

## COLUMN: GUEST DIRECTOR'S LINE

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Black guillemot on Cooper Island east of Barrow, Alaska.

Photo: George Divoky.

## A New Management Plan for the Arctic Waters of the United States

The fishery resources in the Arctic seas controlled by the United States are under a new management regime. In August 2009, the Secretary of Commerce approved a fishery management plan (FMP) for all federal waters north of Bering Strait. This FMP was a joint effort between the North Pacific Fishery Management Council (NPFMC) and National Oceanic and Atmospheric Administration (NOAA) Fisheries. The new FMP effectively closes the U.S. Arctic to commercial fishing until sufficient data become available for sustainable management of Arctic fish stocks. In this article, we describe the conception and crafting of this FMP.

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the NPFMC is authorized to conserve and manage the fishery resources of the U.S. Exclusive Economic Zone (EEZ) off Alaska (waters between 3 and 200 nautical miles [nm] from shore). To date, no commercial fisheries have developed in U.S. Arctic waters and the NPFMC has not had a compelling reason to develop an FMP for this region. However, due to growing concerns over global climate change and impacts on marine ecosystems, and to continue the policy of the NPFMC and NOAA Fisheries to integrate ecosystem considerations into fisheries science and management, the NPFMC recognized the need to prepare for potential changes in U.S. northern marine waters. These changes are likely to include a reduction of seasonal sea ice coverage, which would increase vessel accessibility to the Arctic, and may result in changes to fish distribution and abundance that could make Arctic fisheries a profitable venture.

These concerns parallel a growing awareness of and interest in Arctic ecosystems on the part of NOAA Fisheries and other organizations. The Fourth International Polar Year was declared for 2007–2008; this is a period of time where nations decide to coordinate research, policy, and outreach concerning the polar regions. Through the Russian-American Long-term Census of the Arctic (RUSALCA), NOAA and the Russian Academy of Sciences have jointly been conducting multidisciplinary marine research in the Bering and Chukchi seas since 2004. The U.S. Coast Guard ice-breaker *Healy* has been carrying scientists from NOAA, the University of Alaska, and other institutions into Arctic waters for the last several years. Concerns about increased ocean temperatures have also led NOAA to launch the Loss of Sea Ice Initiative, a research effort designed to investigate the consequences of reduced seasonal sea ice cover on the Bering, Chukchi, and Beaufort seas. See NOAA's Arctic website at [www.arctic.noaa.gov](http://www.arctic.noaa.gov) for more information.

Beginning in 2006, the NPFMC began discussing strategies to prepare for future change in the Arctic region. It explored various policy options, including an FMP, to address management of any existing or potential future commercial fisheries in this region. Under the MSA and other government regulations, the fishery management process requires thorough analyses of the biological, economic, and social impacts of proposed actions. These analyses typically include a consideration of the status quo as well as one or more action alternatives that are reasonable and may accomplish the stated objectives. In the case of the Arctic FMP, the

process began with an initial discussion document that helped frame the issues and included several alternative actions. Staff from the NPFMC and NOAA Fisheries conducted the analysis, which was reviewed by the NPFMC as well as its Ecosystem Committee, Scientific and Statistical Committee, and Advisory Panel. At each step in the process the council also solicited public comments.

As a result of the above process, the NPFMC and NOAA Fisheries developed an Arctic FMP that would (1) close the Arctic to commercial fishing until sufficient information is available to allow sustainable fishing, (2) clarify the management authorities in the Arctic and create a vehicle for addressing future management issues, and (3) implement an ecosystem-based management policy that recognizes the sensitive resources of the U.S. Arctic and the potential for fishery development that might affect those resources, particularly in the face of a changing climate.

Because human residents of the Arctic are extremely dependent on natural resources for survival, a special effort was made to enhance public participation in the policy-making process. Outreach efforts were designed to involve Arctic residents, particularly Native Alaskans, regional Native resource management entities, and other groups interested in the Arctic, in the dialogue and decision making related to adoption of an Arctic FMP. Staff from the NPFMC traveled to Arctic communities to participate in planning commission meetings, borough assembly meetings, and other regional gatherings, and participated in interviews on local radio stations. Flyers, e-mail, and

a website were also used to publicize Arctic fisheries issues.

