NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT
BIOLOGICAL OPINION

Agency:	U.S. Army Corps of Engineers – New England District
Activity Considered:	Maintenance Dredging of the Lower Kennebec River Federal Navigation Project, August 2011 **F/NER/2011/00691**
Conducted by:	National Marine Fisheries Service Northeast Region
Date Issued:	June 29, 2011
Approved by:	[signature]

This constitutes NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Opinion), in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), on the effects of the Army Corps of Engineers (ACOE) New England District's conduct of maintenance dredging of the Kennebec River Federal Navigation Project (FNP) in August 2011. This Opinion is based on information provided in the NMFS August 28, 1997 Opinion on dredging in the Kennebec River Federal Navigation Channel, the November 29, 2000 amendment to the 1997 Opinion, the April 16, 2002 Opinion on the dredging of the Kennebec River Federal Navigational Channel, the January 13, 2004 Opinion on the emergency dredging (performed in October 2003) of the Kennebec River, a series of Opinions produced by NMFS on the effects of dredging at Bath Iron Works, information provided by the ACOE via letter dated March 3, 2011 and May 5, 2011, correspondence with Mr. William Kavanaugh of the ACOE, including e-mails received in May and June 2011, and other sources of information. A complete administrative record of this consultation will be kept at the NMFS Northeast Regional Office. Formal consultation was initiated on March 3, 2011.

CONSULTATION HISTORY

Kennebec River Federal Navigation Channel

The authorized Federal navigation project in the lower Kennebec River consists of a channel 27 feet deep at Mean Lower Low Water (MLLW) and 500 feet wide extending about 13 miles upstream from the river mouth at Popham Beach to the city of Bath. About eight miles upstream of Bath, the FNP provides for a navigation channel 17 feet deep MLLW and 150 feet wide along the east side of Swan Island for 14 miles to the city of Gardiner. An 18-foot deep MLLW and 150 feet wide channel extends through the ledge at Lovejoy Narrows opposite the upper end of Swan Island. A training wall was built along the Beef Rock Shoal opposite the lower end of Swan Island and another training wall was built opposite South Gardiner. A secondary channel 12 feet deep and 100 feet wide was provided along the west-side of Swan Island to Richmond, with the navigation channel deepening to 15 feet MLLW near the upper end of Swan Island. A

16-foot deep MLW channel was provided at Gardiner. A channel 11 feet deep MLLW and 150 feet wide extends seven miles to the upper limit of the FNP in Augusta.

Since the FNP for the lower Kennebec River was deepened to 27 feet deep in the early 1940's, the ACOE has been performing maintenance dredging at the Doubling Point and Popham Beach reaches at approximately three-year intervals. These sites have been dredged a total of approximately 18 times since 1950. Dredging has been performed using a hopper dredge and the amount of material removed has ranged from 4,707 cy to 108,830 cy. Disposal sites have historically been located in the river north of Bluff Head for the material removed from the channel near Doubling Point and at a nearshore disposal site located approximately 0.4 nautical miles south of Jackknife Ledge for the material dredged from the channel at the river mouth near Popham Beach. In recent years, dredging occurred in 1991, 1997, 2000, 2002 and most recently in October 2003 (see Table 1).

Table 1. Maintenance dredging of the lower Kennebec River FNP since 1991.

Location	Dates	Volume Removed (cy)	Observer Present?	Interactions with Shortnose Sturgeon
Doubling Point	Fall 1991	69,000	No	2 lethal
Doubling Point	November 1997	22,000	Yes	0
Doubling Point	December 2000	20,000	Yes	0
Doubling Point	April 2002	25,000	Yes	0
Doubling Point	10/6-10/10/2003	22,310	Yes	3 lethal 2 injured but alive upon release

Several consultations have taken place between NMFS and ACOE on the effects of dredging the navigation channel on shortnose sturgeon. In 1989 and 1991, the ACOE implemented restrictions permitting dredging operations at the Doubling Point reach from September 15 to October 15 and from March 1 through April 30 and at Popham Beach from November 1 through April 30. Consultation on dredging in 1989 and 1991 was concluded informally, with NMFS concurring with the determination that dredging was not likely to adversely affect shortnose sturgeon.

During dredging operations in October 1991, two shortnose sturgeon with severe lacerations were observed floating just downstream of the dredge site. It was assumed that these fish were killed during the ongoing maintenance dredging of the Doubling Point reach. On August 28, 1997, NMFS issued an Opinion to ACOE regarding the effects of maintenance dredging of the navigation channel. The dredging window that was established in 1997 allowed dredging in both the Doubling Point and Popham Beach areas from November 1 through April 30. No interactions with shortnose sturgeon were observed during dredging operations completed in November 1997.

In a letter dated November 29, 2000, NMFS indicated that new information on the distribution of shortnose sturgeon in the Kennebec River was available and that the Opinion issued in 1997 would be amended to include a Term and Condition restricting dredging to the December 1 – March 1 time frame. Dredging of the Doubling Point reach was completed in December 2000 with no interactions with shortnose sturgeon observed.

Consultation was reinitiated in 2002. Based on available information on distribution of shortnose sturgeon, the ACOE proposed that dredging at Doubling Point be allowed from November 1 – April 30. NMFS issued an Opinion on April 16, 2002 on the effects of annual maintenance dredging of the navigation channel in the November 1 – April 30 time frame. Accompanying this Opinion was an Incidental Take Statement which authorized the annual incidental taking of 2 shortnose sturgeon at Doubling Point during December 1 – March 1 and a total of 4 shortnose sturgeon in the November 1 – November 30 or March 2 – April 30 time frame. Dredging occurred in late April 2002 with no interactions with shortnose sturgeon observed.

Due to emergency conditions, the Doubling Point and Popham Beach reaches were dredged most recently in October 2003. Dredging occurred over the course of four days with approximately 22,000 cubic yards of material removed from the channel. During this dredge operation, five shortnose sturgeon were entrained by the hopper dredge operating in the Doubling Point reach. Two of the sturgeon died on board the dredge. The remaining three fish were alive; however, two of the fish suffered significant injuries and although released, likely died due to the severity of their injuries. The fifth fish was released with minor injuries. An Opinion regarding the effects of the emergency dredging operations was issued to the ACOE on January 13, 2004. The navigation channel has not been dredged since October 2003.

DESCRIPTION OF THE PROPOSED ACTION

The proposed work involves maintenance dredging of two portions (Doubling Point and Popham Beach) of the authorized 27 feet deep, 500 feet wide FNP in the lower Kennebec River in August 2011. Additionally, if sufficient funds are available, the ACOE will conduct advance maintenance dredging at Doubling Point. The ACOE, in coordination with the US Navy, has determined that dredging is needed to remove hazardous shoals from the channel in advance of the transit of the U.S. Navy Destroyer, the "SPRUANCE", currently scheduled to depart the Bath Iron Works (BIW) on or about September 1, 2011. The SPRUANCE has been deemed critical to national defense and according to the Navy, its transit from BIW cannot be delayed.

The ACOE is proposing to perform maintenance dredging in the vicinity of Doubling Point (below Bath) and at the mouth of the river near Popham Beach. The ACOE is proposing to remove approximately 70,000 cubic yards (i.e. 50,000 cubic yards from Doubling Point and 20,000 cubic yards from Popham Beach) of clean sandy material. Dredging will alleviate shoaling conditions currently present in the channel. The shoals, especially those in the Doubling Point area, consist of sand-waves oscillating within vertical and horizontal ranges; the elevation at the tips of these sand-waves vary from -19.7' to -26.8 ' below MLLW. The ACOE is also proposing to perform advance maintenance dredging to remove the sand-waves in the vicinity of Doubling Point to a maximum elevation of -32' MLLW in an effort to improve the chance that adequate depths will endure. The proposed work will be performed with a hopper dredge over a three to five week period beginning on or about August 1, 2011. Dredging at Doubling Point to restore depths of 27 feet plus 2 feet of allowable overdepth is expected to take less than 7 days, with dredging to depths of up to 32 feet taking an additional 1 to 2 days, for a total of 8-10 days of dredging at Doubling Point. Dredging at Popham Beach is expected to take 2-4 days. In total, dredging is expected to occur for approximately 12-14 days in August 2011.

The material dredged from the Doubling Point area will be disposed of at the previously used in-river disposal site located north of Bluff Head. Water depths at the in-river disposal site range from about 30' to 100' of water. Material dredged from the Popham Beach area will be disposed at a previously used 500-yard circular near-shore disposal site located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet (see map in Appendix). While the ACOE anticipates completing all three phases of work, the availability of funds will determine how many phases of the proposed work will be completed.

Action Area
The action area for this consultation includes the Doubling Point and Popham Beach reaches of the lower Kennebec River FNP in Maine where dredging will occur; the disposal sites near Bluff Head and Jacknife Ledge and the waters between and immediately adjacent to these areas. The action area also includes the area of the Kennebec River where increased suspended sediment will be present during dredging and disposal operations. Based on analysis of other hydraulic hopper dredging activities (ACOE 1983, Anchor Environmental 2003, Connor et al. 2004), suspended sediment plumes are expected to be fully dissipated at an average distance of 800-1200 meters from the dredge site when a hopper dredge is used. The exact size of the plume is influenced by the sediment type, the particular dredge used, the dredge operator, strength of current and tidal stage and is likely to vary throughout the project. Regardless of these variables, the maximum distance of increased suspended sediment is likely to be 1200 meters from the draghead. Additionally, the action area will include the in-river and nearshore disposal sites and the transit route to and from the disposal sites as well as an area extending 3000-feet from the disposal area where increased levels of suspended sediment are likely to be experienced. This area is expected to encompass all of the direct and indirect effects of the proposed dredging project (see map in Appendix A).

LISTED SPECIES IN THE ACTION AREA
This section will focus on the status of the species within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

Two species listed under NMFS' jurisdiction are likely to occur in the action area for this consultation. Endangered shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic salmon (*Salmo salar*) have been documented in the action area for this consultation. Additionally, the action area is within the area that has been designated as critical habitat for GOM DPS Atlantic salmon. Atlantic salmon and shortnose sturgeon are the only listed species likely to be present at the areas to be dredged and at the Bluff Head dispsosal site. The Jacknife Ledge disposal site is located approximately 0.4 miles off the coast. Several species of listed whales occur seasonally off the coast of Maine. However, given the nearshore location of the Jacknife Ledge disposal site, no listed whales are likely to be present. Thus, listed whales will not be considered further in this Opinion.

Loggerhead (*Caretta caretta*) and leatherback *(Dermochelys coriacea)* are occasionally present in Maine waters and could occur near the Jackknife Ledge disposal area, although any occurrence of these species would be rare. Effects to sea turtles present near the disposal site would be limited to potential exposure to increases in suspended sediment resulting from dredge disposal activities. Any increase in suspended sediment will be temporary and any effects to sea turtles are likely to be limited to temporary displacement from the disposal site during the 1-5 minutes when disposal activities take place. NMFS anticipates that all effects to sea turtles will be insignificant and discountable. Therefore, the proposed action is not likely to adversely affect loggerhead or leatherback sea turtles and these species will nto be considered further in this Opinion.

STATUS OF AFFECTED SPECIES

NMFS has determined that the action being considered in this biological opinion may affect the following endangered or threatened species under NMFS' jurisdiction:

Fish

Gulf of Maine Distinct Population Segment of Atlantic Salmon	Endangered
Shortnose sturgeon	Endangered

This section will focus on the status of these species within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

Gulf of Maine DPS of Atlantic Salmon

The Atlantic salmon is an anadromous fish species that spends most of its adult life in the ocean but returns to freshwater to reproduce. The Atlantic salmon is native to the basin of the North Atlantic Ocean, from the Arctic Circle to Portugal in the eastern Atlantic, from Iceland and southern Greenland, and from the Ungava region of northern Quebec south to the Connecticut River (Scott and Crossman 1973). In the United States, Atlantic salmon historically ranged from Maine south to Long Island Sound. However, the Central New England DPS and Long Island Sound DPS have both been extirpated (65 FR 69459; Nov. 17, 2000).

The GOM DPS of anadromous Atlantic salmon was initially listed by the USFWS and NMFS (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). A subsequent re-listing as an endangered species by the Services (74 FR 29344; June 19, 2009), included an expanded range for the GOM DPS of Atlantic salmon. The decision to expand the geographic range of the GOM DPS was largely based on the results of a Status Review (Fay *et al.* 2006) completed by a Biological Review Team consisting of federal and state agencies and Tribal interests. Fay *et al.* (2006) concluded that the DPS delineation in the 2000 listing designation was largely appropriate, except in the case of large rivers that were excluded in the 2000 listing determination. Fay *et al.* (2006) concluded that the salmon currently inhabiting the larger rivers (Androscoggin, Kennebec, and Penobscot) are genetically similar to the rivers included in the GOM DPS as listed in 2000, have similar life history characteristics, and/or occur in the same zoogeographic region. Further, the salmon populations inhabiting the large and small rivers from the Androscoggin River northward to the Dennys River differ genetically and in important life history characteristics from Atlantic salmon in adjacent portions of Canada (Spidle *et al.* 2003; Fay *et al.* 2006). Thus, Fay *et al.* (2006) concluded that this group of populations (a "distinct population segment") met both the discreteness and significance criteria of the Services' DPS Policy (61 FR 4722; Feb. 7, 1996) and, therefore, recommended the geographic range included in the new expanded GOM DPS.

The newly listed GOM DPS includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The following impassable falls delimit the upstream extent of the freshwater range: Rumford Falls in the town of Rumford on the Androscoggin River; Snow Falls in the town of West Paris on the Little Androscoggin River; Grand Falls in Township 3 Range 4 BKP WKR on the Dead River in the Kennebec Basin; the un-named falls (impounded by Indian Pond Dam) immediately above the Kennebec River Gorge in the town of Indian Stream Township on the Kennebec River; Big Niagara Falls on Nesowadnehunk Stream in Township 3 Range 10 WELS in the Penobscot Basin; Grand Pitch on Webster Brook in Trout Brook Township in the Penobscot Basin; and Grand Falls on the Passadumkeag River in Grand Falls Township in the Penobscot Basin. The marine range of the GOM DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland.

Included in the GOM DPS are all associated conservation hatchery populations used to supplement these natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery (GLNFH) and Craig Brook National Fish Hatcheries (CBNFH), both operated by the USFWS. Excluded from the GOM DPS are landlocked Atlantic salmon and those salmon raised in commercial hatcheries for the aquaculture industry (74 FR 29344; June 19, 2009).

Species Description

Atlantic salmon have a complex life history that includes territorial rearing in rivers to extensive feeding migrations on the high seas. During their life cycle, Atlantic salmon go through several distinct phases that are identified by specific changes in behavior, physiology, morphology, and habitat requirements.

Adult Atlantic salmon return to rivers from the sea and migrate to their natal stream to spawn. Adults ascend the rivers within the GOM DPS beginning in the spring. The ascent of adult salmon continues into the fall. Although spawning does not occur until late fall, the majority of Atlantic salmon in Maine enter freshwater between May and mid-July (Meister 1958; Baum 1997). Early migration is an adaptive trait that ensures adults have sufficient time to effectively reach spawning areas despite the occurrence of temporarily unfavorable conditions that naturally occur within rivers (Bjornn and Reiser 1991). Salmon that return in early spring spend nearly 5 months in the river before spawning, often seeking cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

In the fall, female Atlantic salmon select sites for spawning. Spawning sites are positioned within flowing water, particularly where upwelling of groundwater occurs, allowing for percolation of water through the gravel (Danie et al. 1984). These sites are most often positioned at the head of a riffle (Beland et al. 1982); the tail of a pool; or the upstream edge of a gravel bar where water depth is decreasing, water velocity is increasing (McLaughlin and Knight 1987; White 1942), and hydraulic head allows for permeation of water through the redd (a gravel depression where eggs are deposited). Female salmon use their caudal fin to scour or dig redds. The digging behavior also serves to clean the substrate of fine sediments that can embed the cobble/gravel substrate needed for spawning and consequently reduce egg survival (Gibson 1993). As the female deposits eggs in the redd, one or more males fertilize the eggs (Jordan and Beland 1981). The female then continues digging upstream of the last deposition site, burying the fertilized eggs with clean gravel.

A single female may create several redds before depositing all of her eggs. Female anadromous Atlantic salmon produce a total of 1,500 to 1,800 eggs per kilogram of body weight, yielding an average of 7,500 eggs per 2 sea-winter (SW) female (an adult female that has spent two winters at sea before returning to spawn) (Baum and Meister 1971). After spawning, Atlantic salmon may either return to sea immediately or remain in freshwater until the following spring before returning to the sea (Fay et al. 2006). From 1967 to 2003, approximately 3 percent of the wild and naturally reared adults that returned to rivers where adult returns are monitored--mainly the Penobscot River--were repeat spawners (USASAC 2004).

Embryos develop in the redd for a period of 175 to 195 days, hatching in late March or April (Danie et al. 1984). Newly hatched salmon referred, to as larval fry, alevin, or sac fry, remain in the redd for approximately 6 weeks after hatching and are nourished by their yolk sac (Gustafson-Greenwood and Moring 1991). Survival from the egg to fry stage in Maine is estimated to range from 15 to 35 percent (Jordan and Beland 1981). Survival rates of eggs and larvae are a function of stream gradient, overwinter temperatures, interstitial flow, predation, disease, and competition (Bley and Moring 1988). Once larval fry emerge from the gravel and begin active feeding they are referred to as fry. The majority of fry (>95 percent) emerge from redds at night (Gustafson-Marjanen and Dowse 1983).

When fry reach approximately 4 cm in length, the young salmon are termed parr (Danie et al., 1984). Parr have eight to eleven pigmented vertical bands on their sides that are believed to serve as camouflage (Baum 1997). A territorial behavior, first apparent during the fry stage, grows more pronounced during the parr stage, as the parr actively defend territories (Allen 1940; Kalleberg 1958; Danie et al. 1984). Most parr remain in the river for 2 to 3 years before undergoing smoltification, the process in which parr go through physiological changes in order to transition from a freshwater environment to a saltwater marine environment. Some male parr may not go through smoltification and will become sexually mature and participate in spawning with sea-run adult females. These males are referred to as "precocious parr."

