Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

AGENCY: U.S. Army Corps of Engineers

ACTIVITY CONSIDERED: Maintenance Dredging of the Connecticut River Navigation Channel

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Northeast Regional Office

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BACKGROUND

In 1872, Congress approved a maintenance dredging project in the Connecticut River below Hartford, Connecticut. The project was modified five times during the first half of this century and was authorized to its current description in 1961 under Section 107 of the 1960 amendments to the Rivers and Harbors Act of 1899. Maintenance dredging is needed to facilitate commercial transportation and ensure safety in the river. The U.S. Army Corps of Engineers (Corps), New England Division, prepared a Biological Assessment for a proposed Federal maintenance dredging project in the Connecticut River in 1982 (Corps, 1982). Since then, the Corps has conducted informal consultations with the National Marine Fisheries Service (NMFS), Northeast Region, regarding impacts to the shortnose sturgeon (Acipenser brevirostrum), which is listed on the U.S. List of Threatened and Endangered Species, from individual maintenance dredging operations below Hartford. The individual projects were considered not likely to adversely affect the shortnose sturgeon or any other listed species under NMFS' jurisdiction.

On October 24, 1991, the Corps submitted a biological assessment to NMFS and requested that a biological opinion be issued to determine if proposed changes to the overall maintenance dredging project in the Connecticut River would likely jeopardize the continued existence of the shortnose sturgeon population. On February 3, 1992, NMFS requested a 60-day extension to review the Biological Assessment and issue a final Biological Opinion. The Corps agreed to that request.

The assessment concluded that adverse impacts to shortnose sturgeon would be limited to disposal of dredged material at riverine disposal sites located in known areas of concentration for the species. NMFS has received new information which indicates that some endangered species of sea turtles also may be present in the project area and, therefore, are considered in this opinion. This biological opinion responds to the Corps' request for formal consultation and represents the best scientific and commercial data available to NMFS.

DESCRIPTION OF PROPOSED ACTIVITY

The authorized Federal project includes a 4.5-meter deep mean low water (MLW), 91-meter wide channel from the mouth of the river to the railroad bridge at Lyme, CT, (river kilometer (rkm) 1) and a 4.5-meter deep MLW, 45-meter wide channel between Lyme and Hartford, CT, (rkm 84). The section of the Connecticut River below Hartford is referred to as the "lower" Connecticut River in this opinion. Specific project plans, which remain unchanged from those detailed in the biological assessment prepared by the Corps in 1982, involve dredging individual bars and shoals to allow for unobstructed navigation of commercial vessels (Corps, 1982). The Corps identified 29 bars and shoals in the 68 kilometers of river from Hartford downriver to Brockway, CT, (rkm 16) and four bars in the lower 16 kilometers of river from Brockway to Long Island Sound that require periodic maintenance dredging (Figure 1). The first 25 km of the Connecticut river, the estuarine region, is referred to as the "lower estuary". Each individual dredging project consists of removing approximately 100,000 cubic yards (cy) of sediment from specific shoals in the channel. The greatest amount of material removed was 459,000 cy, dredged in 1984.

All dredged material will be removed by a hopper dredge which hydraulically pumps sediments from the channel bottom to a hopper contained in the vessel. Once the hopper basin is filled, the vessel travels to the designated disposal site and releases material through its bottom doors. The CURRITUCK, a small hopper dredge which has a capacity of only 300 cy, has generally been used over the past ten years, but the Corps may use larger dredges in the future (Mike Penko, pers. comm.). The size of the dredge to be used depends on the amount of shoaling and the distance the dredge must travel to the disposal site. The Cornfield Shoals Disposal Site (Figure 1) in Long Island Sound is proposed for disposal of material dredged from the river mouth to Essex Shoal (rkm 11) (Ray Francisco, pers. comm.). To reduce transport costs, a large capacity hopper dredge would be favored for disposal of dredged material at this site. There are 10 riverine disposal sites located between Brockway Bar and Hartford which will also be used for disposal of dredged material. Use of riverine disposal sites is determined on an individual basis by the Corps and the Connecticut Department of Environmental Protection.

The Corps performs surveys in the river each year after the spring freshet to determine which bars require maintenance. Typically, 8 to 10 river bars are dredged in one season. The bars are mainly composed of medium to fine grain sand. Time-of-year restrictions have been established by the State, NMFS and the United States Fish and Wildlife Service (FWS) between April 15 and June 15 to avoid impacts to anadromous fish including shortnose sturgeon. Dredging is also restricted in the reach of the river between Rock Landing (rkm 35) and Haddam, CT (rkm 33) between August 15 and October 30 to avoid potential impacts on juvenile shad. The proposed dredging schedule for this maintenance project is from July 1 to August 15.

LISTED SPECIES LIKELY TO OCCUR IN THE PROJECT AREA

The following endangered and threatened species may occur in the Connecticut River or at the Cornfield Shoals Disposal Site (collectively referred to as the project area):

Endangered	
Shortnose sturgeon	*Acipenser brevirostrum*
Kemp's ridley sea turtle	*Lepidochelys kempi*
Leatherback sea turtle	*Dermochelys coriacea*
Green sea turtle	*Chelonia mydas*
Threatened	
Loggerhead sea turtle	*Caretta caretta*

There are no species or critical habitat proposed for listing that occur in the project area.

Shortnose sturgeon

The shortnose sturgeon is an endangered species of fish found in major rivers of eastern North America from the Saint John's River in Florida to the Saint John River in New Brunswick, Canada. This species may also be found in estuaries and in the ocean regions adjacent to river mouths. Dadswell et al. (1984) summarized the biological information for discrete shortnose sturgeon populations in the major river systems along the eastern coast of North America and discovered that shortnose sturgeon from the northern populations (in each major river north of Delaware River) seem to grow more slowly, mature older, spawn less frequently and later in the year, have larger eggs, and live longer than the southern populations.

In the Connecticut River, the Holyoke Dam divides the shortnose sturgeon population in two. Although typically anadromous, a landlocked population of shortnose sturgeon exists in this river system between the Holyoke Dam and the Turners Falls Dam in Massachusetts. A second population, the "lower river" population, exists below the dam and ranges down river to Long Island Sound. The lower river population is estimated to include approximately 800 adult animals (Savoy, 1991). Due to the small population size and the slow growing and reproducing nature of shortnose sturgeon, the loss of only a few adults is considered a threat to this species' survival.

