State of Maine Comprehensive Marine Wildlife Conservation Strategy

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Introduction

The State of Maine has maintained a productive Section 6 agreement and conservation strategy since applying in 2005. Although the original agreement consisted only of large whale and sea turtle species, it has grown to include diadromous fish such as the shortnose sturgeon in 2007 and the Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon in 2009. The Maine Department of Marine Resources (DMR) is committed to working with its collaborators through the Section 6 conservation strategies spelled out here to address the needs of these endangered species within the state and associated coastal waters.

Large Whales and Sea Turtles

There are at least 22 species of marine mammals and turtles that are known to frequent the waters of the northern Gulf of Maine. Among these are multiple species of special concern, including five species of federally endangered large whales (North Atlantic right, humpback, finback, sei, sperm) and three species of federally listed turtles (Kemp's ridleys and leatherbacks are endangered, and loggerheads are threatened). The North Atlantic right whale, with a population estimated at about 400 is considered one of the most endangered of the large whales. For decades, since the end of commercial whaling, the right whale has shown little recovery. The lack of right whale recovery has been linked to collisions with ships, entanglement in specific fishing gear, habitat degradation, and disturbance from vessels.

In 1996, NOAA Fisheries (NMFS) convened the Atlantic Large Whale Take Reduction Team (ALWTRT) to prepare a plan that would reduce incidental takes of humpback, fin and right whales listed as endangered species under the Endangered Species Act (ESA). Also included in the plan are minke whales, which are protected under the Marine Mammal Protection Act (MMPA) but are not listed on the ESA. The Atlantic Large Whale Take Reduction Plan (ALWTRP) was prepared in accordance with MMPA provisions that require NMFS to reduce serious injury and mortality of marine mammals from commercial fishing operations. NMFS is responsible for the development and implementation of a Take Reduction Plan for strategic stocks that interact with Category

I and II fisheries, which cause frequent or occasional mortality and/or injury of marine mammals.

The Maine gillnet and lobster fisheries are identified as Category I fisheries on the List of Fisheries under the MMPA, and are documented as causing serious injury and mortality to the endangered North Atlantic right whale. Consequently DMR, in collaboration with the Maine commercial fishing industries, developed a Comprehensive Marine Wildlife Conservation Strategy for Large Whales and Sea Turtles in the State of Maine to reduce the risk posed by these fisheries to right whales and other protected resources. DMR's knowledge of State of Maine licensed fishermen and of the lobster and gillnet fisheries within its waters is integral to successful large whale and sea turtle take reduction. The State of Maine is fully committed to the protection of Atlantic large whales and sea turtles, while at the same time protecting the economic and operational realities of the State's fisheries.

Shortnose Sturgeon

After the inception of the plan it became apparent that the addition of the shortnose sturgeon (*Acipenser brevirostrum*) would not only enhance current research but would aid in the conservation and management of that species. The shortnose sturgeon is currently listed on the federal endangered species list. In 2007 it was added to the State's endangered species list and DMR's section 6 agreement.

Populations of shortnose sturgeon in Maine historically occurred only in the Kennebec/Androscoggin/Sheepscot estuarine complex ("Kennebec complex") and the Penobscot River. Head-of-tide dams, constructed in the early 1800's, prevented sturgeon from reaching upper spawning and nursery habitat and had severe impacts on the populations. The Kennebec complex supports an estimated 9,000 adults, making it the largest population in the US north of the Hudson River. This population appears to be stable or increasing slightly. DMR has conducted several studies to determine the distribution of sturgeon within the complex and the location of essential habitat for spawning, feeding, and overwintering. DMR currently is cooperating with the University

of Maine (UM) to assess the status of shortnose sturgeon in the Penobscot River before the removal of two mainstem hydropower dams. Nearly all fish are PIT-tagged to allow a population estimate, and some receive an internal acoustic tag to allow assessment of habitat use and migration patterns. Data sharing among researchers working in the Penobscot River (UM), the Kennebec complex (DMR), the Saco River (University of New England (UNE)), and the Merrimack River (US Geological Survey (USGS)) has led to important discoveries about out-of-basin migrations being made by shortnose sturgeon. Current plans have expanded from assessing the impact of dam removal to include studying the degree of relatedness of populations in the Gulf of Maine.

Atlantic Salmon

In 2009 the US Fish and Wildlife Service and NOAA Fisheries expanded the Distinct Population Segment (DPS) of Atlantic Salmon to include Maine's three larges river systems; the Androscoggin, Kennebec and Penobscot. The original DPS was federally listed as endangered in 2000.

The historic population of Atlantic salmon in the U.S. is estimated at 500,000 fish. Atlantic salmon could be found in U.S. rivers from the Housatonic in Connecticut northeastward to the St. Croix in Maine. In Maine alone, thirty-four rivers once supported populations of Atlantic salmon. These rivers may have produced as many as 100,000 adults annually prior to the late 1800s. By 1900, essentially all salmon populations south and west of the Kennebec River in Maine had been extirpated, leaving behind small remnant populations in the Penobscot River and various small coastal watersheds in Central and Eastern Maine. By the mid 20th century, an expanded effort was underway by both state and federal agencies to protect and enhance the remaining populations of Atlantic salmon in eastern Maine through dam removal efforts, increased fish management and stocking, and voluntary protection of riparian corridors.

The Penobscot River has had the largest runs of adults during the modern era, with 80% of all U.S. adult returns occurring in this river. In the 1880s, returns as high as 18,000 adults were recorded on the Penobscot. The highest recorded number of returns in recent

times was in 1986 when over 4,100 were captured at the Veazie Dam fishway trap facility. However, populations have declined in the Penobscot since then. In 2008, only 2,115 adults were captured at the Veazie Dam fishway trap facility. These declines ultimately lead to the listing of Atlantic salmon as endangered in some rivers under the Federal Endangered Species Act in December 2000 and an expanded DPS in 2009 that includes the Penobscot, Kennebec and Androscoggin Rivers. The threats that led to the dramatic decline throughout the 1990s are most likely associated with a chain of concurrent events from which the populations have not be able to recover, even as significant known threats are removed. Today a conglomerate of threats exist, ranging from increased predation resulting from a shift in fish species assemblages, to low marine survival, to degraded habitat, to passage barriers.

DMR works with NOAA under a 5-year cooperative agreement that contains five specific elements. Element 1, Adult Salmon Studies, Maine DPS Rivers, is aimed at enumerating and determining origin of adult Atlantic salmon returns to Gulf of Maine DPS rivers. Element 2, Atlantic Salmon Studies, non-DPS Maine Rivers, is focused on enumerating, collecting and interpreting biological data from Atlantic salmon returning to the Penobscot River. Element 3, DPS River Juvenile Salmon Studies, is focused on assessing late summer basin-wide abundance of juvenile Atlantic salmon in at least one river annually. Element 4, Maine River Smolt Studies, is focused on installing and operating rotary screw smolt traps. Element 5, Habitat Assessment and Protection, is focused on developing management plans for the rivers to improve and restore habitat complexity and connectivity.

Conservation Strategy Background

Large Whales and Sea Turtles

A statewide disentanglement network was originally coordinated by the DMR in 2001. This first pass included training over three-hundred Maine Lobstermen at a Level 1 for reporting and stand-by procedures. Forty-four of these lobstermen and all of the State's Marine Patrol officers (MPO's) were trained in disentanglement to at least Level 2, including whale behavior and identification, preliminary entanglement response and

assessment training. Four MPO boat Captains received advanced Provincetown Center for Coastal Studies (PCCS) training, which included the technique for satellite tagging of an entangled whale and video case studies. Special disentanglement tools, based on those created for PCCS, were built for use by the MMP and the advanced trained lobstermen. All Marine Patrol vessels and eleven Level 2 trained lobstermen were issued either full or "mini" disentanglement kits.

Since the creation of the network, it is evolving into a more specialized disentanglement team. The team now consists only of trained DMR responders. This new model will allow DMR to better target specialized training resources and have a small group of people on-call to draw from when response is needed. The Whale Conservation Program's scientist continues to maintain the training of the team, which includes biologists and select MPO's. DMR currently has three staff members trained as Level 3 responders and continues to be committed to elevating training levels to increase response capabilities for ESA listed species. DMR is working with NOAA Fisheries' Large Whale Disentanglement Network to keep up to date on protocols, equipments and trainings.

As a part of DMR's collaborations with the industry, a gear modification research and development program began in 2003. The first effort utilized a contracted Remote Operated Vehicle (ROV) to document experimental rope modifications as well as how standard gear behaved on the bottom. Research progressed into testing various products of low-profile groundline to investigate the operational feasibility and its ability to replace sink rope as a way to reduce groundline entanglements in Maine. This included the distribution of over 300 coils of rope to fishermen for field testing and the deployment of data loggers on experimental line both off of fishing boats and in conjunction with the DMR's Regional Ventless Trap Survey. DMR submitted a proposal in January 2008 to amend the current ALWTRP to allow the use of this experimental low-profile rope with a specific gravity of 1.02 (slightly lighter than the 1.03 definition of sink rope) in certain areas along the coast. This proposal was eventually withdrawn. Subsequently, DMR submitted a proposal to the TRT for an exemption in certain parts of

the state to the sinking groundline requirement. This allowance of float rope would be off-set by a reduction in vertical line numbers, a ban on singles and the adoption of a gear marking scheme. A sub-group of the TRT met to discuss this proposal in July of 2008. Following the inability of the group to determine a cohesive path forward, the proposal was also withdrawn. Recent efforts now focus on understanding baseline amounts of gear, specifically vertical lines, in Maine's lobster fishery seasonally. To this end, DMR has conducted 3 comprehensive gear surveys (2006 to federal permit holders, 2008 and 2010 to all permit holders) to assess the distribution of vertical lines in the state by region, season and configuration. These data, coupled with dealer and harvester reporting information, will be used to understand baseline amounts of gear in coastal waters and will be given to the ALWTRT and NOAA Fisheries for use in large whale risk modeling efforts.

Additionally, a new tool, the annual log, was implemented in 2009 and will continue through at least 2010. An annual log is sent with license renewal materials asking for the maximum number of traps and vertical lines by area and month. While documenting less overall information than the survey, this tool yields a higher response rate from the industry and illustrates the seasonal movement and use of traps and vertical lines.

