Effect Determination for Atrazine

Appendix D. Descriptions of the Six Assessed Listed Species

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1.0 Shortnose Sturgeon

1.1. Species Listing Status

The shortnose sturgeon (*Acipenser brevirostrum*) was federally listed as an endangered species on March 11, 1967 under the Endangered Species Preservation Act (32FR 4001). The National Marine Fisheries Service (NMFS) assumed jurisdiction for the shortnose sturgeon in 1974 (38FR 41370). U.S. EPA (2003b) indicates that primary threats include 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).

1.2. Description and Taxonomy

The shortnose sturgeon (Figure 1) is a member of the Class *Osteichthyes* (bony fish). It is a large fish (up to 4 feet) that is light brown to yellow in color (www.natureserve.org).

Figure 1. Short-nosed Sturgeon
Image obtained from http://www.fws.gov/r5crc/Fish/zf_acbr.html

1.3. Population Status and Distribution

The U.S. Fish and Wildlife Service (USFWS) Reward Program for Atlantic Sturgeon began in 1996. Shortnose sturgeon have been incidentally captured via this program. Most shortnose sturgeon captured via the reward program in the Chesapeake Bay and its tributaries were in the upper Chesapeake Bay north of Hart-Miller Island (U.S. EPA, 2003b). However, fish have also been captured in the lower Susquehanna River, Bohemia River, Potomac River, and Elk River, south of the Bay Bridge near Kent Island, near Howell Point, near Hoopers Island, and in Fishing Bay (U.S. EPA, 2003b). A map of recent locations of shortnose sturgeon catches is in Figure 2 below (map was obtained from U.S. EPA, 2003b).

Figure 2. Map of shortnose sturgeon captured via the Atlantic sturgeon rewards program. Map obtained from U.S. EPA (2003b).

Shortnose sturgeon are benthic fish that feed on a variety of benthic and epibenthic invertebrates including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms (U.S. EPA 2003b). Shortnose sturgeon are long lived (30 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 (U.S. EPA, 2003b).

The species is generally found in river and estuaries and occasionally in full salinity ocean waters, but populations are confined mostly to natal rivers and estuaries (U.S. EPA, 2003b). In northern rivers, the species is freshwater amphidromous, meaning that adults spawn in freshwater but regularly enter saltwater habitats during their life cycle (U.S. EPA, 2003b). Juveniles, however, remain in freshwater for at least 1 to 2 years before migrating behavior begins, and they swim to marine/estuarine waters (Gilbert, 1989). In the southern part of their range, the species is estuarine anadromous where the adults forage at the interface of fresh tidal water and saline estuaries and enter the upper reaches of rivers to spawn. Current information from the recovery plan suggests that Bay individuals fall within the southern river behavior type.

1.3.1. Migration Patterns

Movement patterns vary with fish size and home river location. Juveniles generally move upstream in spring and summer and move back downstream in fall and winter. Movements of juveniles is generally limited to the region above the saltwater/freshwater interface (NMFS, 1998). Adults, as stated earlier, are amphidromous in northern rivers (spawning in freshwater but periodically entering saltwater habitats) and anadramous (spawning in freshwater but inhabiting the fresh/saltwater interface). No coastal migrations are known, possibly due to the reluctance of this species to enter full salinity sea waters (Gilbert, 1989).

Spawning migration is triggered when water temperature exceeds 8^{o}C (NMFS, 1998). Migration is generally described as rapid, directed, and extensive upstream movement (U.S. EPA 2003b). Maximum ground speeds have been reported as high as 20 to 33 km/day, with an average speed is approximately 16 km/day. Upstream movements for spawning adults extend to the upper-most regions of adult occupation or until encountering migration-limiting structures. Adults leave spawning grounds soon after spawning, and reports of directed downstream movement have been correlated with increasing spring water temperatures and river discharge (U.S. EPA 2003b).

1.4. Habitat and Ecological Requirements

The shortnose sturgeon resides in estuaries and coastal rivers along the east coast of North America from the St. Johns River (Florida) to St. John River (New Brunswick, Canada) (NMFS, 1998). The species is generally found in river and estuaries and occasionally in full salinity ocean waters, but populations are confined mostly to natal rivers and estuaries. Current information from the recovery plan (NMFS, 1998) suggests that Bay individuals fall within the southern river behavior type, where the adults forage at the interface of fresh tidal water and saline estuaries and enter the upper reaches of rivers to spawn.

The shortnose sturgeon is anadromous and generally resides in saltwater or brackish water; however, spawning occurs in large freshwater rivers (NMFS, 1998). Adults are typically found in slower current, freshwater or tidal areas of rivers, but spawn in deep, faster current areas of rivers. Larvae inhabit deeper sections of river channels and remain in this habitat for 3-10 years, when they move to the freshwater/saltwater interface. Environmental conditions preferred by the shortnose sturgeon are discussed in the following sections.

1.4.1. Temperature

Preferred temperatures for shortnose sturgeon in the Chesapeake Bay are unknown, but temperature preferences appear to differ across populations (Gilbert, 1989).

1.4.2. Salinity

During their first year of life, shortnose sturgeon tend to occur in fresh water, but can tolerate salinities up to 15 ppt (U.S. EPA, 2003b). Extensive observational and experimental evidence suggests that shortnose sturgeon prefer habitats with less than 5 ppt for all life history stages during summer months (U.S. EPA, 2003b). Based on distributional evidence, older juvenile and adult shortnose sturgeon are limited to oligohaline and low mesohaline regions of estuaries (<15 ppt) (U.S. EPA, 2003b).

Salinity has been shown to be a chief factor contributing to lower (often negative) production of shortnose sturgeon in lower Chesapeake Bay habitats in comparison to tidal fresh habitats (<0.5 ppt) in the upper Chesapeake Bay and major tidal tributaries (e.g., Potomac, Rappahannock, James, and Nanticoke Rivers (Niklitschek, 2001).

1.4.3. Current Velocity

The preference of current velocity appears to depend on the life stage of the shortnose sturgeon. Juveniles and spawning adults appear to prefer waters with faster currents; however, adults typically are found in waters with little to no current (Gilbert, 1989).