First year parr are often characterized as being small parr or 0+ parr (4 to 7 cm long), whereas second and third year parr are characterized as large parr (greater than 7 cm long) (Haines 1992). Parr growth is a function of water temperature (Elliott 1991); parr density (Randall 1982); photoperiod (Lundqvist 1980); interaction with other fish, birds, and mammals (Bjornn and Resier 1991); and food supply (Swansburg et al. 2002). Parr movement may be quite limited in the winter (Cunjak 1988; Heggenes 1990); however, movement in the winter does occur (Hiscock et al. 2002) and is often necessary, as ice formation reduces total habitat availability (Whalen et al. 1999). Parr have been documented using riverine, lake, and estuarine habitats; incorporating opportunistic and active feeding strategies; defending territories from competitors including other parr; and working together in small schools to actively pursue prey (Gibson 1993; Marschall et al. 1998; Pepper 1976; Pepper et al. 1984; Hutchings 1986; Erkinaro et al. 1998; Halvorsen and Svenning 2000; Hutchings 1986; O'Connell and Ash 1993; Erkinaro et al. 1995; Dempson et al. 1996; Halvorsen and Svenning 2000; Klemetsen et al. 2003).

In a parr's second or third spring (age 1 or age 2 respectively), when it has grown to 12.5 to 15 cm in length, a series of physiological, morphological, and behavioral changes occur (Schaffer and Elson 1975). This process, called "smoltification," prepares the parr for migration to the ocean and life in salt water. In Maine, the vast majority of naturally reared parr remain in freshwater for 2 years (90 percent or more) with the balance remaining for either 1 or 3 years (USASAC 2005). In order for parr to undergo smoltification, they must reach a critical size of 10 cm total length at the end of the previous growing season (Hoar 1988). During the smoltification process, parr markings fade and the body becomes streamlined and silvery with a pronounced fork in the tail. Naturally reared smolts in Maine range in size from 13 to 17 cm, and most smolts enter the sea during May to begin their first ocean migration (USASAC 2004). During this migration, smolts must contend with changes in salinity, water temperature, pH, dissolved oxygen, pollution levels, and predator assemblages. The physiological changes that occur during smoltification prepare the fish for the dramatic change in osmoregulatory needs that come with the transition from a fresh to a salt water habitat (Ruggles 1980; Bley 1987; McCormick and Saunders 1987; McCormick et al. 1998). The transition of smolts into seawater is usually gradual as they pass through a zone of fresh and saltwater mixing that typically occurs in a river's estuary. Given that smolts undergo smoltification while they are still in the river, they are pre-adapted to make a direct entry into seawater with minimal acclimation (McCormick et al. 1998). This pre-adaptation to seawater is necessary under some circumstances where there is very little transition zone between freshwater and the marine environment.

The spring migration of post-smolts out of the coastal environment is generally rapid, within several tidal cycles, and follows a direct route (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005). Post-smolts generally travel out of coastal systems on the ebb tide and may be delayed by flood tides (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004, 2005). Lacroix and McCurdy (1996), however, found that post-smolts exhibit active, directed swimming in areas with strong tidal currents. Studies in the Bay of Fundy and Passamaquoddy Bay suggest that post-smolts aggregate together and move near the coast in "common corridors" and that post-smolt movement is closely related to surface currents in the bay (Hyvarinen et al. 2006; Lacroix and McCurdy 1996; Lacroix et al. 2004). European post-smolts tend to use the open ocean for a nursery zone, while North American post-smolts appear to have a more near-shore distribution (Friedland et al. 2003). Post-smolt distribution may reflect water temperatures (Reddin and Shearer 1987) and/or the major surface-current vectors (Lacroix and Knox 2005). Post-smolts live mainly on the surface of the water column and form shoals, possibly of fish from the same river (Shelton et al. 1997).

During the late summer and autumn of the first year, North American post-smolts are concentrated in the Labrador Sea and off of the west coast of Greenland, with the highest concentrations between 56 °N. and 58°N. (Reddin 1985; Reddin and Short 1991; Reddin and Friedland 1993). The salmon located off Greenland are composed of both 1SW fish and fish that have spent multiple years at sea (multi-sea winter fish, or MSW) and includes immature salmon from both North American and European stocks (Reddin 1988; Reddin et al. 1988). The first winter at sea regulates annual recruitment, and the distribution of winter habitat in the Labrador Sea and Denmark Strait may be critical for North American populations (Friedland et al. 1993). In the spring, North American post-smolts are generally located in the Gulf of St. Lawrence, off the coast of Newfoundland, and on the east coast of the Grand Banks (Reddin 1985; Dutil and Coutu 1988; Ritter 1989; Reddin and Friedland 1993; and Friedland et al. 1999).

Some salmon may remain at sea for another year or more before maturing. After their second winter at sea, the salmon over-winter in the area of the Grand Banks before returning to their natal rivers to spawn (Reddin and Shearer 1987). Reddin and Friedland (1993) found non-maturing adults located along the coasts of Newfoundland, Labrador, and Greenland, and in the Labrador and Irminger Sea in the later summer and autumn.

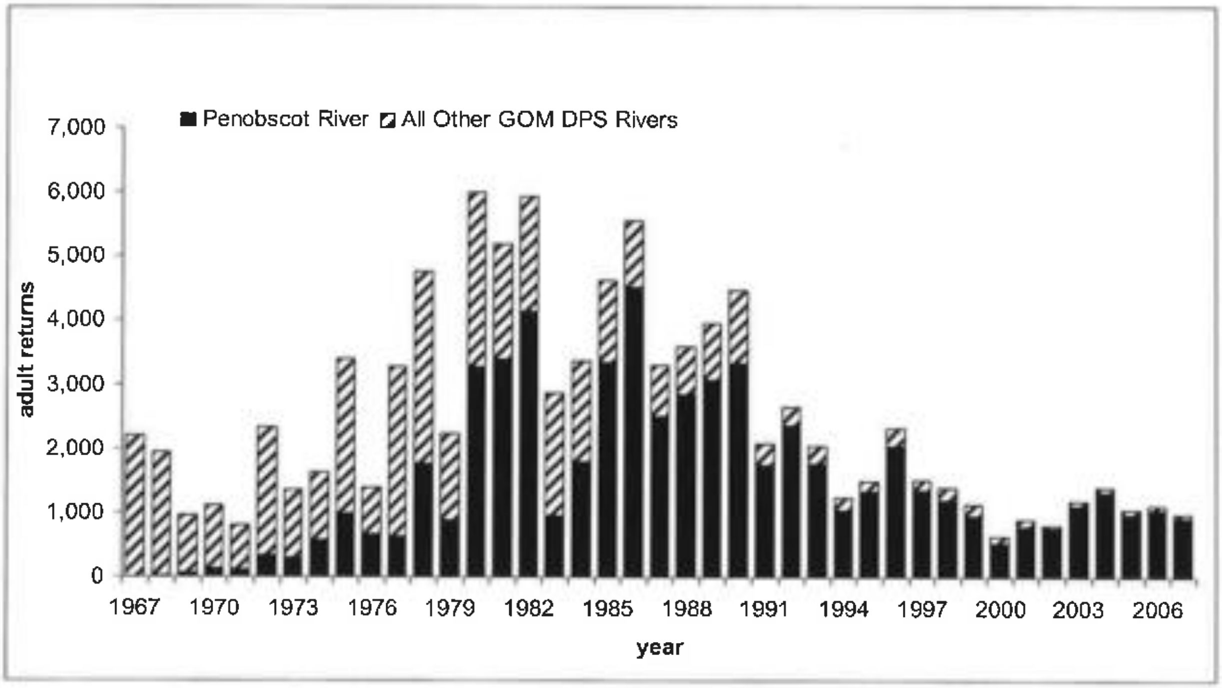
Status and Trends of Atlantic Salmon Rangewide

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

Contemporary abundance estimates are informative in considering the conservation status of the GOM DPS today. After a period of population growth in the 1970s, adult returns of salmon in the GOM DPS have been steadily declining since the early 1980s and appear to have stabilized at very low levels since 2000 (Figure 2). The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from GLNFH that was constructed in 1974. Marine survival remained relatively high throughout the 1980s, and salmon populations in the GOM DPS remained relatively stable until the early 1990s. In the early 1990s marine survival rates decreased, leading to the declining trend in adult abundance observed throughout 1990s. Poor marine survival persists in the GOM DPS to date.

Adult returns to the GOM DPS have been very low for many years and remain extremely low in terms of adult abundance in the wild. Further, the majority of all adults in the GOM DPS return to a single river, the Penobscot, which accounted for 91 percent of all adult returns to the GOM

Figure 1. Adult returns to the GOM DPS 1967-2007.



DPS in 2007. Of the 1044 adult returns to the Penobscot in 2006, 996 of these were the result of smolt stocking and only the remaining 48 were naturally-reared. The term naturally-reared includes fish originating from natural spawning and from hatchery fry (USASAC 2008). Hatchery fry are included as naturally-reared because hatchery fry are not marked; therefore, they cannot be distinguished from fish produced through natural spawning. Because of the extensive amount of fry stocking that takes place in an effort to recover the GOM DPS, it is possible that a substantial number of fish counted as naturally-reared were actually hatchery fry.

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

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

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

Critical Habitat

Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009) (Figure 3). Designation of critical habitat is focused on the known primary constituent elements (PCEs) within the occupied areas of a listed species that are deemed essential to the conservation of the species. Within the GOM DPS, the PCEs for Atlantic salmon are 1) sites for spawning and rearing and 2) sites for migration (excluding marine migration[1]). NMFS chose not to separate spawning and rearing habitat into distinct PCEs, although each habitat does have distinct features, because of the GIS-based habitat prediction model approach that was used to designate critical habitat (74 FR 29300; June 19, 2009). This model cannot consistently distinguish between spawning and rearing habitat across the entire range of the GOM DPS.

The physical and biological features of the two PCEs for Atlantic salmon critical habitat are as follows:

Physical and Biological Features of the Spawning and Rearing PCE[2]

A1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.

A2. Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.

A3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.

A4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.

A5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.

1 Although successful marine migration is essential to Atlantic salmon, NMFS was not able to identify the essential features of marine migration and feeding habitat or their specific locations at the time critical habitat was designated.
2 Appendix A designates the seven physical and biological features of the spawning and rearing PCE as A1 – A7. That convention will be used throughout this opinion.

A6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.

A7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

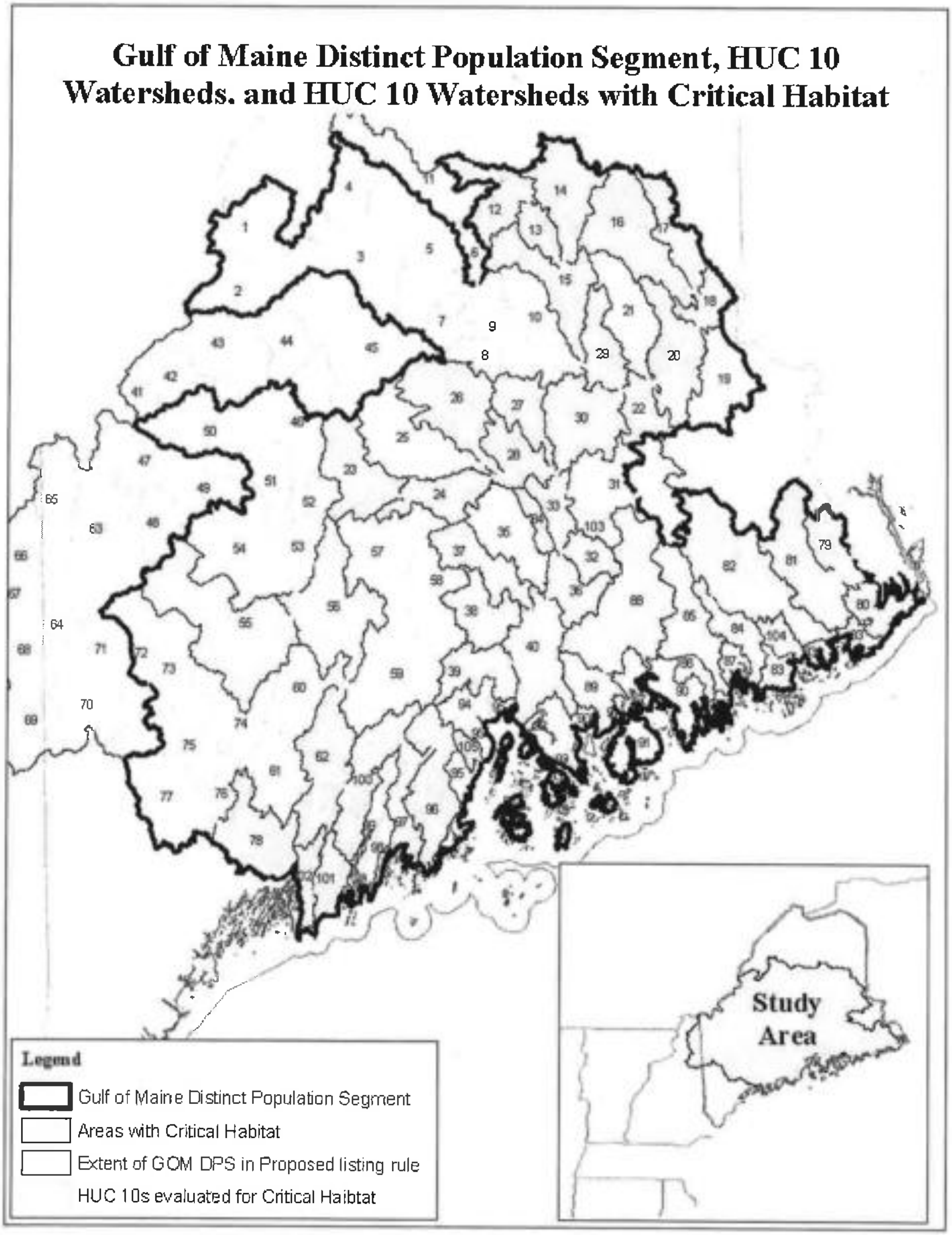


Figure 2. HUC 10 watersheds designated as Atlantic salmon critical habitat within the GOM DPS.

Physical and Biological Features of the Migration PCE[3]

B1. Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations.

B2. Freshwater and estuary migration sites with pool, lake, and instream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon.

B3. Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.

B4. Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.

B5. Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration

B6. Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.

Habitat areas designated as critical habitat must contain one or more PCEs within the acceptable range of values required to support the biological processes for which the species uses that habitat. Critical habitat includes all perennial rivers, streams, and estuaries and lakes connected to the marine environment within the range of the GOM DPS, except for those areas that have been specifically excluded as critical habitat. Critical habitat has only been designated in areas considered currently occupied by the species. Critical habitat includes the stream channels within the designated stream reach and includes a lateral extent as defined by the ordinary high-water line or the bankfull elevation in the absence of a defined high-water line. In estuaries, critical habitat is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

For an area containing PCEs to meet the definition of critical habitat, the ESA also requires that the physical and biological features essential to the conservation of Atlantic salmon in that area "may require special management considerations or protections." Activities within the GOM DPS that were identified as potentially affecting the physical and biological features and therefore requiring special management considerations or protections include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road crossings, mining, dams, dredging, and aquaculture.

Salmon Habitat Recovery Units within Critical Habitat for the GOM DPS

In describing critical habitat for the Gulf of Maine DPS, NMFS divided the GOM DPS into three Salmon Habitat Recovery Units or SHRUs. The three SHRUs include the Downeast Coastal, Penobscot Bay, and Merrymeeting Bay. The SHRU delineations were designed by NMFS to ensure that a recovered Atlantic salmon population has widespread geographic distribution to help maintain genetic variability and, therefore, a greater probability of population sustainability

3 Appendix A designates the six physical and biological features of the migration PCE as B1-B6. That convention will be used throughout this opinion.

in the future. Areas designated as critical habitat within each SHRU are described in terms of habitat units. One habitat unit represents 100 m^2 of suitable salmon habitat (which could be spawning and rearing habitat or migration habitat). Habitat units within the GOM DPS were estimated through the use of a GIS-based salmon habitat model (Wright *et al.* 2008). Additionally, NMFS discounted the functional capacity of modeled habitat units in areas where habitat degradation has affected the PCEs. For each SHRU, NMFS determined that 30,000 fully functional units of habitat are needed in order to achieve recovery objectives for Atlantic salmon. Brief historical descriptions for each SHRU, as well as contemporary critical habitat designations and special management considerations, are provided below.

Merrymeeting Bay SHRU

The Merrymeeting Bay SHRU drains approximately 2,691,814 hectares of land (6,651,620 acres) and contains approximately 372,600 units of historically accessible spawning and rearing habitat for Atlantic salmon located among approximately 5,950 km of historically accessible rivers, lakes and streams. Of the 372,600 units of spawning and rearing habitat, approximately 136,000 units of habitat are considered to be currently occupied. There are forty-five HUC 10 watersheds in this SHRU, but only nine are considered currently occupied. Of the 136,000 occupied units within the Merrymeeting Bay SHRU, NMFS calculated these units to be the equivalent of nearly 40,000 functional units or approximately 11 percent of the historical functional potential. This estimate is based on the configuration of dams within the Merrymeeting Bay SHRU that limit migration and other land use activities that cause degradation of physical and biological features and which reduce the productivity of habitat within each HUC 10. The combined qualities and quantities of habitat available to Atlantic salmon within the currently occupied areas within the Merrymeeting Bay SHRU meet the objective of 30,000 fully functional units of habitat available to Atlantic salmon. Lands controlled by the Department of Defense within the Little Androscoggin HUC 10 and the Sandy River HUC 10 are excluded as critical habitat.

In conclusion, the June 19, 2009 final critical habitat designation for the GOM DPS includes 45 specific areas occupied by Atlantic salmon that comprise approximately 19,571 km of perennial river, stream, and estuary habitat and 799 square km of lake habitat within the range of the GOM DPS and on which are found those physical and biological features essential to the conservation of the species. Within the occupied range of the GOM DPS, approximately 1,256 km of river, stream, and estuary habitat and 100 square km of lake habitat have been excluded from critical habitat pursuant to section 4(b)(2) of the ESA.

Summary of Factors Affecting Recovery of Atlantic Salmon

The recovery plan for the GOM DPS (NMFS and USFWS 2005) and the most recent status review (Fay *et al.* 2006) provide a comprehensive assessment of the many factors, including both threats and conservation actions, currently impacting listed Atlantic salmon.

