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ALASKA FISH AND WILDLIFE RESEARCH CENTER

U. S. FISH AND WILDLIFE SERVICE

POLAR BEAR RESEARCH PROGRAM

BRIEFING REPORT

JUNE 1993

## **INTRODUCTION**

### **Marine Mammals and Fisheries Branch**

Research on marine mammal and fishery resources of the arctic and subarctic environments of the United States is conducted by the Branch of Marine Mammals and Fisheries, Alaska Fish and Wildlife Research Center. Species studied include Pacific walrus, polar bear, sea otter, and a number of nationally and internationally significant salmon species. In addition, the Branch has conducted extensive research on the impacts to sea otters of the Exxon Valdez oil spill that occurred in Prince William Sound, Alaska in 1989. Marine mammal research presently addresses issues of population status and critical life history factors. Genetic and population studies to advance restoration and enhancement of critical salmon stocks in the Pacific Northwest are the primary thrust of the Branch's fisheries program.

### **Polar Bear Research**

Research on polar bear ecology and population status in Alaska has been ongoing since 1967, and was a joint effort between the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game until passage of the Marine Mammals Protection Act (Act) of 1972, when the program became the sole responsibility of the Service. The research effort was concentrated at Barrow during the early years of the program, with lesser efforts occurring at Cape Lisburne. In 1981, the research

program became focused in northern Alaska with operations based at Barrow, Prudhoe Bay, and Barter Island. Use of conventional radio-telemetry and mark/recapture were emphasized during this time period, and the international nature of Beaufort Sea polar bears was documented as shared between the U.S. and Canada. In 1985, the Service research program began using improved satellite telemetry technology on female polar bears in the Beaufort Sea and data collection on movements was greatly enhanced.

Funding of Service polar bear research was increased in 1986 and a second project was initiated in western Alaska with the deployment of satellite telemetry collars on adult females in the southeastern Chukchi Sea. This project was expanded into eastern Russia in 1990 and is now an active cooperative project between the United States and Russia.

## **RESEARCH OVERVIEW**

### **Maternity Denning in the Beaufort Sea**

The distribution of polar bears is circumpolar in the Northern Hemisphere, but known locations of maternal dens are concentrated in relatively few, widely scattered locations. Denning is either uncommon or unknown throughout much of their range. The Beaufort Sea region of Alaska and Canada is one such area. To understand affects of industrial development and proposed increases in hunting, the temporal and spatial distribution of denning in the Beaufort Sea was studied between 1981 and 1991.

Of 90 dens, 48 were on drifting pack ice, 38 on land, and 4 on land-fast ice. The proportion of dens on land was higher in the last half of the study. Bears denning on pack ice drifted as far as 997 km while in dens. There was no difference in cub production by bears denning on land and pack ice.

Female polar bears captured in the Beaufort Sea appeared to be isolated from those caught east of Cape Bathurst in Canada. Of 35 polar bears that denned along the mainland coast of Alaska and Canada, 80% denned between 137°00'W and 146°59'W. Bears did not reuse a den site between years and consecutive dens were 20-1,304 km apart. However, radio-collared bears were largely faithful to substrate (pack-ice, land, land-fast ice) and the general geographic area of previous dens.

### **Responses of Denning Bears to Human Activities**

Reactions of 12 polar bears to various disturbances at den sites were recorded opportunistically during a long-term radiotelemetry study of denning ecology in the Beaufort Sea. Considerable tolerance of anthropogenic disturbances among maternal polar bears was apparent, but responses varied among individuals and seasons. Polar bears appeared most willing to abandon dens early in the denning season. This may be a response to the degree of investment in denning effort which increases with time spent in the den. Anthropogenic disturbances in Alaska's arctic are likely