The fastest growing segment of the Conservation Strategy is the large whale habitat and foraging research component. This work began using the proceedings from the DMR hosted foraging workshop and grew to include research outlined in the ALWTRP whale research matrix. A monitoring program sampling habitat characteristics in Mid-coast and Downeast Maine using plankton and water column sampling began in 2008 and continues through 2010. The data obtained from these sites coupled with on-going summer plankton surveys are being used to build a near-shore right whale habitat forecasting model through collaborations with the University of Maine. Additional work along the eastern coast of the state has included passive acoustic buoy arrays to document the presence and abundance of whales in the area as well as an analysis of the historic humpback photo-identification catalogue to determine baseline entanglement scarification rates.

A grant obtained in 2008 funded a Dtag project in Maine coastal fishing habitats that successfully tagged two humpback whales near Mount Desert Island. Tags recorded over 8 hours of behavior and dive profiles that preliminarily show the whales diving to the bottom during foraging events in addition to using the upper 20 meter of the water column. Data analysis and the fishery context was completed and presented at the Biennial Conference for the Society of Marine Mammalogy in 2009.

The last component of the Plan includes the DMR marine mammal strandings program, which began in the fall of 2005 with dead pinniped response and expanded to include live and dead cetacean response in 2006, and finally live seal response in 2007. The stranding coordinator subsequently implemented response and reporting protocols along with administration of the Maine Strandings Collaborative. Additional activities include maintaining a volunteer network, manning the DMR hosted state-wide Maine Marine Animal Reporting Hotline, and public education and outreach tasks.

Shortnose Sturgeon and Atlantic Salmon

DMR has management authority for diadromous species in Maine, and provides comments on permit applications for projects that could impact these species. In order to protect shortnose sturgeon, the DMR needs to know where essential habitat is located and how many fish utilize it. This allows the DMR to minimize potential impacts from anthropogenic factors (dredging, dams, bridge and pipe crossings, water discharge, etc.). DMR has conducted several studies to estimate the size of the adult shortnose sturgeon population in the Kennebec complex, determine the seasonal distribution of these fish, and delineate essential habitat for important life history events such as spawning, feeding and overwintering. Researchers at UM currently are conducting a study to determine the abundance and seasonal distribution of shortnose sturgeon in the Penobscot River and to identify and map essential habitat as well prior to the proposed removal of two mainstem hydropower dams on or before 2013. Additional concerns include assessment of the Kennebec population since the removal of a head-of-tide dam in 1999.

Additionally, NOAA, DMR and USFWS have been collaborating on a new framework for Atlantic salmon to be adopted by the resource agencies in conjunction with a new governance structure designed to implement and fulfill that framework. The cornerstone of the new framework is the explicit recognition of the current status of Atlantic salmon in terms of abundance, distribution, and diversity; three key parameters that must be maintained and eventually enhanced. Specific measurable goals are identified that are necessary to achieve in order to move from the current abundance, distribution and diversity of salmon to the future desired state of recovery. The framework identifies the need for significant improvements in both freshwater and marine survival in order to move the species from its current status to a future desired state.

As part of the cooperative agreement with NOAA, the DMR staff conducts routine monitoring of the abundance and status of juvenile and adult salmon in most of Maine's Atlantic salmon watersheds, which includes collaborations with partner who operate traps to monitor adult Atlantic salmon returns.

Additionally, research on Atlantic salmon is directed at determining the causes of the precipitous decline in Atlantic salmon returning to Maine waters. Ongoing DMR research projects are aimed at determining survival among freshwater life stages and understanding the biological and environmental factors affecting survival. NOAA-Fisheries salmon research focuses on the same questions in estuarine and marine waters. The two agencies conduct cooperative research designed to link freshwater rearing conditions and smolt emigration to better understand the biotic and abiotic factors affecting the freshwater-marine transition. Components of the cooperative projects are currently underway on the Pleasant, Narraguagus, Dennys, and Penobscot Rivers. These include: parr density and growth, basin-wide estimates of large parr; indices or estimates of smolt emigration smolt; smolt physiology, marine and estuarine smolt trawling, and smolt tracking through estuaries. As part of this collaborative effort, DMR is working with the Mitchell Center at the University of Maine to monitor water quality within Downeast rivers. DMR staff is measuring cobble embededness in juvenile rearing habitat and permeability in spawning habitat to evaluate the relative quality of these across

Maine salmon rivers. The water quality and habitat work are important background for further studies of over-winter parr survival and smolt physiology.

Collaboration with a number of public and private entities that have ongoing marine conservation and education programs (including the University of Maine, University of New England, College of the Atlantic and non-government organizations), have expanded and solidify the credibility of the Conservation Strategy. The Maine Conservation Strategy was developed from the State's recognition that there is a need to enhance the survival and recovery of marine mammals and sea turtles in Maine waters, thereby contributing to their global recovery, while at the same time protecting the economic and operational realities of our State's commercial fisheries. The expansion of recovery efforts to include the shortnose sturgeon and Atlantic salmon is a logical role for the Conservation Strategy and allows Maine to take on more responsibility for the conservation and management of its threatened and endangered species.

Conservation Strategy Objectives

The Maine Conservation Strategy is multi-phase with short and long-term goals, and will be accomplished through these four objectives:

- Protect, manage and enhance marine mammal, sea turtle, shortnose sturgeon, and GOM DPS Atlantic salmon populations by assessing population status and trends as well as life history needs of these species using Maine waters;
- Mitigate negative impacts that may affect populations of or habitats used by marine mammals, sea turtles, shortnose sturgeon and GOM DPS Atlantic salmon;
- Protect and improve habitat quality and connectivity;
- Identify and coordinate existing roles, responsibilities, and activities of the various involved parties, and promote improved coordination among them; and
- Improve and promote public education and participation

Conservation Strategy Collaborators

Federal: National Marine Fisheries Service, United States Coast Guard, United States Navy

State: Department of Marine Resources, Marine Patrol, Department of Transportation Department of Environmental Protection, Department of Inland Fisheries and Wildlife

Industry: Maine Lobstermen's Association, Down East Lobstermen's Association, Southern Maine Lobstermen's Association, Maine Gillnetters Association, Grand Manan Fishermen's Association, East Coast Tuna Association, Gulf of Maine Lobster Foundation

Conservation: New England Aquarium, Provincetown Center for Coastal Studies, Chewonki Foundation, Allied Whale, Whale Center of New England, Maine Island Trail Association, Wells Reserve Laudholm Trust

Academic: University of Maine, College of the Atlantic, Bigelow Laboratories, University of New England, Woods Hole Oceanographic Institute, Gulf of Maine Research Institute

Strandings: New England Aquarium, University of New England, College of the Atlantic- Allied Whale, Isle of Shoals Laboratory, Woods Hole Oceanographic Institute, Mystic Aquarium

Others: Cruise Maine Coalition, Maine Pilots Association, Whale Watches, Harbormasters, York County Veterinary Hospital

2010-2011 Conservation Strategy Goals

- Assess vertical line risk in different use areas of the Maine coast using the gear survey and annual logs sent out to all lobster and gillnet permit holders
- Assess and provide data from Dealer and Harvester reporting to NMFS and the ALWTRT for use in entanglement risk assessment models
- Analyze data from statistically valid ALWTRP compliance surveys with Marine Patrol and NOAA Fisheries.
- Contribute data to the Provincetown Center for Coastal Studies humpback whale scarification study to determine entanglement rates in the northern Gulf of Maine.
- Build preliminary near-shore right whale habitat model with the University of Maine/Gulf of Maine Research Institute.
- Continue acoustic and photo-identification monitoring of large whales around Mount Desert Rock with College of the Atlantic/Allied Whale.
- Continue large whale habitat monitoring program and state-wide plankton surveys
- Add an inshore/offshore plankton survey in the fall
- Perform acoustic monitoring and analysis of data in three locations: known whale habitats around Mount Desert Rock, potential winter right whale habitat west of Jordan Basin, and state-wide within the non-exempt state waters during the peak fishing periods
- Conduct aerial surveys to digitally document the density of buoys and therefore vertical lines through the non-exempt state waters during the peak fishery
- Conduct boat-based gear density surveys year round to document seasonal changes in the fishery
- Collaborate with Woods Hole Oceanographic Institute to run acoustic and oceanographic sampling gliders through acoustic study areas
- Seek funding to tag humpback, fin and right whales along Maine's rocky habitat to determine diving and feeding behaviors
- Obtain funding for State wide coastal aerial sightings surveys for large whales

- Continue to further develop the disentanglement team as well as industry/community outreach programs
- Seek additional Level 3 and 4 training for key members of Maine's disentanglement team
- Continue to establish sea turtle disentanglement protocols and train relevant personnel
- Continue to collaborate with NOAA and establish state floater response protocols
- Continue to collaborate with NOAA and other state strandings programs to outline protocols for large whale and mass stranding events
- Coordinate volunteer training for pinniped and cetacean stranding response
- Determine the status of the population of shortnose sturgeon in both the Penobscot River and the Kennebec complex
- Obtain biological information on shortnose sturgeon in the two above watersheds including estimates of the numbers of adults, spawning, feeding, and overwintering habitats, migratory pathways, and the impacts of riverine discharge on life history parameters.
- Continue to collaborate with NOAA on the Atlantic Salmon recovery Framework and all recovery activities.
- Continue to monitor the abundance and status of juvenile and adult salmon throughout the DPS.
- Continue to assess the causes of the precipitous decline in Atlantic salmon returning to Maine waters.
- Further develop the habitat restoration and connectivity program for Atlantic salmon.

Conservation Strategy Components

Large Whales and Sea Turtles

Disentanglement Network

The disentanglement network is currently being re-designed into a more efficient, cohesive and better trained response team for the State of Maine. In consultation with NMFS, DMR is moving away from the diffuse network model in which many parties were trained at a basic level. Instead, a small team is being created that is made up of 2-4 biologists and 6 MPO's. These individuals will receive upper level training through NMFS and will be on-call to respond to reports of entangled whales state-wide. Additionally, members will receive a kit of disentanglement tools. Tools were also consolidated to be distributed on all large MP vessels, which will be the likely responding platforms.

Authority to disentangle minke whales was received by the State in 2001, and permission to disentangle other large whales is obtained on a case-by-case basis through direct consultation with NOAA and PCCS. To date the Maine Disentanglement Team has successfully disentangled 5 minke whales following protocols established by NOAA incorporated into the Conservation Strategy. Additionally, three staff members have received training for sea turtle disentanglements.

