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ELEMENTS 5 AND 6:

MONITORING AND REVIEW

Abstract: We outline the methods we will use to monitor SGCN and their habitats, describe how we will monitor the progress made in implementing the Action Plan over the next ten years, and address the procedures we will use to review and update the Action Plan. We work closely with federal, state, and private conservation partners to develop and participate in cooperative species monitoring programs. Where possible, monitoring programs target multiple species, usually within the same taxonomic group. In the pages that follow, we describe the monitoring programs that are in place for SGCN in Maine. We include a table for each of the five taxonomic groups that are referenced throughout this plan.

MDIFW and partners identified habitat-scale survey and monitoring needs during development of conservation actions. We present these actions with examples of existing and general survey and monitoring techniques that could be used to achieve these habitat monitoring objectives.

MDIFW and partners developed 11 programmatic actions to help guide Action Plan implementation over the next ten years. Three of these actions address monitoring and are described in greater detail.

MDIFW will use the programmatic actions to monitor conservation action progress at least annually. MDIFW will also establish an Implementation Committee in the Fall of 2015 comprised of agency staff and conservation partners. This committee will review Action Plan accomplishments and address emerging issues or adaptive management needs. We will undertake a comprehensive plan review beginning in year eight of the 2015 Action.

Differences from Maine's 2005 Comprehensive Wildlife Conservation Strategy are discussed.

INTRODUCTION

In the previous chapter, we discussed Maine's strategies for conserving Species of Greatest Conservation Need (SGCN) and their habitats across the state. Maine's approach is built on a foundation of habitat conservation, which is designed to ensure that adequate habitat remains available in perpetuity to support not only Maine's SGCN, but the full array of wildlife occurring in Maine. Those efforts are supplemented with species-specific conservation actions focused on priority stressors for Priority 1 and Priority 2 SGCN.

In this chapter, we outline the methods we will use to monitor SGCN and their habitats. We also describe how we will monitor the progress made in implementing the Action Plan over the next 10 years. Finally, we address the procedures we will use to review and update the Action Plan.

Differences from Maine's 2005 Comprehensive Wildlife Conservation Strategy
In 2005, MDIFW identified the species-specific monitoring programs that were in place for SGCN, and provided extensive detail on the Department's approach to Species Planning. MDIFW's Species Plans provide a framework for monitoring both individual species and their habitats, and the 2005 CWCS referenced this process as the primary mechanism by which we would conduct this work. For some species that had not been ushered through the formal Species Planning process, the 2005 Plan identified additional programs by which we would assess progress in achieving conservation outcomes. The 2005 Plan also described an approach for monitoring statewide changes in habitat, which focused on the use of satellite imagery to measure changes in land cover.

While this plan follows a similar framework as used in 2005 for monitoring SGCN and their habitats, we made several substantive revisions, including:

- Removed references to MDIFW's Species Planning Process, which has evolved since 2005 and has been replaced by the Wildlife Action Plan as the primary planning tool for SGCN conservation
- Streamlined the descriptions of SGCN monitoring programs, and provided most of this information in tabular format rather than within narrative form
- Added a description of how we will monitor the success of implementing Conservation Actions
- Describe the process we will use to review and update the Plan as required by Congress

MONITORING SGCN

SGCN species run the gamut from species for which we have little information, to those that are intensively monitored through formal, multi-state initiatives. We work closely with federal, state, and private conservation partners to develop and participate in cooperative species monitoring programs. Where possible, monitoring programs target multiple species, usually within the same taxonomic group. In the pages that follow, we describe the monitoring programs that are in place for SGCN in Maine. We include a table for each of the five taxonomic groups that are referenced throughout this plan:

- Birds
- Reptiles, Amphibians, and Invertebrates
- Inland Fish
- Mammals
- Marine

Within each table, we use an 'O' for 'ongoing' to indicate that the species is currently being monitored with the referenced approach, and a 'N' for 'new' to indicate that the species is not currently monitored with the referenced approach, but it could be monitored using this methodology if resources become available.

Birds

Currently, 13 distinct programs are used to monitor 116 of the 129 bird SGCN in Maine (Table 5-1). In addition, 9 bird SGCN are monitored using individual, species-specific protocols. Only 10 bird SGCN are not currently subject to some type of formal monitoring program, although monitoring protocols for 2 of these species (American Oystercatcher and Sedge Wren) may be implemented in the near future.

Many of these protocols are statewide in scope, while others, such as the Christmas Bird Count, and the Breeding Bird Survey, occur nationwide.

The Maine Audubon Annual Loon Count is used to monitor the status of loons on selected water bodies across the state. Maine Audubon coordinates more than 900 volunteers who dedicate the morning of the third Saturday in July to finding and counting loons. (http://maineaudubon.org/wildlife-habitat/the-maine-loon-project/)

MDIFW staff collaborate with USFWS to implement the Coastal Waterbird Survey, which provides information on the distribution and abundance of several waterbird SGCN. This program consists of a series of aerial surveys of coastal Waterbirds along the entire coast of Maine. Aerial surveys are conducted over several seasons and are supplemented with on-the-ground boat surveys. It is designed to cover each area of the coast every five years.

The Maine Owl Survey uses a series of established survey routes to document the distribution and relative abundance of owls within the state. Trained surveyors make brief roadside stops along survey routes, and play short tapes of owl calls throughout a 15 minutes listening period.

Migratory Shorebird Survey: The Program for Regional and International Shorebird Monitoring (PRISM) is being implemented by a Canada/US Shorebird Working Group and the U. S. Shorebird Council (Bart et al. 2002) and is based on the Canadian and U. S. shorebird conservation plans (Brown et al. 2001, Donaldson et al. 2001). MDIFW is a participant in this monitoring program (Tudor 2000)

The Maine Waterfowl Brood Count is conducted annually by MDIFW and is used as an index of the size of the breeding waterfowl population found in 36 wetlands (Corr 1988)

The Maine Mid-winter Waterfowl Survey is an aerial inventory conducted annually by MDIFW during the first week of January. It is and index to the total number of waterfowl present in Maine each winter (Corr 1988).

The Vermont Institute of Natural Science (VINS) launched Mountain Birdwatch in the spring of 2000 to establish a monitoring program for Bicknell's Thrush and other montane forest birds. Results from this program are used to measure population trends, monitor changes in bird distribution, model potential breeding habitat, identify conservation opportunities, evaluate proposed development, and predict effects of climate change on mountain songbirds.

Reptiles, Amphibians, and Invertebrates

Currently, ten distinct programs are used to monitor 88 of the 145 reptile, amphibian, and invertebrate SGCN in Maine (Table 5.2). In addition, nine of the SGCN in these taxonomic groups are monitored using individual, species-specific protocols. Forty-six of the SGCN are not currently subject to some type of formal monitoring program, although species-specific monitoring protocols for four of these species (Big-tooth Whitelip, Gaspe Gazelle Beetle, Graceful Clearwing, and Spike-lip Crater) may be implemented in the near future.

The Maine Amphibian Monitoring Program (MAMP) is a volunteer-based program that gathers information on the distribution and abundance of calling amphibians, including two SGCN, the mink frog and northern leopard frog (Maine Audubon 2015). The MAMP is a component of the North American Amphibian Monitoring Program, and has been conducted in Maine since 1997. Currently, approximately sixty road-side routes are surveyed across the state, with distinct survey protocols within coastal, interior, and northern portions of the state.

A series of volunteer-based survey and atlasing programs are the used to monitor many of Maine's invertebrate SGCN. The Maine Butterfly Survey (MBS), Maine Damselfly and Dragonfly Survey (MDDS), Maine Mussel Baseline Atlas, and Maine Bumble Bee Atlas are all designed to collect sighting information from volunteer citizen scientists, to help map the distribution of these species groups across the state. In many cases, these programs are among the first of their kind in the country, and have helped to gather critical information on these understudied and poorly understood taxa. In the future MDIFW hopes to collaborate with partners to develop the Maine Tiger Beetle Atlas, which would gather similar data on three additional SGCN, the Cobblestone Tiger Beetle, the Saltmarsh Tiger Beetle, and the White Mountain Tiger Beetle.

