Papers

An Ecological Study of Mobility and Settlement Patterns Among the Belcher Island Eskimo

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ABSTRACT. A complex of ecological factors favours the development of individual production techniques on the Belcher Islands; settlement formation, therefore, does not result from the requirements of collective economic activity. Economic factors are mainly responsible for changes in settlement composition and location, though at some seasons, social pressures have a strong influence. Settlement composition is based largely on kinship, although personality factors play an important role. Acculturation influences both mobility and settlement patterns.

RÉSUMÉ. *Etude écologique de la mobilité et du dessin des établissements chez les Esquimaux des îles Belcher.* Dans les îles Belcher, un complexe de facteurs écologiques favorise le développement de techniques individuelles de production; c'est pourquoi la formation des établissements humains ne résulte pas des nécessités d'une activité économique collective. Les facteurs économiques sont les principaux responsables des changements dans la composition et la localisation des établissements, bien qu'en certaines saisons, les pressions sociales aient aussi une forte influence. La composition des établissements est largement basée sur la parenté, bien que des facteurs de personnalité jouent aussi un rôle important. L'acculturation a une influence tant sur la mobilité que sur le dessin des établissements.

РЕЗЮМЕ. *Экологическое изучение форм миграции и оседлости среди ескимосов островов Ъелчер.* Комплекс экологических факторов содействует развитию личной промысловой техники на островах Ъелчер; поэтому образование поселков не является следствием нужд коллективной экономической деятельности. Экономические факторы влияют главным образои на изменение состава и расположения поселков, хотя в некоторые времена года социальные факторы тоже имеют большое влияние. Состав поселков обусловливается главным образом родственными связями, хотя вопросы личности тоже играют важную роль. Подъем культуры влияет как на формы миграции, так и на формы оседлости.

INTRODUCTION

Traditional Eskimo settlement patterns indicate a correlation between population numbers and game *availability*, rather than game *abundance*. For example, seals are no more abundant in winter than they are in summer, yet among many Eskimo groups, settlements are large in winter and small in summer. Paradoxically also, the largest population concentration is at the season of most severe environmental pressure. The answer to this paradox is that a scattered summer population exploiting low-density game resources comes together at certain seasons to increase the effectiveness of resource-harvesting through collective activity. Collective hunting is not practised on the Belcher Islands. This is most likely the result of ecological factors, particularly the long open-water season and winter sealing conditions favouring extensive hunting from the kayak. In the absence of collective techniques, the *raison d'etre* of large seasonal settle-

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ments diminishes; furthermore, other factors in combination favour the establishment of small settlements on the Belcher Islands. The first of these factors is the almost complete dependence of the natives on marine resources, mainly seals and seabirds. The second is the kayak hunters' dependence on favourable weather, with the Belcher Islands experiencing some of the least favourable weather in the eastern Arctic. The third is that the individual game animal available to the hunter most of the year, and especially in winter, is small in size; ringed seal, for instance, are usually smaller on the Belcher Islands than they are elsewhere in the Arctic. These factors combined tend to prevent the individual from accumulating food surpluses; in addition, they appear to favour the establishment of small economic units whose unrestrictive organization facilitates opportunistic action on the part of the individual. This flexibility and the variety of productive techniques suggest that an ecological study should attempt to rationalize variations in the observed settlement behaviour, rather than seek rules governing settlement.

PROCEDURE

General Methodology. The author visited the Belcher Islands from May to September 1959, April to October 1960, and February to April 1961. Although most time was spent in one settlement only on each visit, more than one thousand miles of travel on the islands allowed visits to all settlements and to regions of the archipelago habitually travelled by the Islanders. Companions on these occasions freely volunteered information on hunting, travelling, and living conditions, with a minimum of formal questioning. This study is based on data obtained from discussions, observations, and published accounts.

Settlement Coefficient. A quantification of actual occupation of, and hence considered suitability of, a settlement area may be approximated by the following equation:

$$S.C_s = \frac{H_s . t_s}{C_s}$$

where $S.C_s$ = settlement coefficient for a given season (s),

H_s = number of households present at season s,

t_s = length of seasonal occupancy in weeks,

and C_s = seasonal constant, viz., number of weeks constituting the season.

Acculturation Index. Four sets of criteria were used to assess the relative positions of male heads of households along a continuum from those traditionally oriented to those with a high degree of alien-culture aspiration or achievement. These independently variable criteria, with assigned scores, are listed below:

Ownership or utilization of sealskin kayak	10
Non-ownership or non-utilization of sealskin kayak	0
Winter dwelling a snowhouse	10
Winter dwelling a canvas tent	0
Winter parka of skins	10
Winter parka of imported cloth	0
Third class trapper	10
Second class trapper	6
First class trapper	1

In the first three sets of criteria, intermediate scores of 5 were awarded when individuals were in the process of becoming oriented to an alien culture. Rank as a trapper was assessed by actual performance (number of skins obtained) during the two "good" fox years, 1959-60 and 1960-61, and was verified by comparison with recent trading records.

Scores ranged from 1 (highly acculturated) to 40 (traditionally oriented). Each individual's assessment could be subjectively verified by considering his attitudes (where known) to wage employment, hunting, trading, and food choices, religious and recreational activities, and the result of a material culture survey.

The acculturation index of each settlement was the mean score of the constituent household heads. Data from thirteen settlements regarded as "normal" (i.e., with no fluctuation of population through hospitalization or other abnormal cause) has been represented graphically on page 170. For convenience, a semi-logarithmic plot has been employed. Calculation of the correlation, *r*, follows normal statistical procedure.

THE ENVIRONMENT

The Belcher Islands consist of a number of low-lying Precambrian outcrops covering an area of about 2,000 square miles in southeast Hudson Bay. Past glacial activity has eroded the underlying hardrock to produce a landscape characterized by extensive areas of smooth ridges, with countless lakes of all sizes filling the depressions between them.

