

Summary of the Ecosystem Forum 12/3/02

On December 3, the Council sponsored a forum entitled “Observations of Ecosystem Change and Development of Ecosystem Considerations”. This one day forum was held to get the latest information on the status and trends of the marine ecosystems off Alaska, and to discuss how this information might be used in the fishery management process. An audience of over 100 people listened to talks from prestigious panel of speakers including Nathan Mantua (UW), George Hunt (UCI), Ward Testa (NMML), Doug DeMaster (AFSC), David Irons (USFWS), and Pat Livingston (NMFS). A summary of their presentations, and the moderated panel discussion, is provided below.

Presentations

Evidence for climate-related North Pacific regime shifts

Dr. Nathan Mantua (UW) provided an overview of his work on regime shifts in the North Pacific. He defined a ‘regime’ as an equilibrium state or a stable mean state. The marine ecosystem is influenced by both climate change and fishing effects. Nate reviewed both the biological and climate data for changes over time. Changes in fish composition, landings, and recruitment show two distinct patterns with changes occurring in 1976-77 and in 1988-89. The physical climate data show more abrupt changes. The ‘Aleutian low’ (a climatological feature of sea level pressure in winter months) seems to be stable for 20 to 30 year periods, then changes to a different state; changes in the Aleutian low occurred in the mid 1920’s, mid-1940’s, and in 1977. Related to the Aleutian low, winter air temperature records from Kodiak and the Alaska Peninsula showed a big jump in 1977 (especially at King Salmon); from 1955-1977, air temperature averaged 15°F, which jumped to 24°F from 1978-2002. The Pacific Decadal Oscillation also shows a 20 to 30 year persistence, with warm years 1925-46 and 1977-98, and cold years 1947-76. Nitrogen data collected from sediment cores of sockeye salmon lakes (dating back to 500 BC) show even longer term cycles in salmon abundance, suggesting even larger and longer term natural changes. Nate summarized his presentation, noting that regime shifts are real, but the mechanisms that cause climate and ecosystem regime shifts are not understood at this time.

Changes in the Bering Sea and the Oscillating Control Hypothesis

Dr George Hunt (UCI) provided an overview of biological and oceanographic changes in the Bering Sea, and presented a new hypothesis to explain stable states and shifts in the ecosystem. In reviewing the changes that have occurred, George noted the declines in sea lions, fur seals and kittiwakes, indicating that carrying capacity for these organisms has dropped. A closer look at the age composition of pollock eaten by black-legged kittiwakes shows that in 1978 and 1979, the pollock eaten by birds was primarily age 1; after that it shifted to age 0. Consequently, the birds were forced to work harder for their food. George also reviewed the effects of wind on annual ice cover and mixing, and the effects on primary productivity. Prior to 1978, winters were windier, thus producing more ice cover. Ice is important because it effects the timing of primary production in the spring. If the ice persists past late March, the melting causes an ice-edge plankton bloom. If the ice melts early, there is not enough light for a bloom. Additionally, cold water temperatures can slow the plankton bloom, but a late season ice melt in warmer water conditions can cause a very strong bloom. From all these observations, George and others developed the ‘Oscillating Control Hypothesis’. The hypothesis is that the pelagic ecosystem will alternate between primarily bottom-up control in cold regimes and primarily top-down control in warm regimes. In a cold water regime, the plankton production is low and

limits the survival and recruitment of large piscivorous fish such as pollock (thus, a bottom-up limitation). In warm water regimes, plankton populations are high, supporting higher survival and production of predatory fish. In turn, the increase in predatory fish provide a top-down regulation. George noted that these changes affected the survival of marine birds and pinnipeds, which could be expected to have higher production and survival in cold regimes (little competition with piscivorous fish) and in the transisiton period from cold to warm regimes (when there are lots of young pollock, for example). George summarized that his hypothesis provides a good explanation of the current system - we have been in a warm water regime, which in turn, allowed an increase in predatory fish such as adult pollock. The high adult pollock biomass has in turn competed with other predators such as sea lions and marine birds causing these species to decline.

