VIII. Monitoring of Species and Habitats

With its size, challenging logistics, and general lack of information on species and habitats, Alaska faces tremendous obstacles in improving the monitoring of its biodiversity. Yet nongame species can serve as important indicators of ecosystem health and resiliency (i.e., "the canary in the coal mine"). It is important and cost-effective to monitor and manage nongame species to avert the potential need for reactive, costly, and restrictive management. Some efforts have begun, and these can be strengthened and made more robust as a result of the CWCS. Implementation of additional monitoring efforts is needed, especially where anthropogenic effects are concentrated. For information about species-specific efforts and needs, please refer to Appendices 4 and 5. Once monitoring areas and control sites are established, the collection of local and traditional knowledge becomes a high priority.

Alaska has participated in various forums to rank conservation actions related to particular species (e.g., birds) and some habitats, especially the state's aquatic and estuarine areas. For example, through its Alaska's Clean Water Actions initiative (http://www.state.ak.us/dec/water/acwa/acwa_index.htm), DEC, DNR, and ADF&G annually set joint priorities for assessing and monitoring water quality, water quantity, and protecting aquatic habitats. ADF&G also has a long-term commitment to landbird monitoring efforts at the Creamer's Field Migratory Waterfowl Refuge. Along with the migration station at USFWS' Tetlin National Wildlife Refuge, the Creamer's station has been in operation since the early 1990s. It provides information on migration timing and changes in abundance of certain migratory landbird species. It also monitors change in the fattening and molt of migratory songbirds in response to environmental changes.

Banding a Yellow Warbler
K. Sowl, USFWS

At the international level, ADF&G has collaborated with the USFWS and other U.S. agencies in the Arctic Council's CAFF and AMAP initiatives. CAFF's website (http://www.caff.is/) contains information on conserving Arctic flora and fauna, ecosystems and habitat, and monitoring Arctic biodiversity and living resources. AMAP's website (http://www.amap.no/) describes efforts to monitor Arctic pollution, including airborne pollutants and contaminants carried by ocean currents.

Alaska also participates in the International Tundra Experiment (http://www.itex-science.net/), a circumpolar network focusing on impacts of climate change on Arctic vegetation. Some of the premier work on this topic is conducted at the University of Alaska's Toolik Field Station, located on the North Slope.

Through the activities of scientists from USFWS, ADF&G, and other organizations, Alaska participates in sampling networks for some of the animal species and groups selected for bi- or multilateral monitoring in the Arctic: Arctic char, seabirds, shorebirds, ringed seals, and polar bear. These marine mammals, and many of the seabirds and shorebirds monitored internationally (e.g., eiders), are also featured in the CWCS. For a description of the goals for monitoring biodiversity and a list of species for which circumpolar monitoring groups have been established, see http://www.caff.is/sidur/sidur.asp?id=9&menu=program and click on "Monitoring Arctic Biodiversity and Living Resources."

Monitoring is addressed through other key multidisciplinary efforts in Alaska such as the EVOS GEM program (http://www.evostc.state.ak.us/gem/how.html). What makes GEM unique is that it incorporates interagency cooperation and collaboration, public involvement, and accessible, informative data and information on the Gulf of Alaska ecosystem. The 1998 draft Bering Sea Ecosystem Research plan (BSER; http://www.afsc.noaa.gov/refm/reem/doc/sciencer.pdf) represents another excellent model for multidisciplinary efforts (Alaska Fisheries Science Center 1998). The BSER rates as its highest priority those monitoring approaches that:

- Respect the importance of traditional knowledge of Native peoples in understanding the Bering Sea.
- Provide opportunities for local involvement and communication.
- Foster cooperation among agencies and other stakeholders.
- Use and acquire information needed for adaptive management.
- Use a keystone or proxy species approach for monitoring.
- Provide opportunities for international cooperation and communication.
- Enhance technology transfer and communication among stakeholders.

Similar considerations feature prominently in the CAFF biodiversity monitoring model. The CAFF model also relies heavily on the use of standardized methods across the Arctic, so that data can be compared across regions. Using that model (as presented in the CAFF meeting report called "Monitoring Circumpolar Biodiversity Working Groups, Consolidated Results – April 29, 1999"), along with the GEM program and BSER plan as a basis for consideration, monitoring networks established to address needs of featured species and habitats in the CWCS should consider the following as objectives:

- Provide a means to share information, provide advice, and coordinate state monitoring efforts to be nationally and internationally compatible.
- Develop an ecologically based framework.
- Link to needs raised during the CWCS planning process, e.g.:
  a) Detect past and ongoing changes in Alaska's environment and biodiversity.
  b) Distinguish natural and short-term fluctuations from human-induced changes.
  c) Use monitoring as an early warning system that can trigger more specific and focused research and conservation measures.

    d) Provide independent information to test the validity of hypothesized changes.
    e) Implement and help to evaluate the effectiveness of conservation programs.
- Use monitoring results to update and prepare the next iteration of the CWCS.
- Build on existing state monitoring systems.
- Use community-based approaches to monitoring, including indigenous/traditional/local user knowledge.
- Identify indicator species as part of the monitoring framework.

