Monitoring the Conservation of Fish and Wildlife in the Northeast

A Report on the Monitoring and Performance Reporting Framework for the Northeast Association of Fish and Wildlife Agencies

Prepared and compiled by: Foundations of Success

Technical materials developed by state and federal wildlife agency staff and partners across the Northeast

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Executive Summary

Overview. The Northeast Association of Fish and Wildlife Agencies (NEAFWA) Monitoring and Performance Reporting Framework (hereafter, Framework or Monitoring Framework) is the product of a year-long process of NEAFWA working closely with members, partners, stakeholders, and scientific experts. This work was commissioned and approved by the NEAFWA Directors. The Monitoring Framework presented in this document is designed to help each NEAFWA state meet congressional expectations for project effectiveness monitoring and performance reporting for Wildlife Action Plans and State Wildlife Grants programs. With funding from the National Fish and Wildlife Foundation, NEAFWA members and collaborating agencies developed this Framework to offer an effective and cost-efficient mechanism for reporting on the status of Species of Greatest Conservation Need and their habitats within each state and across the Northeast region, and the effectiveness of actions taken to conserve those resources.

Audiences. The two main audiences for this Framework are decision makers responsible for allocating funds to the State Wildlife Grants and NEAFWA resource managers. Decision makers want to know the overall state of the region, and they want to know that the money they are allocating is spent wisely. NEAFWA resource managers are interested in these matters as well, but they also need to know which actions are effective, which are not effective, and why. This is essential information for refining and improving their ongoing and future interventions. The Framework directly addresses the needs and interests of these audiences by collecting information related to the status of fish and wildlife and their habitats and the effectiveness of key interventions used individually by states or across the region.

Framework Description. The Framework itself provides details on what needs to be monitored, what data exist, and how that data should be collected, analyzed, and reported. This document, however, does not present actual data about the health of Northeastern fish, wildlife, and ecosystems. Nor does it present data that illustrate the effectiveness of conservation actions. Rather, it provides the means for NEAFWA members to work together to collect, analyze, and communicate that data.

The Monitoring Framework is designed to help each NEAFWA state meet congressional expectations for Wildlife Action Plans and State Wildlife Grants programs. It will not replace some of the detailed monitoring that states will have to do to ensure that populations of their Species of Greatest Conservation Need do not drop to the point where they will require protection under the federal Endangered Species Act, but it will provide an early warning system for a broad array of Species of Greatest Conservation Need, and it will provide the context or backdrop for states to showcase their fish and wildlife conservation efforts and challenges.

Through an externally-facilitated process, NEAFWA members and regional stakeholders identified eight conservation targets (species, habitats, and/or ecosystems) that collectively represented or encompassed the Species of Greatest Conservation Need that members are working to conserve. Given the short timeframe and limited funding for this project, we focused on terrestrial and freshwater targets. An important next step will be to repeat this process for coastal and marine systems. The targets chosen were (in alphabetical order):

1. Forests
2. Freshwater streams and river systems
3. Freshwater wetlands
4. Highly migratory species
5. Lakes and ponds
6. Managed grasslands and shrublands
7. Regionally Significant Species of Greatest Conservation Need, and
8. Unique habitats in the Northeast.

We then developed a limited suite of monitoring indicators to create a dashboard that could indicate the general health of fish and wildlife and their habitats in the Northeast. The basic assumption was that these indicators would track the health of the targets and in turn, these targets would track the health of the fish and wildlife populations and their habitats. Although the focus of NEAFWA members is on fish and wildlife *species*, several of the indicators are habitat-related *measures* because species need sufficient, good-quality habitat to survive.

NEAFWA members and stakeholders also worked to identify a process for determining the effectiveness of their actions to conserve Species of Greatest Conservation Need. Recommendations include:

1. For effectiveness measures, report primarily on actions supported through State Wildlife Grants,
2. Use the results chains tool to determine the effectiveness indicators,
3. Establish standard effectiveness indicators for common conservation actions, and
4. Promote learning through common databases of conservation actions.

Next Steps. The Framework proposed in this document pulls together the collective input of Fish and Wildlife agency staff and partners across the Northeast. This, however, does not mean that the Framework will be immediately put it into action. Several steps need to happen before NEAFWA states will be ready to implement the Framework or some agreed-upon variation of the Framework. Here, we lay out the main steps. While these are generally in chronological order, some of them will be concurrent with earlier steps or ongoing throughout the process.

- **Present and roll out the Framework to a broader audience:** It will be the role of on-the-ground staff to implement the Framework. These staff must understand the value and utility of the Framework. At a minimum, we will present the Framework at various regional meetings and conferences.
- **Review target indicators for potential overlap and consolidation:** Time constraints in the development of the Framework did not allow us to sufficiently analyze indicators across targets for overlap prior to the release of this draft. As shown in the table below, we see at least two instances where two or more work groups for different targets selected slightly different indicators: Wildlife population trends and Fragmentation-related indicators.

Target	Indicators & Stressors
Fragmentation-related indicators	
Forests	Forest fragmentation index
Freshwater wetlands	Road density
Unique habitats	Proximity to human activity/roads
Unique habitats	Land use/connectivity
Wildlife population trends	
Highly migratory species	Shorebird abundance
Highly migratory species	Abundance of diadromous fish
Highly migratory species	Presence/abundance of monarch butterfly
Unique habitats	Wildlife presence/absence
Unique habitats	Wildlife population trends
Regionally Significant SGCN	Population trends and productivity of federally listed species
Regionally Significant SGCN	State-listing status and heritage rank of highly imperiled wildlife
Regionally Significant SGCN	Population trends of endemic species

If indeed there is some redundancy of indicators within each of the two groups above, and if it is possible to use one indicator where two or more appear almost the same, we can simplify data collection for the Framework (data would still be analyzed separately by target group). Reporting on fewer indicators would also make it easier for our audiences to understand Framework reports. As an example, the indicator Percent Impervious Surface was selected for 3 targets: Freshwater streams and river systems; Freshwater wetlands; and Lakes and ponds. This single indicator was deemed both sufficiently important and sensitive to the needs of the respective targets. Again, the data would be analyzed by target, as each target is impacted differently, but collecting this data from one source reduces the time and costs to implement the Framework.

A next step would be to determine if it is possible to choose one or two common indicators and collect data for just those indicators. For wildlife population trends indicators, it would be useful to gather the knowledgeable “experts” and determine if there are some wildlife that cross multiple targets (e.g., Alleghany woodrats). If so, these wildlife could be a priority for which to collect data. Ideally all proposed indicators would be measured in order to give a robust picture of the status of all conservation targets. Given budget and data constraints, however, this might not be realistic. If a phased-in approach to Framework implementation occurs, one efficient solution and a potential next step is to identify additional indicator similarities and overlaps across targets and determine if we can further reduce redundancies and simplify data collection.

- **Modify target indicators based on feedback from Framework review:** As a first step prior to entering the implementation phase, it is recommended that Framework implementers review and reconsider some of the indicators for targets based on the input from a wide range of reviewers. Reviewer comments are currently compiled in one document and organized by target.

- **Secure resources:** Monitoring and performance reporting are expected from Congress – they must happen. Nevertheless, they cannot happen without financial and staff inputs. Implementing this Framework will require that directors allocate the necessary resources to get the Framework up and running and to keep it operational over the long-term. We, however, have developed this Framework with an eye to keeping costs to a minimum. As the Framework moves into the implementation phase, opportunities to lower costs without significantly impacting the integrity of the Framework should be seriously considered.
- **Determine data management structure:** It will be important to have an initial idea of how the region will collect, manage, and report on data (see Section 5, Data Collection, Management, Analysis, & Communication). Once NEAFWA members implement the Framework, it will become clearer whether the chosen data management structure will work or whether some other arrangement is needed.
- **Develop instructions for data collection:** The appendices provide draft monitoring plans for status and effectiveness measures. In some cases, Fish and Wildlife staff may need more guidance about how to go about collecting data. Thus, it will be necessary to review the appendices and, where relevant, refine them so that so that implementing staff will be clear about what they need to do.
- **Implement the Framework:** Although we could spend a lot of time "perfecting" the Framework, we feel it is important to move into actual implementation. In this step, Fish and Wildlife Agencies would start to collect the data specified in the Framework. In many cases, the first step will be collecting baseline and historical trend data (where available). As of the writing of this report, NEAFWA states, through the Regional Conservation Needs grant program, are in the process of awarding a grant to The Nature Conservancy to summarize the conservation status of the habitat and species targets in the Framework. This will be a great opportunity to both jumpstart implementation and test the Framework's utility.
- **Adapt the Framework and continue to implement:** Based on what we learn in implementing the Framework, it will be important to modify it and continue to implement it. This is an ongoing step that should be continuously revisited.
- **Complete Framework components:** The current version of the Framework lacks information for the Managed Grasslands and Shrublands target and has incomplete information for the Regionally Significant SGCN and Lakes/Ponds targets. To complete the Framework, NEAFWA will need to form working groups for these targets, identify indicators, and develop monitoring plans for those indicators. Over time, NEAFWA members should also consider expanding the Framework to include coastal and marine targets.

This attempt to develop a regional Framework is a first for state Fish and Wildlife agencies. States and the region as a whole will need to determine whether and how they will implement the Framework. States may decide to use it on a state-wide basis to report how they are doing on indicators of regional concern. Alternatively or additionally, the Northeast region could report as a whole on how well the region is protecting habitats and species that span across political boundaries. While this would require additional effort, it would be very powerful to show decision makers progress at the state level, as well as at the regional level—a scale that better captures entire ecosystems and broad-ranging species. Some states may not have sufficient

funding or staff to implement the Framework in full. In such cases, states will need to consider their own priorities as well as those identified in the Framework to determine what parts of the Framework they will implement.

We hope that the Monitoring and Performance Reporting Framework will be implemented across the Northeast and that other regions can learn from our experience and benefit from lessons learned from both our successes and failures. We also hope that NEAFWA members will implement and adapt the Framework over the coming years, adjusting it as needed to best fit their needs and the realities under which they operate. This should be considered a dynamic Framework that will change over time as its implementers learn which indicators are useful and whether there are other indicators that might be more appropriate. Updated versions of this document will be posted at http://rcngrants.org/regional_monitoring.shtml.

This report lays out a Monitoring and Performance Reporting Framework for the Northeast Association of Fish and Wildlife Agencies. We describe in detail the process we used to develop the Framework in a companion document, *Monitoring the Conservation of Fish and Wildlife in the Northeast – The Process.* Both reports and additional materials are available online at http://rcngrants.org/regional_monitoring.shtml.
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Contents

1. Introduction

The Northeast Region

The Northeast Association of Fish and Wildlife Agencies (NEAFWA) includes state Fish and Wildlife agencies from Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, Washington (D.C.) and West Virginia. The NEAFWA members are responsible for managing the species and their habitats in a diverse range of ecosystems that include terrestrial, freshwater, coastal, and marine systems, all set amongst one of the most densely populated regions of the country.

Wildlife Action Plans

All of the fifty-six states and territories across the United States that have developed Wildlife Action Plans (also called Action Plans throughout this document) that represent a collective vision for the future of conservation. The roots of this historic planning effort lie with the Teaming with Wildlife coalition – more than 3,500 agencies, conservation groups, and businesses who have come together to secure funding to keep wildlife from becoming endangered and to keep common species common. The coalition's efforts led to the establishment of the Wildlife Conservation and Restoration Program and the State Wildlife Grants Program in 2000. As a requirement of these programs, Congress asked each state wildlife agency to develop its own specific Action Plan.

Action Plans are proactive plans that assess the condition of each state's wildlife, identify the problems they face, and prescribe actions to conserve wildlife and vital wildlife habitat before they become more rare and costly to protect. These Plans have been designed to prevent wildlife from becoming endangered and to keep common species common. What distinguishes the state Action Plans from previous conservation plans is the focus on *results* for *all* wildlife in *every* state. These proactive Plans outline steps that should be taken now and that ultimately will save states money over the long term.

Need for a Monitoring Framework

Congress and the Office of Management and Budget want to know that the funds they allocated to this conservation work are being spent in a cost-efficient manner, and that states are keeping species off the Endangered Species List. At the same time, from an effectiveness perspective, wildlife managers in each state need to know what is

working, what is not working, and how they could best allocate their limited resources to the most effective conservation actions.

Because the Action Plans are very detailed and include extensive lists of Species of Greatest Conservation Need (SGCN), monitoring all the wildlife and associated habitats described within the plans would be an exceedingly onerous and costly task – one that far exceeds the resources available for the Action Plans themselves. With this in mind, the NEAFWA state directors decided to commission a process to develop a monitoring framework that could be used across the region to inform decision makers and managers on how individual states are faring, as well as how the region as a whole is performing. Although NEAFWA directors commissioned this process, each director will ultimately determine whether to implement the Framework for their own reporting purposes.

In order to be manageable, this framework should focus on the most important monitoring needs common to all states and across the region. This means that the framework cannot provide an all-inclusive view of how the Northeast region is performing. Rather, it must rely on key indicators that are illustrative of overall progress and that will serve as a dashboard of information to guide decision makers – political officials and conservation managers alike.

2. Background of the Monitoring Framework

What Is This Monitoring Framework and Why Is it Important?

The Monitoring and Performance Reporting Framework (hereafter, Framework or Monitoring Framework) presented in this document is designed to help each NEAFWA state meet congressional expectations for project effectiveness monitoring and performance reporting for Wildlife Action Plans and State Wildlife Grants programs. NEAFWA members and collaborating agencies developed this Framework to offer a meaningful and cost-efficient mechanism for reporting on the status of Species of Greatest Conservation Need and their habitats within each state and across the Northeast region, and the effectiveness of actions taken to conserve those resources.

NEAFWA members decided to work together to develop a Monitoring Framework across the region because they felt that if they worked individually, each state would struggle to meet Congressional expectations and goals for conserving SGCN. They felt that working together would simplify reporting requirements, improve monitoring of status change for species and habitats, and more effectively leverage resources.

This Monitoring Framework does not replace the Wildlife Action Plans. Rather, it provides a manageable mechanism for reporting on action plans and State Wildlife Grant programs.

NEAFWA and its partners developed the Monitoring Framework with a focus on using existing data and information, rather than creating new sets of data that states must collect so as to keep the Framework simple and manageable. Nevertheless, individual states may want to collect additional data associated with key SGCN, if they feel some aspects of their work are not sufficiently represented in this regional Monitoring Framework.

The Framework is organized into two main sections:

A) Proposed Status Measures for Eight Conservation Targets: This component includes target and indicator descriptions, as well as first iterations of monitoring plans and indicators that reflect the *status* of eight conservation targets chosen to represent the range of SGCN that NEAFWA states are trying to conserve across the region (page 9).