Inland Fish

The 17 inland fish SGCN are all subject to some form of monitoring, through the application of 15 distinct methodologies (Table 5.3). In most cases, individual species are monitored using multiple methods. Many of the monitoring approaches that apply to inland fish SGCN are components of MDIFW's larger fisheries management program implemented by regional biologists, and are not targeted towards specific species. However, species-specific monitoring protocols are in place for six species in this group. In addition, two new monitoring protocols (eDNA and Trawling) may be applicable to several SGCN in the future. In particular, eDNA, which relies on the detection of DNA in water samples to determine the presence or absence of species within the water body, could prove to be an extremely powerful approach for monitoring rare aquatic taxa.

Mammals

Mammals often occur at relatively low density and occupy large landscapes, making the application of comprehensive, multi-species monitoring protocols challenging. Of Maine's fifteen mammal SGCN, four are currently subject to a species-specific monitoring protocol or a multi-species monitoring program (Table 5.4). In addition, a new initiative, the North American Bat Survey, will ultimately be used to monitor all eight bat SGCN. Monitoring protocols for three mammal SGCN (the Penobscot Meadow Vole, the Long-tailed Shrew, and the Northern Bog Lemming) have yet to be developed.

Marine

<u>Marine Mammals and Sea Turtles:</u>
Programs that monitor marine mammals and sea turtles occur largely through reports from entanglements and gear modification studies. The Maine Department of Marine Resources (MDMR) marine mammal strandings program and sightings program was a component of the conservation and monitoring work until the fall of 2011. The program did not receive the necessary federal funding through the Prescott Grant Program and without any state funds to

support the program it was discontinued. The MDMR, 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. Special disentanglement tools, based on those created for the Large Whale Disentanglement Network, were built for use by the Bureau of Marine Patrol and the advanced trained lobstermen. Recent efforts have focused on understanding baseline amounts of gear, specifically vertical lines, in Maine's lobster fishery seasonally. These efforts gave both state and federal regulators the ability to target potential regulations to areas where they make the most impact for reducing co-occurrence between whales and fishing gear.

MDMR and collaborators at the University of Maine also investigate whale habitat through a monitoring program sampling habitat characteristics in Midcoast and Downeast Maine using plankton and water column sampling. The project will help determine the inshore/offshore and seasonal distributions of *Calanus finmarchicus*, Right Whale prey. Additionally, a Dtag project in Maine coastal fishing habitats was completed that successfully tagged two humpback whales near Mount Desert Island. Dive profiles that show the whales diving to the bottom during foraging events in addition to using the upper 20 meters of the water column.

Finfish: Diadromous, Groundfish, and Ocean Migratory Fish

Both species specific monitoring programs as well as surveys that target multiple species are performed regularly in Maine waters. The Inshore Trawl Survey is a fisheries independent assessment of living resources inside the coastal waters of Maine. Until this survey began in 2000, Maine and New Hampshire were the only states on the east coast not conducting a near shore assessment. While the funding comes from money Congress set aside to provide some economic relief to the groundfish industry, the assessment is more than a groundfish survey. Lobsters, recreational finfish species, and non-commercial species of ecological interest are also assessed. This is truly a multispecies survey that benefits decision makers confronted with issues such as fish stock recovery, fishery management measures, Essential Fish Habitat designations, climate change, Marine Protected Areas and more.

Monitoring programs also include port sampling and reporting from commercial and recreational fishers. During commercial and recreational sampling efforts, biological data including length, weight, and maturity are collected from groundfish, river herring, scallops, urchins, shrimp, and other fished species. MDMR also collects scales and otoliths from fish for ageing.

From May through October, MDMR interviews anglers to estimate of the total number of fish caught, released and harvested; the weight of the harvest; total number of angler trips; and number of people participating in marine recreational fishing in Maine. This part of a National Marine Fisheries Service (NMFS) program (Marine Recreational Information Program) to estimate the impact of recreational fishing on marine resources. Sampling in Washington County continues with the assistance of Maine Sea Grant's Marine Extension Agent and students from the University of Maine at Machias. MDMR staff also target the winter rainbow smelt recreational fishery throughout the state through creel surveys and a catch card program.

MDMR's recreational fishing staff also conduct the NMFS Large Pelagic Survey from July through October to monitor catch and effort of tunas and sharks. This survey consists of dockside vessel interviews and telephone calls to Atlantic Tuna permit holders. Additionally, Volunteer Logbook Programs for Striped Bass and Rainbow Smelt target avid recreational fishers to collect additional information. In this program, anglers record information about fish

harvested or released during each trip, time spent fishing, area fished, number of anglers and target species.

Beach seine surveys in the Kennebec/Androscoggin estuary monitor the abundance of juvenile alosids (shad, alewives, and Blueback Herring), as well as Striped Bass, Rainbow Smelt, and resident species, at 14 permanent sampling sites in the tidal freshwater portion of the estuary and six additional sites in the lower salinity-stratified portion of the river, every other week from mid-May to the end of August. This survey has collected data since 1979 and is used to monitor species assemblages, population trends, and habitat use.

Fish passage efficiency for diadromous species is monitored through collaborative efforts between agencies, universities, and hydropower companies. For example, the U. S. Geological Survey (USGS) Conte Anadromous Fish Research Lab completed three years (2002-2004) of field work on a collaborative project with MDMR, Penobscot Indian Nation, NOAA-Fisheries, and the University of Maine, documenting the upstream migration of adult Atlantic Salmon in the Penobscot River. The research used Passive Integrated Transponder tag technology to gather data on movements of individual adult salmon that can be used to evaluate upstream movements and distribution of salmon within the drainage, the probability that fish are able to access spawning habitat, broodstock management, and the effectiveness of current juvenile stocking practices. Current projects (2014-2015) include monitoring American Shad passage at the Benton Falls Dam on the Sebasticook River and measuring the passage efficiency of fishways in Phippsburg and Bristol for alewife passage.

MDMR conducts routine monitoring of the abundance and status of juvenile and adult diadromous fishes in most of Maine's large watersheds. MDMR operates traps to monitor adult returns on the Penobscot, Narraguagus, and Sebasticook rivers. Brookfield Renewable Energy Group operates traps in the upper Penobscot, the Union River, Kennebec River, Androscoggin River, and the Saco River that provide counts of adult fish and some information on juveniles. The St. Croix Waterway Commission operates a trap on the St. Croix and Algonquin Power operates a trap on the Aroostook River.

Atlantic Salmon monitoring is directed at determining the causes of the precipitous decline in Atlantic salmon returning to Maine waters. Ongoing projects are aimed at determining survival among freshwater life stages and understanding the biological and environmental factors affecting survival. These include parr density and relative abundance, estimates of smolt emigration smolt, smolt physiology, marine and estuarine smolt trawling, and smolt tracking through estuaries. Redd counts are used to track spawning escapement in the Gulf of Maine Distinct Population Segment rivers without adult traps.

Assessments of the population status of Shortnose and Atlantic Sturgeon are performed on the Saco, Kennebec, Androscoggin, and Penobscot rivers and 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.

Spawning smelt runs are assessed annually as a source of information on population status. The survey produces a fishery-independent index of abundance by collecting biological data from spawning runs including information about size and age composition, catch-per-unit-effort, and mortality. As part of this project, fyke net stations are sampled at selected at coastal rivers

in Maine, New Hampshire, and Massachusetts for monitoring. The project has collected standardized data since 2008.

American Eel are monitored through two fisheries independent surveys, a young-of-year survey and yellow eel count. Each spring, MDMR scientists enumerate all young-of-year (glass) eels that migrate upstream into West Harbor Pond for a period of six weeks, and collect biological information (length, weight, pigmentation) on subsamples. The Yellow Eel survey in the Kennebec River watershed is conducted from June to September each year, at two hydropower facilities on the Sebasticook River and one facility on the Kennebec River. This survey provides an annual index of recruitment (multiple year classes) to the Kennebec River watershed.

