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THE POTENTIAL FOR SYSTEMATIC CHANGE WITHIN THE POPULATION RESIDENT AT ISLAND LAKE, MANITOBA

by

Lawrence A. Sawchuk

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Chapter 1

INTRODUCTION

The status of scientific inquiry on the American Indian has been summarized in the following statement of Neel and Salzano,

> The American Indian today presents a series of unusual - and in some respects unique - biological, medical, and humanitarian challenges . . . . . Meeting these challenges will not only provide data of considerable scientific importance, but also data of real value to the Indian as in the Americas he progresses toward those greater opportunities which must be his. (1964:85)

A recent "discussion of the biomedical challenges presented by the American Indian (PAHO, 1968) has excluded representation of numerous important problem areas and populations resident in Canada". (Rokala, 1969: pers. communication)

In 1969, an investigation of the Canadian Indian population, resident upon the Island Lake Reserve in north-eastern Manitoba, was initiated by Dr. D.A. Rokala, Department of Anthropology, University of Manitoba. Corrigan and Segal (1950) reported frequent consanguineous matings between individuals resident at Island Lake associated with an elevated prevalence of congenital dislocation of the hip in the issue of such matings. Rokala (1969: pers. communication) proposed that the Island Lake population may be considered as "an isolate with elevated random or non-random consanguinity between mating types as contributory to the population pathology". The Island Lake project was designed with the awareness that the potential for generating testable hypotheses related to the normal and pathological variability within a human population is contingent upon the control of potential sources of noise through demographic analysis of the population structure (Rokala, 1969: pers. communication).

The present report is based upon research on the Island Lake population conducted under the direction of Dr. D.A. Rokala between March of 1969 and August, 1970. The research design and analytic framework were established for a comprehensive analysis of the demographic-genetic structure of the Island Lake population.

Comprehension of biological and cultural variability exhibited by human populations is contingent upon definition of that population within its spatial and temporal matrices (Rokala, 1971: 1-3). Initial consideration, in this report, is devoted to the ethnohistorical development of the contemporary population of Island Lake. And ethnohistorical approach is relevant insofar as it provides insight into the general cultural-environmental milieu within which the contemporary population has evolved (Chagon, et. al., 1969: 342). Examination of the target population within its ecological setting is an additional important parameter for investigation.

Demographic parameters used in the analysis have been broadly outlined in the WHO Technical Reports of 1964 and 1968. Modifications to the WHO outline as suggested by

Rokala (1969: pers. communication) impart additional sensitivity to the demographic characterization of the heterogeneous communities at Island Lake. Parameters under investigation are: age and sex structure, sex ratio, some marital patterns, and components of fertility, mortality, and migration. These demographic parameters have been investigated within the four constituent administrative bands of the Island Lake Reserve, each considered individually, and in the aggregate population.

Demographic data has been collected through research into ethnohistorical accounts in various archives, vital statistics, administrative records, informants, etc. Relevant demographic data has been integrated into individual records. Records have, in turn, been integrated into biological sibships. All individuals referenced in a single sibship share a common progenitor and progenitrix. Sibships have been, tentatively, linked into biological lineages.

The present study is specifically directed to the elucidation of the potential for systematic change in the genetic structure of human populations through differential rates of mortality, fertility, and emigration. The investigations of Pearson (1897), Powys (1905), Fisher (1958), Neel (1958), and Sutter (1963) attest to the importance of differential fertility in the systematic evolutionary change of human populations. Differential fertility is defined as the differential contribution of offspring by individuals of different hereditary and/or social constitution. The action of differential fertility in concert with differential viability constitutes the evolutionary potential for natural selection (Crow, 1958). According to Crow, the total amount of evolutionary change occurring through the action of natural selection may best be estimated by a consideration of the ratio of the variance in progeny number to the square of the mean progeny number (1958: 4).

The literature reveals widespread acceptance and application of an "Index of Potential Selection Intensity" or "Index of Opportunity for Selection" as a measure of systematic evolutionary change occurring within a human population (Basu, 1969; Bodmer, 1968; Crow, 1961, 1962, 1966, and 1968; Erickson, et. al., 1970; Johnston, 1970; Kirk, 1966 and 1968; Neel and Chagnon, 1968; Salzano, 1963; Salzano et. al., 1970 and Spuhler, 1968). In the present investigation a modified "Index" has been applied to a cohort series (1910-1924) resident at Island Lake. Modifications are directed towards providing unbiased estimates of the differential rates of mortality, fertility and emigration through consideration of male and female components, the use of 'assumed' and 'actual' reference points for the calculation of the respective indices, and an estimate of the variance due to fertility which is not based solely upon completed fertilities.

Definition of the population of the Island Lake Reserve within a temporal and spatial context is presented in Chapter II. Contemporary human variability, "cultural and biological, can only be comprehended within the evolutionary framework of these forms" (Rokala, 1971: 9). The third chapter contains the basic demographic characterization of the target population, with special emphasis given to an estimation of the differential rates of mortality, fertility, and emigration, i.e., the components of the potential for systematic evolutionary change. Generalizations and hypotheses constitute the major portion of the fourth and final chapter.

Chapter 2

ENVIRONMENTAL SETTING AND ETHNOHISTORICAL DEMOGRAPHY

Island Lake is one of the major easterly trending lakes in northern Manitoba. The administrative territory of the Island Lake Band is bounded by latitudes 53°45' and 54°00' north, and longitudes 94°00' (second Meridian) and 95°00' west. Its geographical center is approximately 290 miles northeast of Winnipeg, Manitoba.

The nearest settlements are situated at God's Lake, 60 miles to the north, and Norway House, 120 miles to the west. The territory in and adjacent to Island Lake is underlain by Precambrian rocks forming part of the Canadian Shield. The topography is characterized by relatively low relief, well rounded knolls of rock exposure, and the occurrence of marsh and/or muskeg (UMAL, 1969: 9, Godard, 1963: 1). Island Lake drains to the northeast via Island Lake River into God's Lake and then by God's and Hayes Rivers into Hudson's Bay. The Isbister and Banksian Rivers drain into Island Lake from the south, one from the west, and two, including the Sagawitchewan River, from the east (Wright, 1927: 59).

The climate is continental with short, warm summers, and long, cold winters. Temperatures at the nearest official weather station (God's Lake) vary from a summer mean of 64°F to a winter mean of -12°F (Hastings, 1959). The mean annual precipitation is about 19.4 inches spread uniformly throughout the year.

The area in and adjacent to Island Lake lies within the Hudsonian Biotic province (Dice, 1943: 10-13). Table 1 defines the biotic community of the Island Lake area. The region is forested with black and white spruce, balsam fir, mountain ash, banksian pine, with tamarack, willow, and alder in the drier localities (Godard, 1963: 3). The fauna consists of beaver, martin, mink, muskrat, fisher, lynx, wolverine, fox, black bear, wolf, rabbit, and deer (HBC, 1824: 1; Godard, 1963: 3). There are many species of birds inhabiting the area, with the non-migratory ruffled grouse and spruce partridge of prime economic importance (Godard, 1963: 3). Fish are plentiful and constitute the only dependable local source of food (HBC, 1824: 3; Godard, 1963: 3). Common species are northern pike, perch, and pickerel; with whitefish and trout the principal species exploited commercially (Montreal Gazette, 1929: np.; Godard, 1963: 3).

Table 1

THE BIOTIC COMMUNITY OF ISLAND LAKE

MANITOBA

Common Name	Scientific Name*
Flora	
Black Spruce	Picea mariana (mill.) BsP
White Spruce	Picea glauca (Moench) Voss
Balsam Fir	Abies balsamea (L.) Mill
Mountain Ash	Sorbus decora (Sarg.)Schneid
Banksian Pine	Pinus Banksiana Lamb.
Tamarack (Larch)	Laris Laricina (DuRoi)K.Roch
Willow	Salix planifolia Pursh.
Alder	Alnus crispa (Ait.) Pursh
Mammals	
Beaver	Castor canadensis
Marten	Martes americana
Mink	Mustela Vison
Muskrat	Ondatra Zibethicus
Fisher	Martes pennanti
Canada Lynx	Lynx canadensis
Wolverine	Gulo luscus
(Red) Fox	Vulpes vulpes
Black Bear	Ursus americanus
Wolf (Bush or Timber)	Canis latrans or Canis Lupus
Rabbit (Varying Hare)	Lepus americanus
Deer (White Tailed)	Odocoileus virginianus
Birds	
Ruffled Grouse	Bonasa umbellus
Spruce Partridge (Grouse)	Canachites canadensis
Fish	
Northern Pike	Esox lucius
(Yellow) Perch	Perca flaveseens
Pickerel or Walleye	Stizostedion vitreum
Lake Whitefish	Castostomus clupeaformis
Lake Trout	Salvelinus namaycush

*(Rogers, 1962: A11-A22)

THE SUBARCTIC BAND POPULATION

PRE-RESERVE STATUS

Definition of the pre-reserve 'band' structure and organization of population aggregates inhabiting the Canadian Eastern Subarctic has received the attention of numerous investigators (Dunning, 1959: 54; Fisher, 1969: 10-11; Honigmann, 1964: 332; Rogers, 1969a: 21-55; Service, 1962: 86; Speck, 1962: 277-8; Steward, 1958: 144). Ethnohistorical data pertaining to Island Lake is, however, meagre. Presentation of an idealized structural arrangement of Subarctic band populations, therefore, assumes substantial import as a baseline for the definition of the band organization and structure of the Island Lake population.

In the past, population aggregates representing Cree and/or Ojibwa demographic units maintained optimum exploitation of the biotic community by remaining dispersed throughout the Subarctic forest region for the greater part of the year in small hunting-trapping groups (Dunning, 1959: 63; Fisher, 1969: 14; Hallowell, 1955: 119; Rogers, 1963: 71). Based on residence and economic cooperation and secondarily on kinship (Rogers, 1969a: 28), the hunting-trapping group represented the basic socio-genetic unit of band populations inhabiting the Canadian Eastern Subarctic (Fisher, 1969: 14; Rogers; 1969b: 30). The members of such a group spent the winter months together at a winter camp exploiting the available biota within their hunting area, by trapping, combined with general subsistence activities (Hallowell, 1949: 14; Rogers, 1963: 71). The hunting-trapping group coincides with Dunning's "Co-residential Group" (1959: 55), and what Helm (1965) has termed the "task group" and the "local band" for population aggregates inhabiting the Canadian Western Subarctic region (Helm and Leacock, 1971: 364). The social composition of the hunting-trapping group varied.

> Ideally, it was composed of a man and his three married sons, in which case it could be equivalent to the extended family, but this was rarely so. Often other relatives were involved in the composition of the group and at times with individuals who could trace no kinship connection with other numbers (Rogers, 1969b: 30).

In addition, the size and age-sex composition of the hunting-trapping group varied depending upon "fluctuating population densities within any segment of any given band at a particular time" (Rogers, 1969b: 30), the nature of the biota being exploited, and differential mortalities between the sexes disrupting the sex ratios (Rogers, 1969b: 30). Each hunting-trapping group was quite small, being composed of two to five closely related families, numbering in all seven to twenty-five individuals, all of whom were generally under the direction of the eldest male (Fisher, 1969: 15; Hallowell, 1940: 40; Honigmann, 1956: 58; Rogers, 1963: 71; Skinner, 1911: 57).

