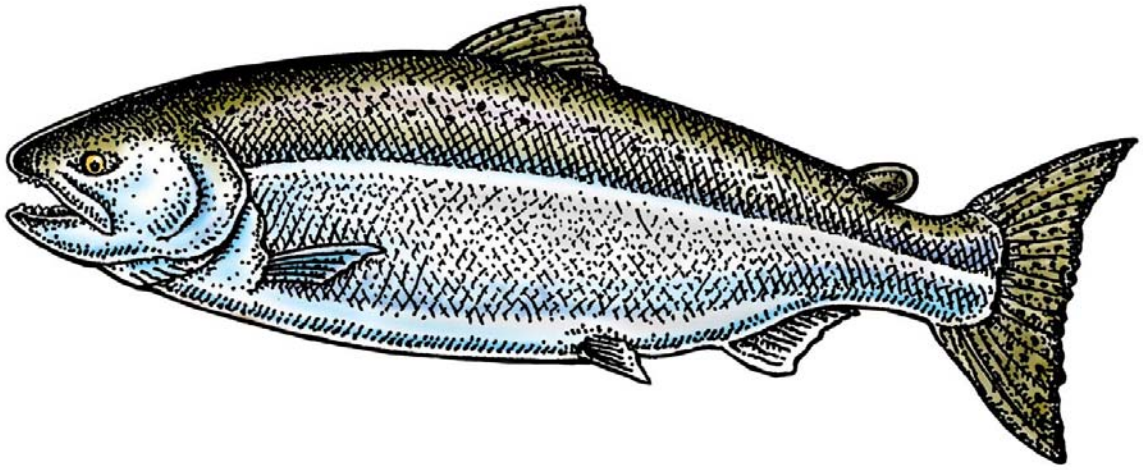
American Fisheries Society

Organized 1870 to Promote the Conservation and Wise Utilization of the Fisheries
Alaska Chapter, organized in 1974

135th American Fisheries Society Annual Meeting in Anchorage

BACKGROUND INFORMATION about CLIMATE RELATED PAPERS



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One of the themes that runs throughout this international fisheries meeting is climate change. Water temperature, currents, salinity and nutrients are the mechanisms of climate change in the oceans and freshwaters. Presentations throughout the week will address changes that have been observed or are predicted to affect many different fish species in many different countries. Changes identified not only by Alaska natives and fisheries scientists across Alaska and Canada, but also across the western, mid-western and eastern U.S. and far south as Mexico and even on Lake Tanganyika near the equator in Africa will be highlighted.

The majority of the papers address climate change particularly as it affects Pacific salmon. Climate changes predicted for Western North America, the habitat of Pacific salmon, include more precipitation, less snow pack, higher summer temperatures and earlier snowmelt—all damaging for salmon. However, fisheries scientists are uncertain how the ability of pacific salmon to adapt to climate variability has been compromised and will be discussing this in more detail.

<u>Sockeye Salmon</u>.

In papers about Alaska sockeye salmon, information will be presented about climate effects in both freshwater and the ocean.

In the freshwater habitat of Alaska sockeye, greater glacial runoff is increasing turbidity in Skilak Lake in the Kenai River system. Both declining food abundance and increased metabolic rate associated with warmer water temperature. Juvenile sockeye salmon have declined in size by 50% food as their food supply declined by 50%. On the other hand, modeling of juvenile sockeye salmon in southwest Alaska indicates that prey production has increased sufficiently in the system to offset the increased metabolic demands due to warming. The model estimated an 11% increase in growth rate associated with warming.

In western Washington modeling of climate, hydrology and salmon population dynamics to examine effects of climate change over the next 50 years suggests that results of habitat restoration for endangered salmon is likely to depend on future climate conditions.

As salmon juveniles move from freshwater lakes and streams to the salty ocean environment, they face a major change not only in body function from absorbing salt to keeping out or eliminating too much salt but also in habitat and predator conditions along with climate conditions.

Different components of Bristol Bay sockeye that were minor producers during one climatic regime have dominated during others. Salmon age structure appears to influence population responses to environmental change within a localized region. **T**he Kvichak sockeye salmon return declined approximately 75%, on average, from 1974-1990 to 1991-1998. Egegik and Ugashik stocks also declined, whereas other stocks did not decline to such a large degree. The lower production of Bristol Bay stocks was primarily associated with reduced returns of salmon that spent two years in freshwater and two years in the ocean. Salmon that spent 1 year in lakes and 3 years in the ocean increased. On the other hand, Kvichak salmon returns have been dominated by salmon that stayed in the ocean for two years (84% of total) and no large returns have been produced by numerous salmon that stayed in the ocean 3 years. Greater adult returns of Bristol Bay salmon following the 1977 ocean regime shift were associated with a similar shift in age composition toward younger smolts and older ocean ages. Stocks experiencing the recent decline continued this age shift whereas other stocks did not. We hypothesize that the recent shift in age composition coupled with reduced reproductive potential of adults is in response to less favorable ocean conditions has contributed to the decline.