Efforts to Protect the GOM DPS and its Critical Habitat

Efforts aimed at protecting Atlantic salmon and their habitats in Maine have been underway for well over one hundred years. These efforts are supported by a number of federal, state, and local government agencies, as well as many private conservation organizations. The 2005 recovery plan for the originally-listed GOM DPS (NMFS and USFWS 2005) presented a strategy for recovering Atlantic salmon that focused on reducing the severest threats to the species and immediately halting the decline of the species to prevent extinction. The 2005 recovery program included the following elements:

1. Protect and restore freshwater and estuarine habitats;
2. Minimize potential for take in freshwater, estuarine, and marine fisheries;
3. Reduce predation and competition for all life-stages of Atlantic salmon;
4. Reduce risks from commercial aquaculture operations;
5. Supplement wild populations with hatchery-reared DPS salmon;
6. Conserve the genetic integrity of the DPS;
7. Assess stock status of key life stages;
8. Promote salmon recovery through increased public and government awareness; and
9. Assess effectiveness of recovery actions and revise as appropriate.

A wide variety of activities have focused on protecting Atlantic salmon and restoring the GOM DPS, including (but not limited to) hatchery supplementation; removing dams or providing fish passage; improving road crossings that block passage or degrade stream habitat; protecting riparian corridors along rivers; reducing the impact of irrigation water withdrawals; limiting effects of recreational and commercial fishing; reducing the effects of finfish aquaculture; outreach and education activities; and research focused on better understanding the threats to Atlantic salmon and developing effective restoration strategies. In light of the 2009 GOM DPS listing and designation of critical habitat, the Services expect to produce a new recovery plan for Atlantic salmon.

Threats to Atlantic Salmon Recovery

A threats assessment done as part of the recovery plan resulted in the following list of high priority threats requiring action to reverse the decline of GOM DPS salmon populations:

- Acidified water and associated aluminum toxicity, which decrease juvenile survival
- Aquaculture practices, which pose ecological and genetic risks
- Avian predation
- Changing land use patterns (e.g., development, agriculture, forestry)
- Climate change
- Depleted diadromous fish communities
- Incidental capture of adults and parr by recreational anglers
- Introduced fish species that compete or prey on Atlantic salmon
- Low marine survival
- Poaching of adults in DPS rivers
- Recovery hatchery program (potential for artificial selection/domestication)
- Sedimentation of spawning and rearing habitat
- Water extraction

Fay *et al.* (2006) examined each of the five statutory ESA listing factors and determined that each of the five listing factors is at least partly responsible for the present low abundance of the GOM DPS. The information presented in Fay *et al.* (2006) is reflected in and supplemented by the final listing rule for the new GOM DPS (74 FR 29344; June 19, 2009). The following gives a brief overview of the five listing factors as related to the GOM DPS.

1. **Present or threatened destruction, modification, or curtailment of its habitat or range** – Historically and, to a lesser extent currently, dams have adversely impacted Atlantic salmon by obstructing fish passage and degrading riverine habitat. Dams are considered to be one of the primary causes of both historic declines and the contemporary low abundance of the GOM DPS. Land use practices, including forestry and agriculture, have reduced habitat complexity (e.g., removal of large woody debris from rivers) and habitat connectivity (e.g., poorly designed road crossings) for Atlantic salmon. Water withdrawals, elevated sediment levels, and acid rain also degrade Atlantic salmon habitat.

2. **Overutilization for commercial, recreational, scientific, or educational purposes** – While most directed commercial fisheries for Atlantic salmon have ceased, the impacts from past fisheries are still important in explaining the present low abundance of the GOM DPS. Both poaching and by-catch in recreational and commercial fisheries for other species remain of concern, given critically low numbers of salmon.

3. **Predation and disease** – Natural predator-prey relationships in aquatic ecosystems in the GOM DPS have been substantially altered by introduction of non-native fishes (e.g., chain pickerel, smallmouth bass, and northern pike), declines of other native diadromous fishes, and alteration of habitat by impounding free-flowing rivers and removing in-stream structure (such as removal of boulders and woody debris during the log-driving era). The threat of predation on the GOM DPS is noteworthy because of the imbalance between the very low numbers of returning adults and the recent increase in populations of some native predators (e.g., double-crested cormorant), as well as non-native predators. Atlantic salmon are susceptible to a number of diseases and parasites, but mortality is primarily documented at conservation hatcheries and aquaculture facilities;

4. **Inadequacy of existing regulatory mechanisms** – The ineffectiveness of current federal and state regulations at requiring fish passage and minimizing or mitigating the aquatic habitat impacts of dams is one of the significant threats to the GOM DPS today. Furthermore, most dams in the GOM DPS do not require state or federal permits. Although the State of Maine has made substantial progress in regulating water withdrawals for agricultural use, threats still remain within the GOM DPS, including those from the effects of irrigation wells on salmon streams;

5. **Other natural or manmade factors** – Poor marine survival rates of Atlantic salmon are a significant threat, although the causes of these decreases are unknown. The role of ecosystem function among the freshwater, estuarine, and marine components of the Atlantic salmon's life history, including the relationship of other diadromous fish species in Maine (e.g., American shad, alewife, sea lamprey), is receiving increased scrutiny in its contribution to the current status of the GOM DPS and its role in recovery of the Atlantic salmon. While current state and federal regulations pertaining to finfish aquaculture have reduced the risks to the GOM DPS (including eliminating the use of non-North American Atlantic salmon and improving containment protocols), risks form

the spread of diseases or parasites and from farmed salmon escapees interbreeding with wild salmon still exist.

Threats to Critical Habitat within the GOM DPS
The final rule designating critical habitat for the GOM DPS identifies a number of activities that have and will likely continue to impact the biological and physical features of spawning, rearing, and migration habitat for Atlantic salmon. These include agriculture, forestry, changing land-use and development, hatcheries and stocking, roads and road-crossings and other in-stream activities (such as alternative energy development), mining, dams, dredging, and aquaculture. Most of these activities have or still do occur, at least to some extent, in each of the three SHRUs.

The Penobscot SHRU once contained high quality Atlantic salmon habitat in quantities sufficient to support robust Atlantic salmon populations. The mainstem Penobscot has the highest biological value to the Penobscot SHRU because it provides a central migratory corridor crucial for the entire Penobscot SHRU. Dams, along with degraded substrate and cover, water quality, water temperature, and biological communities, have reduced the quality and quantity of habitat available to Atlantic salmon populations within the Penobscot SHRU. A combined total of twenty FERC-licensed hydropower dams in the Penobscot SHRU significantly impede the migration of Atlantic salmon and other diadromous fish to nearly 300,000 units of historically accessible spawning and rearing habitat. Agriculture and urban development largely affect the lower third of the Penobscot SHRU below the Piscataquis River sub-basin by reducing substrate and cover, reducing water quality, and elevating water temperatures. Introductions of smallmouth bass and other non-indigenous species significantly degrade habitat quality throughout the mainstem Penobscot and portions of the Mattawamkeag, Piscataquis, and lower Penobscot sub-basins by altering predator/prey relationships. Similar to smallmouth bass, recent Northern pike introductions threaten habitat in the lower Penobscot River below the Great Works Dam.

Today, dams are the greatest impediment, outside of marine survival, to the recovery of salmon in the Kennebec and Androscoggin river basins (Fay *et al.* 2006). Hydropower dams in the Merrymeeting Bay SHRU significantly impede the migration of Atlantic salmon and other diadromous fish and either reduce or eliminate access to roughly 352,000 units of historically accessible spawning and rearing habitat. In addition to hydropower dams, agriculture and urban development largely affect the lower third of the Merrymeeting Bay SHRU by reducing substrate and cover, reducing water quality, and elevating water temperatures. Additionally, smallmouth bass and brown trout introductions, along with other non-indigenous species, significantly degrade habitat quality throughout the Merrymeeting Bay SHRU by altering natural predator/prey relationships.

Status of Atlantic Salmon in the Action Area
Adult Atlantic salmon ascend the rivers of New England beginning in the spring and continuing into the fall, with the peak occurring in June. Spawning occurs in late October through November. In late March or April, the eggs hatch into larval alevins or sac fry. Alevins remain in the redd for about six weeks and are nourished by their yolk sac. Alevins emerge from the gravel about mid May, generally at night, and begin actively feeding. The survival rate of these fry is affected by

stream gradient, overwintering temperatures and water flows, and the level of predation and competition (Bley and Moring 1988). Within days, the free-swimming fry enter the parr stage. In a parr's second or third spring, when it has grown to 12.5-15 cm in length, physiological, morphological and behavioral changes occur (Schaffer and Elson 1975). This process, called smoltification, prepares the parr for migration to the ocean and life in salt water. As smolts migrate from the rivers between April and June, they tend to travel near the water surface, where they must contend with changes in water temperature, pH, dissolved oxygen, pollution levels, and predation. Most smolts in New England rivers enter the sea during May and June to begin their ocean migration. Due to the time of year of the proposed action (i.e., August 2011), the only life stage of Atlantic salmon that would be present in the action area are adults that may be migrating upriver.

Counts for Atlantic salmon in the Kennebec River are available since 2006 when a fishlift was installed at the first dam on the river (Lockwood Dam)(NMFS and USFWS 2009). In 2006, the Kennebec River trap count at the Lockwood Dam was 15 returning adult salmon; in 2007, the number was 16. In 2008, the number of Atlantic salmon observed at the Lockwood fish lift was 22 fish with the majority (15) observed in July and the remainder in June (5), September (1) and October (1). A total of 33 Atlantic salmon were captured at the Kennebec River trap in 2009 as follows: 5 (May); 7(June); 15 (July); 1 (August); 1 (September); 4(October). In 2010, there were a total of 5 returns to the Kennebec River, 4 in June and 1 in October. As of June 10, 2011, 1 adult Atlantic salmon had been documented at the Lockwood fish lift in 2011.

Based on the best available information, there are likely to be a small number of adult Atlantic salmon in the action area at the time when the proposed dredging occurs. No other life stage is likely to be present.

Shortnose Sturgeon

Shortnose sturgeon life history

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. They feed on a variety of benthic and epibenthic invertebrates including mollusks, 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)[4] 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.

4 For purposes of this consultation, Northern rivers are considered to include tributaries of the Chesapeake Bay northward to the St. John River in Canada. Southern rivers are those south of the Chesapeake Bay.

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 and a mean of 11,568 eggs/kg body weight (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 develops 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. Dispersal rates differ at least regionally, laboratory studies on Connecticut River larvae indicated dispersal peaked 7-12 days after hatching in comparison to Savannah River larvae that had longer dispersal rates with multiple, prolonged peaks, and a low level of downstream movement that continued throughout the entire larval and early juvenile period (Parker 2007). Synder (1988) and Parker (2007) considered individuals to be juvenile when they reached 57mm TL. Laboratory studies demonstrated that larvae from the Connecticut River made this transformation on day 40 while Savannah River fish made this transition on day 41 and 42 (Parker 2007).

The juvenile phase can be subdivided in to young of the year (YOY) and immature/ sub-adults. YOY and sub-adult habitat use differs and is believed to be a function of differences in salinity tolerances. Little is known about YOY behavior and habitat use, though it is believed that they are typically found in channel areas within freshwater habitats upstream of the saltwedge for about one year (Dadswell et al. 1984, Kynard 1997). One study on the stomach contents of YOY revealed that the prey items found corresponded to organisms that would be found in the channel environment (amphipods) (Carlson and Simpson 1987). Sub-adults are typically described as age one or older and occupy similar spatio-temporal patterns and habitat-use as adults (Kynard 1997). Though there is evidence from the Delaware River that sub-adults may overwinter in different areas than adults and do not form dense aggregations like adults (ERC Inc. 2007). Sub-adults feed indiscriminately, typical prey items found in stomach contents include aquatic insects, isopods, and amphipods along with large amounts of mud, stones, and plant material (Dadswell 1979, Carlson and Simpson 1987, Bain 1997).

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 reach between 7-9.7°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 their natal river (Kieffer and Kynard 1996). In the Merrimack River, males returned to only one reach during a four year telemetry study (Kieffer and Kynard 1996). Squires (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 (1996) 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 - 15°, and bottom water velocities of 0.4 to 0.8 m/sec (Dadswell et al. 1984; Hall et al. 1991, Kieffer and Kynard 1996, NMFS 1998). For northern shortnose sturgeon, the temperature range for spawning is 6.5-18.0°C (Kieffer and Kynard in press). 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 or sub-adults tend to move downstream in fall and winter as water temperatures decline and the salt wedge recedes and 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). Non-spawning movements include 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. 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 et al. 1994; Rogers and Weber 1995; Weber 1996).

While shortnose sturgeon do not undertake the significant marine migrations seen in Atlantic sturgeon, telemetry data indicates that shortnose sturgeon do make localized coastal migrations. This is particularly true within certain areas such as the Gulf of Maine (GOM) and among rivers in the Southeast. Interbasin movements have been documented among rivers within the GOM and between the GOM and the Merrimack, between the Connecticut and Hudson rivers, the Delaware River and Chesapeake Bay, and among the rivers in the Southeast.

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. Dissolved oxygen (DO) also seems to play a role in temperature tolerance, with increased stress levels at higher temperatures with low DO versus the ability to withstand higher temperatures with elevated DO (Niklitchek 2001).

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 values 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 century and early twentieth century, shortnose sturgeon commonly were taken in a commercial fishery for the closely related and commercially valuable Atlantic sturgeon (*Acipenser oxyrinchus*). 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, in the final recovery plan

NMFS recognized 19 separate 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)[5] 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 1997) 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

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5 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.

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 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. Population sizes vary across the species' range. From available estimates, the smallest populations occur in the Cape Fear (~8 adults; Moser and Ross 1995) in the south and Merrimack and Penobscot rivers in the north (~ several hundred to several thousand adults depending on population estimates used; M. Kieffer, United States Geological Survey, personal communication; Dionne 2010), while the largest populations are found in the Saint John (~18, 000; Dadswell 1979) and Hudson Rivers (~61,000; Bain et al. 1998). As indicated in Kynard 1996, 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 1996 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 or jeopardize 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

(Varanasi 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).

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 on 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 sturgeonare 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.

Global climate change may affect shortnose sturgeon in the future. Rising sea level may result in the salt wedge moving upstream in affected rivers, possibly affecting the survival of drifting larvae and YOY shortnose sturgeon that are sensitive to elevated salinity. Similarly, for river systems with dams, YOY may experience a habitat squeeze between a shifting (upriver) salt wedge and a dam causing loss of available habitat for this life stage.

The increased rainfall predicted by some models in some areas may increase runoff and scour spawning areas and flooding events could cause temporary water quality issues. Rising temperatures predicted for all of the U.S. will likely exacerbate existing water quality problems with DO and temperature. While this occurs primarily in rivers in the southeast U.S. and the Chesapeake Bay, it may start to occur more commonly in the northern rivers. One might expect range extensions to shift northward (i.e. into the St. Lawrence River, Canada) while truncating the southern distribution. Increased droughts (and water withdrawal for human use) predicted by some models in some areas may cause loss of habitat including loss of access to spawning habitat. Drought conditions in the spring may also expose eggs and larvae in rearing habitats. If a river becomes too dry all shortnose sturgeon life stages, including adults, may become susceptible to strandings. Low flow and drought conditions are also expected to cause additional water quality issues. Any of the conditions associated with climate change are likely to disrupt river ecology causing shifts in community structure and the type and abundance of prey. Additionally, cues for spawning migration and spawning could occur earlier in the season causing a mismatch in prey that are currently available to developing shortnose sturgeon in rearing habitat.

Implications of climate change to shortnose sturgeon have been speculated, yet no scientific data are available on past trends related to climate effects on this species and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, the specific effects to this species resulting from climate change are not predictable or quantifiable to any degree that would allow for more detailed analysis in this consultation. Given this uncertainty and the likely rate of change associated with climate impacts (i.e., the century scale), it is unlikely that climate related impacts will have a significant effect on shortnose sturgeon over the temporal scale of the proposed action (i.e., August 2011).

Status of Shortnose Sturgeon in the Kennebec River

On September 19, 1994, NMFS received a petition from the Edwards Manufacturing Company, Inc., to delist shortnose sturgeon occurring in the Androscoggin and Kennebec rivers. In the ensuing status review, NMFS found that the petition to delist this population segment was not warranted because: 1) the population estimate used by the petitioners was less reliable than the best estimate accepted by NMFS; 2) the best population estimate available did not exceed the interim threshold at which the population segment would be a candidate for delisting; 3) no recent information was available to assess the population dynamics; and 4) threats to shortnose sturgeon habitat still exist throughout the Androscoggin and Kennebec rivers (NMFS 1996).

The Kennebec system includes the Kennebec, Androscoggin and Sheepscot Rivers. Shortnose sturgeon occur in the estuarine complex formed by the Sheepscot, Kennebec, and Androscoggin rivers. Atkins (1887) documented the presence of sturgeon in Maine rivers, though they were identified as common sturgeon (*Acipenser sturio*). Fried and McCleave (1973) discovered shortnose sturgeon within Montsweag Bay in the Sheepscot River in 1971. This was the first reported occurrence of shortnose sturgeon in Maine. Shortnose were subsequently found in the Kennebec River by ME DMR in 1977 (Squiers and Smith, 1979). Historically, the upstream extent of shortnose sturgeon in the Kennebec is thought to have been Ticonic Falls (rkm 98).

Sturgeon were tagged with Carlin tags from 1977 to 1981, with recoveries in each of the following years. A Schnabel estimate of 7,200 (95% CI, 5,000 to 10,800) adults for the combined estuarine complex was computed from the tagging and recapture data from 1977 through 1981 (Squiers et al. 1982). A Schnabel estimate using tagging and recapture data from 1998 - 2000 indicates a population estimate of 9,488 (95% CI, 6,942 to 13,358) for the estuarine complex (Squiers 2003). The average density of adult shortnose sturgeon/hectare of habitat in the estuarine complex of the Kennebec River was the second highest of any population studied through 1983 (Dadswell et al, 1984). The Schnabel estimate from 1998-2000 is the most recent population estimate for the Kennebec River shortnose sturgeon population; however, this estimate includes fish from the Androscoggin and Sheepscot rivers as well and does not include an estimate of the size of the juvenile population. A comparison of the population estimate for the estuarine complex from 1982 (Squiers et al. 1982) to 2000 (Maine DMR 2003) suggests that the adult population has grown by approximately 30% in the last twenty years. Based on this information, NMFS believes that the shortnose sturgeon population in the Kennebec River is increasing; however, without more information on the status of more recent year classes (i.e., juveniles) it is difficult to speculate about the long term survival and recovery of this population.