Meeting the requirements of the NOAA Fisheries guidelines for FMPs was particularly challenging for the Arctic. Fishery management plans must specify management quantities, including maximum sustainable yield (MSY) and annual catch limits (ACLs) for target fish species. Estimating such quantities typically requires estimates of abundance or biomass, as well as information on life history variables such as natural mortality. The small amount of fisheries research that has been conducted in the Alaskan Arctic has been infrequent, and rarely of the type that would allow for quantitative assessment of fish stocks. In addition, surveys conducted at the same sites in the Chukchi Sea in 1990 and 1991 (Figure 1) suggested that there is substantial interannual variability in species composition and abundance. Biologists from the NOAA Fisheries Alaska Fisheries Science

Center (AFSC) provided scientific advice for overcoming these challenges.

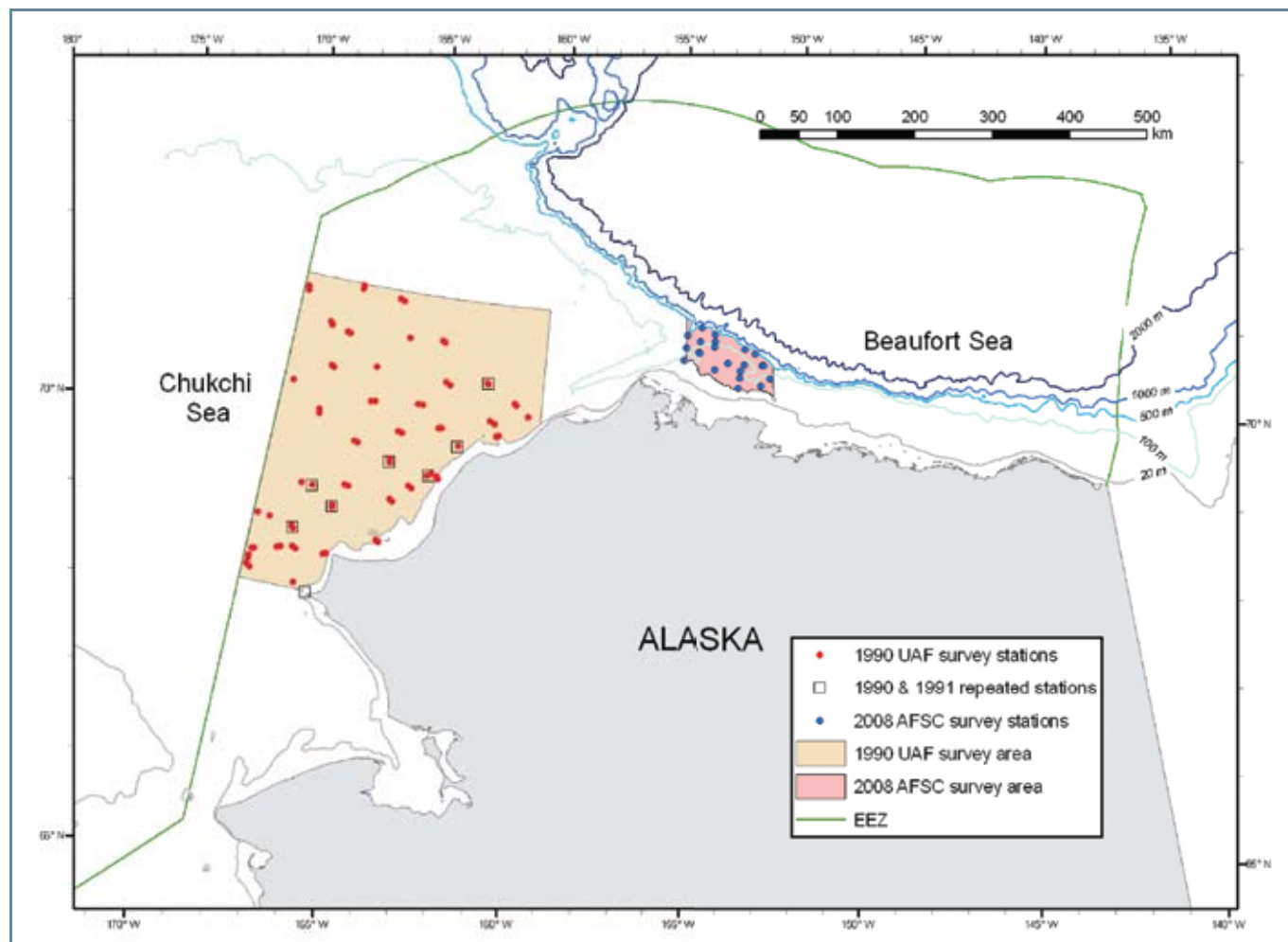
The results of two surveys were usable for estimating the biomass of fish and invertebrates in the Alaskan Arctic. A survey conducted in 1990 by researchers from the University of Alaska Fairbanks provided data regarding the density of fish and crab stocks in the northeastern Chukchi Sea (Figure 1). In August 2008, the AFSC conducted a survey in the western Beaufort Sea that provided

