

## **Initiative to develop a long-term monitoring program at Pacific Region National Wildlife Refuges to assess the impacts of climate change on aquatic resources**

**April 25, 2012**

Fisheries Project Leaders identified three areas of emphasis during their coordination meeting in 2011. One area of emphasis was to assist R1 National Wildlife Refuges to design and implement an aquatic monitoring program for evaluating the impacts of climate change, which is supportive of the Service's Strategic Plan for Responding to Accelerated Climate Change. Based on initial discussion between Fisheries and Refuges, a necessary step for collaboratively developing an aquatic monitoring program is to facilitate coordinated communication among offices and programs to determine if there are common issues concerning monitoring and climate change. If so, then a monitoring program can be designed to address the issues common to Refuges and Fisheries.

The intent of this document is to assist in determining what questions may be shared between the programs. The approach is for Fisheries to articulate an overall goal of the monitoring program, describe basic questions that can be answered to address the goal, and provide examples of variables that potentially can be used as metrics in the design. The hope is that this approach results in a starting point that will encourage dialog between the programs, and lead to articulation from Refuges' perspective so that the concept of an aquatic monitoring program can be further evaluated and developed. In addition, questions are included that we would request Refuges to consider and be prepared to discuss at the upcoming workshop.

*A. Overall goal*—Design a monitoring program to evaluate effects of climate change on aquatic resources. An assumption is that the design will include establishing permanent monitoring sites that are surveyed at some predetermined frequency (e.g., 1-, 2-, 5-year interval).

### *B. Basic questions and associated variables*

*1. How do physical attributes vary through time?* The selection of physical attributes should be based on their expected effects from climate change and biological relevance. Likely continuously collected variables would include water temperature, precipitation, stream discharge, and water levels in lakes/ponds/tidal areas; thus generating data to assess potential changes in timing, frequency, and magnitude over time. It may be appropriate to use some variables being measured by others in the proximity of survey sites, but not at a refuge.

*2. How do biotic attributes vary through time?* The primary biotic attributes of interest are Fisheries' trust species (e.g., listed and imperiled aquatic organisms), and could include other taxa potentially affecting trust species (e.g., non-native invasive fish through interspecific interactions or aquatic invertebrates through food availability). Because aquatic assemblages and communities reflect the integration of prevailing physical and biotic conditions through time, indices derived from assemblage metrics such as species richness, relative abundance, Index of Biotic Integrity, and ecological/physiological traits of select taxa would be the main variables of interest.

*C. Analysis:* The main analyses are presently envisioned to focus on detecting and describing potential temporal changes in physical and biotic attributes, and assessing whether these are associated with the influence of climate change. Additional questions can be developed to address spatial aspects of monitoring (e.g., by incorporating comparisons among refuges, areas off refuges, etc.) and possibly coordinating with ongoing monitoring activities by others.

*D. Questions:* We request Refuges to consider the following questions prior to the upcoming May 2, 2012 Workshop in Vancouver, WA, so that a roundtable discussion can be held. This will assist with assessing the desire and feasibility of our programs to jointly design an aquatic monitoring program.

1. Please describe the goals, basic questions, and variables of an aquatic monitoring program from Refuges' perspective.
2. What specific issues should be focused on at your refuge in designing a monitoring program?
3. Who should be on a workgroup to further develop the monitoring program?
4. Are there specific refuges that should serve as pilot sites?
5. Given the large geographic scale of climate change, what should be the scope of the monitoring program (e.g., all R1 (four states and Pacific Islands), three mainland states, specific area of a basin, or area including R1 and beyond)?