Spawning

In 1999, the Edward's Dam, which represented the first significant impediment to the northward migration of shortnose sturgeon in the Kennebec River, was removed. The Lockwood Dam continues to operate, though it is not thought to impede shortnose access to historic habitat given that the Lockwood Project is situated at Ticonic Falls (rkm 98), the historic upstream extent of shortnose in the Kennebec River. Thus, with the removal of the Edwards dam almost 100% of historic habitat is now accessible. Since the removal of the Edwards Dam, shortnose sturgeon have been documented at the Lockwood Dam (rkm 98) indicating this habitat is being utilized to some extent. It is unknown if additional spawning sites above the site of the former Edwards Dam are now being used. In populations of shortnose sturgeon that have free access to the total length of a river (e.g., no dam within the species' historical range in the river), spawning areas are located at the most upstream reach of the river used by sturgeon (NMFS 1998). Based on this pattern, it is likely that shortnose sturgeon may now be spawning in additional upriver sites. In order to monitor the recolonization of the habitat above Edwards Dam, ME DMR conducted ichthyoplankton surveys from 1997 through 2001. Sampling sites were located both above and below the dam and were surveyed using surface tows with plankton nets and stationary sets with D-shaped plankton nets. While no shortnose sturgeon eggs or larvae were collected above the former dam site in 2000 or 2001 (Wippelhauser 2003), small numbers of eggs and larvae were collected at sites in the first nine kilometers below the site (rkm 61-70). In May of 1999, 135 shortnose sturgeon were captured approximately 10 km below Edwards dam (rkm 60) and were assumed to be on the spawning run. The presence of ELS and the captures in 1999, indicate that the major spawning area for shortnose sturgeon in the Kennebec River is likely located in the first 11 km below the former Edwards Dam site (rkms 59-70) (Squiers et al. 1982, Wippelhauser 2003). While there have not been any directed studies to determine if shortnose sturgeon are utilizing the habitat above the former Edwards Dam for spawning, several shortnose sturgeon have been captured incidental to other studies in Waterville (and some at the base of the Lockwood Dam), 27 km above the former Edwards Dam.

In the Kennebec River, movement to the spawning grounds is suspected to occur in early spring (April - May) when water temperatures are between 8-9°C. In general shortnose sturgeon quickly leave the spawning grounds for summer foraging areas when temperatures exceed 15°C (Squiers et al. 1982).

In the Androscoggin River, shortnose sturgeon migration, and thus spawning, was likely limited historically by the natural falls located at the Brunswick Dam (rkm 44). From 1971-1981, MEDMR conducted gillnet studies to identify spawning areas. During this period large numbers of shortnose sturgeon were captured between Brunswick and Topsham, approximately 400m downstream of the Rt 201 Bridge. Water temperatures ranged between 8.5. and 14.5°C (late April until the end of May), many of the males captured were freely expressing milt and several females were ripe (Squiers et al. 1982). Tracking studies to delineate spawning habitat were performed on the Androscoggin River during 1993. Gill nets were used to capture study animals and catch rates were recorded. Gill net catch-per-unit-effort during this study was the highest recorded in this area, suggesting that the population in the Androscoggin has increased since last surveyed. This study indicated that spawning was concentrated in the reach of river approximately 500m downstream of the Brunswick Dam. Additionally, based upon egg collections at this site, spawning occurred from May 7-19 and temperatures ranged from 7°-17°C. The spawning migration is estimated to extend from the last week in April through May.

Foraging

Foraging areas have been identified in the Sasanoa River entrance[6] and in the mainstem of the Kennebec River below Bath, from mid-April through November or early December (Squiers 1982, Normandeau 1999). Between June and September, shortnose sturgeon forage in shallow waters on mud flats that are covered with rooted aquatic plants. In the summer months,

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6 The Sasanoa River entrance is located directly across the Kennebec River from the Bath Iron Works facility. The river is less than ½ mile wide at this point.

concentrations of shortnose sturgeon have also been known to move up into the freshwater reaches of the Kennebec River and foraging shortnose sturgeon have also been seen in Montsweag and Hockomock Bays in the Sheepscot River, which is located near the eastern end of the Sasanoa River (NMFS 1996). McCleave et al. (1977) examined several stomachs from shortnose sturgeon captured in Montsweag Bay and found crangon shrimp (*Crangon septemspinosous*); clams (*Mya arenaria*); and small winter flounder (*Pseudopleuronectes americanus*) were common prey items.

Overwintering

Studies indicate that at least a portion of the shortnose sturgeon population in the Kennebec River overwinters in Merrymeeting Bay (ME DMR 1996). The seasonal migrations of shortnose sturgeon are believed to be correlated with changes in water temperature. In 1999, when a tracking study was performed by Normandeau Associates, the water temperature near Bath Iron Works (BIW) reached the 8-9°C threshold (believed to be the trigger prompting spawning fish to migrate to the spawning area) in mid-April. Also during the tracking study, several fish presumed to be non-spawning sturgeon, were documented in the Chops Point and Swan Island areas (north of Doubling Point) in late March and then were found to have migrated south to the BIW region (e.g., north and south of the BIW Pier and Museum Point) early in April.

Until a study aimed at specifically determining overwintering locations was conducted by the MEDMR in 1996 for the Maine Department of Transportation (DOT), the sites thought to be the most likely overwintering sites were deep pools below Bluff Head, and possibly in adjacent estuaries such as the Sheepscot (Squiers and Robillard 1997). The 1996 study of overwintering activity suggests that at least one overwintering site is located above Bath. This is based on tracking 15 shortnose sturgeon collected and released in the vicinity of the Sasanoa River (Pleasant Cove), Winnegance Cove (near the Doubling Point reach), and Merrymeeting Bay (north of Bath and the Sasanoa River entrance). Tracking was done from October through January. Eleven of these fish were relocated in Merrymeeting Bay. Two of the fish from Pleasant Cove were never found in Merrymeeting Bay; one Pleasant Cove fish moved to Winnegance Cove and back to Pleasant Cove and another moved to Days Ferry (half way between Bath and Merrymeeting Bay). All of the fish that continued to transmit after November were only found in upper Merrymeeting Bay on the east-side of Swan Island. This is consistent with the trends for movement of shortnose sturgeon in the Delaware River (O'Herron 1992). Overwintering sturgeon in the Delaware River are found in the area of Newbold Island, in the Trenton to Kinkora river reach, in an area geographically similar to the area around Swan Island.

Fisheries sampling was conducted from April 1997 through June 1998 by Normandeau Associates, using a semi-balloon otter trawl with 1 ½ inch mesh in the cod end and a ¼ inch liner. Sampling occurred monthly in April, May and December. At the request of NMFS and Maine DMR, sampling frequency increased to twice monthly from June through November 1997 and April through June 1998. Trawl locations were located near the BIW outfitting pier (T1), south of the pier near the dry dock facility (T2), and south of Trufant Ledge (T3). In August, 1997 additional stations were added near Sasanoa Point (T4), Hanson Bay (T5), north of Hospital Point on the west (T6) and east (T7) shores, and in Winnegance Creek (T8). During high slack tide, two tows were made at each sampling location. Three of these sampling locations are in the vicinity of Doubling Point (T6, T7 and T8) (located approximately one nautical mile south of BIW). Results of the trawl study confirmed that shortnose sturgeon were present in the Bath area from April through November. No sampling was conducted between December and March.

Beginning in 1998, 17 shortnose sturgeon were collected via gillnet in the BIW area and were tagged and released near the capture site. Tracking began in 1998 and continued into 1999. Some of the fixed receivers were moved from their original locations and redeployed in areas of higher shortnose sturgeon abundance. In 1999, tracking was performed in three primary locations from late March through early May and mid-September through Mid-December. Through December 15, all scans detected shortnose sturgeon in the vicinity of BIW. No tracking was conducted between mid-December and mid-March. In addition, trawling activities from 1999-2001 consistently captured shortnose sturgeon in the Bath area from April through November when trawls were deployed. Studies were not conducted outside of that time of year.

Interbasin Movemement

The University of Maine and ME DMR have recently collected data indicating quite extensive coastal migrations between the Kennebec and Penobscot Rivers. The distance between the mouth of the Kennebec and Penobscot rivers is approximately 70 km. These studies were undertaken in 2006 and are ongoing. During 2006 sonic transmitters were implanted in a total of 39 shortnose sturgeon from June 14, 2006-September 27, 2007 in the Penobscot River (Fernandes 2008). Eleven individuals have been subsequently detected by the passive receiver array in the Kennebec River. Fish originating in the Kennebec River have also been subsequently detected in the Penobscot River (Fernandes 2008). The motivation to undertake these coastal migrations is not entirely clear; however, fish migrating from the Penobscot River to the Kennebec River have been documented at known overwintering sites and suspected spawning areas. 7 shortnose sturgeon tagged in the Penobscot River and detected leaving the river between September and November 2007 were subsequently detected in the Kennebec river. 4 of the 7 individuals were located in February of 2008 at the suspected overwintering site in Merrymeeting Bay (Fernandes 2008). Furthermore, some of the females moving from the Penobscot to the Kennebec were also documented with late stage eggs (Fernandes 2008). Telemetry data also indicates that shortnose sturgeon utilize smaller coastal river systems during these migrations. Fish moving between the Penobscot and Kennebec rivers have been documented utilizing a number of small coastal rivers in between these two larger systems including the Darmariscotta, St. George, Medomak, and Passagasawakeag.

Shortnose Sturgeon in the Action Area

Maine DMR has been sampling for shortnose sturgeon in the Kennebec River since 1977. Unpublished data provided by Maine DMR to NMFS indicates that shortnose sturgeon are present in the action area, specifically the Doubling Point region (rkm 15-21) from April through November. Shortnose sturgeon have been captured in this area of the river in August. In August, it is likely that shortnose sturgeon are using this general area for foraging, resting and migrating. Since 1977, a total of 31 net sets have been made in this area, with a total of 134 shortnose sturgeon captured. Using the total data set, a catch per unit effort (number of sturgeon caught per one hour set of a 100m net) for August is calculated at 1.11. When capture data from the 1970s and 1980s is excluded, a CPUE of 1.60 is calculated. As explained above, the shortnose sturgeon population numbers are significantly different from the 1970s to 2000 (Maine

DMR 2003). As such, it is more appropriate to use CPUE data from the 1990s and excluding capture data from the 1970s and 1980s as the 1990s data is a better reflection of the current status of the Kennebec River shortnose sturgeon population.

Little information is available on the use of the Popham Beach area by shortnose sturgeon. Until recently, it was assumed that as shortnose sturgeon were thought to remain within their natal rivers, and Popham Beach is located at the mouth of the river, that any use of this area would be rare. Shortnose sturgeon have recently been documented to migrate between the Kennebec and Penobscot Rivers as well as from the Merrimack River to the Kennebec River. All of these sturgeon would need to pass through the Popham Beach area to reach these destinations.

Recent data collected by UMaine and Maine DMR indicate that migration between river systems in Maine is more extensive than was previously thought. As summarized by Dionne (2010a in Maine DMR 2010), between 2006 and 2009 a total of 68 shortnose sturgeon were implanted with coded acoustic transmitters. Of the 46 active acoustically tagged individuals, 13 remained within the Penobscot River system during the study period. These fish demonstrated an in-river migration pattern that involved downriver movement from the wintering area in the Penobscot River in the spring, followed by gradual upriver movement throughout the summer prior to returning to the wintering area in the fall (Fernandes et al. 2010). Eleven individuals were characterized as "spring emigrants." These fish followed a similar in-river movement pattern to resident fish but made a single migration out of the Penobscot River system in the spring (April 12 – May 11) while the resident fish remained in the estuary. These fish largely returned to the Penosbcot River within two months (May 25 – July 7); with one fish remaining outside the Penobscot River for approximately 1 year. Fifteen tagged fish were determined to be "fall emigrants." These fish followed the typical in-river migration pattern while in the river, with the exception of using the Kennebec River overwintering site. These fish utilized the Penobscot River from mid-spring through early fall (entering between April 19 and June 19 and leaving between September 9 and November 4). The remaining 7 tagged fish were classified as "summer emigrants." The movements of these fish were not as well defined; these fish were observed leaving the Penobscot between June 1 and July 1 with some individuals overwintering in the Penobscot and some in the Kennebec. Returns to the Penobscot were made between April 26 and June 8. At least one of these fish spent over three months in coastal river systems between the Penobscot and Kennebec Rivers.

While this data is limited, it indicates that shortnose sturgeon movements between the Penobscot and Kennebec Rivers may be least likely during the months of July and August. However, without more extensive tracking in the Popham Beach area, it is difficult to predict at what time of year shortnose sturgeon are most likely to occur in this area. As such, NMFS assumes that shortnose sturgeon could be present in the Popham Beach area anytime outside of the overwintering period and that individual shortnose sturgeon could be present in the Popham Beach area during August when dredging is proposed.

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, scientific research, and fisheries, and recovery activities associated with reducing those impacts.

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

The only Federal action that has occurred in the action area is maintenance dredging of the Federal channel. Effects of past dredging are summarized in the "Background of the Action" section above. While NMFS has completed ESA Section 7 consultation on other Federal actions in the Kennebec River (e.g., Lockwood Dam, dredging at BIW), the action area of those consultations is outside the action area considered in this consultation. Effects of these other actions are incorporated into the Status of the Species section above.

Effects of Non-Federally Regulated Actions

Non-Federally Regulated Fishery Operations
Unauthorized take of shortnose sturgeon is prohibited by the ESA. However, shortnose sturgeon are taken incidentally in other anadromous fisheries along the East Coast and may be targeted by poachers (NMFS 1998). The Kennebec River is an important corridor for migratory movements of various species including alewife (*Alosa pseudohernegus*), American eel (*Anguilla rostrata*), Atlantic sturgeon (*Acipenser oxyrhynchus*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), rainbow smelt (*Osmerus mordax*), striped bass (*Morone saxatilis*) and lobster (*Homarus americanus*). Historically, the river and its tributaries supported the largest commercial fishery for shad in the State of Maine. However, pollution and the construction of dams decimated the shad runs in the late 1920's and early 1930's. Shortnose sturgeon in the Kennebec River may have been taken as bycatch in the shad fishery or other fisheries active in the action area. It has been estimated that approximately 20 shortnose sturgeon are killed each year in the commercial shad fishery 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 river has not been well documented due to confusion over distinguishing between Atlantic sturgeon and shortnose sturgeon. Due to a lack of reporting, no information on the number of shortnose sturgeon caught and released or killed in commercial or recreational fisheries on the Kennebec River is available.

Unauthorized take of Atlantic salmon is prohibited by the ESA. However, if present, Atlantic salmon juveniles may be taken incidentally in fisheries by recreational anglers. Due to a lack of reporting, no information on the number of Atlantic salmon caught and released or killed in recreational fisheries in the Kennebec River is available.

Other Potential Sources of Impacts in the Action Area
Scientific Studies
Research projects conducted in the Kennebec River since shortnose sturgeon were first detected in 1971 may have influenced shortnose sturgeon survival, reproduction and/or migration.

Research projects conducted in the action area included, but were not limited to, capturing, measuring, weighing, tagging (internal and external) and obtaining eggs from shortnose sturgeon. There are no current research projects in the Kennebec River permitted by NMFS.

Mr. Tom Squiers of Maine's Department of Marine Resources (DMR) possessed various ESA Section 10(a)(1)(A) Permits to conduct scientific research on shortnose sturgeon in Maine waters, including the Kennebec River, from 1976 through 2001. Over the life of these various permits, several thousand shortnose sturgeon were captured, handled and tagged. Several shortnose sturgeon died as a result of research activities, most often due to entanglement in gill nets. For example, from 1977-1996, 1780 shortnose sturgeon were captured and 30 died. From 1997-2001, approximately 1000 shortnose sturgeon were captured and there were 3 reported mortalities.

Ms. Gail Wipplehauser of Maine DMR currently possesses a Section 10(a)(1)(A) Permit to conduct scientific research on shortnose sturgeon in the Kennebec River. The permit is valid from November 2006 – November 2011. The permit authorizes (annually) capturing, handling, weighing and releasing 500 juvenile or adult shortnose sturgeon each year. Of these 500 fish, 480 may receive PIT tags and 20 may be acoustically tagged. The permit also authorizes the lethal capture of up to 30 shortnose sturgeon eggs and larvae. No research has been conducted under this permit to date.

On July 27, 2007 NMFS Office of Protected Resources issued a Biological Opinion on the effects of issuing a grant to Maine DMR to fund a conservation program for rainbow smelt, Atlantic sturgeon and Atlantic salmon. The activities will occur in several rivers in Maine including the Kennebec River. The Opinion exempts the incidental take of up to 10 live shortnose sturgeon (due to entanglement in gill net gear) and up to 50 shortnose sturgeon eggs in D-nets. No research has been conducted under this program to date.

MDMR has conducted periodic monitoring of Atlantic salmon populations in the Kennebec River. MDMR was authorized in 2009 to sample listed Atlantic salmon in the GOM DPS under the USFWS' endangered species blanket permit (No. 697823) issued pursuant to Section 10(a)(1)(A) of the ESA. Under USFWS permit No. 697823, MDMR is authorized to take (typically meaning capture) up to 2% of any given lifestage of Atlantic salmon during scientific research and recovery efforts (except for adults of which less than 1% can be taken). Lethal take of salmon in the Kennebec River during MDMR sampling is expected to be less than 2% consistent with take estimates for other Maine streams where such records are maintained by MDMR.

It is possible that research in the action area may have influenced and/or altered the migration patterns, reproductive success, foraging behavior, and survival of shortnose sturgeon. Shortnose sturgeon have also been incidentally captured in research activities targeting other species. Most recently, five shortnose sturgeon were captured in a beach seine targeting striped bass in the Kennebec River in the spring of 2007.

Contaminants and Water Quality
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.

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 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 is 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 concentration in pallid sturgeon livers indicates that DDE increase proportionally with fish size (NMFS 1998).

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).

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 and salmon populations. The compounds associated with discharges can alter the pH or receiving waters, which may lead to mortality, changes in fish behavior, deformations, and reduced egg production and survival.

Hydroelectric facilities

The Lockwood Dam is the first impediment to upstream migration on the Kennebec River mainstem. The Lockwood Project includes a fish lift which adult Atlantic salmon have been documented to use, with 15-24 adults documented annually between 2006 and 2009.

There are 9 facilities upstream of the Lockwood Project on the mainstem Kennebec River and an additional 4 on upstream tributaries. There are also 7 facilities located on downstream tributaries. While the effects of these other facilities are largely unknown, they all have the potential to affect flow and water quality in the River and may affect Atlantic salmon in the action area and may impede salmon movements within this river system. To the extent that these upstream facilities affect water conditions (flow, quantity, quality) downstream of the Lockwood project, the operation of these facilities may also affect shortnose sturgeon habitat and/or migration patterns.