With the approach of spring, there was a centripital movement of a number of hunting-trapping groups to a favorable fishing locality where the resultant assemblage concentrated upon communal subsistence activities (ie, fishing, hunting and gathering) and communal ritual activities (Fisher, 1969: 59; Hallowell, 1938a: 130; McGm, 1965: np; Rogers, 1963: 71). The abbreviated summer fusion of hunting-trapping groups permitted manifestation of more extensive organizational patterns, Fisher (1969: 15) states that,

> This short summer phase of the overall organization emphasized the importance of the other side of 'affinal dualism', the role of in-laws and potential spouses.", and "contained the potential for higher evolutionary forms of tribal organization and the basic necessity of the later fur trade organization, the rendezvous, travel and encampment around the trade fort, and the ceremonial exchange of European goods which complemented informal means of exchange within the family hunting band.

This seasonally based aggregation of hunting-trapping groups represented a higher form of evolutionary organization - the loca, named group or band (Fisher, 1969: 15; Rogers, 1969a: 41-47). The local band coincides with Helm's (1965) "regional band", and what Honigmann has referred to as the "macrocosmic group" (Helm and Leacock, 1971: 365).

The local band may be defined as a loosely structured unit with a patrilineal bias (Fisher, 1969: 10; Rogers, 1969a: 46; Service, 1962: 86), which ranged in size from less than fifty to a maximum of one hundred to two hundred individuals (Fisher, 1969: 10; Hallowell, 1955: 119; Rogers, 1969b: 31). The local band inhabited a drainage basin, alone or in conjunction with other such groups (Rogers, 1969a: 46), and underwent a biseasonal fission-fusion associated with the centrifugal-centripetal movement of its constituent hunting-trapping units (Fisher, 1969: 15; Hallowell, 1955: 119; Rogers, 1963: 71). In addition each local band had geographic or territorial limits, its range of habitation being defined by the aggregation of contiguous hunting areas exploited by the respective hunting-trapping groups (Rogers, 1969a: 29). These areas were, strictly speaking, not hunting grounds but areas surrounding traplines, where all resources, except the fur-bearing biota, were available to anyone (Helm and Leacock, 1971: 363).

Leadership among the Algonkians of the Eastern Subarctic was weakly developed as,

> the maximal group was dispersed for the greater part of the year, and there was a concept of individualism that hindered the development of authoritarian leaders except in a charismatic manner and the belief or philosophy allowing individuals to escape domination; a belief that no one had the right to deny a man movement to other areas in search of game (Rogers, 1969a: 47).

The local band was generally under the direction of a head man who was, in effect, a charismatic leader whose religious power helped him to maintain his position (Rogers, 1969b: 41).

The local band was neither strictly exogamous nor endogamous, but agamous in that members could marry inside or outside the band (Fisher, 1969: 11; Grant, 1929: 2; Rogers, 1969a: 33). Historical and ethnographic evidence suggests that the preferred pattern of marriage was that of first cousin or classificatory cousins of the cross-cousin type (Eggan, 1955: 532; Fisher, 1969: 11; Grant, 1929). Formerly, polygamy was practised among population aggregates inhabiting the Canadian Eastern Subarctic, but disappeared under the pressure exerted by missionaries and governmental agents (Dunning, 1959: 182-183; Glover, 1958: 45; Grant, 1929: 2; Hallowell, 1938b: 235; McGm, 1965: np).

Band size among the Algonkian speaking peoples of the Eastern Subarctic was roughly constant, ranging from a minimum of approximately 50 to 75 to a maximum of 125 to 150 individuals (Rogers, 1969b: 31). In the southern region, local band size was somewhat larger (Rogers, 1969a: 31).

Occasionally each such local band may have participated in the formation of a regional population, a population aggregate consisting of a number of local bands occupying a particular geographical area (Rappaport, 1969: 186). Convergence of a number of local bands upon a certain point of trade may have resulted in the formation of a regional population, as

> Trading posts were fewer in number than were the fishing sites where bands formerly gathered, and, therefore, the posts tended to attract larger aggregates (Rogers, 1969b: 32).

Such a population aggregate is equivalent to Roger's "trading post band" (1969a: 42).

In summary, the structural aggrangement of Subarctic band populations appears to have been centered around two fundamental units of social organization, that of the hunting-trapping group and the local, named group or band. Rogers has proposed that this similarity in social organization arose through distinctive mechanisms,

> one might say for the Cree and a few Ojibwa groups on the edge of the Laurentian Uplands of Ontario that their social organization (hunting group band) is an adjustment to a harsh environment in which natural resources are extremely limited and in which the people must scatter widely and in small groups in order to survive,

whereas, the Ojibwa social organization (hunting group band) is,

> a result of their preoccupation with, and highly developed concepts of, witchcraft, in interpersonal relations in which none can trust anyone else and there is a constant fear of one's neighbours (Rogers, 1969b: 37).

Consideration of ecological, temporal and spatial factors reveals a high degree of variability in the organizational and economic parameters of Cree and/or Ojibwa demographic units (eg. Dunning, 1959; Fisher, 1969; Hallowell, 1955; Rogers, 1969a). In lieu of the paucity of information pertaining specifically to the target population, the hypothetical model thus proposed remains at best an approximation of the pre-reserve band structure and organization of the Island Lake population.

EURO-CANADIAN CONTACT

The subject of Euro-Canadian contact and its effects upon the socio-genetic constitution of Algonkian speaking peoples of the Canadian Eastern Subarctic has received the attention of numerous investigators (Dunning, 1959; Fisher, 1969; Hallowell, 1955; Honigmann, 1948; Mason, 1967; Rogers, 1962 and 1964). Ethnohistorical information pertaining to the expression of the fur trade, the missionary, and the government on the Cree and/or Ojibwa in and adjacent to the Island Lake area is meagre or non-existant. The subsequent discussion is therefore, confined to a historical examination of the respective contact agents.

The Fur Trade

The historical record suggests that European contact vis-a-vis the fur trade with Cree and/or Ojibwa population aggregates in and adjacent to the Island Lake area dates back at least to the latter decades of the 18th century. Samuel Hearne's exploration of the Island Lake area in the 1770's reveals that,

> At different parts of this Lake most of the wives and families of those Northern Indians who visit Prince of Wales Fort in October and November generally reside, and wait for their return; as there is little fear of their being in want of provisions, even without the assistance of a gun and ammunition, which is a point of real consequence to them (Glover, 1958: 46).

In or shortly after 1818, the Hudson's Bay Company established a post at the east end of Sagawitchewan Bay, about 1,000 feet east of the first small rapid of the Sagawitchewan River (Flemming, 1940: 459; Grant, 1929: 3; HBC, nd: 1; Voorhis, 1930: 86; Wright, 1927: 56). During this period, the North West Company operated a trading post in the Island Lake area known as Lac des Isles (HBC, 1962:1). By 1822-23, the Hudson's Bay Company had established four trading posts in and adjacent to Island Lake. The resultant aggregates of Sandy Lake, Merry's House, Oxford House, and Island Lake comprised the Island Lake District (HBC, 1824:2).

> This District is bounded by York Factory on the North, by Severn District East and S. East, by Norway House District on the South, and West and by Nelsons River District on the North West (HBC, 1824: 1).

Decline in the fur-bearing animals resulted in the abandonment of Sandy Lake, and Merry's House in 1823 and 1824 (HBC, 1824: 2). In 1827, renewed prosperity within the Island Lake District stimulated the reoccupation of Merry's House (Flemming, 1940: ix). However, by 1833, the Hudson's Bay Company considered it.

> ... expedient to concentrate the business by abandoning the posts of Windy Lake and Merry's House and to establish in their stead a post at the east end of Island Lake, where the fishery is so productive as to afford abundant means of living, can be drawn without inconvenience, like-wise to abandon the post of Manitoo Lake, merely keeping a fisherman there for the support of the people employed on Winter Road, and who would be provided with a few essentials to supply the Indians with when absolutely necessary in the course of the winter ... (Oliver, 1914: 699).

In 1837, the Island Lake post was removed to "a better fisherie about 30 miles distant from the former location" (Oliver, 1914: 783). A few years later it was removed to the north end of Linklater Island at the northeast corner of Island Lake (Montreal Gazette, 1929: np.). "It was again abandoned in 1845, being considered superfluous when Trout Lake was established, and was not included in the list of posts in 1857" (HBC, 1958: 1). In late autumn of 1867, Mr. Cuthbert Sinclair, travelling from Oxford House, established a small post near the mouth of the Island Lake River (Voorhis, 1930: 86; Wright, 1927: 56), which has been in continuous operation ever since (HBC, 1958: 1).

Missionary Activity

Mission activity in the Island Lake area began in the latter decades of the nineteenth century. In 1891, John Hope, a travelling missionary, reported visiting "a small band" of Indians at Island Lake and remarked upon their apparent conversion to Christianity. However, "it was not until 1903 that the United Church began more intensive work among the natives by assigning a resident missionary to the band" (Hallowell, 1938b: 130). During this period, the mission at God's Lake, some 90 miles distant, served as an outstation for the Island Lake residents (Stephenson, 1925: 129). Twenty years later, a Roman Catholic mission was established approximately 10 miles from the older Roman Catholic mission (Paterson, 1952: 5). A second United Church mission was established at Red Sucker Lake in 1951, where an "Indian licensed lay reader takes regular Sunday services, performs burials, baptisms, and marriages" (Paterson, 1952: 6). In 1952, the Oblate Priests and Grey Nuns opened a mission and school at St. Theresa's Point.

The Government

In 1875, the Privy Council of Canada appointed Alexander Morris as Lieutenant-Governor of Manitoba to negotiate a treaty with the Cree and Ojibwa Indians of the Lake Winnipeg drainage area. This territory, north of that secured by treaty number 1, was becoming increasingly valuable as farming land, and it was considered essential that the Indian title be extinguished (Morris, 1880: 143-4). In 1875, the Winnipeg treaty (Number 5) was concluded with the Saulteux and Swampy Cree tribes at Norway House and Beren's River. Its principal features were:

> the relinquishment to her Majesty of the Indian title; the reserving of tracts of land for the Indians, sufficient to furnish 160 acres of land to each family of five; providing for the maintenance of schools; and the prohibition of the sale of intoxicating liquors to the reserves (Morris, 1880: 31) and a present of five dollars per head to the Indians and the payment of annuity of five dollars per head (Canda Sessional Papers, 1876: Appendix D: pxxxi).

Morris instructed his assistants to secure an adhesion of the Island Lake bands to Treaty Number Five.

On July 29, 1909, the Indians of Oxford House, God's Lake and Island Lake Bands met at Oxford House, where they willingly agreed to the terms of the Winnipeg Treaty. Acceptance of this adhesion may be attributed to the fact that,

> They lived far from the main trade routes and their hunting land was neither sought after nor good for farming. To them, the treaty was an unqualified benefit, they lost nothing of value and they gained recognition from the government, with not only annual treaty payments, but of the establishment of an Indian agent who would be responsible for them. This would mean at the very least, agricultural tools, seed, fish-nets, shot, some food, and relief supplies, and medicines (Dunning, 1959: 10-11).

From 1909 to the present treaty payments, the Island Lake Band has been under the supervision of the Canadian Government.

Initially, the Island Lake Band was placed under the auspices of the Norway House Agency (Dept. of Indian Affairs, 1924: 12-13), and later transferred to the Island Lake Agency in 1959 (Dept. of Indian Affairs, 1959: 18-20). As of 1969, the Island Lake Reserve has been divided into four administrative bands: Garden Hill, St. Theresa's Point, Wasagamack, and Red Sucker Lake (Rokala, 1970: pers. communication).

The Department of Indian Affairs was the first government agency involved in providing a number of services directed towards assisting the Indian population. Emphasis was given to the education of the Indian children (Dept. of Indian Affairs, 1923: 7). Initially, the policy was to remove the children from their home to a school located outside the reserve (Rogers, 1964: 37) Norway House and Portage la Prairie served as residential schools for the residents of Island Lake (Dept. of Indian Affairs, 1923: 52; Paterson, 1952: 2). Later, a school was established at the settlement of Garden Hill. Attention was then focused upon providing adequate medical and health services for the Indian population (Dept. of Indian Affairs, 1926: 8).