Spawning in the Connecticut River is known to occur during the last week of April or the first week of May, just below the Holyoke Dam, in a deep depression located immediately downriver of the hydroelectric power station at the dam (Buckley and Kynard, 1985a). Environmental factors which influence spawning include water temperatures between 9°C and 12°C, decreasing river flows, and rock/cobble substrates. Typically, a portion of the reproductive adults migrate to the spawning area in early fall and remain there until late April or the beginning of May. After spawning, adults move downstream quickly, following the freshwater flow and feeding on insect larvae and benthic crustaceans (Dadswell et al., 1984; Savoy, 1991). After hatching, juvenile shortnose sturgeon are believed to move downstream slowly while foraging on benthic prey. Juvenile sturgeon reach a length of 14 to 30 cm after one year of growth. In the Hudson River, juveniles average 25.0 cm after one year of growth (Dadswell, 1984). This characteristic growth pattern is most likely evident for shortnose sturgeon in the Connecticut River as the northern populations of sturgeon appear to share similar growth rates.

Movement patterns and habitat use of shortnose sturgeon have been clarified in the past decade because of intensive radio-tracking studies (Buckley and Kynard, 1985b; Savoy and Gottschall, 1990; Savoy, 1991). Limited information regarding juvenile ecology is available because gill nets, the preferred capture method for shortnose sturgeon research, are only successful with sturgeon greater than 50 cm in length. Research efforts have concentrated on the population ranging from the Holyoke Dam at rkm 137 to Long Island Sound. Buckley and Kynard studied the distribution and biology of shortnose sturgeon from the Holyoke Dam to Long Island Sound by monitoring the movements of 90 adult sturgeon during a four-year radio-tracking program (Buckley and Kynard, 1983a; Buckley and Kynard, 1985b). Those studies revealed the existence of four concentration areas in the lower 137 kilometers of the Connecticut River. These occur at Holyoke (rkm 137); Agawam (rkm 117); Hartford (rkm 84) and the Lower River estuary (rkm 0-25)

(Figure 1). The Holyoke concentration area is the only known spawning site for shortnose sturgeon below the Holyoke Dam (Buckley and Kynard, 1983b). The other locations provide spring/summer feeding and overwintering habitat.

The fall upstream migration is the first occasion for pre-spawning adult sturgeon to move to the spawning grounds at Holyoke. In the winter, shortnose sturgeon that have not yet moved to Holyoke either remain at Agawam and Hartford or move downstream to the lower estuary concentration sites. Overwintering sites are described as discrete and are usually located in deep regions of river channels (Dadswell, 1984). Buckley and Kynard (1985a) found that pre-spawning sturgeon favored overwintering sites where velocity was low (0.3 - 0.7m sec^{-1}). As temperatures rise in the spring, a second migration of pre-spawning adults to the Holyoke Dam occurs from Agawam and Hartford. After spawning in May, adults and juveniles migrate downstream to feed at Agawam, Hartford and the lower estuary. Juvenile shortnose sturgeon feed in deep channels over sandy-mud bottoms (Dadswell et al., 1984). Savoy and Gottschall (1990) found that sturgeon can travel up to 35 km/day on downstream spring migrations. Some animals are able to reach the estuary from the spawning site in five days, but the majority of sturgeon remain in the estuary until mid-July. By August most fish begin to move back upstream to Agawam, Hartford or the spawning grounds at Holyoke. Savoy's data indicate that sturgeon may be found throughout the 84 kilometer range of the river below Hartford during all seasons.

More recent tagging studies by Savoy (1991) have examined the movements of adult sturgeon below Hartford. A radio-tracking program revealed an additional concentration area between Hartford and the lower estuary at Middletown (rkm 40-48). It is likely that sturgeon feed in this area throughout the summer and that Middletown is one of the more important overwintering sites in the lower Connecticut River. Radio telemetry studies have also confirmed that shortnose sturgeon in the lower Connecticut River tend to remain in localized concentration areas during the summer months (Savoy, 1991). In general, only the pre-spawning portion of the population moves upriver in the fall to return to the spawning site in Holyoke. Non-spawners appear to range fewer than 1 or 2 km from known concentration areas. Savoy found that sturgeon moved at rates of 0.01 to 0.10 km/day once they are within concentration areas. Fish that migrated to Holyoke to spawn in May would often return to the same area to feed for the remainder of the spring and summer (Taubert 1980; Buckley 1982). In both the Saint John River, Canada and the Connecticut River, shortnose sturgeon exhibited grouping behavior and were often captured and recaptured together in the same areas (Dadswell, 1979; Buckley 1982). This site-specific behavior suggests the critical nature of sturgeon concentration areas.

Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle is the most severely endangered sea turtle in the world. Nesting occurs on a single stretch of beach near Rancho Nuevo, Tampaulipas, Mexico (Carr, 1963; Hildebrand, 1963). The numbers of nesting females have decreased from an estimated 40,000 individuals in 1947 to approximately 400 turtles in 1991 (Meylan, 1986; R. Byles, pers. comm.). Adult distribution is largely restricted to the Gulf of Mexico. Studies of juvenile Kemp's ridley habitat preferences in the Gulf of Mexico reveal that they are most frequently observed in bays, coastal lagoons and river mouths (Marquez, 1990).

Long Island Sound is known to provide an important developmental and foraging habitat for juvenile Kemp's ridleys (Morreale and Standora, 1988). Most of the Kemp's ridleys collected in Northeast waters average 20 to 30cm in carapace length. An unknown number of juvenile sea turtles use inshore waters of the Northeast region during the summer months. In recent years, the ecology and behavior of sea turtles has been extensively studied through a combination of mark and recapture and radio-tracking programs (Morreale and Standora, 1991). Those studies have shown that Kemp's ridley sea turtles arrive in New York's inshore waters beginning in June or July and forage on benthic crustaceans within Long Island's shallow bays through the fall. An analysis of the turtle's diets revealed that spider crabs (Libinia spp.) and Atlantic rock crabs (Cancer irroratus) are the preferred prey (Burke, 1990b). A study of the movements of Kemp's ridleys showed that as water temperatures drop in the fall, the turtles are forced to emigrate from the Northeast region before they become cold-stunned (Burke et al., 1990a).