In winter, strong winds and temperatures of −10° to 15°F. prevail for several months. Summer temperatures average 50°F., but wind, rain, fog, and overcast are common. These meteorological conditions influence subsistence activities; wind is probably the most important single physical factor limiting the effective hunting of animals in the Arctic, particularly marine mammals. The expectation of weather suitable for open-water hunting in this region is seldom more than 10 per cent of the daylight hours at the beginning of summer, and a gradual deterioration occurs as the season advances (McLaren 1961). Snow falls in October and persists

till May. Lakes freeze in November and by mid-December sea-ice formation is extensive around all but the most exposed coastal sections. From January till mid-May in most years, an ice bridge connects the Belcher Islands to the Ungava mainland, 80 miles to the east.

Although trees are entirely absent, there are several woody species important as fuel; prostrate willows are widespread, dwarf birch and arctic heather are local. Lichens ("reindeer moss") are also gathered, and burn with an intense though short-lived flame. Driftwood, occurring mainly in the west of the Islands, is a principal source of fuel and workable wood. Berry-bearing plants are found throughout the Islands, the fruit ripening in the autumn.

Animal life on the Belcher Islands, like the plant life, is characteristically arctic, although because of the low latitude and other factors the bird fauna is unusually rich. The fish fauna is decidely poor: one fresh-water species only, the arctic char, has economic importance. During the downstream and upstream "runs" good catches are made using nets, though only on a few days of the year; no river system on the Belcher Islands seems to have the capacity for intensive annual exploitation. Mussels and sea urchins are found at certain locations, and these as well as shore fish, such as cod and sculpins, can be of value during bad weather, when hunting is not possible.

On land, there are few species of mammals, and none is plentiful. There are no longer any caribou, and arctic and red fox are generally scarce, though when fat, they may be used for food. The arctic hare is not abundant, but a few are killed by most households each year.

Birds remaining throughout the winter and used for food are snowy owl, ptarmigan, eider duck, old squaw, and guillemot. Eider ducks are especially important, as apart from their abundance and relatively large size, they provide skins still extensively used for clothing by the Islanders. In spring, geese, ducks, and loons of several species arrive; the eggs of geese, ducks, and seabirds are eaten whenever available.

Of the fauna, however, marine mammals are the most important from the Eskimo's viewpoint. Ringed seal and, to a lesser extent, bearded seal are ubiquitous. Harbour seal, harp seal, walrus, and white whale are seasonally present, but, with the exception of the white whale, these species make only infrequent contributions to the local economy (for a fuller discussion, see Freeman 1964). The polar bear is seen infrequently, and is generally restricted to the western part of the archipelago.

The seasonal behaviour of marine mammals is of the utmost relevance in considering the settlement patterns among maritime Eskimo groups. The subject is treated elsewhere from the anthropological viewpoint (e.g., Weyer 1932). Critical studies of seal bionomics with particular bearing on the Belcher Island situation have also been published (McLaren 1958, 1962).

The ringed seal (*Phoca hispida*) is a small, widely distributed inshore species, forming the principal quarry of Eskimo hunters throughout the

Canadian arctic littoral. Belcher Island specimens attain a weight of about 60 pounds. An important feature of this seal's biology (and of probable consequence to Eskimo hunting practice) is the variation in size with latitude. A hunter in northern Baffin Island, for example, will probably obtain seals of twice the average weight of Belcher Island specimens. This seal is not especially gregarious, and the scattered population favours sheltered locations; at any season, complex indented coasts with offshore island or skerry development will have a greater seal population than will simple exposed coasts.

During spring, when ringed seal come to lie on the surface of the ice, their population density (and availability to the hunter) increases with the erosion of the landfast ice.

The bearded seal (*Erignathus barbatus*) is large, averaging about 500 pounds. The meat yield alone makes it important economically, and, in addition, the tough hide has considerable value for a variety of uses. This species is less numerous than the ringed seal. During winter, the bearded seal is generally found away from areas of landfast ice, in the pack ice, or at the floe edge, as it rarely maintains breathing holes.

The white whale (*Delphinapterus leucas*) is of importance also for its size, adult specimens being about 900 pounds in weight. However, the occurrence of this species is almost exclusively limited to the open-water season. Only rarely is it found near the Belcher Islands during winter, though small numbers may occasionally be trapped under rapidly forming sea ice in some deep sheltered bays.

HISTORICAL FACTORS

Trading visits by Islanders to the mainland at the end of the nineteenth century brought them knowledge of Christianity, and by the time of the first visit by Euro-Canadians (in 1915), firearms and imported tools and clothing were in evidence. A population of 150 was reported for 1910; at that time, the Islanders' trade with the mainland was in products of hunting, particularly polar bear skins, seal skins, and walrus ivory (Freeman 1964).

In 1928, a winter trading operation was established in the southwestern part of the archipelago in an effort to encourage fox-trapping. This venture was judged successful, and the trading post moved to the eastern part of the Islands with a resident Euro-Canadian manager. In 1938, the population of the Islands was reported to be 189. About a third of this number became attracted to the vicinity of the trading post and their settlement patterns were altered accordingly. Most of the remainder of the population was distributed in the northern part of the Belcher Islands, with perhaps half as many in the south. The northern segment, living in three or four mutually interacting groups, was some distance logistically, and a progressively increasing distance culturally, from the more acculturated central segment of the population, which resided much nearer

the trading post. This period of intense culture contact for the central groups saw the rise of a messianic movement; following a number of ritual killings, the population numbered 164 in 1941.

The Euro-Canadian trader was withdrawn in 1943, and operations at the post reverted to seasonal trading only. A number of social changes resulted as a succession of local and mainland Eskimos were placed in control of essential supplies. This new "elite" began a series of preferential trading transactions known to have continued up to the present. Under this system, not only successful trappers became favoured by the trader, but also kin and non-related families who aligned themselves with his actions or his expressed wishes.

In 1953, the population was 170, with the same general disposition as in the days of full trading operations a decade earlier. There were now, however, approximately equal numbers occupying several locations in the north, south, and east of the archipelago.

During the summer and autumn of 1954, culture contact of unprecedented intensity resulted in many socio-political and economic changes which directly affected settlement behaviour (Desgoffe 1955). In summary, the new influences included economic subsidy, disruption of the annual cycle through limited wage employment, and the re-establishment of the trading post for year-round operation under the control of a mainland Eskimo. These various factors produced, in effect, a centralization of population in the eastern part of the Islands for many months of the year, delayed dispersal to winter settlement areas, and hastened the return of households to the eastern regions early in the spring.