Marine Invertebrates:
Marine invertebrates are monitored through efforts by state, federal, university, and non-governmental organizations. In addition to the Nearshore Trawl Survey and port sampling programs described above, MDMR collects information about commercial species through fishery independent surveys.

The northern shrimp population is monitored by multiple surveys. Scientists from NMFS, Maine, New Hampshire, and Massachusetts collaborate to conduct a series of tows for northern shrimp in the Gulf of Maine each summer. The survey data provide fishery independent data that are an important component of the assessment of the Gulf of Maine shrimp stock. In the winter of 2014/2015, in an effort to collect information about winter populations of northern shrimp during the fishery closure, MDMR worked with local fishermen in Maine to collect trawl and trap samples to document the species' maturity schedules and size distribution.
Green Sea Urchins are monitored through dive surveys and larval assessments. MDMR and industry divers count and measure urchins at fixed and random sites each spring from Kittery to Eastport. This survey provides fishery independent data that are used in stock assessments to describe the status of the resource and provide a scientific basis for the development of management measures. To monitor larval settlement, MDMR divers deploy settlement plates at Pemaquid Point each spring, collect them during the summer, and examine the plates in the laboratory to enumerate the number of new young-of-the-year sea urchins. This continues a time series begun at that site in the mid-1990s by the University of Maine, which tracks annual sea urchin larval settlement.

Annual surveys of Horseshoe Crab spawning populations and breeding sites have been conducted since 2001 through a joint effort of the MDMR, several coastal watershed volunteer monitoring groups, and a private contractor. Following the drastic depletion of the resource in the Mid-Atlantic States and the resultant increased harvesting of Maine Horseshoe Crabs, anecdotal information was collected which indicated that Maine populations experienced a decline in recent years. These surveys are intended to provide a much-needed update to the last significant assessment of Maine Horseshoe Crabs and breeding locations, which was conducted in 1977 for the Maine State Planning Office. A visual count of spawning horseshoe crabs is made at three sites along the coast during May and June spring tides. This survey relies heavily on volunteers who walk a standard survey transect at high tide counting crabs observed within a 1 meter band. Since 2005, sites have been reduced from 14 to three for budget reasons. In recent years, the continuance of these surveys has relied entirely on volunteer monitoring.

MDMR and industry partners survey the Maine scallop resource annually, rotating among coastal sites from southern Maine to Quoddy Head. Sampling occurs in October-November

prior to the start of the scallop season in December. The surveys provide fishery independent data that are used in stock assessments to describe the status of the resource and provide a scientific basis for the development of management measures. The surveys also provide information on the effectiveness of the closed areas to help guide re-opening strategies.

The National Park Service monitors rocky shores in Maine as part of their Northeast Temperature Monitoring Network that extends to the Boston Harbor Islands in Massachusetts. In Maine, field work is directed towards Acadia National Park, specifically Ship Harbor, Bass Harbor, Otter Point, Schoodic Point and Little Moose Island. Samplings include some Maine coastal islands (Metinic and Petit Manan Islands). Developed and vetted protocols monitor tide pools, barnacle recruitment, vertical distributions of macroalgae and macroinverterates, and counts of target species. This is a long-term, annual sampling program aimed to detect changes in rocky shore fauna and flora on decadal time scales associated with alterations in oceanographic patterns and climate change.

The New England Aquatic Nuisance Species Panel was established in 2001 to monitor, create public outreach programs, suggest policy, and facilitate coordination of these activities among the New England states. While most efforts have targeted freshwater invasives, marine non-native macroalgae and macroinvertebrates species are monitored as part of the Rapid Assessment Survey done by taxonomic experts on floating pontoons and some rocky shores from New York City to Eastport, Maine (Pederson et al. 2005, Wells et al. 2014). Data from these surveys are available from the Massachusetts Invader Tracking and Information System (MITIS; http://mit.sea-grant.net/mitis/mitis_map). Supporting the scientific survey efforts are citizen monitoring programs that increase the spatial and temporal coverage from Rhode Island to Wells, Maine for an abridged list of invasive species. The data collected from 2008 to present are available at the Massachusetts Ocean Resource Information System. http://maps.massgis.state.ma.us/map_ol/moris.php

The incipient network of field station sites called the Field Station and Marine Lab network in the Northeast includes a number of nonprofit and university affiliated coastal stations that monitor rocky and unconsolidated shores in Maine. Some of these projects involve citizen science programs with significant outreach and education. Current stations include the R.S. Friedman Field Station in Cobscook Bay, Hurricane Island in Penobscot Bay, Coastal Studies Center in Casco Bay, and several others.

MONITORING SGCN HABITATS

Many of the SGCN monitoring efforts above also involve some component of habitat monitoring. For SGCN habitats, factors affecting habitat distribution and integrity often occur at regional or even state-wide scales. For example, the health of a headwater stream and its resident SGCN are influenced, in part, by barriers downstream and the watershed as a whole. Likewise, the future distribution of tidal marshes in response to sea level rise (marsh migration) is driven by factors at multiple scales, from individual culverts restricting tidal flow in streams to large-scale sediment accretion dynamics. For other types of habitats, especially marine systems, we simply do not have a clear understanding of current or historic distributions and therefore have limited baseline information to assess changes over time. To address these knowledge gaps, MDIFW and partners identified habitat-scale survey and monitoring needs during development of

conservation actions. We present these actions in Table 5.6 with examples of existing programs (e.g., Stream Smart) and general survey and monitoring techniques (e.g., remote sensing) that could be used to achieve these habitat monitoring objectives. This is not an exhaustive list of approaches but rather a starting place to identify next steps and potential partnerships.

Table 5.6: Proposed habitat monitoring approaches

Habitat Group	Conservation Action Description (Action ID #)	Examples of Potential Monitoring and Survey Programs[1]
Freshwater Aquatic Habitats		
Headwaters and Creeks	• Identify high value native coldwater SGCN fish and other SGCN species habitats that may be vulnerable to watershed scale hydrology effects due to tree loss (#87)	SGCN and habitat surveys, GIS models, remote sensing
Streams, Rivers, Lakes, and Ponds	• Complete a statewide inventory of the status and condition of road and railroad crossings, including on headwater streams (#146) • Conduct a statewide inventory of dams, including on headwater streams (#101) • Identify priority locations for ecological flow management in aquatic habitats (#102) • Increase habitat surveys & models for road stream crossings (#145) • Develop better methods to map potential barriers in priority watersheds (#103) • Track completed road stream crossing projects (#147)	Stream Smart, stream barrier assessments, GIS models, remote sensing
Marine Habitats		
Coastal	• Work with municipalities to identify important SGCN nesting and migratory areas in rocky coast and coastal habitats during comprehensive planning with assistance from programs such as Beginning with Habitat (#167)	SGCN and habitat surveys, Beginning with Habitat
Intertidal	• Develop monitoring systems and rapid response plans to prevent the colonization of invasive/problematic species and diseases in intertidal, subtidal, and tidal marsh habitats (#217) • More frequently update intertidal and subtidal SGCN habitat maps and compare to historical maps to monitor changes in distribution over time (#248) • Continued underwater surveillance of potential and active aquaculture lease sites with a focus on SGCN and important habitats (new)	Maine Invasive Species Network, Beginning with Habitat, eel grass surveys, remote sensing, SGCN and habitat surveys
Rocky Coast	• Identify and prioritize significant nesting, migratory, and wintering areas in rocky coast habitats for contingency planning (#157) • Work with municipalities to identify important SGCN nesting and migratory areas in rocky coast and coastal habitats during comprehensive planning with assistance from programs such as Beginning with Habitat (#158)	SGCN and habitat surveys, Beginning with Habitat, Maine Invasive Species Network

