Discreteness of Alaskan Polar Bear Populations

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Abstract

An objective of Alaska polar bear studies has been to describe movement patterns and relationships between bears to the west of Alaska and to the north of Alaska. Since 1967, 512 polar bears have been marked with numbered car tags, tattoos, and fur dye. Recovery of 69 animals nine months to five years after marking indicates that animals north of Alaska tend to return to that area more commonly than to move to other areas. The average distance of recovery from tagging sites is greater for males than for females. In some cases bears travel against the direction of prevailing ice drift to maintain their position relative to the land. Bears to the west of Alaska have larger skulls and bodies than bears to the north of Alaska. Significant differences in levels of mercury occur in bears from the two areas. Recoveries of marked animals, differences in body and skull sizes, and differences in mercury levels thus indicate that bears to the west of Alaska and bears to the north of Alaska occur as partially discrete geographically isolated populations with only a limited amount of movement between them. Marking studies of other nations indicate that there may be several groups of polar bears that are geographically isolated. Ice movements and return of females to maternal denning areas may help maintain discrete populations. Knowledge of population discreteness allows management areas with harvest quotas to be established. International management plans can be developed where bears cross national boundaries. Delineation of migration routes, denning areas, and feeding areas will allow these areas to receive special consideration as development proceeds and accelerates in the Arctic. Alaska studies have been supported by the Alaska Department of Fish and Game Federal Aid in Wildlife Restoration Program, the U.S. Fish and Wildlife Service, and the Naval Arctic Research Laboratory.

One objective of polar bear studies by the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service is to obtain information on polar bear movements and to determine relationships between bears to the west of Alaska and bears to the north of Alaska. This is part of an international research effort coordinated by the Polar Bear Specialist Group of the International Union for the Conservation of Nature.

Methods

Methods for immobilizing and marking polar bears off the Alaska coast have been described by Lentfer (1968, 1969). Bears are

located from light aircraft by following their tracks or sighting them directly on the sea ice from late February through early May. They are immobilized by injecting 1.6 milligrams per kilogram body weight of Sernylan (phencyclidine hydrochloride, Bioceutic Laboratories, St. Joseph. Missouri, U.S.A.) and a tranquilizing drug intramuscularly with a syringe gun from a helicopter. Acepromazine (Ayerst Laboratories, Inc., New York, U.S.A.) in a dosage of .07—.11 milligram per kilogram body weight is the tranquilizing drug that is now used. Tags, each with the same number and with a legend stating that a reward will be paid for its return, are fastened to each ear. Animals are tattooed on left and right sides of the inside of the upper lip. A number, approximately 40 centimeters high and visible from a distance, is dyed on each side. In most cases all markers on one animal have the same number. The I.U.C.N. Polar Bear Specialist Group has assigned number series to each polar bear country to prevent duplication of marks. Bears are measured and in some cases weighed. A lower rudimentary premolar tooth is removed for age determination. Recapture by tagging crews and killing by hunters of marked animals have provided most movement information. Resightings from barges supplying the north Alaska coast and Coast Guard icebreakers have provided a limited amount of information.

Regulations that require hunters to present hides and skulls of bears harvested to the Alaska Department of Fish and Game for examination have provided teeth for age determinations and measurements for a comparison of sizes of animals west of