In the years following 1955, most of the northern and southern groups gradually returned to earlier winter settlement areas (see Fig. 1). Despite steadily increasing culture contact since 1953, the Eskimo trader, by making only a few subsidy payments at irregular intervals, discouraging the production of handicrafts during the winter months, and living as a hunter-trapper himself, probably helped to prevent a marked devaluation of current cultural norms. Increased income resulting from the new economic opportunities that had been locally available since 1954 was not sufficient to finance technological improvement in resource-harvesting (for details, see Freeman 1964). Thus, for most of the population ecological pressures continued to influence settlement patterns in much the same way as before.

DEMOGRAPHY

During the twentieth century, the Belcher Island population appears to have fluctuated between 150 and 190 persons. A net annual increase of natality over mortality in most years, combined with periodic migrations and epidemics, have caused these fluctuations. Epidemics occur sporadically and are of considerable social and economic moment in a society where adult males and females are almost invariably complementary partners of an economic dyad (see Table 1).

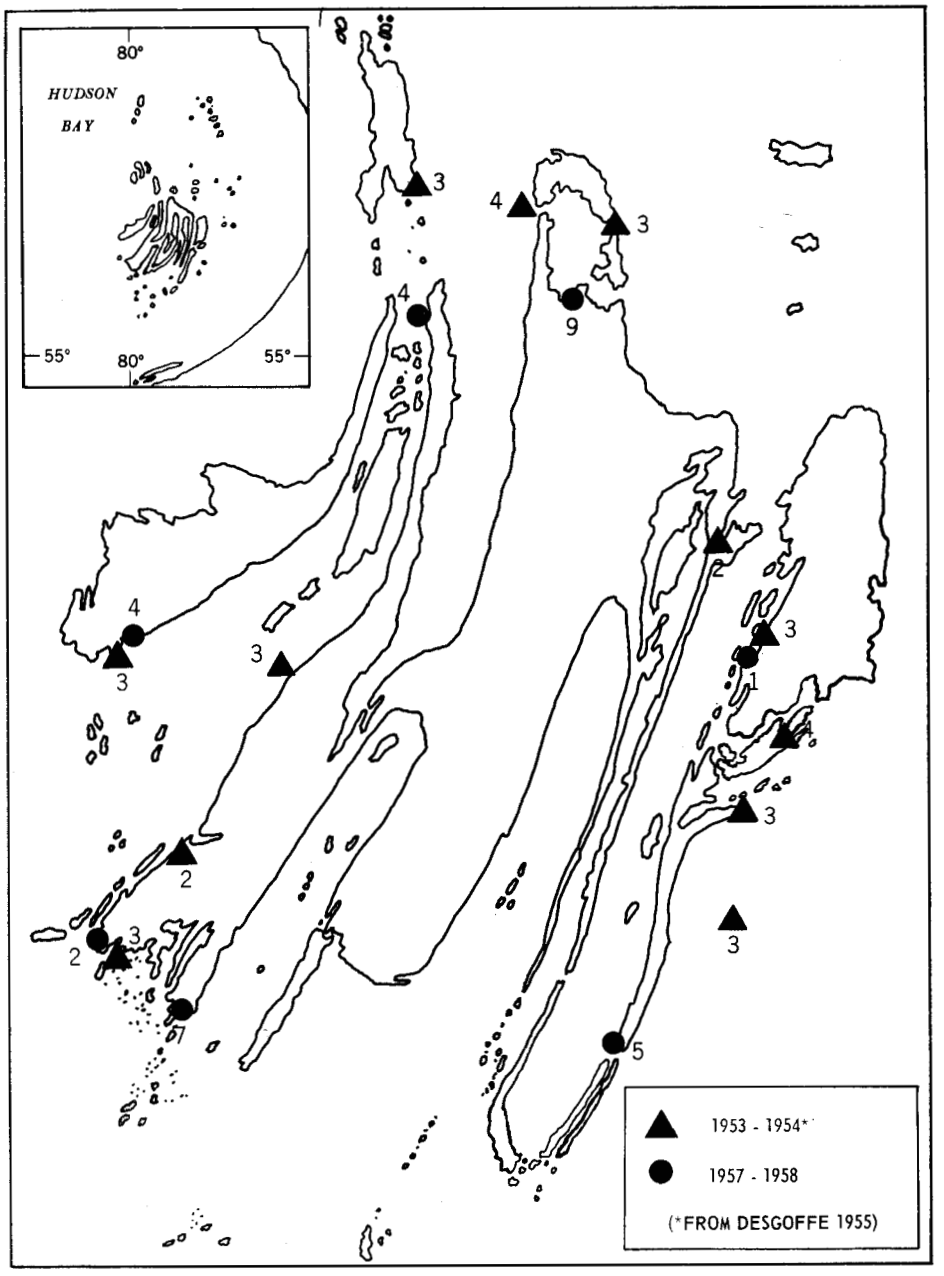

FIG. 1. Number of constituent households and location of winter settlements, Belcher Islands.

Since the early years of this century, there appears to have been a decrease in large scale movements of people between the Islands and the Ungava mainland. The reason for lessened emigration from the Islands appears to have been the increasing scarcity of caribou on the mainland

TABLE 1. Mortality occurring during two epidemics, Belcher Islands.

Date	Ages of males deceased	Ages of females deceased	Cause
Winter 1953-54	54, 30, 28, 18, 1, 1	69, 57, 40, 38, 22, 20, 1	Influenza
Autumn 1961	61, 49, 1	54, 40, 29, 23, 1, 1	Measles

and the establishment of trading facilities on the archipelago.

The last large migration occurred in 1953, when 20 Ungava Eskimos settled on the Islands; by the winter of 1961, only 3 remained, emigration and mortality accounting for the decrease. The motive for this large immigration (which would be considered large at any stage in the Islands' history) was the expectation of better hunting.