Medical authorities have had only occasional contact with the Island Lake residents when a physician would accompany the Indian Agent at Treaty time (Corrigan, 1946: 222). In 1947, a tuberculin program was implemented, followed later by the establishment of two nursing stations at Garden Hill and St. Theresa's Point. In addition to the above services, the Indian Affairs Branch assumed the responsibility of providing relief to destitute families with the implementation of such welfare measures as Old Age Pension, Family Allowance, and Widow's Allowance (Rogers, 1964: 37).

Certain economic opportunities became available to the Indian people. These were finanaced by private industry but often were under the supervision of either the federal or provincial governments. Industries such as commercial fishing and lumbering have stimulated the economic situation at Island Lake, as well as imparted impetus towards an increasingly more sedentary life (Paterson, 1952: 6).

GEOGRAPHIC MOBILITY

A number of investigators have commented upon the geographic mobility of populations representing Cree and/or Ojibwa demographic units inhabiting the Easter Subarctic (Dunning, 1959; Fisher, 1969; Hallowell, 1955; Rogers, 1964 and 1969b). In recent years, investigation into the existence and differential expression of geographic mobility and its potential stablizing or modifying effects upon the composition and distribution of human populations has assumed importance in the study of social and biological variability (eg. Chagnon, et. al., 1964; Neel and Salzano, 1967; Rokala, 1971). Definition of the nature and source of geographic mobility exhibited by Cree and/or Ojibwa population aggregates occupying the area in and adjacent to Island Lake follows from such considerations.

The initial source of external stimuli affecting population mobility in and adjacent to the Island Lake area may be attributed to the firm commitment of the aboriginal population to the Euro-Canadian fur-trade economy. An early report by Hearne in the 1770's reveals that population aggregates in the Island Lake area were in the habit of travelling to Prince of Wale's Fort (Churchill), securing trade goods in exchange for furs (Glover, 1958: 46). By the early nineteenth century, the Hudson's Bay Company had established a number of trading posts within the Island Lake area, the resultant aggregate designated as the Island Lake District (Cumming, 1928: 116; Flemming, 1940: 459; HBC, 1824: 2; Voorhis, 1930: 86). Reports from this early period reveal that the occupation and location of these posts fluctuated depending upon the status of local biotic communities. As a result the composition and distribution of ethnic aggregates inhabiting the Island Lake area are correspondingly modified,

> The Post of Sandy Lake was abandoned in Autumn '23 in consequence of the means of subsistence being too difficult to procure and the Indians, consisting of families, resorted, 14 to Island Lake and the remainder to Trout Lake, Severn District, Merry's House was likewise abandoned in May '24. The returns of that Post, not being sufficient to pay the expense of either a Boat or Canoe, it was judged more advantageous to divide the Indians between Island Lake, York Factory, and Trout Lake, as their hunting grounds lay nearly in the center - between these establishments (HBC, 1824: 2).

By 1827, renewed prosperity within the Island Lake

District stimulated the reoccupation of Merry's House, subsequently followed by an immigration of Cree and/or Ojibwa demographic units from the Trout Lake and Severn River regions (Flemming, 1940: ix). This phenomenon continued as,

> A few years later, Island Lake post was abandoned on account of the scarcity of country produce, most of the Indians moving to Trout Lake, while others went to Little Grand Rapids, and Oxford House (Cumming, 1928: 116).

Repeated disequilibrium between the density of human populations and the carrying-capacity of the environment stimulated further fluctuation in the occupancy and location of trading posts within the Island Lake District (HBC, nd: 1; Montreal Gazette, 1929: np; Oliver, 1915: 699 and 783). The disequilibrium between human population density and environmental carrying-capacity may be attributed to the fact that participation in the fur-trade limited exploitation of the biotic community to its fur-bearing components, thereby reducing the effective carrying-capacity of the environment (Rokala, 1971: 21-22). This phenomenon continued into the twentieth century as traders from Island Lake and Norway House began to travel through northeastern Ontario during the winter months with a supply of goods, trading for furs as they travelled (Rogers, 1962; A27). From 1903-1908, the post at Sandy Lake operated as an outpost of the Island Lake District (HBC, nd.: np). Reports from this period testify to the widespread population mobility stimulated by the fur-trade economy.

> Nearly 500 Indians trade at this post, (Trout Lake) but they do not all belong to the post, part being a roaming population, some of which belong to Marten's Falls and Cat Lake Posts on the Albany River, while others come from York, Severn and Island Lakes (Miller, 1912: 100).

The firm commitment by aboriginal populations to the fur trade economy resulted in widespread population mobility in and adjacent to the Island Lake region throughout the nineteenth and early twentieth centuries. Such considerations support the hypotheses that,

> Involvement in the fur-trade was to substantially modify the ethnic distribution and probably, the composition of Algonkian - and Athabaskan - speaking peoples of the northern United States and Canada (Rokala, 1971: 18).

Information derived from historical and ethnographic sources reveals a number of geographic localities, representing potential or real sources of socio-genetic contact, which may have modified the composition of the Island Lake population. Table 2 abridges the findings of ethnohistorical research. Consideration of the spatial distribution of the respective geographic localities suggests that if socio-genetic contact occurred, it was in fact a non-random process.

In addition, this non-random process appears to have been directed by geographic and socio-psychological isolating mechanisms operating during this period. A number of references testify to the isolated nature of the Island Lake population (Sessional Papers, 1923: 105; UMAL, 1966: 8; WFP, 1927: 1). However, a more definite statement by Grant

Table 2

GEOGRAPHIC MOBILITY: AN ETHNOHISTORICAL RECONSTRUCTION

Locality	Reference
Cat Lake, Ontario	Miller, 1912: 100
Churchill, Manitoba	Glover, 1958: 46
Deer Lake, Ontario	Hallowell, 1938a: 132 Stephenson, 1925: 126
God's Lake, Manitoba	Grant, 1929: 6
Little Grand Rapids, Manitoba	Cumming, 1928: 116 Wright, 1927: 56
Marten's Falls, Ontario	Miller, 1912: 100
Oxford House, Manitoba	Corrigan & Segal, 1950: 540 Cumming, 1928: 116 Grant, 1929: 66 Wright, 1927: 56
Sachigo Lake, Ontario	Dept. of Citizenship and Immigration, 1964: 4
Sandy Lake, Ontario	Hallowell, 1938a: 132 Stephenson, 1925: 126
Trout Lake, Ontario	Cumming, 1928: 116 Flemming, 1940: ix HBC, 1824: 2 Miller, 1912: 100
York Factory,	HBC, 1824: 2

(1929: 4) suggests that "Mossy Portage", a deep swamp approximately three miles in length, served as a geographical barrier that separated the residents of Island Lake from population aggregates to the north and west of them,

> As apparently it was found to be impracticable or else expedient to portage heavy York freighting boats across this bog, Mossy portage became a relay point, ie., freight was brought as far as this portage by crews from York Factory or from Oxford House, where they were met by crews from Island Lake, who took charge of the freight, transferred it to their canoes, and conveyed it to the company's post at Island Lake.

In addition, the differential expression of "socio-psychological" isolating mechanisms appear to have further enforced this non-random socio-genetic-contact, as

> ... even to this day the peoples of Island Lake hold themselves aloof from their countrymen of other bands; even when they meet them on the trail they neither camp with them nor do they eat together (Grant, 1929: 4).

In summary, the existence of isolating mechanisms appears to have reinforced the non-random spatial distribution of potential or real sources of demographic exchange imparted by the firm commitment to the fur-trade economy by Cree and/or Ojibwa population aggregates in and adjacent to the Island Lake area.

THE ESTABLISHMENT OF CONTEMPORARY DISTRIBUTIONS

The contemporary distribution of the Cree-Ojibwa residents at Island Lake, Manitoba issued from the presence and differential expression of the three Euro-Canadian agents: the fur trade, the missionary, and the government.

Whereas the role of the fur trader and the missionary was one of a catalyst, the principal agent responsible for the present distribution of Algonkian-speaking peoples in and adjacent to the Island area was the Canadian Government.

By Treaty No. 5 (adhesion), signed in 1909, the formerly independent local bands occupying the Island Lake area and surrounding district were joined together to form the government band of Island Lake. The initial aggregation of 449 individuals present at the first treaty payments was derived of Cree and/or Ojibwa population aggregates from Red Sucker Lake to the north, Stevenson Lake to the west, and the Cobham and Severn River District to the south (Corrigan and Segal, 1950: 535; Hallowell, 1938a: 132). At first, they gathered only on the northwest shore of Island Lake at Wasagamack, and gradually spread along the shores of Island Lake until they formed the well established settlements of Garden Hill, St. Theresa's Point, and Wasagamack (Corrigan and Segal, 1950: 535). As population density within the Island Lake area steadily increased, the former residents of Red Sucker Lake returned to their former place of residence in the 1950's (NTF, 1970: 4).

The settlements of Garden Hill, St. Theresa's Point, and Wasagamack resulted from the presence of trading posts and churches functioning as focal points for the inhabitants. There is some evidence to suggest that the contemporary settlement distribution reflects a number of sub-populations differentiated in part on the basis of religious affiliation.

After a brief visit to Island Lake in 1938, Hallowell (1938a: 131) reported that,

> In summer the Indians congregate at the western end of the Lake in three settlements, all of which are radial as it were, to the Hudson's Bay Post, which they reach by water. Smooth (or Flat) Rock is approximately nine miles southeast of the post. It is here that most of the Protestant Indians congregate. The Catholic mission, which I was unable to visit, is located at "Maria" Portage (misinigap), almost eleven miles due south from the company. The third settlement is on the western side of Wasagamack (wasig mak) Bay to the Northeast of Maria Portage, of which it is really an outpost.

Nearly fifty years later, this phenomenon still can be discerned,

> The religious difference is still sharply defined; Wasagamack and St. Theresa are Roman Catholic and Garden Hill is Protestent. (UMAL, 1966: 4).

Further elaboration of the potential and real effects of religion upon the present cultural and biological variability exhibited by the Cree-Ojibwa of Island Lake will be forthcoming (Rokala, 1971: pers. communication).

Chapter 3

DATA PRESENTATION

Demographic data on the Cree-Ojibwa of Island Lake, Manitoba were derived from sources described earlier by Rokala (1970: 1). The collection, collation, and analysis of demographic data proceeded within a methodological design formulated by Rokala (1969: pers. communition). All data pertaining to the target population was subsequently integrated into tentative nuclear family units of procreation and/or orientation. Reconstruction of biological units, ie., individual records, sibships and lineages, was attempted. Tabulation and data analysis was facilitated largely through manual operations, with minimum employment of electronic data processing.

Definition of the target population as of December 31, 1969; was achieved through a total enumeration of the Cree-Ojibwa population resident at Island Lake. Characterization of the Island Lake population aggregate was facilitated by the extraction of a cohort series consisting of all females and males born within the 1910-1924 period with and without regard to residence. Such a construct allowed for the calculation of the differential rates of mortality, fertility and emigration within some of the progeny of the founder reserve population. Due to the incompleteness of the genealogical histories for the cohort series, the subsequent characterization of the target population represents an initial attempt at defining the basic demographic parameters of the Cree-Ojibwa resident at Island Lake, Manitoba.

ISLAND LAKE - 1969

Information derived from the band registry for December 31, 1969 revealed a total resident population of 2,789 individuals at Island Lake. The administrative bands of the Island Lake population and their respective sizes as of 1969 are as follows: Garden Hill, 1,251; St. Theresa's Point, 918; Wasagamack, 384; and Red Sucker Lake, 236. The age and sex composition for the Island aggregate, as well as the respective band populations, are presented in Tables 3 through 7. Figures 1 through 5 are graphical representations of these structures.