B) **Proposed Process to Develop Effectiveness Measures:** This component describes a process for identifying a limited set of indicators to assess the effectiveness of common actions or strategies that NEAFWA members are using (page 32).

Box 1 describes the overall adaptive management process and how the steps NEAFWA used build off of this process.

Who Developed This Monitoring Framework?

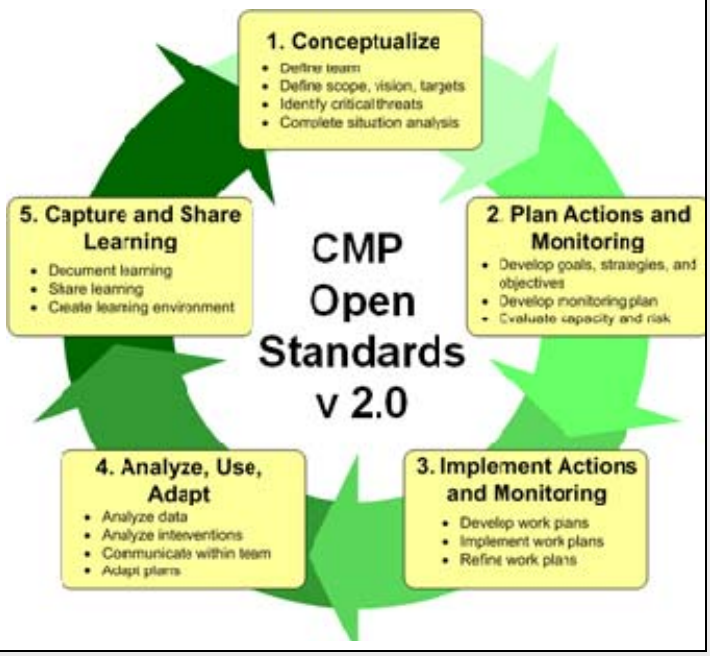
This Framework was commissioned by the NEAFWA State Fish and Wildlife Directors. The technical inputs for this Framework were provided by representatives from the NEAFWA member states, as well as representatives from federal agencies and other partners (see Acknowledgments for a full list of all participants).

A steering committee led the process, with the assistance of external facilitators from Foundations of Success (FOS), a conservation non-profit organization with extensive experience in strategic planning, monitoring and evaluation, and multi-stakeholder facilitation. The steering committee included a mix of representation from state fish and wildlife agencies across the Northeast, US Fish and Wildlife Service (the Federal agency responsible for State Wildlife Grants program), the Association of Fish and Wildlife Agencies, the US Geological Survey, and non-government conservation organizations.

Box 1. Monitoring in the Context of the Project and Program Management Cycle

There is a long history of natural resource management initiatives developing monitoring plans that are never implemented or used. In many cases, practitioners are stymied because they do not know what monitoring data to collect. In others cases, they become paralyzed because, paradoxically, they are collecting too much data that is never analyzed or used.

The Conservation Measures Partnership
Open Standards for the Practice of Conservation



A key premise behind the development of the Framework in this document is that to be useful and feasible to implement, monitoring and performance reporting cannot be developed in isolation. Instead, as shown in the accompanying figure, monitoring has to be one component of an overall project and program management cycle.

The process used to develop this framework builds off of the Conservation Measures Partnership's (CMP) *Open Standards for the Practice of Conservation* and work from CMP members, including, in particular, The Nature Conservancy. Our actions focused primarily on Step 2 (Plan Monitoring) of this cycle. The first step in developing an effective monitoring plan involves defining the project and who the key audiences are for the monitoring data. In our case, we are working on two types of projects: the individual grants funded by State Wildlife Grants and the broader actions State agencies take that are influenced by the State Wildlife Action Plans. As outlined in more detail in this report, our primary audience for this work is decision makers, including the United States Congress and the Office of Management and Budget. However, we also consider on-the-ground resource managers a target audience and thus, have tried to identify indicators that would be of interest to this group and that would not pose an excessive burden in terms of data collection.

The next step involves determining specifically what questions the audiences would like to have answered with the monitoring plan. There are two basic types of questions monitoring addresses:

Status assessments examine the state of the system of interest at any given time, but they are not linked to a specific intervention. A useful analogy is to think of an annual physical exam performed at a doctor's office. The doctor will take standard measures such as blood pressure, cholesterol, and weight. The doctor is essentially assessing the status of your body to determine if everything seems to be well. These measurements are made and tracked over time, even though no treatment has been prescribed. In the conservation world, specific status questions include:

- How is the biodiversity that we care about doing?
- How are the threats to biodiversity changing?

To address these questions, you identify a limited suite of conservation targets that you think represent the overall health of wildlife and their habitats and then determine specific indicators for each target. These indicators should generally reflect key ecological attributes of the target, such as size, condition, and landscape context. In some cases, you may use threat indicators as proxy measures for target health (for a standard classification of direct threats, see CMP web site).

Box 1 (Continued)

E**ffectiveness assessments**, by contrast, examine the impact of specific actions taken by a project or program. Returning to the annual physical analogy from above, if your doctor notices that your cholesterol is high, she might prescribe a healthier diet and a regular exercise routine. Over time, she will continue to monitor your cholesterol, as well as other associated factors (e.g., weight loss, physical strength) to determine the extent to which her interventions were effective. If they are not working, she may then have to try additional interventions such as prescribing cholesterol lowering medications. She will then continue to monitor the effectiveness of this new action. In this case, the measures she is taking are effectiveness measures because they are directly associated with an intervention (diet and exercise or medications), and she is trying to determine the effectiveness of these interventions

In the conservation world, specific effectiveness questions include:

- Are our conservation actions having their intended impact? (Also see CMP website for standard classification system for conservation actions)
- How can we improve the effectiveness of our actions?

In developing a monitoring system, you have to determine the appropriate balance between these different status and effectiveness questions. Once you have identified the specific questions to address, the next step involves determining indicators and methods for each question. An indicator is a unit of information measured over time that documents changes in a specific condition. A good indicator is:

- **Measurable** – Able to be recorded and analyzed in quantitative or qualitative terms
- **Precise** – Defined the same way by all people
- **Consistent** – Not changing over time so that it always measures the same thing
- **Sensitive** – Changing proportionately in response to actual changes in the condition or item being measured

Finally, once you have identified your indicators, you have to determine which specific methods you will use to measure the indicators. A good method is:

- **Accurate –** Gives minimal or no error
- **Reliable –** Results are consistently repeatable
- **Cost-Effective –** Not overly expensive for the data the method yields or for the resources the project has
- **Feasible –** Project team has people who can use the method
- **Appropriate –** Makes sense in the context of the project

It is important to distinguish methods from indicators because any given indicator can be collected with great precision but at great cost, or much less precisely, but at lower cost. The key is to find the appropriate level for your needs. In almost all cases, the single best method is to make use of data that is already being collected by others.

Once you have developed your indicators and measures, the final steps are to implement them, analyze the results, and the use the results to adapt your plans and your actions. The key behind this approach to monitoring is to develop a “dashboard” of a minimum set of indicators that you will track over time to give you the information your audiences need to make the appropriate funding and management decisions.

Sources: Conservation Measures Partnership, The Nature Conservancy, and Foundations of Success

What Was the Process for Developing This Monitoring Framework?

The process we used to develop the Framework is described in detail in a companion document, *Monitoring the Conservation of Fish and Wildlife in the Northeast – The Process* (see also Box 1). Key process steps follow:

1) An initial workshop brought together a large group of key state and wildlife agency representatives and other experts to rapidly identify eight conservation targets (species, habitats, or ecosystems) that could collectively represent the overall status of fish and wildlife Species of Greatest Conservation Need in the Northeast region.
2) Following this workshop, small teams worked on each of the eight targets to identify up to five key indicators that provided a good understanding of the health of their target. Based on those indicators, the teams then developed first iterations of monitoring plans for how to compile and analyze relevant data. These draft plans also included attention to challenges or issues that might arise in the data collection phase.
3) Concurrent with the above steps, a ninth team also worked to establish a process for assessing the effectiveness of actions supported through State Wildlife Grants.
4) Each team working on targets and effectiveness measures also developed mock-ups for their sections for an overall report to decision makers. These mock-ups were limited to two pages per team and served as an effective means to focus the scope of what the team produced.
5) The reports generated by each team were then reviewed at a second workshop that brought together key steering committee members and other technical experts.
6) The products from this process were then compiled into the draft Framework presented in this document by steering committee members and staff of Foundations of Success.
7) This Framework is now available for review and consideration by the NEAFWA State Directors and other key individuals.

Who Is the Audience for the Results of This Monitoring Framework?

The primary audience for reports generated through implementation of this Framework is decision makers, including the United States Congress and the Office of Management and Budget. These decision makers have the power to determine funding levels for State Wildlife Grants programs and, therefore, need to know the money they allocate has been spent well. They also need to be aware of areas where greater funding could make a significant difference to the health of fish and wildlife in the region.

Although decision makers are the primary audience for this work, NEAFWA also recognizes the Framework and resultant analyses need to be useful to its members (state fish and wildlife agencies) and their stakeholders and partners. With this in mind, those participating in

the process tried to identify indicators that would be of interest to on-the-ground managers and that would not pose an excessive burden in terms of data collection – indicators that could help inform their work and indicators for which data were readily available.

How Should This Monitoring Framework Be Used?

This Monitoring Framework does not replace some of the detailed monitoring that states must do to ensure that populations of their Species of Greatest Conservation Need do not drop to the point where they will require protection under the Federal Endangered Species Act. Rather, it provides an early warning system for a broad array of SGCN, and it sets the context for states to showcase their fish and wildlife conservation efforts and challenges.

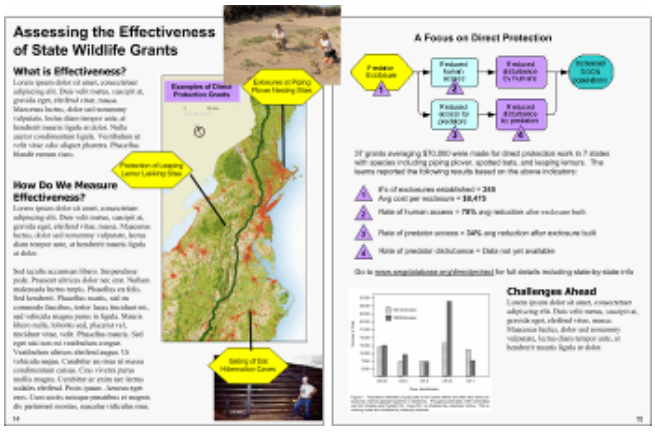
With this in mind, states can use the Framework to report how they are doing on indicators of regional concern. Alternatively or additionally, the Northeast region can report as a whole on how well it is protecting habitats and species that span across political boundaries. While this would require additional effort, it would be very powerful to show decision makers progress at the state level, as well as at the regional level—a scale that better captures entire ecosystems and broad-ranging species. Some states may not have sufficient funding or staff to implement the Framework in full. In such cases, states will need to consider their own priorities as well as those identified in the Framework to determine what parts of the Framework they will implement.

Results reported through the Framework may not always show favorable trends in indicators, but this is not necessarily a reflection of failure on the part of NEAFWA or its member states. Rather, it may signify, for example, that NEAFWA members have managed to slow rates of species' decline, but due to a variety of external factors, they have not completely halted the decline. In reality, such a situation represents a conservation success. All parties should use the Framework to communicate the progress they have made on specific actions, how these actions have influenced the status of fish and wildlife, and what the status of those fish and wildlife would have been in the absence of any action. Moreover, NEAFWA and its member states can use the Framework to identify areas where, despite progress from specific actions, the overall status of habits or species will worsen if they do not receive greater support.

Products Associated with This Monitoring Framework

There are three main products from the work that NEAFWA, partners, and stakeholders did to develop this Framework. These include:

1) **Framework report**. This document is the Framework report. It introduces the Framework, briefly describes it (including what data to collect and how to collect it), and provides detailed guidance for each component of the Framework (in appendices).
2) **Mock-ups of reports to decision makers.** The mock-ups—provided for a couple of targets and the effectiveness component—



illustrate the desired format for eventual reports to decision makers. These reports will be dynamic, colorful, and engaging publications and websites that include graphs, charts, and photos. These reports should help decision makers easily understand the state of fish and wildlife across the Northeast, the effectiveness of the work to conserve these resources, and the importance of their continued support for this conservation work.

3) **Process report.** This report details the process and key decisions NEAFWA used to develop the Framework. This report is intended to help other states who would also like to develop regional monitoring and performance reporting frameworks understand and learn from the NEAFWA process.

What Are the Limitations of This Monitoring Framework?

This Framework has a number of limitations that need to be kept in mind:

- **Limited scope.** The most obvious limitation of this Monitoring Framework is its scope. In an ideal world with unlimited funding for monitoring and decision makers who had endless amounts of time and interest, NEAFWA would have been able to create a framework that involved monitoring every Species of Greatest Conservation Need and its associated habitat across the entire region. However, this is not realistic and we had to make difficult decisions about what would constitute a realistic and yet useful set of indicators to measure. The group chose conservation targets that could collectively encompass much of the fish and wildlife that are the focus of the very comprehensive state Wildlife Action Plans. Our assumption was that if these conservation targets were in good health, then the fish and wildlife that are found in or depend on these targets would also be in good health. While it is not perfect, we feel confident that the information collected using this Framework will provide a good indication of the overall health of fish and wildlife species across the Northeast.
- **Incomplete targets.** We had a group of knowledgeable individuals working on each of the targets. However, we were not able to develop one of the target groups (managed grasslands and shrublands) because of lack of time and specific expertise. Likewise, the Framework component for regionally significant SGCN targets is incomplete. We have left these targets in the overall Framework though because they are important targets at a regional level and we hope that, with time, NEAFWA will be able to better develop these targets. Finally, the lakes and ponds target is incomplete for this version, as team members were making some final decisions about indicators. We expect that this target will be complete for the next version.
- **Gaps in information.** Team members had some remaining questions and uncertainties regarding the indicators or data sources. These uncertainties are noted in the sections for each conservation target. Given the scope of this project, it is not realistic to be able to resolve all questions and uncertainties. Nevertheless, it is important to recognize that as NEAFWA members implement the framework, they will need to address these questions and uncertainties. In the process of doing so, they will also likely have to modify the Framework. In this respect, the Framework should be considered a living document that should be adjusted over time as NEAFWA members implement it and identify opportunities for improvement.