	• Identify invasive plant hot spots in rocky coast habitats (#162)	
Subtidal	• Develop monitoring systems and rapid response plans to prevent the colonization of invasive/problematic species and diseases in intertidal, subtidal, and tidal marsh habitats (#273) • Continue to improve rapid response for oil and gas spills in intertidal and subtidal habitats, including state agencies efforts to have most up-to-date species maps, rapid response protocols in place, and regular scenario training (#266) • Expand surveys of recreational fishing efforts to include SGCN that are not targeted in current survey efforts (#283) • More frequently update intertidal and subtidal SGCN habitat maps and compare to historical maps to monitor changes in distribution over time (#307) • Continued underwater surveillance of potential and active aquaculture lease sites with a focus on SGCN and important habitats (new)	Maine Invasive Species Network, citizen scientist or volunteer monitoring programs, remote sensing, eel grass monitoring
Tidal Marsh	• Build upon and coordinate with existing monitoring efforts to establish a long term tidal marsh monitoring program, with emphasis on assessing sediment dynamics in the context of sea level rise (#177) • Develop monitoring systems and rapid response plans to prevent the colonization of invasive/problematic species and diseases in intertidal, subtidal, and tidal marsh habitats (#191) • Continue and expand monitoring programs that track tidal marsh changes over time (#185)	GIS models, remote sensing, salt marsh accretion monitoring, Saltmarsh Habitat and Avian Research Program, Maine Invasive Species Network
Terrestrial and Freshwater Wetland Habitats		
Floodplain Forests	• Identify aggressive invasives in floodplain forests and pre-treat to prevent spread (#342)	Maine Invasive Species Network, citizen scientist or volunteer monitoring programs
Freshwater Marshes	• Identify high priority road segments/culverts for organism passage among freshwater wetlands (#60)	Road Watch, Beginning with Habitat, SGCN and habitat surveys, GIS models, remote sensing

Grassland-shrubland-early Successional	• Research and identify explicit areas and amounts of grassland, shrubland, and early successional habitats needed to conserve target SGCN (#347) • Assist municipal planning, through programs such as Beginning with Habitat, to identify key grassland, shrubland, and early successional SGCN habitats (#348) • Map and distribute information on existing ruderal habitats (#355) • Map potential ruderal habitats (#356)	GIS models, remote sensing, SGCN and habitat surveys, Beginning with Habitat
Northern Forests and Swamps	• Assess conserved lands, especially northern forests and swamps and rocky summits/outcrops/mountaintops, for climate change resiliency and use this information to guide future conservation efforts (#31) • Identify and conserve boreal forest refugia associated with SGCN (#32) • Continue long-term monitoring of SGCN and SGCN habitats associated with northern forests and swamps (#38) • Continue monitoring for invasive and problematic species and diseases, especially forest insect pests, in northern forest and swamps and south-central forests and swamps (#34) • Continue stewardship/habitat monitoring on conserved northern forest and swamp lands (#30)	GIS models, remote sensing, SGCN and habitat surveys, Maine Invasive Species Network
Rocky Summits-Outcrops-Mountaintops	• Assess conserved lands, especially northern forests and swamps and rocky summits/outcrops/mountaintops, for climate change resiliency and use this information to guide future conservation efforts (#15) • Continue habitat/recreational monitoring stewardship on conserved rocky summit, outcrop, and mountaintop SGCN habitats (#18)	GIS models, remote sensing, SGCN and habitat surveys, citizen science or volunteer monitoring programs
South-Central Forests and Swamps	• Continue monitoring for invasive and problematic species and diseases, especially forest insect pests, in northern forests and swamps and south-central forests and swamps (#74) • Undertake long-term monitoring of SGCN and their habitats in south-central forests and swamps (#71) • Partner with MaineDOT to identify invasive plant "hotspots" along roads and bridges, especially in south-central forests and swamps (#75)	Maine Invasive Species Network, citizen science or volunteer monitoring programs

Statewide Habitat and Conservation Action Monitoring
In addition to SGCN and habitat monitoring, we will track habitat trends and the effectiveness of broad conservation programs at the statewide scale. Several of these approaches are described below. We expect to add approaches as new assessment, mapping, landscape modeling, and remote sensing techniques emerge over the next decade.

1. **Beginning with Habitat (BwH)**
    a. **Description:** BwH is a non-regulatory, habitat-based model that provides wildlife and habitat information to local decision-makers, conservation organizations, and landowners interested in their local wildlife and habitat resources. BwH provides users with the necessary habitat information to voluntarily balance growth with conservation of natural spaces needed for wildlife, recreation, agriculture, forestry, and other resources. In the first decade of the program, BwH worked closely with towns to fulfill this goal. Over the next ten years, BwH will continue to work with towns while also providing enhanced/updated online mapping resources, searchable information on SGCN and conservation actions, and increased technical assistance for landowners and others implementing voluntary SGCN conservation measures. Under the direction of the Action Plan Implementation Committee, the BwH Steering Committee will revise BwH's strategic plan over the next two years to include measurable objectives and performance measures to monitor delivery, utilization, and effectiveness of BwH in supporting local voluntary efforts to conserve Maine's wildlife resources.
    b. **Periodically Assessed Metrics**
        i. Number of towns and regions mapped.
        ii. Number of towns, land trusts, and landowners receiving BwH information and technical assistance.
        iii. Ease of access to up-to-date habitat data for all user groups (government agencies, towns, conservation groups, and landowners).
        iv. Number of users accessing online mapping tools.
        v. Development of improved outreach modules for different user groups, especially landowners.
        vi. Number of conserved acres (including easements) in BwH Focus Areas.
        vii. Number of acres in BwH Focus Areas in "Tree Growth" or "Farm and Open Space" current use tax programs.
        viii. Successful creation of new incentives for towns and landowners to conserve priority SGCN habitats.

2. **Spatial Data Updates**
    a. **Description:** Since Maine's 2005 plan, numerous habitat-related spatial datasets have been updated or created by multiple partners. The Maine Office of Geographic Information System data catalog (http://www.maine.gov/megis/catalog/) provides many of these datasets to the public, and others are available directly from partners. Several datasets are hosted and maintained by MDIFW and BwH and are listed here. These datasets are updated regularly and can be queried to monitor statewide SGCN, land use, and habitat patterns over time.
    b. **Periodically Assessed Metrics**
        i. Impervious/Developed Areas: Areas of impervious surfaces including buildings and roads.

ii. Rare, Threatened, and Endangered Wildlife Data (includes some SGCN): Includes known rare, Endangered, and Threatened species occurrences and/or the associated habitats based on species sightings.
iii. Undeveloped Habitat Blocks: Blocks of undeveloped land, including those greater than 100 acres.
iv. Habitat Connections: Modeled habitat areas needed to maintain or restore functional wildlife travel corridors between undeveloped habitat blocks greater than 100-acres and between higher value wetlands.
v. Riparian Connectors: Modeled crossing locations for wetland dependent species moving between waterways and wetlands divided by roads.
vi. Conserved Lands: The State of Maine's conserved lands database includes lands in federal, state, and non-profit ownership.

3. Habitat Management Guidelines

a. Description: MDIFW and partners will develop non-regulatory habitat management guidelines for priority habitats and species for distribution to landowners, land managers, towns, land trusts, and others. Several habitat conservation actions (see Element 4) address the need for habitat management guidelines (HMG). We include this topic here in order to monitor develop of HMGs statewide.

b. Periodically Assessed Metrics

i. The number of SGCN for which HMGs are developed and published.
ii. The number of landowners, land managers, towns, land trusts, and others that receive HMGs.
iii. The number of landowners, etc., that implement habitat management according to the guidelines.

4. Land Conservation, Stewardship, and Management

a. Description: Cooperate with state and federal agencies, non-profits, landowners, local land trusts, municipalities, and other partners to conserve habitat for priority species using fee acquisition, conservation easements, purchase of development rights, incentives, cooperative management agreements, management plans, improved comprehensive planning, habitat restoration and enhancements, and other conservation tools. Several habitat conservation actions and themes (see Element 4) address habitat conservation and supporting/expanding landowner incentives. This is an extremely important aspect of Maine's efforts to conserve habitats for SGCN, and we have included this topic here in order to track efforts at a statewide scale.

b. **Periodically Assessed Metrics:** To monitor the success of these efforts collectively, we will develop a way to periodically monitor the number of acres under habitat conservation through:

i. Fee acquisition
ii. Conservation easement
iii. Purchase of development rights
iv. Cooperative management agreements and management plans

PROGRAMMATIC MONITORING

MDIFW and partners developed 11 programmatic actions to help guide Action Plan

implementation over the next ten years (see Element 4, Table 6-11). Three of these actions address monitoring and are described in greater detail below:

- **Program 7:** Annually compile agency and partner expenditures and seek additional match opportunities to maximize efficiency and impact of 2015 Action Plan implementation.