The broad base configuration of the age pyramid for the Island Lake aggregate and the constituent band population reflect demographically young or expanding populations (Taylor, 1966: 221). This conclusion is further reinforced by the high percentage of individuals (51.4%) in the age class 0-14 among the Island Lake aggregate. Similiar values are also reported for the respective band populations: Garden Hill, 51.2%; St. Theresa's Point, 50.8%; Wasagamack, 54.9%; and Red Sucker Lake, 49.0%.

In the absence of differential immigration, emigration and mortality between the sexes, the expectation in such a population is that the sex ratio (ie., the ratio of

Table 3

ISLAND LAKE BY AGE GROUP AND SEX: 1969

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	304	10.99	276	9.97	110.14
5-9	224	8.09	240	8.67	93.33
10-14	190	6.86	190	6.86	100.00
15-19	141	5.09	130	4.70	108.46
20-24	122	4.41	128	4.62	95.31
25-29	102	3.69	97	3.50	105.15
30-34	68	2.46	83	3.00	81.92
35-39	41	1.48	47	1.70	87.23
40-44	42	1.52	43	1.55	97.67
45-49	41	1.48	33	1.19	124.24
50-54	29	1.05	25	.90	116.00
55-59	26	.94	23	.83	113.04
60-64	17	.61	15	.54	113.33
65-69	22	.79	17	.61	129.41
70 and over	30	1.08	23	.83	130.43
Total	1399	50.54	1369	49.56	102.19

Total Population Size = 2,768

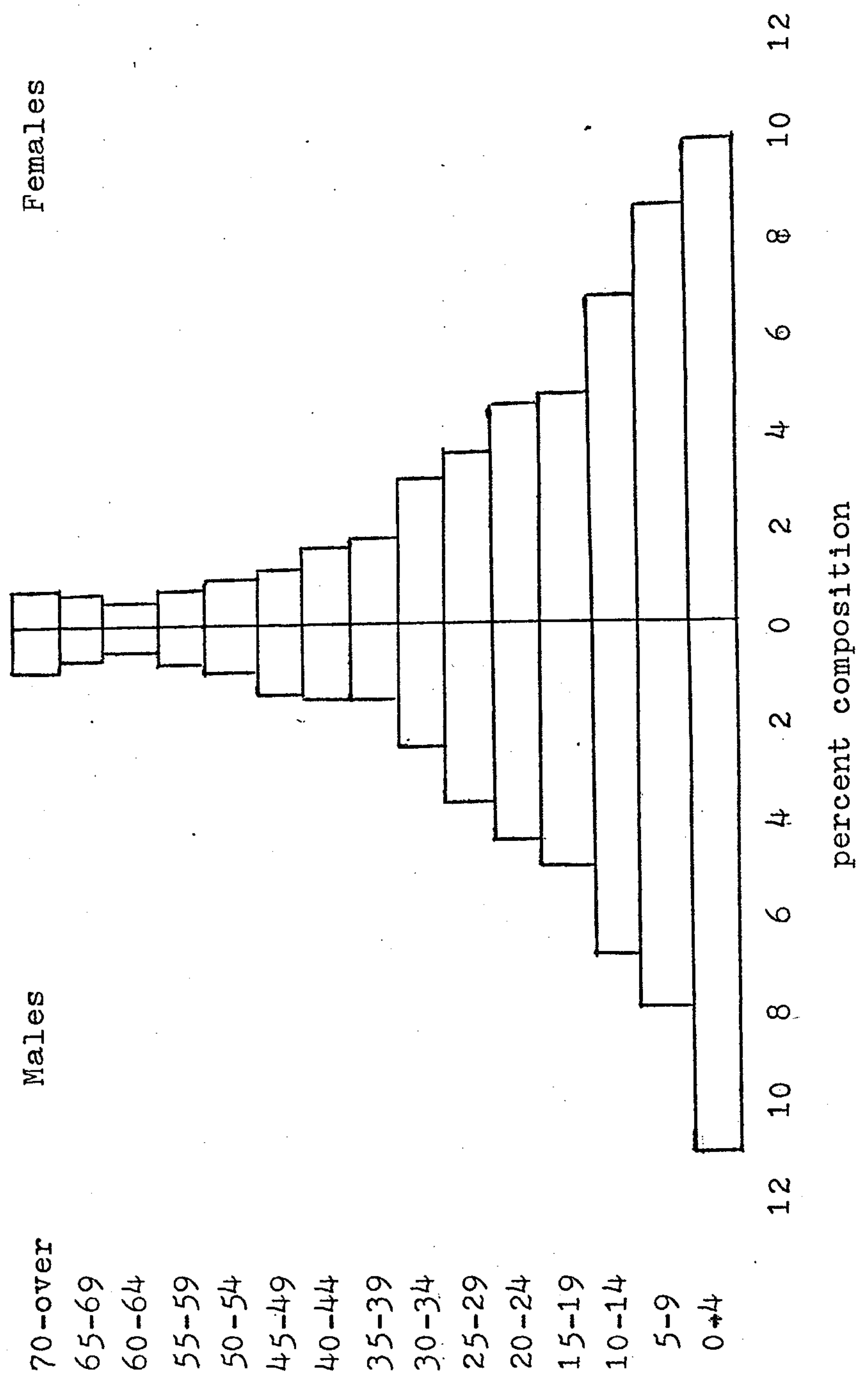

Figure 1

AGE AND SEX PYRAMID OF ISLAND LAKE AGGREGATE: 1969

Table 4

GARDEN HILL BY AGE GROUP AND SEX: 1969

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	143	11.33	123	9.75	116.26
5-9	105	8.32	104	8.24	100.96
10-14	86	6.81	85	6.74	101.18
15-19	57	4.51	52	4.12	109.62
20-24	60	4.75	61	4.83	98.36
25-29	47	3.72	38	3.01	123.68
30-34	26	2.06	43	3.41	60.47
35-39	28	2.18	22	1.74	127.27
40-44	16	1.27	18	1.43	88.89
45-49	19	1.51	18	1.35	111.76
50-54	11	.87	11	.87	100.00
55-59	9	.71	11	.87	81.82
60-64	11	.87	11	.87	100.00
65-69	13	1.03	8	.63	162.50
70 and over	17	1.27	10	.79	170.00
Total	648	51.35	614	48.65	105.54

Total population size = 1,262

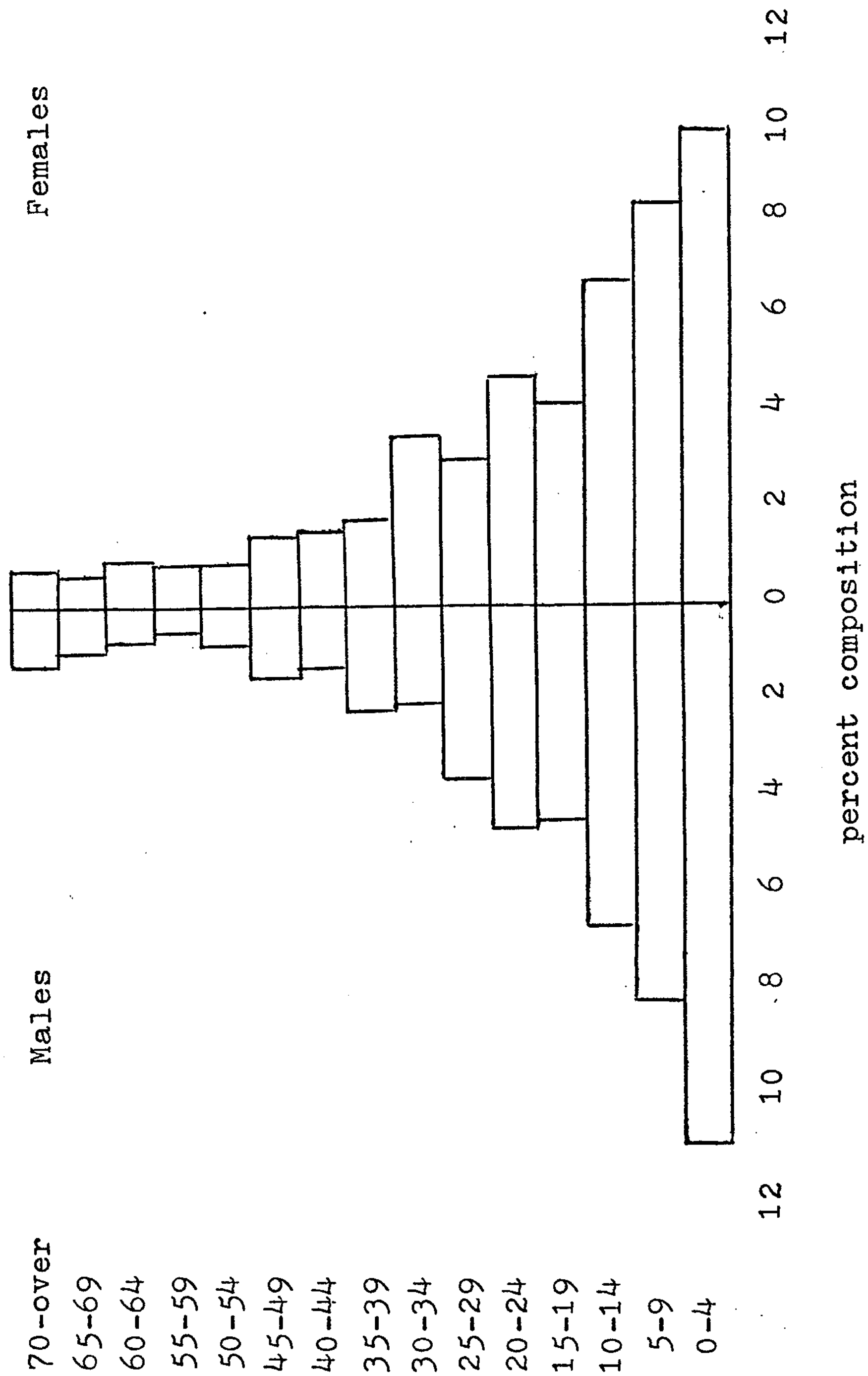

Figure 2

AGE AND SEX PYRAMID OF GARDEN HILL: 1969

Table 5

ST. THERESA'S POINT BY AGE GROUP AND SEX: 1969

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	97	10.64	92	10.09	105.43
5-9	69	7.57	73	8.00	94.52
10-14	71	7.89	60	6.58	118.33
15-19	52	5.70	51	5.59	101.96
20-24	35	3.84	45	4.93	77.78
25-29	37	4.06	31	3.40	119.35
30-34	26	2.85	28	3.07	92.86
35-39	8	.88	17	1.86	47.05
40-44	18	1.97	16	1.75	112.50
45-49	15	1.64	7	.77	214.29
50-54	9	.99	7	.77	128.57
55-59	7	.77	8	.88	87.50
60-64	2	.22	4	.44	50.00
65-69	5	.55	4	.44	125.00
70 and over	9	.99	9	.99	100.00
Total	460	50.44	452	49.56	101.77