density estimates for species there (Figure 1). Both surveys employed identical gear, a bottom otter trawl of the same design used for standard assessment surveys in the Bering Sea. The trawls were equipped with electronic sensors that provided data on bottom contact, net width, and other variables that allowed precise measurement of the area sampled. The density of each species was calculated for each survey haul by dividing the catch weight by the area swept, and a mean density for the survey area was calculated. Those densities were multiplied by the spatial area covered by the surveys to provide estimates of biomass. Because the surveys covered only a portion of the Arctic Management Area (Figure 1 and see side bar), those biomass values are probably underestimates.

The other main challenge was creating an FMP for an area where no commercial fisheries currently exist. This seeming paradox posed legal difficulties, but was



**Figure 1.** Map of the Alaskan Arctic showing management boundaries and locations of survey areas and stations. The Arctic Management Area is bounded by the U.S. Exclusive Economic Zone (EEZ; green line), a line 3 nm from shore (within which is state waters), and Bering Strait (see side bar).



## NEW U.S. ARCTIC FISHERY MANAGEMENT PLAN MANAGEMENT POLICY AND GOALS

ADOPTED BY THE NORTH PACIFIC FISHERY MANAGEMENT COUNCIL, FEBRUARY 2009

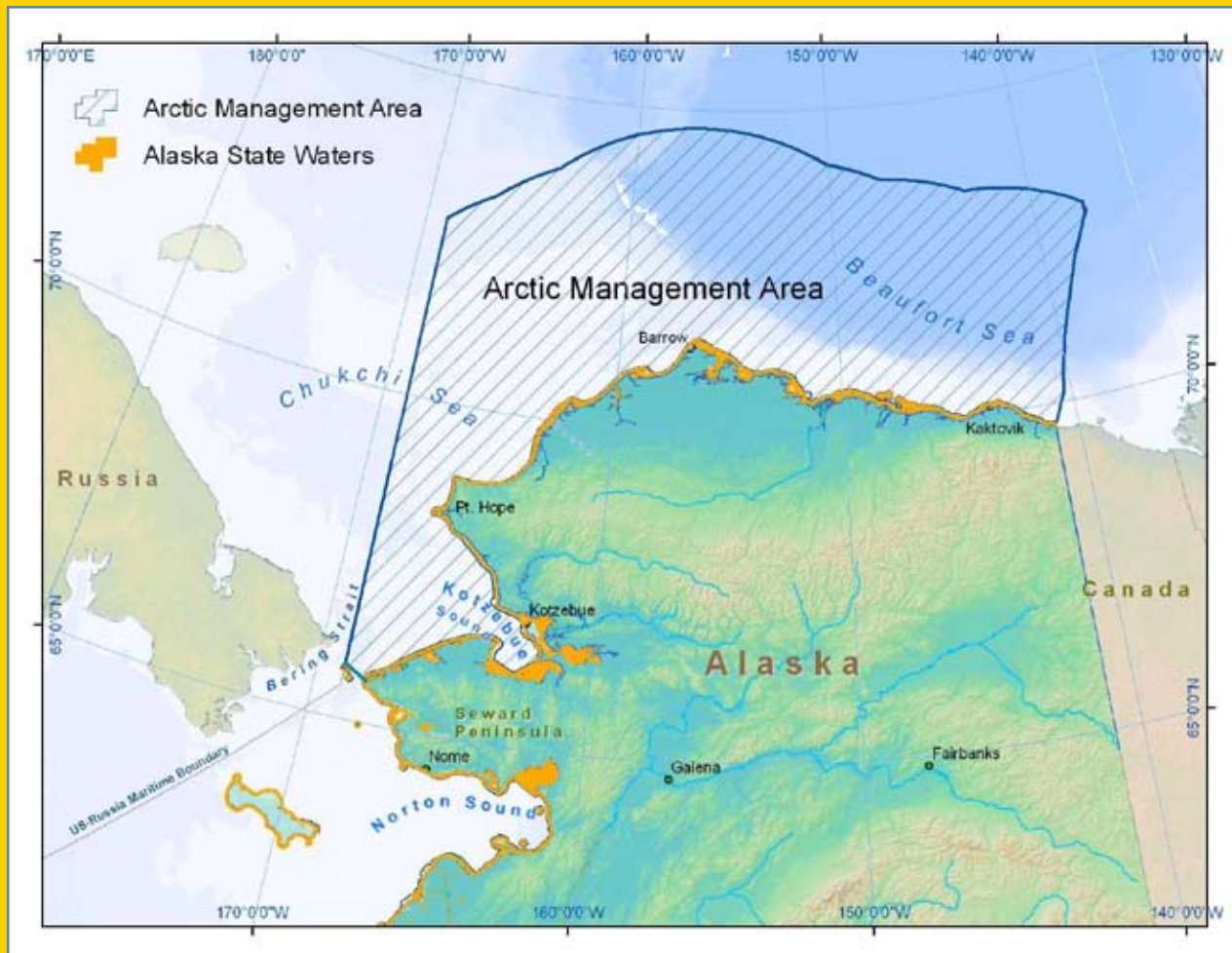
The council recognizes the different and changing ecological conditions of the Arctic, including warming trends in ocean temperatures, the loss of seasonal ice cover, and the potential long-term effects from these changes on the Arctic marine ecosystem. More prolonged ice-free seasons coupled with warming waters and changing ranges of fish species could together create conditions that could lead to commercial fishery development in the U.S. Arctic EEZ off Alaska. The emergence of unregulated, or inadequately regulated, commercial fisheries in the U.S. Arctic EEZ off Alaska could have adverse effects on the sensitive ecosystem and marine resources of this area, including fish, fish habitat, and non-fish species that inhabit or depend on marine resources of the U.S. Arctic EEZ, and the subsistence way of life of residents of Arctic villages. The council views the development of an Arctic FMP as an opportunity for implementing an ecosystem-based management policy that recognizes these issues in the U.S. Arctic EEZ.

The council's management policy for the U.S. Arctic EEZ is an ecosystem-based management policy that proactively applies judicious and responsible fisheries management practices, based on sound scientific research and analysis, to ensure the sustainability of fishery resources, to prevent unregulated or poorly regulated commercial fishing, and to protect associated ecosystems for the benefit of current users and future generations. This management policy recognizes the need to balance competing uses of marine resources and different social and economic goals for sustainable fishery management, including protection of the long-term health of the ecosystem and the optimization of yield from its fish resources. Recognizing that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other non-fishing activities, the council

intends to continue to take appropriate measures to insure the continued sustainability of the managed species and to prepare for possible fishery development in the Arctic. This policy will use and improve upon the council's existing open and transparent process of public involvement in decision making.

Given this management policy, the council's fishery management goals for the U.S. Arctic EEZ are to provide sound conservation and sustainability of fish resources, provide socially and economically viable commercial fisheries for the well-being of fishing communities, minimize human-caused threats to protected species, maintain healthy habitat for marine resources, and incorporate ecosystem-based considerations into management decisions. This policy recognizes the complex interactions among ecosystem components, and seeks to protect important species utilized by other ecosystem component species, potential target species, other organisms such as marine mammals and birds, and local residents and communities.