1.4.5. Depth

Shortnose sturgeon are known to occur at a wide range of depths (U.S. EPA, 2003b). A minimum depth of 0.6 m is necessary for unimpeded swimming by adults. Shortnose sturgeon have been captured at depths of up to 25 m, but are generally found in waters less than 20m (U.S. EPA, 2003b). Shortnose sturgeon have been reported to be observed at depths of 1-25 meters (U.S. EPA, 2003b); however they typically occur in the deepest parts of rivers and estuaries where suitable oxygen and salinity conditions are present (Gilbert, 1989).

1.5. Diet

Dietary information was obtained from NMFS (1998). Shortnose sturgeon are benthic omnivores, although observations of foraging on plant surfaces have also been reported. Juveniles are assumed to rapidly vacuum bottom substrates in a non-selective manner, while adults are considered to be more selective feeders. Shortnose sturgeon are considered to be continuous feeders, based on the presence of food in the gut at all times of the day. Dietary items consist of insect larvae, worms, and mollusks, and preferences appear to change with age. Insect larvae (e.g. *Hexagenia*, *Chaobrus*, and *Chironomus*) and small crustaceans (e.g. *Gammarus*, *Asellus*, and *Cyathura*) are the predominate food items in juveniles, whereas adults feed primarily on small mollusks. In freshwater, these mollusks include *Physa*, *Helisoma*, *Corbicula*, *Amnicola*, *Valvata*, *Pisidium*, and small *Elliptio*. In saline areas, molluscan prey include small *Mya* and *Macoma*

Recent data from the Hudson River show that adult sturgeon feed on gammarid amphipods and zebra mussels. In northern rivers (e.g. the Connecticut River) feeding generally occurs in the freshwater and saline habitats. In the Saint John River estuary, summer foraging grounds can be characterized by highly-vegetated, shallow freshwater regions, with the feeding grounds shifting to sand-mud bottoms in the lower estuary during the fall, winter, and spring. Females in northern rivers are generally considered to fast during the eight months before spawning, but males continue to feed during this period. By contrast, foraging in Southern rivers has been described as occurring in the freshwater/saltwater interface (Pee Dee and Savannah Rivers) or just downstream of this interface (Altamaraha and Ogeechee Rivers). Southern river sturgeon appear to reduce activity, fast, and lose body mass during the summer.

1.6. Reproduction

1.6.1. Length and Age at Maturity

Length at maturity is approximately 45-55 cm, although the time to maturity differs with latitude. Males spawn first at age 2-3 years in Georgia, 3-5 years in South Carolina, and 10-11 years in Canada. Females first spawn at 6 or less years in Georgia, 7-10 years in New York, and 12-18 years in Canada. It is likely that most adults survive spawning. Data in this section was obtained from NMFS (1998).

1.6.2. Periodicity of Spawning

Males seem to spawn more frequently than females, although the overall details of periodicity are poorly understood (NMFS, 1998).

1.6.3. Spawning Habitat

While not documented for all riverine systems including the Chesapeake Bay, the following generalities can be made regarding spawning habitat (NMFS, 1998). When rivers are unencumbered by structures, spawning areas are located at the most upstream

reach of the river used by the sturgeon. Characteristic channel spawning habitats vary only slightly among rivers and include gravel substrate (Saint John River), gravel, rubble and ledge bottom (Androscoggin River), rubble boulder substrate (Merrimack and Connecticut Rivers), riffles (Delaware River), gravel sand/log substrate (Savannah River), and limestone bluffs with gravel/boulder substrate (Altamaha River). Telemetry studies in the Merrimack River placed spawning males in 2.3 to 5.8m deep water with velocities of 0.2 to 0.7 m/sec. Similar results are reported for spawning female telemetry studies in the Connecticut River, with spawning occurring in water that is approximately to 10 meters deep with a bottom water velocity of 0.4 to 1.8 m/sec. High river flows may prevent females form spawning. Reproductive success is likely to be related to endogenous control in female spawning rhythm in response to river conditions. The availability of spawning substrate with crevices has been suggested to be critical to the survival of eggs and embryos.

1.7. Longevity

NOAA (http://www.nmfs.noaa.gov/prot_res/species/fish/Shortnose_sturgeon.html) reports that female shortnose sturgeons have been known to live for up to 67 years; however, males do not typically live more than 30 years (U.S. EPA, 2003b).

1.8. Diseases

A number of parasites have been observed in shortnose sturgeon; however, none have been reported to be detrimental to survival (NMFS, 1998).

1.9. Predators

NMFS (1998) indicates that predation on shortnose sturgeon has not been widely reported, although perch in the Androscoggin River in Maine have been found with young individuals in their stomachs. Also, based on the observation of individuals lacking tails, it appears that sharks and seals may also occasionally prey on shortnose sturgeon (NFMS, 1998).

2.0. Dwarf Wedgemussel

2.1 Species Listing Status

The dwarf wedgemussel (*Alasmidonta heterodon)* was federally listed as an endangered species on March 4, 1990 (55FR 9447). Primary threats include pollution, stream siltation, and habitat alteration (USFWS, 1993).

2.2. Description and Taxonomy

The dwarf wedgemussel (Figure 3) is a small yellowish to brown mussel that is generally less than 1.5 inches. This species is characterized by its reversed dentention pattern (two lateral teeth on the right valve, and one on the left valve).

Figure 3. Dwarf wedgemussel. Image obtained from http://natureserve.org

2.3. Habitat

The dwarf wedgemussel lives on muddy sand, sand, and gravel bottoms in creeks and rivers of varying sizes. Its habitat is also characterized by slow to moderate current and little silt deposition (USFWS, 1993). In the southern portion of its range, it is often concentrated in areas along logs or in root mats.