Species and habitats must be monitored at appropriate scales and using appropriate indicators. For example, the draft BSER (Alaska Fisheries Science Center 1998) gives high priority to using a keystone or proxy species approach for monitoring in the Bering Sea. Meanwhile, the CAFF biodiversity monitoring plan takes a broader view as it seeks to promote monitoring across ecosystems and jurisdictions. Under that plan, useful considerations in selecting the desired scope for monitoring fish and wildlife diversity are:

- Incorporate an established ecosystem-based approach to allow for comparability between ecoregions.
- Design a monitoring process that is easily understood, sustainable, cost-effective, relevant to those involved, and paced appropriately.
- Incorporate cumulative impact assessment and an interdisciplinary approach.
- Include communications and public information as important features of a monitoring network.

To help states address USFWS guidance on CWCS monitoring requirements (see Section 1, page 3, Element No. 5), consultants under contract to Defenders of Wildlife worked with staff from several states to develop and make broadly available a "habitat monitoring framework." The full report is available on the web at http://www.biodiversitypartners.org/infomanage/monitoring/01.shtml. Relevant ideas for Alaska include:

- Tracking of long-term land use changes relative to habitat priorities at a statewide and/or ecoregional scale.
- Creating a statewide, interagency and private sector monitoring group to facilitate coordinated monitoring.
- Involving citizens in some elements of monitoring programs for practical and educational purposes.

CAFF's biodiversity monitoring plan also notes that because virtually everything can relate to biodiversity, it is important to be specific in what is to be monitored. Considerations would include such things as:

- Protocol for data collection and archiving of raw (not interpreted) data in the public domain.
- Involvement of multiple ecoregions where the phenomenon being monitored is common to each of them.

- Monitoring at intervals of a decade or longer to detect change, because Arctic floras grow slowly.
- Protection of sites being monitored for long-term change, perhaps for 100 years.

These recommendations are very similar to the findings generated by participants in Alaska's CWCS process. CWCS participants also raised several issues they felt were critical for improving monitoring efforts in Alaska. First, design programs to be integrative and coordinated with other research and monitoring efforts. For example, bycatch monitoring and monitoring of habitat changes in conservation areas could both be conducted in ways that help Alaska better detect invasive species. Experts also felt that funding recipients should be required to share results with others receiving similar funds. Successful examples included the EVOS GEM program and The Southern Oceans Convention on Antarctic Flora and Fauna. The latter monitors different ecosystem components of the Antarctic, and scientists in that effort specifically bring research together in a periodic report.

Live-trapping small mammals, Montague Island
E. Lance, USFWS

Interpreting historic data sets may provide unique and cost-effective insights into species diversity, abundance, and other characteristics. For example, ADF&G has annual furbearer sealing records dating back to 1977, and the University of Alaska Museum of the North houses a valuable collection of skin, bones, and frozen tissue of some 86,000 mammals. A researcher accessing data through the museum's website recently made an interesting discovery: The size of masked shrews in Alaska has significantly increased in the past 50 years as the state's climate has warmed (Anchorage Daily News 2005). This finding has intrigued scientists because it runs contrary to established biological theories on the relationship between climate and animal body size.

Experts also noted that recent concerns for fish and wildlife health issues, such as West Nile virus in birds or chytrid fungus in amphibians, may have significant effects on some wildlife populations. They felt it was important, therefore, to expand species monitoring efforts to include diseases, as well as potential contaminant-related pathologies like amphibian limb or bird bill deformities. Because birds from the North American and Asian flyways mingle here, Alaska is also a prime location to test for arrival of any avian influenza strains that could potentially affect humans.

Ecosystem Monitoring

Monitoring at the ecosystem level has potential to complement efforts to monitor species and habitats. It involves the analysis and monitoring of the cross-linkages between multiple species, species groups, humans, physical and climatic systems, and both the distinct and cumulative effects and interactions among them.

Currently, Alaska is home to two of the 24 LTER sites in the United States (see http://www.lternet.edu/). Both are terrestrial sites located in the northern part of the state (Toolik Lake in the North Slope foothills, and Bonanza Creek in Interior Alaska). Expanding the LTER program to include terrestrial sites in other parts of the state may be beneficial. Similarly, marine experts involved in CWCS development indicated that Alaska has much to gain from establishing one or more LTERs in its marine environment. The Alaska Maritime National Wildlife Refuge provides an example of a comprehensive approach to marine monitoring (Drew et al. 1996) that has led to a better understanding of the broad mechanisms of ecosystem functions and processes (Croll et al. 2005) and might be useful elsewhere.

Besides ongoing efforts described earlier in this section, experts identified several broad new initiatives related to biological monitoring programs, from regional to national in scope, that may help further the objectives of the Strategy. During implementation, efforts will be made to formally or informally integrate the conservation actions spelled out in this Strategy with these programs. One such program is the newly formed North Slope Science Initiative (NSSI), which focuses entirely on the inventory, monitoring, and research needed to inform the resource-management decisions of member agencies on the North Slope. Another is the National Ecological Observatory Network (NEON), the first national ecological measurement and observation system designed both to answer regional- to continental-scale scientific questions and to have the interdisciplinary participation necessary to achieve credible ecological forecasting and prediction.

