THE COREGONID AND PIKE FISHERY IN MANITOBA: FACTORS INFLUENCING ABUNDANCE OF TRIAENOPHORUS CRASSUS FOREL IN LAKE WHITEFISH (COREGONUS CLUPEAFORMIS MITCHILL) IN COMMERCIALLY FISHED LAKES.

by

MUSA SAMBA SOWE

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ABSTRACT

Temporal patterns in abundance of Triaenophorus crassus Forel in relation to patterns in abundance of species composition of pike (Esox lucius), lake whitefish (Coregonus clupeaformis Mitchill), and lake herring or cisco (Leucicthys tullibee Richardson) in 35 commercially fished Manitoba lakes were studied for the period 1973-1983. Patterns in fishing effort, annual production, differences in body size of lake whitefish, lake sizes and their geographical locations and differences in value between lake whitefish and walleye (Stizostedion vitreum vitreum) were also examined. It was concluded that changes in species composition, annual production levels, fishing effort, and differences in body size of lake whitefish affected abundance of T. crassus in lake whitefish. High flow rates from Churchill, Nelson, and Hayes watersheds were correlated with high annual catch levels. Overfishing or underfishing may have occurred in some of the lakes which may have affected recruitment and density and abundance of T. crassus due to an increase or decrease in smaller lake whitefish. Most of the lakes were located in the north and north-central regions of Manitoba. The southern lakes had lower abundances of T. crassus. Patterns in abundance of T. crassus could not be explained by lake size or location of lakes according to watershed. Although walleye was more valuable than lake whitefish, there was no evidence that they were fished preferentially, nor was there a direct correlation between harvest of lake whitefish and walleye and abundances of T. crassus. The general

trend was towards a change in lake classification to a lower category of lake whitefish i.e. higher abundances of T. crassus. However, inconsistent sampling of lakes for T. crassus, particularly lakes classified as high grade (i.e. with low abundances of T. crassus) such as Patridge Crop, Natawahunan, Guthrie, and Sabomin, contributed to the difficulty in predicting long term trends.

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I. INTRODUCTION

(a) Taxonomy

The genus Triaenophorus, Order Pseudophyllidea, contains at least three species common in Canadian lakes, namely Triaenophorus crassus Forel, Triaenophorus stizostediun Miller, and Triaenophorus nodulosus Pallas (Miller, 1945b and 1945c). The taxonomy of Triaenophorus crassus Forel is outlined in Appendix A.

(b) Life Cycle

Although there are three species of Triaenophorus common in Canadian fish, Triaenophorus crassus is the only one considered to be of economic importance (Ekbaum, 1936; Hjortland, 1927; Miller, 1943a, 1943b and 1943c).

Miller (1943a) showed that adults of the parasite occur in the intestine of pike (Esox lucius), the definitive host. Miller (1943a) further showed that the first larval stage, the procercoid, is found in the copepod (Cyclops bicuspidatus). The procercoid develops in a copepod and if then eaten by any one of the whitefish family, it develops into a plerocercoid (Miller, 1943a, 1943b, 1945b and 1952).

Miller (1943a, 1943b and 1945b) found that lake herring or cisco (Leucicthys tullibee Richardson) is the natural host for the plerocercoid which occurs as the familiar cyst stage in the flesh of coregonids. Appendix B shows the life cycle of T. crassus.

These cysts are pathogenically harmless to mammals but they are obnoxious and objectionable from a consumer's point of view (Bishop, 1968; Dechtair, 1972; Miller, 1952; Nicholson, 1932).

(c) Historical Background

T. crassus, was first described by Forel (1880) in Switzerland (Ekbaum, 1936). Cooper (1918) found cysts of the worm in the muscles of Leucicthys artedii LeSueur and adults in the intestine of pike from North America. The same species was reported later from Minnesota in cisco and pike (Hjortland, 1927). In a survey of Manitoba fishes, Newton (1932) reported cysts of T. crassus in cisco, Leucicthys zenthicus Jordan and Everman, Leucicthys nipigon Koelz, Leucicthys nigripinis Gill and lake whitefish (Coregonus clupeaformis Mitchill).

Wardle (1932) reported T. crassus and T. nodulosus but referred to them at the time as T. tricuspidatus, [Morpha megadentatus and Morpha microdentatus]. Nicholson (1932) investigated the pathogenicity of these worms from Lake Winnipeg and found them harmless to humans.

Ekbaum (1936 and 1937) studied Canadian material available up to that time and compared it with European descriptions. She concluded that the Canadian material was T. crassus and T. nodulosus. Miller (1945c) found Triaenophorus stizostedion Miller in fish from Lesser Slave Lake.

The economic importance of T. crassus led to the search for methods of control of the parasite. An experimental fishery was established at Heming Lake, Manitoba to determine if levels of T. crassus in coregonids could be controlled (Lawler, 1951a and c, 1952, 1953, 1954, 1960a, b, and c; Lawler and McBurney, 1952; Watson, 1963; Watson and Lawler 1965). Similar investigations were carried out at Lesser Slave Lake (Libin, 1953; Miller, 1952, 1953; Miller and Watkins, 1946) and at Square Lake (Miller and Johnson, 1952).

Rosen (1983) assessed factors affecting growth, differentiation and infectivity of procercoid by experimentally infecting Cyclops bicuspidatus thomasi and showed that the intensity of infection was a factor which influenced procercoid size, differentiation and infectivity to the second intermediate host.

The interrelationship of pike, coregonid fishes and Cyclops bicuspidatus is considered to be an important factor in determining the presence or absence of Triaenophorus infection in any particular lake (Miller, 1952). Miller and Johnson (1952) concluded that biological relationship between the three hosts are involved in the presence or absence of the parasites. Lawler (1951a) reported that lake whitefish infection with T. crassus was related to the abundance of pike.

(d) Objectives

The objectives of this study were:

1.) to describe spatial and temporal patterns in abundance and species composition of commercially exploited stocks of pike, lake whitefish and ciscoes in northern Manitoba lakes relative to different infection levels of T. crassus;

2.) to examine whether or not fishing effort by commercial fishermen affects infection trends;

3.) to examine whether or not differences in body size distributions of northern lake whitefish stocks are related to infection trends;

4.) to determine if the abundance of T. crassus in lake whitefish could be correlated with lake size, flow rates of rivers affecting the lakes and anthropogenic effects;

5.) to account for the economic importance of lake whitefish relative to yields of other economically important species, such as walleye.

The data were sufficient to enable me to study:

1.) various lakes in different watersheds for the same period of time;

2.) the Triaenophorus problem in a commercial setting.

This was made possible because the system of collection and compilation of data utilises uniform methods and is managed by a single agency for all of western Canada.

II. MATERIALS AND METHODS

(a) Location of Study Lakes

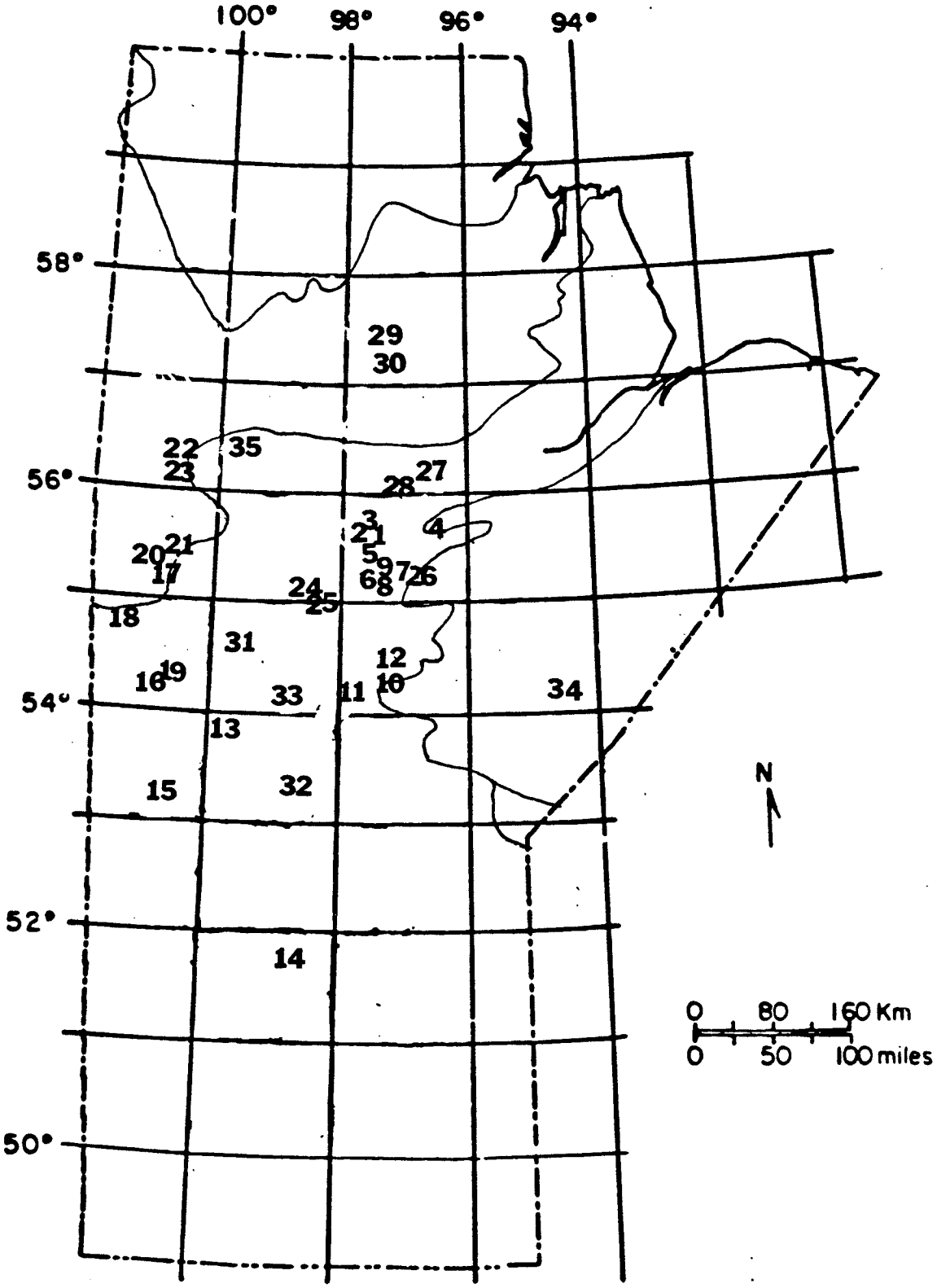
Thirty-five lakes were studied from three watersheds as follows:

Nelson River watershed:	Armstrong
	Bruneau
	Butterfly
	Cedar
	Cormorant
	Halfway
	Herblet
	Guthrie
	Kiski
	Landing
	Natawahunan
	Pakwa
	Patridge Crop
	Playgreen
	Setting
	Sipiwesk
	St. Martin
	Wekusko
	Walker
	William
	Wintering
	Witchai
	Wuskwatim
	Yawningstone
Churchill River watershed:	Barrington
	Granville
	Kipahigan
	Kisseynew
	Northern Indian
	Opachuanau
	Sisipuk
	Southern Indian
Hayes River watershed:	Dafoe
	Gods
	Sabomin

Lakes were chosen on the availability and consistency of pertinent data.

Figure 1. Distribution of lakes in study area.