Gear Modification Research and Development

DMR recognizes that disentanglement is a stop-gap measure, and that preventative gear modification or reduction efforts are necessary to reduce the threat of entanglement to large whales in Maine waters. Many fishermen became interested in the development of alternative operationally viable gear modifications and the summarization of data describing the industry and several projects including low-profile line deployment and gear surveys were done to address this need. While research has ended on experimental gear modifications, DMR is expanding work that defines baseline attributes of the lobster fishery, including gear density, seasonality and configurations.

A comprehensive vertical line survey was mailed out to all lobster and gillnet license holders early in 2010. This new survey will be used to assess the amounts and configurations of gear being set in different areas by month after the sinking groundline and other regulations went into effect in 2009. Coupled with data from dealer and harvester reporting, new analyses are uncovering baseline densities and seasonality of gear not previously known. Additionally, DMR is working with NMFS to incorporate this data into the model that their contractor, Industrial Economics (IEC), is building to assess the risk of entanglement to large whales due to vertical lines in different areas. Preliminarily, over 700 lobster and over 50 gillnet surveys have been returned and are currently being entered into databases. Once this is complete in the summer of 2010, the data will be released to the above mentioned parties. No other extensive gear surveys are planned beyond 2010.

A new tool was introduced in October of 2009. Annual logs were mailed to all lobster license holders with their annual license renewals materials. These logs ask only for the maximum number of traps and vertical lines fished in each area by month for the 2009 season. DMR has received over 2,500 logs and is currently working on getting them entered into a database. This information can be used by the state and the ALWTRT to track traps and vertical line movements seasonally with a higher response rate than the more in-depth gear surveys. Logs will be sent out again in October of 2010 to assess the 2010 fishing season.

DMR worked with Marine Patrol, the NOAA Fisheries Northeast Science Center and the Northeast Regional Office to implement a pilot program for monitoring compliance rates with the ALWTRP regulations. This involved standardized methods for hauling and checking gear for compliance with regulations as well as doing vertical line count estimates on the water that can be used to extrapolate gear densities and/or ground-truth gear densities derived from vertical line surveys. Sampling occurred in October of 2009 as well as March of 2010. Preliminary results suggest that compliance with the sinking groundline regulation was good, however outreach needs to increased for other regulations such the red marker on the vertical line. Data from both surveys is still being compiled and will be available for review at the next ALWTRT meeting.

Lastly, DMR ran a pilot project to determine vertical line densities out of Bar Harbor in collaboration with the College of the Atlantic (COA) during the summer of 2009. That project is being expanded starting in July 2010 to include three sampling areas that cover the state and will run in all months of the year. The aim of this project is to get on the water counts of vertical line densities and be able to compare that with densities estimated from paper surveys. Extra funds have recently become available to conduct this project for a full year along with the complementary use of imaging aerial surveys to digitally document the density of vertical lines in non-exempt state waters during the peak fishery. Aerial surveys will be conducted September through November 2010. Buoys from collected images will be digitized, coded based on confidence and translated

to an ArcGIS format. Once in this format, data can be layered with other data sources, such as whale sightings, to determine potential area of entanglement risk.

Foraging Research

Foraging work through the DMR is crafted through research priorities identified by the state sponsored large whale foraging workshop that was held in the fall of 2005 and the ALWTRP whale research matrix.

DMR is entering its third year of habitat monitoring in which two sites, one in Mid-coast and one Downeast, are compared to an on-going site on Jeffery's Ledge. These three sites are sampled twice a month year round to determine seasonal variation of plankton structure and density. Vertical tows, CTD drops, and surface samples are taken at each sampling. Additionally, the Downeast site also is equipped with a four buoy acoustic array that is deployed for three months out of the year during traditional whale sighting months in the late summer/early fall. Data from the monitoring sites and acoustic buoys are still being analyzed.

July of 2010 will be the third field season for the statewide inshore/offshore plankton survey. This survey uses vertical tows, CTD drops, horizontal plankton tows using Tucker Trawls, and a Laser Optical Plankton Counter to determine the structure and abundance of plankton in different areas of the state. Preliminary data have yielded one sampling site, near Mount Desert Rock, that had copepod abundances above the feeding threshold for right whales. Data from these surveys will inform the near-shore right whale habitat forecasting model being built by the University of Maine/Gulf of Maine Research Institute for the State of Maine. Additionally, an extra survey will be conducted in the fall of 2010 to test the theories for the overwintering locations of copepods and compare the inshore to offshore habitats during this season.

DMR and Allied Whale have been working with scientists at the Provincetown Center for Coastal Studies to contribute photos from the northern Gulf of Maine to their database for determining the scarification and therefore entanglement rates of humpback whales.

DMR is expanding passive acoustic coverage of the state in 2010. The array mentioned above near Mount Desert Rock will continue to collect data in the summer around that area and the Inner Schoodic Ridges. This data will be able to be compared to sighting rates, species identifications, and individual behavior observed in the area by COA/Allied Whale researchers. Additionally, 2009 was the first year that DMR has been able to recover data from a pop-up acoustic buoy in the region west of Jordan Basin in collaboration with COA. This area is hypothesized to be a winter breeding ground for right whales. That data is currently being analyzed. Acoustic buoys will continue to be placed in that area at least through April of 2011. Additional acoustic buoys are being placed through-out non-exempt state waters in the fall of 2010. These data will be used to determine the overlap of large whale distribution with lobster gear during the peak fishing season for these areas. Three of the selected sites also intersect with areas chosen to test offshore wind turbines. One site was chosen close to the shipping lanes outside Portland Harbor.

Strandings Program

The DMR accepted the letter of authority from NOAA Fisheries to respond to dead pinnipeds in the fall of 2005. The responsibilities of the state increased in the spring of 2006 when it also took over the letter of authority for live and dead cetacean response and in April of 2007 we accepted authority for responding to live pinnipeds from Kittery to Rockland. In order to streamline communication and efficiently administer the Maine Strandings Collaborative, DMR sponsored the Maine Marine Animal Reporting Hotline. The hotline has received 2,600 calls, 2151 to report pinnipeds and 423 to report cetaceans. In addition to response and reporting duties for all calls placed through the hotline, the coordinator conducted training sessions in conjunction with the University of New England and Maine Marine Patrol. Training is an important piece to the large scale public outreach project that began in the spring of 2006 and continues presently. The main objectives of outreach efforts are to advertise the hotline number and educate the public of the programs responsibilities in responding to live and dead marine mammals and sea turtles. The strandings program continues to grow. Multiple training sessions are

planned for the upcoming months as well as additional outreach materials. In addition, the coordinator is in close contact with NOAA and the other Maine strandings groups working on protocols for floaters, large cetaceans and mass stranding events in the state.

Shortnose Sturgeon

The research being conducted by the DMR and the University of Maine on shortnose sturgeon is in direct response to seven recommendations in the 1998 Final Recovery Plan for the Shortnose Sturgeon *Acipenser brevirostrum*. These tasks include determining abundance, age structure and recruitment, sampling for sturgeon in areas of historic occurrence, documentation of seasonal distribution and essential habitat, development of criteria to identify critical habitat, designating identifiable habitat for sturgeon populations, ensuring fish passages, and examining the relationship between dam discharge levels and spawning success.

From 1977 to 2001, DMR used gillnets, PIT tagging, and radio and acoustic telemetry in the Kennebec complex to document the distribution and abundance of adult shortnose sturgeon and to identify their spawning feeding and overwintering habitats. The removal of Edwards Dam in 1999 opened up 17 miles of previously inaccessible riverine habitat to sturgeon and other diadromous fishes. Proposed research will begin to assess the impacts of dam removal on the recovery of shortnose sturgeon and whether and to what degree this habitat has been re-colonized.

In 2006, researchers at UM initiated a study to determine the status of shortnose sturgeon and Atlantic sturgeon in the Penobscot River. Similar to the Kennebec studies, gillnets, PIT tagging, and acoustic telemetry are being used to document the distribution and abundance of adult shortnose sturgeon and to identify their spawning feeding and overwintering habitats. DMR has been awarded NOAA funding to continue the work for three years. A major impetus for this study is the proposed removal of the two lowermost dams on the river.

To date a total of 568 shortnose sturgeon have been captured in the Penobscot River of which 444 have been PIT-tagged and 68 fitted with an acoustic tag.

Disposition	2006	2007	2008	2009	Total
Caught	63	99	185	221	568
PIT tagged	59	87	147	151	444
Acoustic tagged	21	19	17	11	68

Preliminary estimates of the Penobscot River-wide shortnose sturgeon population from mark-recapture data are 1425 adults (95% CI: 203, 2647) using a modified Peterson model and 1531(95% CI: 885, 5681) using a simple Schnabel estimate (Fernandez 2008).

Acoustic telemetry led to the discovery of an overwintering area in Bangor near river km 36.5, while telemetry and the recovery of a shortnose sturgeon in the Penobscot that had been PIT tagged in 1999 in the Kennebec complex demonstrated that shortnose sturgeon routinely migrate between the Penobscot and Kennebec rivers (Fernandez 2008). In 2007, 2008, and 2009 a total of 10, 15, and 12 of the shortnose sturgeon that had been tagged in the Penobscot River in prior years were detected in the Kennebec complex. Penobscot-tagged fish display the following behavior (Wippelhauser, unpublished data): shortnose sturgeon that enter the Kennebec complex in the fall move quickly to the overwintering area; a smaller number enter the Kennebec complex in the spring; spring immigrants and some of the overwintering fish subsequently move to known or historical spawning areas; the remainder of the overwintering fish move downstream or return to the Penobscot.

Several events in 2009 demonstrated that shortnose sturgeon in the Gulf of Maine make long-distance migrations outside of the natal river. Two shortnose sturgeon were captured (and immediately released) in the Saco River, one by a UNE scientist gillnetting Atlantic sturgeon and one by a recreational fisherman (James Sulikowski, pers. Comm). In addition, a shortnose sturgeon PIT-tagged in the Kennebec complex in 2000 was captured in the Merrimack River in December (Micah Kieffer, pers. Comm).