Collaboration

Humans are an integral part of Alaska's ecosystems. In response to the experts' collective recommendations, the Strategy contains numerous conservation actions aimed at obtaining local knowledge and involving communities in monitoring (e.g., by sampling the stomachs of species taken for subsistence purposes). Some of the pioneering work on incorporating traditional knowledge in Alaska (Miraglia 1998) was done after the Exxon Valdez oil spill, as part of the GEM program. Overall, GEM has resulted in valuable collaborative working relationships and science-based models that can be applied in studying trophic interactions and ecosystems elsewhere in the state. Extensive community involvement is central to the GEM program. Citizen volunteers assist in observations and data gathering, and Alaska Natives are consulted for traditional ecological knowledge. Strong community involvement permits the program to compile a more extensive and expansive database.

Commercial fisheries can make valuable contributions to the conservation of nontarget species with which fishermen come in contact, and models now exist on how to incorporate ecological observations by small-scale, indigenous, and commercial fishermen. Information such as onboard observers' logbook records (e.g., of seabird activity and die-offs) can augment scientific studies and enhance species and ecosystem conservation efforts, including for at-risk species such as Steller's and Spectacled Eiders. A 2001 symposium at the University of British Columbia, entitled "Putting Fishers' Knowledge to Work," included presentations on methods for obtaining and accurately representing fishermen's knowledge. The fact that over 200 people from 23 countries and many representatives of North American indigenous groups attended this meeting testifies to a growing recognition of the value of traditional knowledge for managing fish and wildlife resources.

Recording information aboard a commercial fishing vessel
M. LaCroix, Fishery Observer

Alaska's land managers can offer valuable assistance to the CWCS implementation effort in coming years. For example, some existing conservation lands are well suited as long-term control sites for evaluating the effects of habitat fragmentation outside their boundaries. Other sites are ideally positioned to monitor effects of climate change, including northward encroachment of species from more temperate regions. Land managers can bring special expertise and assistance to monitoring efforts in Alaska. In addition, private landowners may gain public relations or other benefits by making their lands available as monitoring sites. The CWCS is an opportunity to provide strategies for helping them realize those benefits, and identify other mutually advantageous relationships.

As we move to expand data gathering and improve monitoring approaches in Alaska, incentives for participation and collaboration may or may not be needed. Much will depend on how well the public understands the basic ecological issues and the long-term value of its contributions. Some people may require little added incentive besides knowing they are helping to improve conservation of the species or ecosystems upon which their livelihoods or recreational enjoyment depend. Prospective "citizen monitor" volunteers may be energized by changes that affect their day-to-day lives (e.g., reduced snow cover, altered bird breeding and plant flowering dates) or in what they see happening to habitats over long periods (e.g., elimination of amphibian breeding ponds due to coastal isostatic uplift). Alaska's growing population of senior citizens may be receptive to the idea that contributing

their time to monitoring efforts keeps them active and involved and leaves a legacy of much-needed baseline information for future generations.

Industries and nongovernmental organizations may find beneficial reasons and means to assist with Alaska's monitoring needs, including by providing matching funds, expertise, or in-kind services on multipartner projects. Where incentives to collaborate in monitoring and other CWCS efforts are needed, we can be both practical and creative. For example, with the right incentives, universities can encourage students in the sciences to devote a term's or summer's work to part of a long-term monitoring project in Alaska. In addition, the University of Alaska announced it is providing computer ownership and other incentives designed to promote greater participation in the sciences by Alaska Native high school and university students.

Cross-border collaborations have been especially effective for the management and monitoring of commercially important species. Experts noted that they also would be important for nongame species and ecosystem processes, especially collaborations with Canada, Mexico, Russia, and other countries associated with major flyways and dispersal routes.

Funding criteria related to monitoring priorities must help focus effort effectively. Experts warned of the "diluting" effects if, in the interests of being fair, decision-makers of agencies and conservation organizations spread funding across the state during each funding cycle. Instead, experts recommended that Alaska focus efforts in a way that advances priority work and then gradually revise priorities to begin focusing elsewhere.

Summary

Monitoring specifics will be developed as part of the CWCS implementation process. The descriptions of needs for each species in Appendix 4 provide substantial background and specific recommendations that should serve as a starting point. Specific steps to advance CWCS monitoring objectives include:

- Conduct an overview of existing monitoring activities in Alaska to identify gaps and deficiencies for key species, habitats and systems.

Monitoring water quality in Beaver Creek, a Kenai River tributary D. Palmer, USFWS

- Develop strategies for identifying new partners, strengthening existing relationships, and trying new methods of collaboration.
- Evaluate the need for different types of monitoring (populations, habitats, systems) across different scales (local, regional, statewide) with respect to the major causal factors of decline.
- Develop priority system(s) for addressing gaps and deficiencies and supplementing existing efforts.
- Design appropriate monitoring activities and programs.
- Coordinate meetings with partners and stakeholders to discuss ways of meeting monitoring priorities and to identify respective roles and responsibilities.

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