3. Section A: Proposed Status Measures for Conservation Targets

As described in Box 1**, Status Assessments** examine the state of the system of interest at any given time. Specific status questions include:

- How are the fish and wildlife that we care about doing?
- How are the threats to fish and wildlife changing?

Status assessments gauge the status or general health of fish and wildlife populations and their habitats, without being linked to any specific intervention. They are analogous to the assessments a doctor will undertake at a yearly physical exam.

To define the status measures for the Northeast region, we used a methodology that builds off of work done by The Nature Conservancy and adopted by several organizations, including member organizations of the Conservation Measures Partnership.[1] In NEAFWA's case, the desired end product was a monitoring framework that reported on existing actions. With this in mind, we used specific tools and methodologies from the broader adaptive management process to develop the Framework.

The process for NEAFWA involved answering the question "What eight 'conservation targets' would you select to represent the fish and wildlife resources of the Northeast?" This is one of the first steps in a strategic planning process that includes identifying the direct threats and indirect threats and opportunities affecting those conservation targets. Our task, however, was focused specifically on the monitoring plan. With this in mind, we developed a limited suite of monitoring indicators to create a dashboard of the general health of fish and wildlife and their habitats in the Northeast. To identify appropriate indicators, we instructed teams to consider size and condition of the conservation target and the landscape context in which it is located – The Nature Conservancy calls these "key ecological attributes." The basic assumption was that these indicators would track the health of the targets and in turn, these targets would track the health of the fish and wildlife populations and their habitats. We also asked teams to fill out templates for each target, in which they would describe the target, prioritize indicators for the target, provide a condition assessment (if known), and develop the initial inputs for a monitoring plan (where are the data located, what is the quality of the data, who will collect the data, etc.). The outputs for this work are presented in Appendices 1-8.

In the following section, we summarize the target descriptions and chosen indicators (see Table 1 for a list of targets and indicators). The set of indicators within each target are in priority order, as determined by the target working groups. Criteria to determine priority included indicator

[1] See TNC, 2007. Guidance for Steps 2 & 3: Define Scope and Focal Targets & Assess Viability of Focal Conservation Targets in the TNC *Conservation Action Planning Handbook.* The Nature Conservancy, Arlington, VA. Available at: http://conserveonline.org/workspaces/cbdgateway/cap/resources.

relevance, cost, feasibility, proxy power/sensitivity, communications power, and quality of existing data. This priority order could shift in the future if new data or technology become available. Regardless, the prioritization will be important in situations in which limited resources restrict the extent to which the entire Framework can be implemented. For details on the targets and their indicators, please refer to the appendices to this document.

Table 1. Targets, Stressors, and Proposed Indicators

Fish, Wildlife, and Habitats (in alphabetical order)	**Proposed Indicators** (in order of importance for each species or habitat)	**Key Stressors** (in order of importance for each species or habitat)
1. Forests	1a. Forest area – by forest type 1b. Forest area – by reserve status 2. Forest composition and structure – by seral stage 4. Forest bird population trends	3. Forest fragmentation index 5. Acid deposition index
2. Freshwater streams and river systems	2. Distribution and population status of native eastern brook trout 4. Index of biotic integrity	1. % impervious surface 3. Stream connectivity (length of open river) and number of blockages 5. Distribution and population status of non-indigenous aquatic species
3. Freshwater wetlands	1. Size/area of freshwater wetlands 3. Buffer area and condition (buffer index) 4a. Hydrology – upstream surface water retention 4b. Hydrology – high and low stream 5. Wetland bird population trends	2. % impervious surface flow 6. Road density
4. Highly migratory species	1. Migratory raptor population index 2. Shorebird abundance 3. Bat population trends 4. Abundance of diadromous fish (indicator still under development) 5. Presence of monarch butterfly	
5. Lakes and ponds	3. Overall Productivity of Common Loons	1. % impervious surface/landscape integrity 2. % shoreline developed (shoreline integrity)
6. Managed grasslands and shrublands	To be developed	
7. Regionally Significant Species of Greatest Conservation Need	1. Population trends and reproductive productivity of federally listed species 2. State-listing status and heritage rank of highly imperiled wildlife 3. Population trends of endemic species	
8. Unique habitats in the Northeast.	2. Wildlife presence/absence 3. Wildlife population trends	1. Proximity to human activity/roads 4. Land use/land cover changes

Some Important Caveats

The Monitoring Framework is designed to help each NEAFWA state meet congressional expectations for Wildlife Action Plans and State Wildlife Grants programs. It will not replace some of the detailed monitoring that states will have to do to ensure that populations of their SGCN do not drop to the point where they will require protection under the Federal Endangered Species Act, but it will provide an early warning system for a broad array of SGCN, and it will provide the context or backdrop for states to showcase their fish and wildlife conservation efforts and challenges.

The two main audiences for this Framework are decision makers responsible for allocating funds to the State Wildlife Grants and NEAFWA resource managers. In order to be manageable, this Framework focuses on the most important monitoring needs common to all states and across the region. This means that the Framework cannot provide an all-inclusive view of how the Northeast region is performing. Rather, it must rely on key indicators that are illustrative of overall progress and that will serve as a dashboard of information to guide decision makers - political officials and conservation managers alike.

To really get a sense of the state of fish and wildlife across the Northeast, it is necessary to look at data collected for the whole suite of indicators across all targets. No one indicator – or even set of indicators – in isolation is sufficient to provide an adequate portrait of fish and wildlife status. Together, however, the indicators in this Framework can facilitate a broad assessment of how fish and wildlife in general are doing.

This leads to another important caveat: Not all species will be captured in this Framework. As discussed earlier, the scope of the Framework is necessarily limited by the resources available. Those involved in the Framework development chose targets and indicators that they felt would do a reasonably good job of representing the general status of the greatest number of fish and wildlife species. Several of these targets and indicators are habitat-related because species need sufficient, good-quality habitat to survive. Though neither perfect nor inclusive, this strategic decision seemed the most appropriate, given the resources available.

Finally, another issue to keep in mind is that some indicators are based on data that are measured only periodically (e.g., every 5 or 10 years). In these cases, Framework implementers will need to rely on other indicators within the target group to show annual trends. Over time, it may be necessary to identify additional indicators to ensure that there are sufficient indicators to adequately track annual trends.

Target 1. Forests

See Appendix 1 for a draft plan that describes the forests target and the data to be collected.

Description of Forests Target

Forests are the dominant ecosystem of the Northeast landscape, covering over 65% of its total area. Trees structure the forest, but forests include the diversity of shrubs, herbs, wildlife, and soils, as well as the natural and human disturbances that shape them. This target does not include wetland forests, as these are addressed under the wetlands target.

Subtargets:
There are several subtargets within the broader forests target:

- **Southern Broadleaf Evergreen Forest** – beech-magnolia-oak forests and live oak forests in the Atlantic coastal plain region.
- **Coastal Plain Pine Forest** – longleaf pine and other pine forests of the Atlantic coastal plain region.
- **Central Oak Hardwood & Pine Forest** –common central hardwood types.
- **Northern & Central Mesophytic Hardwood & Conifer Forest** –common northern hardwoods types (including red spruce-fir-hardwoods).
- **Eastern North America Ruderal and Plantation Forest** – both planted (plantation) forest and forests established on abandoned agricultural or other heavily disturbed sites.

Indicators of Forests Status

1a. Forest Area - by Forest Type

This indicator reports the areal extent of forested lands in the northeastern United States. Knowing how much land is forested is vital to making informed decisions about forests. Gains and losses in forest area directly affect the public's continued enjoyment of the goods and services that forests provide – for example, recreation, lumber, and watershed protection. Gains and losses in forest size affect the type of species and processes that occur in the patches. They also affect the resistance and resilience of forests to natural and anthropogenic disturbances (adapted from Heinz Center 2002).[2] Forest Inventory and Analysis (FIA) Program has available data on forest type throughout the Northeast.

1b. Forest Area - by Reserve Status

This indicator reports how much forest land there is in particular land use categories based on conservation reserve status. Knowing how much land is forested and how much is in reserve is vital to making informed decisions about forests. Forests in reserve versus non-reserve often have very different goals, differences that are reflected in management priorities and practices (adapted from Heinz Center 2002).[3] The FIA Program also has available data on reserve status of forested areas in the Northeast.

2. Forest Composition and Structure - by Seral Stage

This indicator reports the percentage of forest lands with stands in several development stages. Forests of different developmental stages often provide different goods, services, and values. For example, woodpeckers and species that need trunk cavities for nesting find older forests, with their dead trees, a suitable habitat. Younger forests, with their rapid growth and smaller trees, provide habitat for species such as the Kirtland's warbler, which can only live in forests recently regenerated after fire (adapted from Heinz 2002).[4] Seral stage is currently available from FIA data based on saw-timber seral stages: (1) Non-stocked, (2) Small diameter, (3) Medium

[2] Heinz Center. 2002. The State of the Nation's Ecosystems. Measuring the Lands, Waters, and Living Resources of the United States. The H. John Heinz III Center for Science, Economics, ad the Environment. Cambridge University Press, New York, NY 270 pp.
[3] Ibid.
[4] Ibid.

diameter, and (4) Large diameter. An alternative ecologically-based measure of seral stage has five stages: (1) Sapling, (2) Pole, (3) Mature, (4) Old-growth and (5) Mature-sapling mosaic (see Goodell and Faber-Langendoen 2007 for details).[5]

3. Forest Fragmentation Index

Habitat fragmentation is the process of subdividing continuous habitat into smaller patches, resulting in a variety of deleterious effects on wildlife populations. This indicator reports on the relative level and causes of forest fragmentation in northeastern forests based on a GIS data and methods developed by Wade (2004)[6] for the National Atlas Project. Wade reports on three fragmentation indices: forest connectivity (pff), human caused fragmentation (pfa) and natural fragmentation (pfn). For this indicator, the mean value of each index will be calculated for the region as a whole and for all subtargets.

4. Forest Bird Population Trends

Birds stand out among other wildlife taxa as excellent indicators of forest condition. They occur in all forest types and respond quickly to environmental change. Many bird species are sensitive to less visibly apparent threats as well, such as chemical toxins, climate change, or various forms of avian disease. Birds also have a popular appeal that can be used to engage volunteers in data collection at spatial and temporal scales that would otherwise be impossible. This indicator draws on results of the North American Breeding Bird Survey (BBS; 1966-2006) for four groups of birds: Woodland Breeding Birds, Successional or Scrub Breeding Birds, Cavity Nesting Birds, Mid-story or Canopy Nesting Birds. For each group, we will report the number of species with sufficient data to qualify for analysis, the proportion of these species with significant negative trends, the proportion with significant positive trends, the proportion with no significant trend detected, and the mean trend for the group. BBS data are limited to roadside habitat and are subject to sources of error and bias, however the length, continuity, and geographic scope of the survey are unparalleled in the region.

5. Acid Deposition Index

This indicator reports on the relative sensitivity of northeastern forests to acid rain as estimated by spatially explicit models of sulfur and nitrogen deposition (Miller et al. 2005).[7] Excess sulfur and nitrogen can have a profound effect on forest ecosystems by reducing the supply of nutrients available for plant growth. This increases the vulnerability of forests to climate, pest and pathogen stressors. Over time, acid deposition can lead to reduced overall forest health, smaller timber yields and eventual changes to forest species composition. The metric for this indicator will be the percentage of forest area considered to be “impaired” by acid deposition (Miller 2005), summarized for the region as a whole and for each subtarget. This indicator requires spatially explicit information on current forest cover, soil characteristics, and relative levels of sulfur and nitrogen deposition. Data on land cover and soils can be obtained from a variety of sources and generally provide a “snap shot” of current conditions. On the other hand, data on

[5] Goodella, Lisa and Don Faber-Langendoen. 2007. Development of stand structural stage indices to characterize forest condition in Upstate New York. Forest Ecology and Management. Vol. 249, Issue 3. Pages 158-170

[6] Wade, Tim. 2004. Causes of Forest Fragmentation in the United States – 270 Meter Resolution: National Atlas of the United States, Reston, VA. (http://www.nationalatlas.gov/)

[7] Miller, E.K., A. VanArsdale, G.J. Keeler, A. Chalmers, L. Poissant, N. Kamman, and R. Brulotte. 2005. Estimation and Mapping of Wet and Dry Mercury Deposition Across Northeastern North America. Ecotoxicology 14: 53-70.s

sulfur and nitrogen are monitored on a continuous basis and are likely to have the largest impact on measuring changes to this indicator over time.

Table 2. Summary Matrix of Forest Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1a. Forest Area – by Forest Type	Areal extent of forested lands	Forest Inventory and Analysis (FIA) Program	Margin of error in can be as high as 10% FIA categories for Reserve status need to be migrated to the Conservation Lands categories
1b. Forest Area – by Reserve Status	How much forest in a land use category	FIA Program	Margin of error in can be as high as 10% FIA categories for Reserve status need to be migrated to the Conservation Lands categories
2. Forest Composition & Structure by Seral Stage	% of forest lands with stands in several development stages	FIA	FIA data currently only available for timberlands – recent memorandum of understanding has given US Forest Service permission to establish plots in national parks FIA data based on saw-timber age but would be preferable to use ecologically based seral stage index. Methods available for converting but need more testing.
3. Forest Fragmentation Index	Relative level & causes of forest fragmentation Index based on forest connectivity, human caused fragmentation, & natural fragmentation	US EPA National Atlas Project	Fragmentation index data is out of date – need to run again with current data
4. Forest Bird Population Trends	Population trends of Woodland Breeding Birds, Successional or Scrub Breeding Birds, Cavity Nesting Birds, Mid-story or Canopy Nesting Birds	North American Breeding Bird Survey (BBS)	BBS data limited to roadside habitat, subject to multiple sources of bias and error, and do not include environmental or management covariates

Indicator	Description	Potential Data Sources	Potential Issues*
5. Acid Deposition Index	Forest area considered "impaired" by acid deposition (for region & sub-targets)	US NADP, CASTNet, and NOAA's AirMon deposition monitoring network	Differences in sampling design, frequency, & analysis across programs (though data sets appear compatible) Analysis requires complex spatial monitoring & skilled GIS technicians

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

Target 2. Freshwater Streams and River Systems

See Appendix 2 for a draft plan that describes the freshwater streams and river systems target and the data to be collected.