Total Population Size = 912

Figure 3

AGE AND SEX PYRAMID OF ST. THERESA'S POINT: 1969

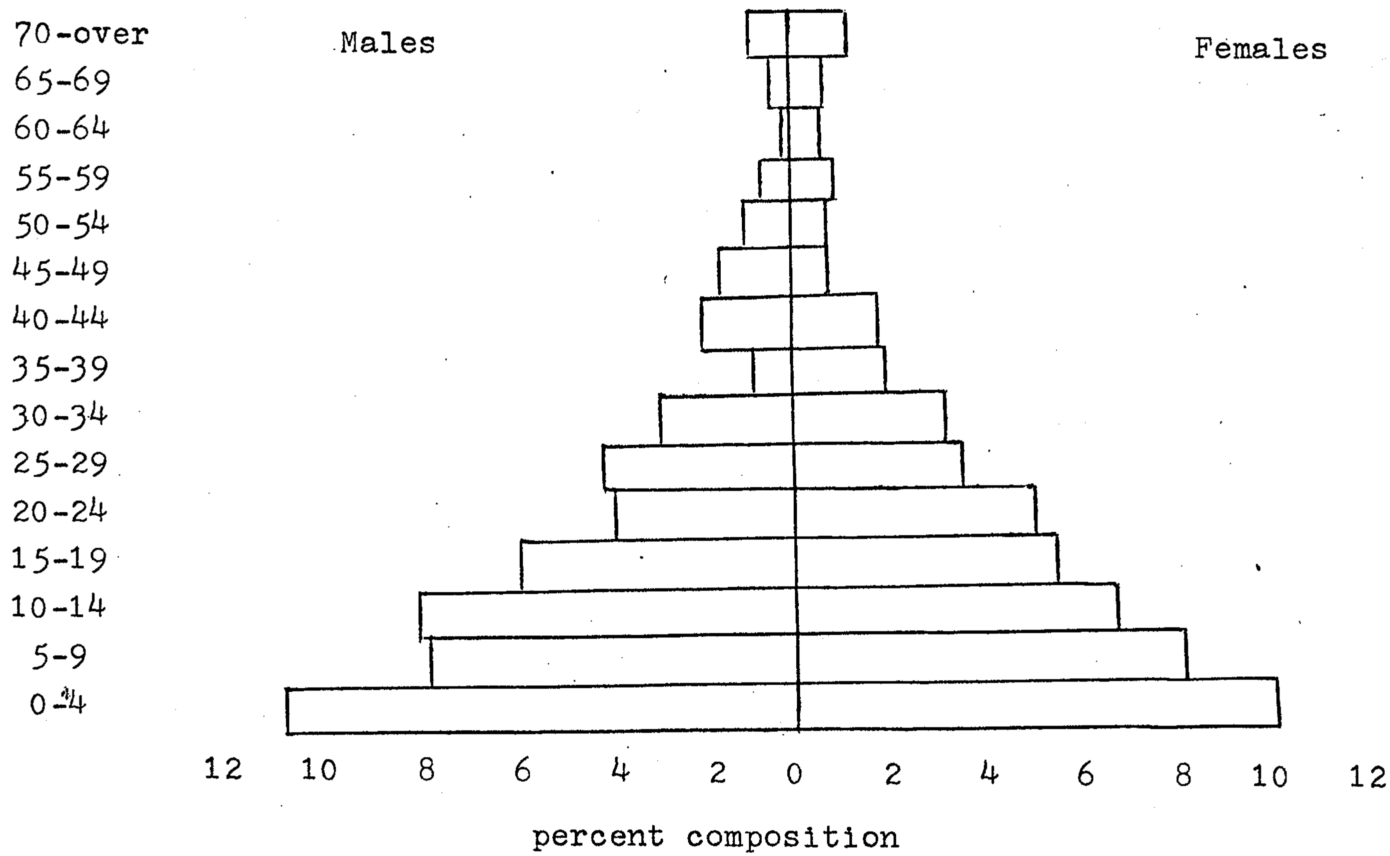

Table 6

WASAGAMACK BY AGE GROUP AND SEX: 1969

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	37	10.28	41	11.39	90.24
5-9	36	10.00	38	10.56	94.73
10-14	24	6.70	25	6.94	96.00
15-19	19	5.28	16	4.44	118.75
20-24	16	4.44	14	3.89	114.29
25-29	9	2.50	15	4.17	60.00
30-34	12	3.33	8	2.20	150.00
35-39	3	.83	4	1.11	75.00
40-44	3	.83	4	1.11	75.00
45-49	4	1.11	5	1.14	80.00
50-54	3	.83	4	1.11	75.00
55-59	6	1.67	2	.56	300.00
60-64	2	.56	1	.28	200.00
64-69	3	.83	3	.83	100.00
70 and over	1	.28	2	.28	50.00
Total	178	49.94	182	50.06	97.80

Total Population Size = 360

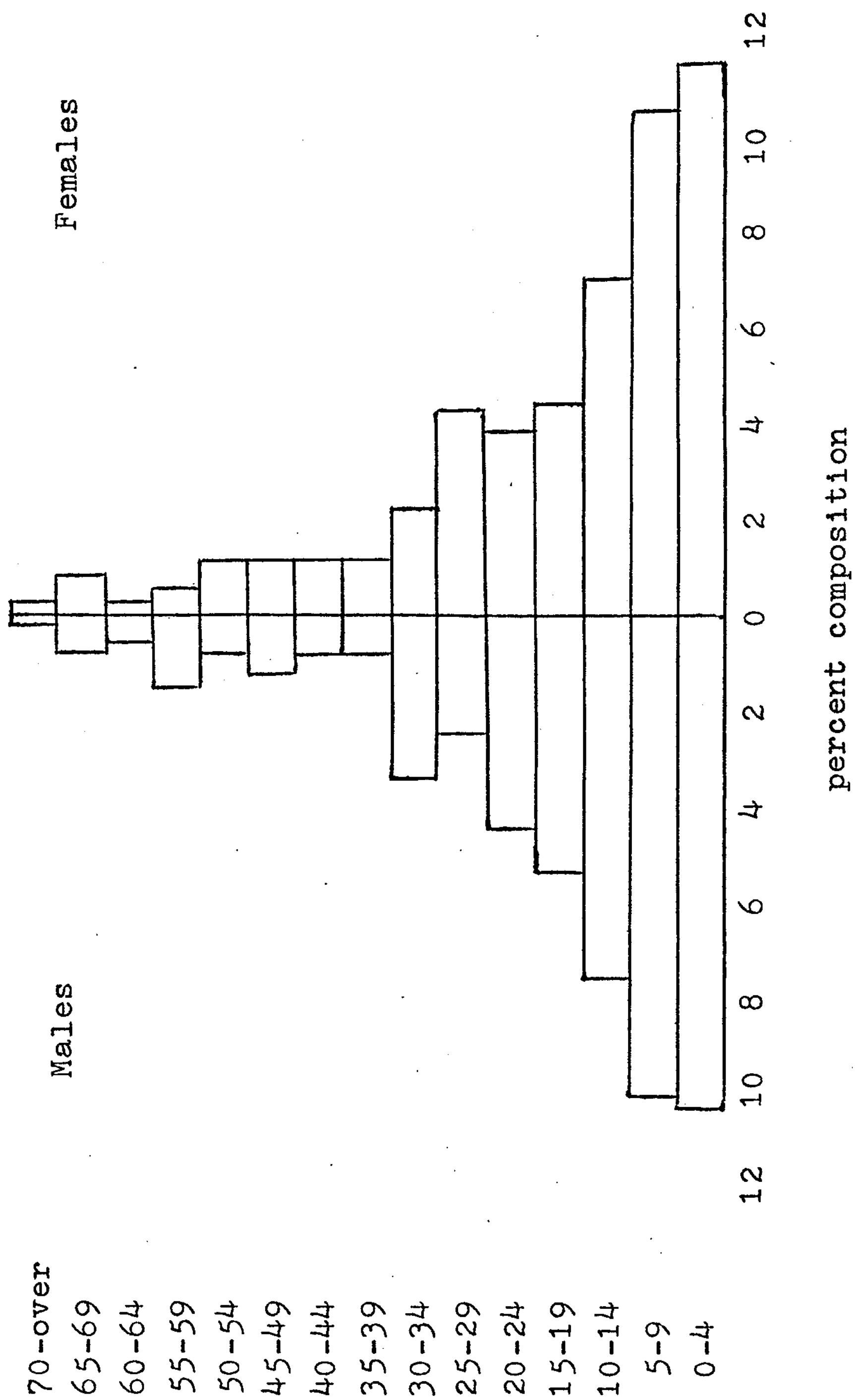

Figure 4

AGE AND SEX PYRAMID OF WASAGAMACK: 1969

Table 7

RED SUCKER LAKE BY AGE GROUP AND SEX: 1969

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	27	11.53	20	8.54	135.00
5-9	14	5.98	25	10.68	56.00
10-14	9	3.84	20	8.54	45.00
15-19	12	5.12	11	4.70	109.09
20-24	11	4.70	8	3.41	137.50
25-29	9	3.84	13	5.55	69.23
30-34	4	1.70	4	1.70	100.00
35-39	2	.85	4	1.70	50.00
40-44	5	2.13	5	2.13	100.00
45-49	3	1.28	4	1.70	75.00
50-54	6	2.56	3	1.28	200.00
55-59	4	1.70	2	.85	200.00
60-64	2	.85	0	.00	----
65-69	1	.43	0	.00	----
70 and over	3	1.28	3	1.28	100.00
Total	112	47.86	122	52.14	91.80