Atlantic Salmon

The DMR counts and determines the origin of adult Atlantic salmon returns to Gulf of Maine DPS rivers with salmon trapping facilities and by conducting autumn redd counts. In addition, the DMR is examining the feasibility of improving methods to document adult salmon injuries, and their sources through photographs, standard classifications, and staff training. Juvenile salmon research is focused on assessing late summer basin-wide abundance of juvenile Atlantic salmon in at least one river annually, conducting electrofishing surveys, to facilitate developing of range-wide juvenile salmon abundance indices, and to better understand relationships among density and size at age, riverine ecological conditions, and stocking strategies. DMR staff collect age-1 and age-2 Atlantic salmon parr for captive rearing as river-specific broodstocks at USFWS hatcheries from the Narraguagus, Dennys, Sheepscot, Machias, East Machias, and Pleasant rivers and capture sea run adults for transfer to the hatchery as well. Smolt research is conducted using rotary screw smolt traps on the Narraguagus River above Beddington Lake and on a Penobscot basin tributary for index sampling from mid-April through the end of the smolt run.

Along with the work DMR conducts to increase the numbers of Atlantic salmon throughout the DPS, the DMR is working to improve the quality of habitat and access to habitat. Habitat work is focused on developing management plans for the rivers, and developing and testing hypotheses on the links among habitat quality and salmon population that will lead to habitat restoration prescriptions. Many factors continue to impede recovery. Dams continue to block the passage of adults to spawning habitat. The capability of the assessable habitat to successfully incubate eggs and produce juvenile salmon is limited due to sedimentation, reduced flow and water quality. Non-point source pollution from roads, agriculture, forestry and development continue to alter the sediment loading in the rivers as well as inputting chemicals and other pollutants from overland flow. Climate change and marine survival are also unknown factors, but are thought to be somewhat responsible for the declining populations. The focus of DMR's current research is to better understand factors that may limit habitat.

Future Programs

Large Whales and Sea Turtles

Disentanglement Network

DMR is in the middle of changing the disentanglement response network to a more team-based model. The new plan will allow for additional training, which will be done in the fall of 2010. Additionally, DMR is working on revised protocols, and standard operating procedures that will be approved by NMFS.

The minke whale and sea turtles are currently the only species that the Maine disentanglement network is authorized to address without the direct involvement of NOAA and PCCS. With the exception of right whale disentanglements, a logical outgrowth of the Conservation Strategy is increased responsibility and authority for other large whales as training expands and is permitted. Further advanced training is needed and DMR, NOAA Fisheries and PCCS remain committed to offering such training to network members in the state.

Gear Research and Development

The final analysis of the 2010 gear survey data, coupled with dealer and harvester reporting, will be completed and available in the summer of 2010. Additionally, annual logs will continue to be a source of data on the maximum number of traps and vertical lines fished through the 2010 fishing season in the least. Ways in which to ground-truth this industry dependent data, such as boat and aerial based surveys will continue to be explored.

The boat and aerial based gear density surveys will begin in 2010. Boat-based surveys commence in July and will be done in each of the three areas monthly for one year. Aerial surveys will begin in September and will document the non-exempt state waters one time during the peak fishing season in these waters.

A gear trawling project is beginning to be developed by DMR in collaboration with NMFS and the Gulf of Maine Lobster Foundation. The timeline for this project is still unclear but DMR is committed to beginning this project before summer of 2011. One of the ways in which the lobster industry in Maine can deal with a reduction in the numbers of vertical lines allowed would be to increase the number of traps on a vertical line. DMR plans to enlist fishermen to trawl up some of their gear, from singles and pairs to triples or fours, and documents their experiences through logbooks and increased sea sampling. The methods for the project are being developed in the summer of 2010. If implementation is not possible by fall then it will be conducted starting in the spring of 2011.

Foraging Survey

There are several on-going projects that will continue through 2010. These include the habitat monitoring stations, the plankton survey, photo-identification for scarification rate studies and acoustics near Mount Desert Rock and Jordan Basin (in the winter). Additional acoustics in non-exempt state waters and an expanded season in the Jordan Basin site will begin in the summer and fall of 2010.

DMR is also beginning collaborations with the Woods Hole Oceanographic Institute to implement an autonomous glider component to the acoustic monitoring. The gliders will be deployed in both the Jordan Basin site and the non-exempt state waters, overlapping with passive acoustic buoys deployed there. The glider will take data on oceanographic characteristics, plankton density and occurrence and record whale sounds for a month or more along pre-determined transects and sampling points. DMR hopes to get this work in line to begin in October of 2010 and secure funding for research to continue through 2012.

DMR will also be seeking funding to resume the tagging program for humpback, fin and right whales over Maine's rocky bottom habitat. Learning the dive profile and feeding habits of whales in this unique environment will aid in understanding when and where these endangered species are at risk for entanglement.

Strandings Program

Since the establishment of the Maine Marine Animal Reporting Hotline and hiring a state stranding coordinator, DMR has accepted the lead role in live and dead pinniped and cetacean response. This centralized approach will continue to allow for increased collaborations within existing stranding networks through the state supported Maine Strandings Collaborative and will lead to a streamlined communication system to facilitate prompt response to strandings of cetaceans, pinnipeds, and sea turtles along the entire Maine coastline. DMR will continue to host and coordinate the centralized hotline and will dispatch reports to the appropriate member of the Maine Strandings Collaborative while further building collaborations to expand outreach, pinniped and cetacean protocols and research disposal options such as composting. DMR will also help develop, coordinate and train the network's volunteer corps to ensure that the entire coastline is covered for all reports.

Shortnose Sturgeon

In the Kennebec complex DMR will be documenting any changes in habitat use and re-colonization of historic areas after the 1999 dam removal. Research in the Penobscot River will concentrate on estimating the size of the population and documenting basic life history parameters. Baseline information will be essential in light of the proposal to remove two dams in potential sturgeon habitat. Both studies will be done using gillnets to catch sturgeon, after which biological data will be taken and fish will be outfitted with a combination of PIT and acoustic tags. These tagging methods will aid in the discovering the concentrations of sturgeons, delineation of habitat uses and determining the criteria for essential habitat.

Atlantic Salmon

Habitat

DMR is working on enhancing the level of work related to habitat. Tens of thousands of miles of salmon rivers and streams flow throughout the state of Maine. Structures such as bridges, culverts and dams disrupt migratory pathways block diadromous fish from

their spawning and rearing habitats. DMR views connectivity as occurring along four interrelated dimensions: longitudinal (flow within the stream channel), lateral (linkages between the stream channel and the riparian/floodplain system), vertical (linkages between the stream channel and contiguous groundwaters) and temporal (variation over time). An array of state and federal agencies and nonprofit organizations are working collaboratively in Maine to reconnect fish with their native habitat and to restore riverine, coastal, and Gulf of Maine health. The goal of this project is to address impediments to salmon and improve ecosystem connectivity in Maine's coastal watersheds. Addressing critical passage problems at high-value sites will be initiated through biological planning, permitting, assessment and/or construction.

5 Year Cooperative Agreement

The current cooperative agreement between NOAA and DMR ends in May of 2011. DMR is currently working with NOAA on the development of a new agreement with modified elements: Element 1 - Adult Salmon Stock Assessment. Element 2 - Freshwater Productions Assessment of Parr and Smolt. Element 3 - University of Maine Salmon Spatial Ecology and Ecosystem Research. Element 4 – Estuarine Ecosystems and Diadromous Fish Communities. And, Element 5 – Dam Related Connectivity. These specific elements have come about through the development of a new management framework that focuses on an adaptive process and new governance structure.

ATS Management Framework

The fundamental goals of the new framework are to increase the abundance and persistence of wild Atlantic salmon spawning in Maine rivers. These issues were highlighted in reports conducted by the National Research Council (NRC) and by SEI Consulting. The NRC report recommended that recovery planning efforts for Atlantic salmon adopt a systematic, structured approach to making management decisions, focused on understanding critical uncertainties and on developing strategies that address key sources of ecological risks. The SEI report noted that the recovery program lacks a clear decision making framework that successfully integrates key management strategies: research, mitigation activities, monitoring, stock assessment, and hatchery production. In

response, the Atlantic Salmon Management Board, composed of representatives from the three lead agencies (as well as the Tribes), decided to explore a new collaborative approach for moving forward with recovery actions. One aspect of this response involves the establishment of Action Teams that will take the lead on developing a plan to address priority hypotheses relating to DPS recovery. Another aspect is the decision to seek outside help in developing a revised management framework, based on methods drawn from structured. It is anticipated that this new Atlantic salmon framework will be in place by the end of 2010.

FEDERALLY ENDANGERED SPECIES IN MAINE WATERS

(and including the threatened Minke Whale)

North Atlantic right whale (*Eubalaena glacialis)*

Description: North Atlantic right whales are the world's rarest cetacean, with estimates of between 300 and 325 individuals in existence today. Right whales are large, rotund, slow-swimming whales that inhabit shallow, coastal waters along the East Coast of the United States and Canada. Due to their slow speed, large size, high blubber content (thus floating when dead), and propensity to inhabit coastal waters, right whales were considered the "right" whales for 19th century whalers to hunt. Easily distinguishable from other whales, right whales lack a dorsal fin, have a V-shaped spout or blow, and have callosities (wartlike structures) near their eyes, blowhole, lower jaw, and rostrum. These callosities, unique to each individual, allow researchers to identify different animals. Adult right whales, mostly black with white on their bellies, grow from 44-55 feet and weigh between 45 and 55 tons, with females being larger than males. Their flippers, broad and up to five feet long, are located just below and behind the eyes. They have a large head (about 1/3 total body length), paired nostrils, and a curved mouth containing gray baleen with fine bristles. Between 200 and 270 baleen plates are rooted in a right whale's upper jaw, and can be up to seven feet long.

Whaling: Right whale populations in the both North Atlantic and North Pacific were nearly extirpated by commercial whaling. European whaling began with the Basques in the 11th century in the Bay of Biscay, then spread to Labrador by 1530 and to New England by the 1600s. In the North Pacific, intense whaling began in the Gulf of Alaska in 1835; by 1900 the North Pacific right whale population was extremely depleted. Soviet whaling further reduced the eastern population during the 1960s to its present numbers of approximately 100 animals. Right whales were hunted primarily for their oil and baleen. Whale oil, extracted from the blubber, was primarily used as an illuminant and to a lesser extent for the tanning of leather and the manufacture of candles, soap, and lard substitutes. Baleen was used to make fashionable women's clothes, whips, and canes.

Range and Habitat: Right whales occur in the North Atlantic and North Pacific in extremely low numbers. The North Pacific right whale (*Eubalaena japonica*) population is thought to contain only a few hundred animals at best. In the North Atlantic, right whales have historically been sighted from Iceland to Florida. However, after the end of commercial whaling, their range became limited to five primary areas along the East Coast of the United States and Canada. These areas include the Bay of Fundy Conservation Area (Canada), Scotian Shelf Conservation Area (Canada), Cape Cod Bay critical habitat, Great South Channel critical habitat, and the critical habitat established off the coast of southern Georgia and northern Florida. In the U.S., critical habitat designations can be made pursuant to the Endangered Species Act for federally listed endangered species.