The USFWS (**http://endangered.fws.gov/i/F12.html**) reports that the current range of the dwarf wedgemussel is now known to occur in only 12 sites. The following locations for the dwarf wedgemussel are listed in the recovery plan (U.S. FWS, 1993) associated with Chesapeake Bay drainage:

Tuckahoe Creek (Choptank River) Drainage

Norwich Creek in Queen Anne's and Talbot Counties, Maryland

Long Marsh Ditch in Queen Anne's and Caroline Counties, Maryland

Potomac River Drainage
- McIntosh Run in Saint Mary's County, Maryland
- Nanjemoy Creek in Charles County, Maryland
- Aquia Creek in Stafford County, Virginia

York River Drainage
- South Anna River in Louisa County Virginia

In addition, recently reported populations in Virginia (VA DGIF, 2006) and Maryland (McCann, 2006) include populations in the Rappahannock River drainage and the Southeast creek and Corsica River watershed. Characterization of these waters is provided in Table 1 below.

Table 1. Known Locations of Dwarf Wedgemussels in the Chesapeake Bay Watershed			
Location	**County, State**	**Description[a]**	**Status of Population and Major Threats**
Tuckahoe Creek Drainage			
Norwich Creek	Queen Anne's and Talbot Counties, Maryland	Headwater streams	**Status:** Poor, not reproducing **Threats:** Non-point chemical pollution; sedimentation from agriculture; population density too low to allow successful reproduction; residential, highway, or industrial development
Long Marsh Ditch; Mason Branch	Queen Anne's/Caroline Counties, MD	Headwater streams	**Status:** Poor, not reproducing **Threats:** Non-point chemical pollution, sedimentation from forestry operations; sedimentation from agriculture; population density too low to allow successful reproduction; headwater channelization and "stream improvement" projects Mason Branch and Long Marsh Ditch records likely represent a single population
Potomac River Drainage			
McIntosh Run	Saint Mary's County, Maryland	Headwater streams	**Status:** Fair, reproducing **Threats:** Residential, highway, or industrial development
Nanjemoy Creek	Charles County, Maryland	Headwater streams	**Status:** Fair, reproducing **Threats:** Not listed
Aquia Creek	Stafford County, Virginia	Headwater streams	**Status:** Fair to good **Threats:** Non-point chemical pollution; Sedimentation from forestry operations; Sedimentation from agriculture; Residential, highway, or industrial development
York River Drainage			
South Anna River	Louisa and Hanover Counties, VA	Headwater streams	**Status:** Poor **Threats:** Sedimentation from forestry operations; sedimentation from agriculture; population density too low to allow successful reproduction; residential, highway, or industrial development
Po River	Spotsylvania County, VA	Headwater streams	**Status:** Not listed **Threats:** Not listed
Rappahannock River Drainage			
Rappahannock River	Spotsylvania County	Headwater streams, mid-level reach	Location data from Virginia Department of Game and Inland Fisheries, 2006 (DWM_locations_dist1783. Vector digital data. Acquired August 01, 2006.)
Carter Run	Fauquier County	Headwater streams	
Southeast Creek or Corsica River Drainage			
Browns branch, Granny Finley, Southeast Creek tributary	Queen Anne's County, MD	Headwater streams	Location Data from Maryland Department of Natural Resources, 2006 Brown's branch, Granny Finley branch, and Southeast creek tributary records may represent a single metapopulation
Corsica River tributary			

2.4. Feeding

Little specific information is available on the feeding items of the dwarf wedgemussel. The dwarf wedgemussel filter feeds on suspended detritus, Zooplankton, and phytoplankton (U.S. EPA, 2003b). As a filter feeder, high silt levels in water may result in valve closure. Like other freshwater mussels, the dwarf wedgemussel feeds by filtering food particles from the water column. The diet of dwarf wedgemussel glochidia, like other freshwater mussels, comprises fish body fluids (once encysted).

2.5. Reproduction

During spawning, males discharge sperm to the water column. Female siphon the sperm and the eggs are fertilized in the female suprebranchial cavity or gills. The dwarf wedge-mussel is considered to be a long-term brooder, where fertilization typically occurs in mid-summer and fall. Glochidial release for long-term brooders has been observed to occur during the fall and winter. However, periods of gravidity and glochidial release are highly variable based largely on with latitude (USFWS, 1993). The glochidial host is unknown though suspected to be an anadramous fish. Four fish species (tesselated darter, *Etheostoma olmstedti*, Johnny darter, *Etheostoma nigrum*, mottled sculpin, *Cottus bairdi, and* slimy sculpin, *Cottus cognatus*) have been identified as possible glochidial hosts (www.natureserve.org, accessed June 28, 2006).

2.6. Mobility

Other than passive movement downstream during flood events, adult dwarf wedgemussels are not likely to move significant distances. However, dispersal occurs while glochidia are associated with host fish (www.natureserve.org, accessed June 28, 2006).

3.0 Sea Turtles

Status and Life History of the four sea turtle species (data obtained primarily from Seney (2003), VIMS (Virginia Institute of Marine Science),
http://www.fisheries.vims.edu**, and Chesapeake Bay Program web site at**
http://www.chesapeakebay.net/info/seaturtle.cfm**)**

The Chesapeake Bay is an important seasonal foraging ground for several sea turtle species. Approximately 5,000-10,000 sea turtles enter the Bay during the summer months (May – October). Of these, the majority are juvenile loggerheads (estimated 90%) and juvenile Kemp's ridleys (<10%). Individuals from the Atlantic populations of green and leatherback sea turtles also enter Bay waters, but in substantially fewer numbers. Adult sea turtles spend most of their lives migrating within the open ocean, but begin to enter the Chesapeake Bay when water temperatures reach 18-20^{o}C, generally in mid- to late-May.

Sea turtles (especially loggerheads and Kemp's ridleys) find rich food supplies within Bay waters, where they concentrate their feeding around river mouths and higher salinity waters in the southern portion of the Bay. The turtles remain in the Bay for most of the summer and early fall and return south once water temperatures drop.

There are no known nesting beaches of the four assessed sea turtles within the Chesapeake Bay area. In general, major threats to sea turtles in the U.S. include: destruction and alteration of nesting and foraging habitats, incidental capture in commercial and recreational fisheries, entanglement in marine debris, and vessel strikes.