Global Climate Change
There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities - frequently referred to in layman's terms as "global warming." Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The EPA's climate change webpage provides basic background information on these and other measured or anticipated effects (see www. epa.gov/climatechange/index.html). Activities in the action area that may have contributed to global warming include the combustion of fossil fuels by vessels.

The impact of climate change on Atlantic salmon is likely to be related to ocean acidification, changes in water temperatures, potential changes to salinity in rivers, and the potential decline of forage. These changes may effect the distribution of species and the fitness of individuals and populations due to the potential loss of foraging opportunities, displacement from ideal habitats and potential increase in susceptibility to disease (Elliot and Simmonds 2007). A decline in reproductive fitness as a result of global climate change could have profound effects on the abundance and distribution of Atlantic salmon in the action area, and throughout their range.

The impact of climate change on shortnose sturgeon in the action area is likely to be related to changes in water temperatures, potential changes to salinity in rivers, and the potential decline of forage. These changes may effect the distribution of species and the fitness of individuals and populations due to the potential loss of foraging opportunities, displacement from ideal habitats and potential increase in susceptibility to disease (Elliot and Simmonds 2007). A decline in reproductive fitness as a result of global climate change could have effects on the abundance and distribution of shortnose sturgeon in the action area, and throughout their range.

As described above, global climate change may affect shortnose sturgeon and Atlantic salmon by affecting the distribution of prey, water temperature and water quality. To the extent that air pollution, for example from the combustion of fossil fuels by vessels operating in the action area, contributes to global climate change, then it is also expected to negatively affect shortnose sturgeon and Atlantic salmon in the action area. However, given the likely rate of change associated with climate impacts (i.e., the century scale), it is unlikely that climate related impacts not already captured in the Status of the Species sections above, will have a significant effect on the status of Atlantic salmon or shortnose sturgeon in the action area over the temporal scale of the proposed action (i.e., through August 2011).

Summary of the Status of Atlantic salmon and shortnose sturgeon in the action area

Shortnose sturgeon in the Action Area
Based on the best available data, shortnose sturgeon are expected to occur in the action area from April through November, with the largest numbers being present from mid-spring to early fall. Outside of the April – November time period, shortnose sturgeon are present at overwintering sites located upstream of the action area. During the August period when dredging will occur, adult and juvenile shortnose sturgeon are likely to be foraging, migrating and resting in the action area. As explained above, shortnose sturgeon in the action area are affected by other anthropogenic impacts, including effects of the operation of the Lockwood Dam, the potential for incidental capture in recreational and state fisheries, interactions during scientific research, and are affected by activities that impact water quality. However, despite continuing anthropogenic impacts, the shortnose sturgeon population in the Kennebec River demonstrated a significant increase in population size from the 1980s to 2000 and NMFS believes that the population is stable at this level and may be continuing to increase.

Atlantic salmon in the Action Area
As explained in the Status of the Species section above, Atlantic salmon only occur in the mainstem of the Kennebec River between April 10 and November 7 each year. Upstream migrating adults could be present in the action area throughout this time period. Outmigrating smolts would be moving downstream through the action area from April through June. Due to the time of year when dredging will occur (August 2011) and the types of habitats in the action area, no spawning or overwintering fish will be affected; similarly no Atlantic salmon eggs or other early life stages would be present in the action area during this time of year. Additionally, as the action area consists of deep waters, no parr would occur in the action area.

Table 3.

Number of Atlantic salmon captured at the Lockwood Project fish trap in 2008 and 2009						
	May	June	July	August	September	October
2008	0	5	15	0	1	1
2009	1	4	14	1	1	3
2010	0	4	0	0	0	4

The only life stage that could be present during August would be adults returning to the Kennebec from the ocean. Very few adult Atlantic salmon are likely to be present in the action area during August. As evidenced by the counts at the Lockwood fish trap (see Table 3), very few Atlantic salmon have been documented during August, with the majority in June, July and October. Returning adults are not known to forage while making their upstream migrations. Movements through the action area by migrating adults are likely to be rapid, with residence times of less than 1 day.

Atlantic salmon in the GOM DPS currently exhibit critically low spawner abundance, poor marine survival, and are still confronted with a variety of threats. Numbers of endangered adult Atlantic salmon returning to the GOM DPS are extremely low, with only 1014 adults in 2007, and only 16 of these returning to the Kennebec (NMFS and USFWS 2009). Atlantic salmon in the action area are affected by the operation of the Lockwood Dam as well as other upstream hydroelectric projects and other anthropogenic impacts including the potential for incidental capture in recreational and state fisheries, interactions during scientific research, and are affected by activities that impact water quality.

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 and Atlantic salmon in the action area and their habitat within the context of the species current status, the environmental baseline and cumulative effects. As explained in the Description of the Action, the proposed action under consideration in this Opinion is maintenance dredging of the Doubling Point and Popham Beach areas of the Kennebec River FNP to be carried out in August 2011.

As explained in the Description of the Action section above, a hopper dredge will be used for all dredging. Below, the discussion will consider the effects of hopper dredging, including the risk of entrainment of fish as well as the effects of suspended sediment associated with the dredging operations. Following, there is a discussion of the effects of disposal activities and a discussion of other effects of the proposed dredging including effects on prey and foraging. Last, there is a discussion on the effects of the proposed dredging and disposal operations on critical habitat designated for Atlantic salmon.

Entrainment in Hopper Dredge

Hopper dredges are typically self-propelled seagoing vessels. They are equipped with propulsion machinery, sediment containers (i.e., hoppers), dredge pumps, and other specialized equipment required to excavate sediments from the channel bottom. Hopper dredges have propulsion power adequate for required free-running speed and dredging against strong currents.

A hopper dredge removes material from the bottom of the channel in thin layers, usually 2-12 inches, depending on the density and cohesiveness of the dredged material (Taylor, 1990). Pumps within the hull, but sometimes mounted on the dragarm, create a region of low pressure around the dragheads; this forces water and sediment up the dragarm and into the hopper. The more closely the draghead is maintained in contact with the sediment, the more efficient the dredging (i.e., the greater the concentration of sediment pumped into the hopper). In the hopper, the slurry mixture of sediment and water is managed to settle out the dredged material solids and overflow the supernatant water. When a full load is achieved, the vessel suspends dredging, the dragarms are raised, and the dredge travels to the disposal site where dredged material is placed. As noted above, a hydraulic hopper dredge will be used for the proposed dredging.

As noted in the "Background" section above, shortnose sturgeon have been entrained in hopper dredge operations in the Kennebec River in the past. A review of records of sturgeon entrainment maintained by the ACOE indicates that shortnose sturgeon have not been reported entrained during any other hopper dredge operations along the Atlantic coast; however, Atlantic sturgeon and Gulf sturgeon have been reported being entrained occasionally during hopper dredging operations, particularly in the Southeastern U.S.

Dredging is scheduled in August 2011, with approximately 70,000 cy of material being removed (50,000 from Doubling Point and 20,000 from Popham Beach). Dredging at Doubling Point will be completed within 8-10 days and dredging at Popham Beach will take an additional 2-4 days. Shortnose sturgeon are likely to be present during August when the dredging is scheduled to take place. As explained above, dredging of these areas of the navigation channel has occurred routinely in the past; however, since 1991, dredging has rarely occurred during a time of year when shortnose sturgeon were likely to be present. Additionally, observers were not present aboard the dredge for any operations occurring prior to 1997. Even since 1997, observers have only been present on board the dredge at the Doubling Point reach. As such, there is no information on any historic interactions that may have occurred at Popham Beach.

As noted above, in 2003, five shortnose sturgeon were entrained in the hopper dredge Padre Island over three days of dredging in the Kennebec River FNP at Doubling Point. Based on the time of year (early October) and the geographic location of the incidents, it is assumed that these fish were in the process of migrating upstream to overwintering areas. As illustrated in Table 1, since 1991 dredging of the navigation channel has occurred 5 times. While no observers were on board the dredge in 1991, two shortnose sturgeon were observed in the vicinity of the dredge with injuries consistent with entrainment. Other recent dredging events have taken place at a time of year when shortnose sturgeon are unlikely to be present.

While there are differences in timing of these past dredge events, the exclusion of events occurring at times of year when shortnose sturgeon were not likely to be present in the dredged area and the exclusion of events with no observer coverage, allow NMFS to calculate a risk of entrainment. Using these factors to exclude dredge events, the only remaining event is the October 2003 emergency dredging event. As noted above, these entrainments are the only reported entrainments of shortnose sturgeon during hopper dredging operations over this species' range; therefore, it is not possible to include data sets for dredging occurring in other river systems. During the 2003 dredging event, observers were present for dredging at Doubling Point but not at Popham Beach. Approximately 22,000 cubic yards of sand were removed by the hopper dredge Padre Island and 5 shortnose sturgeon were entrained. Using this data, an entrainment rate of 1 shortnose sturgeon per approximately every 4,400 cubic yards of material removed is calculated.

As noted above, the above referenced dredging occurred over several days in October 2003. Based on the known distribution of shortnose sturgeon in the Kennebec River, more shortnose sturgeon are likely to be present in the action area during August when dredging is currently scheduled compared to October; in October it is likely that some shortnose sturgeon would have already left the Doubling Point area and moved upstream to the known upstream overwintering areas. The assumption that more shortnose sturgeon are likely to be present near Doubling Point in August as compared to October is confirmed when the CPUE for shortnose sturgeon captured in Maine DMR sampling is compared. For August, a CPUE of 1.60 shortnose sturgeon/100m net hour is calculated; for October, the corresponding CPUE is 0.96. The CPUE for August is 1.66 times greater than the CPUE for October. In August then, it is reasonable to expect that the rate of encounter would be 1.66 times greater than the encounter rate in October. Adjusting the entrainment rate from above with this factor results in an estimated entrainment rate of 1 shortnose sturgeon per every 2,650 cubic yards removed.

Approximately 50,000 cy of material is proposed for removal at Doubling Point. Using the entrainment rate calculated above (1 shortnose sturgeon/2,650 cy) no more than 19 shortnose sturgeon are likely to be entrained in the hopper dredge operating at Doubling Point in August 2011. This calculation has been based on a number of assumptions including the following: that shortnose sturgeon are evenly distributed throughout rkm 15-21 including the shoals where dredging will take place, that the hopper dredge to be used for this dredge cycle has an entrainment rate equivalent to the Padre Island, and that shortnose sturgeon are equally likely to be encountered throughout the time period when dredging will occur. While this estimate is based on several assumptions, it is reasonable because it uses the best available information on the distribution of shortnose sturgeon in the action area and the entrainment rate has been adjusted to compensate for the greater number of sturgeon likely to be in the action area in August as compared to October.

As explained above, observers have only been required at Doubling Point and NMFS has no data on entrainment of shortnose sturgeon during past dredging operations at Popham Beach. However, it should be noted that there have also been no anecdotal reports of shortnose sturgeon interactions with a dredge at Popham Beach and no reports of dead shortnose sturgeon in the area following dredging. Given that only a percentage of shortnose sturgeon are likely to participate in coastal migrations and assuming that only coastally migrating fish are likely to be present in the Popham Beach area and that time spent in this area is expected to be limited, fewer shortnose sturgeon are likely to be present in the Popham Beach area compared to the Doubling Point area. However, as no information is available on the number of shortnose sturgeon that are likely to occur at Popham Beach or a correcting factor to assess the number of sturgeon at Popham Beach compared to Doubling Point, for the purposes of this consultation NMFS will make the conservative assumption that shortnose sturgeon are as likely to occur at Popham Beach as at Doubling Point. Approximately 20,000 cy of material is proposed for removal at Popham Beach. Using the entrainment rate calculated above (1 shortnose sturgeon/2,650 cy) no more than 8 shortnose sturgeon are likely to be entrained in the hopper dredge operating at Popham Beach in August 2011.

There is evidence that some shortnose sturgeon, particularly juveniles or smaller adults, could be entrained in the dredge and survive. For example, three of the five shortnose sturgeon entrained by the dredge Padre Island during the October 2003 emergency dredging were alive when initially observed but two of these had significant injuries that likely reduced their chances for post-release survival. As the extent of internal injuries and the likelihood of post-entrainment survival is unknown, and the size of the fish likely to be entrained is impossible to predict, it is reasonable to conclude that any shortnose sturgeon entrained in the hopper dredge are likely to be killed. As such, the proposed action is likely to result in the mortality of no more than 27 shortnose sturgeon.

Atlantic salmon
As explained above, very few Atlantic salmon are likely to be present in the action area when dredging occurs. There are no known incidences of Atlantic salmon being captured in a hopper dredge. As Atlantic salmon are highly mobile and not likely to be concentrated in the action area there is little risk of individuals being entrained in the dredge. The risk of entrainment is further reduced by the distribution of adult Atlantic salmon in the upper water column, not near the bottom where the drag heads are located while actively dredging. As such, it is extremely unlikely that any Atlantic salmon would be entrained during the dredging operations scheduled for August 2011. As explained above, very few Atlantic salmon are likely to be present in the action area when dredging occurs. There are no known incidences of Atlantic salmon being captured in a hopper dredge. As such, NMFS has determined that no Atlantic salmon are likely to be injured or killed as a result of interactions with the dredge equipment.

Interactions with the Sediment Plume- during dredging
Dredging operations cause some sediment to be suspended in the water column. This results in a sediment plume in the water, typically present from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are influenced by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (ACOE 1983).

Resuspension of fine-grained dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density, turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. Use of this "overflow" technique can result in a larger sediment plume than if no overflow is used. Overflow is typically used when dredging fine grained material. The ACOE has indicated that overflow may occur during the proposed dredging; however, given that the material to be removed is 98% sand, it is not likely that the contractor will need to overflow to efficiently fill the hoppers According to the ACOE, any material that is overflowed is expected to settle rapidly out of the water column. In 2001, a study was done in the Delaware River of overflow and nonoverflow hopper dredging. Monitoring of the sediment plumes was accomplished using a boat-mounted 1,200-kHz Broad-Band Acoustic Doppler Current Profiler (ADCP). The instrument collects velocity vectors in the water column together with backscatter levels to determine the position and relative intensity of the sediment plume. Along with the ADCP, a MicroLite recording instrument with an Optical Backscatterance (OBS) Sensor was towed by the vessel at a depth of 15 ft. The MicroLite recorded data at 0.5-sec intervals. Navigation data for monitoring were obtained by a Starlink differential Global Positioning System (GPS). The GPS monitors the boat position from the starting and ending points along each transect.

Transects were monitored in the test area to obtain the background levels of suspended materials prior to dredging activities. A period of 8 minutes following the dredge passing during non-overflow dredging showed the level of suspended material to be returning to background levels. No lateral dispersion of the plume out of the channel was observed during the non-overflow dredging operation. During overflow dredging, a wider transect was performed to determine the lateral extent of the plume. No significant change above background levels could be detected. At 1-hr elapsed time following the end of the overflow dredging operation, the levels of suspended material returned to background conditions. Again, no lateral dispersion of the plume out of the channel area was observed.

During dredging operations, suspended sediment and turbidity will be increased in the area near where the dredge is operating. While suspended sediment and turbidity monitoring has not occurred during hopper dredge operations in the Kennebec River, information on the likely levels of suspended sediment is available from other sources. Based on analysis of other hydraulic hopper dredging activities (ACOE 1983, Anchor Environmental 2003, Connor et al. 2004), suspended sediment plumes are expected to be fully dissipated at an average distance of 800-1200 meters from the dredge site when a hopper dredge is used. As noted above, levels of suspended sediment are expected to return to background levels within an hour of the dredge passing through a particular area (see also Anchor Environmental 2003). Hayes (1986) reports that hopper dredging with overflow results in suspended sediment levels of 25-700 mg/l within 400 feet of the draghead; without overflow, suspended sediment levels are 25-200 mg/l within the same distance.

The life stages of shortnose sturgeon most vulnerable to increased sediment are eggs and larvae which are subject to burial and suffocation. As noted above, no eggs and/or larvae will be present in the action area. Juvenile and adult shortnose sturgeon are frequently found in turbid water and would be capable of avoiding any sediment plume by swimming higher in the water column. Laboratory studies (Niklitschek 2001 and Secor and Niklitschek 2001) have demonstrated shortnose sturgeon are able to actively avoid areas with unfavorable water quality conditions and that they will seek out more favorable conditions when available. While the increase in suspended sediments may cause shortnose sturgeon to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movement further up in the water column, or movement to an area just outside of the navigation channel where suspended sediment levels are expected to be near background levels. Additionally, as dredging will only take place for approximately 1 hour at a time, with breaks occurring when the dredge moves to the disposal site, there will be periods of time each day when elevated levels of suspended sediment are not likely to be experienced. The ACOE has estimated that on an average day, the dredge is likely to be actively removing sediment for a non-continuous period of about 10 hours. Further, dredging at each location (Doubling Point and Popham Beach) will occur over a period of time less than 10 days (Doubling Point) and 4 days (Popham Beach), making any potential effects to the movement and behavior of shortnose sturgeon in the immediate area temporary. Based on this information, any increase in suspended sediment is not likely to affect the movement of shortnose sturgeon between foraging areas and/or concentration areas during any phase of dredging or otherwise negatively affect shortnose sturgeon in the action area.

Suspended sediments can have lethal and sublethal effects on Atlantic salmon. Sublethal effects of suspended sediments can include impairment of swimming activity, respiration, and predator avoidance. Sedimentation has been identified as a threat particularly to early life stages of Atlantic salmon; however, as explained above, only adult Atlantic salmon are likely to occur in the action area during August when dredging will occur. Although adult Atlantic salmon movement through estuaries is less understood, it can be expected that adults would not be present in the action area for more than one day as movement through the estuary is expected to be directed and rapid. As indicated above, a single day exposure to TSS in excess of 50 mg/l is a moderate stress to salmonids and TSS levels in portions of the action area, particularly the area near the draghead, are likely to be well above 50mg/l. However, as noted above, dredging will only take place for approximately one hour at a time, and approximately 10 non-continuous hours over the course of each day, and any adult Atlantic salmon present in the action area are expected to be there for less than one day. Therefore, any exposure of adult Atlantic salmon to TSS levels of 50 mg/l or higher will be for a period significantly less than 24 hours. As such, any effects of the sediment plume on Atlantic salmon will be insignificant and not result in any injury, mortality or delays in migration.