Number in Figure 1	Lake Name	Location	
		Latitude (0")	Longitude (0")
1	Armstrong	96° 55'	55° 43'
2	Bruneau	97° 33'	55° 01'
3	Landing	97° 26'	55° 171'
4	Dafoe	96° 15'	55° 44'
5	Patridge Crop	97° 29'	55° 38'
6	Sabomin	97° 15'	55° 18'
7	Natawahunan	97° 09'	55° 42'
8	Sipiwesk	97° 35'	55° 05'
9	Wintering	97° 43'	55° 23'
10	Butterfly	97° 16'	54° 26'
11	Playgreen	97° 58'	54° 16'
12	Walker	96° 57'	54° 42'
13	William	99° 21'	53° 54'
14	St. Martin	98° 20'	51° 40'
15	Cedar	100° 10'	53° 30'
16	Cormorant	100° 49'	54° 14'
17	Guthrie	100° 38'	55° 17'
18	Kisseynew	101° 35'	54° 58'
19	Yawningstone	100° 51'	54° 21'
20	Kipahigan	101° 55'	55° 20'
21	Sisipuk	101° 50'	55° 45'
22	Barrington	100° 15'	56° 55'
23	Granville	100° 30'	56° 18'
24	Halfway	98° 24'	55° 03'
25	Setting	98° 38'	55° 00'
26	Wuskwatim	98° 32'	55° 32'
27	Wekusko	96° 20'	56° 30'
28	Witchai	96° 50'	56° 00'
29	South Indian	98° 30'	57° 10'
30	North Indian	97° 20'	57° 20'
31	Herblet	99° 54'	54° 56'
32	Pakwa	98° 53'	54° 51'
33	Kiski	98° 55'	54° 16'
34	Gods	94° 15'	54° 40'
35	Opachuanau	99° 37'	56° 44'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(b) Data Sources

Commercial catch records for the period 1973-1983 were obtained from the Economics Branch and lake class (a randomly chosen fish sample is filleted and sliced to expose cysts, the number of which determine lake class) data from the Inspection and Surveys Branch, both of the Department of Fisheries and Oceans (DFO) in Winnipeg. Lake class data was not available by season.

Commercial catch records and lake parameters for the same lakes for the period 1973-1982 were obtained from the Province of Manitoba, Department of Natural Resources (Peters and Wall, 1983), and for the period 1977-1982 (Thompson, personal communication).

Spring monthly mean flow rates of the three major rivers (Nelson, Churchill and Hayes) were obtained from records published by the Waters Resource Branch, Environment Canada.

Summer "initial" prices ($/lb.) records for 1973-1983 were obtained from the Freshwater Fish Marketing Corporation (FFMC) (Popko, Personal Communication).

(c) Inspection of Commercial Catches

Lake whitefish and cisco from Canadian lakes are inspected by DFO for cysts of *T. crassus* prior to exporting to the USA, Europe and interprovincial markets.

Various procedures have been devised for the purpose of inspection of catches since 1946. Kennedy (1946) discussed the method used at the time. According to this method sample sizes were fixed and depended only on the size of the lake. Such a sampling plan was later considered unsatisfactory (Kennedy, 1946; Oakland, 1950). Consequently the idea of

"sufficient" samples was proposed to eventually replace the fixed sample technique.

Kennedy (1946) defined a sufficient sample as one in which statistical analysis showed that there is not more than one chance in 100 that the rate of infection in the lake exceeds 50 cysts/100 pounds of fish. The maximum infection tolerance limit was set at 50 cysts/100 pounds for export lake whitefish. For this purpose, the average number of cysts/fish and the standard error were derived (Kennedy, 1946). The fiducial limits of the average for 99% were calculated for these data. These fiducial limits were multiplied by 100 and divided by the average weight of the fish in the sample to give an unbiased estimate of the fiducial limits of the average number of cysts/100 pounds of fish (Kennedy, 1946).

A "sufficient" sample, by definition, is one where the upper limit is less than 50 cysts/100 pounds of fish (Kennedy, 1946). With this method Kennedy (1946) noted that more than 50 cysts/100 pounds in the sample was "sufficient" to show that a lake was not suitable for providing fish for export. He also found that samples with 40 or more cysts/100 pounds of fish may not be sufficient unless it consisted of more than 200 fish. Kennedy (1946) noted that as the rate of infection approached 50 cysts/100 pounds of fish, the size of the required sample approached infinity.

Oakland (1949 and 1950) described the use of sequential sampling of fish to determine infection (Wald, 1945). This methodology was developed to determine infection levels in various sizes of lake whitefish and for lake whitefish that are marketed as fillets, dressed or round (total weight) fish (Oakland, 1949). The number of fish to be

sampled from a shipment was read directly from charts for a lake whose infection rate was known. The fish selected at random were examined for the presence of T. crassus. If the number of cysts/fish extended beyond the upper rejection line, which was calculated according to Wald (1945), the lot was rejected. If the number of cysts/fish was below the lower acceptance line, the lot was accepted for export (Oakland, 1950). Oakland (1950) noted that to apply this sampling procedure, it was necessary to quantitatively describe the distribution of the parasite in the sample. The number of cysts/fish from a given sample was found to be distributed in a negative binomial fashion.

The inspection procedure in operation at the present time was devised in 1973 by the Inspection and Surveys Branch of the Department of Fisheries and Oceans (McGregor, personal communication). It is based on the number of samples rejected relative to the risk of rejection of a shipment of known size. The procedure requires that shipments of lake whitefish from Canadian freshwater lakes are to be sampled in order to determine infection rates at least once a year.

The number of fish to be sampled from any shipment depends on the total size of shipment (Table 1).

The required number of individual fish is "randomly" chosen from a shipment and each fish is filleted and sliced to expose cysts. The rate of infection (RI) is calculated as follows:

$$[1]\quad RI\ (\text{number of cysts/100 lbs. of lake whitefish}) = \frac{\text{total number of cysts}}{\text{total weight of the sample (lbs.)}} \times 100$$

These infection estimates are used to classify lakes as shown in Table 2.

Table 1. Sampling schedule used by the Inspection and Surveys Branch of the Department of Fisheries and Oceans.

Total Number of Containers	Sample Size (number of fish)
1	may be waived
2	2
3 - 10	3
11 - 50	5
51 - 100	8
101 - 201	12
201 and over	16

Source: Surveys and Inspection Branch, Department of Fisheries and Oceans, Winnipeg.

Table 2. RI values of lake classification.

Classification	RI
A "export"	$\leq$ 40
B "continental"	40 - 80
C "cutter"	> 80

Source: Surveys and Inspection Branch, Department of Fisheries and Oceans, Winnipeg.

Fish produced from "export" lakes can be exported to the USA. Catches from these lakes are required to be sampled and inspected at least once a year. Fish produced from "continental" lakes can be shipped interprovincially or exported to Europe. For export of fish from continental to the lakes to the USA, each shipment from the lakes should be cut to ensure a cyst count of less than 40 cysts/100 lbs. of

fish. Fish from "cutter" lakes are processed into fish meal.

The classification programme is intended to minimize sampling. Newly exploited lakes are sampled as often as possible until sufficient data to classify them are accumulated.

(d) Standardization of Data

The annual catch records obtained from the Economics Branch of the DFO were separated by fish species, seasonal records, and size categories of jumbo, large, medium and small whitefish. Size categories of "cutter" quality catches of lake whitefish were not recorded.

Summer season catches of a particular year, winter season catches of the same year and winter season catches of the following year were treated as catches of one year. For example, catches of the year 1973 include catches of the summer 1973, winter 1973-74 (November and December 1973 and January to March 1974).

Due to minor discrepancies between lake class and commercial catch data from DFO and the Fisheries Branch, Province of Manitoba, Department of Natural Resources, lake classifications of DFO were used for the sake of consistency.

All catch records were converted to metric units. Except for the commercial catch records obtained from the Fisheries Branch, Department of Natural Resources, all other commercial catch records were converted to round weight. For this purpose, the marketed values were multiplied by conversion factors according to the Manitoba Fisheries Fact Book (Peters and Wall, 1983). The factors were derived from results from FFMC processing or provincial regulations. They are the same factors used by DFO.

Jumbo, large, medium and small size classes of lake whitefish were used as a measure of size distributions.

Abundance of T. crassus:

The term abundance is used here as the product of prevalence x mean intensity, according to Margolis et al., (1982).

(e) Calculations

Routine statistical analysis were performed according to Snedecor and Cochran (1967).

Ratios of lake whitefish size classes from individual lakes and means of large and medium size classes of lake whitefish for the three watersheds (Nelson, Churchill and Hayes) were determined.

Fishing effort, yield/unit of surface area and catch/effort (CUE) were calculated as follows:

i) Fishing Effort:

[2] Fishing effort $= \frac{\text{total number of deliveries}}{\text{total number of fishermen}}$

$$\frac{(\text{no. of deliveries})}{(\text{no. of fishermen})} \quad \frac{(\text{N.D.})}{\text{F}}$$

Example: Armstrong Lake, for the year 1973:

Number of deliveries = 23
Number of fishermen = 1

$$\text{Fishing effort} = \frac{23}{1} \quad \frac{\text{N.D.}}{\text{F}}$$

A delivery is a transaction completed by a fisherman in a particular period, usually one week. The number of deliveries is the only available index of fishing effort. The number of deliveries is divided by the number of fishermen in order to account for the number of operating fishermen. In northern

Manitoba lakes, this index approximates the effort of a fisherman who sets 1400 meters of 108 and/or 134 mm mesh gill nets each day for one week (Anon., 1981); 4¼ inch and 5¼ inch mesh nets are used by all fishermen.

ii) Yield per Unit of Surface Area of Lake (yield/surface area):

$$[3]\ \text{Yield/surface area} = \frac{\text{total catch}}{\text{surface area of lake}} \quad \frac{\text{kg}}{\text{ha}}$$

Example: Armstrong Lake, for the year 1973:

Total catch = 6,875 kg
Surface area of lake = 2,859 ha

$$\text{Yield/surface area} = \frac{6,875}{2,859} = 2.4 \ \frac{\text{kg}}{\text{ha}}$$

iii) Catch per Unit Effort (CUE):

$$[4]\ \text{CUE} = \frac{\text{total catch}}{\text{fishing effort}} \quad \frac{\text{kg}}{\text{no. of del./fisherman}} \quad \text{(kg/N.D/F)}$$

Example: Armstrong Lake, for the year 1973:

Total catch = 6,875 kg
Fishing effort = 23 N.D.

$$\text{CUE} = \frac{6,875}{23} = 298.9 \ \text{kg/ND/F}$$

(f) Temporal Changes in Relative Proportions of Lake Whitefish and Walleye in Commercial Catches and Landed Values

Initial prices for summer catches were used and were the prices first paid to the fishermen before the final sale of their fish by FFMC. Summer prices were more stable and the majority of catches were delivered to Freshwater Fish Marketing Corporation during this time.

III. RESULTS

(a) Species Composition of Cisco, Lake Whitefish and Pike in Commercial Catches of Lakes

Table 3 lists classifications of all lakes used in this analysis. Table 4 lists lakes according to geographical location (northern, north-central and southern regions). Appendix C gives annual production of cisco, lake whitefish and pike for the period 1973-1983. Appendices D, F, G, H indicate temporal changes of cisco, lake whitefish and pike over time. Appendix E lists lakes according to size categories of small (lakes with areas less than 10,000 ha), intermediate (lakes with areas between 10,000 and 30,000 ha) and large (lakes with areas above 30,000 ha) lakes.