Description of Freshwater Streams and River Systems Target

Freshwater Stream and River Systems are defined as all non-tidal flowing surface waters. The physical, chemical, and biological properties of streams vary considerably throughout the Northeast. Most (although not all) of this variability is due to differences in stream size, latitude, and geology. These, in turn, influence temperature, gradient, substrate (the material that makes up the stream bottom), how much acidity can be neutralized, and the primary sources of food for stream invertebrates. Although some states have described the different types of streams found within their borders, a thorough investigation to characterize the different types of streams found throughout the Northeast is warranted. Several efforts in the Northeast are beginning to address this need, such as the Great Lakes Regional Aquatic Gap Analysis Project.

Indicators of Freshwater Streams and River Systems Target

1. Percent Impervious Surface

The proportion of land area covered with impervious features (e.g. roads, parking lots, driveways, and roof-tops) is associated with degradation of streams and rivers. Due to reduced infiltration of rainwater, flooding tends to be more frequent and erosive. As a result, increasing amounts of impervious land cover in a watershed contributes to increases in stream temperature, more sediment, and less structural habitat. Chemical pollution also tends to be higher in areas with an abundance of roads, parking lots, and houses. The USGS is the source of National Land Cover Data (NLCD), which includes GIS-compatible data layers on impervious surfaces and is anticipated to be updated approximately every 10 years.

2. Distribution and Population Status of Native Eastern Brook Trout

The eastern brook trout (*Salvelinus fontinalis*) provides a useful indicator because it is a popular game fish, its presence is indicative of the highest quality streams, with both good water quality and physical habitat, and it is recognized by resource managers and the scientific community as an important and imperiled species for northeast aquatic systems. Loss of eastern brook trout from streams and watersheds represents a severe loss of ecosystem integrity and biodiversity. The Eastern Brook Trout Joint Venture (www.easternbrooktrout.org) provides current statistics

on brook trout populations in subwatersheds throughout the Northeast. The statistics describe the current status of brook trout populations in those subwatersheds where brook trout historically thrived. Classifications range from "Intact" (90-100% historical habitat occupied by self-reproducing brook trout) to "Greatly reduced" (1-50% historical habitat occupied by self-reproducing brook trout) to "Extirpated" (brook trout have vanished from the subwatershed).

3. Stream Connectivity (Length of Open River) and Number of Blockages

Stream blockages such as dams, weirs, and culverts can prevent migratory fishes access to spawning and nursery habitats. They have also been responsible for population extirpations, reductions in river basin distribution, and general population depletion of migratory species throughout the world, including the northeastern United States. Like migratory species, many resident fishes move to preferred local seasonal habitats for spawning and feeding and also to refugia during times of stress. The influence of blockages on resident fishes can be profound. The most pervasive influence may be as barriers to upstream re-colonization. Blockages can interrupt interactions among individuals in different streams. Fragmented and isolated populations upstream of a blockage can result in local extinctions following catastrophic events. These events may displace or eliminate all or part of a stream fish community, after which re-colonization is impossible. Stream blockages may have more pronounced effects on rare resident species because fragmentation of populations of rare species often increases the likelihood of local extinction. Barriers have also been implicated in the decline of freshwater mussels in parts of the northeastern United States. Among other data available, USFWS's National Fish Passage Program collects data on connectivity and blockages.

4. Index of Biotic Integrity

A multi-metric index can help summarize complex physical, chemical and biological information for streams and other aquatic habitats. These metrics are based upon *expected* conditions for minimally disturbed streams of similar type. For fish, these multi-metric measures, based upon the structure and functional components of a biotic assemblage, are often referred to as an *Index of Biotic Integrity* (IBI). A multi-metric index builds upon individual aspects of stream health such as the presence or absence of rare, threatened, or endangered fish species, the number of pollution-sensitive benthic macroinvertebrates, and trophic status to provide a comprehensive assessment of the ecological health of a system. The benthic macroinvertebrate IBI is widely used by state and federal agencies to assess the ecological integrity of streams and has been incorporated into the water quality criteria regulations of some state agencies. As such, it has been valuable for prioritizing streams for restoration and protection.

5. Distribution and Population Status of Non-Indigenous Aquatic Species

Non-indigenous aquatic species are those that enter a body of water or aquatic ecosystem outside of their historic or native range. They may be vertebrates, invertebrates, plants, or diseases (e.g., common carp (*Cyprinus carpio*) in freshwater systems). Invasive non-indigenous aquatics are a major cause of biodiversity loss. They alter ecosystems by preying on or out-competing native species, hybridizing with native species, or introducing and spreading diseases to native species. Non-indigenous aquatic species may be more likely to become established when stream and watershed conditions are degraded, such as when waters warmed as a result of watershed damage support non-indigenous fish species that could not survive under colder conditions.

The National Biological Information Infrastructure (NBII) Invasive Species Information Node provides links to databases of aquatic and terrestrial invasive species (http://invasivespecies.nbii.gov/dbases.html). The most comprehensive way to access information on the geographic distribution of non-indigenous aquatics is through the USGS Nonindigenous Aquatic Species (NAS) website (http://nas.er.usgs.gov/queries/). In addition, NatureServe maintains a database of the current and historic presence of native species, which can be used to estimate the reduction in native fauna from historic levels.

Table 3. Summary Matrix for Freshwater Streams and River Systems Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. % Impervious surface	Proportion of land area covered with impervious features	National Land Cover Data (NLCD)	Watersheds as the scale at which to assess imperviousness
2. Distribution and Population Status of Native Eastern Brook Trout	Population dynamics of Eastern Brook Trout	State fisheries agencies, Eastern Brook Trout Joint Venture website	Distribution, resolution and consistency of the data Capacity to fund compiling and analyses
3. Stream Connectivity (Length of Open River) and Number of Blockages	Length of open river Blockages to stream connectivity by dams, weirs, and culverts	USFWS Fish Passage Program, NGOs and Federal agencies involved with fish passage, Sport Fish Restoration and SWG projects collect fish count data	Frequency and timeliness of updated information/data collection
4. Index of Biotic Integrity	Multi-metric index that includes complex physical, chemical and biological information for streams and other aquatic habitats	State fisheries/ natural resources agency or state affiliate of the EPA	Sound development of each metric of the IBI Differences in stream type Comparability of IBI scores across the region
5. Distribution and Population of Non-Indigenous Aquatic Species (NAS)	Populations of species in an aquatic ecosystem outside of its historic or native range	USGS-NAS program, *NatureServe*	Data collection is piecemeal NAS will only become more widespread over time, so unclear how to gauge success

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

Target 3. Freshwater Wetlands

See Appendix 3 for a draft plan that describes the freshwater wetlands target and the data to be collected.

Description of Freshwater Wetlands Target

Wetlands are ecological communities that occur at the transition of terrestrial and aquatic systems and are defined by hydrology (depth and duration of flooding), soils, and vegetative cover type. They include wetlands formed by peat (bogs/fens), freshwater marshes, floodplain or swamp forest, and vernal pools. U.S. Fish and Wildlife Service's Wetlands Status and Trends survey monitors wetlands because they support a variety of fish and wildlife species and contribute to the aesthetic and environmental quality of the U.S. Millions of Americans use freshwater wetlands annually for hunting, fishing, bird watching and other outdoor activities.

Indicators of Freshwater Wetlands Target

1. Size/Area of Freshwater Wetlands

This indicator shows trends in the total extent of wetlands in the contiguous U.S., regardless of land ownership. Data analysis and assessment of wetland area, including trends analysis, have been regularly conducted by the US Fish and Wildlife Service beginning in the 1950s. Surveys are conducted approximately every 10 years using a probabilistic design Thousands of sample plots are examined with the use of aerial imagery, and about one-third are verified in the field to address questions of image interpretation, land use coding, and attribution of wetland gains or losses. This is a priority indicator because it has a clear and measurable baseline, trends are readily interpreted, and it is very relevant to policy makers. Next steps in using this indicator include working with the USFWS to generate a northeast states evaluation, and addressing the fact that the survey may omit or undercount certain types of wetlands (forested, ephemeral, and well-drained agriculture) and does not include wetland parcels less than approximately 1 acre.

2. Percent Impervious Surface

Percent (%) impervious surface in a watershed (Hydrologic Unit Code – 11) is a good indicator of relative impact of nearby land use, and is also rapid and cost-effective to assess. Impervious surfaces are a major anthropogenic stressor to wetlands and contribute to reductions in native vegetation and increases in nutrient loads, sediment, water temperature, and contaminants. Data to assess percent impervious surface are readily available from the 2001 National Land Cover Dataset (NLCD), the National Hydrography dataset (NHD), and National Wetland Inventory (NWI) maps. A standardized wetland classification system is currently being created for the 14 northeast states via the Northeast Habitat Classification and Mapping project, which will greatly enhance our ability to assess and compare impacts from impervious surfaces. Condition gradients (excellent, good, fair, poor) for impervious surface impacts to wetlands have been defined for this project (see Appendix 3); full implementation of this indicator is easily calculated, especially if one, standardized, automatic computer analysis is defined and used across all states.

3. Buffer Area and Condition (Buffer Index)

Buffers can be characterized by their extent (length), width (depth), and condition. The ability of buffers to protect a wetland increases with the extent of buffers along the wetland perimeter. A wider buffer has a greater capacity to serve as habitat for wetland edge dependent species, to reduce the inputs of non-point source contaminants, to control erosion, and to generally protect the wetland from human activities. The condition or composition of the buffer, in addition to its width and extent around a wetland, determines the overall capacity of the buffer to perform its critical functions. One metric of this indicator is the Buffer Index (taken from Collins et al. 2006),[8] which is a measure of the overall area and condition of the buffer immediately surrounding the wetland, using 2 measures: percent of wetland with buffer and average buffer width. This metric can be adapted for remote sensing data and for small buffers. Condition gradients (excellent, good, fair, poor) for buffers have been defined for this project (see Appendix 3), full implementation of this indicator is easily calculated, especially if one, standardized, automatic computer analysis is defined and used across all states. The next step in improving buffer analyses will be to fully digitize wetland maps.

4a. Hydrology – Upstream Surface Water Retention (primary metric)

Upstream surface water retention is a measure of the percentage of the contributing watershed that drains into water storage facilities (e.g., reservoirs, sediment basins, or retention ponds), which are capable of storing surface water from several days to months. Ecological processes of riparian areas are driven to a large degree by the magnitude and frequency of peak flows and the duration and volume of base flows. The biotic and physical integrity of riparian areas are dependent on the natural variation associated with these flow characteristics. The amount of water retained in upstream facilities has a direct effect on these flows and subsequent effects on the biotic and physical integrity of the riparian area. The next step to fully implement this indicator is to compile GIS layers of surface water retention facilities.

4b. Hydrology – High and Low Stream Flow (secondary metric)

Flow is a critical aspect of the physical structure of stream ecosystems and associated floodplain wetlands. High flows shape the stream channel and clear silt and debris from the stream. Some fish species depend on these high flows for spawning. Low flows define the smallest area available to stream biota during the year. In some cases, the lowest flow is no flow at all—particularly in arid and semi-arid regions where intermittent streams are common. Riparian vegetation and aquatic life in intermittent streams have evolved to complete their life histories during periods when water is available; however, extended periods of no flow can still impact their survival. The timing of high and low flows also influences many ecological processes. Data for this indicator is collected by USGS stream gauging sites.

5. Wetland Bird Population Trends

Birds stand out among other wildlife taxa as excellent indicators of wetland condition. They occur in all wetland types and respond quickly to environmental change. Their mobility allows them to leave locations that do not meet their basic requirements and colonize areas where suitable habitat arises. Moreover, birds have a popular appeal that can be used to engage

[8] Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2006. California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas. Version 4.2.3. 136 pp.

volunteers in data collection at spatial and temporal scales that would otherwise be impossible. Because birds are biologically meaningful and practical indicators, they have been the subject of countless studies in the Northeast. The North American Breeding Bird Survey (BBS) presents the opportunity to describe changes in wetland bird populations since 1966. However, BBS data are limited to roadside habitat, are subject to multiple sources of bias and error, and do not include environmental or management covariates.

6. Road Density

This indicator is designed to measure the road density of paved and first dirt class roads. Roads are a primary form of habitat modification and can have negative effects on wetlands, including, for example, loss of wetland biodiversity, habitat fragmentation, and barriers to amphibian movement. TIGER (Topologically Integrated Geographic Encoding and Referencing System), NWI, or National Land Cover Data (NLCD) can be used to calculate the length of road per unit area. A ranking of wetland condition (excellent, good, fair, poor) needs to be identified. Until then, relative condition can be ascertained; the smaller the road density, the better the wetland condition.

Table 4. Summary Matrix for Freshwater Wetlands Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. Size/Area of Freshwater Wetlands	Total extent of wetlands by area	USFWS Status and Trends http://wetlandsfws.er.usgs.gov/status_trends/index.html	Differing wetland classification methods Ephemeral waters not recognized as wetland type Forested wetlands and small isolated patches are difficult to photo-interpret
2. % Impervious surface	Percent (%) impervious surface in watershed	NWI maps; NLCD 2001 Impervious Surface layer; future use of NHD High Resolution maps; NHD+, NLCD non-natural layers	Lack of fully digitized wetland maps Lack of standardized wetland classification system Lack of automated computer analyses for impervious surface across states
3. Buffer Area and Condition	Buffer Index – Overall area and condition of the buffer immediately surrounding the wetland, calculated using 2 measures: percent of wetland with buffer and average buffer width.	Collins et al (2006), adapted for remote sensing, and for small buffers.	Lack of fully digitized wetland maps Lack of automated computer analyses for buffers across states

Indicator	Description	Potential Data Sources	Potential Issues*
4a. Hydrology – Upstream Surface Water Retention (primary metric) 4b. Hydrology – High and Low Stream Flow (secondary metric)	Amount of water retained in upstream water storage facilities Flow of water in streams and rivers	Data layers on water diversions managed by USGS	Variability across states on water diversion data Non-random gauge placement by USGS
5. Wetland Bird Population Trends	Changes in population levels of 7 species of wetland-breeding birds: Great Blue Heron Marsh Wren Prothonotary Warbler Northern Waterthrush Louisiana Waterthrush Red-winged Blackbird Swamp Sparrow	North American Bird Breeding Survey (BBS), Atlantic Flyway Breeding Waterfowl Survey (BWS)	BBS counts birds in roadside habitat, including wetlands, so trends may not reflect changes in overall wetland bird populations BBS subject to multiple sources of bias and error and exclude environmental or management covariates There is a need for regionally coordinated monitoring designed specifically for wetland birds, including secretive marsh birds
6. Road Density	Road density of paved and first dirt class roads	US Census Bureau, TIGER (Topologically Integrated Geographic Encoding and Referencing System), NWI, NLCD	Lack of fully digitized wetland maps Lack of standardized wetland classification system Lack of automated computer analyses for road density across states

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

Target 4. Highly Migratory Species

See Appendix 4 for a draft plan that describes the highly migratory species target and the data to be collected.