The most common form of capture of Kemp's ridley turtles in New York waters is by incidental captures in pound nets. The research program conducted by Morreale and Standora relies on these occurrences to confirm the arrival of juvenile sea turtles into the Long Island region (Morreale and Standora, 1990). Turtles caught in pound nets are released unharmed and subsequently used for ecological studies throughout the summer and fall seasons. The animals are usually tagged and/or supplied with radio transmitters and released alive beginning in July. Movements and behaviors of juvenile sea turtles are monitored by telemetry to reveal characteristic patterns of this lifestage. The turtles, which are most commonly captured in the Orient Harbor-Gardiners Bay region, have been tracked throughout most of the bays and inlets of Eastern Long Island and out into Long Island Sound.

The telemetry and recapture data collected by Morreale and Standora reveals important details about sea turtle movements in New York waters. In 1988, one Kemp's ridley sea turtle was followed for ninety-one days along the north side of Long Island until it reached the mouth of the Housatonic River on September 2. During the 1989 tracking season, another Kemp's ridley sea turtle was tracked in the eastern end of Long Island Sound. This turtle was released on July 26 in Gardiners Bay and moved northward and eastward into Block Island Sound, remaining in waters of 100m depth. In early August, the turtle was relocated along the Connecticut coastline near Niantic, CT. This animal's track showed a directed movement eastward (August 12) along the shoreline and then south out of Block Island Sound to the ocean (August 23). This illustrates that juvenile Kemp's ridley sea turtles can and do use Connecticut's coastal waters. It is possible that they may be found at the mouth of the Connecticut River although this has never been documented.

Green Sea Turtle

This primarily tropical species is rarely located in temperate waters although it is known to be a summer and fall inhabitant of New York's inshore waters. The green sea turtle is a solitary nektonic animal that feeds on eelgrass (Zostera marina) and algae in protected nearshore waters (Burke et al., 1991). Major green turtle nesting areas in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Suriname (where the species is considered threatened), and on the east coast of Florida (where the species is considered endangered). More information is needed before estimates of the green turtle population size can be made (USFWS and NMFS, 1991). Although it is not currently possible to determine the origins of juvenile green sea turtles found along the Atlantic coast from Florida to Massachusetts, they are presumed to be from the endangered stock which nests in Florida in declining numbers.

Green turtles appear in the Northeast in benthic feeding grounds once they have reached a length of 20 to 25 cm. The Long Island Sound region is considered to be an important habitat in the early lifestages of the green sea turtle. Typically, juvenile green turtles are first sighted near Orient Point in June or July when they are captured in pound nets (Morreale and Standora, 1990 and 1991). Turtles concentrate in Long Island Sound as they grow, foraging among seagrasses and/or algae. A study of the diet of 11 green turtles from New York waters revealed that 90 percent of the green turtles with a carapace length measuring between 25 and 40 cm had consumed the seagrass Zostera marina (Burke et al., in press). In addition, green turtles also ate various genera of algae, including Fucus, Sargassum, Codium, Ulva, and Enteromorpha. Successive captures of individual turtles over a three-month period indicated that juvenile green turtles were successfully feeding and growing within Long Island Sound (Morreale and Standora, 1990 and 1991). Like the Kemp's ridley, the green turtle moves southward in late fall as water temperatures decline in Long Island Sound.

Loggerhead Sea Turtle

The western Atlantic population of the loggerhead turtle, the second largest in the world, is recognized as a threatened species and nests in the southeastern United States. Due to the inability to count subadults, it is impossible to estimate the size of the U.S. loggerhead population. An estimate of 14,150 females nesting per year in the southeastern United States is generally agreed upon as a best approximation and provides a useful index to population size and stability (USFWS and NMFS, 1991). As hatchlings, loggerheads move offshore and are believed to associate with Sargassum until they reach a straight carapace length of 40 to 50 cm (NMFS & USFWS, 1991). After a few years, juveniles move inshore to nutrient-rich estuarine regions where they develop into subadults. These nearshore feeding migrations during late June to early November occur near Cape Cod and Long Island but may range as far north as Nova Scotia. The species' winter and early spring range is south of 37°00'N in estuarine rivers, coastal bays, and shelf waters of the southeastern United States. Loggerheads move northward as surface water temperatures reach 20°C.

Loggerheads usually forage near high energy beaches but may also enter bays, lagoons and estuaries. This species mainly prefers benthic invertebrates and decapod crustaceans as prey items although they will also feed on jellyfish (Dodd, 1988). Juvenile and subadult loggerheads move into Long Island Sound in June and remain until November, mostly feeding on crabs, mollusks, and algae. In 1990, Morreale and Standora reported 36 incidental captures of loggerheads in pound nets in this region from July until November. By late fall, turtles retreat from Long Island Sound to warmer waters from North Carolina to Florida (Nelson, 1988).

Leatherback Sea Turtle

This species is widely distributed throughout the world, nesting on tropical beaches and feeding in temperate waters on its preferred prey, jellyfish (Cyanea capillata). Easily distinguished from other sea turtles, the leatherback is characterized by its large spindle-shaped body and leathery, unscaled carapace. Leatherbacks are usually sighted in colder waters and at higher latitudes than other sea turtles (NMFS, 1990). In general, this species maintains a pelagic existence but is known to enter coastal waters during the reproductive season or when jellyfish move inshore in late summer and fall (Marquez, 1990). Aerial cetacean and sea turtle population survey data from the summer and fall of 1982 reported that the highest densities of leatherback turtles near Long Island occurred in the New York Bight area (URI, 1982). There are very few known occurrences of leatherbacks within New York's inshore bays. In 1991, the Mystic Marinelife Aquarium reported thirteen dead strandings and five live sightings of leatherback sea turtles along the Rhode Island coast (R. Nawojchik, pers. comm.). These events began in August and lasted until mid-October. This inshore movement of leatherbacks probably corresponded to the location of prey items.