3.1 Species Listing Status

3.1.1. Loggerhead (*Caretta caretta*)

The loggerhead sea turtle was federally listed under the Endangered Species Preservation Act (32FR 4001) as threatened throughout its range on July 28, 1978 (FWS 1978; 43 FR 32800). Both NMFS and the USFWS are responsible for administering the provisions of the Endangered Species Act as they apply to the loggerhead sea turtle. NMFS has the lead responsibility in the marine environment, and the USFWS has the lead responsibility on nesting beaches. Threats to loggerhead populations include numerous human activities on nesting beaches and offshore, alterations to the ecosystem, pollution, beach debris, predation, natural catastrophes, fisheries of various types, illegal harvest and industrial and residential activities and development.

On January 14, 2002, NMFS received a petition to reclassify the Northern and Florida Panhandle subpopulations of the loggerhead turtle as distinct population segments with endangered status and to designate critical habitat. NMFS published a 90-day finding stating the petition presented substantial information that the reclassification may be warranted and announcing the initiation of a status review (NOAA/NMFS 2002; 67 FR 38459) (http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html). It should be

noted, however, that the proposed critical habitat for the loggerhead sea turtle is well outside of the Chesapeake Bay watershed defined as the action area for this assessment.

3.1.2. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's ridley sea turtle was first listed as endangered on December 2, 1970 (35 FR 18319-18322) by the USFWS, based on the following causes of population decline:

(1) shrimp trawling and commercial fisheries;
(2) development near principle nesting beach in Mexico;
(3) management practices at Rancho Nuevo;
(4) marine pollution and debris; and
(5) other man-induced stressors (dredging, oil mining, commercial and recreational boating)

On August 21, 1992, USFWS and NMFS issued a recovery plan for the Kemp's ridley (NMFS, 1992) with the goal of downlisting the Kemp's ridley from Endangered to Threatened and to recover the population to at least 10,000 nesting females per season. The recovery plan is currently under status review based on increased knowledge of the species and evaluation of on-going conservation efforts and accomplishments. Once completed, the revised recovery plan will address current threats to and needs of the species, highlight conservation accomplishments undertaken to date and specifically address the planning requirements of the Endangered Species Act (ESA).

3.1.3. Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle was listed as endangered on June 2, 1970 (35 FR 8491-8498). Population decline of the leatherback is attributed to:

(1) poaching (illegal egg harvesting/collection) especially in the U.S. Virgin Islands (USVI) nesting beaches;
(2) modification of beach nesting environment, including: erosion, armoring, nourishment, artificial lighting, cleaning, increased human presence, recreational beach equipment, vehicular driving, hatchling mortality;
(3) marine environment threats, such as entanglement and ingestion of marine debris;
(4) commercial fisheries (bycatch, drowning, injury), boat collisions, oil and gas exploration, development transportation and storage; and
(5) pollution (industrial agricultural or residential, pesticides, heavy metals, PCBs).

The leatherback has designated critical habitat within the United States, but outside of the Chesapeake Bay watershed defined as the action area for this assessment. Sandy Point Beach in St. Croix was designated as critical habitat on September 26, 1978 (43 FR 43688). In addition, on March 23, 1979 (44 FR 17710-17712), the waters adjacent to Sandy Point Beach, St. Croix, USVI were designated as critical habitat to provide protection for turtles using these waters for courting, breeding, and as access to and from nesting beaches.

A recovery plan for Atlantic population of leatherbacks was issued on April 6, 1992 with the goals of increasing the adult female population over the next 25 years and acquiring at least 75% of USVI nesting habitat in public ownership.

3.1.4. Green Sea Turtle (*Chelonia mydas*)

The green sea turtle was federally listed under the Endangered Species Preservation Act (32FR 4001) as endangered for breeding colonies in Florida and on the Pacific coast of Mexico and threatened elsewhere on July 28, 1978 (FWS 1978; 43 FR 32808). Threats to green populations include numerous human activities on nesting beaches and offshore, alterations to the ecosystem, pollution, beach debris, predation, natural catastrophes, fisheries of various types, illegal harvest and industrial and residential activities and development.

Critical habitat was designated for the green sea turtle (50 CFR 226.208) for the waters surrounding the island of Culebra, Puerto Rico, from the mean high water line seaward to 3 nautical miles (5.6 km). These waters, which are outside of the Chesapeake Bay watershed defined as the action area for this assessment, include Culebra's outlying Keys including Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla Culebrita, Arrecife Culebrita, Cayo de Luis PeZa, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven (http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm)

3.2 Description and taxonomy

3.2.1. Loggerhead Sea Turtle

The loggerhead sea turtle (Figure 4) is a member of the Family Cheloniidae with five living genera and six species of hard-shelled sea turtles. *Caretta caretta* is the largest living hard shelled turtle with a typical adult carapace length of 85-100 cm and an average weight of 115-135 kg. Adults and sub-adults are reddish brown but may be tinged with olive, and many scutes have yellow borders. The bridge and plastron are cream to yellow. Head pigmentation varies from reddish or yellowish chestnut to olive brown, with many scales yellow bordered. Limbs and tail are dark above, and yellowish toward the borders and below. The plastron is hingeless and has two longitudinal ridges, which disappear with age. The massive head is broad posteriorly and rounded in the front with a short and broad snout. Mature males have wider, posteriorly tapering shells than the females, plus, long, thick tails which extend beyond the rear carapacial rim, a large recurved claw on each forelimb and more yellow pigment on the head. Normal fertile eggs range in 35-55 mm in diameter and weigh 26-47 g. Hatchlings are dull brown in color. Average size at hatching is 45 mm long; average weight is 20 g. (Ernst, 1994; http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html).

Figure 4. Loggerhead sea turtle from Caretta Research Project – Wassaw Island, Georgia

Image courtesy of Dennis Desmond 2001

3.2.2. Kemp's Ridley Sea Turtle

The Kemp's ridley (Figure 5) was allocated to genus Lepidochelys when it was realized that it was congeneric with the olive ridley sea turtle species. It was determined that the two species have enough morphological differentiation to justify designation of the Kemp's as a separate species (NMFS, 1991).

The Kemp's ridley sea turtle is one of the smallest of all extant turtles, with adults weighing less than 45 kg and a straight carapace length around 65 cm. Shells are almost as long as they are wide. Adults have a light grey-olive carapace and a cream-white or yellowish plastron. Males and females resemble each other in coloration. The male turtle has typical secondary sexual characteristics, including a longer tail, more distal vent, recurved claws, and a softened plastron during breeding. The Kemp's has a triangular-shaped head with a somewhat hooked beak with large crushing surfaces (http://www.fws.gov/kempsridley/kempsfactsheet.html).