Since 1953, immigration has been slight: 4 people in 1954; 4 in 1959; and 1 in 1960. These included the families of both the Eskimo trader and the Eskimo catechist; both of these men were, in fact, born on the Islands, but had spent most of their lives on the mainland.

Hospital treatment is the main reason for emigration from the Islands (see Table 2), but many return after a year, and some after two or even more years of treatment; more than half of the individuals hospitalized receive treatment for tuberculosis or related diseases. Fluctuating frequency of hospitalization resulted from the irregularity of visits by health teams. The large 1960 evacuation (Table 2) was suspiciously linked to a recurrence of the harmful culture-contact situation analyzed by an earlier writer (Desgoffe 1955).

TABLE 2. Ages of Belcher Island Eskimos recently hospitalized.

Date	Ages of Males	Ages of Females
Summer 1954	64, 55, 54, 24	55, 50, 43, 35, 22
Summer 1959	30, 16	16, 11, 9
Summer 1960	62, 31, 17, 10	60, 54, 44, 34, 33, 30, 17, 12, 7, 5

Migration to mainland settlements, with their greater wage-earning, recreational, educational, and welfare services, accounted for only two instances of emigration in the 3 years (1959-61) for which there are data. In both cases, the emigrants were young unmarried adults.

HOUSEHOLD COMPOSITION

Households are formed at or shortly after marriage, though lack of capital (represented by dogs, sled, tent, etc.) may delay the establishment of a discrete household for an indefinite period.

Residence after marriage appears to be initially uxorilocal, in agreement with the pattern observed among other Ungava Eskimo groups (Willmott 1961; Honigmann 1962; Graburn 1964).

Households may be simple or compound; the former consists of a single nuclear or stem family in a dwelling, whereas the latter is composed of two or more family units living in a multiple dwelling and sharing a common entrance. Compound households result from the absence or incapacity of an otherwise irreplaceable contributing adult member; they also result, though less frequently, from the loss of a male adult. The reason appears to be that whereas a male is dependent on the full-time attention of a capable woman for daily domestic tasks, a female alone or having dependents can maintain a household by relying on the gifts of food and raw materials any successful member of a settlement is obliged to provide for the less fortunate. Thus, elderly couples or widows with small children will continue to maintain separate households, though their economic autonomy has largely disappeared. (Government subsidy had yet to be made regularly available before the autumn of 1960).

Household sizes during the winter of 1959-60 ranged from 3 to 8 persons, with a mode of 5 and mean of 5.5 persons.

During 1959 and 1960, 97 per cent of the households in summer and 91.4 per cent in winter were simple rather than compound. An analysis of these 89 simple households showed that the nuclear family comprised 54 per cent of the summer households, and 66 per cent of the winter households; in a further 22 per cent of summer and winter households, one or both elderly parents of one of the spouses resided in that household. In 7 out of 8 cases where this occurred, the parents lived with the eldest of their married children. In one case, the parent lived in the household of her youngest married daughter; this may be taken as continuing (initial) uxorilocality of the young couple (who had been married 3 years before) owing to their continued economic dependence on that parent for household property.

SETTLEMENT COMPOSITION

From a study of Ungava Eskimo kinship terminology, Graburn (1964) concluded that the basis of settlement was co-residence of male siblings after marriage (following initial uxorilocality) and that there is at all times only one norm of residence for all individuals in the society. The co-residence of married brothers in the same settlements on the Belcher Islands agrees to a large extent with the pattern established by Graburn. Thus, during the winter, at the time of greatest dispersal, from a total of 6 pairs of married brothers, 5 pairs co-resided in 1959, and 4 pairs in 1960 and 1961.

The largest winter settlement was that of Kritusuk (Fig. 2). The nucleus of this group was the patrilocal extended family. The breakdown of this large settlement was due to certain personality differences, aggravated by

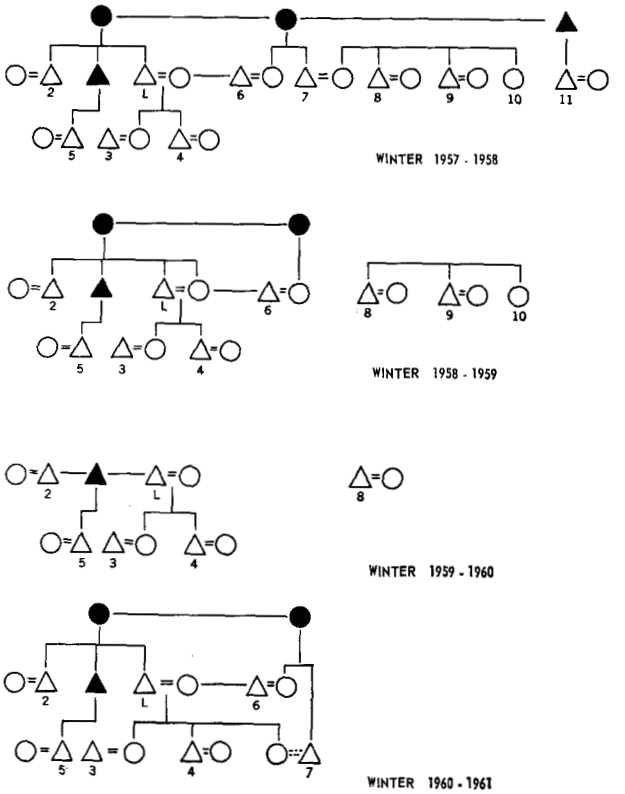

FIG. 2. Yearly variation in composition of Kritusuk's settlement, 1957-61. Numbers refer to constituent households; L is leader.

economic and social problems (for summary, see Freeman 1964). The first stage of the breakdown was through the kin link 7, and the subsequent movement away of the extended sibling group, now unrelated to the core family.

The importance of kin linkage to settlement composition is further seen by reference to the destination of the families leaving Kritusuk's settlement; 7 and 8 join their respective brothers, 11 goes to his wife's brother (who is also his sister's husband's brother), and 10 goes to live at the settlement of his sister's husband's brother.