Bering Sea

Other papers at the four-day meeting will examine the not only the relationship between climate change and salmon in the Bering Sea but also snow crab, cod and flatfish.

A special all-day session on Wednesday will be devoted to “BASIS” a new international research program that is focusing on how Pacific salmon will respond to changes in the Bering Sea ecosystem. The scope and scale of the research, which is

coordinated by the North Pacific Anadromous Fish Commission, is unprecedented– involving the cooperative efforts of scientists from the five major salmon-producing nations of the North Pacific Rim: Canada, Japan, Korea, Russia, the United States In the first 3 years of the program, BASIS investigations (2002-2004) have coincided with ocean warming and intensification of water exchange between the Pacific Ocean and the Bering Sea, which has important implications for salmon production.

Changes such as warmer water can trigger changes in the Bering Sea ecosystem. Some of the most dramatic changes in the physical and biological environments of the southeastern Bering Sea occurred recently. These changes are expected to alter the habitat, plants, and animals in the food chain, including the juvenile salmon found there.

The lack of ice over the southeastern Bering Sea shelf during recent winters resulted in increased water temperatures in the water column. Changes in seawater temperature and chemistry in the Bering Sea can affect the entire food chain. At the base of the chain, one-celled plants called "phytoplankton" provide food for small marine animals called "zooplankton", which in turn are an important food source for many species of fish, seabirds, and marine mammals.

A preliminary indicator of a change in the Bering Sea was the occurrence of an unusual bloom of marine algae over the southeastern Bering Sea shelf during the summers of 1997-2001. Scientists hypothesize that lack of winter storms or wind during this period produced conditions leading to a huge bloom or "megabloom" of a one-celled plant, called a "coccolithophore", in the southeastern Bering Sea in summer. .Summer megablooms of coccolithophores were rare in the Bering Sea before 1997. Evidence for the importance of the changing levels of small plants and animals in the ocean can be found in the returns of adult salmon, which respond quickly to climatic changes.

BASIS scientists speculate that the combination of coccolithophore megablooms and relatively cool sea surface temperatures in the southeastern Bering Sea in summer-fall 1997-2001 restricted the offshore distribution and effective feeding area of juvenile sockeye salmon. As a result, the carrying capacity or maximum number of juvenile sockeye salmon that could be supported by the Bering Sea ecosystem was reduced in 1997-2001. Since the start of BASIS field research in 2002, relatively warm ocean temperatures and a lack of coccolithophore megablooms in the southeastern Bering Sea in summer seem to have contributed to high growth and survival of juvenile sockeye salmon. Subsequently, returns of adult salmon have increased in Bristol Bay, Alaska, the home of the world's largest sockeye salmon runs.

<u>Other Regions of North America and the World</u>

In other regions of the world, signs of the impact of climate change are emerging. Climate change in the American great plains is expected to result in less frequent but more severe precipitation events. More floods increase scouring, decrease primary productivity and nutrient retention and therefore capacity to support freshwater fish. In

the Great Lakes climate change is affecting water level fluctuations, wetland distributions, thermal regimes fish habitat use patterns. Some species and guilds are more sensitive to water level, temp and habitat changes. For example, a strong correlation between declining burbot catches and increasing water temperatures suggests that continued warming may limit the maximum size of burbot in warming lakes and even wipe out burbot populations in New York.

Even as far south as Mexico El Nino conditions over the last 3 decades are correlated diminished spawning of some species of 23-72% and with increased spawning of other species 39-97%. Across the globe in Lake Tanganyika, near the equator, primary productivity and fish catches have declined as the lake warmed over the past century.

Media Conference on Climate Change

An opportunity to interview Fisheries and Climate Change experts is scheduled Monday, September 12, 1 pm in the media room (Egan mezzanine conference room) with selected experts on climate change available for press interviews.

Free media registration is provided by the American Fisheries Society.

Approximately 2,300 fisheries scientists are expected to attend, including some of the world's foremost experts on fish and fisheries. The technical program includes 1,800 oral and poster presentations over four days. The meeting will be held at the Egan Center and Performing Arts Center September 11-15, 2005.

The American Fisheries Society is the world's oldest and largest fisheries science society, with more than 9,000 members in 70 countries. Its mission is to improve the conservation and sustainability of fishery resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals. The society publishes four journals, Fisheries magazine, and up to a dozen books every year.

For more information, visit our website: http://wdafs.org/Anchorage2005/media.htm or contact Kate Wedemeyer at 334-5278.

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