Ecology: Right whales occur singly, in pairs, or in small groups of three to eight in feeding areas. Occasionally groups of up to 30 whales are seen. New England waters represent a major feeding and nursery area. In March and April, right whales congregate in the plankton-rich waters in Cape Cod Bay and off Georges Bank in the Gulf of Maine. During the summer and fall, the whales spend their time in the Bay of Fundy and the southeastern coast of Nova Scotia feeding and demonstrating courtship behaviors (August and September). During the winter months, a portion of the population, mainly females and juveniles, migrates to the calving grounds in the shallow waters between Savannah, Georgia and Cape Canaveral, Florida. Most adult males do not travel to the calving grounds. Calving peaks between December and March after a gestation period of approximately twelve months. Calves average 15 feet in length at birth and nurse for at least nine months. Females give birth every three to five years. Males and females reach sexual maturity at a body length of approximately 45 feet, and at an age between seven and ten years. Although right whales do produce extensive and complex sounds under water, they do not produce "songs" as humpback whale males do, nor do they use these sounds in echolocation as toothed whales do.

Right whales skim feed both at the surface and underwater by swimming with their mouths open. They swim through dense aggregations of copepods (small crustaceans about the size of a grain of rice) and occasionally krill (shrimp-like animals), and filter water through their baleen. The tiny critters remain inside the whales' mouths and are swallowed whole.

Threats: Because North Atlantic right whales are slow moving, spend considerable time at the surface, and inhabit inshore areas, current threats include collisions with ships and entanglements in fishing gear. Collisions with vessels have killed at least 13 right whales since 1976. There were 16 recorded encounters between right whales and fishing gear from 1975-1989 and 57% of photographed whales exhibit scars or injuries indicating interactions with lines and/or nets. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale watching may occasionally cause harassment, but this is believed to be insignificant. Due to the extremely small population size, any mortality is considered significant and may limit population recovery.

Conservation and Management: The North Atlantic right whale population is estimated to contain approximately 300 individuals. Since 1937, the species has had nearly complete protection but numbers continue to decline. In 1970 right whales were listed as endangered under the Endangered Species Act (ESA). Additional protection from illegal take and harassment is afforded through the Marine Mammal Protection Act (MMPA) which covers all marine mammals in the U.S. In Maine, right whales were state-listed as endangered until 1997. At that time, the Legislature removed them from the list, along with other listed marine species. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Right whales are carefully monitored annually along the East Coast through both aerial and boat-based surveys, and a photographic catalog has been established by the New England Aquarium to identify and track individuals. Right whales were the subject of intense public debate in the late 1990s, when the National Marine Fisheries Service (NMFS) was sued to designate critical habitat for right whales and to institute protective measures that had the potential to close some inshore fisheries. In response, NMFS designated three critical habitat areas: two feeding grounds (Cape Cod Bay and Great South Channel) and one calving ground (coastal waters off Georgia and Florida). In 1996, the Atlantic Large Whale Take Reduction Team was established to develop a Take Reduction Plan to reduce serious injury and mortality to large whales (finback, right, humpback, and minke) from accidental entanglements in fishing gear in the North Atlantic. The plan, published in February 1999, implements specific gear closures, as well as gear modifications to try to reduce interactions between fishing gear and large whales.

Rorqual whales

The following four whale species (humpback, finback, sei, and minke) are rorquals: whales that have ventral, or throat, pleats extending from the chin toward the navel. These pleats allow a whale's throat to expand while feeding, as a whale engulfs water and food.

Humpback whale (*Megaptera novaeangliae)*

Description: Humpback whales are relatively common in the Gulf of Maine and are frequently observed by whale watchers. Humpbacks are large, black whales that readily show their flukes when diving, thus making them excellent animals to identify and study. They have wart-like sensory knobs called tubercles on their head and lower jaw. Like right whales, they have paired blowholes, and their blow or spout is bushy and can reach about ten feet in height. Dorsal fins vary among individuals and are located far back on the body on a hump. Humpbacks have long, narrow flippers (1/4 to 1/3 of total body length) with knobs on the anterior margin and which are usually all white, though the dorsal surface may be spotted with black. Baleen plates, rooted in the upper jaw, are all or mostly black and number between 270 and 400 on each side of the mouth. Ventral pleats, numbering between 14 and 22, extend from the tip of the lower jaw to the belly. The flukes are all black above and have a highly variable black and white pattern below (from all black to all white), allowing researchers to identify individual animals as they dive. Barnacles can be found on the chin, anterior portion of the ventral pleats, anterior edges of the flippers, and edges of the flukes. Humpbacks range in length from 52 to 56 feet and weigh approximately 40 tons. Females are larger than males.

Range and Habitat: Humpback whales live in all oceans, but are uncommon in arctic regions. During the summer months, they migrate to higher latitudes to feed. In the North Atlantic, populations occur in the Gulf of Maine, Nova Scotia, Newfoundland and Labrador, and Greenland. Humpbacks primarily inhabit the waters over the continental shelf.

Ecology: Humpback whales migrate to feeding areas in northern latitudes in the summer, and return to warm, tropical waters to winter and breed. On their northward migration, they pass through New England waters in April and May. Some animals remain in the Gulf of Maine for the summer, where they feed primarily on krill, herring, sand lance, and other small fish. Other humpbacks continue north, reach Labrador by July, and remain there until September. On their southward migration, they pass again through New England waters from October to December. Humpbacks can be observed singly, in pairs, or in groups of twelve or more. When preparing for a deep dive, they expose a greater portion of their back, curve their body, and display the flukes at an angle perpendicular to the water's surface. These acrobatic whales are often seen breaching (leaping out of the water), lobtailing (standing on their head and slapping their tail on the water), and waving and splashing their flippers on the water. Vocalizations include loud whistles and wheezing sounds, which may be used for communication. During the breeding season, males produce complex "songs" presumably to attract females or even to display dominance over other males. Humpbacks reach sexual maturity at about nine years, when males are 33 feet long and females are 36 feet. Breeding mainly takes place during the winter months in low latitudes in the shallow waters of the Caribbean Sea. Calving occurs at two-year intervals, but some females produce a calf every year. The gestation period lasts 11-12 months and the calf is weaned at 5-6 months of age or when it reaches approximately 25 feet in length. Humpbacks may live to be 50 years old.

Humpback whales feed by lunging into schools of prey. Many populations use bubble "nets" or clouds of bubbles to concentrate and trap prey. Humpbacks engulf huge amounts of water and prey, which expands their ventral pleats. They then use their enormous tongues to filter the water out through their baleen, while the prey gets swallowed whole.

Threats: Humpback whales were easy targets for whalers because they inhabit waters close to shore, and are slow swimmers. Based on whaling records, 28,000 humpbacks were killed between 1905 and 1965. Today, entanglement in fishing gear occurs frequently in the Gulf of Maine. Studies show that 48-65% of the animals in this region bears entanglement scars, and four to six entanglements are documented annually. Additional threats include ship strikes, disturbance from underwater acoustics, commercial whale watching and research boats, and habitat degradation. Commercial fishing may compete with whales directly for some species (herring), or may remove predators, like mackerel, of sand lance, which is a preferred food item for humpbacks.

Conservation and Management: Humpback whales are among the most endangered of the large whales. In 1955, the International Whaling Commission banned the commercial whaling of humpbacks in the North Atlantic and in 1965 banned the hunt for humpbacks worldwide. Today humpbacks are listed as endangered on the ESA and are also protected under the MMPA. Populations are believed to be slowly increasing; about 8,000 individuals remain in the western North Atlantic. Worldwide population estimates stand between 15-20,000, which is equal to 15-20% of original population estimates. Human-caused injury and mortality are believed to be frequent enough to be limiting the

rate of recovery. Humpback whales were listed as endangered in Maine until 1997, when the Legislature removed the animal from the state list. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Finback whale *(Balaenoptera physalus)*

Description: Finback whales (also referred to as "fin" whales) are second in size only to blue whales. Finbacks are long (up to 78 feet), sleek, and streamlined rorqual whales that have 50 to 100 ventral pleats. Finbacks demonstrate an unusual characteristic in which the lower jaw is asymmetrically colored whitish on the right side and mottled black on the left. Otherwise, the body is light gray to brownish-black on the back and sides, and the underside of the body, flippers, and flukes is white. A pale chevron originates behind the blowholes and slants toward the flukes to form a broad "V" shape across the back. On the right side of the head, most finbacks have swirls (called the "blaze"). Researchers distinguish individual animals using the chevron, blaze, and dorsal fin, which is quite prominent and located far back on the body. Finbacks have paired blowholes and a distinctive, robust spout that rises 20 feet into the air. Prior to a dive, they arch their back and show their dorsal fin but rarely lift their flukes above the water. Fin whales may have between 260 and 480 baleen plates on each side of the mouth. Baleen is normally black or olive green, except for the first third of the baleen on the right side, which is white. Females are slightly larger than males and both sexes weigh between 50 and 70 tons. Finbacks can be distinguished from blue whales by their smaller size, unique coloration, longer, narrower head, and taller dorsal fin. They are also among the quickest of the large whales, achieving speeds of up to 25 knots. Sei whales are smaller and more slender than finbacks, have a uniformly colored dark gray to black body, and relatively tall, erect, falcate dorsal fin.

Range and Habitat: Finbacks live in all oceans in coastal and offshore waters. They are most commonly found 25 miles or more from shore. Since finbacks have complex seasonal movements and inhabit a broad latitudinal range, migration may not occur in this species. However, some studies indicate that some populations may shift in the winter to occupy the summer habitats of others. North Atlantic finbacks are most abundant between Long Island and Labrador and are typically observed in 50-100 fathom areas over the continental shelf. New England waters represent a major feeding area for this stock. Some individuals over-winter near Cape Cod; however, peak abundance in the Gulf of Maine occurs from April through October.