ASSESSMENT OF IMPACTS

Direct Effects

<u>Shortnose sturgeon</u>

With the limited information available, it is not possible to identify ecological patterns of all age-classes and/or both sexes of the shortnose sturgeon population in the Connecticut River. Detailing shortnose sturgeon movements is complicated by their long life span, delayed maturity and nonannual spawning (Buckley and Kynard, 1985). Migration patterns that are observed during one year are not always seen in consecutive years because mature adults will not return to the spawning site each year. Also, radio-tagging studies can only provide data on a small percentage of animals and are not representative of all age-classes or both sexes of the shortnose sturgeon population. More information on juvenile ecology is needed to assess impacts to this portion of the population. Knowledge of the sex ratio of shortnose sturgeon as well as the distribution and movements of males and females in the Connecticut River would allow us to forecast more realistic levels of impact to the population. Dredging and in-water disposal activities in known shortnose sturgeon concentration areas and during peak use of these areas will likely affect the species and its habitat by

1. Entrainment in the hopper dredge
2. Burial during disposal operations
3. Destruction of habitat/prey resources
4. Disruption of migratory movements
5. Dispersion of pollutants

1. Entrainment in the hopper dredge

The Biological Assessment (Corps, 1991) states that shortnose sturgeon are not likely to be entrained in the dragheads of the dredge during operations because sturgeon smaller than 25 cm would not be present in the lower estuary during the time of dredging and that entrainment of larger fish (>45 cm) is not likely. Although juvenile shortnose sturgeon hatch at Holyoke, it is not known how far downstream they may move during the summer. Dadswell (1984) reported that the downstream limit of juvenile shortnose sturgeon migration in the Saint John Estuary, Canada extends beyond the normal salt-wedge excursion during flood periods. In the Hudson River Estuary, Dovel (1981) reported that both recently-hatched larvae and young fish also moved downstream to brackish water during the summer and early fall. Salt water usually does not intrude more than 13 km above the river mouth (Brockway Id.), and never exceeds rkm 25 (Buckley and Kynard, 1985b). In years when the spring freshet is exceedingly high, the salt-wedge may not extend beyond the Lyme, Connecticut Railroad Bridge.

NMFS does not concur with the Corps' conclusion that juvenile sturgeon would not be at risk from dredging because they are only found upstream of the project area. It is possible that foraging young sturgeon might follow the adults and older juveniles to the feeding concentration areas in the estuary, and beyond the normal upstream limit of saltwater intrusion. Dadswell et al. (1984) reported the presence of juvenile shortnose sturgeon in the Saint John Estuary during the summer. Kynard (pers. comm.) has also suggested that juvenile shortnose sturgeon probably migrate to the estuary to feed along with adults. Their small size and apparently close association with the benthos would make young sturgeon particularly vulnerable to entrainment in a hopper dredge.

In addition, the possibility of impacting adult sturgeon, greater than 45 cm long, is not unlikely since there is evidence that adult sturgeon are entrained from hopper dredges in other regions. Endangered species observer efforts in South Carolina in 1990 documented the lethal take of two Atlantic sturgeon (69 cm), Acipenser oxyrhynchus, from hopper dredging in the Georgetown Entrance Channel (see Figure 2) (Slay 1992, pers. comm.). Larson and Moehl (1988) also referenced that three adult spiny dogfish, Squalus acanthias, were entrained by a hopper dredge in Grays Harbor, Washington. Both of these species' lengths are well within the size range of adult sturgeon in the Connecticut River. The NMFS Southeast Region has documented takes of loggerhead sea turtles, measuring 65 cm, in dragheads. Therefore, adult sturgeon in the 40 to 60 cm range must be considered vulnerable to entrainment in hopper dredges. The potential for entrainment in hopper dredges would most likely increase with the use of larger size hopper dredges. Although there are no documented direct takes of shortnose sturgeon from hopper dredges, two dead sturgeon (sp. undetermined) were discovered with severe lacerations downstream of a Corps dredging operation in the Kennebec River (Corps, 1991). It is possible that more shortnose sturgeon have been harmed by hopper dredges, but that these incidents have not been recognized.

Hopper dredges operate at moderate speeds and trail powerful dragheads which suck up bottom materials at a rate of up to 2000 cubic yards per hour. Sturgeon and sea turtles can be entrained in the dragheads, which can measure 8-10 feet in size, and subsequently forced through the system. Marine organisms, including sturgeon and sea turtles, may get deposited into the hopper basin along with the heaviest sediments or become part of the overflow that washes over the side of the vessel with the lighter sediments and excess water. The overflow may be screened by steel mesh baskets which trap organisms that are drained from the hopper. The screening of this overflow is the principal way of documenting the take of marine species. The take of shortnose sturgeon can go undetected if fish either sink to the bottom of the hopper basin with dredged sediments or if sturgeon parts on the baskets are not noticed or are unrecognizable.

Hastings (1983) studied the distribution of shortnose sturgeon before, during, and after maintenance dredging by the Corps in the Delaware River in the fall of 1983. Based on attempted catches made in the vicinity of the dredge site, Hastings found that shortnose sturgeon were temporarily displaced from concentration areas. Large aggregations of sturgeon are known to congregate in shallow regions of the lower Connecticut River and are believed to be the most vulnerable to the effects of dredging (Savoy, unpublished data).

Savoy (1991) studied the movements and occurrence of sturgeon in the lower estuary of the Connecticut River from 1989 to 1991. Telemetry data from radio-tracked sturgeon revealed that fish strongly associate with the shallow, sandy bars south of the Brockway Bar Channel (Savoy, unpublished data). High numbers of sturgeon were also found within the Essex Shoal and Calves Island channels. About 50 percent of sturgeon tracked in the estuary were located on shallow flats while the other fifty percent utilize deep channel areas. Because it is not possible to identify the sex of these animals before tagging, NMFS does not know what proportion of males and females are using the two habitats. Knowledge of sexual habitat preferences would aid in assessing the risk associated with this dredging project. The Corps states that the most frequently dredged bars in the project area are the bars and shoals in the estuarine portion of the river. These areas are usually dredged once every 2-4 years. Dredging during the summer months is likely to adversely affect shortnose sturgeon. Their heavy use of these areas as feeding sites and the negative impacts associated with hopper dredges places shortnose sturgeon at risk from dredging activities.