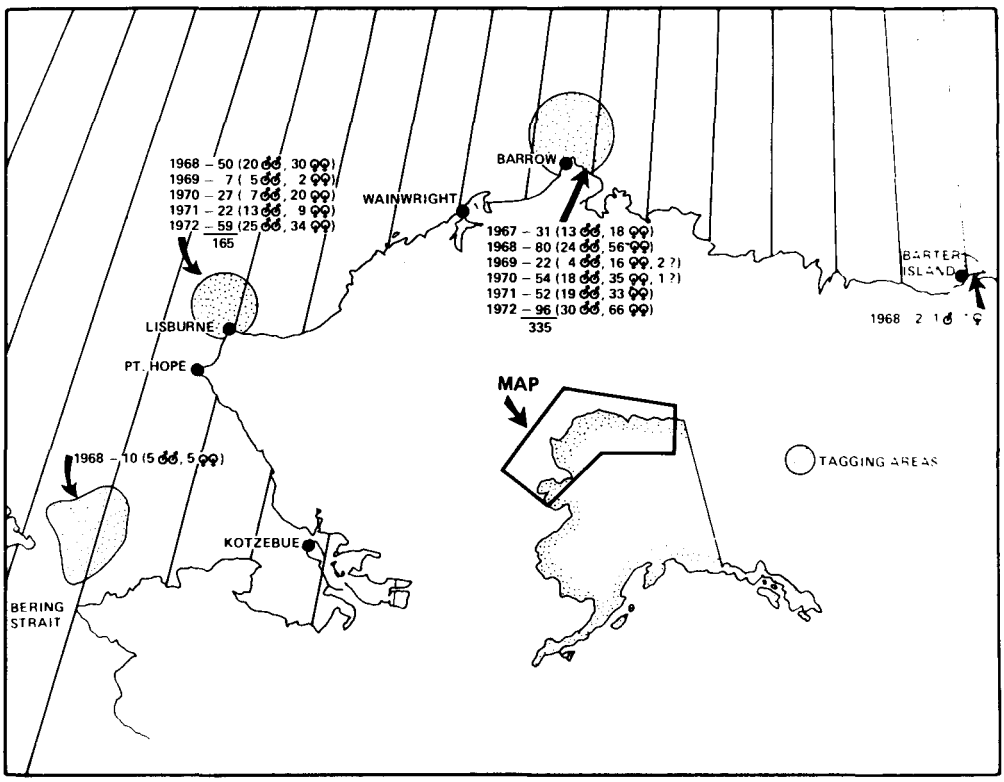

Figure 1. Number of polar bears tagged by area and year.

Alaska and north of Alaska. Measurements are length and width for hides and condylobasal length, greatest length without the lower jaw, and zygomatic breadth for skulls.

Hunters have provided specimen material including liver and muscle tissue for determination of mercury content. Tissues collected in 1972 have been analyzed by flameless atomic absorption at the Institute of Arctic Biology, University of Alaska.

Findings

Of 512 polar bears tagged off the Alaska coast from 1967 through 1972 (Fig. 1.), 69 have been recovered by Alaska-based scientists or hunters 9 months or longer after tagging, a period of time which is considered significant from a long-term movement standpoint. The longest interval between tagging and recovery of an individual animal has been 5 years. Of the 66 recoveries which could be identified as to individual animal, 23 were recaptured and 43 were killed by hunters (Fig. 2 and 3). As an aid to interpreting Fig. 2 and 3, in Fig. 2, of 208 bears captured or killed at Barrow 9 months or longer after the first season of tagging at Lisburne, 1 (0.5 percent) had been tagged at Lisburne.

The number of recoveries is low and data should be interpreted with caution. Nevertheless it appears that bears tagged at Cape Lisburne may be harvested on the coast in the vicinity of Wainwright at a significantly higher rate than elsewhere. It also appears that bears of both sexes tagged at Barrow are recovered at a significantly