Disposal Operations
For the proposed dredging project, dredged material will be placed at an in-river and nearshore disposal site. While this will result in an increase in suspended sediment in the immediate vicinity of sand placement, any effects are likely to be minor and temporary. The ACOE has estimated that each disposal event will last 1-5 minutes (the time it will take to empty the hopper), with 8-10 trips to the disposal site each day. Shortnose sturgeon and Atlantic salmon near the disposal area may be exposed to increased suspended sediment levels. During the discharge of sediment at a disposal site, suspended sediment levels have been reported as high as 500mg/L within 250 feet of the disposal vessel and decreasing to background levels (i.e., 15-100mg/L depending on location) within 1000-6500 feet (ACOE 1983). The ACOE has reported that disposal at Bluff Head can result in a plume of suspended sediment extending for up to 3000 feet from the dredge disposal barge which is consistent with other available reports.

Burial during disposal operations is another potential effect of dredging operations. Burial is probably most likely during the overwintering period when fish would be more lethargic. Burial may also be more likely with the disposal of dense materials such as rocks and clay, rather than sand. Overwintering areas characteristically are areas of lower energy conditions, like deep pools, where the fish can expend less energy during a time period when they are not actively foraging. However, as the proposed action will take place in August, no overwintering fish would be present in the action area. Burial during the summer is extremely unlikely to occur as shortnose sturgeon are very active at these times of year and are likely to be able to swim away from any sediment plume.

As explained above, exposure to elevated suspended sediment levels can cause stress to Atlantic salmon. The best available information indicates that an exposure of 50mg/L above background for more than 24 hours can be moderately stressful for Atlantic salmon. While disposal operations are likely to result in TSS levels greater than 50mg/L above background, few, if any, adult Atlantic salmon are likely to be present near the disposal site. Any adult Atlantic salmon in the action area will be migrating upstream and are likely to be present in the action area for less than 24 hours. However, as noted above, disposal will only take place for 1-5 minutes, approximately 8-10 times a day, with at least 1 hour between disposal events and conditions returning to background levels between disposal events. Additionally, any adult Atlantic salmon present in the action area are expected to be there for less than one day. Therefore, any exposure of adult Atlantic salmon to TSS levels of 50 mg/l or higher will be for a period significantly less than 24 hours. As such, any effects on Atlantic salmon of exposure to an increase in suspended sediment resulting from disposal operations will be insignificant and not result in any injury, mortality or delays in migration.

The best available information on the effects of TSS on shortnose sturgeon is summarized above. Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580mg/L to 700,000mg/L depending on species. Sublethal effects have been observed at substantially lower turbidity levels. For example, prey consumption was significantly lower for striped bass larvae tested at concentrations of 200 and 500 mg/L compared to larvae exposed to 0 and 75 mg/L (Breitburg 1988 in Burton 1993). Studies with striped bass adults showed that pre-spawners did not avoid concentrations of 954 to 1,920 mg/L to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993). The Normandeau 2001 report identified five species in the Kennebec River for which TSS toxicity information was available. The most sensitive species reported was the four spine stickleback which demonstrated less than 1% mortality after exposure to TSS levels of 100mg/L for 24 hours. Striped bass showed some adverse blood chemistry effects after 8 hours of exposure to TSS levels of 336mg/L. While there have been no directed studies on the effects of TSS on shortnose sturgeon, shortnose sturgeon juveniles and adults are often documented in turbid water and Dadswell (1984) reports that shortnose sturgeon are more active under lowered light conditions, such as those in turbid waters. As such, shortnose sturgeon are assumed to be as least as tolerant to suspended sediment as other estuarine fish such as striped bass.

The life stages of shortnose sturgeon most vulnerable to increased sediment are eggs and larvae which are subject to burial and suffocation. As noted above, no eggs and/or larvae will be present in the action area. Juvenile and adult shortnose sturgeon are frequently found in turbid water and would be capable of avoiding any sediment plume by swimming higher in the water column. Laboratory studies (Niklitschek 2001 and Secor and Niklitschek 2001) have demonstrated shortnose sturgeon are able to actively avoid areas with unfavorable water quality conditions and that they will seek out more favorable conditions when available. While the increase in suspended sediments may cause shortnose sturgeon to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movement further up in the water column, or movement to an area just outside of the disposal site where suspended sediment levels are expected to be near background levels. Additionally, as disposal operations will only take place for less than an hour at a time, with breaks occurring when the dredge moves back to the dredge site, there will be periods of time each day when elevated levels of suspended sediment are not likely to be experienced. Further, disposal operations at each location will occur over a period of time less than 9 days (disposal from Doubling Point) and 7 days (disposal from Popham Beach), making any effects to the movement and behavior of shortnose sturgeon in the immediate area temporary. Based on this information, any increase in suspended sediment is not likely to affect the movement of shortnose sturgeon between foraging areas and/or concentration areas during any phase of dredging or otherwise negatively affect shortnose sturgeon in the action area.

Release of Contaminated Sediment
In addition to the release of sedimentation, dredging operations also have the potential to release contaminants that are present in the material to be dredged. However, the coarse, sandy nature of the material to be dredged makes it unlikely that any contaminants would adhere to the sand particles. Therefore, no release of contaminated material is expected.

Effects to Shortnose Sturgeon Habitat and Foraging
Since dredging involves removing the bottom material down to a specified depth, the benthic environment will be impacted by dredging operations. Shortnose sturgeon foraging grounds in the Kennebec estuary are typically shallow waters and mud flats covered with rooted aquatic plants. As the areas to be dredged are subject to constant scouring and resettling of sediment, it is unlikely that the areas to be dredged support significant benthic resources. While shortnose sturgeon are likely to be foraging in nearby areas and may be present in the areas to be dredged while resting or migrating, the areas to be dredged are not likely to be concentration areas for foraging shortnose sturgeon. As such, few shortnose sturgeon are likely to be actively feeding in the area to be dredged and any effects of the removal of any potential forage items during dredging operations will be insignificant.

Disposal operations can also affect foraging habitat by burying prey. However, the disposal sites are not known to be used by foraging shortnose sturgeon and any effects to shortnose sturgeon foraging by disposal operations will be insignificant.

Shortnose sturgeon are known to seek out deeper waters during the summer months that serve as thermal refugia. The area to be dredged is consistent with the depths sought by shortnose sturgeon and water quality monitoring indicates that dissolved oxygen levels would be suitable for shortnose sturgeon. The proposed dredging will not alter the area in a manner that precludes shortnose sturgeon from using the action area for thermal refugia. The area to be dredged is unlikely to be used as a resting area given the strong currents experienced in the channel.

Shortnose sturgeon feed on a variety of benthic invertebrates. Shortnose sturgeon generally feed when the water temperature exceeds 10°C and in general, foraging is heavy immediately after spawning in the spring and during the summer and fall, with lighter foraging during the winter (ACOE 2000, NMFS 1996). While the sandy, shifting nature of the substrate in the areas to be dredged means that these areas are unlikely to support stable benthic communities or large concentrations of potential shortnose sturgeon forage items, shortnose sturgeon forage items have limited mobility (clams and other benthic invertebrates) and are unlikely to be able to actively avoid the dredge and the proposed dredging is likely to entrain and kill at least some of these potential forage items.

The area to be dredged at Doubling Point and Popham Beach (less than 0.05 square miles total) represent a very small percentage of the range of shortnose sturgeon in the Kennebec River in the summer months and an even smaller percentage of the Kennebec River as a whole. While there is likely to be some reduction in the amount of prey in the channel areas, the area affected is small and the action will result in the loss of only a portion of the available forage in the dredged area. Depending on the species, recolonization of a dredged channel can begin in as short as a month (Guerra-Garcia and Garcia-Gomez 2006). The dredged area is expected to be completely recolonized by benthic organisms within approximately 12 months (USACE 2001, US DOI 2000). These conclusions are supported by the conclusions of a benthic habitat study which examined an area of Thimble Shoal following dredging and concluded that recolonization of the area following hopper dredging was rapid with macrobenthic organisms abundant on the first sampling date following cessation of dredging activities (less than a month later). Benthic sampling done by O'Herron and Hastings (1985) in association with past ACOE maintenance dredging in the Delaware River found that *Corbicula* recolonized the dredge areas during the subsequent growing season. However, the post-dredge individuals collected were smaller than pre-dredge individuals and provided less biomass. O'Herron and Hastings (1985) found that adult shortnose sturgeon may not be able to efficiently utilize new molluscan colonizers due to the limited biomass until the end of the second growing season after dredging. Based on this information, shortnose sturgeon should only be exposed to a reduction in forage in the areas where dredging occurs for one to two seasons immediately following dredging.

NMFS anticipates that while the dredging and disposal activities may temporarily disrupt normal feeding behaviors for shortnose sturgeon by causing them to move to alternate areas, the action is not likely to remove critical amounts of prey resources from the action area and any disruption to normal foraging is likely to be insignificant. Additionally, as (1) the area to be affected by dredging is small; (2) few motile organisms will be affected by the proposed dredging and; (3), recolonization of the benthic community will be rapid and complete within 2 years, NMFS has determined that any effects to foraging shortnose sturgeon will be temporary and insignificant.

Effects to Atlantic salmon foraging

Atlantic salmon adults that may be present in the action area are not likely to be foraging as adults making upstream migrations from the ocean are not known to forage. As such, the proposed action will not affect the ability of these individuals to feed.

Critical Habitat designated for Atlantic salmon

The action area is a known migratory corridor for both juvenile and adult Atlantic salmon. A migratory corridor free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds or prevent emigration of smolts to the marine environment is identified in the critical habitat designation as essential for the conservation of Atlantic salmon. The Primary Constituent Elements (PCE) for designated critical habitat of listed Atlantic salmon in the action area are:

1) Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations;
2) Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation; and,
3) Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.

NMFS has analyzed the potential impacts of the project on designated critical and PCEs in the action area. NMFS has determined that the effects to these PCEs will be insignificant for the reasons outlined below.

The project will not result in a migration barrier as the turbidity and suspended solids present in the water column during dredging will only affect a small portion of the river at any given time and will not prevent adult Atlantic salmon for passing through the action area in a timely manner and reaching their upstream destination. As such, the action will not prevent adult Atlantic salmon from accessing spawning grounds. As no downstream migrating salmon will be present at the time of year when dredging will occur, the action will not create a barrier that delays or prevents emigration of smolts to the marine environment. Further, as increases in turbidity and suspended will be temporary, there will be no lingering effects of the action that would result inin a migration barrier at a future time. The proposed action will not alter the habitat in any way that would increase the risk of predation to individual adult Atlantic salmon that may be present in the action area during dredging and disposal operations. The action is also not anticipated to affect the native fish community in a way that would decrease the buffering ability to individual adult Atlantic salmon that may be present in the action area. Any effects to the water column will be limited to temporary increases in suspended sediment; there will be no other water quality impacts of the proposed action and therefore the project is not expected to adversely affect water quality at the time of any salmon migrations in the action area. Atlantic salmon present in the action area are not likely to be foraging. While dredging and disposal operations can affect benthic resources, salmon are not benthic feeders and the forage base for this species is not expected to be affected by dredging operations. Finally, as the action will not affect the natural structure of the nearshore habitat, there will be no reduction in the capacity of substrate, food resources, and natural cover to meet the conservation needs of listed Atlantic salmon. Based upon this reasoning, NMFS has determined that any effects to designated critical habitat in the action area will be insignificant.

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.

Several features of the shortnose sturgeon's natural history, including delayed maturation, non-annual spawning (Dadswell et al. 1984; Boreman 1997), and long life-span, affect the rate at which recovery can proceed. The effects of future state and private activities in the action area that are reasonably certain to occur during the dredging operations are recreational and commercial 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 and commercial fishing for anadromous fish species may result in incidental takes of shortnose sturgeon. However, positive identification and distinction between Atlantic sturgeon and shortnose sturgeon are difficult and therefore, historically, takes have not been quantified. 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.

Impacts to Atlantic salmon from non-federal activities are largely unknown in this river. It is possible that occasional recreational fishing for other fish species may result in incidental takes. There have been no documented takes in the action area, however, there is always the potential for this to occur when fisheries are known to operate in the presence of Atlantic salmon. The effects of future state and private activities in the action area that are reasonably certain to occur during the proposed action are recreational and commercial fisheries, discharge of pollutants, and development and/or construction activities resulting in excessive water turbidity and habitat degradation.

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.

Cumulative impacts from federal and private actions occurring in the Kennebec River have the potential to impact shortnose sturgeon. These include direct and indirect modification of habitat due to hydroelectric facilities and the introduction of pollutants from paper mills, sewers, and other industrial sources. Hydroelectric facilities can alter the river's natural flow pattern and temperatures and release of silt and other fine river sediments during dam maintenance can be deposited in sensitive spawning habitat nearby. Pollution has been a major problem for this river system, which continues to receive discharges from sewer treatment facilities and paper production facilities (metals, dioxin, dissolved solids, phenols, and hydrocarbons). Shortnose sturgeon in the Kennebec River can often be seen leaping out of the water. This activity has been linked to an increased likelihood of boat strikes and the potential for stranding. For example, in 1997 the Maine DMR documented a dead female shortnose sturgeon in the bottom of a boat at a marina in Bath and BIW has reported a dead shortnose sturgeon on a dock at their facility. Shortnose sturgeon in the Kennebec River are also subject to the threat of dredging, as evidenced by the mortality of at least five shortnose sturgeon in this river system since 2003, and subject to interactions with research targeting shortnose sturgeon and other species.

Cumulative impacts from federal and private actions occurring in the Kennebec River have the potential to impact Atlantic salmon and critical habitat designated for this species. These include direct and indirect modification of habitat due to hydroelectric facilities and the introduction of pollutants from paper mills, sewers, and other industrial sources. Hydroelectric facilities can alter the river's natural flow pattern and temperatures and release of silt and other fine river sediments during dam maintenance can be deposited in sensitive spawning habitat nearby. These facilities also often represent barriers to normal upstream and downstream movements. Passage through these facilities may result in the mortality of downstream migrants. Pollution has been a major problem for this river system, which continues to receive discharges from sewer treatment facilities and paper production facilities (metals, dioxin, dissolved solids, phenols, and hydrocarbons).

INTEGRATION AND SYNTHESIS OF EFFECTS

As explained in the "Effects of the Action" section above, the proposed dredging of shoaled areas within the Doubling Point and Popham Beach reaches of the Kennebec River main channel is likely to result in the entrainment of no more than 27 shortnose sturgeon. Based on the volume of dredging estimated for each reach, it is anticipated that 19 shortnose sturgeon will be entrained at the Doubling Point reach and 8 at the Popham Beach reach. While it is possible that some sturgeon may survive entrainment in the dredge, due to the unpredictable nature of the injuries that may be suffered during entrainment and the lack of information on the likelihood that injured fish will survive after release, NMFS has determined that it is likely that all of these sturgeon could suffer from injuries and die as a result of entrainment. Thus, in its entirety, the proposed action is likely to result in direct physical effects (i.e., capture, physical injury or mortality) to no more than 27 shortnose sturgeon, with no more than 27 mortalities. As explained in the "Effects of the Action" section, all other effects on shortnose sturgeon and their habitat are likely to be insignificant or discountable. Additionally, effects to Atlantic salmon and critical habitat designated for the GOM DPS of Atlantic salmon are expected to be insignificant. The following discussion provides NMFS' determinations of whether there is a reasonable expectation that shortnose sturgeon and Atlantic salmon will experience reductions in reproduction, numbers, or distribution in response to the effects of the proposed action, and whether any reductions in the reproduction, numbers or distribution of these species can be expected to appreciably reduce the species' likelihood of surviving and recovering in the wild.

Shortnose Sturgeon

Summary of status of shortnose sturgeon

Historically, shortnose sturgeon are believed to have inhabited nearly all major rivers and estuaries along nearly the entire east coast of North America. Today, only 19 populations remain. The present range of shortnose sturgeon is disjunct, with northern populations separated from southern populations by a distance of about 400 km. Population sizes range from under 100 adults in the Cape Fear and Merrimack Rivers to tens of thousands in the St. John and Hudson Rivers. As indicated in Kynard 1996, 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. The only river systems likely supporting populations close to expected abundance are the St John, Hudson and possibly the Delaware and the Kennebec (Kynard 1996), making the continued success of shortnose sturgeon in these rivers critical to the species as a whole.

The Schnabel estimate based on Maine DMR survey data from 1998-2000 is the most recent population estimate for the Kennebec River shortnose sturgeon population; however, this estimate includes fish from the Androscoggin and Sheepscot rivers as well and does not include an estimate of the size of the juvenile population. A comparison of the population estimate for the estuarine complex from 1982 (Squiers et al. 1982) to 2000 (Maine DMR 2003) suggests that the adult population grew by approximately 30% in the intervening twenty years. Based on this information, NMFS believes that the shortnose sturgeon population in the Kennebec River is increasing.

In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act."

While no reliable estimate of 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. The lack of information on the status of populations such as that in the Chesapeake Bay add uncertainty to any determination on the status of this species as a whole. 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. As described in the Status of the Species, Environmental Baseline, and Cumulative Effects sections above, shortnose sturgeon in the action area are affected by habitat alteration, bycatch in commercial and recreational fisheries, water quality and in-water construction activities. Despite these ongoing threats, numbers of shortnose sturgeon in the action area are considered stable or increasing and this trend is expected to continue over the duration of the proposed action (i.e., through August 2011).

While the dredging is likely to kill up to 27 shortnose sturgeon, this number represents a very small percentage of the shortnose sturgeon population in the Kennebec River, which is believed to be increasing, and an even smaller percentage of the total population of shortnose sturgeon rangewide. The best available population estimates indicate that there are approximately 9500 adult shortnose sturgeon in the Kennebec River and an unknown number of juveniles. While the death of 27 juvenile or adult shortnose sturgeon will reduce the number of shortnose sturgeon in the population compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this population or its increasing trend as this loss represents a very small percentage of the population (0.28%) and it is not likely that this reduction in numbers would be detectable at the population scale.

A reduction in the number of shortnose sturgeon in the Kennebec River would have the effect of reducing the amount of potential reproduction in this system as the fish killed would have no potential for future reproduction. However, it is estimated that on average, approximately 1/3 of adult females spawn in a particular year and approximately ½ of males spawn in a particular year. Given that the best available estimates indicate that there are more than 9,000 adult shortnose sturgeon in the Kennebec River, it is reasonable to expect that there are at least 3,000 adults spawning in a particular year. It is unlikely that the loss of 27 shortnose sturgeon in a one-time event would affect the success of spawning in subsequent years. Additionally, this small reduction in potential spawners is expected to result in an insignificant reduction in the number of eggs laid or larvae produced in future years and similarly, an insignificant effect on the strength of subsequent year classes. Additionally, the proposed action will not affect spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede shortnose sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Kennebec River. Further, the action is not expected to reduce the river by river distribution of shortnose sturgeon. Additionally as the number of shortnose sturgeon likely to be killed as a result of the proposed action is approximately 0.28% of the Kennebec River population, there is not likely to be a loss of any unique genetic haplotypes and therefore, it is unlikely to result in the loss of genetic diversity.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable effect on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of shortnose sturgeon because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity (see status of the species section above), and there are thousands of shortnose sturgeon spawning each year.

