparation

(2) If any interactions with Atlantic sturgeon occur, the NEFSC should document the interaction in the written report. Additionally, NEFSC should inform PRD of the interaction within 24 hours. Atlantic sturgeon should be netted if determined to be safe to do so. If possible, measurements and photographs should be obtained, as well as a fin clip for ongoing genetic analyses. If any Atlantic sturgeon are killed during sampling activities, the specimen should be refrigerated or frozen until disposal procedures are discussed with NMFS's NER.

REINITIATION OF CONSULTATION

This concludes formal consultation with the NEFSC concerning the effects of proposed fisheries sampling in the Penobscot River on listed shortnose sturgeon. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, Section 7 consultation must be reinitiated immediately.

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APPENDIX A

Incident Report of Sturgeon Take

Species ______________________________
Date ____________________ Time (specimen found) __________

Geographic Site ____
Location: Lat/Long ____
Water Depth ______________________________
Weather conditions ____
Water temp: Surface ____________ Below midwater (if known) ____________

Type of Gear and Mesh Size ____
____

Other Comments on Location ____
____

Species Information: (please designate cm/m or inches.)

Fork length (or total length) _____________________ Weight ______________________

Condition of specimen/description of animal

____
____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY

Fish tagged: YES / NO Type of Tag and Numbers : __________________________________
____

Photograph attached: YES / NO
(please label *species, date, geographic site* and *vessel name* on back of photograph)

Comments/other (include justification on how species was identified)

____
____
____
____

Observer's Name ____
Observer's Signature ____

APPENDIX

SHORTNOSE STURGEON SALVAGE FORM

Version 09-21-2007 for documenting dredge interactions

INVESTIGATORS'S CONTACT INFORMATION

Name: First ____________ Last ________________

Agency Affiliation ______________________________

Address ______________________________

____

Area code/Phone number ______________________________

UNIQUE IDENTIFIER (Assigned by NMFS)

DATE REPORTED:

Month ☐☐ Day☐☐ Year 20☐☐

DATE EXAMINED:

Month ☐☐ Day☐☐ Year 20☐☐

SPECIES: (check one)

☐ shortnose sturgeon

☐ Atlantic sturgeon

☐ Unidentified *Acipenser* species

Check "Unidentified" if uncertain.

See reverse side of this form for aid in identification.

LOCATION FOUND: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)

River/Body of Water ____________ City ________________ State ____

Descriptive location (be specific) ______________________________

____

____

Latitude ____________ N (Dec. Degrees) Longitude ____________ W (Dec. Degrees)

CARCASS CONDITION at time examined: (check one)

☐ 1 = Fresh dead

☐ 2 = Moderately decomposed

☐ 3 = Severely decomposed

☐ 4 = Dried carcass

☐ 5 = Skeletal, scutes & cartilage

SEX:

☐ Undetermined

☐ Female ☐ Male

How was sex determined?

☐ Necropsy

☐ Eggs/milt present when pressed

☐ Borescope

MEASUREMENTS: Circle unit

Fork length ________ cm / in

Total length ________ cm / in

Length ☐ actual ☐ estimate

Mouth width (inside lips, see reverse side) ________ cm / in

Interorbital width (see reverse side) ________ cm / in

Weight ☐ actual ☐ estimate ________ kg / lb

TAGS PRESENT? Examined for external tags including fin clips? ☐ Yes ☐ No Scanned for PIT tags? ☐ Yes ☐ No

Tag #	Tag Type	Location of tag on carcass
____________	____________	____________
____________	____________	____________

CARCASS DISPOSITION: (check one or more)

☐1 = Left where found

☐2 = Buried

☐3 = Collected for necropsy/salvage

☐4 = Frozen for later examination

☐5 = Other (describe) ____________

Carcass Necropsied?