Appendices C and D, and Table 3 showed that increase in levels of T. crassus, as indicated by a change of lake class from "B" class to "C" class, occurred with the presence of cisco in 37.1% (13 lakes) of the lakes (Armstrong, Bruneau, Cormorant, Kiski, Landing, Pakwa, Setting, Granville, Kipahigan, Opachuanau, Kisseynew, South Indian and Walker). Of these lakes nine (Armstrong, Bruneau, Cormorant, Kiski, Landing, Pakwa, Setting and Walker) were located in the north-central region of the Nelson River watershed, three lakes (Granville, Opachuanau and South Indian) were in the northern region and Kisseynew was in the southern region of the Churchill River watershed (Table 4). Six of the lakes (Armstrong, Bruneau, Granville, Kisseynew, Opachuanau and Pakwa) were small lakes. Five others (Kipahigan, Landing, Kiski, Setting and Walker) were intermediate lakes and two lakes (Cormorant and South Indian) were large lakes (Appendix E).

In 37.7% (13 lakes) of the lakes (Butterfly, Cedar, Guthrie, Halfway, Natawahunan, North Indian, Playgreen, Sabomin, Sipiwesk, Sisipuk, Wekusko, Wintering and Wuskwatim) abundance of T. crassus did not change with the presence of cisco in commercial catches (Appendix F; Table 3). Eight of these lakes (Butterfly, Halfway, Guthrie, Natawahunan, Playgreen, Sipiwesk, Wintering and Wuskwatim) were located in the north-central and one lake (Cedar Lake) in the southern region of the Nelson River watershed. North Indian Lake was located in the northern region of Churchill River watershed and Sabomin was in the north-central region of Hayes River watershed (Appendix E).

Change in abundance of T. crassus occurred with absence of cisco in commercial catch records in 11.43% (4 lakes) of the lakes (Barrington, Dafoe, Gods and Herblet) (Appendix G). Barrington was located in the northern region of Churchill, and Dafoe and Gods were in the north-central region of Hayes River watershed. Herblet was in the north-central region of Nelson River watershed (Table 4). Herblet and Dafoe were small lakes, Barrington an intermediate lake and Gods a large lake (Appendix E).

Abundance of T. crassus remained unchanged (lake classes remained "A") with absence of cisco in 14.29% (5 lakes) of the lakes (Patridge Crop, St. Martin, William, Witchai and Yawningstone) (Appendix H). William, St. Martin and Yawningstone were located in the southern region, Witchai in the northern region and Patridge Crop in the north-central region of the Nelson River watershed (Table 4). Three of the lakes (Patridge Crop, Yawningstone, and Witchai) were small lakes, one lake (William) was intermediate and the size of St. Martin Lake was not known (Appendix E).

Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg / effort (kg/ND/F)	Yield area (kg / hect)
Nelson	Armstrong	1973		6,875	23	289.90	2.0
		1974		17,808	25	712.32	6.0
		1975	B	4,574	8	571.75	2.0
		1976		7,048	8	881.00	3.0
		1977	B	-	-	-	-
		1978	B	1,168	5	232.00	0.4
		1979		11,131	23	483.00	4.0
		1980	B	10,824	27	400.00	4.0
		1981	B	8,756	17	515.00	3.0
		1982	C	6,999	16	437.30	2.0
		1983	C	2,774	16	483.89	1.8
		Mean		7,796	16	483.89	2.4
	Bruneau	1973		5,943	19	321	4.0
		1974	B	8,625	14	602	6.0
		1975	B	6,156	7	879	4.0
		1976		4,870	19	256	3.0
		1977	C	3,885	13	299	3.0
		1978	C	971	6	162	1.0
		1979		5,014	9	557	4.0
		1980	B	7,819	10	782	5.0
		1981	C	2,508	8	334	2.0
		1982	C	3,615	10	381	3.0
		1983	C	1,874	12	156	1.0
		Mean		4,661	11		3.0
	Butterfly	1973		-	-	-	-
		1974		3,524	10	352.4	2.0
		1975		5,080	8	635.0	3.0
		1976		10,393	14	742.4	6.0
		1977	A	5,404	16	337.8	3.0
		1978	A	952	4	238.0	0.5
		1979	A	13,797	28	492.8	7.0
		1980	A	4,702	16	293.8	3.0

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	Butterfly	1981	A	3,458	10	345.8	2.0
		1982	A	6,172	19	324.8	3.0
		1983		-	-	-	-
		Mean		5,942	14	418.0	3.3
	Cedar	1973		582,024	3.85	151,175	0.5
		1974		685,162	19.18	35,722	5.4
		1975	A	608,705	50.91	11,956	5.0
		1976	A	781,223	50.88	15,354	6.2
		1977	A	838,731	41.98	19,979	7.6
		1978	A	963,296	40.69	23,764	7.7
		1979		976,444	43.88	22,293	8.3
		1980	A	1,047,135	49.79	21,031	6.9
		1981	A	875,174		-	
		1982	A	592,026	25.00	23,681	4.5
		1983		536,336	29.16	18,392	4.2
		Mean		771,478	33	34,326	5.6
	Cormorant	1973		19,278	8.0	1,752	0.6
		1974		17,870	18.0	993	0.5
		1975	B	7,224	6.0	1,204	0.2
		1976		12,525	17.0	737	0.4
		1977	C	12,657	15.0	844	0.4
		1978	C	14,007	25.0	560	0.4
		1979		42,594	46.0	926	1.3
		1980	C	77,889	44.0	1,770	2.0
		1981	C	21,198	32.0	662	0.6
		1982	C	41,334	29.0	1,450	1.0
		1983	C	-	-	-	-
		Mean		26,657	24.0	1,089	0.74

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	Guthrie	1973		14,128	15	942	4
		1974		13,965	15	931	4
		1975	A	16,930	17	996	5
		1976		15,838	11	1,439	5
		1977	A	20,155	4	4,742	6
		1978	A	18,985	5	3,797	5
		1979		17,161	15	1,144	5
		1980	A	15,243	12	1,270	4
		1981	A	11,513	18	639	3
		1982	A	6,407	18	356	2
		1983	A	6,629	9	737	2
		Mean		14,629	13	1,545	4
	Halfway	1973		39,819	16	2,568	14
		1974		33,348	60	556	11
		1975	A	19,649	34	578	7
		1976	A	32,396	31	1,045	11
		1977	A	20,561	10	2,056	7
		1978	A	4,302	9	478	2
		1979		19,323	45	429	7
		1980	A	19,749	18	1,097	7
		1981	A	14,607	25	584	5
		1982	A	17,502	13	908	6
		1983	A	16,507	7	229	6
		Mean		21,615	24	957	8
	Herblet	1973		5,090	6	848	2
		1974		6,259	8	782	2
		1975	B	9,947	11	904	3
		1976		11,408	12	950	4
		1977	B	12,526	8	1,002	4
		1978	B	13,493	15	899	5
		1979		11,196	11	1,007	4
		1980	A	11,980	11	1,089	4

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	Herblet	1981	A	16,925	15	1,128	6
		1982	B	231	1	231	5
		1983	C	15,450	8	2,017	5
		Mean		10,409	10	1,806	4
	Kiski	1973		7,039	9	782	0.3
		1974	B	9,662	15	644	0.4
		1975	B	6,818	12	593	0.3
		1976	B	4,119	10	412	0.2
		1977	B	6,058	8	757	0.3
		1978	B	4,609	7	709	0.8
		1979		8,986	4	2,075	0.4
		1980	B	-	-	-	-
		1981	C	4,007	6	667	0.1
		1982		-	-	-	-
		1983		6,480	8	2,492	0.1
		Mean		6,420	9	1,015	0.32
	Landing	1973		29,371	14	2,077	3.0
		1974		26,477	13	2,106	2.0
		1975		25,776	12	2,216	2.0
		1976		1,217	2	608	0.1
		1977	B	24,607	11	2,237	2.0
		1978	C	10,279	4	2,705	0.1
		1979		25,263	8	3,008	2.1
		1980	C	9,937	7	1,526	0.8
		1981	C	19,126	7	2,694	1.6
		1982	C	41,192	6	7,245	3.4
		1983	C	19,585	8	2,382	1.6
		Mean		21,166	8	2,619	1.7

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	Natawahunan	1973		333	1	333	0.07
		1974	A	12,831	23	558	3
		1975		7,393	16	462	2
		1976	A	5,767	15	384	1
		1977	A	8,297	17	488	2
		1978		-	-	-	-
		1979		16,633	9	1,900	4
		1980	A	18,532	18	1,011	4
		1981	A	13,362	11	1,252	3
		1982	B	15,992	13	1,199	4
		1983		14,939	7	2,038	3
		Mean		11,408	13	963	3
	Pakwa	1973		17,132	21	836	4
		1974		19,915	21	948	5
		1975	B	21,515	18	1212	5
		1976		19,790	26	769	5
		1977	C	17,788	18	975	3
		1978	C	13,563	18	831	2
		1979		9,447	12	787	4
		1980	C	16,442	18	913	4
		1981	C	16,550	30	552	4
		1982	C	18,479	27	692	5
		1983	C	-	-	-	-
		Mean		17,062	21	852	4
	Patridge Crop	1973		10,198	24	66	1.0
		1974		15,557	41	379	2.0
		1975	A	13,624	32	426	2.0
		1976	A	10,723	28	383	2.0
		1977		11,168	11	508	2.0
		1978	A	3,210	8	401	0.4
		1979		3,754	6	626	0.5
		1980	A	4,386	7	626	0.6

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg / hect)
Nelson	Patridge Crop	1981	A	2,489	6	415	0.3
		1982	A	4,417	9	490	0.6
		1983	A	4,155	5	831	0.6
		Mean		4,607	17	514	1.0
	Setting	1973		28,397	41	693	2
		1974		33,327	54	623	3
		1975	B	38,480	23	1,337	3
		1976	C	39,198	42	940	3
		1977	C	39,941	31	1,278	3
		1978	C	37,850	17	2,226	3
		1979		50,840	26	2,226	4
		1980	C	16,008	14	1,945	1
		1981	C	12,294	17	1,143	0.9
		1982	C	8,461	7	710	0.6
		1983	C	12,703	12	1,104	0.9
		Mean		28,863	27	1,196	2.2
	Sipiwesk	1973		22,629	25	917	0.6
		1974		72,078	27	2,645	0.6
		1975	A	68,662	19	3,552	2.0
		1976	A	20,163	19	1,050	0.5
		1977	A	8,787	19	475	0.2
		1978	A	58,704	16	3,531	2.0
		1979		65,651	32	2,061	2.0
		1980	A	88,501	32	2,673	2.0
		1981	A	114,046	48	2,376	3.0
		1982	A	60,929	41	1,498	3.0
		1983	A	56,629	33	1,695	1.0
		Mean		57,889	28	2,044	1.4

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg / hect)
Nelson	Wekusko	1973		176	1	176	.008
		1974	B	43,352	14	3,053	2.000
		1975	A	72,339	22	3,288	3.300
		1976	A	72,389	15	4,771	3.300
		1977	A	73,902	16	4,506	3.300
		1978	A	68,559	20	3,485	3.300
		1979	A	102,626	17	6,037	3.100
		1980	A	69,736	26	2,717	4.600
		1981	A	74,536	19	3,923	3.100
		1982	A	73,810	19	3,818	3.300
		1983	A	-	-	-	-
		Mean		65,143	17	3,577	3
	William	1973		52,954	7	7,708	5
		1974		59,641	5	11,928	5
		1975	A	27,106	8	3,200	2
		1976	A	34,406	7	5,074	3
		1977	A	57,512	8	6,954	5
		1978	A	55,355	6	8,744	5
		1979		63,786	5	13,288	5
		1980	A	81,295	4	2,309	7
		1981	A	46,595	13	3,727	4
		1982	A	58,412	13	4,672	5
		1983	A	58,585	16	3,661	5
		Mean		54,150	8	6,879	5
	St. Martin	1973		113,444	10	11,768	?
		1974		184,504	15	12,628	?
		1975	A	207,023	8	26,172	?
		1976	A	266,535	12	21,740	?
		1977	A	263,014	15	17,652	?
		1978	A	391,049	15	25,938	?
		1979		575,032	22	26,486	?