Total Population Size = 234

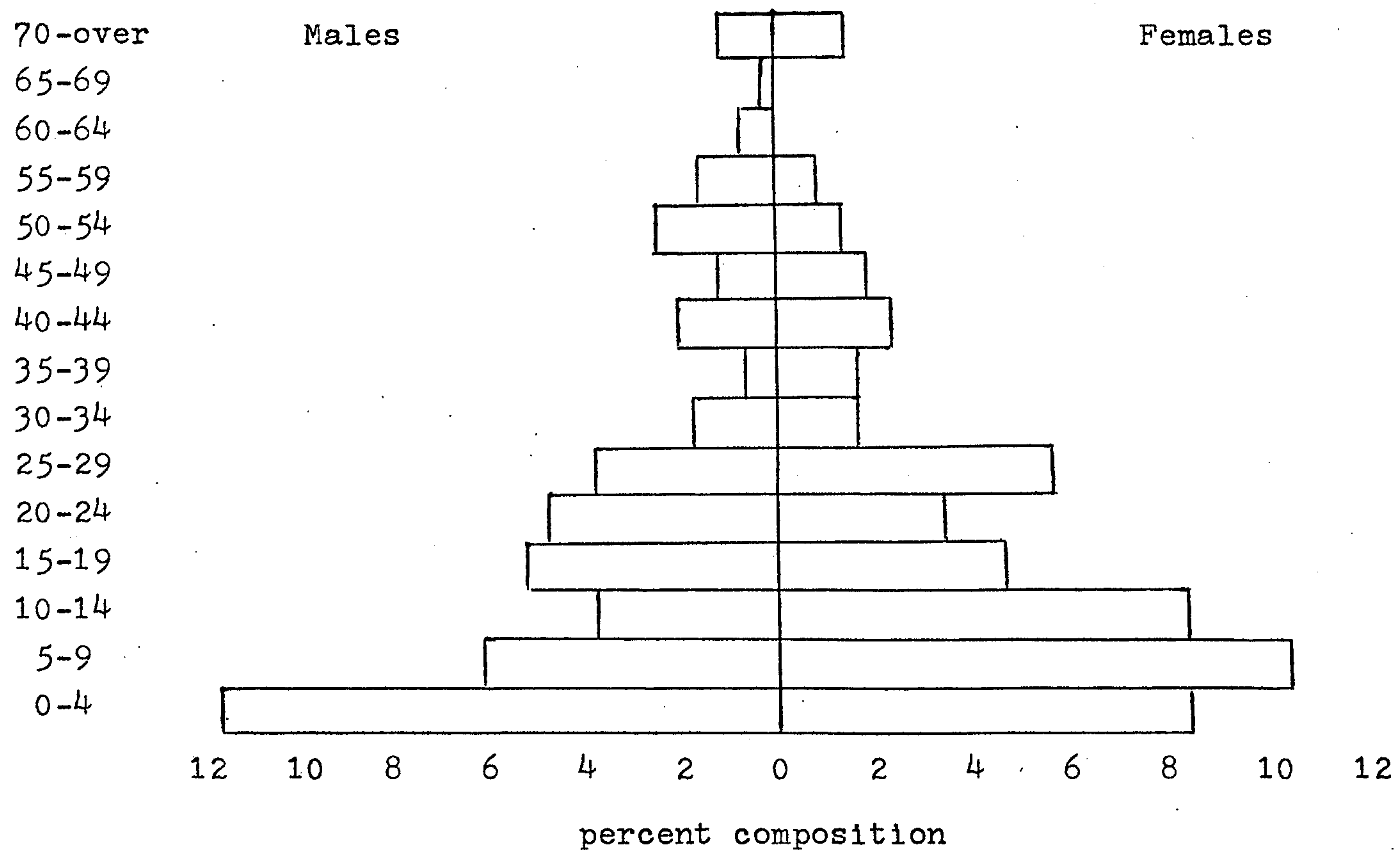

Figure 5

AGE AND SEX PYRAMID OF RED SUCKER LAKE: 1969 males per 100 females) start at a level slightly in excess of 100 at ages under 5 years, arrive at unity between ages 40 and 50, continue to decline at the higher age categories (Hawley, 1957: 363; Spiegelman, 1968: 61). The sex ratio for all ages of the Island Lake aggregate is 102.2. Similiar minor deviations from unity are observed in Garden Hill, 105.5; St. Theresa's Point, 101.8; Wasagamack, 97.8; and Red Sucker Lake, 91.8. The most apparent disparity in the sex ratio is the disportionate number of males to females in the age group under 15 years for the Red Sucker Band, 76.9. Little explanation can be offered for the occurrence of this phenomenon other than possible deviations associated with a relatively small sample of individuals, or the action of systematic agents of change operating upon this particular age category.

ISLAND LAKE - 1910-1924

Marital Patterns

Two parameters of investigation were employed in the elucidation of marital patterns among the Island Lake cohort series, the mean age deviation between marital pairs and the age at termination of the first live birth for the female and male components.

Of the 116 first marriages recorded for the Island Lake cohort series, the mean age deviation between marital pairs is 4.19 ± 3.87 (mean and standard deviation) years (husbands older). To allow for random error, the calculation of 95% confidence intervals for the mean age deviation indicates that the actual mean lies between 3.48 and 4.90 years. A 't' test conducted on the marital age deviation revealed a significant statistical difference at the 95% level of confidence = .05 is t t.025, 116=1.99, exceeded by t - 8.38, reject Ho at the 95% level). A calculated median age deviation of 3.52 suggests that the distribution about the mean is nearly symmetrical (Snedecor and Cochran, 1967: 123). A statistical summary of the data is presented in Table 8.

A sample of 112 marital unions, exclusively first, where birthdates were known revealed that the mean age of females at the termination of their first livebirth is 19.99 years, with 95% confidence intervals set at 19.31 and 20.67. The figure derived for the male component is 24.08 years, with the actual mean between 23.40 and 24.76. A 't' test between the respective ages at termination of the first livebirth revealed a significant statistical difference between the mean ages for the female and male series = .05 is t t.025, 112=1.99, exceeded by t = 6.01, reject Ho at the 95% level). The calculated median age values for the female (18.82) and the male (23.46) series reflect a slight negative deviation from their respective mean age figure. Table 9 presents a summary of data on the mean age of the female and male series at termination of their first livebirth.

Table 8

MEAN DEVIATION BETWEEN MARITAL

PAIRS FOR 1910-1924 COHORT SERIES

Age Deviation	Frequency
-15	0
-14	0
-13	0
-12	0
-11	1
-10	0
-9	0
-8	0
-7	2
-6	0
-5	0
-4	0
-3	1
-2	2
-1	3
0	4
+1	7
+2	12
+3	15
+4	21
+5	11
+6	11
+7	4
+8	8
+9	5
+10	4
+11	2
+12	0
+13	2
+14	0
+15	1

Mean +4.190 (where + = husbands older)
L_1 of Mean +3.48
L_2 of Mean +4.90

S.D. 3.865

Median 3.52

Total Sample Size = 116

Table 9

MEAN AGE AT FIRST LIVEBIRTH FOR 1910-1924 COHORT SERIES

Age	Male Frequency	Female Frequency
12	0	1
13	0	2
14	0	1
15	0	0
16	0	3
17	1	9
18	0	26
19	0	17
20	10	21
21	14	9
22	21	5
23	14	3
24	13	5
25	10	4
26	6	0
27	5	1
28	6	0
29	4	0
30	3	1
31	1	1
32	0	1
33	1	1
34	0	1
35	1	0
36	0	0
37	0	0
38	2	0
39	0	0
Mean	24.08	19.99
L_1 of Mean	23.40	19.31
L_2 of Mean	24.76	20.67
S.D.	3.625	3.630
Median	23.46	18.82

Total Sample Size = 112

It is of interest to note that after visiting the settlements of God's Lake, Oxford House and Island Lake, Grant (1929: 3) reported,

> The majority of the girls marry about the age of 18 years; almost everyone of them is married before reaching the age of 20 years. There are not more than three or four unmarried men over 21 years in the 3 localities.

Such observations impart additional information regarding the marital patterns of the Island Lake cohort series.

Size and Age-Sex Composition

Definition of the target population with respect to size and age-sex composition issued from an analysis of the tentative genealogical histories of the Island Lake residents and the application of information yielded from the analysis of marital patterns of the cohort series described earlier.

Reconstruction of the Island Lake population aggregate as of 1924 resulted in the enumeration of a total resident population of 635 individuals. This value represents an increase of less than 1 percent over that figure of 625 quoted by the Department of Indian Affairs, 1924. The age and sex composition by 5 year intervals of the Island Lake population in 1924 is presented in Table 10. Figure 6 is a graphic illustration of this structure.

The broad base of the pyramid and the large percentage of individuals (47.77%) in the age class 0-14 years suggests that the Island Lake population in 1924 was a population replacing itself. This conclusion is borne out by the data on fertility and survival of the Island Lake cohort series to follow.

The overall sex ratio for the 1924 Island Lake population aggregate is 108.88, reflecting a slight predominance of males. The most apparent deviation from unity is the excess of males to females in the age class under 5 years. Analysis of mortality among the cohort series, differentiated on the basis of sex, offered no explanation for the apparent discrepancy in the sex ratio at the 0-4 age interval. In the absence of information pertaining to the sex-ratio of Island Lake over an extended period of time, little explanation can be offered for the occurrence of this phenomenon other than possible deviations associated with a relatively small sample of individuals, or the action of differential fertility and/or differential emigration operating upon this particular age category.

Mortality

Mortality was differentiated according to sex and the attainment of the respective assumed and actual reproductive parameters. Estimates of mortality issued from a cohort of individuals born within the 1910-1924 period and resident within the Island Lake area. Definition of survival to reproduction was modified from the traditional approach by distinguishing the 'actual' age of reproductive onset for males and females as determined from the cohort (ie. 19.99 for females and 24.08 for males). Tables 11 and 12 present data on mortality estimates.

Table 10

THE ISLAND LAKE POPULATION BY 5-YEAR AGE INTERVALS AND SEX: 1924

Group	Male #	Male %	Female #	Female %	Ratio
Under 5	75	11.81	45	7.09	166.67
5-9	50	7.87	37	5.83	135.14
10-14	37	5.83	31	4.88	119.35
15-19	19	2.99	25	3.94	76.00
20-24	26	4.09	19	2.99	136.84
25-29	13	2.05	17	2.68	76.47
30-34	23	3.62	12	1.89	191.67
35-39	10	1.57	19	2.99	52.63
40-44	11	1.73	9	1.42	122.22
45-49	11	1.73	8	1.26	137.50
50-54	3	0.47	6	0.94	50.00
55-59	5	0.79	5	0.79	100.00
60-64	1	0.12	0	0.00	------
n_1	284	44.72	233	36.70	121.88
P_r	14	2.20	15	2.36	93.33
R	33	5.20	56	8.82	58.93
N	331	52.12	304	47.88	108.88

Where P_r represents prereproductive individuals whose age is unknown.
R represents reproductive individuals whose age is unknown.

Total Population Size = 635

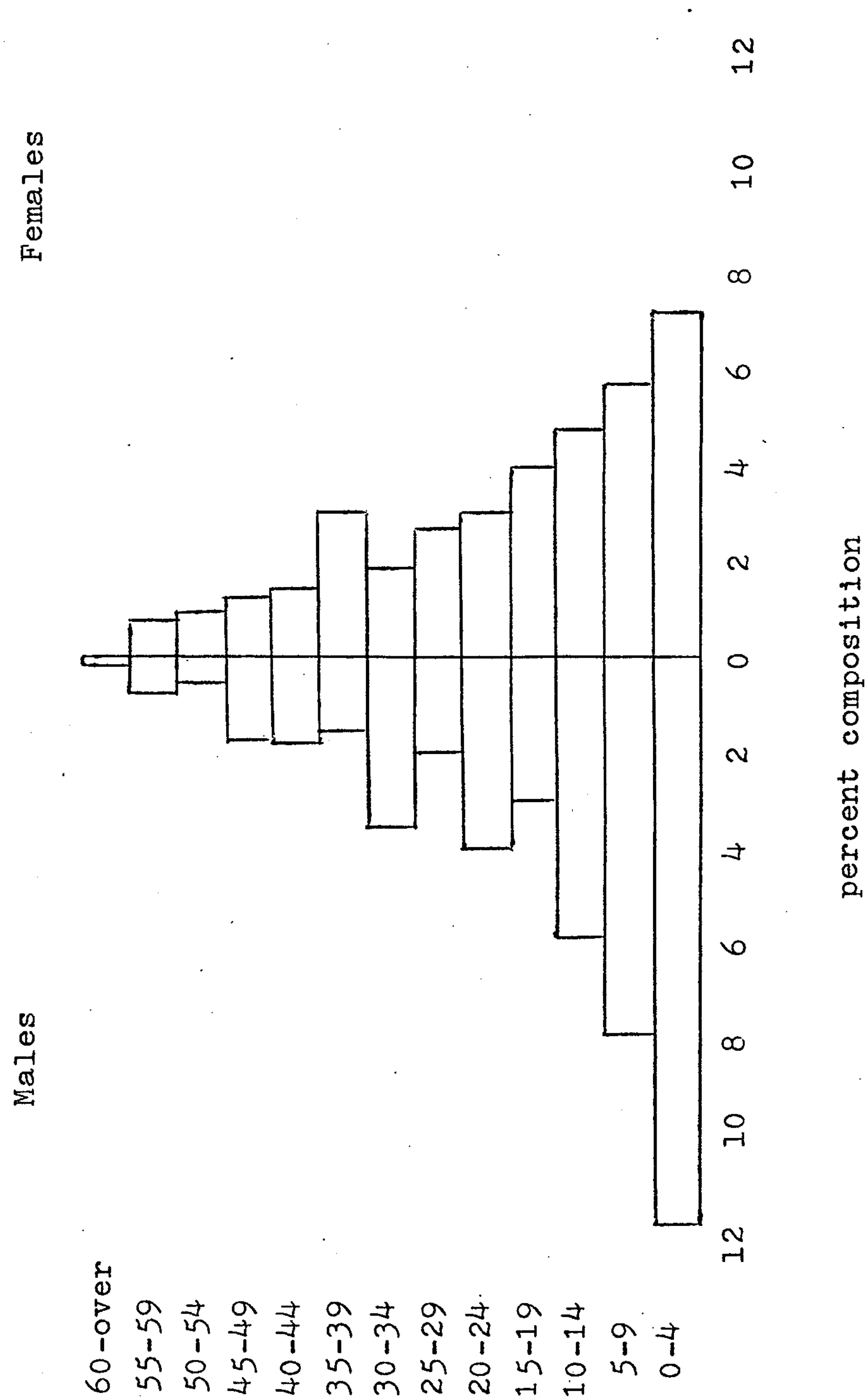

Figure 6

AGE AND SEX PYRAMID OF ISLAND LAKE AGGREGATE: 1924*

*Based on individuals whose age was known.