Figure 5. Nesting Kemp's ridley at Padre Island National Seashore
Credit: Cynthia Rubio, NPS (www.seaturtle.org)

3.3.3. Leatherback Sea Turtle

The leatherback (Figure 6) is the largest living sea turtle and is so distinctive that it is placed in its own family, Dermochelyidae. Its skeletal morphology is unique and karyological studies support placement of the leatherback in its own family; all other extant sea turtles are in the family Cheloniidae. The carapace of the leatherback is slightly flexible and has a rubber-like texture. It is about 4 cm thick. The animal is somewhat barrel-shaped. The front flippers are proportionally longer than in other sea turtles. Weights of the Atlantic populations range from between 262-506 kg for adults. The internal core body temperature appears to be several degrees warmer than ambient, which may be due to its large body mass, subepidermal fat, countercurrent heat exchanges in the flippers, or brown adipose tissue, which is potentially heat-generating (NMFS, 1991).

Figure 6. Nesting leatherback, image courtesy of National Marine Fisheries Service (http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.html)

3.3.4. Green Sea Turtle

The green sea turtle (Figure 7) is a member of the Family Cheloniidae. This species commonly grows to a size of slightly less than 105 cm and a weight of 150 - 180 kg. It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of costal scutes, none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes. Hatchlings weigh about 25 g, and are about 50 mm long. Hatchlings are black on top and white on the bottom. Normal fertile eggs range in 35-58 mm in diameter and weighing 286-65 g. (Ernst et al., 1994; http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm)

Figure 7. Photograph taken from http://www.nmfs.noaa.gov/pr/species/turtles/green.html

3.4. Population Status and Distribution

3.4.1. Loggerhead Sea Turtle

The USFWS North Florida Field Office fact sheet (http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm) states that "The loggerhead sea turtle occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. However, the majority of loggerhead nesting is at the western rims of the Atlantic and Indian oceans. Although the

major nesting concentrations in the United States are found in South Florida, loggerheads also nest from Texas to Virginia, but outside of the Chesapeake Bay watershed defined as the action area for this assessment.

Genetic research involving analysis of mitochondrial DNA has identified five different loggerhead nesting subpopulations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina through Northeast Florida; (2) South Florida Subpopulation occurring from just north of Cape Canaveral on Florida's east coast and extending up to around Sarasota on Florida's west coast; (3) Dry Tortugas, Florida, Subpopulation, (4) Northwest Florida Subpopulation occurring on Florida's Panhandle beaches; and (5) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico. These data indicate that gene flow between these five regions is very low." http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm .

Between 2,000 and 10,000 loggerhead sea turtles enter the Chesapeake Bay each spring/summer (May to early November (Kimmel, Driscoll and Brush, 2006)) when the sea temperatures rise to about 68^{o}F (18 – 20^{o}C). The majority of these turtles are juveniles utilizing the Bay seasonally as a feeding ground, although some are previously tagged adults (http://www.chesapeakebay.net/info/seaturtle.cfm, http://www.2fla.com/loggerhead.htm, and http://www.fisheries.vims.edu/turtletracking/stsp.html). The Bay, with its rich food supply and extensive shoals, provides ideal habitat for the development of the young turtles. Many of the turtles remain in the Virginia portion of the Bay where salinities are higher (http://www.chesapeakebay.net/info/seaturtle.cfm). Loggerheads concentrate their feeding around river mouths and areas of the Bay deeper than 13 feet. The turtles remain in the Bay for the summer and early fall, leaving only with the first major northeasterly storm of the season.

3.4.2. Kemp's Ridley Sea Turtle

The Kemp's ridley is the most endangered sea turtle in the world. In the late 1940's, there were an estimated tens of thousands of nesting Kemp's ridleys on the beach of Rancho Nuevo, Mexico. The population declined to around 300 nesters in 1985. Since then, both the U.S. and Mexico have made conservation of this species a priority (NMFS, 2000).

Unlike most other sea turtles, the range of the Kemp's ridley is more restricted. They are found within the Gulf of Mexico and up through the Atlantic coast of the United States. From the Gulf, juveniles generally travel north with the vernal warming to feed in the coastal waters of Georgia through New England. Both post-hatchlings and juveniles are recruited to coastal benthic environments along the Atlantic and Gulf coasts. As benthic feeders, Kemp's ridleys inhabit the neritic zones along these coasts (NMFS, 2000). Developmental habitat, especially for foraging, has been identified within the Chesapeake Bay (Lutz et al., 1997).

3.4.3. Leatherback Sea Turtle

Leatherback turtles are highly pelagic and migrate from tropical to cold waters. They nest on beaches in tropical areas, including Costa Rica, St. Croix, and Florida for Atlantic populations. They feed in areas of high jellyfish concentrations, which can extend into the temperate North Atlantic. They are frequently sighted in the Chesapeake Bay through aerial surveys, especially in summer months near the mouth of the Bay, where they are presumed to be feeding in fairly shallow coastal waters (http://www.nae.usace.army.mil/projects/ma/ccwf/app3g.pdf#search=%22eis%20appendix%203-g%20leatherback%22). Leatherback strandings in the Chesapeake are generally adults. Those found in the Bay are most likely Caribbean nesters. Nesting beaches in the United States include Florida, North Carolina, etc., that are outside of the Chesapeake Bay watershed defined as the action area for this assessment.

3.4.4. Green Sea Turtle

The USFWS North Florida Field Office fact sheet (www.fws.gov/northflorida/SeaTurtles/Turtle Factsheets/green-sea-turtle.htm) states that "the green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies, all of which are outside the action area of this assessment, in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina, and in larger numbers in Florida. The Florida green turtle nesting aggregation is recognized as a regionally significant colony. About 200 to 1,100 females are estimated to nest on beaches in the continental U.S.