Based on the information provided above, the death of up to 27 shortnose sturgeon resulting from the proposed dredging will not appreciably reduce the likelihood of survival (i.e., it will not increase the risk of extinction faced by this species) for this species given that: (1) the population trend of shortnose sturgeon in the Kennebec River is increasing; (2) the death of 27 shortnose sturgeon represents an extremely small percentage of the number of shortnose sturgeon in the Kennebec River and a even smaller percentage of the species as a whole; (3) the loss of these shortnose sturgeon will not change the status or trends of the species as a whole; (4) the loss of these shortnose sturgeon is likely to have an undetectable effect on reproductive output of the Kennebec River population of shortnose sturgeon or the species as a whole; (5) and, the action will have only a minor and temporary effect on the distribution of shortnose sturgeon in the action area and no effect on the distribution of the species throughout its range.

In certain instances an action may not appreciably reduce the likelihood of a species' persistence is not likely that this reduction in numbers would be detectable at the population scale.

A reduction in the number of shortnose sturgeon in the Kennebec River would have the effect of reducing the amount of potential reproduction in this system as the fish killed would have no potential for future reproduction. However, it is estimated that on average, approximately 1/3 of adult females spawn in a particular year and approximately ½ of males spawn in a particular year. Given that the best available estimates indicate that there are more than 9,000 adult shortnose sturgeon in the Kennebec River, it is reasonable to expect that there are at least 3,000 adults spawning in a particular year. It is unlikely that the loss of 27 shortnose sturgeon in a one-time event would affect the success of spawning in subsequent years. Additionally, this small reduction in potential spawners is expected to result in an insignificant reduction in the number of eggs laid or larvae produced in future years and similarly, an insignificant effect on the strength of subsequent year classes. Additionally, the proposed action will not affect spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede shortnose sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Kennebec River. Further, the action is not expected to reduce the river by river distribution of shortnose sturgeon. Additionally as the number of shortnose sturgeon likely to be killed as a result of the proposed action is approximately 0.28% of the Kennebec River population, there is not likely to be a loss of any unique genetic haplotypes and therefore, it is unlikely to result in the loss of genetic diversity.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable effect on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of shortnose sturgeon because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity (see status of the species section above), and there are thousands of shortnose sturgeon spawning each year.

Based on the information provided above, the death of up to 27 shortnose sturgeon resulting from the proposed dredging will not appreciably reduce the likelihood of survival (i.e., it will not increase the risk of extinction faced by this species) for this species given that: (1) the population trend of shortnose sturgeon in the Kennebec River is increasing; (2) the death of 27 shortnose sturgeon represents an extremely small percentage of the number of shortnose sturgeon in the Kennebec River and a even smaller percentage of the species as a whole; (3) the loss of these shortnose sturgeon will not change the status or trends of the species as a whole; (4) the loss of these shortnose sturgeon is likely to have an undetectable effect on reproductive output of the Kennebec River population of shortnose sturgeon or the species as a whole; (5) and, the action will have only a minor and temporary effect on the distribution of shortnose sturgeon in the action area and no effect on the distribution of the species throughout its range.

In certain instances an action may not appreciably reduce the likelihood of a species' persistence but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that shortnose sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in a small reduction in the number of shortnose sturgeon in the Kennebec River and since it will not affect the overall distribution of shortnose sturgeon other than to cause minor temporary adjustments in movements in the action area. The proposed action will not utilize shortnose sturgeon for recreational, scientific or commercial purposes or affect the adequacy of existing regulatory mechanisms to protect this species. The proposed action is likely to result in the mortality of up to 27 shortnose sturgeon; however, the loss of these individuals in the short term is not expected to affect the persistence of the population of the Kennebec River population of shortnose sturgeon or the species as a whole. In summary, the effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction since the action will cause the mortality of only a small percentage of the shortnose sturgeon in the Kennebec River and an even smaller percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. Therefore, the proposed action will not appreciably reduce the likelihood that shortnose sturgeon can be brought to the point at which they are no longer listed as endangered or threatened. Based on the analysis presented herein, the proposed action, resulting in the mortality of no more than 27 shortnose sturgeon is not likely to appreciably reduce the survival and recovery of this species.

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

The number of GOM DPS Atlantic salmon in the Kennebec River is very small, with adult returns from 2006-2008 ranging between 15 and 22; for 2009, 24 returns were documented through October 13, 2009.

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

Based upon the best available scientific information as discussed above, NMFS has determined that the proposed dredging will not result in the entrainment of any Atlantic salmon and as such will not result in the injury or mortality of any Atlantic salmon due to interactions with the dredge. The proposed action will result in the exposure of any individual adult Atlantic salmon present in the action area during the dredging and disposal to increased levels of suspended sediment. However, as exposure is expected to be short term, all effects of this potential exposure will be insignificant. In summary, no adult Atlantic salmon are expected to be injured or killed as a result of the proposed action.

This action will not reduce reproduction of Atlantic salmon in the Kennebec River because it will (1) not result in the mortality of any Atlantic salmon and therefore will not effect any potential reproduction of that individual; (2) not affect any spawning adults; (3) not affect spawning habitat; and (4) as recovery from exposure to increased suspended sediment levels is expected to be rapid and complete, will not affect the reproductive fitness of any individual by reducing fecundity or increasing the interval between spawning.

This action will not reduce the numbers of Atlantic salmon in the Kennebec River because it will not result in the mortality of any Atlantic salmon. The proposed action will not reduce distribution because the action will not impede Atlantic salmon from accessing any habitat, including spawning, foraging or overwintering grounds in the Kennebec River. Further, the action is not expected to reduce the river by river distribution of Atlantic salmon.

For these reasons, NMFS believes that there is not likely to be any reduction in reproduction, numbers or distribution of GOM DPS of Atlantic salmon in the Kennebec River or the species as a whole. As there will not be a reduction in reproduction or numbers of Atlantic salmon in the Kennebec River and no reduction in the rangewide distribution of this species, 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 Kennebec River population of Atlantic salmon or the species as a whole.

Critical Habitat designated for Atlantic salmon
As explained above, the proposed action will have only an insignificant effect on critical habitat designed for the GOM DPS of Atlantic salmon. This conclusion is based on the determination that there will be no permanent impacts to the habitat and because: (1) the project will not result in a migration barrier to or through any estuarine habitat; (2) the project will not increase the risk of predation; (3) the project will not affect the forage of adult Atlantic salmon because of the timing and location; and, (4) there will be no effects to the natural structure of the nearshore

habitat and therefore there will be no reduction in the capacity of substrate, food resources, and natural cover to meet the conservation needs of listed Atlantic salmon.

CONCLUSIONS

After reviewing the current status of the Kennebec River population of shortnose sturgeon and the status of shortnose sturgeon rangewide, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the action, as proposed, is not likely to cause any reduction in the likelihood of survival and recovery in the wild of the Kennebec River population or the species as a whole and is therefore not likely to jeopardize the continued existence of shortnose sturgeon. No critical habitat has been designated for shortnose sturgeon, therefore, none will be affected. NMFS also concludes that the proposed action is not likely to adversely affect the GOM DPS of Atlantic salmon and is therefore not likely to jeopardize the continued existence of the GOM DPS of Atlantic salmon. Similarly, the action is not likely to adversely affect critical habitat designated for the GOM DPS of Atlantic salmon and therefore will not result in the destruction or adverse modification of this habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit 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 dredging project has the potential to directly affect shortnose sturgeon by causing shortnose sturgeon to become entrained in the dredge. These interactions are likely to cause injury and/or mortality to the affected shortnose sturgeon. Based on the known seasonal distribution of shortnose sturgeon in the Kennebec River and information available on historic interactions between shortnose sturgeon and dredging operations, NMFS anticipates that no more than 27 shortnose sturgeon are likely to be entrained during the August 2011 hopper dredging operations. As explained in the accompanying Opinion, while some of these entrained sturgeon may survive and be released unharmed there is a high level of mortality likely associated with entrainment in a hopper dredge. Therefore this estimated level of take will include shortnose sturgeon injured and/or killed as a result of dredging operations as well as shortnose sturgeon entrained and released apparently unharmed.

NMFS believes this level of incidental take is a reasonable estimate of the likely incidental take given the seasonal distribution and abundance of shortnose sturgeon in the action area, the level of take historically in the action area, and the level of take of shortnose sturgeon at other dredging projects. 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

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the Kennebec River population of shortnose sturgeon:

1. NMFS must be contacted prior to the commencement of dredging and again upon completion of the dredging activity.

2. The ACOE shall ensure that hopper dredges are outfitted with state-of-the-art deflectors on the draghead and operated in a manner that will reduce the risk of interactions.

3. For hopper dredge operations in the Kennebec River, including dredging at Doubling Point and Popham Beach, a NMFS-approved observer must be present on board the hopper dredge any time it is operating in the river.

4. The ACOE shall ensure that dredges are equipped and operated in a manner that provides endangered/threatened species observers with a reasonable opportunity for detecting interactions with listed species and that provides for handling and collection of sturgeon entrained during project activity. Full cooperation with the endangered/threatened species observer program is essential for compliance with the ITS.

5. The ACOE shall ensure that all measures are taken to protect any shortnose sturgeon that survive entrainment in a hopper dredge.

6. All interactions with listed species during dredging operations must be properly documented and promptly reported to NMFS.

Terms and conditions

1. To implement RPM #1, the ACOE must contact NMFS (Julie Crocker: by email (julie.crocker@noaa.gov) or phone (978) 282-8480 or (978)-281-9328)) within 3 days of the commencement of the dredging and again within 3 days of the completion of dredging activity. This correspondence will serve both to alert NMFS of the commencement and cessation of dredging activities and to give NMFS an opportunity to provide ACOE with any updated contact information or reporting forms.

2. To implement RPM #2, hopper dredges must be equipped with the rigid deflector draghead as designed by the ACOE Engineering Research and Development Center, formerly the Waterways Experimental Station (WES), or if that is unavailable, a rigid sea turtle deflector attached to the draghead. Deflectors must be checked and/or adjusted by a designated expert prior to a dredge operation to insure proper installment and operation during dredging. The deflector must be checked after every load throughout the dredge

operation to ensure that proper installation is maintained. Since operator skill is important to the effectiveness of the WES-developed draghead, operators must be properly instructed in its use.

3. To implement RPM #3, observer coverage on hopper dredges must be sufficient for 100% monitoring of hopper dredging operations. This monitoring coverage must involve the placement of a NMFS-approved observer on board the dredge for every day that dredging is occurring. As the dredge will be operating with the cages open, there must be sufficient observer personnel to allow the observer to work in shifts and still obtain 100% observer coverage to allow for maximum likelihood of detecting any sturgeon present in the hopper. The ACOE must ensure that ACOE dredge operators and/or any dredge contractor adhere to the attached "Monitoring Specifications for Hopper Dredges" with trained NMFS-approved observers, in accordance with the attached "Observer Protocol" and "Observer Criteria" (Appendix A).

4. To implement RPM #4, the observer shall be the only one allowed to clean off the overflow screen. Additionally, any aquatic biological material is the cages must be documented and cleared out only by the observer.

5. To implement RPM #4, the ACOE must ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize takes of listed species. Training shall include measures discussed in Appendix A.

6. To implement RPM #5, any shortnose sturgeon observed in the dredge hopper must be removed with a net and, if alive, returned to the river away from the dredge site.

7. To implement RPM #6, if a shortnose sturgeon or their parts are taken in dredging operations, the take must be documented on the form included as Appendix B and submitted to NMFS along with the final report.

8. To implement RPM #6, the ACOE must contact NMFS within 24 hours of any interactions with shortnose sturgeon, including non-lethal and lethal takes. NMFS will provide contact information annually when alerted of the start of dredging activity. Until alerted otherwise, the ACOE should contact Julie Crocker: by email (julie.crocker@noaa.gov) or phone (978) 282-8480 or the Section 7 Coordinator by phone (978)281-9328 or fax 978-281-9394).

9. To implement RPM #6, the ACOE must photograph and measure any shortnose sturgeon observed during project operations (including whole sturgeon or body parts observed at the disposal location or on board the dredge, hopper or scow) and the corresponding form (Appendix B) must be completed and submitted to NMFS **within 24 hours** by fax (978-281-9394).

10. To implement RPM #6, in the event of any lethal takes of shortnose sturgeon, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or

freeze) until disposal procedures are discussed with NMFS. The form included as Appendix B must be completed and submitted to NMFS as noted above.

11. To implement RPM #6, the ACOE must require that if any lethal take of shortnose sturgeon occurs, the NMFS-approved observer must take fin clips (according to the procedure outlined in Appendix C) to be returned to NMFS for ongoing analysis of the genetic composition of the Kennebec River shortnose sturgeon population.

12. To implement RPM #6, the ACOE must submit a final report summarizing the results of dredging and any takes of listed species to NMFS within 30 working days of the completion of the dredging (by mail to the attention of the Section 7 Coordinator, NMFS Protected Resources Division, 55 Great Republic 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. 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. ACOE 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.

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 and where dredging and disposal activities are taking place and will require ACOE to report any take in a reasonable amount of time, as well as implement measures to monitor for capture during dredging. The ACOE has reviewed the RPMs and Terms and Conditions outlined above and has agreed to implement all of these measures as described herein and in the referenced Appendices. The discussion below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the action as proposed by the ACOE.

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 and where dredging and disposal activities are taking place and will require ACOE to report any take in a reasonable amount of time, as well as implement measures to monitor for entrainment during dredging. 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. ACOE 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. The ACOE has reviewed the RPMs and Terms and Conditions outlined above and has agreed to implement all of these measures as described herein and in the referenced Appendices. The discussion below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the action as proposed by the ACOE.

RPM #1 and Term and Condition #1 are necessary and appropriate because they will serve to ensure that NMFS is aware of the dates and locations of all dredging activities. This will allow NMFS to monitor the duration of dredging activities as well as give NMFS an opportunity to provide ACOE with any updated contact information for NMFS staff. This is only a minor change because it is not expected to result in any delay to the project and will merely involve an occasional telephone call or e-mail between ACOE and NMFS staff.

RPM #2 and Term and Condition #2, are necessary and appropriate as the use of draghead deflectors is accepted standard practice for hopper dredges operating in places and at times of year when sea turtles are known to be present and has been documented to reduce the risk of entrainment for sea turtles, thereby minimizing the potential for take of these species. It is expected that the use of draghead deflectors would also reduce the potential for entrainment of sturgeon. The requirement to use draghead deflectors represents only a minor change as all of the hopper dredges likely to be used for this project, (including the ACOE owned dredge McFarland which could potentially be used for the proposed maintenance dredging), already have draghead deflectors, dredge operators are already familiar with their use, and the use will not affect the efficiency of the dredging operation.

RPM #3 and #4 as well as the implementing Term and Conditions (#3, 4 and 5) are necessary and appropriate because they require that the ACOE have sufficient observer coverage to ensure the detection of any interactions with listed species. This is necessary for the monitoring of the level of take associated with the proposed action. The inclusion of these RPMs and Terms and Conditions is only a minor change as the ACOE included some level of observer coverage in the original project description and the clarification of coverage and responsibilities will not represent an increase in the cost of the project and will not result in any delays. These also represent only a minor change as in many instances they serve to clarify the duties of the inspectors or observers.

RPM #5 and Term and Condition #6 are necessary and appropriate to ensure that any shortnose sturgeon that survive entrainment in the dredge is given the maximum probability of remaining alive and not suffering additional injury or subsequent mortality through inappropriate handling. This represents only a minor change as following these procedures will not result in an increase in cost or any delays to the proposed project.

RPM #6 and Terms and Conditions (#8-12) are necessary and appropriate to ensure the proper handling and documentation of any interactions with listed species as well as requiring that these interactions are reported to NMFS in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and Terms and Conditions represent only a minor change as compliance will not result in any increased cost, delay of the project or decrease in the efficiency of the dredging operations.

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 located in the action area and is not likely to adversely affect the GOM DPS of Atlantic salmon or critical habitat designated for Atlantic salmon. To further reduce the adverse effects of the dredging on listed species, NMFS recommends that ACOE implement the following conservation recommendations.

(1) The ACOE should ensure that dredging is completed as quickly as possible. In the future, maintenance dredging should be avoided during the summer months (i.e., June – September).

(2) Population information on certain life stages is still sparse for this river system. ACOE should support further studies to evaluate habitat and the use of the river, in general, by juveniles as well as use of the area upstream of the former Edwards Dam by all life stages.