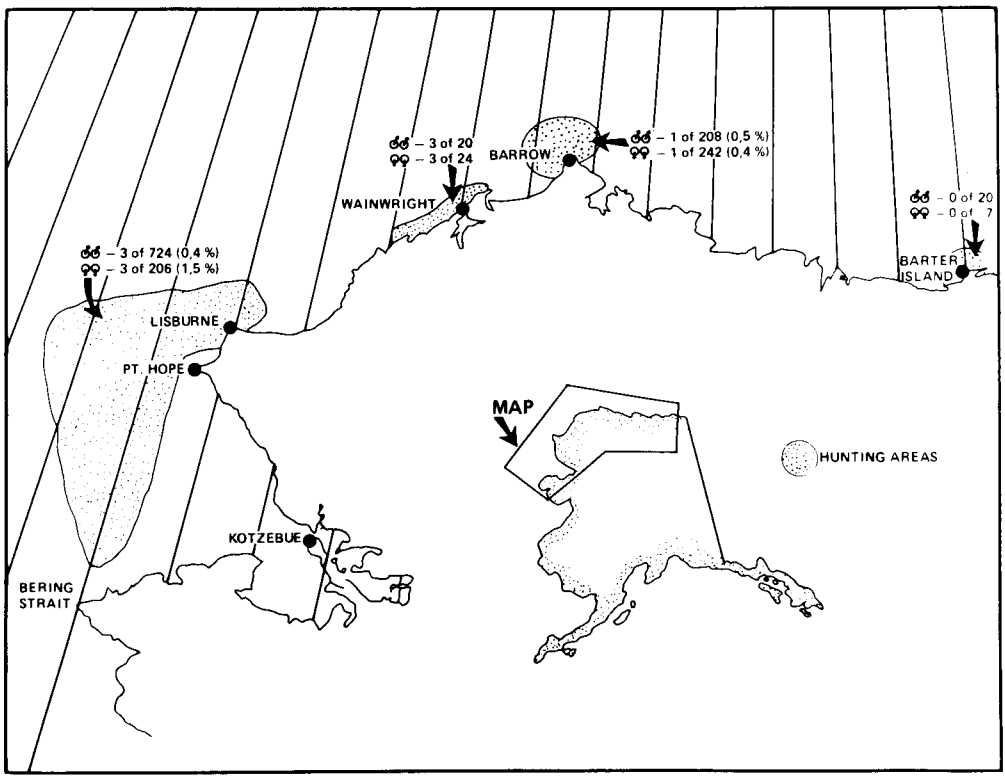

Figure 2. Number of polar bears tagged at Lisburne which have been recaptured and harvested in major recovery areas, and percentages which these Lisburne tagged bears comprise of the total capture and harvest of each major recovery area.

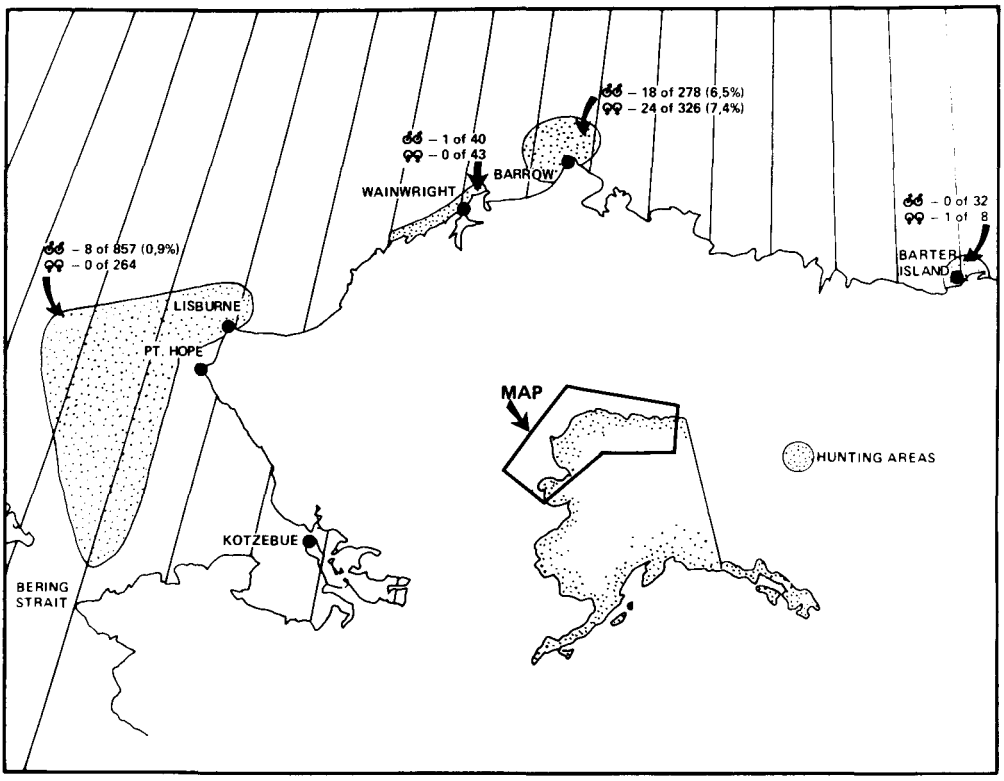

Figure 3. Number of polar bears tagged at Barrow which have been recaptured and harvested in major recovery areas, and percentages which these Barrow tagged bears comprise of the total capture and harvest of each major recovery area.

higher rate in the Barrow area than elsewhere. A comparison between the two major recovery areas shows that only 0.9 percent of the males and none of the females recaptured and killed in the major recovery area west of Alaska were tagged at Barrow, while 6.5 percent of the males and 7.4 percent of the females recaptured and killed in the major recovery area north of Alaska were tagged at Barrow. More males than females have made significant movements from where tagged.

There has been little opportunity for recovery of tagged animals adjacent to Russia because Russia prohibits hunting and relatively few animals have been captured there for tagging.

Six bears marked north of Barrow which have been killed by hunters or recaptured by Canadian Wildlife Service polar bear tagging teams in the Yukon Territory of northwestern Canada are not included in the above recovery data. One bear tagged by the Canadian Wildlife Service northeast of the MacKenzie Delta in the Yukon Territory was recovered north of Alaska's Colville Delta. Considering the number of bears harvested and tagged in the Yukon Territory, it appears the amount of movement between the area north of Alaska and the area northwest of Canada is limited, but a detailed analysis will have to be done in cooperation with Canadian workers to verify this point.