A very small number of green sea turtles enter the Chesapeake Bay each summer. Occasional juveniles and adults are seen (Mansfield and Kimmel, personal communication 2006, http://www.chesapeakebay.net/info/seaturtle.cfm and http://www.fisheries.vims.edu/turtletracking/stsp.html). The Bay, with its rich food supply and extensive shoals, provides ideal habitat for the development of the young turtles. Many of the turtles remain in the Virginia portion of the Bay where salinities are higher.

3.5. Habitat

3.5.1. Loggerhead Sea Turtle

The habitat for loggerhead sea turtles depends upon its lifestage. During its lifetime, the loggerhead lives in three basic ecosystems: terrestrial (nesting beach), neritic zone (water depths do not exceed 200 meters and includes continental shelf), and the oceanic zone (water depths are greater than 200 meters).

The loggerhead wanders widely throughout the marine waters of its range; it has been found as far as 240 km out in the open sea, but rarely is it seen east of the western boundary of the Gulf Stream, where it occupies cooler waters than those of the Gulf

Stream. It enters bays, lagoons, salt marches, creeks, and the mouths of large rivers as well as ship channels. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. Subadults and adults are free swimming, but hatchlings and juveniles are most often found along current fronts, downswells or eddies associated with drifting mats of *Sargassum.* Loggerheads nest on ocean beaches and occasionally on estuarine shorelines with suitable sand. Nests, which are outside the action area for this assessment, are typically made between the high tide line and the dune front but sometimes occur among the shrubs and grasses behind the beach. Most loggerhead hatchlings originating from U.S. beaches are believed to lead a pelagic existence in the North Atlantic gyre for an extended period of time, perhaps as long as 10 to 12 years, and are best known from the eastern Atlantic near the Azores and Madeira. Once they reach a certain size, these juvenile loggerheads begin recruiting to coastal areas in the western Atlantic where they become benthic feeders in lagoons, estuaries, bays, river mouths, and shallow coastal waters. These juveniles occupy coastal feeding grounds for a decade or more before maturing and making their first reproductive migration, while the females return to their natal beach to nest (Ernst, 1994 and http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm).

A high percentage of the loggerheads that enter the Chesapeake Bay are juveniles that have transitioned from an oceanic existence to a neritic existence. They migrate to this area on a seasonal basis during the summer. Loggerheads live along the channel edges (5 to 13 meters), forage on the bottom, and appear to have foraging site fidelity (Byles, 1988, Keinath *et al.* 1987, Kimmel et al., 2006). As stated previously, tagged adult loggerheads have also been found in the Bay.

3.5.2. Kemp's Ridley Sea Turtle

Habitat for the Kemp's ridley, outside of nesting beaches, includes mostly nearshore and inshore shallow waters, usually less than 50 m deep. The Kemp's ridley remains near the Atlantic coast and in the northern Gulf of Mexico, inhabiting Louisiana waters and the shoreline of the Florida Keys, where it is closely associated with mangrove swamps. This species also is found in salt marsh habitats. Juvenile Kemp's ridleys may use sargassum sea grass mats for refuge and as a food source. Within the Chesapeake, Kemp's ridleys tend to stay in the shallower, coastal areas, foraging in beds of eelgrass. Its preferred sections of nesting beach are usually backed up by extensive swamps or large bodies of open water having seasonal narrow ocean connections. (Ernst, 1994; http://www.chesapeakebay.net/info/seaturtle.cfm; http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/Kemps-Ridley-Sea-Turtle.htm).

3.5.3. Leatherback Sea Turtle

The leatherback is a highly pelagic species, inhabiting open ocean from as far south as the Cape of Good Hope and Argentina to as far north as Iceland and Nova Scotia. Occasionally, the leatherback will enter the shallow waters of bays and estuaries, presumably to follow food sources. Both adults and juveniles appear to be highly pelagic, as both are seldom observed near the coast. The preferred nesting beaches for

female leatherbacks are generally high-energy beaches, with proximity to deep water, generally rough seas, and sufficiently-sloped sandy beaches backed with vegetation (Ernst, 1994; http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/Leatherback-Sea-Turtle.htm).

3.5.4. Green Sea Turtle

The habitat for green sea turtles depends upon the turtle's lifestage. During its lifetime, the green lives in three basic ecosystems: terrestrial (nesting beach), convergence zones in the pelagic habitat, and benthic feeding grounds in relatively shallow, protected waters (NMFS Recovery Plan 1991). Green turtles are generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms (NMFS, 1991). Open beaches with a sloping platform and minimal disturbance are required for nesting. Green turtles have strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches. Hatchlings have been observed to seek refuge and food in *Sargassum* rafts.
http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm).

3.6. Diet

Table 2 summarizes the habitat requirements and typical food source items for each of the four sea turtle species in this assessment. The prey items listed in Table 2 include scientific names for only those specific species found within the Chesapeake Bay (http://www.chesapeakebay.net/info/seaturtle.cfm).

Table 2. Habitat Requirements and Typical Food Items for Assessed Sea Turtles				
Species	**Habitat requirements**	**Food item (taxa)**	**Food item (common name)**	**Food item (scientific name)**
Loggerhead	Neritic (near shore) Waters less than 200m Bays/river mouths Saline	Crustacean	Horseshoe crab	*Limulus polyphemus*
			Blue crab	*Callinectes sapiudus*
			Hermit crab	*Pagurus spp.*
			Mantis shrimp	*Squilla impusa*
		Plant	Eelgrass	*Zostera marina*
			Widgeon grass	*Ruppia maritima*
		Invertebrate	Jellyfish	
			Other invertebrates	
		Mollusk	Atlantic oyster drill	*Urosalpinx cinera*
			Hard clam	*Mercenaria mercenaria*
		Fish	Atlantic menhaden	*Brevoortia tyrannus*
			Spot	*Leiostomus zanthurus*
			Atlantic croaker	*Micropogonias undulatus*
			Bluefish	*Pomatomus saltatrix*
			Striped bass	*Morone saxatilis*
			Oyster toadfish	*Opsanus tau*
Kemp's ridley	Neritic/inshore Waters less than 50 m Swamps/salt marshes Saline	Crustacean	Blue crab	*Callinectes sapiudus*
			Horseshoe crab	*Limulus polyphemus*
			Hermit crab	*Pagurus spp.*
			Mantis shrimp	*Squilla impusa*
			Eastern American oyster	*Crassostrea virginica*
		Mollusk	Bivalves	
			Shrimp	
		Invertebrates	Jellyfish	
			Sea urchins	
		Plant	Eelgrass	*Zostera marina*
			Widgeon grass	*Ruppia maritima*
		Fish	Various fish species	
Leatherback	Open ocean/deep waters River mouths/shallow waters to feed Saline	Invertebrates	Pink comb	*Beroe ovata*
			Sea walnut	*Mnemiopsis leidyi*
			Other jellyfish	
			Other invertebrates	
Green	Shallow waters Reefs, bays, inlets	Plants	Algae	
			Sea grass	