☐Yes ☐No

Date Necropsied: ____________

Necropsy Lead:

____

PHOTODOCUMENTATION:

Photos/vide taken? ☐ Yes ☐ No

Disposition of Photos: ____________

____

____

SAMPLES COLLECTED? ☐ Yes ☐ No

Sample	How preserved	Disposition (person, affiliation, use)
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________

Comments:

____

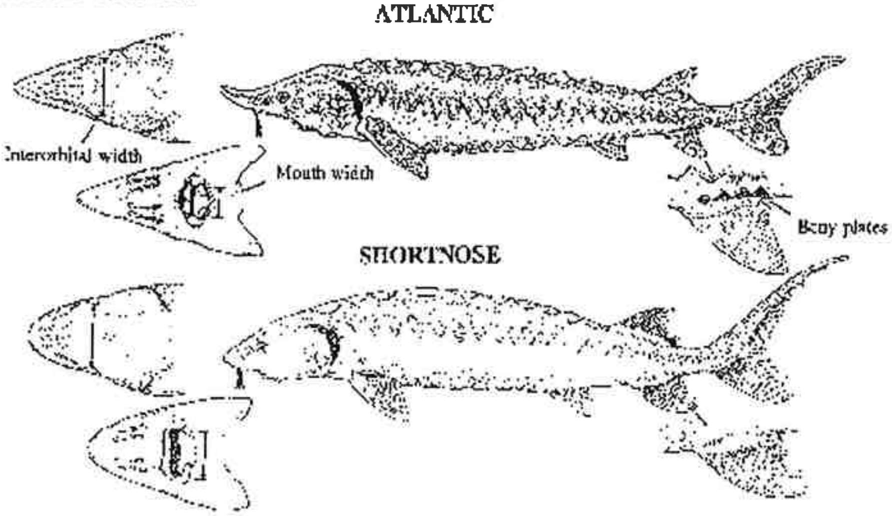
____

____

Distinguishing Characteristics of Atlantic and Shortnose Sturgeon

Characteristic	Atlantic Sturgeon, *Acipenser oxyrinchus*	Shortnose Sturgeon, *Acipenser brevirostrum*
Maximum length	> 9 feet/ 274 cm	4 feet/ 122 cm
Mouth	Football shaped and small. Width inside lips < 55% of bony interorbital width	Wide and oval in shape. Width inside lips > 62% of bony interorbital width
*Pre-anal plates posterior to rectum	Large paired pre-anal plates, often followed by a second pair of plates and another, larger single plate	1-3 pre-anal plates, never paired
Plates along the anal fin	Large rhombic plates found along the lateral base of the anal fin	No plates along the base of anal fin
Habitat/Range	Anadromous; spawn in freshwater but primarily lead a marine existence	Freshwater amphidromous; aside from seasonal migrations to estuary, rarely occurs in the marine environment

* From Vecsei and Peterson, 2004



Describe any wounds / abnormalities (note tar or oil, gear or debris entanglement, propeller damage, etc.). **Please note if no wounds / abnormalities are found.**

____

____

____

____

____

Data Access Policy: Upon written request, information submitted to National Marine Fisheries Service (NOAA Fisheries) on this form will be released to the requestor provided that the requestor credit the collector of the information and NOAA Fisheries. NOAA Fisheries will notify the collector that these data have been requested and the intent of their use.

Fax completed for within 24 days of date of the interaction to: Dana Hartley, Shortnose Sturgeon Recovery Coordinator, NOAA Fisheries Northeast Region, One Blackburn Drive, Gloucester, MA 01930
Phone: 978-281-9300 x6514; Fax: 978-281-9394; E-Mail Dana.Hartley@noaa.gov

APPENDIX C

Procedure for obtaining fin clips from shortnose sturgeon for genetic analysis

Obtaining Sample

1. For any dead shortnose sturgeon, after the specimen has been measured and photographed, two one-inch clips from the caudal fin shall be taken.

2. Each fin clip should be placed into a vial of 95% ethanol and the vial should be labeled with the species name, date, name of project and the fork length and total length of the fish along with a note identifying the fish to the appropriate observer report.

Storage of Sample

1. If it is not possible to immediately send the sample to NMFS, the sample should be refrigerated or frozen.

Sending of Sample

1. All vials should be sealed with a lid and further secured with tape. Vials should be placed into Ziploc or similar resealable plastic bags. Vials should be then wrapped in bubble wrap or newspaper (to prevent breakage) and sent to:

   Dana Hartley, Shortnose Sturgeon Recovery Coordinator
   Northeast Regional Office
   Protected Resources Division
   One Blackburn Drive
   Gloucester, MA 01930

2. Upon sending a sample, contact Dana Hartley at 978-281-9300, ext. 6514 or Pat Scida at 978-281-9208 to inform NMFS to expect a sample.