Description of Highly Migratory Species Target

This target is comprised of migratory species or populations of resident species that are migratory through the northeastern states at some point in their life cycle. At least four sub-target groups make up this target: birds, mammals, diadromous fish, and migratory invertebrates (notably the monarch butterfly). While each species faces distinct threats, the group shares several key ecological attributes that make them important as a broad-based indicator of

conservation effectiveness in the northeastern region. This target focuses on the migratory life cycle of the species involved and develops indicators based on monitoring during migration. Two broad ecological features of this target that are most closely linked to this region include: stopover habitats necessary for the survival of the species and critical to successful migration, and ecological threats and processes directly affecting species in migration, such as wind power development. Some regional ecosystem functions, such as migratory corridors and linkages could also be considered part of this target, although we did not identify specific indicators for them.

Indicators of Highly Migratory Species Target

1. Migratory Raptor Population Index

Well-established raptor migration concentration sites across the northeastern region provide an ideal indicator of a suite of high-order predators that have in the past and may again be used as a bell-weather for environmental responses to broad-scale factors. The Migratory Raptor Population Index (RPI) is a sophisticated analysis of existing, ongoing hawk migration counts that track the direction in annual population trend for the most commonly observed birds of prey at the best-monitored sites. RPI has been developed for at least 5 northeastern hawk count sites, and provides an indicator of the health of highly migratory birds of prey, which themselves are good indicators of higher-order functions in the environment.

2. Shorebird Abundance

Indicative of changes at hemispheric scales, migratory shorebirds concentrate at well-known points during migration. This indicator includes migratory shorebirds monitored through the Program for Regional and International Shorebird Monitoring (PRISM) and its International Shorebird Surveys (ISS) coordinated by Manomet Center for Conservation Science. An international network of shorebird stopover sites is currently monitored, predominately by volunteers, and information is collated from many sites in the northeastern states into a national database. Raw data are in the form of counted or estimated totals at a site.

3. Bat Mortality

Bat mortality at wind energy installations is an indicator that is derived from observations of mortality of poorly known migratory bats, particularly migratory tree bats in the genus *Lasiurus*, at recently developed wind energy installations. The species include the red bat, hoary bat, and silver-haired bat. Monitoring for these species has been established at wind power sites in the Allegheny Mountains since installation in about 2004. Pennsylvania has developed and is employing monitoring protocols at sites statewide, while other states have developed but not yet implemented guidelines. Consistent use of standard methods across the region is needed for this indicator to be most effective. Raw data are in the form of dead animals per turbine per day.

4. Abundance of Diadromous Fish

Several species important to this region are highly migratory, including the American shad (*Alosa sapidissima*) and the Atlantic eel *(Anguilla rostrata*) as well as native Atlantic salmon populations. These species face a number of threats closely tied to the Freshwater Streams Target, particularly stream blockages (an indicator for that target). Monitoring efforts that track the abundance of diadromous fish serve as an indicator for both migratory species and freshwater

habitats. *(Note: This indicator should be part of the Framework, but it has not yet been developed in Appendix 4)*

5. Presence of Monarch Butterfly

The Monarch Butterfly is the best known of several migratory insect species in the northeastern states. This is a species associated with early-succession habitats, completing one breeding cycle within the Northeast prior to its migration to Mexico. Some monitoring is in place to track this species during migration. A volunteer network has been established to report monarch migration, and national tag recoveries are collated into a web-based database.

Table 5. Summary Matrix for Highly Migratory Species Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. Migratory Raptor Population Index	Direction in annual population trend for the most commonly observed birds of prey at the best-monitored sites	NGOs & volunteers, guided by Hawk Migration of North America (www.hmana.org)	Robust indices need to be developed for more sites with longer-term data sets
2. Shorebird abundance	Migratory shorebird population trends	Manomet Center for Conservation coordinates (www.manomet.org)	Further analysis is needed to evaluate survey intensity & sampling issues necessary to produce a reliable index
3. Bat Mortality	Mortality of poorly known populations of migratory bats (particularly those in the genus *Lasiurus*) at recently developed wind energy installations	USFWS, State Agencies, & wind developers in collaboration	Methodology is just now being developed & standardized for mortality monitoring to compensate for carcass removal & searching efficiency
4. Abundance of Diadromous Fish	Represented in other targets, so not developed here	Represented in other targets, so not developed here	Represented in other targets, so not developed here
5. Presence of Monarch Butterfly	Monarch Butterfly population trends	Several efforts, including Cape May Bird Observatory	Standardized monitoring methods & data management standards are needed

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

Target 5. Lakes and Ponds

See Appendix 5 for a draft plan that describes the lakes and ponds target and the data to be collected.

Description of Lakes and Ponds Target

Lakes and ponds are defined as all naturally occurring permanent standing bodies of freshwater, including those that may be altered, modified, or dammed. Delaware and Maryland have no naturally occurring lakes, and Virginia has very few. Lakes and ponds are highly diverse in terms of size, configuration, water chemistry, and biota. Differences between lakes and ponds are also less than clear, but in general, ponds are considered those standing water bodies sufficiently shallow to allow sunlight to reach the pond bottom. Potential threats to lakes and ponds in the northeast include direct habitat modification, flow alteration, pollution, invasive species, and climate change. The desired conditions for all lake and pond communities include:

- Naturally reproducing populations of Species of Greatest Conservation Need (SGCN)
- Intact shorelines.
- Minimally disturbed littoral zones
- Evolutionary processes not accelerated by disturbance
- Pollutant levels below concentrations that would adversely affect SGCN
- Absence of exotic species that adversely affect SGCN
- Unimpeded access of SGCN to habitats required for the maintenance of complete life cycle functions
- Unaltered hydrological and temperature regimes

Indicators of Lakes and Ponds Target

1. Percent Impervious Surface/Landscape Integrity

The proportion of land area covered with nonporous features (e.g. roads, parking lots, driveways, and roof-tops) has been shown to be associated with degradation of lakes and ponds. Due to reduced infiltration of rainwater, flooding tends to be more frequent and erosive. As a result, increasing amounts of impervious land cover in a watershed contributes to increases in water temperature and sediments washed into water bodies. Chemical pollution also tends to be higher in areas with an abundance of roads, parking lots, and houses. Generally, the degree of imperviousness increases with increasing urbanization within a watershed. The USGS is the source of National Land Cover Data (NLCD), which includes GIS-compatible data layers on impervious surfaces and is anticipated to be updated approximately every 10 years.

2. Percent Shoreline Developed (Shoreline Integrity)

This indicator would report on the degree of human development within 200 meters of the shoreline of lakes and ponds in the Northeast US. The degree of shoreline integrity, or the percentage of shoreline developed can be calculated using National Land Cover Data (NLCD) and data classification developed as part of NEAFWA's Regional Habitat Classification Project.

Development along the shores of lakes and ponds in the Northeast can be detrimental to Species of Greatest Conservation Need populations that utilize these habitats. Shoreline development

contributes to eutrophication through both impervious cover runoff, septic system leeching, and direct modification and simplification (e.g., removal of vegetation and woody debris sources for the lake) of the shoreline. Most lakefront developments are serviced by septic systems because of their seasonal use or distance from wastewater treatment plants. Because of their proximity to lakes, septic systems can become a source of subsurface phosphorus seepage to the lake. Poorly functioning waterfront septic systems have been shown to be an important source of phosphorus and nitrogen in a wide range of lake systems (Harper 1995, Robertson and Harman 1999, Arnade 1999).[9] Direct application of fertilizers and pesticides near the shoreline can enter the lake or pond and aggravate aquatic habitat degradation. Although the relative impact of shoreline and shoreline buffer development versus watershed development to overall lake biotic integrity has not been well studied, shoreline development has been associated with many other negative impacts on lake ecosystems. For example, a number of studies have noted declining fish abundance or diversity with increasing shoreline development (Hinch and Collins 1993, Hinch et al 1994, Bryan and Scranecchia 1992).[10] Fish foraging and spawning have also been shown to decline as a direct function of cottage or home density around the lakeshore (Engel and Pederson 1998).[11] Alteration of the littoral habitat is particularly noted as a critical concern because many fish species spend at least part of the lifecycle in the shallow littoral zone of lakes and ponds. Maintaining shade, leaf litter, woody debris, complexity of emergent and submergent plants, and water quality components of the littoral habitat becomes increasingly difficult with shoreline development. Bird species, such as eagles, loons, and songbirds, have also been found to avoid developed lakes. Whether due to loss of nesting sites, changes in prey base, or lack of tolerance for noise or other disturbances, their avoidance has been noted at a relatively low rate of cottage development (Johnson and Brown 1990, Heimberger et al 1983).[12] Similar relationships have been discovered for amphibians and reptiles which utilize the lakeshore to bask, feed, nest, and overwinter (Engel and Pederson 1998).[13] Since lakefront property is so desirable, it is quite common to have intense lakefront development in otherwise lightly developed watersheds. These shorelines are often increasingly developed as additional owners build summer homes or cottages and seek both good access to the water and an unobstructed view of the lake. The greatest density of homes is usually found within 500 ft (150m) of the lake and less density further away.

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[9] Harper, H.H. 1995. Effects of Groundwater Seepage from Septic Tank Areas on Nutrient Loadins and Bacteriological Inputs to Clear Lake.
Arnade, L.J. 1999. Seasonal Correlations of Well Contamination and Septic Tank Distance. Ground Water 36(6):920-923.

[10] Hinch, S.G. and Collins, N.C. 1993. Relationships of Littoral Fish Abundance to Water chemistry and Macrophyte Variables in Central Ontario Lakes. Canadian Journal of Fisheries and Aquatic Sciences 50.
Hinch, S.G., Somers, K.M., and N.C. Collins. 1994. Spatial Autocorrelation and Assessment of Habitat-Abundance Relationships in Littoral Zone Fish. Canadian Journal of Fisheries and Aquatic Sciences 51:701-712.
Bryan, M.D. and D.L. Scranecchia. 1992. Species Richngess, Composition, and Abundance of Fish Larvae and Juveniles Inhabiting Natural and Developed Shorelines of a Glacial Iowa Lake. Environmental Biology of Fishes 35.

[11] Engel, S. and J.L. Pederson. 1998. The Construction, Aesthetics, and Effects of Lakeshore Development: A Review. Wisconsin Department of Natural Resources.

[12] Johnson, W.N. Jr., and P.W. Brown. 1990. Avian Use of a Shoreline buffer Strip and an Undisturbed Lakeshore in Maine. Northern Journla of Applied Forestry 7: 114-17.
Heimberger, M., Euler, D, and J. Barr. 1983. The Impact of Cottage Development on Common Loon Reproductive Success in Centeral Ontario. Wilson Bulletin 95:431-439.

[13] See footnote 11.

3. Overall Productivity of Common Loons

Loons (*Gavia* spp) are generally considered to be good indicators of high quality lacustrine habitats. With increasing human presence and activity in formerly high quality areas, however, the status of Common loon (*Gavia immer*) now also serves as indicator of aquatic health and landscape-level alterations in aquatic environments (Evers 2004).[14] As a top predator in the aquatic food chain of many lakes, the Common loon can also serve as a good measure of mercury in lacustrine systems. Monitoring the status of the Common loon can also provide fisheries and wildlife managers with insight into the status of other Species of Greatest Conservation Need that utilize lakes and ponds in the Northern-most northeast states (MA, ME, NH, NY, VT).

Estimating Overall Productivity of Common Loons: Estimated overall productivity is best determined by counting the number of territorial pairs and the number of fledged young within a target area (or number of chicks fledged per number of territorial pairs). Because the number of young that actually fledge is difficult to substantiate, most monitoring programs use a surrogate of "chicks greater than 6 weeks of age" (or nearly in full basic plumage). Chick mortality after six weeks is minimal and serves as a suitable predictor of fledging rate (Evers 2004).[15]

Table 6. Summary Matrix for Lakes and Ponds Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. % Impervious Surface	Proportion of land area covered with impervious features	National Land Cover Data (NLCD)	Watersheds as the scale at which to assess imperviousness
2. % Shoreline Developed	Degree of development within 200 meters of the shoreline of lakes and ponds	NLCD NEAFWA's Regional Habitat Classification Project	Potential need to adjust buffer distance to lake size NLCD data updated only every 10 years (last update 2001)
3. Overall Productivity of Common Loons	# territorial pairs # of fledged young within a target area Or # chicks fledged per # territorial pairs	Loon monitoring programs exist in ME, MA, NH, NY, and VT. Generally managed collaboratively by state Fish & Wildlife agencies and non-governmental organizations.	Lakes with loons that are not breeding probably should not use loons as an indicator species, since loons regularly wander and use lakes for non-breeding purposes. Changes in loon chick productivity should be assessed over several years in order to reduce impact of single year dips or peaks.

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

[14] Evers, D. C. 2004. Status assessment and conservation plan for the Common Loon (Gavia immer) in North America. U.S. Fish and Wildlife Service, Hadley, MA.
[15] Ibid.

Target 6. Managed Grasslands and Shrublands

A working group for the managed grasslands and shrublands target did not form. Participants in the process to develop the Monitoring Framework agreed managed grasslands and shrublands were an important target and a place should be reserved for it in the framework so that a working group can form in the near future to identify appropriate indicators.

Description of Managed Grasslands and Shrublands Target

To be completed at a later date

Indicators of Managed Grasslands and Shrublands Target

To be completed at a later date

Target 7. Regionally Significant Species of Greatest Conservation Need (SGCN)

See Appendix 7 for a draft plan that describes the SGCN target and the data to be collected.
To be completed at a later date

Description of SGCN Target

Species of Greatest Conservation Need (SGCN) are defined as aquatic and terrestrial wildlife species with small or declining populations or other characteristics that make them vulnerable. They include those species that are deemed rare, imperiled and those for which status has not been established. The relatively small geographic area of individual Northeast states necessitates interstate cooperation for conserving species of greatest conservation need. Most often, coordinated efforts to collect data, develop management strategies, and track progress toward species recovery do not take place until after species have undergone extensive scientific and political review and are listed under the federal ESA.

State Wildlife Grants and the completion of State Wildlife Action Plans provide new opportunities for coordinating species monitoring and management efforts. For most species, habitat-based or multi-species conservation approaches are most practical. Nevertheless, some species that have already undergone significant population declines or range reductions in the region need more targeted single species or guild-based approaches to maintain viability.