- **Program 8:** Track SWAP conservation action implementation accomplishments by agencies and partners.

  With over 500 SGCN and habitat-related conservation actions, successful implementation of Maine's 2015 SWAP will require collaborative efforts among MDIFW and its many conservation partners. Furthermore, State Wildlife Grant funds are limited and, as a state, we need to ensure these dollars are being spent efficiently to achieve desired conservation outcomes. Within the first few years of Plan implementation, MDIFW will work closely with partners to develop tracking systems for conservation expenditures and expenses. MDIFW will develop feedback mechanisms to track partner efforts and accomplishments and use this information to periodically assess the effectiveness of the 2015 SWAP. MDIFW is currently developing a Tracking and Reporting Actions for the Conservation of Species compliant tracking system for agency projects and may develop a similar mechanism for partners. MDIFW also will highlight Action Plan progress and successes at periodic meetings with partners and through media as part of Programmatic Theme 2. To further leverage limited funds, MDIFW also will work with partners to maximize existing and identify new match opportunities, especially for volunteer time that was not previously tracked.

- **Program 9:** Develop SMART (Specific, Measurable, Achievable, Results-oriented, and Time-bound) style objectives for high priority habitat-scale and SGCN conservation actions.

  MDIFW and partners developed a comprehensive menu of conservation actions to address Maine's most pressing SGCN and habitat needs. The list is long, despite taking several measures to include only the most important actions (e.g., only developing actions for medium or high level stressors). This is due to several reasons. First, Maine has a wide range of habitats, from subtidal mollusk reefs to high altitude alpine meadows. The stressors affecting these habitats and their SGCN residents are extremely nuanced and often habitat-specific. Furthermore, we are fortunate to have a broad partner base with diverse interests and missions, from habitat conservation and research to advocacy. Rather than present a restricted list applicable to only a subset of partners, we opted to present the full suite of actions so that partners across the state can find a nexus to some aspect of the plan.

  We recognize that we cannot implement every action in the plan, even with broad partner support. In order to focus our efforts, we will use the prioritization approach presented in Element 4 to evaluate proposed conservation actions that are not already underway. We may first focus on the 20% of actions ranked as 'critical' for Biological Priority, but we also will consider lower-ranked partner-driven efforts. For actions determined to have sufficient biological impact and feasibility, we will establish SMART objectives to monitor action accomplishments over the next ten years and include this information in tracking programs developed under Programs 7 and 8 above.

ELEMENT 6: PLANS FOR REVISION

States are required to review and revise, as appropriate, Wildlife Action Plans at least every ten years. MDIFW will use the programmatic actions above to monitor conservation action progress at least annually. As described in Elements 7-8, MDIFW will also establish an Implementation Committee in the Fall of 2015 comprised of agency staff and conservation partners. This committee will meet at least annually to review Action Plan accomplishments and to address any emerging issues or adaptive management needs. We will undertake a comprehensive plan review beginning in year eight of the 2015 Action Plan that will include reviewing the criteria and literature used for designating SGCN. We will revisit the stressor levels assigned to SGCN and habitats and determine if our actions sufficiently prevented additional declines or actually improved stressor rankings.

Table 5.1 Status of Population Monitoring for Maine's Bird Species of Greatest Conservation Need.

Scientific Name	Common Name	Priority	Species-Specific Monitoring	Maine River Bird Survey	Breeding Bird Survey	Christmas Bird count	Mountain Birdwatch	Kennebunk Plains / TNC Annual Survey	Maine Audubon Annual Loon count	Maine Coastal Waterbird Survey	Maine Owl Survey	Maine Colonial Waterbird Survey	Migratory Shorebird Survey (PRISM/ISS)	Waterfowl Brood Counts	Mid-winter Waterfowl Survey	IFW regional shorebird surveys for SWH designation and mapping
Botaurus lentiginosus	American Bittern	3		O												
Fulica americana	American Coot	3		O												
Falco sparverius	American Kestrel	3		O												
Haematopus palliatus	American Oystercatcher	3	N													
Anthus rubescens	American Pipit	2	N				O									
Setophaga ruticilla	American Redstart	2			O											
Picoides dorsalis	American Three-toed Woodpecker	3			O		O									
Scolopax minor	American Woodcock	3														
Sterna paradisaea	Arctic Tern	1		O												

Fratercula arctica	Atlantic Puffin	2														
Icterus galbula	Baltimore Oriole	3		O	O											
Riparia riparia	Bank Swallow	1		O	O											
Tyto alba	Barn Owl	3									O					
Hirundo rustica	Barn Swallow	2		O	O											
Bucephala islandica	Barrow's Goldeneye	1		O												
Setophaga castanea	Bay-breasted Warbler	3			O		O									
Megaceryle alcyon	Belted Kingfisher	3		O	O											
Catharus bicknelli	Bicknell's Thrush	1					O									
Chlidonias niger	Black Tern	2		O												
Mniotilta varia	Black-and-white Warbler	2			O		O									
Picoides arcticus	Black-backed Woodpecker	3			O		O									
Pluvialis squatarola	Black-bellied Plover	3		O									O			N
Coccyzus erythropthalmus	Black-billed Cuckoo	3			O											
Setophaga fusca	Blackburnian Warbler	3			O											
Nycticorax nycticorax	Black-crowned Night-heron	2		O												
Setophaga striata	Blackpoll Warbler	3			O		O									
Setophaga caerulescens	Black-throated Blue Warbler	3			O											

Setophaga virens	Black-throated Green Warbler	3			O		O									
Vermivora cyanoptera	Blue-winged Warbler	2	N		O			O								
Dolichonyx oryzivorus	Bobolink	3			O			O								
Chroicocephalus philadelphia	Bonaparte's Gull	3		O												
Poecile hudsonicus	Boreal Chickadee	2			O	O										
Buteo platypterus	Broad-winged Hawk	3		O												
Toxostoma rufum	Brown Thrasher	2			O			O								
Cardellina canadensis	Canada Warbler	2			O											
Setophaga tigrina	Cape May Warbler	3			O		O									
Setophaga pensylvanica	Chestnut-sided Warbler	2			O											
Chaetura pelagica	Chimney Swift	2		O	O											
Petrochelidon pyrrhonota	Cliff Swallow	3		O	O											
Gallinula galeata	Common Gallinule	2		O												
Gavia immer	Common Loon	3		O												
Uria aalge	Common Murre	3														
Chordeiles minor	Common Nighthawk	3		O												

Sterna hirundo	Common Tern	2		O												
Calidris alpina	Dunlin	3		O									O			N
Tyrannus tyrannus	Eastern Kingbird	2		O	O											
Sturnella magna	Eastern Meadowlark	2			O			O								
Megascops asio	Eastern Screech-Owl	3									O					
Pipilo erythrophthalmus	Eastern Towhee	2			O			O								
Antrostomus vociferus	Eastern Whip-poor-will	2	O													
Contopus virens	Eastern Wood-Pewee	2			O											
Coccothraustes vespertinus	Evening Grosbeak	2			O											
Spizella pusilla	Field Sparrow	3			O											
Passerella iliaca	Fox Sparrow	3			O											
Aquila chrysaetos	Golden Eagle	2		O												
Ammodramus savannarum	Grasshopper Sparrow	1						O								
Perisoreus canadensis	Gray Jay	3														
Ardea herodias	Great Blue Heron	2		O												
Phalacrocorax carbo	Great Cormorant	1		O												
Puffinus gravis	Great Shearwater	3														
Aythya marila	Greater Scaup	2		O												
Tringa melanoleuca	Greater Yellowlegs	3		O									O			N