From these considerations (see also Fig. 3), it is evident that there is flexibility in settlement composition from year to year. Only rarely does a settlement remain constant for more than 2 years; families less closely related to the leader are generally the least permanent. Economic liaisons to finance joint ownership of a whaleboat, for example (cf. Balikci 1964; Willmott 1961), were nowhere apparent on the Belcher Islands, and no other potentially permanent liaisons outside of kinship were present. However, though flexibility is apparent, moves are to some extent predictable along recognized lines of kinship.

The presence of an unrelated kin group established with Kudlayok's winter settlement (Fig. 3) was the result of his recent immigration to the Belcher Islands from Ungava, and the consequent need for local guidance

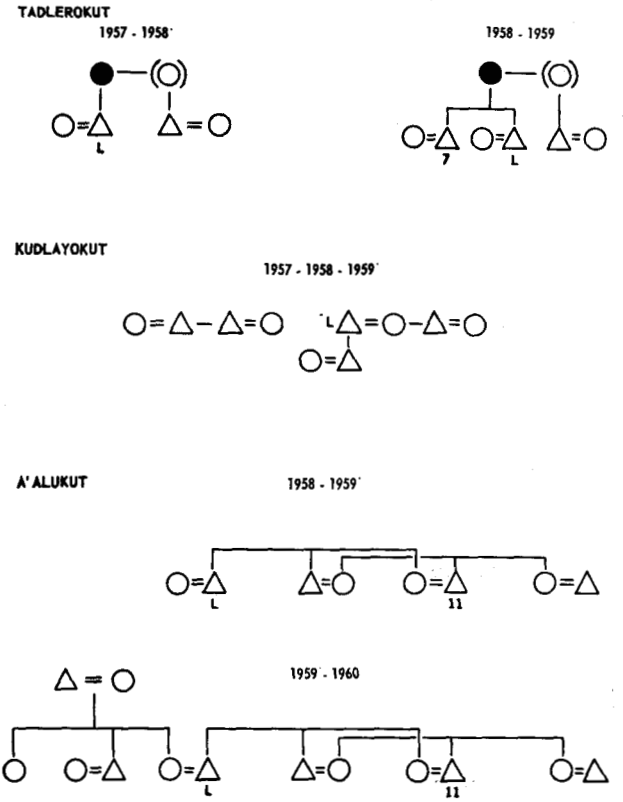

FIG. 3. Settlement composition in consecutive winters, Belcher Islands. L is leader's household; numbered households, as in Fig. 2.

and for crew members for his whaleboat. However, there was no question of permanence in the association; in the autumn of 1960, for example, Kudlayok's wife's brother left the settlement (see below). The factor which initially established the liaison between immigrant and native families is unknown; however, the bond was strongly maintained by personality factors, the leader being full of praise for the younger member of the associated sibling group. (The importance of personality factors in Iglulik Eskimo social organization is stressed by Damas 1963; see also Balikci 1964). The nature of the link between the two families in Tadlerok's winter settlement in 1957-58 (Fig. 3) was similarly based on personality preference.

LEADERSHIP

At each settlement, during winter dispersal, one man is regarded as the leader. His influence in day-to-day affairs may be imperceptible, especially if economic conditions are favourable. His judgement is accepted when a decision is made to move the settlement; indeed, in several cases it was discovered that in all such matters his was the only opinion voiced. Settlement composition can also be influenced by the leader; this happened once in 1959 and again in 1960, when in each case a family moved from

a settlement at the express wishes of the leader. In one case, the brother-in-law of the leader said he had heard (from another): "K. doesn't want me in camp this winter." He blamed this on his poor hunting the previous fall whilst recovering from an injury.

As is generally reported for other Eskimo groups, the leader excels as a hunter (however, cf. Damas 1963, p. 186); this was indirectly verifiable by certain other accomplishments in the Belcher Island situation. These included the size of the leader's dog team, the number of dependents he supported, and his standing as a trapper. In each case, the leader was the oldest active member of the settlement. These data are summarized in Table 3 for the sample winter 1959-60; each of the 5 settlements referred to had 5 or more households.

TABLE 3. Some leadership qualities, Belcher Islands, 1959-60.

Leader	Number of dogs	Dependents supported	Trapping returns
Kritusuk	—	††	††
A'aluk	††	—	††
Kudlayok	†	—	††
Tadlerok	†	†	—
Sanikiloak	—	†	†

†† Appreciably largest number in settlement
† Largest number in settlement
— Fewer compared to some others in settlement

Leadership was strongest among the northern settlements: Kritusuk was elder kinsman of a large extended family; A'aluk was the senior member of an extended sibling group with associated affines; and Kudlayok, although a recent (1953) immigrant from Ungava, had, by possessing a motorized whaleboat and by heading his own large kinship group at the time of his arrival, established his immediate importance on the Belcher Islands (see Figs. 2 and 3 for composition of these settlements). The two southern settlements were led by men whose authority was partly derived from outside the community. Tadlerok was formerly in charge of camp trading arrangements, and subsequently became recognized as a leader by various Euro-Canadian agencies. In similar fashion, Sanikiloak was placed in charge of a government-owned communal whaleboat; in this capacity he was frequently called upon to make decisions for those in his own and in other settlements. These southern settlements have weak kin linkage and experience the greatest compositional variation from year to year.

SETTLEMENT AREAS

The location of settlements varies both seasonally and annually; however, a consistent pattern of preference by individual households and by