3.6.1. Loggerhead Sea Turtle

Although feeding behavior may change with age, this species is carnivorous throughout its life. Their diet varies by region. Hatchlings eat small animals living in seagrass mats, which are often distributed along drift lines and eddies. Juveniles and adults eat a wide variety of prey such as conchs, clams, crabs, horseshoe crabs, shrimps, sea urchins, sponges, fishes, squids, and octopuses. They particularly favor benthic invertebrates. During migration through the open sea, loggerheads eat jellyfish, pteropods, floating mollusks, floating egg clusters, squids, and flying fishes (http://www.tpwd.state.tx.us/huntwild/wild/species/endang/animals/reptiles_amphibians/logghead.phtml).

The Virginia Institute of Marine Science Sea Turtle Program (VIMS) has collected diet data and gut samples from stranded and incidentally caught sea turtles in Virginia (including the Chesapeake Bay) since 1979. The monthly distribution of samples has been consistent with Virginia stranding patterns, and the majority of samples were collected in May and June. The straight carapace length (SCL) of loggerheads collected as part of the VIMS sea turtle program ranged from 33.0 to 98.7 cm. The majority of these turtles were classified as "benthic immatures", and the size range is representative of the overall loggerhead strandings in Virginia.

Examination of turtles that stranded in Virginia during the late 1970s and early 1980s indicated that loggerheads fed primarily on Atlantic horseshoe crab (*Limulus polyphemus*). Blue crabs, spider crabs, rock crabs, clam bodies, and fish were also found in some digestive tracts. Data from 1980 to 1994, 1997, and 2000 to 2002 indicate a shift in loggerhead diet from predominantly horseshoe crab during the early to mid-1980s to predominantly blue crab during the late 1980s and early 1990s. Loggerhead diet in the mid-1990s and 2000 to 2002 was dominated by finfish, particularly menhaden (*Brevoortia tyrannus*) and croaker (*Micropogonias undulatus*). Additionally, spider crabs and rock crabs became more prevalent in the diet during the 1990s, and hermit crabs (and their moon snail shells) were observed more frequently in samples from 2001 and 2002. These dietary shifts suggest that fishery-related declines in horseshoe crab and blue crab populations have caused loggerheads to instead forage on fish caught in nets or on discarded bycatch. A slight seasonal effect on diet was also detected, and the diet of juvenile loggerheads differed somewhat from that of the adults. Although sample size discrepancies should be kept in mind, horseshoe crab, hermit crab, and whelk consumption increased with size (and therefore age) of loggerheads, while blue crab consumption appeared to decrease with size. Turtles in the middle size classes consumed bony fish most frequently, and none of the largest turtles (90.0-99.9 cm SCL) had consumed fish (Seney, 2003).

3.6.2. Kemp's Ridley Sea Turtle

Kemp's ridleys are primarily carnivorous, with a preference for crab species, especially blue crab (*Callinectes sapidus*). These turtles also feed on other mollusks, crustaceans, jellyfish and invertebrates, fish, and marine plants and algae. While hatchlings and juveniles normally feed at the surface, adult Kemp's ridleys feed on the bottom of coastal habitats as well. Seney (2003) analyzed gut samples from Kemp's stranded in the Chesapeake Bay and identified numerous Bay organisms, which are summarized in Table 2.

3.6.3. Leatherback Sea Turtle

Oceanic jellyfish are the preferred prey of the leatherback sea turtle throughout its lifestages. They also may incidentally ingest algae, vertebrates, and other invertebrate species. The leatherback will often follow schools of jellyfish floating at the ocean's surface for its food source; however, it also finds some of its prey in benthic habitats,

especially near shallower coastal habitats. It has been estimated that hatchling leatherbacks eat approximately their weight in jellyfish per day for growth and maintenance (Ernst, et al, 1994). Jellyfish found in the Chesapeake Bay include pink comb (*Beroe ovata*) and sea walnut (*Mnemiopsis leidyi*), among other species (Chesapeake Bay program website).

3.6.4. Green Sea Turtle

Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae with small amounts of animal foods such as sponges, crustaceans, sea urchins, and mollusks. (http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm, http://www.tpwd.state.tx.us/huntwild/wild/species/endang/animals/reptiles_amphibians/greentur.phtml).

3.7. Respiration and Diving Behavior

Sea turtles have great capacity for long and deep dives. Estimates of sea turtles in the wild indicate that they spend as little as 3-6% of their time at the surface. Sea turtles have a high tolerance to hypoxia and an efficient oxygen transport system that allows them to remain submerged for long periods of time. Though they spend much of their time under the ocean's surface, most of their dives are likely shallow. Sea turtles are capable of closing their nasal passages when diving and have orbital salt glands for excess salt excretion. Leatherbacks can also conserve body heat to allow for foraging in cold waters. The diving ability of sea turtles allows them to feed within the water column and in benthic environments. There is much variation in the diving behavior within and across species (Lutcavage and Lutz, 1997).

3.8. Reproduction

3.8.1. Loggerhead Sea Turtle

Size and Age at Maturity
Age at sexual maturity is believed to be about 20 to 30 years. Mature females from several nesting beaches have straight-line carapace lengths of at least 65.1-87.0 cm (average 79.2-96.4 cm) with body masses of 70.3-180.7 kg (average 100.7-118.2 kg). Although these measurements were taken from obviously mature turtles, maturity is probably attained at a shorter carapace length, perhaps 60-70 cm. The age at maturity may also vary between populations, possibly owing to genetics, but more likely because of differential feeding and growth rates (Ernst, 1994).