Histrionicus histrionicus	Harlequin Duck	1	O	O												
Podiceps auritus	Horned Grebe	3		O												
Eremophila alpestris	Horned Lark	3			O			O								
Leucophaeus atricilla	Laughing Gull	3		O												
Oceanodroma leucorhoa	Leach's Storm-petrel	3														
Ixobrychus exilis	Least Bittern	1		O												
Empidonax minimus	Least Flycatcher	3		O	O											
Calidris minutilla	Least Sandpiper	3		O									O			N
Sternula antillarum	Least Tern	1	O	O												
Tringa flavipes	Lesser Yellowlegs	1	N	O									O			N
Melospiza lincolnii	Lincoln's Sparrow	3			O											
Egretta caerulea	Little Blue Heron	3		O												
Asio otus	Long-eared Owl	3									O					
Clangula hyemalis	Long-tailed Duck	3		O												
Parkesia motacilla	Louisiana Waterthrush	3			O											
Geothlypis philadelphia	Mourning Warbler	3			O											
Ammodramus nelsoni	Nelson's Sparrow	2	O													

Colaptes auratus	Northern Flicker	3			O											
Circus cyaneus	Northern Harrier	3		O												
Setophaga americana	Northern Parula	3			O											
Stelgidopteryx serripennis	Northern Rough-winged Swallow	3		O	O											
Contopus cooperi	Olive-sided Flycatcher	2			O		O									
Icterus spurius	Orchard Oriole	3		O	O											
Falco peregrinus	Peregrine Falcon	1		O												
Podilymbus podiceps	Pied-billed Grebe	3		O												
Pinicola enucleator	Pine Grosbeak	3			O	O										
Charadrius melodus	Piping Plover	1	O	O												
Setophaga discolor	Prairie Warbler	2			O											
Haemorhous purpureus	Purple Finch	3			O		O									
Progne subis	Purple Martin	2	N	O	O											
Calidris maritima	Purple Sandpiper	1	O	O												
Alca torda	Razorbill	2														
Loxia curvirostra	Red Crossbill	3			O		O									
Calidris canutus rufa	Red Knot	1	N	O									O			N

Phalaropus fulicarius	Red Phalarope	3	N	O												
Phalaropus lobatus	Red-necked Phalarope	2	N	O												
Gavia stellata	Red-throated Loon	3		O												
Sterna dougallii	Roseate Tern	1		O												
Pheucticus ludovicianus	Rose-breasted Grosbeak	3			O											
Regulus calendula	Ruby-crowned Kinglet	2			O		O									
Arenaria interpres	Ruddy Turnstone	2		O									O			N
Euphagus carolinus	Rusty Blackbird	1	O													
Ammodramus caudacutus	Saltmarsh Sparrow	1														
Calidris alba	Sanderling	2	O	O									O			N
Piranga olivacea	Scarlet Tanager	3		O	O		O									
Cistothorus platensis	Sedge Wren	1	N													
Calidris pusilla	Semipalmated Sandpiper	2		O									O			N
Limnodromus griseus	Short-billed Dowitcher	3		O									O			N
Asio flammeus	Short-eared Owl	2									O					
Egretta thula	Snowy Egret	3		O												
Tringa solitaria	Solitary Sandpiper	2	N	O												

Porzana carolina	Sora	3		O												
Falcipennis canadensis	Spruce Grouse	3														
Catharus ustulatus	Swainson's Thrush	3			O		O									
Oreothlypis peregrina	Tennessee Warbler	2			O											
Tachycineta bicolor	Tree Swallow	2		O	O											
Bartramia longicauda	Upland Sandpiper	1	O	O	O			O								
Catharus fuscescens	Veery	2			O											
Numenius phaeopus	Whimbrel	2	N	O									O			N
Zonotrichia albicollis	White-throated sparrow	3			O		O									
Loxia leucoptera	White-winged Crossbill	3		O	O		O									
Tringa semipalmata	Willet	3	N	O									O			N
Hylocichla mustelina	Wood Thrush	1			O											
Coturnicops noveboracensis	Yellow Rail	2		O												
Setophaga petechia	Yellow Warbler	3			O											
Empidonax flaviventris	Yellow-bellied Flycatcher	3		O	O		O									
Coccyzus americanus	Yellow-billed Cuckoo	2			O											

Table 5.2 Status of Population Monitoring for Maine's Reptile, Amphibian, and Invertebrate Species of Greatest Conservation Need.

Scientific Name	Common Name	Priority	Species-specific Monitoring	Voluntary Sightings network	Maine Amphibian Monitoring Project (MAMP)	NE Regional Blanding's and Wood Turtle Survey & Monitoring	Maine Amphibian & Reptile Atlasing Project (MARAP)	Maine Butterfly Survey (MBS)	Maine Damselfly & Dragonfly Survey (MDDS)	Maine Mussel Baseline Atlas & Surveys	Maine Bumble Bee Atlas (MBBA)	Maine Tiger Beetle Atlas	Maine Road Herp Hotspot Monitoring Project
Hydroptila blicklei	A Caddisfly	3											
Hydroptila parachelops	A Caddisfly	3											
Hydroptila tomah	A Caddisfly	3											
Ochrotrichia denningi	A Caddisfly	3											
Ameletus browni	A Mayfly	3											
Baetisca berneri	A Mayfly	3											
Baetisca carolina	A Mayfly	3											
Baetisca lacustris	A Mayfly	3											
Baetisca rubescens	A Mayfly	3											
Hexagenia	A Mayfly	3											

rigida													
Metretopus borealis	A Mayfly	3											
Nixe horrida	A Mayfly	3											
Parameletus midas	A Mayfly	3											
Rhithrogena undulata	A Mayfly	3											
Siphlonurus barbaroides	A Mayfly	3											
Siphlonurus barbarus	A Mayfly	2											
Siphlonurus demaryi	A Mayfly	2											
Cucullia speyeri	A Moth	3											
Lepipolys perscripta	A Moth	3											
Nepytia pellucidaria	A Moth	3											
Chaetaglaea cerata	A Noctuid Moth	2											
Alloperla voinae	A Stonefly	3											
Neoperla mainensis	A Stonefly	3											
Xylena thoracica	Acadian Swordgrass Moth	3											
Bombus pensylvanicus	American Bumble Bee	2									O		
Satyrodes appalachia	Appalachian Brown	3						O					
Stylurus	Arrow Clubtail	3							O				

spiniceps													
Cordulegaster obliqua	Arrowhead Spiketail	3	O						O				
Bombus ashtoni	Ashton's Cuckoo Bumble Bee	2									O		
Chaetaglaea tremula	Barrens Chaetaglaea	3											
Speranza exonerata	Barrens Itame	2											
Metarranthis apiciaria	Barrens Metarranthis Moth	2											
Enallagma durum	Big Bluet	3							O				
Stagnicola mighelsi	Bigmouth Pondsnail	1	O										
Neohelix dentifera	Big-tooth Whitelip	3	N										
Tramea lacerata	Black Saddlebags	3							O				
Emydoidea blandingii	Blanding's Turtle	1	O			O	O						N
Ambystoma laterale	Blue-spotted Salamander	2	O				O						N
Callophrys lanoraieensis	Bog Elfin	3	O					O					
Zale lunifera	Bold-based Zale Moth	3											
Ophiogomphus colubrinus	Boreal Snaketail	1	O						O				
Xylotype capax	Broad Sallow	3											
Neurocordulia	Broad-tailed	3							O				

michaeli	Shadowdragon												
Alasmidonta varicosa	Brook Floater	1	O							O			
Bombus griseocollis	Brown-belted Bumble Bee	3									O		
Leucorrhinia patricia	Canada Whiteface	2	O						O				
Tramea carolina	Carolina Saddlebags	3							O				
Ischnura hastata	Citrine Forktail	3							O				
Lycaena dorcas claytoni	Clayton's Copper	2	O					O					
Cicindela marginipennis	Cobblestone Tiger Beetle	1	O									N	
Gomphus vastus	Cobra Clubtail	3							O				
Hesperia metea	Cobweb Skipper	3	O					O					
Anax longipes	Comet Darner	3	O						O				
Progomphus obscurus	Common Sanddragon	3							O				
Satyrium titus	Coral Hairstreak	3	O					O					
Plebejus idas empetri	Crowberry Blue	2	O					O					
Argia translata	Dusky Dancer	3							O				
Atrytonopsis hianna	Dusted Skipper	3	O					O					
Erora laeta	Early Hairstreak	2	O					O					
Terrapene carolina	Eastern Box Turtle	2	O				O						N