In the Biological Assessment, the Corps stated that dredging impacts to shortnose sturgeon outside of the concentration areas would be insignificant since sturgeon would not be concentrated in those sections. Even though it has been demonstrated that shortnose sturgeon do concentrate in certain areas of the lower estuary, the data is only representative of the radio-tracked individuals and may not be indicative of the distribution and movements of the entire population. Furthermore, sturgeon may also transit between different feeding areas and would be susceptible to dredging and disposal activities in various segments of the river. Sturgeon use of the Connecticut River below Hartford in July and August appears to be distributed among four areas including the Hartford site. Impacts associated with dredging and disposal activities cannot be assumed to be restricted to just these specific areas. Until NMFS has more conclusive data on the population in the lower Connecticut River from radio-tracking and gill net capture studies, it cannot be assumed that shortnose sturgeon distribution is limited to these four locations.

2. Burial during disposal operations

Disposal of dredged material above Essex Shoal will be at designated riverine disposal sites along the project route. Shortnose sturgeon that cluster in deeper channel areas in the lower part of the Connecticut River might be impacted by this activity. Hopper dredges, including the Corps'-owned CURRITUCK, are capable of releasing dredged material quickly. Since shortnose sturgeon are reported to demonstrate allegiance to specific concentration areas, including many of the deep areas adjacent to channels in the lower estuary, it is likely that animals would either be buried by the dredge slurry or displaced from significant habitats (Savoy, 1991). Juveniles that feed in the deeper regions of the lower Connecticut River, would be vulnerable to burial from disposal of dredged material due to their small size. Adverse impacts to the shortnose sturgeon population as a result of losses to juveniles would not be realized for 8-10 years, when this age class would become reproductively active. Riverine disposal has the potential to disrupt feeding activities or eliminate traditional feeding sites where both adults and juveniles congregate.

3. Destruction of habitat/prey resources

According to Dadswell et al. (1984), shortnose sturgeon are primarily benthic feeders. Adults and juveniles eat crustaceans and insects in freshwater regions, while adults foraging in saline areas prefer mollusks.

There is no published data on shortnose sturgeon feeding in the lower Connecticut River. A Corps Environmental Assessment (1986) reported that invertebrate species likely to occur in the estuarine portion of the river include capitellid and spionid polychaetes, crustaceans, bivalves and gastropods. Kynard reports that adult shortnose sturgeon in the Connecticut River feed heavily on bivalve clams (B. Kynard, pers. comm.). Dadswell et al. (1984) found that adult sturgeon in the Saint John River, New Brunswick, Canada, feed over sandy bottoms in the summer, concentrating on molluscans. Stomach contents from adults that were feeding in saltwater contained Mya arenaria or Corbicula manilensis and a large amount of mud and bottom debris. Soft-shell clams can be found in silty-sand intertidal and subtidal areas throughout the lower estuary (Corps, 1986).

Carlson and Simpson (1987) examined the stomach contents of juvenile shortnose sturgeon that were impinged on power plant intake screens in the Upper Hudson River Estuary. The most abundant prey items discovered in young- of-year sturgeon were midge larvae and amphipods. Yearling and juvenile sturgeon consumed the amphipods Gamarus spp. and the isopod Cyathura. Amphipod densities peak in late summer and contributed to the greatest percentage of biomass in juvenile sturgeon diets at that time.

Preferred foraging grounds appear consistent in northern sturgeon populations. Shortnose sturgeon prefer feeding over sandy-mud bottoms in the Hudson Estuary (Carlson and Simpson, 1987). In the lower portion of the Saint John Estuary in New Brunswick, Canada, shortnose sturgeon foraging grounds are characterized as sand-mud bottoms with depths of 5-15m (Dadswell, 1979). Dadswell found that juvenile sturgeon from the Saint John Estuary fed on benthic crustaceans or insect larvae while adults preferred molluscan prey. In saline regions of the river, adult sturgeon fed primarily on Mya arenaria and Macoma balthica. Savoy reports that shortnose sturgeon are probably not feeding on mollusks in the lower part of the Connecticut River but are concentrating on the more abundant mysids and shrimp (Savoy, pers. comm.). Summer appears to be a critical feeding season for shortnose sturgeon as feeding activity peaks in water temperatures above 10°C (Dadswell, 1979). In the lower Connecticut River water temperatures average 23°C to 30°C from late June to September (Corps, 1991).

As water temperatures drop in the fall, sturgeon cease feeding and migrate to overwintering areas. In the Saint John Estuary in Canada, Dadswell (1979) found that by late September, sturgeon have emigrated from summer foraging grounds to discrete overwintering sites in deep saline regions in the lower estuary. Disposal of sediments in deeper overwintering sites of the Connecticut River would affect shortnose sturgeon that traditionally return to those specific sites each year. Although feeding activity diminishes during the winter when water temperatures are lower, those areas are considered ecologically important to the population.

Dredging can dramatically reduce the quality of shortnose sturgeon habitat by removing potential food sources at a critical time of the year. The Corps (1986) reported that dredging would remove benthic organisms from 45 acres of channel area in the lower five shoals in the river. An analysis of benthic diversity performed by the Corps in 1986 showed that the sandy areas contained a high abundance of crustaceans and insects. Since sturgeon use the lower Connecticut River for feeding during the summer months, disturbance to habitat and prey might impact sturgeon development and potentially affect the success of next season's spawning. Although benthic invertebrates are often able to recolonize an area after a disturbance, this prey resource is essentially lost for at least one season. Also, the smaller juvenile invertebrates that do successfully recolonize do not provide an energy-efficient source of nutrients for shortnose sturgeon. Since sturgeon are known to feed in the same discrete, concentrated areas each year, frequent disturbances to these habitats would repeatedly affect shortnose sturgeon over the life of this dredging project.

4. Disruption of migratory movements

Shortnose sturgeon move upstream in the late summer and fall as estuarine waters become more saline and water temperatures decrease. Fall upstream migrants head to overwintering sites at Middletown, Hartford, Agawam or to the spawning grounds at Holyoke, MA. Shortnose sturgeon migratory movements in the Connecticut River are known to follow narrow channels in the river (Savoy, pers. comm.; Kynard, pers. comm.). It is not known whether or not sturgeon are able to utilize other areas in the river when travelling long distances. Disruption of migratory movements may affect sturgeon that are unable to avoid dredging activities occurring in a migratory pathway. More information is needed on sturgeon use of the Connecticut River to determine exactly when and where in the river shortnose sturgeon movements occur.