Body and skull sizes indicate differences between bears to the west of Alaska and bears to the north of Alaska. Comparison of hide and skull sizes by age class of bears taken by hunters shows that animals taken

to the west of Alaska are larger than animals taken to the north of Alaska. During the 20-year period prior to 1973 when sport hunting of polar bears was popular and was permitted, hunting guides and trophy hunters were aware of the size difference and hunted to the west of Alaska when an exceptionally large animal was desired. Of 140 record size polar bear skulls listed by Boone and Crocket (1971), 134 are from west of Alaska. The six skulls from north of Alaska rank in size as Numbers 40, 94, 94, 123, 140, and 140. Manning (1971) in a statistical comparison of measurements of polar bear skulls from Spitsbergen, Greenland, Canada, and Alaska shows that skulls from bears to the west of Alaska are significantly larger than skulls from bears to the north of Alaska. Differences in skull measurements between the two areas are greater for males than for females.

Differences in mercury accumulations in tissues from bears from the two areas provide more evidence of discreteness of populations. Mercury levels in liver and muscle tissue from bears killed by hunters in March and April 1972 were significantly higher in animals north of Alaska than in animals west of Alaska (Galster and Lentfer, in preparation).

Discussion

The data then suggest that bears to the west of Alaska and bears to the north of Alaska form essentially discrete populations with only a limited amount of movement between them. A line extending northwest from Point Lay has been chosen as a rather arbitrary dividing line between these populations. The higher rate of recovery of marked animals in the north area suggests that bears there are part of a smaller population than bears in the west area. Other recent findings (Jonkel 1970; Larsen 1971; Lønø 1972) indicate that bears in other areas also form geographically isolated sub-populations. Several factors may help to maintain sub-populations.

Lentfer (1972) discusses possible effects of ice movements on bears off the Alaska coast. Fig. 4 shows that moving ice could transport bears in various ways. Bears could reach the northern Bering Sea, normally the southern limit of their range off Alaska, by drifting on ice carried by the current moving to the southeast from the vicinity of Wrangel Island. Bears could then be carried north and northwest toward Wrangel Island, or north and northeast past Point Hope and Cape Lisburne and then along the Alaska coast toward Point Barrow. Bears north of Point Barrow could drift west toward Wrangel Island, or north and then in the Beaufort Gyre in a clockwise movement to the east and then to the south past the west side of the Canadian archipelago, finally moving northwest from the vicinity of Banks Island back toward Point Barrow.

Ice movement could thus tend to isolate sub-populations west and north of Alaska. Bears west of Alaska could drift back and forth between Wrangel Island and Bering Strait. Bears north of Alaska could be part of a population that remains in the area north of Alaska east to the Canadian islands. On the other hand, drifting ice could transport bears to a degree which would either prevent formation of isolated geographic groups or provide for only a limited amount of mixing off the coast of Alaska. Bears from the vicinity of Wrangel Island could be carried to Bering Strait and then past Cape Lisburne to Point Barrow and the Canadian archipelago. Bears from the northwestern section of Canada could drift past northeastern Alaska on their way toward Wrangel Island. At the present time the actual influence of ice movements is unknown.

Active movements of the bears themselves should be considered as well as their passive movements on drifting ice. Polar bears travel in their search for feeding areas, denning sites, mates, and more solid ice at the time of spring breakup. Bears travel on their own independently of ice movement northward from the southern Chukchi Sea in March prior to ice breakup. Along the north coast of Alaska there is a pronounced movement of bears to the east during the spring. This appears to be from an area where ice is breaking up to an area where the