In implementing the management policy and goals, the council will consider and adopt, as appropriate, measures that prevent unregulated or poorly regulated fishing; apply ecosystem-based management principles that protect managed species from overfishing and protect the health of the entire marine ecosystem; where appropriate and practicable, include habitat protection and bycatch constraints; authorize and regulate commercial fishing in the U.S. Arctic EEZ consistent with the goals and objectives of the management policy should commercial fishery development be proposed in the future; and apply the council's precautionary, adaptive management approach through community-based or rights-based management. All management measures will be based on the best scientific information available.



Map of the Arctic Management Area under authority of the North Pacific Fishery Management Council's newly-adopted Arctic Fishery Management Plan. Note: the boundaries of the EEZ shown are the U.S. claim.


solved using an elegant mathematical approach to identify target fisheries that could be commercially viable. Briefly, fish prices from existing fisheries in the Bering Sea were combined with catch-per-unit-effort (CPUE) data from the Bering Sea to produce an estimate of "revenue-per-unit-effort," i.e., the money that could be earned from a particular fishery given a certain amount of effort. Those data were used to create benchmarks for an expected level of CPUE and price that would make a commercial fishery viable. When this formula was applied to the Arctic, three species met these benchmarks: snow crab (*Chionoecetes opilio*), Arctic cod (*Boreogadus saida*), and saffron cod (*Eleginus gracilis*). For each target species, MSY and status determination criteria were calculated.

The last step in the specification process was the determination of optimum yield (OY). Federal fisheries must be man-



Typical catch during a survey conducted by the Alaska Fisheries Science Center in the western Beaufort Sea. The catch is dominated by brittle stars with a few *opilio* crabs and fishes.

Photo: NOAA Fisheries.



Length 10cm  
Diameter 3.2cm  
Weight 77.25g

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The Reader uses enhanced PC software to initialize, configure, upload, view and analyze data. LoggerVUE also enables advanced graphing and file export to a variety of formats.

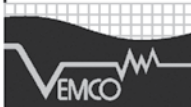
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aged to achieve OY, which the MSA defines as the catch that "will provide the greatest overall benefit to the nation...taking into account the protection of marine ecosystems." This means that catch limits are formulated by reducing MSY based on scientific uncertainty as well as economic and ecological considerations. Because the level of uncertainty in the Arctic is very high (due to the scarcity of data), fishing there is very expensive, and all three species are important ecosystem components, the OY for each species was set at essentially zero. A small amount of catch was allowed to meet subsistence needs. The FMP specifies a number of requirements, including the collection of data sufficient for effective management and an impacts analysis, that need to be met before opening a target fishery is considered.

In addition to the three target species, all remaining fish species in Arctic waters were designated "ecosystem component" species. This is a new FMP category created as a result of the reauthorization of the MSA and provides the authority for conservation of non-target species without requiring specification of optimum yield and other status determination criteria as is required for target species (the entire environmental and socioeconomic analysis document prepared to support the decision to adopt a new Arctic FMP is available at [www.fakr.noaa.gov/analyses/arctic/earirf0809final.pdf](http://www.fakr.noaa.gov/analyses/arctic/earirf0809final.pdf)).

At its February 2009 meeting, the NPFMC voted unanimously to adopt the new FMP for the Arctic Management Area (side bar). This action does not affect the management of Pacific salmon species because an existing salmon-specific FMP closes the entire Arctic to salmon fishing. In addition, fishing for Pacific halibut (*Hippoglossus stenolepis*) is managed by the International Pacific Halibut Commission, which has closed the Arctic to halibut fishing. The commercial fishing closure also does not apply to subsistence or personal use fisheries, or any fisheries prosecuted in Alaska state waters of the Arctic. The Arctic FMP was approved by the Secretary of Commerce in August 2009. For more information, visit either the NPFMC Arctic fishery management web page ([www.fakr.noaa.gov/npfmc/current\\_issues/Arctic/arctic.htm](http://www.fakr.noaa.gov/npfmc/current_issues/Arctic/arctic.htm)) or the NOAA Arctic fisheries page ([www.alaskafisheries.noaa.gov/sustainablefisheries/arctic](http://www.alaskafisheries.noaa.gov/sustainablefisheries/arctic)).