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	St. Martin	1980	A	475,900	13	36,383	?
		1981	A	483,301	12	39,102	?
		1982	A	150,415	5	30,951	?
		1983	A	-	-	-	?
		Mean		310,995	13	24,882	
	Walker	1973		34,721	10	3,339	2.5
		1974		29,752	23	1,294	2.2
		1975	C	4,127	4	1,159	0.3
		1976		16,166	9	1,848	1.2
		1977	B	31,063	12	2,823	2.3
		1978	C	-	-	-	-
		1979		30,959	19	1,644	4.6
		1980	C	63,762	20	3,130	4.6
		1981	C	63,191	34	1,864	4.6
		1982	C	26,574	4	6,779	1.9
		1983	C	7,114	5	1,355	0.5
		Mean		27,948	14	2,524	2
	Wintering	1973		29,127	17	1,713	3.0
		1974		29,259	22	1,320	3.0
		1975	A	24,338	16	1,509	2.0
		1976	A	21,043	11	1,978	2.0
		1977	A	19,670	9	2,235	2.0
		1978	A	7,531	4	1,719	0.7
		1979		3,105	4	717	1.0
		1980	A	14,077	7	2,110	1.0
		1981	A	48,737	11	4,390	5.0
		1982	A	44,715	15	2,915	4.0
		1983	A	37,005	7	5,286	4.0
		Mean		25,328	11	2,353	2.5

Continued on page 25

Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg / hect)
Nelson	Witchai	1973		-	-	-	-
		1974		5,571	7	796	2
		1975	A	11,000	10	110	3
		1976	A	13,653	21	650	4
		1977	A	11,631	22	540	3
		1978	A	10,309	13	793	3
		1979		6,442	13	496	2
		1980	A	13,256	16	829	4
		1981	A	10,242	17	602	3
		1982	A	12,329	28	440	3
		1983	A	510	27	19	.14
		Mean		9,494	17	528	3
	Wuskwatim	1973		14,274	9	1,573	2
		1974	B	41,287	4	1,009	6
		1975	B	-	-	-	-
		1976		19,493	18	1,076	3
		1977	A	14,632	18	1,076	3
		1978	A	-	-	-	-
		1979		-	-	-	-
		1980	A	18,375	26	716	3
		1981	A	21,890	30	742	3
		1982	A	-	-	-	-
		1983	A	26,710	12	2,308	4
		Mean		22,380	15	1,288	3
	Yawning-stone	1973		2,306	6	407	2.0
		1974		820	7	117	0.7
		1975	A	946	3	315	0.8
		1976		5,220	10	522	0.4
		1977	A	-	-	-	-
		1978	A	229	2	115	0.2
		1979		3,357	9	373	3.0

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Nelson	Yawning-stone	1980	A	678	6	113	0.6
		1981	A	-	-	-	-
		1982		-	-	-	-
		1983		-	-	-	-
		Mean		1,937	6	280	2
Churchill	Barrington	1973		19,874	29	685	1
		1974		6,950	12	579	0.4
		1975	C	18,713	6	1,100	1
		1976	B	29,927	35	855	2
		1977	B	21,105	30	704	1.3
		1978	B	32,200	41	785	2
		1979		25,702	57	451	1
		1980	C	21,162	27	784	0.6
		1981	C	9,231	18	512	2
		1982	C	25,710	4	7,005	2
		1983	C	36,431	67	543	2
		Mean		22,455	30	1,273	1.4
	Granville	1973		30,790	8	3,801	7
		1974		13,832	5	2,766	3
		1975	B	27,527	21	1,332	6
		1976	B	79,278	209	379	17
		1977	B	95,685	24	4,045	21
		1978	B	51,228	6	3,659	11
		1979	C	84,934	30	2,831	19
		1980	B	62,497	15	4,310	14
		1981	C	63,154	14	4,429	14
		1982	C	90,096	14	6,491	20
		1983	C	11,273	4	3,100	2
		Mean		55,481	32	3,377	12

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Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Churchill	Kipahigan	1973		57,557	15	3,837	6.0
		1974	B	60,779	18	3,315	6.0
		1975		46,713	9	5,190	5.0
		1976	C	41,642	13	3,203	4.0
		1977	C	35,899	20	4,487	4.0
		1978	C	29,760	17	1,750	3.0
		1979		18,657	13	1,435	2.0
		1980	C	20,578	20	1,028	2.0
		1981	C	17,521	18	973	2.0
		1982	C	-	-	-	-
		1983		15,011	3	2,492	0.56
		Mean		34,412	15	2,771	3.5
	Kisseynew	1973		26,073	26	1,003	3
		1974		42,551	25	1,702	6
		1975	B	33,392	19	1,757	4
		1976	C	24,031	16	1,502	3
		1977	C	23,029	17	1,354	3
		1978	C	45,206	8	5,650	6
		1979		40,029	14	2,859	5
		1980	C	31,280	12	2,720	4
		1981	C	19,044	32	595	3
		1982	C	41,836	39	1,072	5
		1983	C	30,392	29	1,066	4
		Mean		32,441	21	1,935	4
	N. Indian	1973		50,547	29	1,763	3.0
		1974		65,820	13	506	0.3
		1975		65,431	7	9,183	3.0
		1976	A	59,967	23	2,476	3.0
		1977		-	-	-	-
		1978		51,962	18	2,922	3.0
		1979		5,324	10	532	3.0

Continued on page 28

Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Churchill	N. Indian	1980	A	45,443	80	568	2.0
		1981	A	27,022	13	2,119	1.0
		1982	A	38,226	7	5,791	2.0
		1983		17,336	26	6,556	0.9
		Mean		36,484	23	3,242	2
	Opachuanau	1973		16,081	15	1,084	2
		1974		-	-	-	-
		1975	B	16,636	3	5,315	2
		1976	B	28,158	20	1,351	4
		1977	B	23,371	10	2,460	3
		1978	B	32,075	9	3,695	4
		1979		11,461	12	944	1
		1980	B	22,620	10	2,249	3
		1981	C	22,869	13	1,781	3
		1982	C	45,936	19	2,376	6
		1983	C	12,965	10	1,297	2
		Mean		23,217	12	2,385	3
	Sisipuk	1973		620	1	620	.04
		1974	A	6,690	7	955	.40
		1975		2,966	14	1,816	2.0
		1976	A	-	-	-	-
		1977	A	2,671	4	668	.20
		1978	A	20,691	8	2,364	1.30
		1979		16,011	11	1,515	1.00
		1980	A	42,947	8	5,577	2.70
		1981	A	40,510	8	5,114	2.50
		1982	A	23,510	14	6,717	1.50
		1983	A	25,947	8	3,382	1.60
		Mean		18,256	8	2,873	1.3

Continued on page 29

Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg / hect)
Churchill	S. Indian	1973		354,181	28	12,599	2
		1974		-	-	-	-
		1975		359,632	28	12,964	2
		1976	A	537,343	36	14,677	3
		1977	A	526,713	30	17,734	3
		1978	A	471,619	35	13,467	2
		1979		542,239	33	16,362	3
		1980	B	484,118	33	14,841	2
		1981	B	388,335	34	11,375	2
		1982	C	179,559	17	10,771	0.9
		1983	C	191,652	17	11,240	0.9
		Mean		403,539	29	13,603	2
Hayes	Dafoe	1973		2,603	8	325	1
		1974		-	-	-	-
		1975	B	-	-	-	-
		1976	B	7,353	16	460	3
		1977	B	6,835	10	707	3
		1978	C	11,991	24	500	4
		1979		9,810	20	491	4
		1980	B	8,096	18	450	3
		1981		-	-	-	-
		1982		-	-	-	-
		1983		-	-	-	-
		Mean		7,781	16	489	3
	Gods	1973		-	-	-	-
		1974		166,926	20	8,560	2.0
		1975	B	109,965	21	5,343	1.0
		1976	B	53,595	16	3,372	0.5
		1977	C	90,176	25	3,578	0.9
		1978	B	69,502	27	2,568	0.7
		1979		51,665	20	2,429	0.5

Continued on page 30

Table 3. Annual production of all species (kg round weight), fishing effort (ND/F),[1] CUE,[2] (kg/ND/F),[3] yield unit surface (kg/ha) for the period 1973-1983.

Watershed	Lake	Year	Lake Class	Total Catch (kgs)	Fishing Effort (ND/F)	CUE kg effort (kg/ND/F)	Yield area (kg) (hect)
Hayes	Gods	1980	C	98,066	29	3,340	0.9
		1981	C	-	-	-	-
		1982	C	59,206	24	2,449	0.6
		1983	C	-	-	-	-
		Mean		87,387	23	3,954	1
	Sabomin	1973		3,007	5	668	2
		1974		4,010	30	134	3
		1975	A	1,435	8	179	1
		1976	A	1,854	9	206	1
		1977	A	1,661	4	415	1
		1978	A	4,050	4	1,012	3
		1979		6,021	7	860	4
		1980	A	4,288	5	858	3
		1981	A	9,653	6	1,608	7
		1982	A	4,362	6	727	3
		1983	A	6,710	13	516	5
		Mean		4,277	9	653	3

[1] ND/F Number of deliveries per fisherman

[2] CUE Catch per unit effort

[3] Kg/ND/F Kilograms per number of deliveries per fisherman

Lake Class: A Export

B Continental

C Cutter

Table 4. Distribution of lakes according to geographical region (ie., northern, north-central and southern)

Northern Lakes (lakes above Lat. 56°)	North-central Lakes (lakes between Lat. 54° and 56°)	Southern Lakes (Lakes below Lat. 54°)
Barrington	Bruneau	Kisseynew
Granville	Armstrong	Cedar
Opachuanau	Halfway	St. Martin
Wekusko	Kipahigan	William
North Indian	Setting	Yawningstone
Witchai	Landing	
	Cormorant	
	Pakwa	
	Kiski	
	Butterfly	
	Playgreen	
	Patridge Crop	
	Sabomin	
	Walker	
	Dafoe	
	Sisipuk	
	Natawahunan	
	Sipiwesk	
	Wintering	
	Wuskwatim	
	Gods	
	Herblet	
	Guthrie	

According to Green and Derksen (1984).

(b) Changes in Size Proportions of Lake Whitefish as a Function of CUE

Appendix I lists lake whitefish size proportions of jumbo, large, medium and small, for lakes used in this analysis. Table 3 lists total CUE for individual lakes. Appendices D, F, G and H show temporal changes of cisco, pike and lake whitefish over time, 1973-1983. Appendix E lists lakes according to size categories of small, intermediate and large. Table 4 lists lakes according to geographical location (northern, north-central and southern regions).

Linear regression analysis of relative proportion of large and medium lake whitefish as a function of total CUE (Appendices K, L) revealed three general trends as shown in Figures 3, 4 and 5.