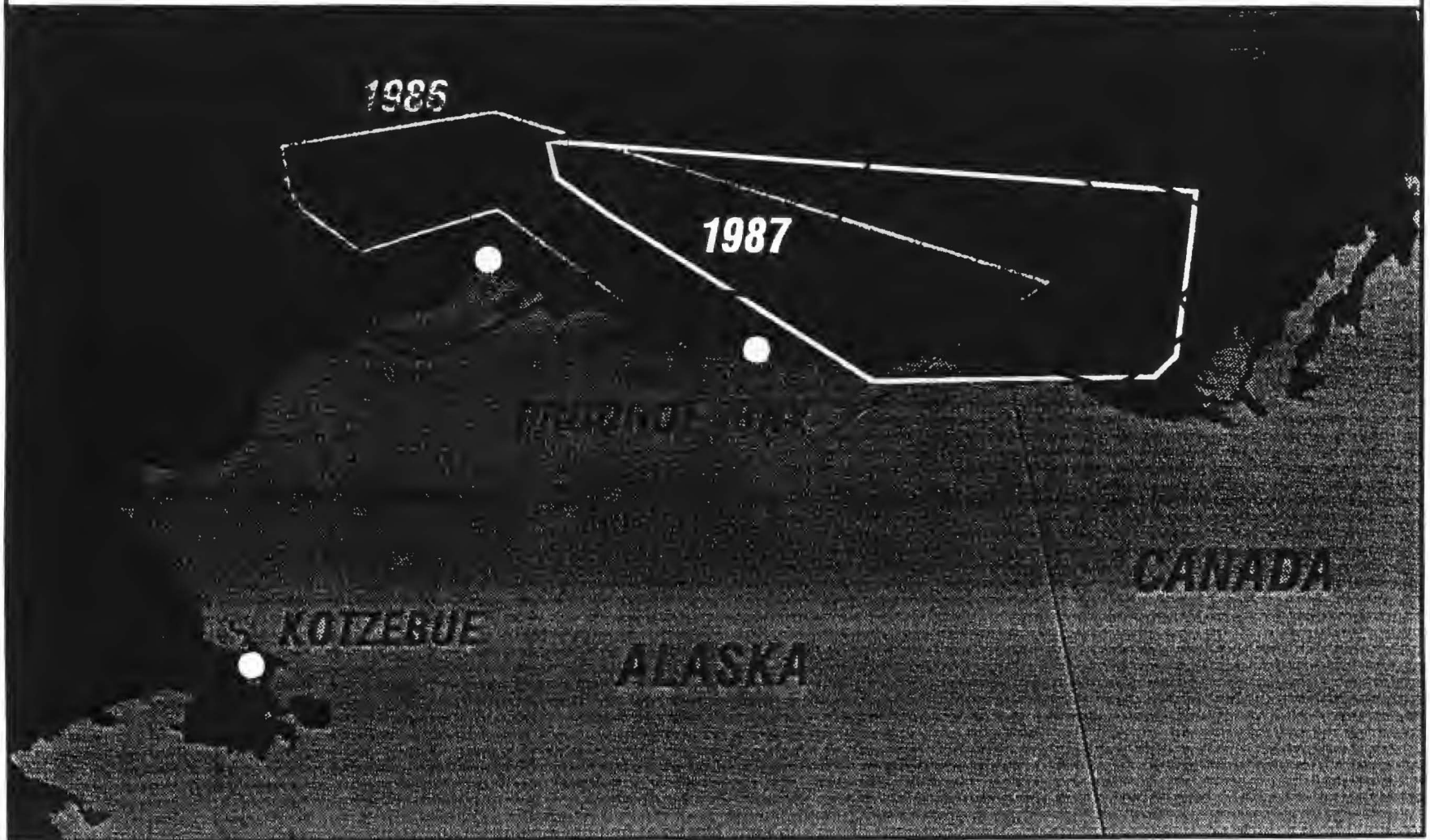
to increase in the future. Results of this study suggest some exposed bears will be resilient to those disturbances and will not be significantly affected. Temporal and spatial restrictions on some human activities should reduce the likelihood of adverse responses among other bears.