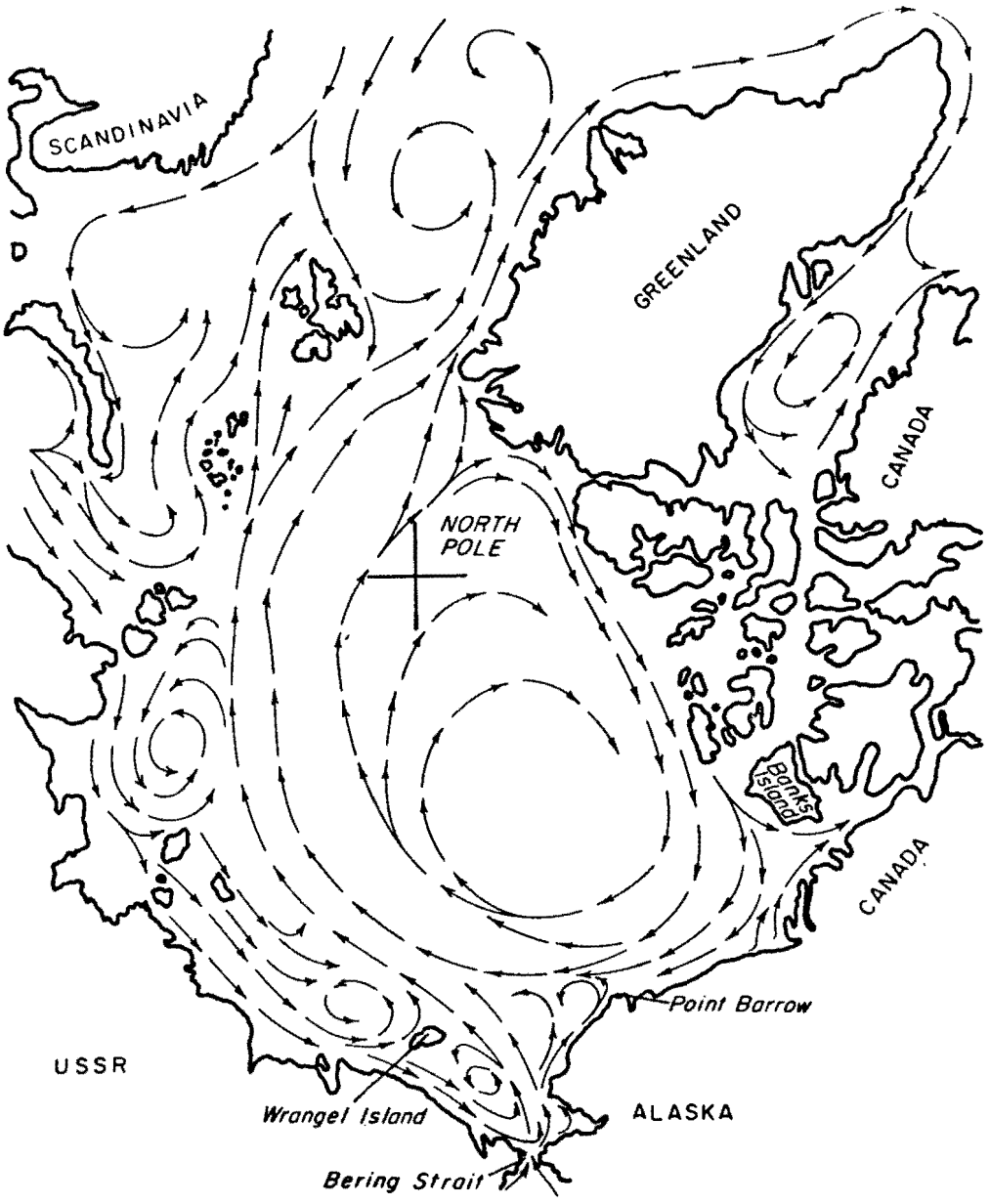

Figure 4. General surface circulation, North Polar Basin. (From Oceanographic Atlas of the Polar Seas. 1958. U.S. Navy Hydrographic Office, Washington, D.C.)

ice is still quite solid. It is interesting that this movement is against the direction of prevailing ice drift and therefore tends to keep animals in a fixed position relative to the land.

Return of individual animals to previously used denning areas may help maintain discrete populations. "Core" denning areas on land where animals concentrate for denning year after year have been described by Harington 1968; Jonkel *et al.* 1972; Lønø 1970; Uspenski and Chernyavski 1965. Occurrence of new cubs on heavy pack ice north of Alaska as far as 100 miles from shore indicates that some bears den on drifting ice. Although these animals would have been transported by the moving ice during their 5-month denning period, they could remain as part of one population associated with the Beaufort Gyre.

The occurrence of sub-populations of polar bears who spend much of their lives on drifting ice but may return to fixed denning areas indicates that animals can perhaps navigate. If they can navigate on changing sea ice with no constant reference points, the mechanisms for doing so would be most interesting to study.

Knowledge of population discreteness has a direct bearing on management and utilization of polar bears. The Alaska Department of Fish and Game in 1970 established separate polar bear management areas each with harvest quotas west and north of Alaska. Canada likewise has established management areas with harvest quotas. Where populations occur within an area controlled by one country, a unilateral management program may be adequate. Bilateral management programs may be necessary for populations which occur in areas controlled by two countries, and international agreements may be desirable for bears occurring on the high seas. Delineation of routes of movement and denning and feeding areas is also important in order to provide protection as development in the Arctic proceeds and accelerates.

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