Figure 2 shows examples of lakes where in relation to CUE, proportions of large and medium whitefish diverged (mediums increased as the large decreased). 22.9% of the lakes (Cormorant, Guthrie, Kisseynew, Patridge Crop, Landing, Opachuanau, Wintering, Witchai and Wuskwatim) showed this trend (Figure 2; Appendix K). Cormorant, Guthrie, Landing, Wintering, Wuskwatim and Patridge Crop were in the north-central region and Witchai in the northern region of the Nelson River watershed. Opachuanau is in the northern region and Kisseynew in the southern region of Churchill River watershed (Appendix E). Yields of large lake whitefish for all the above lakes had negative slopes. The slopes for medium lake whitefish were negative for Guthrie and Patridge Crop and were positive for the remaining lakes (Cormorant, Kisseynew, Landing, Opachuanau, Wintering, Witchai and Wuskwatim lakes) (Appendix L). In four of the lakes (Cormorant, Kisseynew, Landing and Opachuanau) the abundance of T. crassus increased with an increase in

cisco in commercial catches (Appendix D; Table 3). In three lakes (Guthrie, Wintering and Wuskwatim lakes), no change in abundance of T. crassus occurred with the presence of cisco (Appendix F; Table 3). In two lakes (Patridge Crop and Witchai) no change in abundance of T. crassus occurred with absence of cisco (Appendix H; Table 3).

Four of the lakes (Cormorant, Kisseynew, Landing, Opachuanau) had high abundances of T. crassus and five lakes (Guthrie, Wintering, Patridge Crop, Wuskwatim and Witchai) had low abundances of T. crassus (Table 3). In Cormorant, Landing and Patridge Crop lakes, proportions of large size lake whitefish were high in early 1970's and decreased with increasing CUE over time. Medium size lake whitefish were low during the same period and increased with increasing CUE and a decreasing large class of whitefish (Appendix K). Guthrie, Kisseynew, Opachuanau, Wintering and Landing were intermediate lakes and Cormorant was a large lake.

Figure 4 gives examples of lakes, where, in relation to CUE, large and medium whitefish classes converged (as mediums decreased the large size class increased). 40% (14 lakes) of the lakes (Armstrong, Barrington, Cedar, Granville, Halfway, Herblet, Natawahunan, Playgreen, Sabomin, Setting, Sisipuk, Sipiwesk, Walker and Wekusko) showed this trend (Appendix K; Figure 3). Natawahunan, Halfway, Herblet, Playgreen, Setting, Sipiwesk and Walker were in the north-central region, Wekusko was in the northern region and Cedar was in the southern region of Nelson River watershed. Barrington, Sisipuk and Granville were located in the north-central region of Churchill River watershed (Table 4). Sabomin is in the north-central region of Hayes River watershed (Table 4). Eight of the lakes (Sisipuk, Halfway, Sipiwesk,

Cedar, Natawahunan, Wekusko, Sabomin, and Playgreen) had low abundances of T. crassus. Six of the lakes (Granville, Armstrong, Barrington, Herblet, Setting and Walker) were lakes with high abundances of the parasite (Table 3). Low abundances of T. crassus occurred when low yields of medium lake whitefish and high yields of large lake whitefish occurred in Cormorant, Bruneau, Patridge Crop and Landing lakes. Abundances of T. crassus increased with increasing yields of medium and decreasing yields of large whitefish in these lakes (Appendices J, K). Presence of cisco in commercial catches correlated with increasing abundances of T. crassus in four of the lakes (Armstrong, Granville, Setting and Walker) (Appendix D; Table 3). In eight of the lakes in this category (Sisipuk, Halfway, Sipiwesk, Cedar, Natawahunan, Wekusko, Sabomin, and Playgreen), presence of cisco did not affect abundances of T. crassus (Appendix F; Table 3).

Examples of lakes where no apparent correlation occurred between the two size classes (the two size classes were parallel) are shown in Figure 5. 14.3% (5 lakes) (Gods, Kiski, Kipahigan, William, Yawningstone lakes) showed this trend (Appendices K, L). Yields of the large classes in three of these lakes (Kipahigan, William and Yawningstone) had negative slopes and two lakes (Kiski and Gods) had positive slopes. For medium classes of lake whitefish, Kipahigan and William had negative slopes while Yawningstone, Kiski and Gods had positive slopes. Yawningstone was a small lake, Kiski, Kipahigan and William were intermediate lakes and Gods was a large lake (Appendix E). Three lakes in this category (Kiski, Gods and Kipahigan) had high abundances of T. crassus and two lakes (William and Yawningstone) had low abundances of T. crassus.

In 20% (7 lakes) of the lakes (Dafoe, Butterfly, Bruneau, Pakwa, North Indian, South Indian and St. Martin), there was no consistent trend between the two size classes (Appendix I). Yields of large whitefish for four of these lakes (Dafoe, Pakwa, South Indian and St. Martin) had positive slopes and three of the lakes (Butterfly, Bruneau and North Indian) had negative slopes (Appendix L). For medium classes, Bruneau, Dafoe and South Indian lakes had positive slopes while Pakwa, St. Martin, Butterfly and North Indian lakes had negative slopes. Butterfly, Pakwa and Bruneau lakes were in the north-central and St. Martin in the southern region of the Nelson River watershed. North Indian and South Indian lakes were in the northern region of the Churchill River watershed. Dafoe was in the north-central region of Hayes River watershed (Table 4). Dafoe, Butterfly, Pakwa, Bruneau and South Indian lakes had high abundances of T. crassus (Table 3). Butterfly, North Indian and St. Martin lakes had low abundances of T. crassus (Table 3).

In three of the lakes (Bruneau, Pakwa and South Indian), presence of cisco was correlated with increasing abundances of T. crassus (Appendix D; Table 3). Presence of cisco did not affect abundances of T. crassus in two of the lakes (Butterfly and North Indian) (Appendix F; Table 3). In Dafoe, abundances of T. crassus fluctuated but returned to original levels in the absence of cisco (Appendix G; Table 3). In St. Martin Lake, no cisco was recorded in commercial catches and abundance of T. crassus remained unchanged (Appendix H; Table 3).

Size Distribution According to Watershed:

Appendix M gives mean proportions of large and medium lake whitefish over time, 1973-1983, in the Hays, Churchill

Figure 2

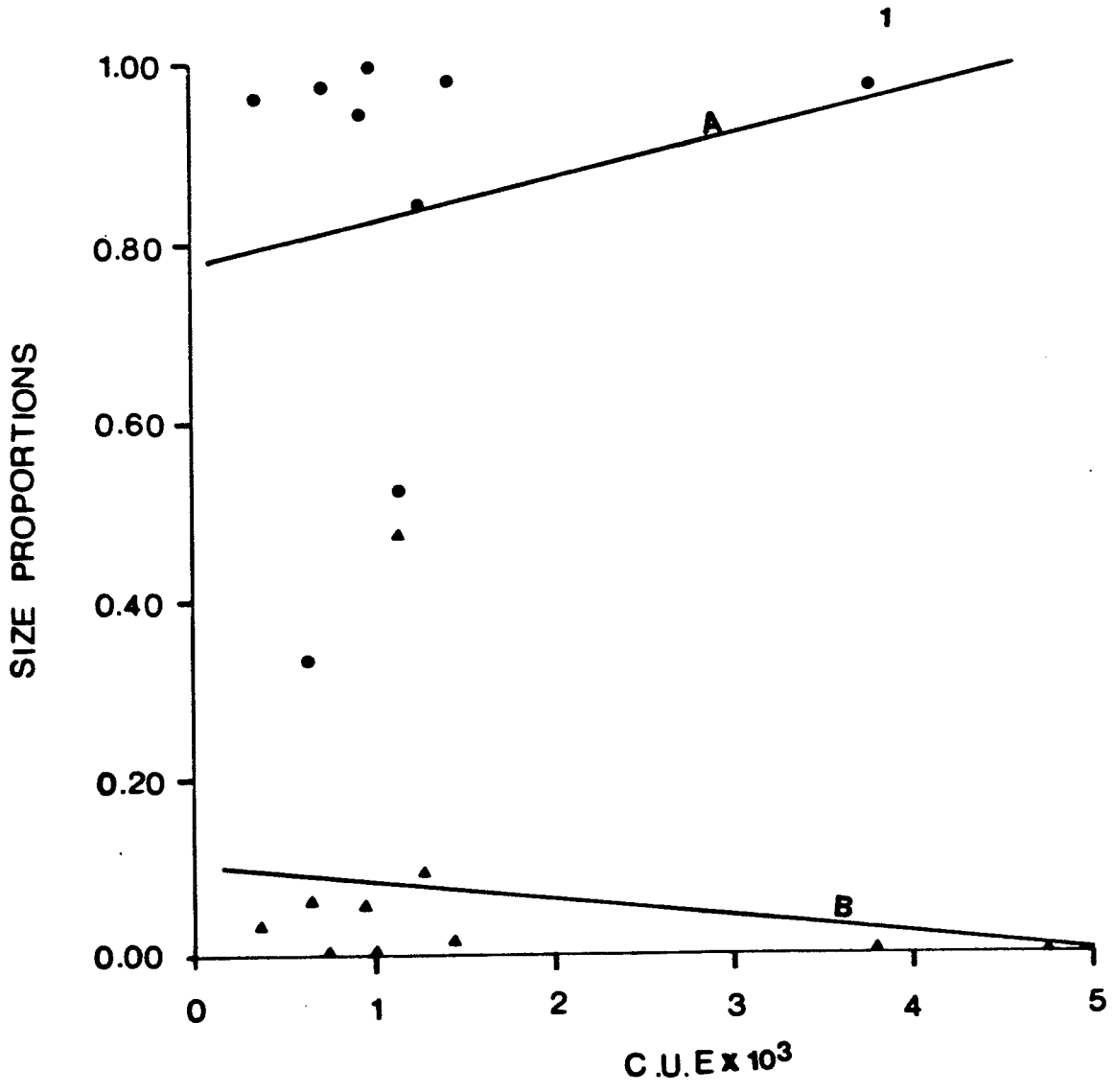
Examples of concomitant changes in proportions of medium and large size lake whitefish as a function of CUE (kg/N.D/F)

Note: Medium size lake whitefish increased as large size lake whitefish

Legend

(A) Proportions of medium size lake whitefish
(B) Proportions of large size lake whitefish