### **Movements, Distribution, Status and Trends.**

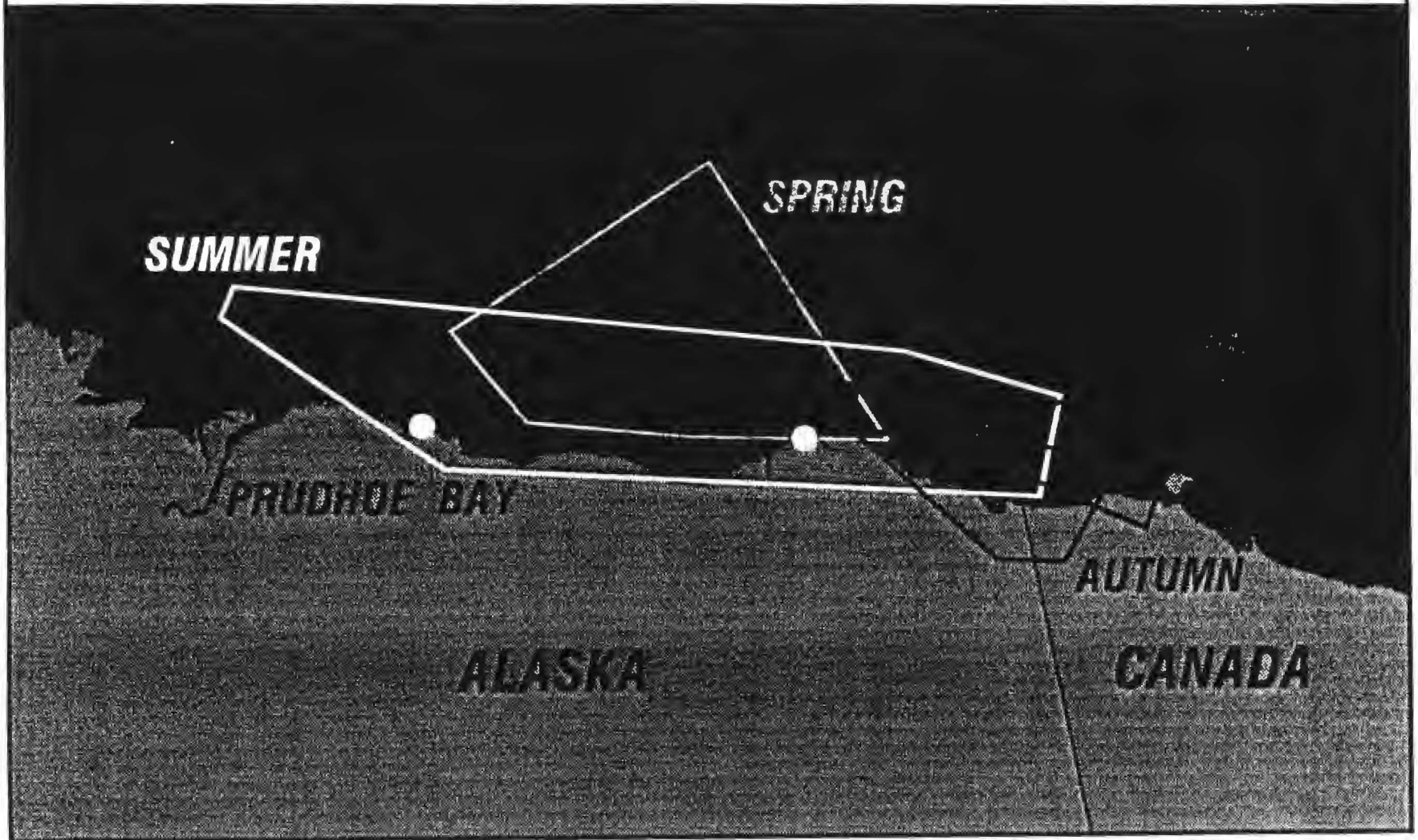
**Beaufort Sea**--Preliminary assessments of radiotelemetry data suggest that there is a strong separation between bears of the Beaufort Sea (along the north coast of Alaska and the Canadian mainland) and those occurring east of the Tuktoyaktuk Peninsula in Canada. Segregation from those of the Chukchi Sea (along the western Alaska Coast) exists but is not as well defined as that to the east. Movements of individual bears are large and variable among seasons, years, and bears. Available data indicate that an accurate picture of how a bear uses its environment may take 3-4 years, emphasizing the need for long term studies if accurate information is desired.

Analyses suggest that the population in Northern Alaska has recovered strongly after reaching a low in the early 1970's. The population appears to have grown throughout the 1980's and may be approaching K-carrying capacity. For example, preliminary analyses indicate that births and survival of young animals are both lower than in the 1970's. Likewise, survival of older animals is higher. By comparison to the population in the 1970's, the Beaufort Sea population now is comprised of far more

**Annual activity areas used by satellite collared bear #1734 between 1986 and 1989. Annual variation in areas, determined by the minimum convex polygon method, verify the need for long term studies of polar bears.**



**Seasonal activity areas of satellite collared bear #6606, as determined by the minimum convex polygon method, in the eastern Beaufort Sea during 1988.**



old animals, both male and female. Females of all ages are having smaller litters less often—which translates into fewer cubs being born.