Table 11

DEATH PRIOR THE ASSUMED AND ACTUAL AGES OF REPRODUCTION*

	Females			Males			Total	
	#	%F	%T	#	%M	%T	#	%T
Death prior 15	32	22.22	9.58	48	25.26	14.37	80	23.95
Lost prior 15	1	0.70	0.30	2	1.06	0.63	3	0.93
Total	33	22.92	9.88	50	26.32	15.00	83	24.88
Death prior $\bar{x}$	35	24.31	10.48	56	30.00	16.78	91	27.26
Lost prior $\bar{x}$	22	15.34	6.59	22	11.05	6.57	44	13.16
Total	57	39.65	17.07	78	41.05	23.35	135	40.42

*Based on a total sample of 334 individuals (144 females and 190 males) born within the 1910-1924 period.

Table 12

DEATH SUBSEQUENT TO THE ATTAINMENT
OF THE ASSUMED AND ACTUAL AGES OF REPRODUCTIVE ONSET*

	Females		Males		Total	
	#	%	#	%	#	%
Death Without Marriage						
Survival to 15	5	1.50	9	2.69	14	4.19
Survival to $\bar{x}$	1	0.30	2	0.60	3	0.90
Survival through Reprod. Period	0	0.00	1	0.30	1	0.30
Death With Marriage						
Survival to 15	18	5.39	11	3.29	29	8.68
Survival to $\bar{x}$	17	5.09	7	2.09	24	7.18
Survival through Reprod. Period	1	0.30	3	0.90	4	1.20
Lost						
During the Reprod. Period	34	10.18	37	11.08	71	21.26
After completion of Reprod. Period	0	0.00	0	0.00	0	0.00

*Based on a total sample of 334 individuals born within the 1910-1924 period.

In the compilation of mortality, difficulties arose as a result of the incomplete status of the genealogical histories of the Island Lake cohort series. A 'lost' category was thus employed. Such a category consisted of individuals whose death or emigration could not be specifically distinguished, and a female component whose marriage was not ascertained and consequently placed in the lost category. The lost category represents then a potential source of error by attributing emigration and unascertained marriage to the mortality estimate. However subsequent research by Rokala reveals that the majority of those which have been indicated lost have died, and that a number of children who were born and died, not previously ascertained due to the incomplete status of the genealogical histories, are now under control (1971: pers. communication).

Of the 334 individuals (144 females and 190 males) born within the 1910-1924 period, a total of 80 individuals died prior to the age of 15. The mortality estimate is distributed proportionately between the two sexes (32 female and 48 male). The inclusion of the 'lost' category resulted in an additional increment of less than 1% to the total mortality estimate prior to the assumed age of reproduction. Estimation of mortality on the bases of determined age of reproduction resulted in the enumeration of 35 female and 56 male deaths, a total of 91. An additional increment of 44 deaths (22 female and 22 male) issued from the inclusion of the lost category for the estimation of mortality prior to the actual age of reproduction. An increase in the magnitude of 15.54% issued from the utilization of the more sensitive parameter for the estimate of mortality prior to the age of reproduction.

Table 12 (p. 49) presents data on mortality subsequent to the attainment of the assumed and actual age of reproductive onset for the Island Lake cohort series. A total of 15 individuals (5 female and 10 male) died without marriage. For those individuals with marriage, the figure is 33 (19 female and 14 male). By combining the respective categories, the mortality estimate presents an equal distribution between the two sexes (24 female and 24 male), with a total of 48. The inclusion of the lost category imparts a substantial increment to the mortality estimate with a total of 71 deaths (34 female and 37 male).

Fertility

Fertility was tabulated on the basis of number of children ever born and upon those surviving to the age of 15 or the date of enumeration December 31, 1969. The sample upon which the subsequent tabulations are based includes males and females within the cohort series, as well as marital pairs where at least one member was born within the 1910-1924 period, with and without regard to residence. The age of 15 was utilized as the assumed age of reproductive onset (eg. Eaton & Mayer, 1953), and the age of 45 marked completion of the reproductive period (eg. Cross & McKusick, 1970). Tables 13 and 14 present data on fertility and survival.

The mean number of children ever born to females whose reproductive performance is complete by virtue of age or death prior to 45 is 6.45 $\pm$ 4.26. The figure derived for the males series is 6.99 $\pm$ 3.86, and that for marital pairs was 5.74 $\pm$ 4.08. For those females who survived the reproductive period, the mean number of children ever born is 7.80 $\pm$ 3.96. The mean number of children ever born for those males of similiar status is 7.97 $\pm$ 3.58.

The average number of children surviving to the age of 15 or enumeration for females whose reproduction is complete by virtue of attaining an age of 45 or death is 5.47 $\pm$ 3.95. The average number of surviving children per male of comparable status is 6.15 $\pm$ 3.96. For those females and males over the age of 45, the mean number of surviving children is 6.51 $\pm$ 3.68 and 7.23 , $\pm$ 3.61 respectively.

The slight increase in the mean number of children per completed family may be attributed to the inclusion of individuals in the former category whose reproductive performance was cut short by death. Tests of significance conducted at the 95% level revealed no significant difference in the average number of children born to individuals over the age of 45 and those whose reproduction is complete by virtue of attaining an age of 45 or death. There also appears to be a slight increase in the mean number of children for the male cohort series, however, no statistical difference could be detected between the two sexes. Employ-

Table 13

SIBSHIP SIZE BY FEMALES, MALES, AND MARITAL PAIRS, WITHIN COHORT SERIES WITH MARRIED OR UNMARRIED STATUS, WITHOUT REGARD TO RESIDENCE*

	Number of children ever born																			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	N	$\bar{x}$	S.D.	Median
Females																				
All	10	14	11	1	6	8	7	10	16	3	9	10	9	5	1	2	122	6.45	4.26	6.40
Alive (-45)	4	5	6	1	2	4	3	10	13	3	9	10	9	4	1	2	86	7.80	3.96	7.62
Males																				
All	5	10	8	5	8	7	8	13	13	8	16	9	7	5	2	1	125	6.99	3.86	6.92
Alive (-45)	0	7	6	1	4	4	4	12	13	7	14	8	8	5	2	1	96	7.97	3.58	7.77
Sibship																				
All	16	29	12	10	10	14	12	17	16	8	13	12	11	4	1	2	187	5.74	4.08	5.25

*Differentiated on the basis of all parents or parental pairs within the reproductive period (15-45) and those surviving to the age of 45.

Table 14

SURVIVING SIBSHIP SIZE BY FEMALES AND MALES WITHIN COHORT SERIES, RESIDENCY WITHIN SAMPLING AREA*

	Number of children surviving to age 15, or enumeration Dec. 31, 1969.																			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	N	$\bar{x}$	S.D.	Median
Females																				
All	17	13	7	2	5	12	6	12	13	9	3	8	3	4	0	0	114	5.47	3.95	5.17
Alive (-45)	8	4	6	2	3	8	4	12	13	9	3	9	1	4	0	0	86	6.51	3.68	6.67
Males																				
All	14	11	7	4	5	10	6	16	11	10	13	7	2	6	1	0	123	6.15	3.96	6.25
Alive (-45)	5	5	5	2	3	8	5	14	11	9	12	8	2	6	1	0	96	7.23	3.61	7.09

*Differentiated on the basis of all parents or parental pairs within the reproductive period (15-45) and those surviving to the age of 45.

ing the test criterion $F = s_1^{2}/s_1^{2}$ for equality between variances (Snedecor and Cochran, 1967: 116-117), there appears to be no statistical differences in the variances of the respective fertility components at the 95% level of confidence. Calculation of the median for the respective fertility components reveals that the mean and median tend to coincide, suggesting that the distribution about the mean is symmetrical. Such an observation imparts support for the application of parametric statistical procedures for the analysis of the Island Lake cohort series.

Emigration

Table 15 presents data on emigration pertaining to the residents of Island Lake born within the 1910-1924 period. Analysis of the cohort series revealed a total emigrant aggregate of 20 individuals (10 female and 10 male). Such a figure represents a total socio-genetic loss in the order of approximately 6% as calculated from a total of 334 individuals born within the 1910-1924 period. A total of 12 individuals (6 female and 6 male) migrated out of Island Lake prior to the actual age of reproduction. As shown in Table 15, emigration within the reproductive period usually coincided with marriage.

ESTIMATES OF EVOLUTIONARY CHANGE

Following Crow (1958), the total amount of change occurring within a human population through the action of

Table 15

EMIGRATION PARAMETERS OF THE ISLAND

LAKE COHORT SERIES*

	Females		Males		Total	
	#	%	#	%	#	%
Prior to age of Reprod.						
assumed	3	0.90	6	1.80	9	2.69
actual	6	1.80	6	1.80	12	3.59
Within Reprod. (15-45)						
with marriage	6	1.80	4	1.20	10	3.00
without marriage	1	0.30	0	0.00	1	0.30
Completed Reprod. (-45)						
with marriage	1	0.30	0	0.00	1	0.30
without marriage	0	0.00	0	0.00	0	0.00

*Based on a total sample of 334 individuals born within the 1910-1924 period.

natural selection may be measured by the Index of Selection Intensity, that is, the ratio of the variance in progeny number to the square of the mean progeny number. The Index may be partitioned into its respective components due to differential mortality and differential fertility. The mortality component is,

$$Im = \frac{Pd}{Ps}$$

where Pd is the proportion of all births dying prior to the age of reproduction, and Ps that proportion surviving to reproduction. The fertility component is,

$$If = Vf/\bar{x}^2$$

where Vf is the variance in the number of births per individual reaching the age of reproduction, and $\bar{x}$ the mean number of children ever born to all individuals. The Index of Selection Intensity may be represented as

$$I = Im + \frac{1}{Ps} \; If$$

Assuming that the variance due to differential mortality and differential fertility is completely heritable, the Index sets an upper limit to the potential rate of change occurring via natural selection. Inasmuch as the difference in the demographic parameters of mortality and fertility may not be completely heritable, the term 'potential' is employed. The significance and application of such an Index for predicting the rate of change for a particular trait is contingent upon the genetic component of that particular phenomenon, and its correlation to fitness.

Fitness is defined as "the capacity to survive and leave descendents" (Livingstone and Spuhler, 1965: 119).

Recently, Johnston and Kensinger (1971) have introduced an additional parameter in the calculation of the potential of evolutionary change within a group, that of the selection due to embryonic mortality. The Index of Selection Intensity may now be considered of three components,

> The first component is due to prenatal mortality, Ime, the second to childhood mortality, Imc, and the third is If, the component due to differential fertility of the survivors, though considered now relative to the probability of surviving from the early embryonic stage (Johnston and Kensinger, 1971: 358).

The above modifications have not been incorporated into the present investigation.

Table 16 presents data on the coefficients of selection potential due to differential mortality and differential fertility, as well as the two components combined. The sample upon which the tabulations are based includes females, males, and marital pairs 'ever born' rather than 'living only' as the omission of those individuals dying within the reproductive period may introduce a considerable source of error by increasing the mean number of progeny per parent and correspondingly a decrease in the variance (Spuhler, 1962; Neel and Chagnon, 1968). The inclusion of the actual age of reproduction as determined from the sample imparts an additional parameter to elucidation of the potential for change operating through natural selection on the residents of Island Lake born within the 1910-1924 period.