1 Guthrie Lake
2 Kisseynew Lake
3 Sabomin Lake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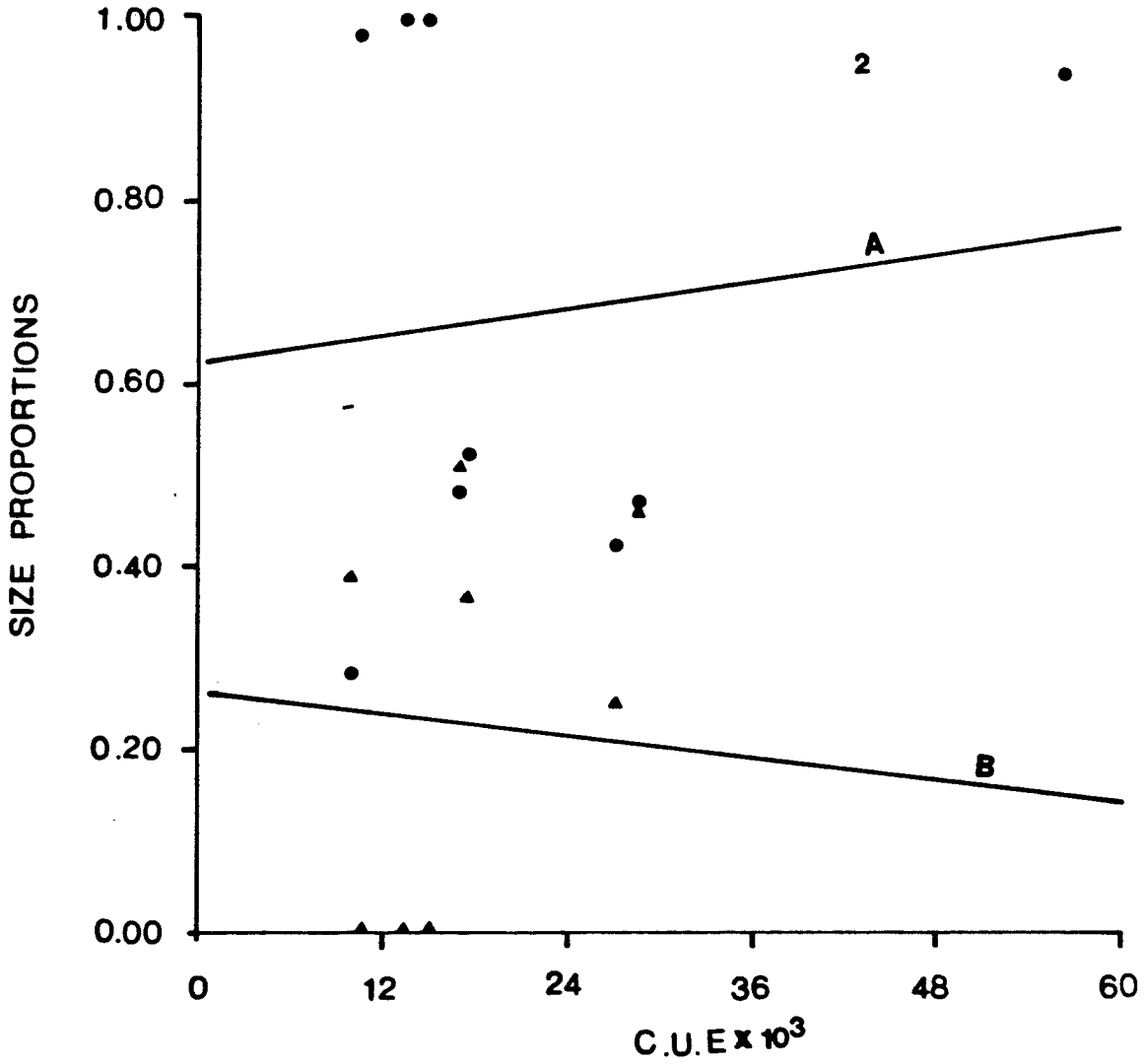
1.00
0.80
0.60
0.40
0.20
0.00
A
B
SIZE PROPORTIONS
0
1
2
3
4
5
C.U.E x 10³


1.00
0.80
0.60
0.40
0.20
0.00
SIZE PROPORTIONS
2
A
B
0
12
24
36
48
60
C.U.E x 10³

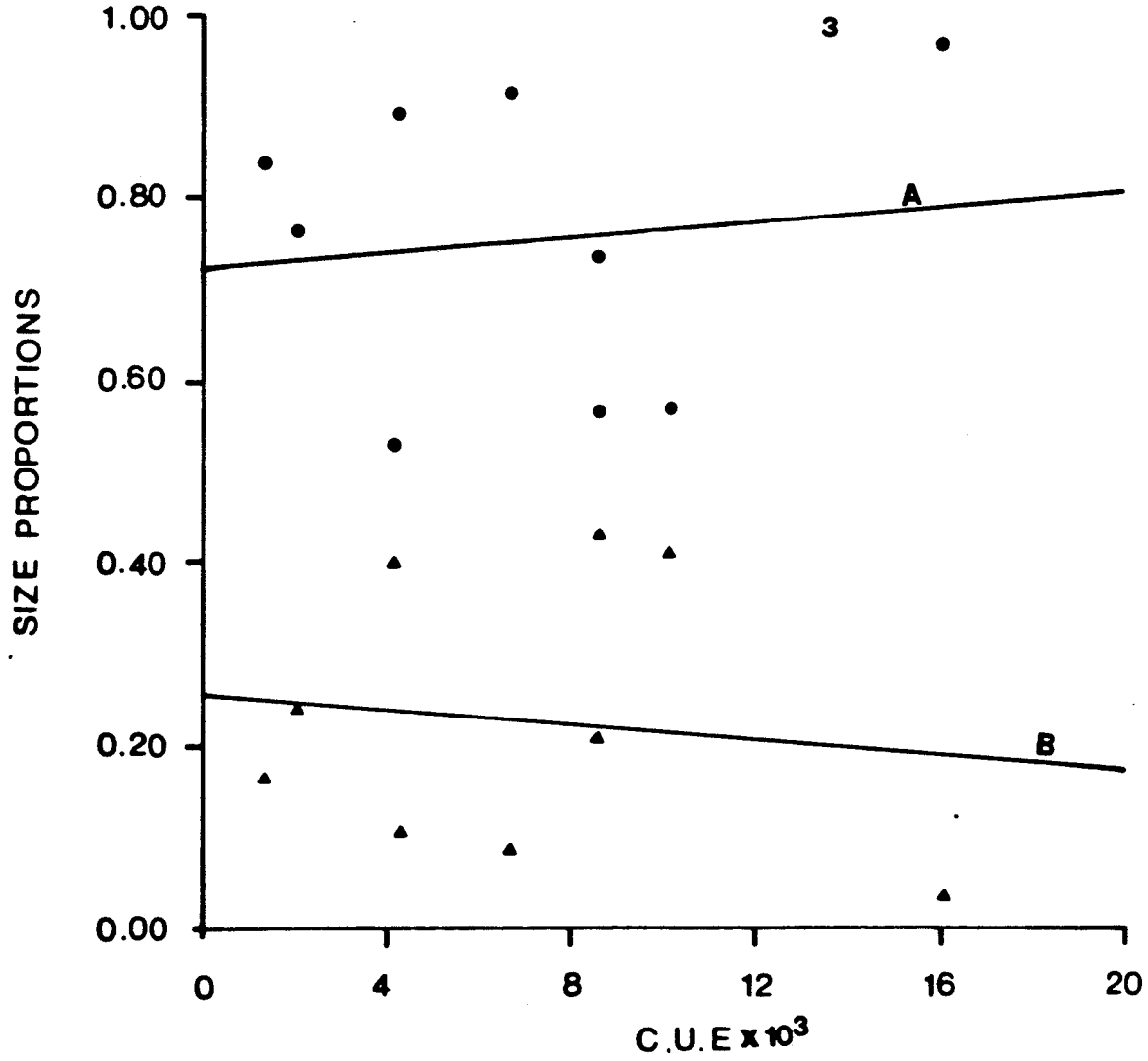

1.00
0.80
0.60
0.40
0.20
0.00
SIZE PROPORTIONS
3
A
B
0
4
8
12
16
20
C.U.E x 10³

Figure 3

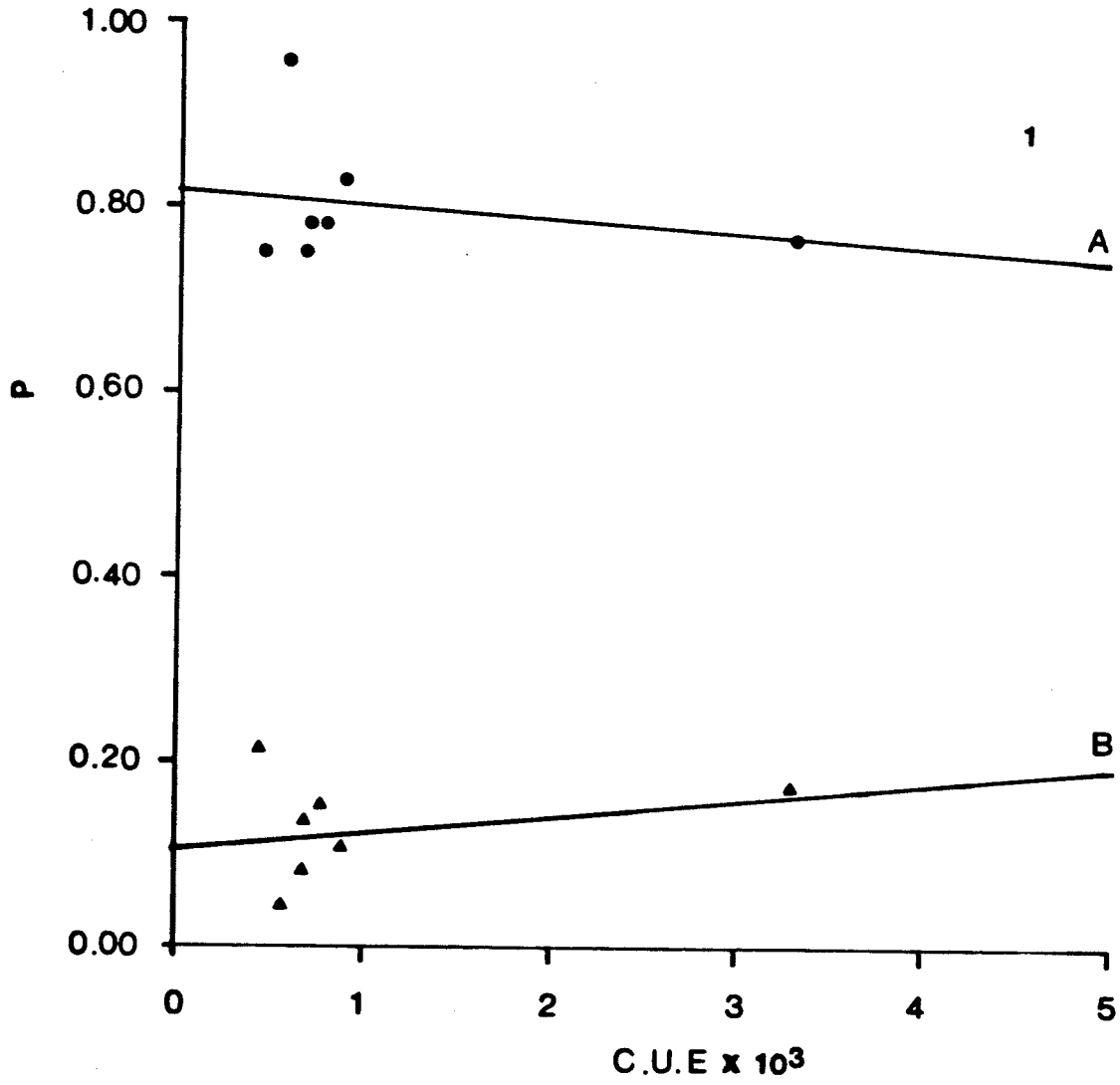
Concomitant changes in proportions of medium and large size lake whitefish as a function of CUE (kg/N.D/F)

Note: Medium size lake whitefish decreased as large size lake whitefish increased.