carolina													
Hemileuca maia maia	Eastern Buckmoth	2											
Thamnophis sauritus	Eastern Ribbon Snake	2	O				O						N
Satyrium edwardsii	Edwards' Hairstreak	2	O					O					
Nannothemis bella	Elfin Skimmer	3							O				
Ophiogomphus anomalus	Extra-striped Snaketail	3							O				
Bombus fernaldae	Fernald's Cuckoo Bumble Bee	3									O		
Boloria frigga saga	Frigga Fritillary	1	O					O					
Nebria nivalis gaspesiana	Gaspe Gazelle Beetle	3	N										
Hemaris gracilis	Graceful Clearwing	3	N										
Callophrys hesseli	Hessel's Hairstreak	1	O					O					
Paonias astylus	Huckleberry Sphinx	3											
Somatochlora incurvata	Incurvate Emerald	3							O				
Bombus insularis	Indiscriminate Cuckoo Bumble Bee	2									O		
Callophrys gryneus	Juniper Hairstreak	2	O					O					
Oeneis polixenes	Katahdin Arctic	1	O					O					

katahdin													
Bombus citrinus	Lemon Cuckoo Bumble Bee	3									O		
Hesperia leonardus	Leonard's Skipper	3						O					
Arigomphus furcifer	Lilypad Clubtail	3							O				
Vertigo malleata	Malleated Vertigo	3	O										
Celithemis martha	Martha's Pennant	3							O				
Lithobates septentrionalis	Mink Frog	3			O		O						N
Danaus plexippus	Monarch	3						O					
Vertigo paradoxa	Mystery Vertigo	2	O										
Libellula needhami	Needhams Skimmer	3							O				
Enallagma laterale	N England Bluet	2	O						O				
Hemileuca lucina	N England Buckmoth	3											
Floridobia winkleyi	N England Silt Snail	3	O										
Coluber constrictor constrictor	Northern Black Racer	1	O				O						N
Plebejus idas	Northern Blue	2						O					
Storeria dekayi dekayi	Northern Brownsnake	2					O						N
Lithobates pipiens	Northern Leopard Frog	2			O		O						N

Gyrinophilus porphyriticus porphyriticus	Northern Spring Salamander	2	O				O						N
Stagnicola oronoensis	Obese Pondsnail	3	O										
Zale obliqua	Oblique Zale	3											
Somatochlora minor	Ocellated Emerald	3							O				
Libellula semifasciata	Painted Skimmer	3							O				
Zanclognatha martha	Pine Barrens Zanclognatha	1											
Citheronia sepulcralis	Pine Devil	2											
Lithophane lepida lepida	Pine Pinion	2											
Psectraglaea carnosa	Pink Sallow	2											
Boloria chariclea grandis	Purple Lesser Fritillary	2	O					O					
Ophiogomphus howei	Pygmy Snaketail	2	O						O				
Somatochlora brevicincta	Quebec Emerald	2	O						O				
Ischnura ramburii	Rambur's Forktail	3							O				
Gomphus quadricolor	Rapids Clubtail	2	O						O				
Xystopeplus rufago	Red-winged Sallow	3											
Williamsonia lintneri	Ringed Boghaunter	1	O						O				

Somatochlora albicincta	Ringed Emerald	3							O				
Epeorus frisoni	Roaring Brook Mayfly	1	O										
Bombus affinis	Rusty-patched Bumble Bee	1									O		
Cicindela marginata	Salt Marsh Tiger Beetle	2	O									N	
Bombus sandersoni	Sanderson's Bumble Bee	3									O		
Polygonia satyrus	Satyr Comma	3						O					
Enallagma pictum	Scarlet Bluet	2	O						O				
Erythrodiplax berenice	Seaside Dragonlet	3							O				
Aeshna juncea	Sedge Darner	2							O				
Papilio brevicauda gaspeensis	Short-tailed Swallowtail	3	O					O					
Catocala similis	Similar Underwing	3											
Vertigo morsei	Six-whorl Vertigo	1	O										
Erynnis brizo	Sleepy Duskywing	2	O					O					
Thorybes bathyllus	Southern Cloudywing	3						O					
Lapara coniferarum	Southern Pine Sphinx	3											
Lanthus vernalis	Southern Pygmy Clubtail	2							O				
Spartiniphaga	Spartina Borer	3											

inops	Moth												
Rhionaeschna mutata	Spatterdock Darner	3	O						O				
Papilio troilus	Spicebush Swallowtail	3	O					O					
Appalachina sayana	Spike-lip Crater	3	N										
Pteronarcys comstocki	Spiny Salmonfly	3											
Epiaeschna heros	Swamp Darner	3	N						O				
Leptodea ochracea	Tidewater Mucket	1	O							O			
Siphlonisca aerodromia	Tomah Mayfly	1	O										
Enallagma carunculatum	Tule Bluet	3							O				
Lycia rachelae	Twilight Moth	2											
Cupido amyntula maritima	Western Tailed Blue	3						O					
Cicindela ancocisconensis	White Mountain Tiger Beetle	2	O									N	
Glyptemys insculpta	Wood Turtle	1	O			O	O						N
Bombus fervidus	Yellow Bumble Bee	3									O		
Lampsilis cariosa	Yellow Lampmussel	1	O							O			
Bombus terricola	Yellowbanded Bumble Bee	3									O		
Aeshna	Zigzag Darner	3							O				

sitchensis													
Alasmidonta undulata	Triangle Floater	3	O							O			
Anodonta implicata	Alewife Floater	3	O							O			
Margaritifera margaritifera	Eastern Pearlshell	3	O							O			
Clemmys guttata	Spotted Turtle	1	O				O						N
Orconectes limosus	Spinycreek Crayfish	3	N										

Table 5.3 Status of Population Monitoring for Maine's Inland Fish Species of Greatest Conservation Need.

Scientific Name	Common Name	Priority	Species-specific Monitoring	Clerk Creel Census	Voluntary Creel Census	Baitfish Dealer Inspections	Stream Electro Fishing	Lake Electro Fishing	Gill Netting	Trap Netting	Telemetry/Marking	eDNA	Beach Seines	Minnow Traps/Pots	Fishway Traps	Trawling	SCUBA / Snorkeling	Experimental Angling	Monitoring Salmon Traps & Lifts	Spawning Stock Surveys
Lethenteron appendix	American Brook Lamprey	3	N				O				N	N								
Salvelinus alpinus oquassa	Arctic Charr	1	O	O	O				O	O	O	N					O	O		O
Notropis heterolepis	Blacknose Shiner	3	N			O	O	O			N	N	O	O	N					
Notropis bifrenatus	Bridle Shiner	2	N			O	O	O			N	N	O	O	N					
Culaea inconstans	Brook Stickleback	3	N				O				N	N	N	O	N					
Salvelinus fontinalis	Brook Trout	3	O	O	O		O	O	O	O	O	N			O		O	O	O	O
Lota lota	Burbot	3	N	O	O		O	N	N	N	N	N			N			N		
Erimyzon oblongus	Creek Chubsucker	3	N			O	O	N	N	O	N	N	O	O	N					
Hybognathus	Eastern	3	N			O	O	O					O	O	N					

regius	Silvery Minnow																			
Salvelinus namaycush	Lake Trout	3	O	O	O			O	O	O						N	O	O		O
Coregonus clupeaformis	Lake Whitefish	2	O	O	O		N	N	O	O					N	N	N	O		O
Rhinichthys cataractae	Longnose Dace	3	N			O	O	O					O	O	N					
Catostomus catostomus	Longnose Sucker	3	N			O	N	O	O	O					O					
Margariscus margarita	Pearl Dace	3	N			O	O	O					O	O	N					
Esox americanus americanus	Redfin Pickerel	2	O	O			O	N		N			N							
Prosopium cylindraceum	Round Whitefish	2	O	O	O		N	N	O	O					N	N	N	N		N
Etheostoma fusiforme	Swamp Darter	2	N				O						O				N			

Table 5.4 Status of Population Monitoring for Maine's Mammal Species of Greatest Conservation Need.