Periodicity of Nesting and Egg Production
The United States nesting season generally extends from about May through August with nesting occurring primarily at night. Loggerheads are known to nest from one to seven times within a nesting season (mean is about 4.1 nests per season) at intervals of approximately 14 days. Mean clutch size varies from about 100 to 126 along the

southeastern United States coast. Incubation ranges from about 45 to 95 days, depending on incubation temperatures. Hatchlings generally emerge at night. Remigration intervals of 2 to 3 years are most common in nesting loggerheads, but remigration can vary from 1 to 7 years (**http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm**). Many females return to the same beach during successive nesting seasons. Of all the sea turtles, loggerheads are known to nest the furthest north on the eastern coast of the United States. They regularly nest in Florida, Georgia and the Carolinas. Some nest as far north as Virginia, just outside of the Chesapeake Bay; however, nesting has even been recorded in New Jersey (Ernst, 1994). No reports have been located to indicate that any loggerheads have nested inside the Chesapeake Bay.

3.8.2. Kemp's Ridley Sea Turtle

Age at reproductive maturity is largely unknown and has been estimated between 7-20 years. Carapace length of nesting females averages 65 cm (Miller, 1997). It is presumed that mating occurs near the coast of nesting beaches, just before females come to shore to nest. Kemp's ridleys nest diurnally along the Texas and Mexico shore between April and July. While females occasionally nest individually, most come up to nest in large groups (now hundreds of females and historically, thousands of females). These group nesting events are known as arribadas and usually occur with a strong wind from the northeast. On average, Kemp's ridleys nest every two years at an average of 2-3 times per nesting season with a 10-28 day interval between nesting events. Females oviposition approximately 100 eggs per nesting event (NMFS, 2000).

3.8.3. Leatherback Sea Turtle

Size and age at reproductive maturity is largely unknown. Nesting females have an average carapace length of 150 cm and age at reproductive maturity ranges between 6-15 years. On average, leatherbacks nest every 2-3 years, between 6 and 10 times per nesting season, with an internesting interval of 8-12 days. Leatherbacks nest nocturnally and generally oviposit 70-90 eggs. Leatherbacks are unique in that they also lay a number of "eggs," consisting of shelled excess albumin, after oviposition. Incubation generally lasts between 55-75 days. Like other sea turtles, it is assumed that they breed near their nesting ground prior to nesting. Males are spotted in the neritic zone during the nesting season, where it is presumed that females mate with one or more males prior to laying her clutch (Ernst, 1994 and Miller, 1997).

3.8.4. Green Sea Turtle

Size and Age at Maturity

Estimated age at sexual maturity is between 19 to 24 years. Males begin to show the lengthened mature tail at 64-65 cm. Those with 75 cm carapaces have fully developed tails, but the female carapace length at maturity varies between populations (65 cm to longer than 83 cm) (Ernst, 1994).

Periodicity of Nesting and Egg Production
The nesting season varies with the locality. In the Southeastern U.S., it is roughly June through September. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years. A female may lay as many as nine clutches within a nesting season (overall average is about 3.3 nests per season) at about 13-day intervals. Clutch size varies from 75 to 200 eggs, with an average clutch size of 136 eggs reported for Florida. Incubation ranges from about 45 to 75 days, depending on incubation temperatures. Hatchlings generally emerge at night. (**http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm**). Females show a high degree of nest site fidelity returning to the same beach during successive nesting seasons. They regularly nest in Florida with smaller numbers nesting in Georgia and the Carolinas. No reports have been located to indicate that any green sea turtles have nested inside the Chesapeake Bay. Mating generally occurs offshore of nesting beaches (Ernst, 1994).

3.9. Longevity

There is little information on the lifespan of sea turtles; however, they are believed to be long-lived animals. Kemp's ridleys have been documented to survive at least 20 years in captivity (Ernst, 1994), but sea turtles generally do not survive well in captivity. Dodd (1988) estimated that the maximum life span of a wild female loggerhead sea turtle is 47-62 years. Maximum longevity in the wild is unknown; however, on the basis of skeletal data, Zug and Balazs (1985) estimated that a 93-cm Hawaiian female green sea turtle had possibly lived 66 years.

3.10. Diseases

Most diseases that threaten sea turtles become problematic only when that turtle is held in captivity for any length of time. Natural disease threats to sea turtles include: malnutrition, bacterial and fungal infections (systemic or deep mycoses – pulmonary), parasitic conditions and fibropapillomatosis. Turtles suffering from multifocal bacterial encephalitis have been found stranded in the Chesapeake Bay (George 1997). The most significant disease threatening the survival of loggerhead and green sea turtles is an epidemic of fibropapillomatosis. The tumors grow on the soft body tissue and shell. They often appear around the eye, the flippers and in the mouth. When vision and swimming ability are impaired, the turtles are unable to feed. The tumors can invade internal organs, thus impeding normal function. This disease has been observed on a global basis and has crossed species. The tumors have been proven to be infectious and appear to be viral in origin; at this time, research points to a herpes virus (http://www.turtlehospital.org/fibropapilloma.htm).

3.11. Predators

Although sea turtles are subject to predation throughout their life cycle, predation is particularly high during the first two years of life. The highest predation occurs during incubation and during the race of the hatchlings to the sea. Nest and hatchling predators

are determined by the wildlife present on nesting beaches and can include the following: ants, ghost crabs, raccoons, coatis, skunks, coyotes, and other small wild and domestic mammals, wild hogs, crows, vultures, gulls, owls, hawks, grackles, snakes and humans. Predation continues to be high until the turtles are big enough to avoid being swallowed by large carnivorous fishes such as groupers, snappers, and jacks. Sharks are a formidable predator throughout the life cycle of sea turtles, although larger turtles can often avoid a shark attack by presenting the flat side of the plastron or carapace to prevent biting (http://www.tpwd.state.tx.us/huntwild/wild/species/endang/animals/reptiles_amphibians/loggheadphtml; and Ernst, 1994). Humans are a major predator throughout the lifespan of the turtles, from nest poaching to commercial fisheries bycatch.

4.0 References

References are in Section 8 of the Pesticide Effects Determination