Sub targets:

- Federally listed and candidate wildlife in the region (e.g., Roseate tern and piping plover)
- Highly imperiled species without federal status (e.g., Blanding's turtle, Eastern small-footed bat, Allegheny woodrat, and ringed-bog hauter)
- Species endemic to the region, or with a high proportion of their distribution and abundance in the region (e.g., Bicknell's thrush, E. ribbon snake)

Indicators of SGCN Target

1. Population Trends and Reproductive Productivity of Federally Listed Species

The status of federally listed wildlife would rely on population recovery goals, productivity measures to determine management effectiveness and progress toward recovery. A variety of academic, public and private conservation organizations collect data annually for most federally listed species. These data are accessible through USFWS's ECOS Database.

2. State-Listing Status and Heritage Rank of Highly Imperiled Wildlife

This indicator includes the proportion of NatureServe/Natural Heritage A and B ranked populations of highly imperiled species with no federal listing status on Conservation Land. Summaries of changes in state-listing and heritage status changes could indicate changes in abundance or condition of these species. Consensus among biologists is that species long-term viability is uncertain due to factors such as low reproductive rates and loss of populations from large portions of historic range. (See Wildlife Species of Regional Conservation Concern in the Northeastern United States, published in Northeast Wildlife, Volume 54, 1999, pages 93-100). Existing data range from intensive radio-tracking and population studies to distribution surveys based on accumulated and verified sightings (e.g., Heritage element occurrences) through NatureServe/State Natural Heritage Programs.

3. Population Trends of Endemic Species

This indicator tracks population trends of species endemic to the region, or with a high proportion of their distribution and abundance in the region (High Regional Responsibility). Bird species are the only species in this category that have population trend data (from the BBS). State Natural Heritage Programs/ NatureServe can provide distribution data.

Table 7. Summary Matrix for SGCN Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. Population Trends and Reproductive Productivity of Federally Listed Wildlife	Population trends (e.g., presence, abundance, distribution and/or reproductive success) Productivity measures to determine progress towards recovery goals	USFWS's ECOS Database	
2. State-Listing Status and Heritage Rank of Highly Imperiled Wildlife	State-listing and Natural Heritage status	NatureServe/State Natural Heritage Program Distribution Data	Highly variable and periodic data

Indicator	Description	Potential Data Sources	Potential Issues*
3. Population Trends of Endemic Species	Population size and distribution of regionally endemic species	BBS and USGS for bird data, State Natural Heritage Programs/ NatureServe for distribution data	

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

Target 8. Unique Habitats of the Northeast

See Appendix 8 for a draft plan that describes the unique habitats target and the data to be collected.

Description of Unique Habitats Target

Unique habitats include those wildlife habitats with characteristics and features not addressed in the major habitat targets identified elsewhere in the *Northeast Monitoring and Performance Reporting Framework.* This category includes both unique and rare habitats that have been identified within each northeastern state through ground surveys and/or satellite imagery, but will allow the addition of new sites located during the monitoring process. Unique habitats are often geomorphic in nature and include such habitats as rock outcrops, talus and scree, cliffs, caves, karsts, and mines. They provide a unique habitat or serve a unique function for wildlife species. Examples of such habitats or functions include: snake denning, gestating and basking sites; bat hibernacula; and avian nest sites. These habitats are difficult, if not impossible, to mimic or recreate in more common ecosystems and habitats.

Subtargets:

- **Caves, karsts, mines:** Caves are naturally occurring and geomorphic in nature, underground chamber(s) that is (are) accessible from the surface. Karsts (naturally occurring) include underground limestone caverns formed by the erosive process of underground streams. Mines include underground human-made excavation sites.

- **Rocky habitats:** Rocky habitats are geomorphic in nature and are not captured within any formal habitat classification system. They include:
    - Talus consists of broken rocks including boulders, shelter and other large rocks with sparse, if any, vegetation, with many crevices reaching below the surface.
    - Scree consists of smaller pieces of broken rock than talus and is extremely unstable.
    - Cliffs include steep, vertical rock surfaces.
    - Ridgeline may be found along the top of a cliff or may run the linear length of a mountain top; geomorphic features are exposed.
    - Outcrops include isolated, rocky accumulations throughout forested habitats. They provide shelter and basking areas for smaller wildlife species.

- **Barren lands:** Barren lands include those areas in transition between open grassland and forest. They may include savanna habitats.

- **Natural grasslands:** Natural grasslands include those lands naturally consisting of native grasses (warm or cool season; have not been converted from agricultural lands) and may require minimal management (e.g., prescribed burns, alternate mowing) to minimize succession.

- **Alpine/higher elevations:** Alpine zones pertain to areas, typically sloping, on or part of any lofty mountain above the timber line where low, shrubby vegetation and ground cover (lichens, grasses, sedges) persist.

- **Waterfalls:** A waterfall consists of a river or stream flowing over a cliff face or slope for a long enough distance that it creates a certain amount of agitation in the water below. An additional criterion is that a "true" waterfall has free-falling water. We exclude from waterfalls the water that flows downhill fast over bedrock or boulders - a phenomenon that many would define as a cascade.

Indicators of Unique Habitats Target

Spatial and remote sensing data for all five indicators of Unique Habitats status exist on a state-by-state basis through state agencies, universities, and other organizations.

1. Proximity to Human Activity/Roads

Human activity has been reported to cause nest failures and abandonment, population declines due to indirect and direct mortality, and stress to breeding wildlife. Understanding the proximity of human activity and roads to and the effects on critical nesting/ breeding, foraging, and wintering sites will provide insight to the impacts on wildlife species and help inform future planning and management efforts.

2. Wildlife Presence/Absence

The presence of a species alone does not indicate a population is stable or recovering but will provide a location for continued monitoring. Proof of productivity and increasing numbers of individuals are necessary to understand population and/or metapopulation dynamics. Absence in an area does not necessarily indicate a population decline. However, if a population shows a short or long-term presence at a site, its disappearance or decline in individuals at the site may be cause for concern. It is unlikely for species using sub-targets that are geomorphic in nature to move to another location given the uniqueness of these sites (e.g., temperature regulation, aspect to sun, elevation, underground depth accessibility). However, birds and mammals using barren lands and natural grasslands may change locations due to limited resources or other variables, and therefore, a decline in their presence would require additional surveys to determine if the decline is a population decline or a location shift.

3. Wildlife Population Trends

Understanding the effects of a changing landscape on a population is critical to the development and implementation of management strategies. SGCN populations' baseline database must be developed in order to evaluate the long-term effects of the ever-changing landscape (through natural or manmade processes). SGCN are often wildlife species sensitive to disturbance and that

require specific micro- and macro-habitats (e.g., nests in trees of a particular diameter within a particular vegetated structure; hibernacula reaching below the frost line and maintaining stable temperatures). When those characteristics are altered, the impacts could be detrimental to the species that depend upon them.

4. Land Use/Land Cover Changes

Species using these unique habitats (sub-targets) often rely upon these areas for critical life stages (e.g., hibernacula, gestation/birthing/nesting areas) or for their survival, conducting all their activities within the designated habitat. As these areas are naturally (e.g., succession, rock slides, cave-ins, drought) or human- (e.g., development, filling/ blocking) altered, these species must adapt or find suitable habitat elsewhere, forcing them to use valuable fat resources in search of new sites. By monitoring these areas, management plans to maintain optimal habitats can be developed, implemented, and evaluated at priority locations and adapted as necessary.

Table 8. Summary Matrix for Unique Habitats Indicators

Indicator	Description	Potential Data Sources	Potential Issues*
1. Proximity to Human Activity/Roads	Distance to roads or human activity (including "active" recreational activity)	Spatial data layers exist on a state-by-state basis (state agencies, universities, etc.)	Lack of information/ standardization across states Sub-target habitats difficult to discern through spatial data
2. Wildlife Presence/Absence	Presence/absence of wildlife populations, and productivity if present (focusing on those species dependent upon unique habitat for their survival and/or reproduction)	State Natural Heritage Programs or Biotics databases	Lack of information/ standardization across states Lack of standards across states for survey methods and species tracked Sub-target habitats difficult to discern through spatial data
3. Wildlife Population Trends	Population trends (e.g., presence, abundance, distribution and/or reproductive success) in relation to changing land use at or around unique habitats	Spatial data layers exist on a state-by-state basis (state agencies, universities, etc.)	Lack of information/ standardization across states Lack of standards across states for survey methods and species tracked Sub-target habitats difficult to discern through spatial data
4. Land Use/Land Cover Changes	Land use/ land cover changes at or surrounding unique sub-target habitats	Spatial data layers exist on a state-by-state basis (state agencies, universities, etc.)	Lack of information/ standardization across states Sub-target habitats difficult to discern through spatial data Requires long-term monitoring to see severe change at a regional level; may appear stable for some time during reporting

** See also, Some Important Caveats mentioned at the beginning of the Proposed Status Measures section.*

4. Section B: Proposed Process to Develop Effectiveness Measures

E**ffectiveness assessments** examine the impact of specific actions taken by a project or program. Specific effectiveness questions include:

- Are our conservation actions having their intended impact?
- How can we improve the effectiveness of our actions?

Effectiveness assessments are linked to discrete interventions or actions taken by specific actors (organizations, networks, governments, etc.). Returning to the annual physical analogy from Box 1, your doctor would be undertaking an effectiveness assessment if she were to monitor your cholesterol and analyze how/if a healthier diet and exercise regime affected your cholesterol levels.

In the conservation field, we use effectiveness measures to determine whether our conservation actions are effective and how to improve them over time. To this end, we developed a series of recommendations for NEAFWA members.

Recommendation 1: Focus Effectiveness Measures on State Wildlife Grant Programs

The first decision that we faced was determining the focus of our effectiveness measures. In particular, we had to decide between reporting on:

- **State Wildlife Grants –** Assessing the effectiveness of the specific conservation actions funded by State Wildlife Grants (e.g., a grant to fund protection of caves used by endangered bats at a specific site).
- **Wildlife Action Plans (also, Action Plans)** – Assessing the effectiveness of any initiative that was somehow catalyzed by the Wildlife Action Plans, regardless of whether it has SWG funding (e.g., decisions by a state highway department to reroute a road corridor to avoid sensitive wildlife habitat).
- **Both State Wildlife Grants and Wildlife Action Plans** – Assessing both of the above.

Obviously, in a world of unlimited resources, we would want to track the effectiveness of both State Wildlife Grant program activities and Wildlife Action Plan activities. Given available resources and constraints, however, we recommend initially focusing primarily on the State Wildlife Grant program activities and then over time, expanding the system to track the broader range of activities related to Wildlife Action Plan implementation.

Recommendation 2: Use Results Chains to Determine Effectiveness Indicators

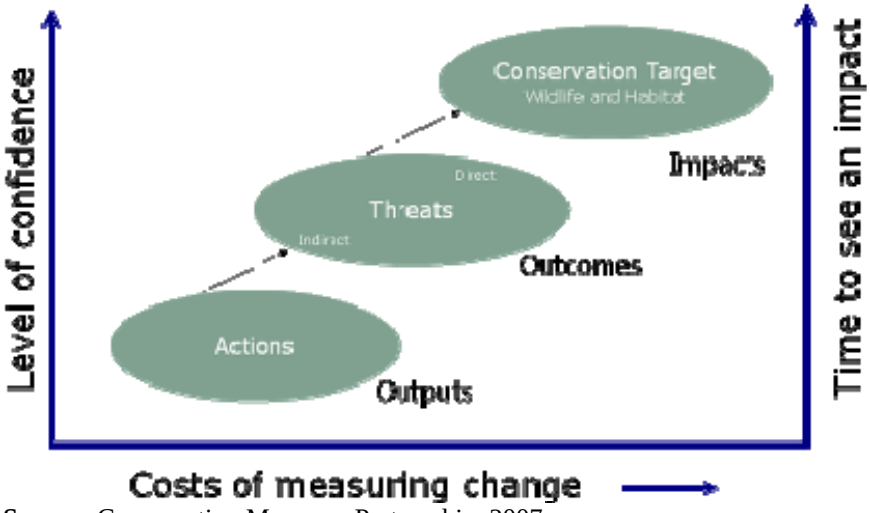
One key challenge to measuring conservation effectiveness involves determining a limited and practical set of indicators to assess for different types of conservation actions. Take for example, two conservation projects:

- **Action A: Gating Bat Caves** – This action involves placing physical barriers at the mouth of caves used as roosting sites by endangered bat species. The barriers are designed to keep out humans and feral cats that are negatively impacting the bat populations.
- **Action B: Research on Invasive Aquatic Weeds** – This action involves conducting research to understand how invasive aquatic weeds colonize lakes and what measures can be taken to avoid spreading invasive aquatic weeds.

In each of these examples, to measure effectiveness, it is not sufficient to track the immediate outputs of the actions – if you just count the number of bat gates built or the number of research findings or reports produced, you have no idea whether these actions are contributing to bottom line results. On the other hand, you also cannot just measure the target of concern. If you just count the number of bats in the roosting caves or the number of lakes that are weed free, you do not know whether your actions have made a difference. Furthermore, if you focus on the target, you may not detect any change until it is too late to take action – it is not very helpful to note that the bats have disappeared from a cave.

As Figure 1 shows, good effectiveness measures require developing an understanding of what in evaluation parlance is called the linkage between Outputs, Outcomes and Impacts. In the conservation world, this is the chain linking actions, changes in threats, and the status of the conservation target.

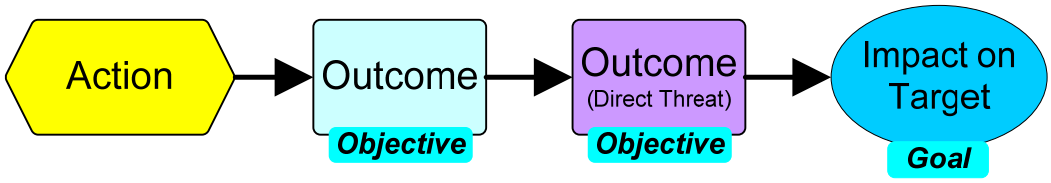
Figure 1. Effectiveness Measures Require Linking Actions to Targets



Source: Conservation Measures Partnership, 2007

Results chains are a powerful tool that has recently been adopted by many conservation organization and teams to help them establish these links and determine appropriate effectiveness indicators.[16] A results chain is a tool that shows how a project team believes a particular action it takes will lead to some desired result. More specifically, for conservation projects, a results chain represents a team's assumptions about how their conservation actions will contribute to reducing important threats, leading to the conservation of priority targets. In essence, results chains are diagrams that map out a series of causal statements that link short-, medium-, and long-term results in an "if…then" fashion. As shown in Figure 2, there are three basic components of a results chain: a conservation action, expected outcomes, and desired impact. Using these components, a project team can then go on to define objectives and goals that describe desired future outcomes and impacts.