Scientific Name	Common Name	Priority	Species-specific Monitoring	Voluntary Sightings network	North American Bat Survey	N England Cottontail Range-Wide Conservation Strategy Monitoring
Alces alces americanus	Moose	3	O			
Eptesicus fuscus	Big Brown Bat	2			N	
Lasionycteris noctivagans	Silver-haired Bat	2			N	
Lasiurus borealis	Eastern Red Bat	3			N	
Lasiurus cinereus	Hoary Bat	3			N	
Lynx canadensis	Canada Lynx	2	O	O		
Microtus pennsylvanicus shattucki	Penobscot Meadow Vole	2				
Myotis leibii	Eastern Small-footed Myotis	1			N	
Myotis lucifugus	Little Brown Bat	1			N	
Myotis septentrionalis	Northern Long-eared Myotis	1			N	
Ondatra zibethicus	Muskrat	3	O			
Perimyotis subflavus	Tri-colored Bat	2			N	
Sorex dispar	Long-tailed Shrew	3				
Sylvilagus transitionalis	N England Cottontail	1	O	O		N
Synaptomys borealis sphagnicola	Northern Bog Lemming	1	O			

Table 5.5 Status of Population Monitoring for Maine's Marine Species of Greatest Conservation Need.

Scientific Name	Common Name	Priority	Species-specific Monitoring	Clerk Creel Census	Voluntary Creel Census	Mandatory Reporting	Stream Electro Fishing	Lake Electro Fishing	Gill Netting	Trap Netting	Beach Seines	Fishway Traps	DMR trawl survey	SCUBA / Snorkeling	Experiemental Angling	Voluntary Sightings network	Monitoring Salmon Traps & Lifts	Spawning Stock Surveys	Habitat Mapping	Species Interaction Studies	Environmental/Habitat Change Effect Studies
Calanus finmarchicus	A Copepod	3	N																	N	N
Alosa pseudoharengus	Alewife	2	O			O	O			O	O	O	O					O	O	N	N
Anguilla rostrata	American Eel	2	O			O	O			O	O	O	O					O	O		N
Arrhoges occidentalis	American Pelican Foot	2	O											O					N		N
Ammodytes americanus	American Sand Lance	3											O								
Alosa sapidissima	American Shad	1	O	O	O		O		O	O	O	O	O					O	O		
Thunnus thynnus	Atlantic Bluefin Tuna	2		O	O	O												O			
Gadus morhua	Atlantic Cod	1	O	O	O	O							O					O			
Zirfaea crispata	Atlantic Great Piddock	2	O											O					N		N
Salmo salar	Atlantic Salmon	1	O				O					O		O			O	O	O	N	O
Placopecten magellanicus	Atlantic Sea Scallop	3	O			O							O	O					O	N	N

Acipenser oxyrinchus	Atlantic Sturgeon	1	O						O		O		O					O	O		
Anarhichas lupus	Atlantic Wolffish	2											O					O	N		
Dipturus laevis	Barndoor Skate	2	O										O								
Mytilus edulis	Blue Mussel	3	O			O							O						O	N	N
Prionace glauca	Blue Shark	3	O	O																	
Balaenoptera musculus	Blue Whale	2														O					
Alosa aestivalis	Blueback Herring	1	O			O	O			O	O	O	O					O	O	N	
Boreotrophon clathratus	Clathrate Trophon	2	O											O					N		N
Colus pygmaeus	Colus Snail	2	O											O					N		N
Asterias rubens	Common Sea Star	2	O										O	O					N		N
Crossaster papposus	Common Sun Star	2	O										O	O					N		N
Alopias vulpinus	Common Thresher Shark	3	O	O																	
Alcyonium digitatum	Dead Man's Fingers	3	N																N	N	N
Crassostrea virginica	Eastern oyster	3	O			O													O	N	N
Margaritifera margaritifera	Eastern Pearlshell	3	O											O					N		N
Balaenoptera physalus	Finback Whale	2	O													O					
Asterias forbesi	Forbes's Starfish	2	O											O					N		N
Mya truncata	Gaper Clam	3	O											O					N	N	N
Strongylocentrotus droebachiensis	Green Sea Urchin	2	O			O							O	O					O	N	N
Chelonia mydas	Green Seaturtle	2														O					

Melanogrammus aeglefinus	Haddock	1		O	O	O							O					O	N		
Phocoena phocoena	Harbor Porpoise	2	O													O			O		
Mercenaria mercenaria	Hard-shelled Clam	3	O			O							O						O	N	N
Limulus polyphemus	Horseshoe Crab	1	O																O		N
Megaptera novaeangliae	Humpback Whale	1	O													O			O		
Chlamys islandica	Icelandic Scallop	3	O										O	O					N	N	N
Lepidochelys kempii	Kemp's Ridley Seaturtle	2														O					
Terebratulina septentrionalis	Lamp Shell	2	O											O					N		N
Dermochelys coriacea	Leatherback Seaturtle	1														O					
Limacina helicina	Limancina Snail	3	O											O					N		N
Caretta caretta	Loggerhead Seaturtle	2														O					
Boreotrophon truncatus	Murex	2	O											O					N		N
Eubalaena glacialis	North Atlantic Right Whale	1	O													O			O		
Gorgonocephalus arcticus	Northern Basket Starfish	2	O										O	O					N		N
Pandalus borealis	Northern Shrimp	1	O			O							O						O		O
Cucumaria frondosa	Orange-footed Sea Cucumber	2	O			O							O								
Lebbeus polaris	Polar Lebbeid Shrimp	2	O										O	O					N		N

Lamna nasus	Porbeagle	2	O	O																	
Psolus fabricii	Psolus	2	O											O					N		N
Psolus phantapus	Psolus	2	O											O					N		N
Solaster endeca	Purple Sunstar	2	O										O	O					N		N
Osmerus mordax	Rainbow Smelt	1	O	O	O	O				O	O		O					O	O	N	N
Thyonidium drummondii	Sea Cucumber	2	O										O								
Gersemia rubiformis	Sea Strawberry	2	O											O					N		N
Balaenoptera borealis	Sei Whale	2	O													O			O		
Isurus oxyrinchus	Shortfin Mako	2	O	O																	
Acipenser brevirostrum	Shortnose sturgeon	1	O						O		O							O	O		
Sphyrna zygaena	Smooth Hammerhead	3	O	O																	
Malacoraja senta	Smooth Skate	2	O										O								
Mya arenaria	Softshell Clam	3	O			O													O	N	N
Physeter macrocephalus	Sperm Whale	2	O													O					
Ptychatractus ligatus	Spindle Shell	2	O											O					N		N
Lebbeus groenlandicus	Spiny Lebbeid Shrimp	2	O										O	O					N		N
Anarhichas minor	Spotted Wolffish	3	N																		
Morone saxatilis	Striped Bass	2	O	O	O						O		O					O	O		
Amblyraja radiata	Thorny Skate	2	O										O								
Limneria undata	Wavy Lamellaria	3	O											O					N		N

Stephanasterias albula	White Sea Star	2	O										O					N		N
Pseudopleuronectes americanus	Winter Flounder	2	O			O							O					O	O		O
Leucoraja ocellata	Winter Skate	2	O										O								

KEY TO ACRONYMS

BwH	Beginning with Habitat
GIS	Geographic Information System
HMG	Habitat Management Guidelines
NMFS	National Marine Fisheries Service
MDIFW	Maine Dept. of Inland Fisheries and Wildlife
MDMR	Maine Dept. of Marine Resources
SGCN	Species of Greatest Conservation Need
SMART	Specific, Measurable, Achievable, Results-oriented, and Time-bound
SWG	State Wildlife Grants
TRACS	Tracking and Reporting Actions for the Conservation of Species

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Table 5.6	Proposed Habitat Monitoring Approaches

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