Ecology: Finback whales are the most common whale species in the Gulf of Maine. They travel singly or in groups of 3 to 7 animals or more during certain times such as feeding. In the Gulf of Maine, finbacks feed on herring, capelin, squid, and krill. They have been observed circling schools of fish at high speed, rolling on their right side, and engulfing the dense school of fish. The white right jaw may aid in capturing prey. Finbacks can dive as deep as 755 feet in search of food and can consume up to two tons of food a day. As with other rorquals, finbacks engulf large volumes of food and water, expanding the ventral pleats, then contracting them to let the water out, trapping their

prey in the baleen. These whales become sexually mature between five and ten years of age, when they attain a length of 55-60 feet. Breeding occurs during the winter and gestation lasts about 12 months. Calves weigh about two tons at birth and are weaned at six to eight months of age, at a length of 35-40 feet. Females usually have a calf every two to three years. Finbacks can live to be at least 80 years old.

Threats: Given their speed and preference for the open sea, finbacks were almost completely protected from early whalers. With the modernization of fast boats and harpoon guns, and the depletion of the larger blue whales from commercial whaling, finback whales fell victim to 20th century whalers. In the Southern Hemisphere alone, 725,000 finbacks were killed. Like other large whales, today finbacks are faced with entanglement in fishing gear and collisions with ships. Marine ecosystem changes induced by global warming and pollution may affect food availability. Recreational whale watching may occasionally cause harassment, but this is believed to be insignificant. Despite these threats, populations continue to grow.

Conservation and Management: After the slaughter of 40,000 whales annually for decades, the International Whaling Commission (IWC) lowered whaling quotas for finback whales in the mid-1970s, then reduced them to zero in 1985. In 2000, the IWC estimated a population of 2,200 finbacks between Virginia and the Gulf of St. Lawrence, and several thousand likely exist off eastern Canada. With an 'endangered' listing on the ESA in 1970, finback populations off eastern North America are believed to be increasing. Finback whales were listed as endangered in Maine until 1997, when the Legislature removed them from the list. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Sei whale (*Balaenoptera borealis)*

Description: Sei whales (pronounced "say") are smaller than finbacks but larger than minke whales. Sei whales can reach 60 feet and weigh 30 tons, with females slightly larger than males. Sei whales have a high, columnar blow or spout, which can extend 6-8 feet. Sei whales can be distinguished from finbacks in that sei whales have a larger, more erect dorsal fin; dark undersides of the flippers and tail flukes; lack of asymmetrical coloration and dorsal chevron; and a bluish gray body color with whitish spots, most likely caused by cookie-cutter shark bites. Sei whales, being rorquals, have 30 to 60 ventral pleats extending well forward of the belly and 300 to 410 baleen plates on each side of the mouth.

Range and Habitat: Sei whales are found in all oceans. In the North Atlantic they range from Iceland to the Venezuela coast but are seen infrequently in U.S. waters. Episodic incursions into the Gulf of Maine occur rarely, and may be followed by years or decades of no sightings. These whales breed and feed in open waters, and are frequently observed in temperate waters in the summer and subtropical waters in the winter. Two stocks have tentatively been identified in the North Atlantic. One occurs in the Labrador Sea in June and migrates northward later in the summer along the coasts of Labrador, West

Greenland, and possibly Iceland. The other occurs off the continental slope of the U.S. during the winter and migrates northward by mid-June to Georges Bank, the Northeast Channel, and Browns Bank.

Ecology: Sei whales are usually seen alone or in pairs, but sometimes thousands may gather if food is abundant. Like the northern right whale, they are "skimmers", feeding near the water surface using their baleen to filter squid, copepods, euphausiids, and amphipods from the water column. Sei whales are also "gulpers" like humpback whales, and feed on krill and small schooling fish by engulfing one mouthful of prey and water at a time. Sei whales are probably the fastest cetaceans, capable of swimming up to 25 knots for short distances. These whales erratically change swimming direction, making the species easy to identify for whalers. Sei whales are shallow divers and only remain submerged for five to ten minutes. Both sexes become sexually mature at about eight to ten years of age, which corresponds to a length of 36 feet for males and 40 feet for females. Breeding occurs between November and March, with a peak in January, and breeding intervals are generally two to three years. Gestation lasts between eleven and twelve months and calves are weaned at six to eight months old, when they reach 24-27 feet in length. These whales may live as long as 74 years.

Threats: The hunting of sei whales in the North Atlantic began in the 1800s. A whaling station at Blandford, Nova Scotia killed hundreds of sei whales in the 1900s, and 200,000 were killed worldwide during this time period, particularly in Antarctica. In 1972, stocks were estimated to be only 21% of original numbers, and in the early 1980s as few as 2,200 to 2,300 individuals were estimated in U.S. Atlantic waters. Today, sei whales are at risk of collisions with ships. Marine ecosystem changes induced by global warming and pollution may be affecting food availability. Populations in the North Atlantic and North Pacific are believed to be reasonably abundant today, despite these threats.

Conservation and Management: As a result of protection received through the IWC, ESA, and MMPA, commercial hunting is no longer a problem for sei whales. Cetacean experts believe that sei whale populations are increasing, but data are sparse. Given their pelagic ecology, there have been no reported fishery-related injuries or mortalities. Sei whales were listed as endangered in the state of Maine until 1997, when the Legislature removed these animals from the state list. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Minke whale (*Balaenoptera acutorostrata*)

Description: Minke whales are the smallest of the rorquals. Males can grow to a length of 32 ft. and females to 36 ft. At sea, minkes can be confused with fin whales but they differ in many ways. Minkes are much smaller, lack the asymmetrical coloration pigmentation on the lower jaw, lack a distinctive blow or spout, and have a distinctly different dive sequence from fin whales. Minke whales have a narrow, pointed snout with a slender, streamlined body, which is dark grey to black on the back and lightening to white on the belly and undersides of the flippers. There are often areas of light gray on

their flanks, one just above and behind the flippers and the other behind the head. Individuals in the Northern hemisphere have a diagonal white band on the upper surface of each flipper, commonly called "minke mittens." Their heads are triangular, with a single sharp longitudinal ridge along the top and forward of the blowhole. Minkes have twin blowholes, typical of all baleen whales. Short baleen plates (230 to 360) are found on each side of the upper jaw. The breathing sequence consists of 5-8 blows at intervals of less than a minute, followed by a deep dive that can last up to 20 minutes. Minkes normally take only 1 or 2 breaths between dives when travelling. The dorsal fin always appears with the blow and the tailstock is arched high into the air before sounding, but the flukes are never shown unless the animal breaches.

Range and Habitat: Minke whales can be found virtually worldwide, but are less common in the tropics than in cooler waters. Minkes often enter estuaries, bays, and inlets and during the summer may feed around headlands and small islands. Most migrate seasonally from polar feeding grounds to warm temperate to tropical breeding grounds, although there appear to be some groups resident year-round. Three geographically isolated populations occur, in the North Pacific, the North Atlantic, and the Southern Hemisphere.

Ecology: Minke whales are generally attracted to ships and often approach moving vessels. They are fast swimmers that can keep pace with a ship travelling at 24-30 knots per hour. Minkes may suddenly appear alongside a vessel without warning but are unlikely to bow-ride. Minkes observed breaching usually leave the water at a 45° angle and re-enter without twisting or turning their bodies. Most of the body may leave the water with the initial surge and the entire dorsal fin is often visible. The back can be arched, allowing for a clean dolphin-like re-entry, or held straight causing a tremendous splash as it lands on its stomach.

Conservation and Management: Since minkes are the smallest of the seven great whales, their size made them uneconomical to harvest commercially while the larger whales were abundant. This species was afforded protection with the declaration of the moratorium on whaling by the International Whaling Commission in 1986. Norway and Japan argue for the harvesting of minkes in small numbers on a regular basis, as the species is abundant and is not listed as endangered or threatened.

Although not federally listed, minke whales, common in Maine waters and protected under the Marine Mammal Protection Act, are a primary concern of the State of Maine, and a letter was sent to NMFS in 2001 seeking State authorization to manage all entanglement and recovery efforts for minke whales within Maine State waters. Authorization was granted that same year.

Sperm whale (*Physeter catodon (*or *macrocephalus))*

Description: Sperm whales were immortalized in Herman Melville's epic *Moby Dick.* These distinctive cetaceans are the largest of the toothed whales and are easily identified by their large, blunt, barrel-shaped heads that comprise about one third of the total body

length for adult males and one fourth for adult females. Their narrow lower jaws contain 40-50 conical teeth that fit into sockets in the upper jaw. A single blowhole (characteristic of toothed whales) is located on the left front end of the head. The spout projects forward and to the left at a 45-degree angle, unlike that of any other whale. There are two to ten short, deep grooves on the throat. The dorsal fin is thick and has a low profile, forming a compressed hump. Behind the dorsal fin a series of bumps extend down the spine toward the flukes, and the skin on the back has a wrinkled appearance. The flippers, short and broad, are located a short distance below and behind the eyes. The large, triangular flukes are deeply notched. Sperm whales are dark gray but may appear brown in the sunlight, with white around the mouth and white patches on the belly and flanks. Adult males are larger than females by about one-third (males to 60 feet, females to more than 36 feet) and weigh twice as much (up to 54 tons for males and 25 tons for females).

Range and Habitat: Sperm whales are found in all oceans except the Arctic. In the North Atlantic, they are found from Nova Scotia to the Gulf of Mexico but are rarely observed in the Gulf of Maine. They prefer deep waters and generally stay along the edge of the continental shelf in water 500 to 1,000 fathoms deep. Males travel alone or in groups, and can be found in higher latitudes feeding during the summer and lower latitudes during the winter. Females, calves, and juveniles travel much less and remain in temperate and tropical waters year round.

Ecology: Sperm whales feed primarily on large and medium-sized squid, although octopuses, sharks, skates, and other fishes are also taken. Their search for squid accounts for much of their biology, behavior, and annual and seasonal movements. Each day, an adult male eats about 3.5 percent of its body weight. Many animals bear scars from encounters with giant squid. Sperm whales feed in areas of upwelling, such as the edges of the continental shelf, where food is plentiful. They can dive to depths of 3,000 feet and can remain underwater for periods lasting from 20 minutes to over an hour. Like other toothed whales, they use sonar to detect and locate prey. A sperm whale's head contains a large reservoir of waxy liquid called spermaceti, which may be used as a buoyancy regulator. They are social animals and may occur in groups of 1,000 or more individuals. Males form harems during the breeding season in a polygamous mating system. In the Northern Hemisphere, mating occurs from January to July, and peaks from March through May. The gestation period lasts 16-17 months, the longest of all whale species. In the Atlantic, calving occurs from May to November near the Azores. Females nurse their calves for at least two years and will not conceive again for another four to six years. Sperm whales may live to be 60-70 years old.