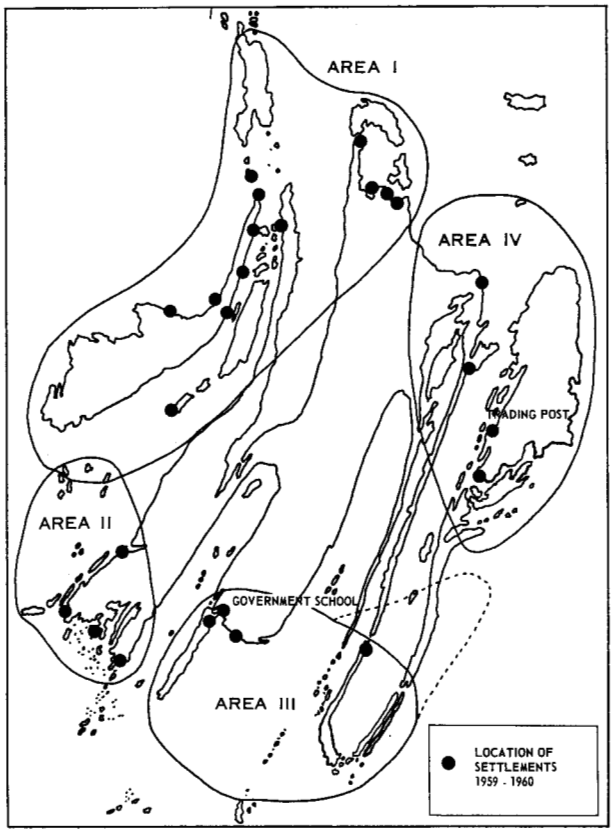

FIG. 4. Settlement areas on the Belcher Islands.

groups of households suggests an underlying rationale behind actual choice of settlement areas. In matters of settlement, a marked conservation is evident; for example, the community appears to be divided into "northerners" and "southerners," two groups which claim to have geographic knowledge of only the northern or southern parts of the archipelago respectively. The few men who have knowledge of the whole archipelago are among the most acculturated of the Islanders.

Two factors reflect the suitability of an area for settlement: the first is the size of the population supported, and the second is the length or frequency of occupation. Both these characteristics were combined to give a *settlement coefficient*, due allowance being made for varying lengths of the different seasons. By use of this coefficient, one obtains empirically derived assessments of the preference for, and hence supposed suitability of, given settlement areas. Assessments based on biogeographic considerations and on the opinions expressed by Islanders were used to delimit the 4 major settlement areas shown in Fig. 4; each of these areas possesses distinct ecological characteristics and is habitually frequented by particular households. Settlement coefficient data for several winters are presented in Table 4. Despite variation, the overall pattern shows a statistically

TABLE 4. Settlement coefficient data, Belcher Islands.

Winter	Area I	Area II	Area III	Area IV
1953-54*	16	5	3	12
1957-58	16	9	5	1
1958-59	22	3	3	2
1959-60	16	6	6	3
1960-61	9	6	7	9
	$CHI^2 = 27.42$	(12 d.f.)		$P < 0.01$

*1953-54 data from Desgoffe 1955

significant association (p. <0.01), which suggests that the observed population disposition reflects a consistent preference by groups of households for particular regions of the archipelago having distinct ecological characteristics.

Proximity to good hunting was given in almost every case as the prime reason for choosing a particular winter settlement area. This was to be expected in a region where food shortage was a constant threat and where, at that time, there was no outside subsidy to reduce anxiety. Other considerations, such as proximity to driftwood supplies or good trapping, or historical precedent, were not generally voiced, even though some answers received suggested that consideration was given to such matters. The point here is that the individual hunter, or leader of a group, makes a purely personal assessment of a settlement area based on his knowledge of several alternatives. In many cases, an individual's ecological knowledge is both limited and strongly biased. The bias is due to a strong preference for living in a particular ecological milieu. However, is there, in fact, any objective basis for settlement in relation to food resources? Certainly there is no reason to question the importance of food availability as an influence in demographic matters among subsistence hunters in general, and among the Belcher Island Eskimos in particular. The availability of driftwood or foxes may be prime motives in some cases; however, the need to hunt, for dog food especially, is mandatory.

Values for available biomass (food, oil, and dog food) for each settlement area are given in Table 5. Only those species of animals that contribute in a potentially constant (and hence potentially predictable) manner to the winter economy are considered. Estimates of seal abundance are according to the theoretical considerations of McLaren (1958, 1962); other estimates are from local knowledge. The errors inherent in any census such as this make absolute estimates of questionable significance, but it is believed that relative estimates are fairly realistic (Fay and Cade 1959).

TABLE 5. Estimates of biomass available to hunters in winter, Belcher Islands.

Species	Approx. Wt.	Area I Abundance	Area I Biomass	Area II Abundance	Area II Biomass	Area III Abundance	Area III Biomass	Area IV Abundance	Area IV Biomass
Ringed seal	28 kg.	7.3×10^3	20.5×10^3	2.6×10^3	7.4×10^4	4.6×10^3	12.9×10^4	4.1×10^3	11.5×10^4
Bearded seal	212 kg.	3.65×10^3	15.5×10^5	1.3×10^3	5.4×10^5	2.3×10^3	9.8×10^5	2.05×10^3	8.7×10^5
Polar bear	400 kg.	1×10^1	4.0×10^2	1×10^1	4.0×10^2	1×10^1	4.0×10^2	0	0
Walrus	600 kg.	1×10^1	6.0×10^2	0	0	0	0	0	0
Eiders	2.5 kg.	1×10^3	2.5×10^3	1×10^3	2.5×10^3	1×10^2	2.5×10^2	1×10^2	2.5×10^2
Old squaw	.75 kg.	1×10^2	7.5×10^1	1×10^2	7.5×10^1	1×10^1	$.75 \times 10^1$	1×10^1	$.75 \times 10^1$
Black guillemot	.4 kg.	1×10^3	4.0×10^2	1×10^3	4.0×10^2	1×10^2	4.0×10^1	1×10^2	4.0×10^1
TOTAL BIOMASS		17.6×10^5		6.2×10^5		11.1×10^5		9.85×10^5	
Density kg./sq. km.			1.3×10^4		1.2×10^4		8.0×10^3		1.1×10^4