Buckley and Kynard (1983a) discovered that the spawning period for shortnose sturgeon occurs over a brief 5-7 day period in May. Factors which negatively influence sturgeon movements upstream to the spawning site could affect that year's recruitment by affecting an animal's arrival at the spawning site. Channelization alters natural current patterns which may interrupt critical migrations by confusing or deterring shortnose sturgeon that are travelling between important habitats.

5. Release of Contaminated Material

The most recent sediments analyzed from the Connecticut River were collected in 1982. Levels of oil, grease and heavy metals were reported to be low (Connecticut Dept. of Environmental Protection Class I) and Cadmium levels were 3-7 ppm (Class II) (Corps, 1991). PCB levels were also low (34-250 ppb). In the past ten years elevated levels of polyaromatic hydrocarbons (PAH's) and PCB's, which were never tested for in 1982, have been discovered at various sites along the river. PAH's are highly toxic substances and are believed to be carcinogenic to fish. PCB's have reproductive effects. Resuspension of contaminated materials, particularly those including PAH's, may be detrimental to shortnose sturgeon.

Sea Turtles

Morreale and Standora (1989, 1990) confirmed the annual presence of juvenile Kemp's ridley, loggerhead and green sea turtles in Long Island Sound. Turtles move into the region in June and July and usually remain until their southern migrations begin in late October or early November. Most of the animals appear to concentrate in the productive nearshore waters around Orient Point and Noyack Bay, although animals may move further out into the Sound. A mark/recapture and radio-telemetry program indicated that all species exhibited active foraging behavior and high growth rates during the warm months of July, August and September. By late October, most of the tracked turtles had started emigrating out of New York waters (Morreale and Standora, 1990). Recaptures of loggerhead, Kemp's ridley and green sea turtles in Long Island Sound demonstrated that, in general, turtles moved very little from their original point of capture. Seventy-five percent of the recaptured turtles had not moved more than 10 km over the three month study period. This indicates that sea turtles show site fidelity to specific feeding areas.

To date, the Kemp's ridley is the only sea turtle that has been located on the Connecticut side of Long Island Sound. Although the green and loggerhead sea turtle have never been sighted near the mouth of the Connecticut River, the habitat would seem to support these species, in addition to the Kemp's ridley, because the coastal waters are highly productive and contain many prey resources normally consumed by these sea turtles (S. Morreale, pers. comm.). Morreale and Standora have discovered that sea turtles prefer sites within Long Island Sound that are characterized by high concentrations of algae, fish, mollusks, seagrasses and crustaceans, all of which have been documented in the coastal areas of Connecticut (CT DEP, 1984).

There are two possibilities for the low incidence of sea turtles along the Connecticut coastline. Sea turtle research efforts in Long Island Sound are primarily restricted to the research program that is directed by the Okeanos Foundation on Long Island, NY. Therefore, sightings of sea turtles in Connecticut are rare since there is very little effort to look for them there. Secondly, as Morreale and Standora have reported, the factors that lead to obtaining sea turtles for research purposes include incidental captures in pound nets and occurrences of stranded, cold-stunned turtles. Both of these sources for sea turtles appear to be limited to the eastern Long Island region. Pound nets are not highly used in Connecticut waters (CT DEP, 1984) and cold-stunned turtles most often strand on northward facing beaches of Long Island due to the prevailing winds (i.e., surface currents) that affect the location of these events (Burke, 1991).

Hopper dredging operations at the mouth of the Connecticut River during July and August have the potential to adversely affect sea turtles by entrainment into dragheads or by destruction and/or removal of habitat. Of the three types of dredges that are commonly used in projects (clamshell, hopper, and pipeline), the higher speed and powerful dragheads of the hopper make it the greatest threat to sea turtles.

A biological opinion issued by the NMFS Southeast Region concerning the adverse effects of hopper dredging stated that Kemp's ridley and green turtles are particularly vulnerable to the impacts of hopper dredging activities (NMFS, 1991). In the Kings Bay, Georgia channel 3 endangered Kemp's ridley turtles and 3 green turtles were lethally taken by hopper dredges in one season. This unprecedented level of a documented take alerted NMFS to the potential for cumulative damage to sea turtle populations from hopper dredges. Another potential effect on sea turtles that forage in nearshore waters by the mouth of the Connecticut River is the loss of benthic food sources from removal or burial of prey. Hopper dredging can severely impact shallow habitats. Seagrass beds, which serve as feeding pastures for green sea turtles, are susceptible to damage from boating or dredging activities (Zieman, 1976). The destruction of available foraging sites from dredging may have negative effects on green turtles, causing them to lose available prey resources in the region.

Hopper dredges have also taken large numbers of loggerhead sea turtles in dredging operations in the southeastern United States (NMFS, 1991). In this region, loggerheads seem to concentrate in ship channels where they are most likely to be effected by hopper dredging. Subadult loggerheads are by far the most common sea turtle to be killed by hopper dredges. Hopper dredging of the Cape Canaveral Channel in Florida during the period of July through November, 1980 resulted in at least 71 loggerhead sea turtle mortalities. NMFS believes that the levels of sea turtle mortality in the Southeast, which seem to be associated with greater population sizes, are much higher than could be expected for sea turtles in Northeast waters.

Four takes of Kemp's ridley sea turtles were reported for maintenance dredging activities which were conducted using a hopper dredge in King's Bay and Brunswick Harbor, Georgia (NMFS, 1991). The Kemp's ridley is believed to be in the greatest danger of extinction of all the sea turtles and is considered especially vulnerable to the adverse impacts associated with hopper dredging. The NMFS Southeast Region has reported that ninety-five percent of all sea turtle/dredge encounters result in mortality. In the southeastern United States these mortality rates varied among species and different size animals. In Long Island Sound, where only juvenile Kemp's ridley are found, the extent of mortality may be greater because the animals are smaller and may be more easily drawn into the dragheads.

It is not likely that dredged material disposal at the Cornfield Shoals Disposal site will endanger any sea turtle or habitat for any sea turtle species since this region is at a depth not utilized by the animals.