Status and trends of marine mammals off Alaska

Dr. Ward Testa and Dr. Doug DeMaster provided an overview of marine mammal populations. For Steller sea lions, the surveys indicate that both adults and pup production are declining, with a 1990-2002 average of 4.1% and 5% per year. The population of fur seals numbers 1.2 million worldwide, with about 80% found in the Pribilof Islands. They were listed as depleted in 1983, and are declining at about 5% per year. Annual pup production is currently about 160,000 per year, suggesting that the decline will continue into the foreseeable future. Interestingly, since the first sighting of fur seal pups on Bogoslof Island in 1980, pup production has increased 50% per year, with over 5,000 pups observed in the past summer survey. Obviously, some of the breeders are immigrating to Bogoslof from the Pribilof Islands. Genetic information collected from harbor seals indicate that there are many populations in Alaska. Population trends differ among regions with the highest increases around Kodiak and Ketchikan (+7% / yr) and the biggest decreases in Glacier Bay (-9% / yr). Gray whales were removed from the endangered species list in 1994 and number about 18,000. Interestingly, gray whales used to spend a lot of time foraging in the Chirikof Basin, but appear to have moved further north into the Chukchi Sea area. Arctic bowhead whales have increased since the turn of the century, increasing at about 3.2% per year, and the population now numbers about 10,000. About 49 bowhead whales are harvested for subsistence each year. North Pacific right whales are endangered, with the population estimated at less than 100 animals. This population was severely depleted in the 1960's (poaching by russians into the 1970's). The good news is that a female right whale and calf was observed last summer in the Bering Sea. NMFS will be revisiting a petition this year to designate critical habitat for this species. Sea otters in the Aleutian Islands have declined 70% in the last few years, with the most recent population estimated at 2,000 otters.

Status and trends of seabirds off Alaska

Dr. David Irons (USFWS) reviewed the seabird population data . Alaska is an extremely productive area for seabirds with over 150 million present in summer months. Some rookeries have over 1 million breeding birds. Some species feed at the surface (e.g., kittiwakes), whereas others can dive for their food (e.g., murre). Seabirds mostly feed on small fish and krill. They eat millions of tons of fish (primarily age 0 and 1 pollock) each summer in Alaska. The birds try to forage as close to the colony as possible, and chick production reflects foraging success. The USFWS has an extensive monitoring program at several dozen sites, with data collected on population trends, productivity, and diet composition. Many of the studies focus on kittiwakes and murre. David noted that population trends seem to reflect changes in the environment, and that these changes were different across regions of Alaska. For example, in the Pribilof Islands from 1976 to 1998, common murre increased, thick billed murre were stable, and both black-legged kittiwakes and red-legged kittiwakes declined. In Prince William Sound, piscivorous birds declined from 1972 through 89, whereas non-piscivious species increased.

The Ecosystem Chapter and incorporating ecosystem information

Pat Livingston (NMFS) reviewed the evolution of the Ecosystem Considerations chapter of the annual SAFE report, and the development of ecosystem indicators. The Chapter was first issued in 1995, and subsequent issues contained a variety of information but was not standardized. Since 2000, the Chapter has a standardized content, providing information on ecosystem trend indicators. The indicators were built around the Councils' ecosystem-based management goals (maintain biodiversity, habitats, and sustainability, with the understanding that humans are part of the ecosystem). Pat provided examples of status and trend information used for the biological and physical indicators of the ecosystem. Future Ecosystem Chapters will include additional information on HAPC biota and non target species, plankton, herring, salmon, and shellfish data. The goal of the Chapter is to develop more quantitative indicators for ecosystem-based assessment.

Moderated Discussion

A moderated discussion of the panel was stimulated by numerous questions from the audience. In response to a question of how well the Council is doing relative to ecosystem management, panel members noted that the Council has an excellent record, but there are additional actions that could be considered to more explicitly apply ecosystem-based management measures (e.g., F40 report recommendations, other methods used worldwide such as CCAML explicit targets, predator set-asides, TACs adjusted for climate conditions). Many other questions and additional discussion revolved around the Oscillating Control Hypothesis. It was noted that the Bering Sea has been in a top-down control since 1982, when the large biomass of adult pollock dominated (referred to as 'a wall of mouths'). It was noted that we may now be heading to a bottom-up cold regime, and we may need to adjust our management strategy to accommodate these changes. It was noted that there have been many changes in the Bering Sea in recent years (e.g., reduced water flow, coccolithophore blooms, increasing whale abundance, change in PDO), so other changes are to be expected.