Table 16

ESTIMATION OF THE POTENTIAL FOR EVOLUTIONARY CHANGE: TOTAL SELECTION INTENSITY (Crow, 1958) AND THE POTENTIAL FOR SYSTEMATIC CHANGE*

	Female	Male	Marital Pair
Mean progeny number = $\bar{x}$	6.45	7.97	5.74
Variance = Vf	18.12	12.85	16.69
Fertility Index = If	0.436	0.202	0.507
Proportion surviving = P_s			
assumed	------	0.75	------
actual	------	0.60	------
Mortality Index = Im			
assumed	------	0.333	------
actual	------	0.667	------
$If/P_s = If_s$			
assumed	0.581	0.269	0.676
actual	0.727	0.337	0.845
Total Index = I			
assumed	0.911	0.599	1.006
actual	1.397	1.007	1.515
Proportion remaining = P_{re}	-----	0.936	-----
Emigration Index = Ie	-----	0.069	-----
Total Index = I^s	1.558	1.142	1.686

*Based on the number of children ever born to a parent or parental pair within the cohort series 1910-1924, with married or unmarried status, without regard to residence. The age of 15 as the assumed age of reproduction, and the actual age of reproduction as determined from target population.

The mortality index (Im) based on the assumed age of reproduction for the Island Lake cohort series is 0.333. Using the actual age of reproduction for the calculation of Im, the mortality index is 0.667 an increase in the estimate of potential selection due to differential mortality in the magnitude of approximately 100 percent. The effects of the two mortality estimates upon the calculation of the respective estimates of evolutionary change possible are correspondingly dramatic. In the absence of a statistic to test whether or not the difference in the two estimates is significant, little more can be said except that the assumed age of reproduction may represent a considerable source of error by underestimating the mortality component and correspondingly the index of selection potential.

The values of potential selection due to differential fertility derived for the Island Lake cohort series range from a minimum of 0.202 for males to a maximum of 0.507 for marital pairs, Table 16 (p. 59). The fact that statistical tests conducted on the mean number of progeny and the corresponding variances for the female, male, and marital pair series did not reveal any significant differences, the range of variability thus exhibited must in turn be interpreted as lacking any significant difference. Such a consideration suggests that the application of fertility indexes for the detection of differentials in reproductive performance is a rather insensitive parameter of investigation.

As Table 16 (p. 59) indicates, the amount of selection possible among the Island Lake cohort series is relatively low, where 0 indicates no change (Livingstone and Spuhler, 1965: 119). The indexes of total selection intensity derived for females, males and marital pairs range from 0.599 to 1.006 calculated on the basis of assumed age of reproduction and from 1.077 to 1.515 for the actual age of reproduction. The values of Im and If suggest that both differential mortality and differential fertility contribute nearly equal components to the coefficient of selection potential for the Cree-Ojibwa of Island Lake. Inspection of the indexes of total selection intensity derived for the male series suggests that the individual male differences in fertility and mortality are relatively lower than those exhibited by females and marital pairs. The fact that such a difference is statistically significant, further issue may be made for the need of caution when interpretating the respective indexes of potential selection intensity.

Following a suggestion by Rokala (1970: pers. communication), the total amount of systematic change occurring within a human population may be estimated by the inclusion of an emigration component to Crow's index of total selection intensity (1958). Systematic change is defined as the change in gene frequency "in a manner predictable both in amount and in detection" occurring through the action of differential rates of mortality, fertility and emigration (Falconer, 1960: 23). The emigrant component is

$$Ie = \frac{Pem}{Pre}$$

where Pem is the proportion migrating out of the target population prior to the completion of the reproductive period, and Pre that proportion remaining within the population until termination of the reproductive period. The potential for systematic change may be represented by

$$Is = Im + \frac{1}{Pre\ Ps}\ If + \frac{1}{Ps}\ Ie$$

Using emigration data derived for the Island Lake cohort series, Table 15 (p. 56), a total emigrant aggregate of 20 individuals (10 females and 10 males) migrated out of the target population prior to completion of the reproductive period. These individuals gave rise to a Pem value of 0.064, a Pre value of 0.936, and correspondingly an emigration index of 0.069.

Estimates of the potential for systematic change are 1.558, 1.192, and 1.686 for females, males, and marital pairs respectively, Table 16 (p. 59). Of the total index of 1.558 for the female cohort series, the relative contribution of each component may be differentiated as follows: the proportion due to differential mortality, 42.8%, due to differential fertility, 49.8%, and that due to differential emigration is 7.4%. The relative contribution of differential mortality is 58.6% and 39.5%, differential fertility, 30.7% and 53.5%, and 10.7% and 7.0% for differential emigration among the male and marital pair cohort series respectively.

A modified version of Crow's Index of Selection Intensity indicated that the selection potential for the Cree-Ojibwa of Island Lake ranged from 1.007 to 1.515, the variation exhibited by the respective potential selection indices appear to be derivative of insignificant statistical differences. Calculations of the mortality component, prior to the assumed and actual age of reproduction revealed the former underestimated selection potential due to differential mortality; the mortality component was slightly larger than that due to differential fertility. By an extension of this approach, an index to measure the maximum amount of evolutionary change occurring through the systematic agents of differential mortality, differential fertility, and differential emigration was devised. The potential for systematic change among the residents of Island Lake ranged from 1.142 to 1.686; the component due to emigration consistently less than that of differential mortality or differential fertility.

Chapter 4

SUMMARY: DISCUSSION

This investigation represents an initial attempt to define some of the parameters of the Cree-Ojibwa residents at Island Lake, Manitoba. Estimates of the potential for evolutionary change due to the differential expression of mortality, fertility, and emigration among the residents of Island Lake born within the 1910-1924 period issued from an analysis of the socio-demographic parameters of the target population.

Rokala (1971) has proposed that the firm committment by the aboriginal population to the fur trade economy was to substantially modify the ethnic composition and distribution of Algonkian-speaking peoples resident within the Canadian Eastern Subarctic. As participation in the fur trade involved exploitation of the fur-bearing components of the regional biota, geographic mobility and probable gene flow was derived from the resultant disequalibrium between population density and environmental carrying capacity. Information yielded from ethnographic and historical sources attest to the widespread geographic mobility associated with participation in the Euro-Canadian fur trade economy by population aggregates in and adjacent to the Island Lake area. Further issue should be made of the fact that the resultant mobility was not in fact randomly composed, but represented the movement of kin orientated units (eg. the hunting-trapping group) comprising "a constellation of related genotypes and almost certain to contain poorly representative frequencies of alleles" (Johnston, 1970: 102). The sociogenetic implications of such mobility are further compounded with the fact that the direction of this geographic mobility was in fact also non-random.

Analysis of the structure and composition of the Island Lake population aggregate within its defined 1910-1924 temporal dimension revealed a number of significant demographic factors:

(1) a young expanding population was indicated by the age structure of the reconstructed 1924 pyramid, the mean number of surviving offspring per parent whose reproduction is complete, and the resultant population aggregate as of 1969; (2) a mean age differential of 4.19 ± 3.865 years (husbands older) at first marriage for Island Lake couples, and a mean age for primagravida females of 19.99 ± 3.630 and 24.08 ± 3.625 for the male complement; (3) a relatively high mean and variance for the number of ever born and surviving offspring per adult female and male, a characteristic of simple agriculturalists or pastoralists (Neel & Chagnon, 1968: 686; Salzano, et. al., 1964: 486); a statistically insignificant difference in the differentials in reproductive performance among the female, male and marital pair series, the male component exhibiting a slightly higher mean and lower variance; (5) a moderate (assumed = 33.3%)

to high level (actual = 66.7%) of mortality prior to the age of reproduction; (6) a relatively insignificant role assigned to the parameter of differential emigration as a potential source of socio-genetic loss. The extent to which these demographic features are characteristic to band populations resident within the Canadian Eastern Subarctic awaits future investigations.

The index of total selection intensity (Crow, 1958) has been granted widespread acceptance by the scientific community as a measure of the total amount of evolutionary change occurring through the action of natural selection. The index was applied and, subsequently, modified to estimate the amount of selection possible within the population resident at Island Lake, Manitoba. Specific modifications included: (1) calculation of the selection potential due to differential mortality on the actual age of reproduction as determined from the sample; and (2) calculation of the component due to differential fertility on the basis of all individuals within the reproductive period, rather than "living" only.

Calculations of mortality prior to (1) the assumed and (2) the actual age of reproduction, revealed that the former underestimated the selection potential due to differential mortality. Given these observations, one is led to question the appropriateness of the "assumed" parameter currently in use by the scientific community. The observed range of variability in the fertility indices, exhibited by female, male and marital pairs, was generated by insignificant statistical differences between the mean and variance for the number of children ever born per parent or parental pair. This suggests the need for caution when interpreting minute differences in the coefficient of selection potential due to differential fertility.

The indices of total selection intensity derived for the Island Lake cohort series 1910-1924 were 1.397, 1.007, and 1.515 for females, males and marital pairs respectively. As indicated by the respective coefficients, the amount of selection possible among the Cree-Ojibwa is relatively low. The derived indices of selection potential lie within the mid-range of the values (0.4 - 3.7) reported by Spuhler (1962) for 80 populations of various sizes and technological levels. Despite the relatively high mortality rate prior to the age of reproduction, the respective values suggest that the Cree-Ojibwa of Island Lake were not subjected to too stringent selective pressures.

The derivation and application of a measure of the potential for systematic change occurring within human populations issued from an extension of Crow's Index of Selection Intensity. Such an Index measures the relative efficiency of systematic change if all observed variances due to mortality, fertility, and emigration are the results of genetic factors. Indices of the potential for systematic change derived for the Island Lake cohort series are 1.558, 1.142 and 1.686 for females, males and marital pairs respectively. The relative contribution of the emigration component to the total index proved to be quite low, relative to the contributions of differential mortality and differential fertility. Emigrátion, therefore, represents a minimal source of potential evolutionary change for the Cree-Ojibwa residents of Island Lake, Manitoba.

As an interesting corollary, Rokala (1971: pers. communication) has suggested that similiar indices be directed towards the estimation of the potential for systematic change in socio-cultural and linguistic parameters of small-scale human populations. Expression of differential fertility, mortality and emigration may have a profound effect upon the cultural or linguistic configuration manifest, in respect to a single or multiple parameters, within a local population. Such an observation is, of course, dependent upon the extent of parent-child and sib-sib correlations, covariances, etc., relative to those found between random pairs for the variables investigated. Determination of the regression of covariation in linguistic variables, for example, upon a parameter such as the coefficient of kinship within small-scale populations might prove to be a further valuable indicator of cultural and linguistic relationships to demographic variables (Rokala, et. al., 1972: in preparation).

A number of investigators (eg. Ives, 1969: 27; Rokala, 1971: 336) have commented upon the frequent isolation of band populations on reservations closed to socio-genetic exchange, and the potential detrimental effects associated with resultant elevation in the frequency of consanguineous matings. Such a condition may in fact be further aggravated by the presence of partially isolated subpopulations within such reserve systems, defined on the basis of religious affiliation. Although adequate documentation is lacking for the Island Lake population, there is some evidence to suggest that adherence to a particular religion coincides with former socio-cultural boundaries that existed in the past. The maintenance of such boundaries may have ensued in part from religious affiliation defining the number of socially acceptable potential spouses.

In conclusion, the research presented represents an initial attempt at fixing the order of magnitude for some of the parameters of the population dynamics of the population resident at Island Lake, Manitoba. Future investigations on the target population will undoubtedly increase the precision of the preceding statements.

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