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

REINITIATION OF CONSULTATION

This concludes formal consultation on the ACOE's authorization of dredging proposed by ACOE at Doubling Point and Popham Beach in August 2011. 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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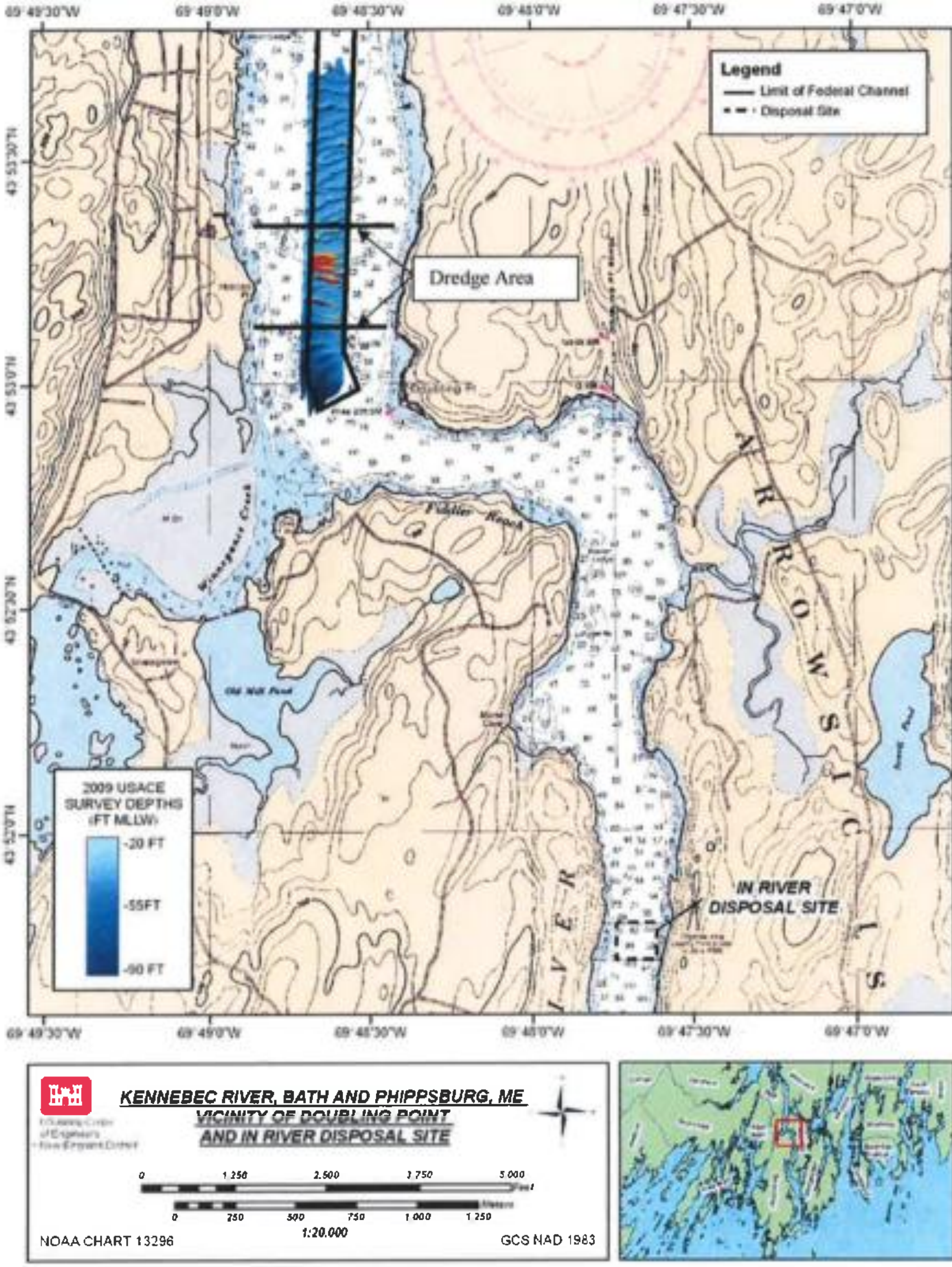
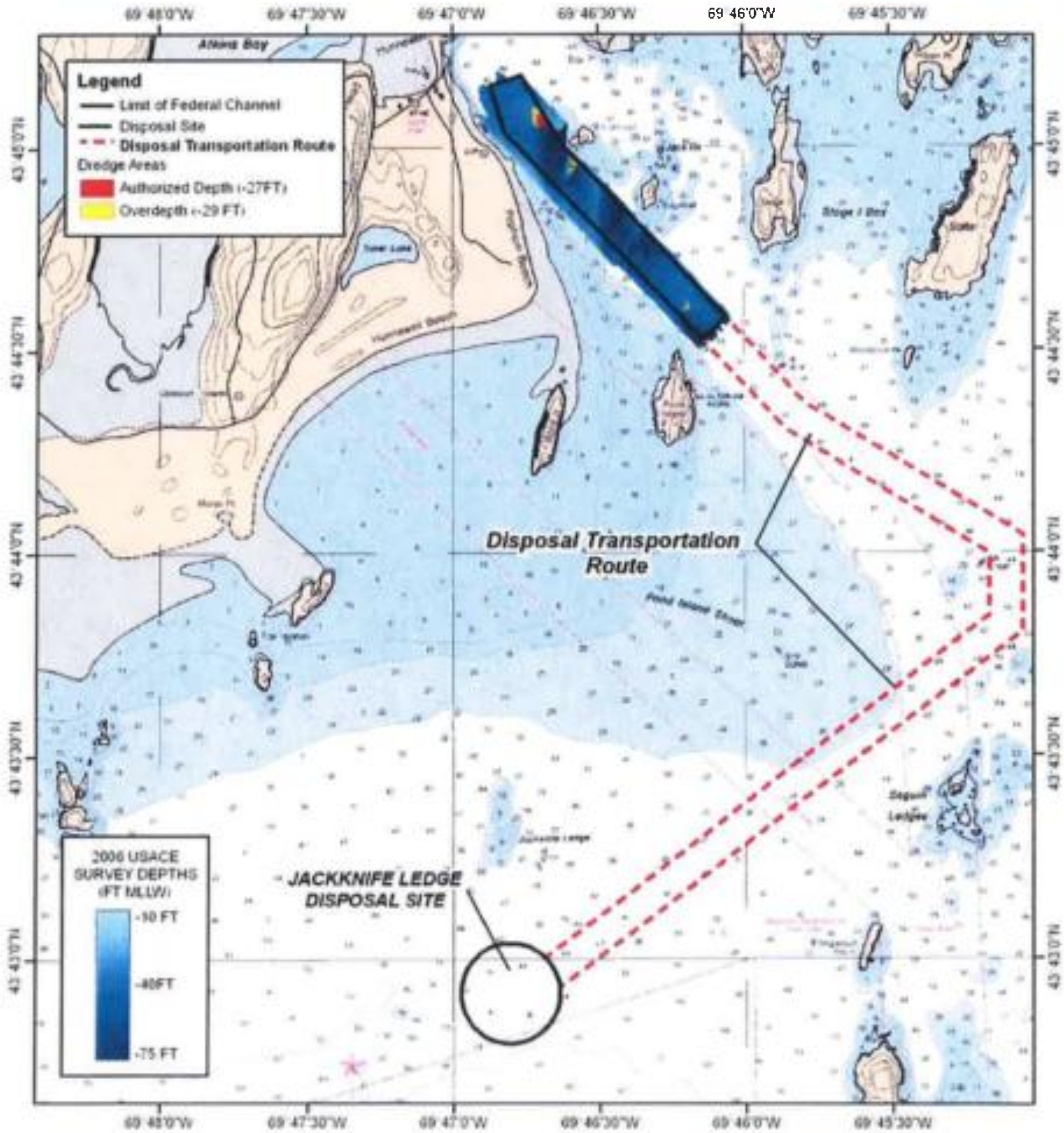
Appendix A
Map 1



ATTACHMENT 2

Appendix A
Map 2



KENNEBEC RIVER, BATH AND PHIPPSBURG, ME
VICINITY OF POPHAM BEACH
AND NEARSHORE DISPOSAL SITE

0 990 1 980 2 970 3 960 4 950 Feet
0 500 1 000 1 500 Meters
1:24,000

NOAA CHART 13295

GCS NAD 1983

ATTACHMENT 3

APPENDIX B.

MONITORING SPECIFICATIONS FOR HOPPER DREDGES
Kennebec River Summer 2011

I. EQUIPMENT SPECIFICATIONS

A. Baskets or screening

NMFS normally requires that baskets or screening be installed over the hopper inflows with openings no smaller than 4 inches by 4 inches to provide 100% coverage of all dredged material. Typically, baskets/screening will allow for better monitoring by observers of the dredged material intake for listed species and their remains. However, based on past experience on the Kennebec River, NMFS is requiring that the dredge operate with the screens open, to allow entrained sturgeon to travel directly to the hopper. Screens, however, must be available for installation should it be determined during dredging activities that their use would be beneficial for minimizing or monitoring take. The baskets or screening must be safely accessible to the observer and designed for efficient cleaning.

B. Draghead

The draghead of the dredge shall remain on the bottom **at all times** during a pumping operation, except when:

1) the dredge is not in a pumping operation, and the suction pumps are turned completely off;
2) the dredge is being re-oriented to the next dredge line during borrow activities; and
3) the vessel's safety is at risk (i.e., the dragarm is trailing too far under the ship's hull).

At initiation of dredging, the draghead shall be placed on the bottom during priming of the suction pump. If the draghead and/or dragarm become clogged during dredging activity, the pump shall be shut down, the dragarms raised, whereby the draghead and/or dragarm can be flushed out by trailing the dragarm along side the ship. If plugging conditions persist, the draghead shall be placed on deck, whereby sufficient numbers of water ports can be opened on the draghead to prevent future plugging.

Upon completion of a dredge track line, the drag tender shall:

1) throttle back on the RPMs of the suction pump engine to an idling speed (e.g., generally less than 100 RPMs) **prior to** raising the draghead off the bottom, so that no flow of material is coming through the pipe into the dredge hopper. Before the draghead is raised, the vacuum gauge on the pipe should read zero, so that no suction exists both in the dragarm and draghead, and no suction force exists that can impinge a turtle on the draghead grate;
2) hold the draghead firmly on the bottom with no flow conditions for approximately 10 to 15 seconds before raising the draghead; then, raise the draghead quickly off the bottom and up

to a mid-water column level, to further reduce the potential for any adverse interaction with nearby turtles;

3) re-orient the dredge quickly to the next dredge line; and

4) re-position the draghead firmly on the bottom prior to bringing the dredge pump to normal pumping speed, and re-starting dredging activity.

C. Floodlights

Floodlights must be installed to allow the NMFS-approved observer to safely observe and monitor the hopper, baskets or screens.

D. Intervals between dredging

Sufficient time must be allotted between each dredging cycle for the NMFS-approved observer to inspect the hopper for any entrained sturgeon and, if necessary, thoroughly clean the baskets and screens for sturgeon or sturgeon parts and document the findings. Between each dredging cycle, the NMFS-approved observer should also examine and clean the dragheads and document the findings.

II. OBSERVER PROTOCOL

A. Basic Requirement

A NMFS-approved observer with demonstrated ability to identify sturgeon species must be placed aboard the dredge(s) being used, starting immediately upon project commencement to monitor for the presence of listed species and/or parts being entrained or present in the vicinity of dredge operations.

B. Duty Cycle

NMFS-approved observers are to be onboard for every day of the dredging project until project completion. While onboard, the observer coverage must be 100%. That is, an observer must be on duty to monitor all dredge operations and monitor the hopper for the presence of entrained sturgeon. Only the observer should be allowed to clean the screens/cages and all biological material must be documented. In addition, the observer shall be the only one allowed to clean off the overflow screen.

C. Inspection of Dredge Spoils

During the required inspection coverage, the trained NMFS-approved observer shall inspect the hopper at the completion of each loading cycle for evidence of shortnose sturgeon. The Endangered Species Observation Form shall be completed for each loading cycle, whether listed species are present or not. If any whole (alive or dead) or turtle parts are taken incidental to the project(s), Julie Crocker (978) 282-8480 or the NMFS Section 7 Coordinator (978) 281-9328 must be contacted within 24 hours of the take. An incident report for shortnose sturgeon take

(Appendix B) shall also be completed by the observer and sent to Julie Crocker via FAX (978) 281-9394 within 24 hours of the take. Incident reports shall be completed for every take regardless of the state of decomposition. NMFS will determine if the take should be attributed to the incidental take level, after the incident report is received. Every incidental take (alive or dead, decomposed or fresh) should be photographed, and photographs shall be sent to NMFS either electronically (julie.crocker@noaa.gov). All completed load sheets, photographs, and relevant incident reports, as well as a final report, shall be submitted to NMFS NER, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298.

D. Information to be Collected

For each sighting of any endangered or threatened marine species (including whales as well as sea turtles), record the following information on the Endangered Species Observation Form (Appendix C):

1) Date, time, coordinates of vessel
2) Visibility, weather, sea state
3) Vector of sighting (distance, bearing)
4) Duration of sighting
5) Species and number of animals
6) Observed behaviors (feeding, diving, breaching, etc.)
7) Description of interaction with the operation

E. Disposition of Parts

If any shortnose sturgeon (alive or dead, decomposed or fresh) or shortnose sturgeon parts are taken incidental to the project(s), NMFS (Julie Crocker (978) 282-8480) must be contacted within 24 hours of the take. All whole shortnose sturgeon, or shortnose sturgeon parts, must be photographed and described in detail on the Incident Report (Appendix B). The photographs and reports should be submitted to Julie Crocker, NMFS, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298. After NMFS is notified of the take, it may instruct the observer to save the animal for future analysis if there is freezer or refrigerator space. Disposition of dead shortnose sturgeon will be determined by NMFS at the time of the take notification. If the species is unidentifiable the subject should be photographed, placed in plastic bags, labeled with location, load number, date and time taken, and placed in cold storage.

III. OBSERVER REQUIREMENTS

Submission of resumes of endangered species observer candidates to NMFS for final approval ensures that the observers placed onboard the dredges are qualified to document takes of endangered and threatened species, to confirm that incidental take levels are not exceeded, and to provide expert advice on ways to avoid impacting endangered and threatened species. NMFS does not offer certificates of approval for observers, but approves observers on a case-by-case basis.

A. Qualifications

Observers must be able to:

1) differentiate between leatherback (*Dermochelys coriacea*), loggerhead *Caretta caretta*), Kemp's ridley *(Lepidochelys kempii*), green (*Chelonia mydas*), and hawksbill *(Eretmochelys imbricata*) turtles and their parts, and shortnose (*Acipenser brevirostrum*) and Atlantic (*Acipenser oxyrinchus oxyrinchus*) sturgeon and their parts;
2) handle live sea turtles and sturgeon and resuscitate and release them according accepted procedures;
3) correctly measure the total length and width of live and whole dead sea turtle and sturgeon species;
4) observe and advise on the appropriate screening of the dredge's overflow, skimmer funnels, and dragheads; and
5) identify marine mammal species and behaviors.

B. Training

Ideally, the applicant will have educational background in marine biology, general experience aboard dredges, and hands-on field experience with the species of concern. For observer candidates who do not have sufficient experience or educational background to gain immediate approval as endangered species observers, the below observer training is necessary to be considered admissible by NMFS. We can assist the ACOE by identifying groups or individuals capable of providing acceptable observer training. Therefore, at a minimum, observer training must include:

1) instruction on how to identify sea turtles and sturgeon and their parts;
2) instruction on appropriate screening on hopper dredges for the monitoring of sea turtles and sturgeon (whole or parts);
3) demonstration of the proper handling of live sea turtles and sturgeon incidentally captured during project operations. Observers may be required to resuscitate sea turtles according to accepted procedures prior to release;
4) instruction on standardized measurement methods for sea turtle and sturgeon lengths and widths; and
5) instruction on how to identify marine mammals; and
6) instruction on dredging operations and procedures, including safety precautions onboard a vessel.

APPENDIX C

ENDANGERED SPECIES OBSERVER FORM
Kennebec River FNP

Daily Report

Date: ______________________________

Geographic Site: ____

Location: Lat/Long ____________________ Vessel Name ___________________________

Weather conditions: ____

____

Water temperature: Surface ____________ Below midwater (if known) ____________

Condition of screening apparatus: ______________________________________

____

____

Incidents involving endangered or threatened species? (Circle) Yes No

(*If yes, fill out Incident Report of Sea Turtle/Shortnose Sturgeon Mortality*)

Comments (type of material, biological specimens, unusual circumstances, etc:)

____

____

____

Observer's Name: ____

Observer's Signature: ______________________________________

Species	# of Sightings	# of Animals	Comments

Incident Report of Shortnose Sturgeon Take
Page 1 of 2

Species ______________________________
Date __________ Time (specimen found) _________

Geographic Site ____
Location: Lat/Long ____

Dredge Load No. ____
Location where specimen recovered

____
____

Weather conditions ____

Water temp: Surface ___________ Below midwater (if known)___________
Water Depth:_________________ Salinity_____________ DO ______________

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 *Please record all tag numbers.* Tag # _______________

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

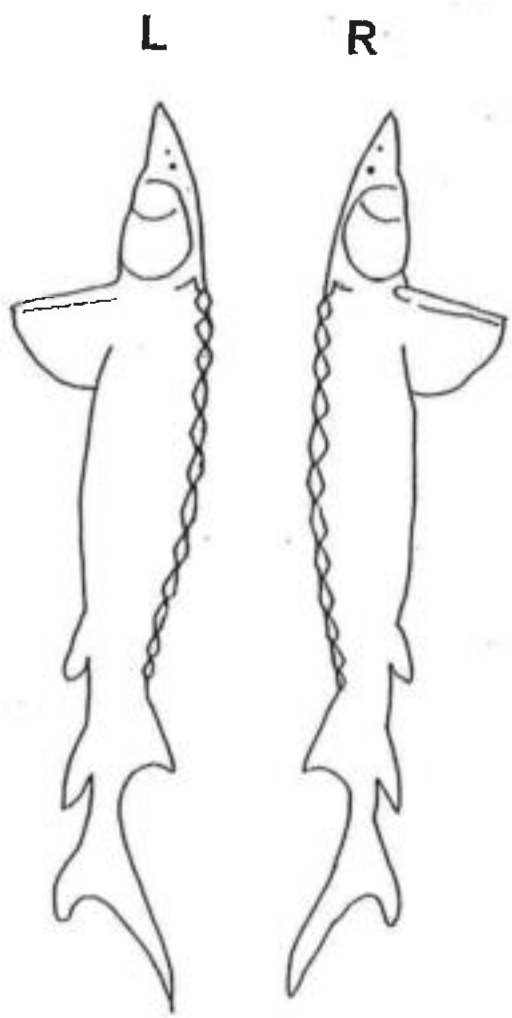
Comments/other (include justification on how species was identified)

____
____
____
____

Observer's Name ____________________________________
Observer's Signature ____________________________________

Incident Report of Shortnose Sturgeon Take
Page 2 of 2

Draw wounds, abnormalities, tag locations on diagram and briefly describe below



Description of fish condition:

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:

____

____

____

APPENDIX D

Procedure for obtaining fin clips from sturgeon for genetic analysis

Updated April 2009

Obtaining Sample

1. Wash hands and use disposable gloves. Ensure that any knife, scalpel or scissors used for sampling has been thoroughly cleaned and wiped with alcohol to minimize the risk of contamination.

2. For any sturgeon, after the specimen has been measured and photographed, take a one-cm square clip from the pelvic fin.

3. Each fin clip should be placed into a vial of 95% non-denatured 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. All vials should be sealed with a lid and further secured with tape Please use permanent marker and cover any markings with tape to minimize the chance of smearing or erasure.

Storage of Sample

1. If possible, place the vial on ice for the first 24 hours. If ice is not available, please refrigerate the vial. Send as soon as possible as instructed below.

Sending of Sample

1. 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:

   Julie Carter
   NOAA/NOS – Marine Forensics
   219 Fort Johnson Road
   Charleston, SC 29412-9110
   Phone: 843-762-8547

   a. Prior to sending the sample, contact Russ Bohl at NMFS Northeast Regional Office (978-282-8493) to report that a sample is being sent and to discuss proper shipping procedures.