Threats: For nearly two centuries, sperm whales were the staple of the New England whaling industry. During this time, over one million animals were killed, hunted for their spermaceti, ambergris (a waxy substance in their digestive tracts), and oil. The head of a sperm whale contains three to four tons of spermaceti, which was used as a lubricant for machinery, as well as for the manufacture of ointments and smokeless candles. Whale oil was once used as a fuel for lamps, and also as a lubricant and the base for skin creams and cosmetics. Today the major threats to sperm whales are entanglements in fishing

gear and collisions with ships. Other threats include ocean pollution and the ingestion of plastics.

Conservation and Management: Current population trends for sperm whales are unknown. However, current population estimates in the Atlantic are 20-100,000 animals and they have been listed on the ESA since 1970. Sperm whales were listed as endangered in Maine until 1997, when the Legislature removed the animals from the state list. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Kemp's ridley turtle (*Lepidochelys kempii)*

Description: The Kemp's or Atlantic ridley turtle is the smallest marine turtle, averaging 20-28 inches in length. Adults have an almost circular or slightly heart-shaped grayish-green carapace (top shell), which is typically wider than long and serrated along the rear margin. The plastron (bottom shell) is white, while the head and limbs are gray. Males are distinguished from females by a long, prehensile tail; a thick, curved claw on each forelimb; and a concave plastron. Females have a shorter tail that barely extends past the edge of the carapace; lack recurved claws on the forelimbs; and have a flat, ridged plastron. Atlantic ridleys have a parrot-like beak for feeding and paddle-like limbs for swimming.

Range and Habitat: Adult ridleys are primarily restricted to the warm waters of the Gulf of Mexico and are rarely reported in the cold Gulf of Maine waters. Immature animals inhabit the Gulf of Mexico north to Long Island Sound, New England, and Nova Scotia. In the late summer and fall, juveniles are frequently seen south of Cape Cod. Venturing north of Cape Cod often leads to cold-stunning events, especially in the fall. Atlantic ridleys feed on the bottom of shallow, coastal and estuarine areas (typically less than 150 feet deep) and juveniles may use mats of floating *Sargassum* (sea grass) for refuge and foraging.

Ecology: Atlantic ridleys become sexually mature between 7 and 15 years. Most nesting occurs from April to August along one beach on Mexico's northeastern coast, near Rancho Nuevo. Courtship and mating occurs offshore in close proximity to the nesting beaches, and females return to shore to nest every one to two years. Females nest in groups, which once numbered in the thousands, and lay one to four clutches with 20-28 days in between each clutch. These clutches can be separated by more than five miles between nesting sites. Nests are excavated in fine sand, either on the beach itself or on the dunes, which can be up to 180 feet from the water. Clutch size varies from 100-110 eggs, and incubation lasts 45-60 days. Following nesting, adults migrate to their principal feeding areas in the Gulf of Mexico, where they remain until the next nesting cycle. Juveniles travel as far north as the New England coast. Prey items include crabs, shrimp, sea urchins, snails, bivalves, cephalopods, jellyfish, fish, marine plants, and algae.

Threats: The decline of Atlantic ridleys is attributed to the heavy harvest of eggs; killing of adults for meat and other products; and the high level of incidental take by shrimp trawlers. In Mexico, continued threats include degradation of beach habitat through development and population growth, dredging and channelization projects, oil spills, and entanglement in and ingestion of marine debris.

Conservation and Management: The Atlantic ridley is one of the most endangered sea turtles and in 1970 was federally listed on the ESA throughout its entire range. Populations have declined since 1947, when an estimated 42,000 females nested in a single day. A current population estimate totals 1,500 to 3,000 individuals. Slight population increases are attributed to strict protection of individuals and nesting sites as well as the use of turtle excluder devices (TEDs) in shrimp trawls in the U.S. and Mexico. Recovery programs include captive rearing of juveniles, and the establishment of a second nesting colony at Padre Island, Texas. Given the rarity of this sea turtle in Maine, little can be done here to effectively contribute to the recovery of Atlantic ridleys. Entanglement in fishing gear and mortality from trawlers may take some turtles in the Gulf of Maine each year. Due to their endangered status on the federal ESA, Atlantic ridley and leatherback sea turtles were state-listed as endangered in Maine from 1986-1997. However, in 1996 the Maine Legislature changed the State's Endangered Species Act to no longer automatically list federally listed species. As a result, these species were removed from the Maine Endangered Species List in 1997. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Loggerhead turtle (*Caretta caretta*)

Description: The loggerhead turtle is the largest living hard-shelled turtle, exceeded in length and weight only by the leatherback. Adults are typically 2 - 3 feet in carapace length and weigh about 300 pounds. The carapace (top shell) is reddish brown and may be tinged with olive, and the edges of the scutes may be yellow. The plastron (bottom shell) is yellow and hingeless, with two longitudinal ridges that disappear with age. The head varies in color from reddish or yellow chestnut to olive brown, and the many scales on the top and sides of the head have yellow borders. The skin on their limbs and tail is dark above and yellowish along the borders and below. Males are distinguished from females with wider shells that taper toward the rear, long, thick tails, a large recurved claw on each forelimb, and more yellow pigmentation on the head.

Range and Habitat: Loggerheads are widely distributed through most of the world's warm oceans. In the western Atlantic they range as far north as Newfoundland in the summer, although sightings along the Maine coast and in the Gulf of Maine are rare. Loggerhead distribution varies widely according to life stage. Hatchling turtles use driftlines of *Sargassum* for refuge and food in the open ocean. Subadults move into shallow coastal regions and adults spend their time in subtropical continental shelf waters, bays, lagoons, and estuaries. Along the northern limits of their range, loggerheads may become cold-stunned and die from hypothermia.

Ecology: Loggerheads reach sexual maturity between 10 and 30 years and may reproduce for 30 years. Primary nesting areas in the U.S. occur along the East Coast of Florida, with additional sites in the Carolinas and Georgia. In Atlantic waters, peak nesting months are May through July, although nesting may occur from January to September. Adults travel long distances from feeding areas to nesting beaches. Females typically return to nest at 1-7 year intervals at the same beach over her lifetime. She may lay up to 9 clutches a season in 11 - 15 day intervals. Nests are constructed on beaches above the high-tide line typically within 4 or 5 hours of sunset. The female excavates a nest chamber using her flippers and deposits 45 - 200 soft, leathery eggs, which incubate for 49 - 76 days. Hatchlings emerge at night and crawl across the beach to the sea. Loggerhead prey items include sponges, jellyfish, squid, shrimp, amphipods, sea urchins, and fish. Loggerhead behavior depends on water temperature. At temperatures of 13 - 15°C they become lethargic, at 10ºC they adopt a stunned floating posture, and at colder temperatures they may hibernate. When cool they bask on the water surface and when overheated they seek out cooler waters. They may live to be 62 years of age.

Threats: Loggerhead turtle population decline can be attributed to increased mortality in shrimp trawls, coastal development, disturbance of nesting females, pollution and marine litter, and nest predation.

Conservation Needs: Loggerhead populations are declining worldwide, but are still the most abundant species in U. S. coastal waters. About 50,000 - 70,000 nesting females are estimated in the southeastern U. S. The species was federally-listed as threatened in 1978. Estimated annual mortality of 5,000 - 15,000 turtles (primarily juveniles) accrue from drowning in shrimp nets. From 1986 - 1997, the loggerhead was state-listed as endangered in Maine because of their federal listing status. However, in 1996, the Maine Legislature changed the Maine Endangered Species Act to discontinue the automatic state-listing of federally-listed species. However, this species was overlooked and remained on the state endangered species list while all others were removed in 1997. In late 2003, Maine Department of Marine Resources petitioned the State Legislature to relist Federally endangered and threatened marine species. This was achieved in 2004.

Leatherback turtle (*Dermochelys coriacea*)

Description: The leatherback turtle is the world's largest living marine turtle. Adults reach 11 feet in length and weigh between 650 and 1,500 pounds. Leatherbacks have a smooth shell covered with rubber-like skin lacking the scutes, or hard bony plates, which are characteristic of most other turtle species. Seven prominent keels run the length of the carapace (top shell), which is teardrop-shaped and tapers to a point at the tail. The shell is dark brown to black and is covered with small white to yellowish blotches. The head and neck are black or dark brown with a few white, yellow, or pink blotches. Limbs are paddle-like with black and white spotting, and the front flippers are proportionately longer than those of any other sea turtle. Males have concave plastrons (bottom shell), a more tapered carapace, and tails that are longer than their hind limbs, whereas females have extensive pink blotches on their head and a tail that is half the length of a male's.

Range and Habitat: Leatherbacks are found in all the world's oceans except the Antarctic. In the Atlantic, they range from the Gulf of Mexico and the Caribbean Sea to Newfoundland and Labrador and across to Norway and the British Isles. They are the most frequent marine turtle encountered in the Gulf of Maine and are commonly observed in most years. Leatherbacks are pelagic unless nesting on tropical and subtropical beaches.

Ecology: Leatherbacks are unique among reptiles in that they have the ability to regulate their body temperature and keep it warmer than the surrounding water. Adaptations include a countercurrent heat system, a thick insulating layer of oil-saturated fat under the skin, and a large body mass that can retain heat. These adaptations allow individuals to range as far north as the Labrador coast in the summer. Because of these and other distinctive features, leatherbacks were separated from other turtle species and placed in a unique taxonomic family (*Dermochelyidae*). Females reach sexual maturity at about 4 ft. carapace length; for males, size at maturity is unknown. Nesting locations are scattered through the Gulf of Mexico, Caribbean, and the southeast United States. The largest nesting assemblages are found in the U. S. Virgin Islands, Puerto Rico, and Florida. Small numbers of leatherbacks have been reported nesting in Texas and Georgia. Female leatherbacks may nest at 2 - 3 year intervals, and emerge from the sea around midnight to excavate a nest chamber into which they deposit 80 - 90 eggs. Incubation lasts 60 - 65 days, and hatchlings emerge after dark. A female may lay 6 clutches a season at 8 - 12 day intervals. Leatherbacks prefer to feed on jellyfish, comb jellies, salps, and other related animals. Their mouth, throat, and esophagus are lined with numerous spines to aid in the swallowing of their slippery prey. Leatherbacks follow the migration of jellyfish, their primary food source, along the Gulf Stream and into the Gulf of Maine in late summer, then return to southern waters of the Gulf of Mexico and along the Florida coast by winter. In some years they can be locally common south of Long Island and in central and eastern portions of the Gulf of Maine. Since the leatherback's preferred food is the arctic jellyfish, the outer Gulf of Maine is an important feeding area. Leatherbacks are pelagic, but occasionally enter shallow waters in bays and estuaries and typically occur west of the Gulf Stream at water depths of less than 200 feet. They dive almost continuously to depths of up to several thousand feet.