Legend

(A) Proportions of medium size lake whitefish
(B) Proportions of large size lake whitefish

1 Barrington Lake
2 Granville Lake
3 Walker Lake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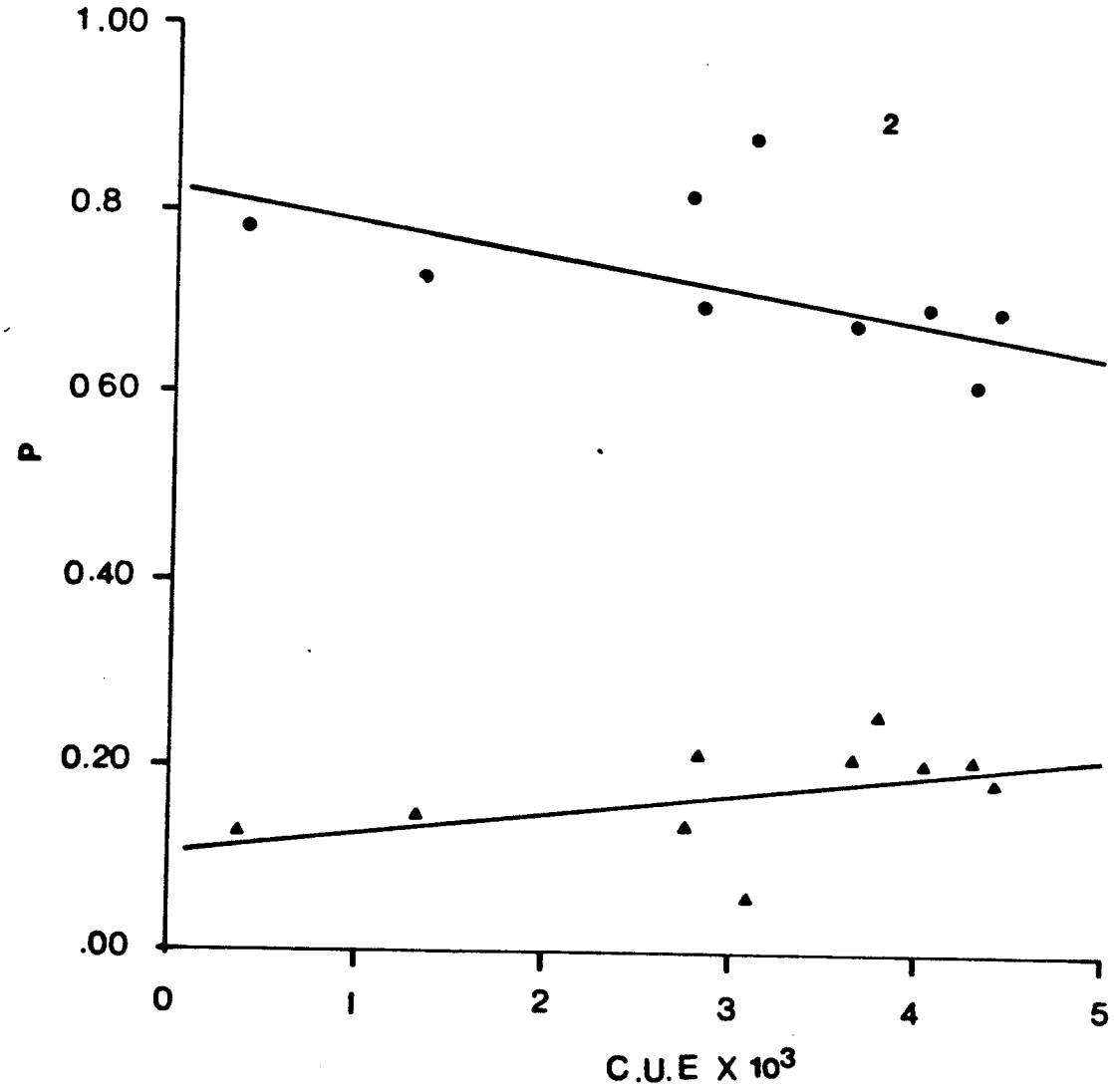
0.80
0.60
0.40
0.20
0.00
p
1
A
B
0
1
2
3
4
5
C.U.E x 10³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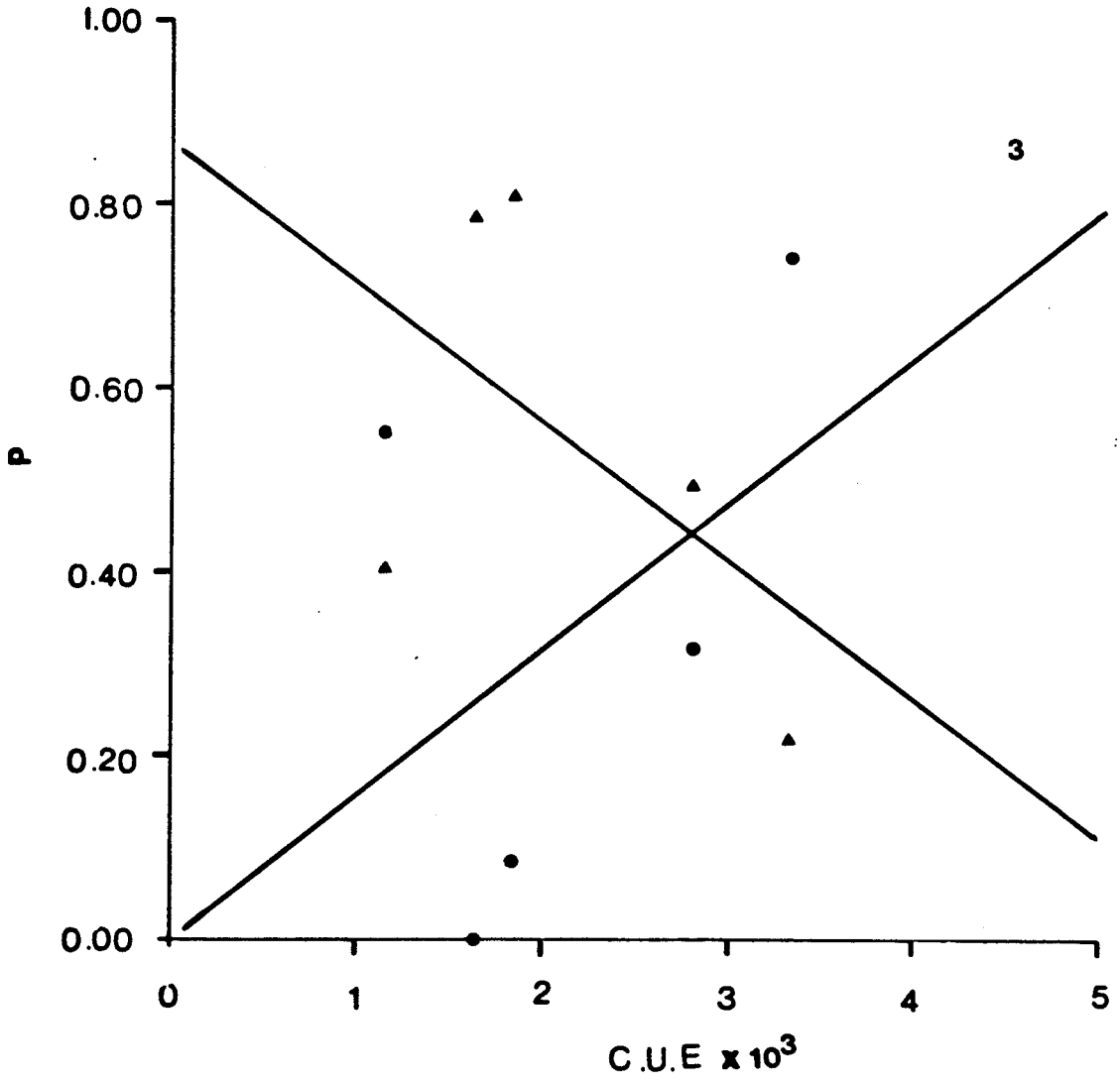
0.40
0.20
.00
P
2
0
1
2
3
4
5
C.U.E X 10³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0.20
0.00
p
0
1
2
3
4
5
C.U.E x 10³
3

Figure 4

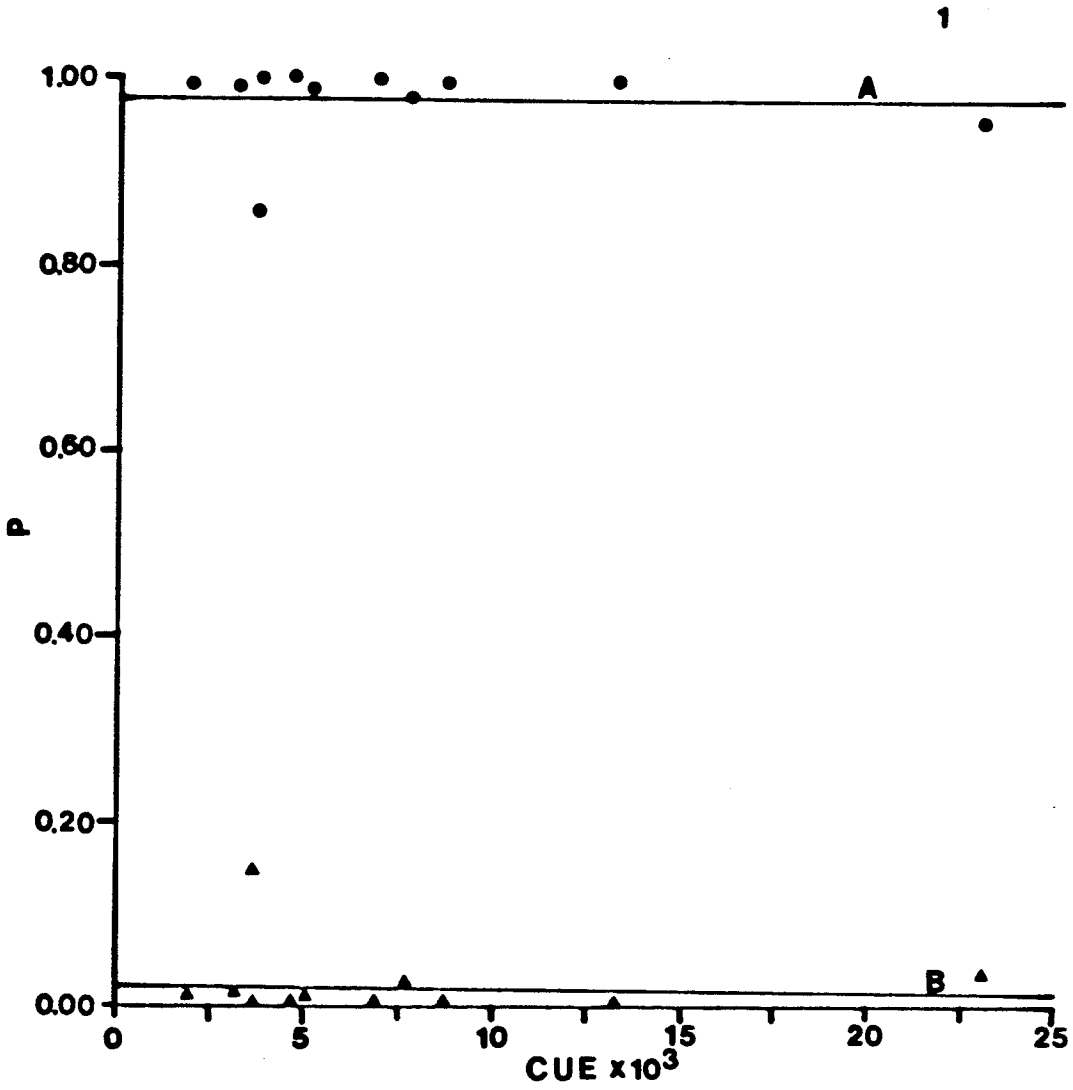
Concomitant changes in proportions of medium and large size lake whitefish as a function of CUE (kg/N.D/F)

Note: No correlation occurred between the two size classes.