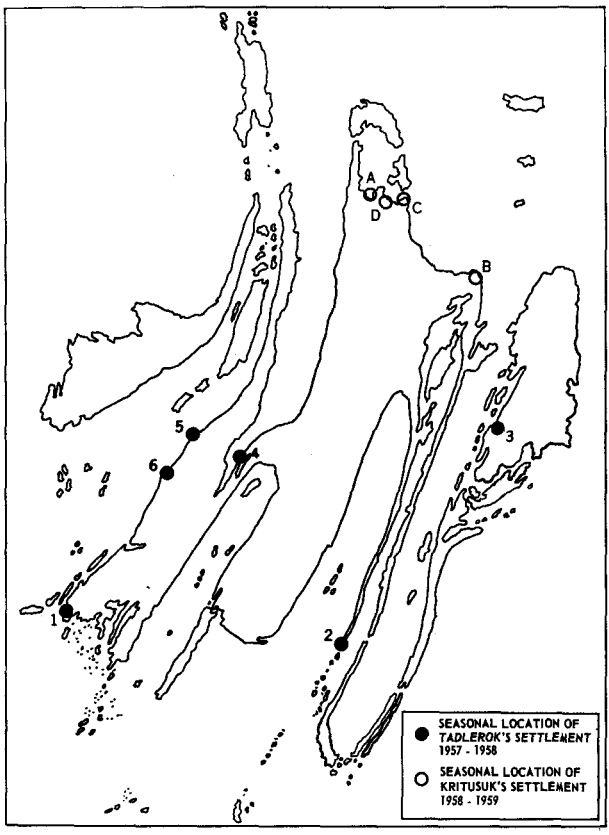

FIG. 5. Examples of settlement mobility patterns, Belcher Islands.

Comparisons of Tables 4 and 5 show certain correspondences in area ranking. Area I, for example, with consistently heavy settlement, is seen to contain the most resources. Area II, although having low total biomass, appears on the average to be the second most favoured settlement area. The explanation for this apparent anomaly is probably the favourable density of biomass, which makes it a good hunting area.

In summary, we might cautiously conclude that a consistent pattern of winter settlement can be demonstrated from our data, and that this settlement pattern appears to correlate, at least in part, with the potential availability of dominant food species.

SETTLEMENT MOBILITY

Settlements fluctuate in composition, in location, and in their degree of interaction with other settlements. Movement is, in fact, an adaptive device allowing fuller exploitation of the economic potential of the total environment. Fig. 5 illustrates two types of settlement behaviour; numbers 1 to 6 correspond to the locations of Tadlerok's settlement in winter, spring, summer, early autumn, late autumn, and winter, respectively, for

the year 1957-58. This large annual migration (175 miles) allows considerable interaction with other settlements. In contrast is Kritusuk's settlement in 1958-59, where locations in winter-spring, summer, autumn, and winter are indicated in Fig. 5 by the letters A to D, respectively. Kritusuk's annual migration was small (40 miles) and took place at the peripheries of two adjacent settlement areas (I and IV), thus allowing negligible interaction with other settlements.

For a variety of historical and psychological reasons, certain individuals now require resources that are widely scattered and were either not available or not considered of such importance in earlier times (e.g., wage employment, foxes, driftwood, etc.). To illustrate this statement, it was necessary to assess objectively the degree of acculturation of each household; the *acculturation index* of each settlement was the mean household score at that settlement (see page 155). The correlation coefficient, r, calculated from acculturation indices and lengths of annual migration obtained from all settlements for sample years between 1957 and 1960 inclusive, indicates a definite relationship ($r = -0.809$) between the degree of acculturation and mobility among settlements on the Belcher Islands (Fig. 6).

THE SEASONAL ECONOMIC CYCLE

Whether seeking seals at breathing holes (or elsewhere) during winter, stalking them on sea ice in spring, or hunting them from a kayak in summer and autumn, the Belcher Islander rarely seeks or has the advantage of co-operation with others during the productive phases of the hunt. For company or safety, two men may choose to travel together to any given hunting place, but on arrival, each man hunts on his own.

Mutual co-operation is as well marked at the distributive phase as it is lacking at the productive phase of economic activity. Sharing follows a pattern that depends mainly on the type of game and the needs of

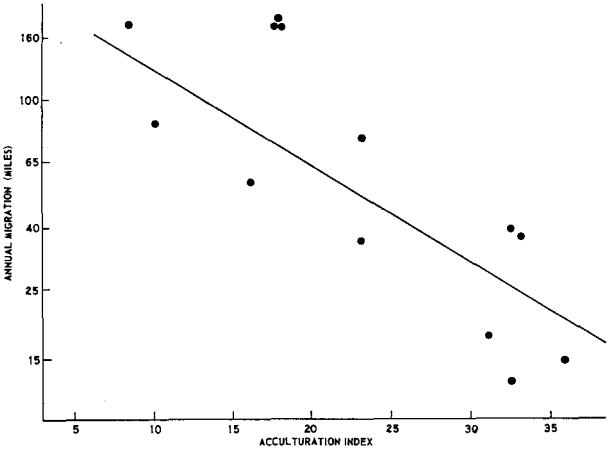

FIG. 6. Relationship between acculturation and mobility. Belcher Islands, 1957-60.

settlement members. Gifts of food may be made to kin in other settlements, but day-to-day sharing is only among co-resident members of the settlement.

In early winter, sealing occurs most frequently at the edge of the land-fast ice, (i.e., at the "floe edge"). Seals are shot in the water and retrieved with the kayak, which is a hunting technique considered more comfortable and rewarding than waiting motionless at the seal's breathing hole, and is also safer than hunting at current-maintained open water in the fast ice. Thus in early winter, nearness to the floe edge is a factor in the location of winter settlements. During late winter, the distance from some settlements to the floe edge increases considerably because of the steadily increasing ice cover, particularly in the eastern part of the archipelago. This does not very often result in a move, but rather in a change in hunting technique; at this season of less intense cold, many prefer to hunt at seal breathing holes.

However, as with all other sealing methods practised locally, this is an individual activity and therefore requires no changes in either settlement composition or attitudes. The south coast of the Belcher Islands is relatively poor for this type of hunting, and open water where alternative techniques could be employed is a long distance away, so there is a low incidence of settlement along this coast, apart from the extreme southeast and southwest where especially favourable local situations prevail. At these especially favourable locations, current-maintained pools occur in the fast ice; these pools are generally small in size, but may provide a surprising yield of seals and, in some years, whales also. However, sustained hunting soon exhausts the supply of seals, and no settlement of size can be supported by hunting only at such locations. Small settlements can benefit from nearness to these open-water places, particularly in the southeast where other forms of hunting can be disappointing. The presence of mussel beds in the pools, and the frequent visits of eider duck throughout the winter are added factors favouring nearby settlements.

