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ABSTRACT

The United States identified the following research plans that reflect the five research components identified under the NPAFC Science Plan for 2016-2020 (NPAFC Doc. 1665): 1) Status of Pacific salmon and steelhead trout; 2) Pacific salmon and steelhead trout in a changing North Pacific Ocean; 3) New technologies; 4) Management systems; 5) Integrated information systems. In order to improve monitoring and enforcement efforts, the North Pacific Anadromous Fish Commission (NPAFC) scientists developed BASIS (Bering-Aleutian Salmon International Survey) during 2002, a comprehensive survey of the Bering Sea epipelagic ecosystem. The NPAFC, BASIS working group completed the research after a successful 10-year program, and the working group was disbanded during 2015. The US modified the acronym during 2016 (Bering Arctic Subarctic Integrated Surveys) to describe the current integrated ecosystem research in Alaska's Large Marine Ecosystems.

UNITED STATES NATIONAL RESEARCH PLAN

The United States identified the following research plans that reflect the five research components identified under the NPAFC Science Plan for 2016-2020.

U-1: Migration and Survival Mechanisms of Juvenile Salmon in the Ocean Ecosystems

Research activities take place primarily in the coastal waters of the eastern Gulf of Alaska, eastern Bering Sea, and US Arctic (BASIS). Activities include:

(1) repeated measurements of the habitat, and stock-specific life history characteristics of salmon from their early marine residence period to their later migration through coastal waters;
(2) fine-scale field studies that focus on aggregations of salmonids to look for specific processes or factors that influence their distribution, behavior, and growth;
(3) studies on diet overlap and prey selectivity among salmon and other fishes;
(4) genetic stock-identification studies of juvenile, immature, and maturing salmon;
(5) monitoring of thermally marked salmon;
(6) studies of growth and size of juvenile and immature salmon;
(7) modeling salmon production based on interannual variability in early marine salmon survival and growth;

(8) describing the trophic dynamics of juvenile salmon and their predators in coastal waters;
(9) bioenergetic models of juvenile salmon growth; and
(10) archival tagging of immature and maturing salmonids.

U-2: Climate Impacts on Pacific Salmon Production in the Bering Sea, Gulf of Alaska and US Arctic

Research activities encompass those listed under U-1 with emphasis on monitoring biological and physical environments (integrated ecosystem surveys) over a number of years to understand the impact of climate change and variability on salmon and groundfish (walleye pollock, Pacific cod, sablefish, rockfish) within US eastern Pacific Ocean, Large Marine Ecosystems.

The United States plans to conduct integrated ecosystem assessments in the coastal eastern Gulf of Alaska (odd years), southeastern Bering Sea (even years), and the US Arctic (Chukchi Sea and Beaufort Sea) during summers of 2017 and 2019. Annual surveys are scheduled for the northern Bering Sea (60N to Bering Strait) and inside waters of northern southeast Alaska (southeast coastal monitoring).

Specific questions include:

(1) How will climate change and climate cycles affect anadromous salmon stocks and ecologically related species?
(2) What are the key climatic factors affecting cyclical changes in food production and pelagic fish communities?
(3) How will climate change and climate cycles impact the available salmon habitat?
(4) How will warming in the Arctic impact salmon movement northward?
(5) Will salmon colonize regions of the Arctic in the near future?

U-3: Biological Monitoring of Key Salmon Populations

Research activities under this component are addressed in U-1 for key salmon populations. The key populations monitored during the ocean surveys include:

(1) Southeast Alaska pink, chum, and Chinook salmon – Southeast Coastal Monitoring (SECM) project;
(2) eastern Gulf of Alaska shelf for Chinook salmon (Columbia River, Canadian origin and southeast Alaska)
(3) western Alaska Chinook and chum salmon – Yukon River, northern Bering Sea.
(4) western Alaska sockeye salmon (Bristol Bay) – southeastern Bering Sea (BASIS) during even years.
(5) NMFS Auke Creek Weir – southeast Alaska weir located in Auke Bay, Alaska. For the last 30 years, this continues to provide a comprehensive accounting of all

salmon species including pink, chum, sockeye, and coho salmon transiting between Auke Lake and Auke Bay. Population trend patterns are being used to understand potential effects of long-term climate changes.

(6) NMFS Little Port Walter Marine Station – research hatchery releasing approximately 150,000 age-1 Chinook salmon smolts annually. Data from our 36-plus years of Chinook salmon hatchery releases provide one of the most comprehensive resources available for tracking stock distribution and survival trends.

The United States will continue to monitor catch and escapement (where available) and hatchery releases for salmon populations returning to the Pacific Northwest and to coastal Alaska river systems. These data have been provided each year to NPAFC for use in the annual Statistical Yearbook.

U-4: Development and Applications of Stock Identification Methods and Models for Management of Pacific Salmon

Research activities under this component are designed to find and apply markers capable of identifying populations of salmon migrating in the North Pacific Ocean and Bering Sea. Markers include both the application of thermal 'tags' to otoliths of hatchery fish as well as the naturally occurring DNA variation that describes wild populations. Otolith protocols are well established. A continuing task for genetics laboratories is to develop standardized methods of genetic analysis among Parties. This standardization has been conveniently leveraged by collaboration among agencies and universities working on Pacific Salmon Commission and State of Alaska studies. Years of successful collaboration among laboratories of the NPAFC parties have enabled the development of shared rangewide datasets for Chinook, sockeye and chum salmon. Development of these datasets continues as does the initial work on similar datasets for coho and pink salmon. Both types of stock identification assist in identifying the origins of stocks harvested in mixed-stock fisheries and in determining the oceanic distribution of the stocks.

In addition to continued monitoring of thermally marked salmon in research activities outlined above and in U-1, the United States will also continue to collect and report on high-seas coded-wire tags (CWT) recovered from both the Bering Sea and North Pacific Ocean. These CWT recoveries come from research surveys by NPAFC member Parties and from salmon caught as bycatch in US Gulf of Alaska and Bering Sea-Aleutian Islands groundfish fisheries.