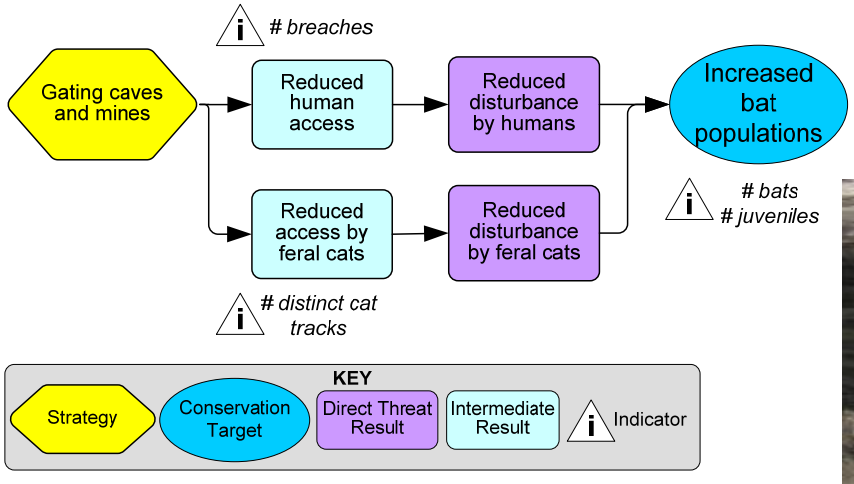
Figure 2. The Basic Components of a Results Chain



Source: Foundations of Success, 2007

Returning to our Gating Bat Cave example, Figure 3 presents a basic results chain for this conservation action.

Figure 3. Bat Cave Results Chain



[16] FOS 2007. *Using Results Chains to Improve Strategy Effectiveness. An FOS How-To Guide.* Foundations of Success, Bethesda, Maryland, USA. Available at http://www.fosonline.org/Site_Page.cfm?PageID=168.

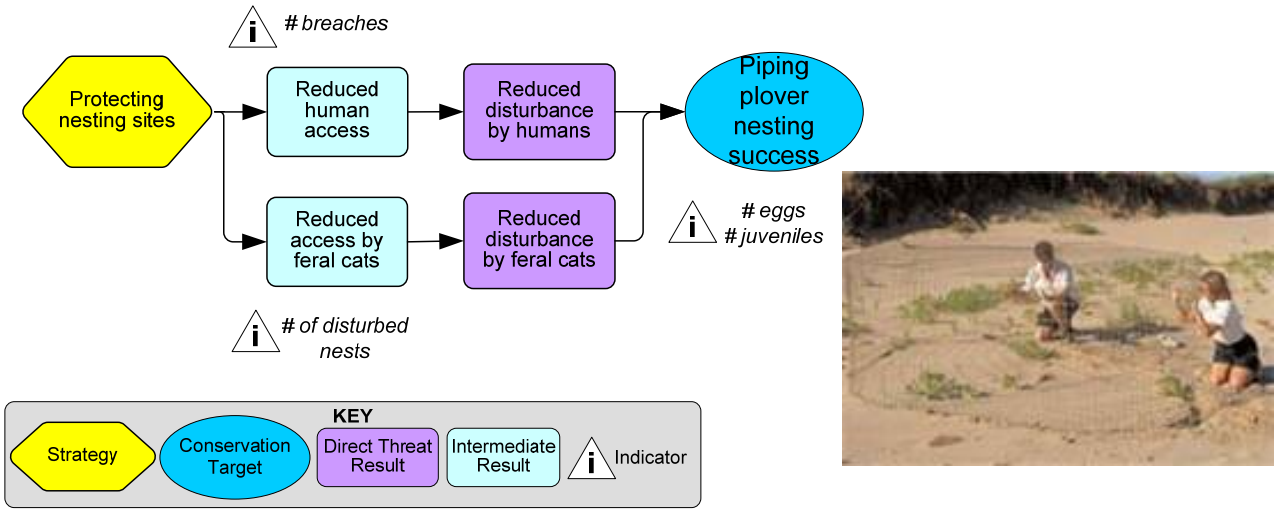
Although this example is fairly straightforward, it illustrates several key features of results chains. Specifically, they:

- **Make Core Assumptions Explicit –** In effect, the project team is assuming that if they gate the caves and mines, they will reduce access by humans and feral cats. This will in turn reduce disturbance and ultimately lead to increased or stabilized bat populations.
- **Identify a Limited Set of Key Indicators –** Based on this results chain, the team can then develop several specific indicators to assess each key result across this chain (e.g., number of breaches and number of distinct cat tracks).
- **Establish a Time Frame for Anticipated Results** – In this case, the project team will expect to see a reduction in the number of human breaches and cat tracks immediately after the gates are established. However, there may be a time lag before the bat populations will then rebound. To this end, after six months the team might expect to be able to report on reduced breaches or cat tracks but probably will not show measurable increases in the population.
- **Create a Basis for Learning** – If the project team implements the gates and observes a decrease in human breaches, but does not observe a decrease in cat tracks, then they can go back and try to figure out why their assumptions did not work out as planned. Maybe they missed an entrance to the cave being used by cats, or maybe cats are somehow getting through the barrier. This learning becomes the basis for true adaptive management.

Recommendation 3: Establish Standard Effectiveness Indicators for Common Conservation Actions

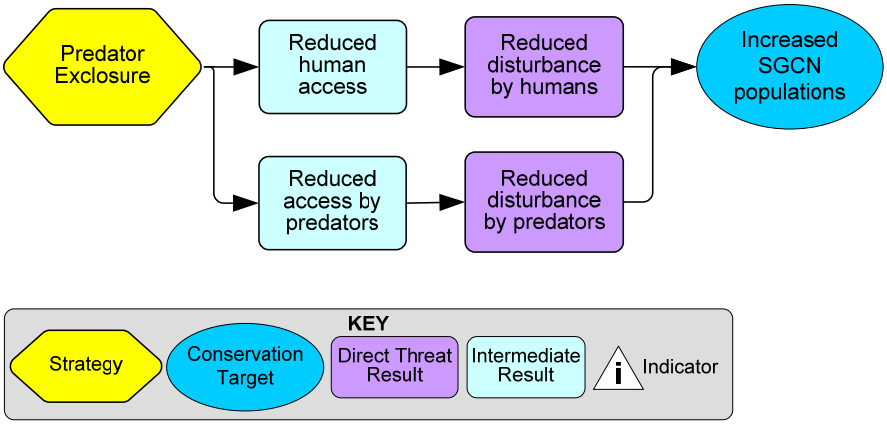
The next challenge involves developing ways of comparing the effectiveness of different but related conservation actions. For example, another SWG funded conservation action might focus on protecting nesting sites for Piping Plovers. This results chain is shown in Figure 4 (See Appendix 9 for some draft results chains for different Fish and Wildlife strategies).

Figure 4. Piping Plover Nest Site Protection Results Chain



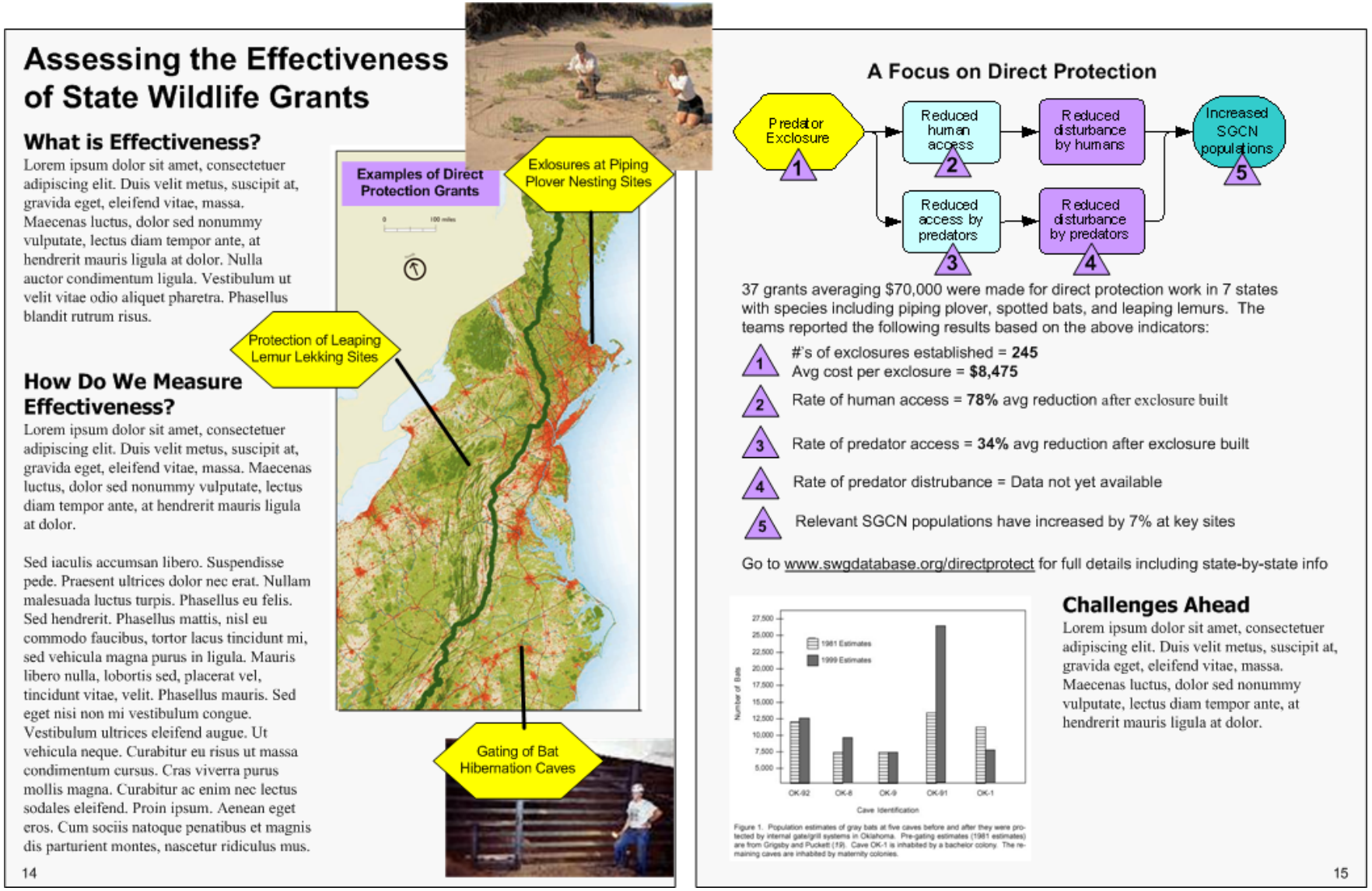
Although this chain involves a different action, it has the same basic structure as the bat gating chain. Extending this thinking further, it is possible to create a generic species protection results chain that might look something like Figure 5.

Figure 5. Generic Predator Exclosure Results Chain



This chain could be used to specify indicators that could then be collected across all similar actions and summarized in a report. Figure 6 illustrates how NEAFWA could compile and communicate effectiveness data to Federal agencies and resource managers in a clear and concise format. It uses a results chain to show what results need to occur and what indicators NEAFWA should collect to be able to show effectiveness. For example, the chain identifies five indicators and reports on each, where data are available. A decision maker can quickly review this report and determine how resources were spent and what results those resources produced. Although often it will not be possible to immediately report on all outcomes in the chain, NEAFWA could use the results chain and this engaging and concise format to communicate what results it expects and what needs to happen to see those results.

Figure 6. Mockup of Effectiveness Report



The challenge going forward will be to identify the specific strategies applicable to most or all of the Northeast region for which results chains need to be developed. Table 9 presents a list of some of the key actions that seem likely candidates based on the IUCN-CMP classification of conservation actions.[17]

Table 9. Key Actions for Which Generic Results Chains Could be Developed

1.1 Site/Area Protection
- 1.1.1 Land acquisition

1.2 Resource & Habitat Protection
- 1.2.1 Land protection

2.1 Site/Area Management
- 2.1.1 Site protection
- 2.1.2 Environmental review
- 2.1.3 Habitat surveys and assessment

2.2 Invasive/Problematic Species Control
- 2.2.1 Invasive plant control
- 2.2.2 Invasive animal control

2.3 Habitat & Natural Process Restoration
- 2.3.1 Land clearing/prescribed burns
- 2.3.2 Plantings for SGCN management
- 2.3.3 Dam removal/fish passage
- 2.3.4 Lake/impoundment restoration

3.1 Species Management
- 3.1.1 Baseline Survey/Research
- 3.1.2 Database/GIS/Map development
- 3.1.3 SGCN conservation planning

3.2 Species Recovery
- 3.2.1 Spawning/nesting sites

3.3 Species Re-Introduction
- 3.3.1 Species translocation
- 3.3.2 Artificial propagation/stocking

4.2 Training
- 4.2.1 Information exchange with stakeholders

4.3 Awareness & Communications
- 4.3.1 Outreach on program benefits

Recommendation 4: Promote Learning Through Common Databases of Conservation Actions

In addition to providing a basis for assessing the effectiveness of specific conservation actions funded by State Wildlife Grants, the results chain methodology also provides the ability to dramatically enhance cross-project learning. Conservation is an action-oriented discipline. Conservation practitioners are using and gaining experience about their strategies and actions every day. Furthermore, much of what they learn is either never written down, or is not shared beyond the project team or (at best) their organization. To this end, practitioners need tools to support collaboration and learning so they can identify other practitioners with relevant experience, facilitate sharing information and expertise within and across organizations, and potentially link up with donors looking for projects similar to theirs.

To address these needs, imagine a scenario a few years from now in which a conservation practitioner in the Northeast will be able to go online and immediately access information about experiences of fellow practitioners regionally and globally, as well as contribute his or her own experiences. In particular, the practitioner will be able to search for a specific conservation action and will be able to learn the conditions under which the action was applied, the results of the action (both successes and failures), and any lessons that emerged. Practitioners will also be able to select any given location and learn about the specific conservation projects taking place there.

For example, suppose a team of protected area managers has tried two conservation actions. In one case, they applied an herbicide at varying intervals to control an invasive weed, and in

[17] IUCN-CMP. 2006. Unified Classification of Conservation Actions, Version 1.0.

another, they tried to educate local landowners about how to stop the spread of invasive species. They found that the herbicide was highly effective (once they figured out that they needed to apply the herbicide in the Fall when the plant was pulling nutrients down into its roots), but the education action did not work at all.