During May, seals are stalked as they sleep at their breathing holes or elsewhere on the fast ice. The best areas for winter sealing are also most productive at this time. However, during June, open coastlines become less suitable as it is there that the earliest break-up of sea ice occurs. The best spring sealing, which depends on safe ice, may continue several weeks longer in sheltered areas, thus settlements at that time are in the more landlocked, sheltered coastal sections.

Once the sea ice disappears, three factors are important. The first is the continued need for sheltered or landlocked sealing areas to increase the possibility of hunting from boats in windy weather. The second is the need to reduce the distance to the trading post, as travel is not as easy by boat as it is by sled. The third factor is strictly social: after a winter of living in small dispersed settlements, reduced ecological pressures during spring allow increased social contacts through visiting and the joining together of certain settlements. Unfortunately, the summer density of seals is no

greater than it is in winter, and, in addition, losses from sinking are maximal in summer. This threat of reduced hunting returns, compounded by logistic difficulties, is countered by a number of households' leaving spring settlements and constituting a summer grouping in the vicinity of the trading post. These particular households include those that more readily accept Euro-Canadian values, and are consequently not too discouraged by the knowledge that hunting is meagre in the over-exploited region adjacent to the trading post. Those remaining in the spring settlements may now find local hunting adequate, but sometimes households move to other localities (especially favourable for fish, wildfowl, or whales) during the open-water season.

Settlements situated at or near a river or lake containing char disperse to winter settlement areas after the autumn fishing season. Frequent storms at this season make it an absolute necessity for those with large boats to seek a sheltered harbour. Sealing is very uncertain owing to the poor weather, but occasional whales may be taken, and sometimes walrus. Usually, however, food is scarce in the autumn, and at that season the most marked inland orientation occurs: men and women fish in lakes, women and children spend much time gathering berries and woody plants and lichens for fuel. Fuel now becomes very important, and for this reason, as much as for any other, the autumn settlement is unlikely to be sited in exactly the same place from year to year.

Conditions are usually favourable for building snow houses from late November, though in some years not until January. If a household decides to remain in a tent during the winter months, proximity to abundant driftwood for heating is imperative; 3 households had abandoned the use of snow houses for winter habitation by 1958. Some other households in the west and southwest of the Islands move from snow houses to tents before the end of winter (starting in March), when less intense cold, longer days, and a lessening interest in trapping makes it easier to do so. All are forced to move from snow houses to tents by the end of April, although by then driftwood is not so important as fuel, since tundra plants are sufficient for heating purposes.

Whereas hunting is a traditional activity intimately connected with the Eskimo value system, trapping is a relatively recent innovation and has produced, in varying degrees, marked economic and political changes among Eskimo groups (see Balikci 1964). However, on the Belcher Islands, owing largely to the very real scarcity of foxes, changes for the most part are slight, though they affect some individuals much more than they do others. Trapping is again a highly individual activity; pelts are not normally shared even within households, though the meat of the fox is, and food obtained from trading the pelt is shared in the same way as is other food.

There does not appear to be any notion of territorial rights based either on trapping or on other resources. In 1959 and 1960, two recent immigrants from Ungava set traps widely in the regions trapped by long-standing residents, and a number of other settlement moves in these two seasons

were accompanied by corresponding alterations in trapping locations. Men trap in a mosaic pattern over the same area of land and are unaware of the proximity of traps of even members of their own settlement, a situation entirely inconsistent with the notion of personal rights to a given resource. It is maintained by some informants that the best trapping is to be had in the west of the Belcher Islands. Only one man asserted that he was positively influenced in his choice of settlement area by the promise of good trapping; this man was an immigrant from Ungava, where for several decades trapping has been systematic, rather than marginal (as it is on the Belcher Islands).

CONCLUSION

Settlements on the Belcher Islands are composed of a number of interacting households. The ideal household corresponds to the nuclear family. Households can be considered potentially stable in time, insofar as certain non-ideal circumstances (including kinship obligations) permit the maintenance of an ideal composition. The formation or reconstitution of an autonomous economic unit is the rationale underlying changes in household composition.

Patrilocal residence of male siblings after marriage is the basis of settlement composition. Seasonal or annual changes in settlement composition result from economic pressures; in the latter case more particularly, personality factors are additionally important. Fragmentation of settlements occurs across the weakest kin linkages (in relation to the leader) and illustrates the importance of kinship as a solidary mechanism in settlement structure.

The household functions as the basic economic unit in acquisitive phases of the hunting economy; generally, distribution occurs on a settlement-wide basis, though sharing practices depend on a number of variables. Trapping is a marginal economic activity, with the household functioning as both the unit of production and the unit of major distribution.

An awareness of historical background, and particularly of acculturating influences, is considered basic to an understanding of settlement mobility patterns. The end point of increasing acculturation among several arctic and subarctic hunter-trapper societies appears to be the formation of large sedentary and possibly permanent villages situated at the point of trade and subsidy. In progressing to this state, as are a number of Canadian Eskimo groups (including the Belcher Islanders), there is a stage of increased nomadism which appears to vary in intensity with the level of acculturation reached or the degree of "alien-culture aspiration" possessed. The seasonal distribution of "income" on the archipelago results in extended migration: in winter to the west, where foxes are considered most abundant, and in summer to the east, where there is the greatest opportunity for wage employment. Thus the movements of settlements or households with no particular aspirations towards a cash economy are irregular and small scale in

contrast to the regular east-west migrations of the more acculturated members of the community.

The location of seasonal settlements conforms in general outline to biogeographic features; coastal characteristics are important in influencing the actual numbers of seals, as well as in influencing their availability to the hunter.

The presence of seemingly well-defined settlement areas that are habitually frequented by particular groups of households is partly explained by earlier historical influences combined with limited ecological knowledge (the result of patrilocal residence).

There are no prescribed territorial rights to natural resources, but behavioural norms maintain social distance between non-related individuals in Eskimo society (e.g., Weyer 1932; Petersen 1963). This, too, restricts free intercourse between settlement areas; such interaction as occurs takes place at the seasons of least ecological pressure, namely spring and early summer.

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