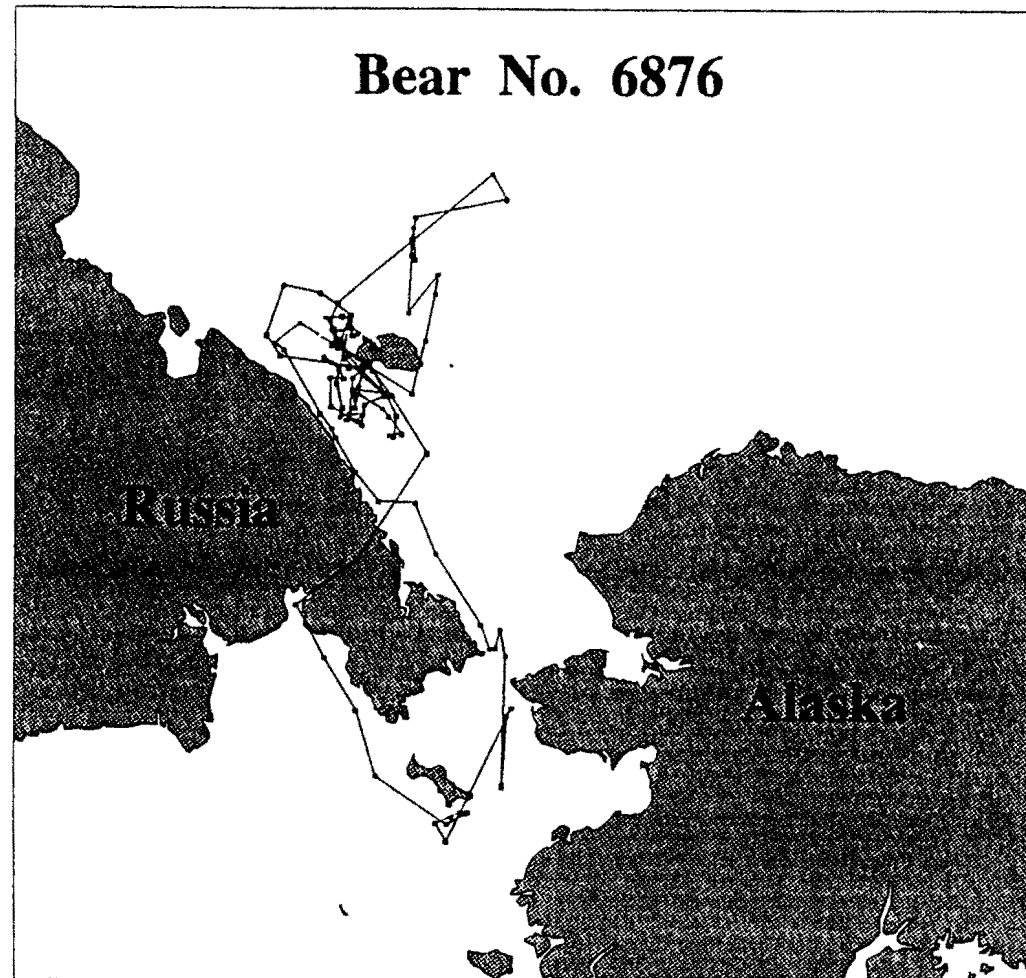
**Western Alaska/Russia**--The early phases of the western Alaska polar bear project were designed to delineate the bounds of the population, and it became apparent that the polar bear resource in western Alaska was seasonally shared with Russia. An "average" female polar bear in western Alaska might spend only 25-40% of her time in Alaskan waters, with the remainder of the year in Russian waters. Attempts to census western Alaska polar bears without including Russian territory would be of limited value because the numbers of polar bears that seasonally use the coastal waters of Alaska vary annually.

The current population estimate (based on Beaufort Sea only) was derived from multiple-year mark/recapture data that is very labor intensive. However, the Marine Mammals Protection Act requires the Service to manage polar bears at optimum sustainable population levels, therefore, necessitating recurring Service population assessment activity. However, the high annual cost of multiple-year mark/recapture programs limits their applicability to a routine population monitoring program. The expanse of the area of concern, the low density of polar bears, and the international aspects of this polar bear population require innovative methods for obtaining valid population estimates. A joint U.S./Russia cruise along the ice edge during the minimum ice cover