Threats: Leatherback declines are attributed to tremendous over-harvest of eggs, killing adults, and incidental takes by shrimp trawlers. Leatherbacks become entangled in longlines, fish traps, buoy anchor lines, and other ropes and cables. Entanglement in fishing gear and mortality from trawlers likely occurs in the Gulf of Maine each year and usually results in drowning. Leatherbacks eat a wide variety of marine debris, especially plastic bags and Styrofoam pieces, balloons, and plastic pellets. They are also vulnerable to boat collisions and are at risk when encountering oil spills. Degradation of beach habitat, dredging and channelization projects also cause mortality.

Conservation and Management: Leatherback turtle populations are declining rapidly. The worldwide population may be only 20,000-30,000 nesting females. Only a few hundred nest in the southeastern U. S. The leatherback was federally listed as endangered in 1970. Strict protection of individuals and nests and the use of turtle

excluder devices (TEDs) in shrimp trawls have contributed recently to slight population increases. From 1986 to 1997, the leatherback was state-listed as endangered in Maine because of their federal listing status. However, in 1996, the Maine Legislature changed the Maine Endangered Species Act and discontinued the automatic state-listing of federally-listed species. As a result, this species were removed from the Maine Endangered Species List in 1997. However, in late 2003 Maine Department of Marine Resources petitioned the State Legislature to re-list Federally endangered and threatened marine species. This was achieved in 2004.

Shortnose sturgeon (*Acipenser brevirostrum*)

Description: Shortnose sturgeon are uncommon in the Gulf of Maine, and are found in only four river systems: the Kennebec/Androscoggin/Sheepscot estuarine complex (hereafter Kennebec River) and the Penobscot River in Maine, the Merrimack River in Massachusetts, and the St. John River in New Brunswick, Canada. For river systems where population estimates are available, the Merrimack has the smallest number of adults fish (<100), and the St. John River has the second largest (~18,000 adults). The Kennebec River population was estimated to be 5046-10765 adults for the period 1977-1981 and 6942-13358 adults for the period 1998-2000. Studies are currently being conducted to estimate the size of the Penobscot River population.

Shortnose sturgeon attain a maximum length of about 120 cm, a maximum weight of 24 kg, and a maximum age of 50-60 years. They have a heterocercal (uneven) caudal fin, five rows of bony scutes that run the length of the body, and four barbels in front of the ventral protrusible mouth. Adult shortnose sturgeon are similar in appearance to similar-sized juvenile Atlantic sturgeon with which they co-occur. The two species can be distinguished by the ratio of mouth width (MW) to the bony interorbital width (IOW): for shortnose sturgeon MW>62% of IOW and for Atlantic sturgeon MW<55% of IOW.

Range and Habitat: Shortnose sturgeon occupy large coastal rivers of eastern North America. Nineteen distinct population segments of shortnose sturgeon currently inhabit 25 river systems from the Saint John River, New Brunswick Canada, to the St. Johns River, Florida. Shortnose sturgeon appear to spend most of their life in their natal river system, and only occasionally enter the marine environment. Those that have been captured in the ocean have been taken close to shore. Populations of shortnose sturgeon appear to exhibit varying degrees of anadromy depending on the river system they inhabit. In the Kennebec River, adults use brackish and freshwater for most of the year.

Ecology: In the Gulf of Maine, shortnose sturgeon spawn over a variety of hard substrates (gravel, cobble, rubble, or ledge) in mid-spring when river temperature increases to about 9ºC. Spawning typically ceases at 12-15ºC, and can be inhibited by high freshwater flows. Spawning periodicity is poorly documented, but males spawn more frequently than females in all northern populations. In the St. John River, for example, males spawned at 2-year intervals and females at 3 to 5-year intervals.

Shortnose sturgeon are opportunistic benthic foragers. Juveniles feed on small crustaceans and insects. Adults in freshwater consume mollusks, benthic crustaceans, and insects; in estuaries they feed on mollusks, shrimps, and polychaete worms.

In late spring and early summer in the Kennebec River, shortnose sturgeon are distributed throughout the river, and are often seen jumping out of the water. In the fall, shortnose sturgeon congregate in overwintering areas.

Threats: Shortnose sturgeon inhabit the main stems of their natal rivers, migrating between freshwater, brackish, and saline reaches. Dams, even those with fishways, may prevent shortnose sturgeon from reaching freshwater spawning habitat. Construction of dams, bridges, and tidal hydropower projects, channel dredging, and discharge of pollutants can degrade or destroy important habitat (spawning, feeding, overwintering, migratory pathways) or result in direct mortality or morbidity. Impingement on cooling water intake screens, dredging, and incidental capture in other fisheries can also result in mortality or injury of adults and juveniles.

Conservation and Management: The shortnose sturgeon was listed as endangered on March 11, 1967. They remained on the endangered species list with the enactment of the ESA in 1973.

Gulf of Maine DPS Atlantic salmon (*Salmo salar*)

Description: Atlantic salmon have a complex life history that ranges from territorial rearing in rivers to extensive feeding migrations on the high seas. During their life cycle Atlantic salmon go through several distinct phases that are identified by specific changes in behavior, physiology, morphology, coloration, and habitat requirements. Atlantic salmon are quite capable of surviving in and adapting to a wide range of habitat types and their success as a species is determined by their ability to adapt to and utilize an array of foraging and defensive strategies that maximize survival. Juvenile salmon have been documented utilizing riverine, lake, and estuarine habitats; incorporating opportunistic and active feeding strategies; defending territories from competitors including other parr; and working together in small schools to actively pursue prey.

Range and Habitat: Atlantic salmon is an anadromous species, which means they reproduce in freshwater and live as adults in the North Atlantic Ocean, returning to the river where they were born to spawn. Adult Atlantic salmon return to their natal rivers in the spring or fall and find a suitable place in the river to hold until spawning. In the fall, the female makes a redd (a nest) in the stream bottom using her tail. She deposits her eggs and the male fertilizes them. The eggs develop during the winter and the fry emerge in the spring. Fry develop into parr by the end of the first summer in the river. Parr spend two winters in the river before undergoing a transition called smoltification in the early spring of the third year. This process prepares them for living in sea water. Once at sea, they travel toward Greenland where they live for two years before returning to spawn in the same stream where they were born. Unlike Pacific salmon that die after spawning, Atlantic salmon do not always die and adults can return to the ocean after

spawning to repeat the cycle multiple times. The fish's complex life cycle demands many different habitat types, from deep pools for adults to reside during the hot summer months to coarse gravel for spawning.

The expanded DPS is comprised of all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin northward along the Maine coast to the Dennys, including all associated conservation hatchery populations used to supplement natural populations; currently, such populations are maintained at Green Lake and Craig Brook National Fish Hatcheries. The expanded DPS contains 1,300 river km and 12,616,690 acres.

Ecology: Atlantic salmon habitat requirements change as they grow; fry generally need slower moving, shallower waters than do parr or spawning salmon, and substrate that is smaller, on average, than that favored by parr. A heterogeneous reach that contains all of these habitat types is important to the survival of the species. Adults need to have holding areas within 800 meters of the spawning grounds to have a place to hide and rest during spawning. The total amount of spawning habitat ultimately determines the productivity of a river. When fry emerge from the spawning area they will move downstream up to 200 meters from the redd to an area with lower water velocities. As the fry grow and become parr, they move to areas with deeper water, larger substrate, and higher velocities if the habitat is diverse enough. Young of the year (parr in their first year) tend to use riffles whereas older parr use rapids and runs, and even pools on occasion. Juveniles will also move to different habitats seasonally and use habitats selectively depending on competition, predation, and availability of habitat.

Both inter- and intra-specific competition affect how juveniles use available habitat. A diverse habitat offers more spatial niches for salmon, as well as their competitors. Juveniles need and seek cover from predators, which they can obtain three settings: deep water, shade, and rocks or other material in the channel such as wood. Juveniles use the best habitat available, resorting to habitats of lower quality only when necessary.

Habitat heterogeneity is important, particularly in rivers subject to freezing in the winter and high temperatures and reduced flows in the summer. Juveniles will move from riffle-run areas to more suitable areas depending on the spatial arrangements of the habitat and they require shelter during stressful times in winter and summer. During these times, juveniles move from living just above the stream bottom to seeking shelter under a rock, referred to as a home stone. Substrate with a low percentage of fine material is critical to survival during these times, enabling salmon to burrow under the home stones. Temperature affects the spatial use of habitat, with salmon using areas with higher velocities such as runs as temperature increases and slower moving waters at low temperatures. Ecological processes, such as contributions of LWD, are responsible for creating the required heterogeneity within the stream channel.

Threats: The problems facing Atlantic salmon have been identified in many documents, the two most recent are the *Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (Salmo salar)* (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2005) and the *Status Review for Anadromous Atlantic salmon (Salmo salar) in the United States* (Fay et al. 2006), which includes listing factors and

threats facing the species. The high priority threats identified in the Recovery Plan are mostly a result of human actions including: acidified water and associated aluminum toxicity, aquaculture practices, depleted diadromous fish communities, incidental capture of adults and parr by recreational fishermen, introduced fish species that compete or prey on Atlantic salmon, changing land use patterns, low marine survival, poaching of adults in DPS rivers, the recovery hatchery program (potential for artificial selection/domestication), sedimentation, water extraction and climate change. The Status Review included several additional threats: reduced and degraded spawning and rearing habitat, reduced habitat complexity and connectivity, degraded water quality, altered ambient stream water temperatures, incidental capture of adults and parr by commercial fisheries, ineffective or non-existent fish passage, and altered ecosystem function. The State of Maine sees the joint Federal jurisdiction of the species between National Marine Fisheries Service and U.S. Fish and Wildlife Service as an additional threat.

Conservation and Management: The Maine Department of Marine Resources (MDMR), U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) share responsibility for Atlantic salmon. Atlantic salmon are listed under the Endangered Species Act (June 15, 2009) and are at critically low levels. There is a strong public desire and legal mandate to recover this species, which will result in benefits to the ecosystem and to the general public.