If this team could post their results online in a format that could be easily scanned and reviewed by others, then other practitioners around the world that are facing this weed at their site could search the databases, find these results, and learn from them. Furthermore, if there were a group that was interested in conducting a systematic review of the conditions under which the herbicide was effective or whether education worked to stop the spread of weeds, then this group would have access to the original study that they could then add to their analyses.

Throughout this process, the protected area managers would retain full control over the data that they contribute to the online records. Furthermore, the system would be set up in such a way that it would only require minimal effort for them to contribute and update their results. Finally, the system would also enable the project to post their conservation needs, and as a result, to "market" these needs to donors who might be interested in providing support.

Today, there are several prototypes of such a system in action. For example, The Nature Conservancy has established its ConPro Database which contains a description of the actions being used by over 900 projects around the world.

To achieve the above vision, we do not have to develop one standard database to which all practitioners must contribute their information. Instead, we merely need to develop and implement a set of standards that govern the exchange of data among databases around the world. In particular, these standards have three parts:

- **Common Data Fields** – The fields that needs to be collected for each action and/or project.

- **Database Access Rights** – The terms upon which participating databases must agree regarding the mutual exchange of information.

- **Search Portal** – The requirements for a portal that users can employ to search all participating databases.

Appendix 10 provides a detailed description of these fields as well as this broader process.

5. Data Collection, Management, Analysis, & Communication

The implementation of this Framework will require some system for data collection, management, analysis, and communication. What that system should be, however, will depend on the degree to which states or the region as a whole implements this Framework. If states decide to simply use the suggested indicators and collect and report data on their own, there is probably not much need for a formal data collection and management system. If, however, states are interested in collecting the indicators and being part of a broader effort to roll-up and report on those indicators across the Northeast, then some sort of system is clearly necessary.

Among the issues that need to be resolved are:

- How will data be collected?
- Where will data be stored?
- Who will manage the data, including making changes and updates as necessary?
- Who will analyze and interpret the data?
- Who will be responsible for producing a region-level report for decision-makers (if states are interested in this option)?
- Who will have access to the information?
- How will intellectual property rights be handled?
- How will the information be shared more widely?

With the information we have at this point, it is neither possible nor appropriate to determine what system should be used. Instead, we offer a few scenarios of possible systems. As the Monitoring Framework is modified and rolled out, it will become clearer which system makes the most sense. These scenarios are not mutually exclusive – it may make sense to combine different elements from the different scenarios.

Data Collection, Management, and Storage

Scenario A: All states implement this Framework and want to report results at both a state and a regional level. Under this scenario, there are a few options for data collection and management:
Option 1. Centralized data collection and management: All data flows into one repository, centrally managed by someone designated by NEAFWA – perhaps a performance monitoring coordinator. Data are collected by the coordinator or by the States and then standardized to a regional level. Data are physically recorded in a central location.

Option 2. State level data collection and management: States collect and manage the data. They do most or all of the data interpretation to provide the indicator in the format needed for the region-level report. They then share this information with the performance monitoring coordinator.

Option 3. Data remains in original home databases or institutions, which then generate reports at the requested level: States and/or performance monitoring coordinator solicit reports on indicators directly from the institutions housing this data. Data are not formally recorded or stored in a NEAFWA database.

Scenario B: The states implement this Framework only at a state level. In this situation, it would make most sense for states to handle the data at the state level. A regional data collection and management system would not be necessary.

Scenario C: The states do not implement this Framework. In this case, no action would be needed.

Data Analysis and Communication

Getting the data is only half the battle. It is important to also determine who will analyze the data and how will they communicate their analyses. The most obvious options for data analysis include:

Scenario A: Performance monitoring coordinator analyzes all data and produces a report to decision makers. Under this scenario, the responsibility lies primarily with one person. Even so, it would be necessary for the coordinator to consult with states and regional experts to ensure analyses are accurate.

Scenario B: Team(s) analyzes all data and produces a report to decision makers. Here, the performance monitoring coordinator might lead the effort, but the analyses themselves would be performed by the team(s) as a whole. Each target or each indicator might have its own separate team, since expertise is likely to be target or indicator-specific.

Scenario C: Analyses are done by a 3rd party and provided directly to NEAFWA. Some of the institutions housing the data might be able to produce reports with the data already analyzed. This would still require some work on NEAFWA's part to translate those analyses into a report to decision-makers. This would be more a question of presentation rather than content.

In terms of communication, NEAFWA – perhaps through a performance monitoring coordinator or some other mechanism – would ultimately be responsible for reporting to decision-makers (if states are interested in rolling up data to a regional level). How this data is communicated can take a number of formats which include:

- 20-30 page glossy publication to decision-makers, comprised of 2-page summaries from each target group and the effectiveness group (see Figure 6 on page 37 for an example). *Note: this is the product we have been envisioning throughout the process. This should definitely be a communications product, but there may be others;*
- The same publication in Web format with hyperlinks to more detailed information on each of the indicators;
- Longer, more detailed report and condition assessment per target, which would be primarily aimed at state and federal wildlife managers (see Appendices as a start);
- 2 page pamphlet with a few key highlights, aimed at the broader public with the purpose of raising general awareness; and
- Presentations at wildlife conferences around the country,

Key Data Analysis Issues to Keep in Mind

By necessity, this Framework draws on existing data sources as much as possible. However, these sources vary widely in consistency, scale, quality, and direct applicability. Biases and measurement errors are highly likely to influence the quality of the existing data collected through this Framework's implementation and, therefore, the relevance of the analyses. Given this situation, it can be difficult to determine if changes in trends represent true changes or are the result of a change in data quality. For instance, some trends in the Breeding Bird Survey data are likely due to changes in observers, routes, and/or methods. This will be less of an issue with

presence/absence data, but it is still something that the Framework implementers should always make sure they understand the quality of their data. If data indicate a problem in the population status of certain species or ecosystems, there should be an investigation into the data sources to determine if the problem is a real problem or if it is an artifact of the data. The Framework is designed to guide decision-making and, as such, it is important that the Framework be based on sound data and critical analyses of that data. Implementing the Framework is not a matter of simply collecting the data; it will clearly require an investment of time and energy.

6. Next Steps

The Framework proposed in this document pulls together the collective input of Fish and Wildlife agency staff and partners across the Northeast. This, however, does not mean that the Framework will be immediately put it into action. Several steps need to happen before NEAFWA states will be ready to implement the Framework or some agreed-upon variation of the Framework. Here, we lay out the main steps. While these are generally in chronological order, some of them will be concurrent with earlier steps or ongoing throughout the process.

- **Present and roll out the Framework to a broader audience:** It will be the role of on-the-ground staff to implement the Framework. These staff must understand the value and utility of the Framework. At a minimum, we will present the Framework at various regional meetings and conferences.
- **Review target indicators for potential overlap and consolidation:** Ideally all proposed indicators would be measured in order to give a robust picture of the status of all conservation targets. Given budget and data constraints, however, this might not be realistic. One efficient solution and a potential next step is to identify indicator similarities and overlaps across targets and determine if we can reduce redundancies and simplify data collection. For example, % Impervious Surface is an indicator for 3 targets: Freshwater streams and river systems; Freshwater wetlands; and Lakes and ponds. It would be ideal to collect this data from one source and thus reduce the time and costs to implement the Framework. The data collected would need to be analyzed by target, as each target is impacted differently, but at least the data collection could be simplified. An initial review of the current lists of indicators reveals two additional areas where there is the potential to simplify data collection: Wildlife population trends and Fragmentation-related indicators. For wildlife population trends indicators, it would be useful to gather the knowledgeable "experts" and determine if there are some wildlife that cross multiple targets (e.g., Alleghany woodrats). If so, these wildlife could be priority wildlife for which to collect data. Likewise, there is potential for identifying one or two common indicators related to habitat fragmentation. Several target groups identified indicators for this threat, but each group chose slightly different indicators. A next step would be to determine if it is possible to choose one or two common indicators and collect data for just those indicators. Again, the data would need to be analyzed separately by target group, but the collection process itself could be simplified.
- **Review target indicators for potential overlap and consolidation:** Time constraints in the development of the Framework did not allow us to sufficiently analyze indicators across targets for overlap prior to the release of this draft. As shown in the table below, we see at

least two instances where two or more work groups for different targets selected slightly different indicators: Wildlife population trends and Fragmentation-related indicators.

Target	Indicators & Stressors
Fragmentation-related indicators	
Forests	Forest fragmentation index
Freshwater wetlands	Road density
Unique habitats	Proximity to human activity/roads
Unique habitats	Land use/connectivity
Wildlife population trends	
Highly migratory species	Shorebird abundance
Highly migratory species	Abundance of diadromous fish
Highly migratory species	Presence/abundance of monarch butterfly
Unique habitats	Wildlife presence/absence
Unique habitats	Wildlife population trends
Regionally Significant SGCN	Population trends and productivity of federally listed species
Regionally Significant SGCN	State-listing status and heritage rank of highly imperiled wildlife
Regionally Significant SGCN	Population trends of endemic species

If indeed there is some redundancy of indicators within each of the two groups above, and if it is possible to use one indicator where two or more appear almost the same, we can simplify data collection for the Framework (data would still be analyzed separately by target group). Reporting on fewer indicators would also make it easier for our audiences to understand Framework reports. As an example, the indicator Percent Impervious Surface was selected for 3 targets: Freshwater streams and river systems; Freshwater wetlands; and Lakes and ponds. This single indicator was deemed both sufficiently important and sensitive to the needs of the respective targets. Again, the data would be analyzed by target, as each target is impacted differently, but collecting this data from one source reduces the time and costs to implement the Framework.

A next step would be to determine if it is possible to choose one or two common indicators and collect data for just those indicators. For wildlife population trends indicators, it would be useful to gather the knowledgeable “experts” and determine if there are some wildlife that cross multiple targets (e.g., Alleghany woodrats). If so, these wildlife could be priority wildlife for which to collect data. Ideally all proposed indicators would be measured in order to give a robust picture of the status of all conservation targets. Given budget and data constraints, however, this might not be realistic. If a phased-in approach to Framework implementation occurs, one efficient solution and a potential next step is to identify additional indicator similarities and overlaps across targets and determine if we can further reduce redundancies and simplify data collection.

- **Modify target indicators based on feedback from Framework review:** As a first step prior to entering the implementation phase, it is recommended that Framework implementers review and reconsider some of the indicators for targets based on the input from a wide range of reviewers. Reviewer comments are currently compiled in one document and organized by target.

- **Secure resources:** Monitoring and performance reporting are expected from Congress – they must happen. Nevertheless, they cannot happen without financial and staff inputs. Implementing this Framework will require that directors allocate the necessary resources to get the Framework up and running and to keep it operational over the long-term. We, however, have developed this Framework with an eye to keeping costs to a minimum. As the Framework moves into the implementation phase, opportunities to lower costs without significantly impacting the integrity of the Framework should be seriously considered.
- **Determine data management structure:** It will be important to have an initial idea of how the region will collect, manage, and report on data (see Section 5). Once NEAFWA members implement the Framework, it will become clearer whether the chosen data management structure will work or whether some other arrangement is needed.
- **Develop instructions for data collection:** The appendices provide draft monitoring plans for status and effectiveness measures. In some cases, Fish and Wildlife staff may need more guidance about how to go about collecting data. Thus, it will be necessary to review the appendices and, where relevant, refine them so that so that implementing staff will be clear about what they need to do.
- **Implement the Framework:** Although we could spend a lot of time "perfecting" the Framework, we feel it is important to move into actual implementation. In this step, Fish and Wildlife Agencies would start to collect the data specified in the Framework. In many cases, the first step will be collecting baseline and historical trend data (where available). As of the writing of this report, NEAFWA states, through the Regional Conservation Needs grant program, are in the process of awarding a grant to The Nature Conservancy to summarize the conservation status of the habitat and species targets in the Framework. This will be a great opportunity to both jumpstart implementation and test the Framework's utility.
- **Adapt the Framework and continue to implement:** Based on what we learn in implementing the Framework, it will be important to modify it and continue to implement it. This is an ongoing step that should be continuously revisited.
- **Complete Framework components:** The current version of the Framework lacks information for the Managed Grasslands and Shrublands target and has incomplete information for the Regionally Significant SGCN and Lakes/Ponds targets. To complete the Framework, NEAFWA will need to form working groups for these targets, identify indicators, and develop monitoring plans for those indicators. Over time, NEAFWA members should also consider expanding the Framework to include coastal and marine targets.

7. Concluding Remarks

This document summarizes the NEAFWA Monitoring and Performance Reporting Framework. The Framework offers states across the Northeast a template for collecting data on key indicators that will help them broadly assess the health of the key ecosystems and the fish and wildlife that inhabit them. The Framework will also help States meet Congressional expectations for State Wildlife Grant programs Wildlife Action Plan implementation. The proposed Framework intentionally strives to collect the minimum data necessary to make good decisions so that the

bulk of state wildlife funding continues to go directly to the on-the-ground interventions promoted by the Wildlife Action Plans. Although this Framework is quite general, relative to the extensive detail of the wildlife action plans, we are confident that, when implemented, the resulting analyses will provide decision-makers and state wildlife managers with sufficient information to make informed funding and management decisions.

We hope that others will learn from this first attempt by state fish and wildlife agencies to develop a monitoring framework to for an entire region. We encourage those interested in developing a framework for their region to consult a companion document to this report, *Monitoring the Conservation of Fish and Wildlife in the Northeast – The Process.* We welcome any comments or questions about the NEAFWA Monitoring and Performance Reporting Framework, as we plan to refine it as needed throughout its implementation.

8. List of Appendices

The following appendices are provided as accompanying documents.

Appendix 1: Indicators for Forest Target

Appendix 2: Indicators for Freshwater Streams and River Systems Target

Appendix 3: Indicators for Freshwater Wetlands Target

Appendix 4: Indicators for Highly Migratory Species Target

Appendix 5: Indicators for Lakes and Ponds Target

Appendix 6: Indicators for Managed Grasslands & Shrublands Target

Appendix 7: Indicators for Regionally Significant Species of Greatest Conservation Need (SGCN) Target

Appendix 8: Indicators for Unique Habitats of the Northeast Target

Appendix 9: Examples of Results Chains

Appendix 10: Proposed Data Fields for Strategy Effectiveness Database

Acknowledgements

We are very grateful for the time, effort, and critical thought that fish and wildlife managers and state and federal officials, and NGO partners have invested in the drafting and review of this Framework. In particular, we are grateful to the participants of the target and effectiveness working groups. Without their hard work and dedication, we would not have been able to produce as robust a framework in the time available for this effort.

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