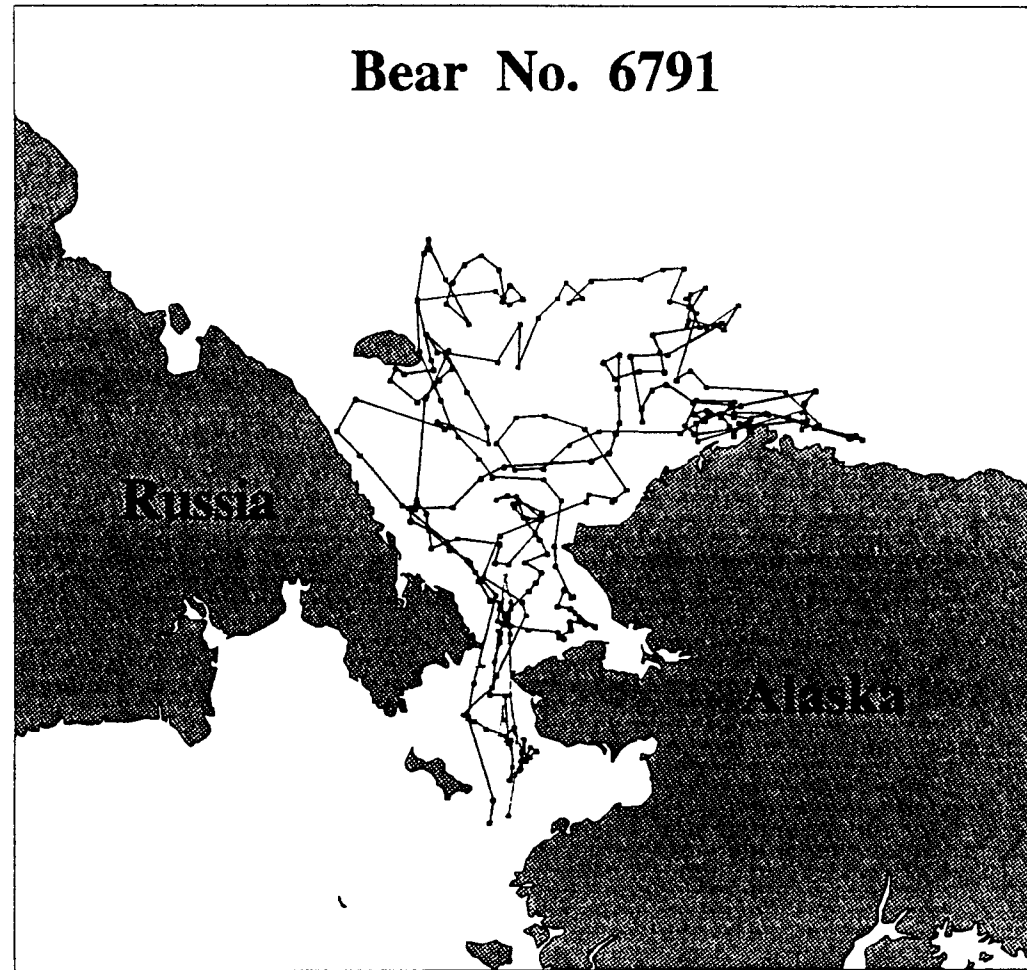
period in September/October 1995 has been proposed where Russian helicopters based on a Russian ship would conduct line transect and mark/recapture surveys, with complimentary capture and marking of polar bears, along the ice edge between Barrow and Wrangel Island. Joint analyses of survey data and report preparation would require additional international travel the following year. Survey methodologies are under development through funding by Region 7 of the Service with a test survey on the Beaufort Sea scheduled for September, 1993.

### **Satellite Remote Sensing in Studies of Habitat Use in Polar Bears**

To investigate the feasibility of using satellite-based remote sensing to study habitat use of polar bears, the distributions of satellite locations of radio-collared adult female bears were compared to sea ice concentration in the Bering and Chukchi Seas. Ice concentrations were determined with satellite-based passive microwave imaging (Special Sensor Microwave/Imager [SSM/I]). The study illustrated major limitations of satellite-based remote sensing for studies of habitat use by polar bears. The usefulness of these images is limited by the lack of ground-truth data to support the classification of ice types and by the coarseness of the resolution. Habitat use could be investigated only on a broad geographic scale and could not distinguish areas of small ice flows ( $<6 \text{ km}^2$ ) from water. This type was commonly used during summer, with a maximum of 54% and a