Indirect Effects

The impacts associated with maintenance dredging in the Connecticut River will effect shortnose sturgeon and sea turtles over many years. Dredging at the mouth of the river and in the lower estuary is likely to occur every 2-4 years because the bars and shoals accrete the greatest amount of sediments each year (Corps, 1986). Impacts to shortnose sturgeon and its habitat would be greatest in the lower estuary where densities of fish are higher during the proposed dredging season (July-August). Sea turtles that may be using the mouth of the Connecticut River as foraging grounds would be adversely impacted and/or displaced by extensive dredging operations which disturb feeding areas. This project is not designed to augment the recreational vessel capacity of the Connecticut River but to relieve navigational difficulties already experienced by existing commercial vessel traffic. Therefore, it is not likely that the incidence of boat collisions with sea turtles will increase as a result of this project.

Cumulative Effects

<u>Sea Turtles</u>

Other sources of human-induced mortality and/or harassment of sea turtles in Long Island Sound include incidental takes in commercial fishing operations, boat collisions and ingestion of foreign debris. Natural mortalities of turtles, including disease (parasites), predation and cold-stunning also occur in Northeast waters. The most frequent anthropogenic source of mortality for sea turtles in New York waters is by collisions with recreational boaters (S. Morreale, pers. comm.). Deaths may also result from ingestion of plastics and debris and from accumulation of toxic substances. The food preferences of leatherbacks (jellyfish) and green turtles (algae, seagrasses) cause them to be particularly susceptible to ingestion of foreign materials. Necropsies of leatherback and green turtles from the New York Bight area showed that 1 of 4 green and 10 of 33 leatherback turtles had plastic debris in their digestive tracts (S. Morreale, pers. comm.). It is difficult to make quantitative assessments of the level of mortality from these sources although their impact could be severe. Future dredging and/or beach nourishment in the inner bays of the eastern tip of Long Island also pose a threat to sea turtle species. Destruction of habitat or turtle interactions with dredge vessels could result from these activities.

Shortnose sturgeon

The shortnose sturgeon is currently threatened by other activities in the Connecticut River. Most severe are the potential impacts to the sturgeon spawning site below the Holyoke Dam. In the summer of 1991 an unauthorized temporary causeway was placed in the Connecticut River just upstream of the shortnose sturgeon spawning site. Ordinary water flows over the causeway may have caused sediments to be deposited into the spawning area. Shortnose sturgeon require a clean rock/cobble bottom to deposit their eggs. Unfavorable substrates could make it impossible for eggs to adhere to critical interstitial areas.

A second, potentially damaging occurrence at the sturgeon spawning site is a release of coal tar to the Connecticut River, upstream of the spawning area. The potential effects of coal tar on the spawning success of the adult population, shortnose sturgeon egg survival and larval development have yet to be investigated. Coal tar contains toxic PAH's that are known to be carcinogenic.

In other regions of the Connecticut River, shortnose sturgeon are threatened by commercial and sport fishing activities and power plants along the edges of the river. The shad gillnet fishery is believed to take shortnose sturgeon incidentally, although catch rates are not available (Kynard, pers. comm.; Savoy, pers. comm.). Impingement of shortnose sturgeon on power plant intake screens is also believed to contribute to sturgeon mortality in the Connecticut River.

CONCLUSIONS

Sea Turtles

NMFS concludes that maintenance dredging of the Connecticut River may adversely affect but is not likely to jeopardize the continued existence of endangered Kemp's ridley (Lepidochelys kempi), green (Chelonia mydas), or threatened loggerhead sea turtle (Caretta caretta). The endangered leatherback sea turtle (Dermochelys coriacea) is not likely to be affected by this project. This opinion is based on minimal sightings of sea turtles at or near the mouth of the Connecticut River and the general abundance of sightings on the Long Island side of Long Island Sound. Morreale and Standora have tracked sea turtles within Long Island Sound for the past three years and have not observed any animals actually in the mouth of the Connecticut River. A Kemp's ridley sea turtle was tracked near Niantic, CT, approximately seven miles from the mouth of the Connecticut River, but this was the closest approach of a sea turtle to the project area. The lack of sea turtle observations in the Connecticut River may be due to a lack of sighting effort in that area; However, the best available scientific information indicates that sea turtles are predominantly utilizing the shallow bay areas around Long Island and do not seem to transit across the Sound in substantial numbers. Prevailing winds and oceanographic features of Long Island Sound most likely contribute to this finding. Direct impacts to sea turtles can be avoided entirely if dredging near the mouth of the river occurs between December 1 and June 1 when water temperatures are colder and sea turtles are not likely to be encountered. A sea turtle observer program would document any incidence of sea turtle mortalities as a result of hopper dredging in the Connecticut River.

Shortnose sturgeon

NMFS concludes that the proposed maintenance dredging project in the Connecticut River, which will involve use of a hydraulic hopper dredge in July and early August, is likely to jeopardize the continued existence of the shortnose sturgeon. Adult shortnose sturgeon (greater than 45 cm total length) use of the lower Connecticut River, particularly the lower estuary, during the period proposed is extensive and well defined (Savoy, 1990, 1991; Buckley and Kynard, 1985). Moreover, it is probable that juveniles also utilize the lower estuary for feeding during the summer (Dadswell, 1984; Dovel, 1981). Hopper dredging and riverine disposal within the lower Connecticut River is likely to affect the Connecticut River shortnose sturgeon population by entrainment in hopper dragheads and potential burial of young-of-year and juvenile sturgeon. In addition, significant feeding habitat may be buried or destroyed and migratory movements may be disrupted.

REASONABLE AND PRUDENT ALTERNATIVE

Alternative actions to avoid jeopardy to shortnose sturgeon were discussed with the Corps during formal consultation. Implementation of the following reasonable and prudent alternative is required to avoid the likelihood of jeopardizing the continued existence of the shortnose sturgeon in the Connecticut River.

1. Hopper dredging for this maintenance project below Hartford, Conneticut must be restricted to August 15 to April 1.

2. Disposal of dredged material must not occur in Connecticut River disposal sites below Brockway Bar.

3. The Corps must coordinate with the Connecticut Department of Environmental Protection in selecting riverine disposal sites between Hartford and Brockway Bar. Pertinent data from radio-tracked shortnose sturgeon must be reviewed to assist in determining appropriate disposal sites.