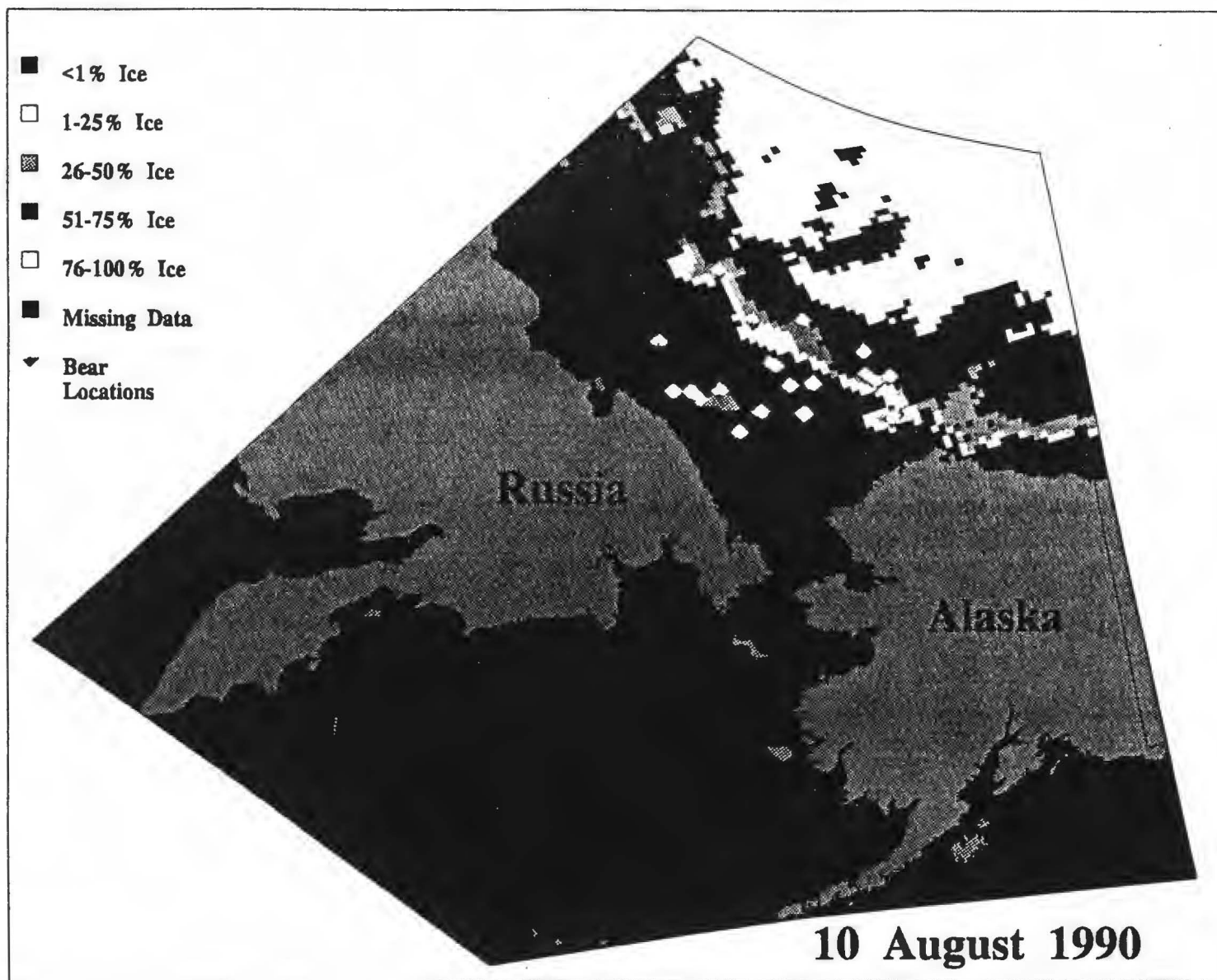


Three-year record of a female bear originally collared off Wrangel Island, Russia, in 1990 showing annual variation in movements (1990--black; 1991--green; 1992--red).



Four-year record of a female bear originally collared off Barrow, Alaska, in 1989 showing annual variation in movements (1989--purple; 1990--black; 1991--green; 1992--red).





Locations of radio-collared polar bears (red) with respect to various ice habitat types as developed from ice satellite imagery data. Bears apparently in water (blue) are likely actually on small ice floes. This illustrates the difficulty that present imagery technology has in distinguishing small ice floes from water.

late summer average of 36% of bears in the habitat. Although the imagery implies bears were in water this is unlikely. Polar bears are capable of swimming long distances and thus would have no difficulty using small floes some distance from the ice pack. Accuracy of satellite data also may be reduced by geolocation errors. Geolocation errors were reported to be usually  $\leq 8$  km, much less than the image resolution, except during 1989, when errors of 50 to several hundred kilometers were reported.

However, the data do suggest that habitat use by female polar bears varies during the year. The data-gathering and management capabilities of remote sensing and GIS technologies present the opportunity to include spatial and temporal changes as components of habitat studies, although limitations in accuracy and precision of remotely-sensed habitat data must be addressed.