4. As new information on shortnose sturgeon distribution and movements becomes available, the dredging window may be adjusted or restricted in certain regions of the Connecticut River.

5. If the Corps plans to use types of dredging equipment other than the hopper dredge (i.e. clamshell), it must consult with NMFS before operations begin.

REINITIATION OF CONSULTATION

Reinitiation of formal consultation is required if (1) the amount or extent of taking specified in the incidental take statement is met or exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Biological Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA requires that all Federal agencies use their authorities to carry out programs for the conservation of endangered and threatened species. NMFS has determined that hopper dredging operations in the Connecticut River are not likely to jeopardize the continued existence of endangered or threatened sea turtles, despite the possibility that sea turtle(s) may be taken. NMFS also believes that maintenance dredging of the lower Connecticut River, in addition to cumulative effects, will jeopardize the continued existence of shortnose sturgeon unless reasonable and prudent alternatives are followed. To further reduce and/or eliminate adverse impacts to shortnose sturgeon, juvenile Kemp's ridley, green and/or loggerhead sea turtles, NMFS recommends the Corps implement the following:

1. The Corps shall arrange for NMFS-approved observers to monitor hopper spoil, overflow, screening and dragheads for endangered sea turtles and shortnose sturgeon and their remains. Sea turtle observers shall be aboard hopper dredges operating between Saybrook Outer Bar (rkm 1) to the railroad bridge (rkm 5) and disposal at the Cornfield Shoals Disposal Site for 50 percent coverage. To document any takes of shortnose sturgeon, observers shall be aboard hopper dredges over the entire project area for 50 percent coverage. An endangered species observer program must utilize qualified observers who can demonstrate their ability to identify individual sea turtle species in-water and identify sea turtle and shortnose sturgeon parts after entrainment in a hopper dredge. NMFS-approved training for endangered species observers shall be used for those individuals who do not initially qualify as NMFS-approved observers.

2. The Corps should avoid riverine disposal in known shortnose sturgeon concentration areas in the lower Connecticut River. NMFS encourages close cooperation with the CT DEP regarding selection of disposal sites above the Brockway Bar region.

3. The Corps should support future research to determine age structure and sex ratio of the shortnose sturgeon population in the Connecticut River. There is a need to know which age-classes and sexes are being represented in concentration areas in the lower Connecticut River. Knowledge of juvenile as well as male/female distribution could assist the Corps in making appropriate decisions on where and when to dredge in the Connecticut River.

4. The Corps should support future research to define critical shortnose sturgeon habitat in the lower Connecticut River

and more accurately determine the timing of sturgeon movement into and out of these regions. This information will allow fine-tuning of dredging windows.

5. The Corps should initiate a research program that will document juvenile sea turtle utilization of Connecticut coastal waters. Sea turtle movements and distribution within Long Island Sound, especially those of green and loggerhead turtles, are still largely unknown. Current and future management needs in this region would benefit from more ecological studies.

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INCIDENTAL TAKE STATEMENT

Section 7(b)(4) of the ESA provides for issuing an incidental take statement on the agency action if the biological opinion concludes that the action is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. In this situation, NMFS will issue an incidental take statement that specifies the impact of any incidental taking of endangered or threatened species, provides for reasonable and prudent measures that are necessary to minimize impacts, and sets forth terms and conditions which the action agency must comply with to implement the reasonable and prudent measures. Incidental takings resulting from the agency action, including incidental takings caused by activities authorized by the agency, are authorized under this statement only if those takings are in compliance with the specified terms and conditions.

NMFS believes that an acceptable mortality rate for shortnose sturgeon in the Connecticut River is 5 percent. With a conservative estimate of 700 adult animals in the lower Connecticut River, human-induced mortality should not exceed 35 animals/year. Other suspected sources of shortnose sturgeon takes in the river include incidental catch in commercial/recreational fishing operations, pollution and impingement on power plant intake screens. NMFS believes that as many as 25 adult fish may be removed from the population by these other means. Therefore, a total of 10 adult shortnose sturgeon could be taken from dredging operations on an annual basis. The accuracy of observer monitoring of shortnose sturgeon takes is difficult to quantify, but it is likely that half of the sturgeon taken would not be seen by an observer. Therefore, NMFS has established a low level of incidental take along with appropriate measures to monitor this impact. A documented lethal, incidental take level of five (5) shortnose sturgeon mortalities is set pursuant to Section 7(b)(4) of the ESA.

NMFS is uncertain of the probability of encountering endangered sea turtles in the proposed maintenance dredging site at the mouth of the Connecticut River. We have concluded that juvenile Kemp's ridley, green and loggerhead sea turtles may be using the project site during the summer months and that they may be adversely affected by hopper dredging. NMFS has established a level of incidental take and terms and conditions necessary to minimize and monitor this impact. A documented lethal, incidental take level of one (1) Kemp's ridley or green, or five (5) loggerhead turtle mortalities is set pursuant to Section 7(b)(4) of the ESA.

The level of take listed above represents an <u>annual</u> total allowable take for all dredging in the Connecticut River. If the incidental take meets or exceeds this level, the Corps must reinitiate consultation. NMFS believes that the following terms and conditions are necessary to implement the reasonable and prudent measures that would minimize the impact of hopper dredging in the Connecticut River:

Terms and Conditions

1. The Corps must arrange for onboard endangered species observers to document any incidental takes of shortnose sturgeon and/or sea turtles between August 15 and December 1.

2. The dredge must be equipped with screening or baskets to better monitor the intake and overflow of dredged materials for sea turtles, shortnose sturgeon and their remains. Every effort must be made to collect turtle and sturgeon parts which travel through the hopper and exit in the overflow material. Inflow screening is recommended whenever possible. New approaches for sampling for sea turtle and shortnose sturgeon parts are encouraged.

3. Weekly reports must be submitted to NMFS detailing dredging activity and any incidences with endangered species. An annual report must be submitted to NMFS that summarizes the results of dredging in the Connecticut River and the probable impacts on endangered/threatened sea turtles and shortnose sturgeon. This report should be submitted to NMFS within 30 working days of completion of any given maintenance dredging project.