Legend

(A) Proportions of medium size lake whitefish
(B) Proportions of large size lake whitefish

1 William Lake
2 Kiski Lake
3 Gods Lake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0.60
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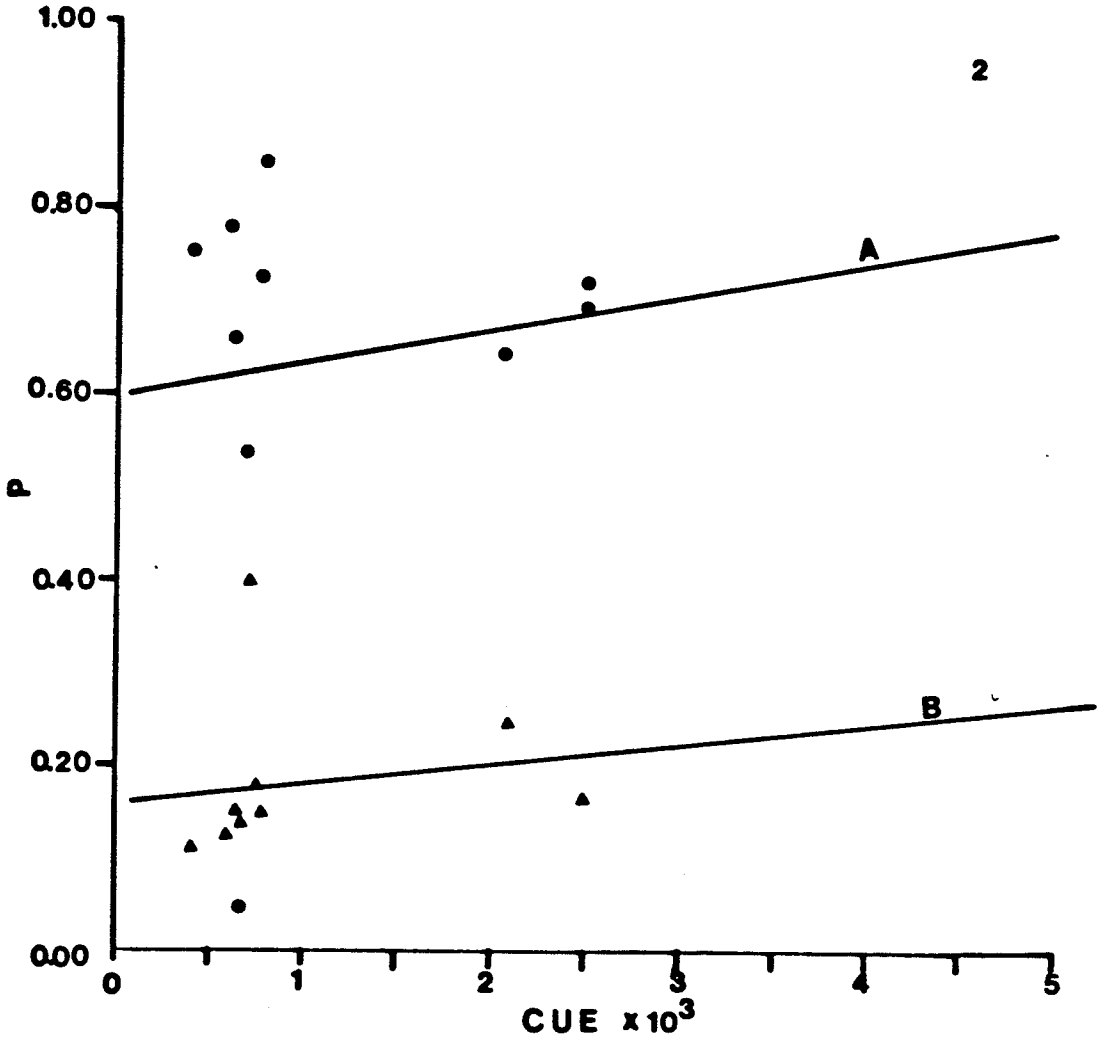
0.20
0.00
p
A
B
0
5
10
15
20
25
CUE x10^3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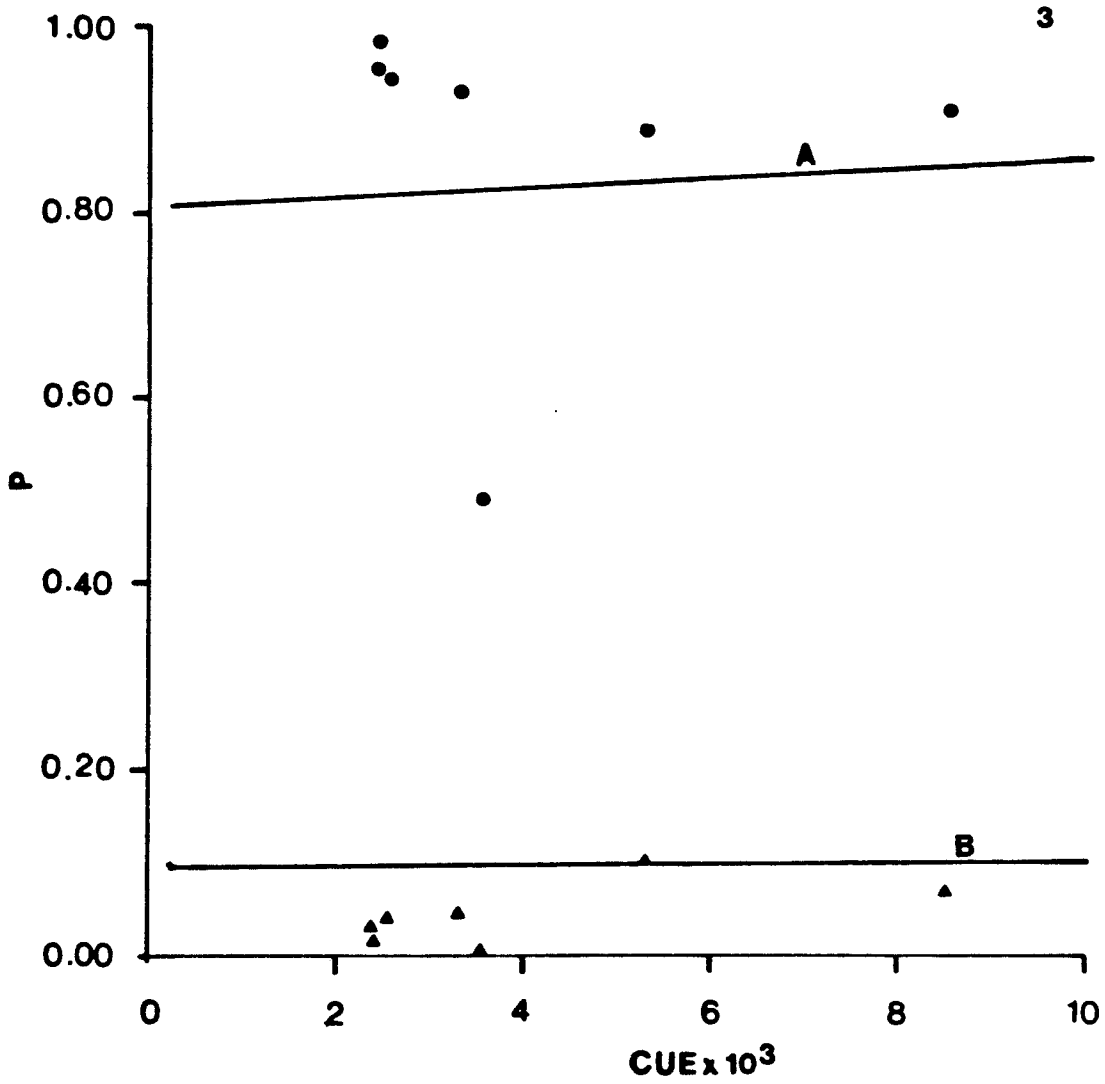
0.60
0.40
0.20
0.00
a
2
A
B
0
1
2
3
4
5
CUE x10^3


3
1.00
0.80
0.60
0.40
0.20
0.00
P
A
B
0
2
4
6
8
10
CUE x 10³

and Nelson watersheds. Appendix N shows temporal changes in large and medium classes of lake whitefish in commercial catches from lakes in the Hayes, Churchill and Nelson River watersheds. Appendix O shows concomitant changes in large and medium sized lake whitefish over time in the three watersheds. Appendix P gives the regressions of large and medium size lake whitefish in the three watersheds.

Appendix M shows that yields of medium lake whitefish were highest in the Hayes River watershed, intermediate in the Churchill River watershed and lowest in the Nelson River watershed.

Linear regression analysis indicated that as large sized lake whitefish increased, medium sized lake whitefish decreased (Appendix O). The slopes for whitefish classes for all three watersheds were negative. Hayes River watershed had a correlation coefficient of 0.610, F value of 504.62 and 1 and 10 degrees of freedom. Nelson had a correlation coefficient of 0.610, F value of 1.38 and 1 and 10 degrees of freedom. Churchill had a correlation coefficient of 0.826, F value of 12.85 and 7 degrees of freedom.

(c) Spatial and Temporal Trends in Catch, Effort and CUE

Table 3 lists classifications of all lakes used in this analysis. Table 4 lists lakes according to geographical location (northern, north-central and southern). Appendix Q gives species composition (in marketed weight) of lake whitefish, pike, walleye and others for lakes, during the period 1973-1982. Appendix R shows temporal changes in total

yield by species. Figure 5 shows examples of lakes where decline in production was correlated with an increase in the abundance of T. crassus. Appendix S shows temporal changes in catch/delivery (kg/number of deliveries). Appendix E lists lakes according to lake sizes of small, intermediate and large. Appendices D, F, G and H show temporal changes in species proportions of cisco, lake whitefish and pike. Appendix S gives lake size categories of small, intermediate and large lakes used in this analysis.

i) Catch:

There were irregular fluctuations in total annual production in 60% (21 lakes) of the lakes (Armstrong, Barrington, Butterfly, Cedar, Dafoe, Granville, Halfway, Herblet, Kiski, Kisseynew, Natawehunan, North Indian, Opachuanau, Patridge Crop, Sabomin, Sisipuk, Sipiwesk, Walker, William, Witchai and Yawningstone) (Appendix Q). Wider fluctuations occurred in nine of the above lakes (Butterfly, Cedar, Kisseynew, Barrington, Armstrong, Sisipuk, Sabomin, North Indian and Yawningstone) (Appendix Q). Cedar and Yawningstone lakes were located in the southern region, and Armstrong and Butterfly lakes in the north-central region of the Nelson River watershed (Table 4). Barrington and North Indian Lakes were in the northern, Sisipuk in the north-central and Kisseynew were in the southern region of the Churchill River watershed (Table 4).

Total annual catches were higher in the early 1970's in 34.3% (12 lakes) of the lakes (Bruneau, Gods, Kipahigan, Cormorant, Guthrie, Halfway, Kiski, Landing, Pakwa, Patridge

Crop, South Indian and Cedar) (Appendix Q). Abundance of T. crassus were lower in those lakes in the same period (Table 3). Production declined with increasing abundances of the parasite in eight of these lakes (Cormorant, Bruneau, Gods, Kiski, Kipahigan, Landing, South Indian and Pakwa) (Appendix M; Table 3). Abundance of T. crassus remained unchanged in Cedar, Guthrie, Halfway and Patridge Crop lakes with similar downward trends in production (Appendices Q, R; Table 3). Lakes in this category were located in the north and north-central regions of the Nelson River watershed (Bruneau, Cormorant, Kiski and Pakwa) and Churchill River watershed (Gods, Kipahigan and South Indian) (Table 4).

Total catches were higher in the mid 1970's in 34.3% (12 lakes) of the lakes studied (Setting, Herblet, St. Martin, Natawahunan, Kisseynew, Opachuanau, Playgreen, Sisipuk, Wekusko, William, Barrington and Granville) (Appendices Q, R). This was a period when abundances of T. crassus started to increase in six of the lakes (Setting, Kisseynew, Herblet, Barrington, Granville and Opachuanau) (Appendices Q, R). Annual catches declined in these lakes with increasing abundances of T. crassus. These lakes were located in the north-central regions of Nelson River watershed (Setting, Granville, Playgreen, Herblet, Wekusko and William) and Churchill River watershed (Barrington and Sisipuk). Kisseynew Lake was located in the southern region of the Churchill River watershed (Table 4).

Annual total catches progressively increased from

Figure 5

Temporal changes in total yield

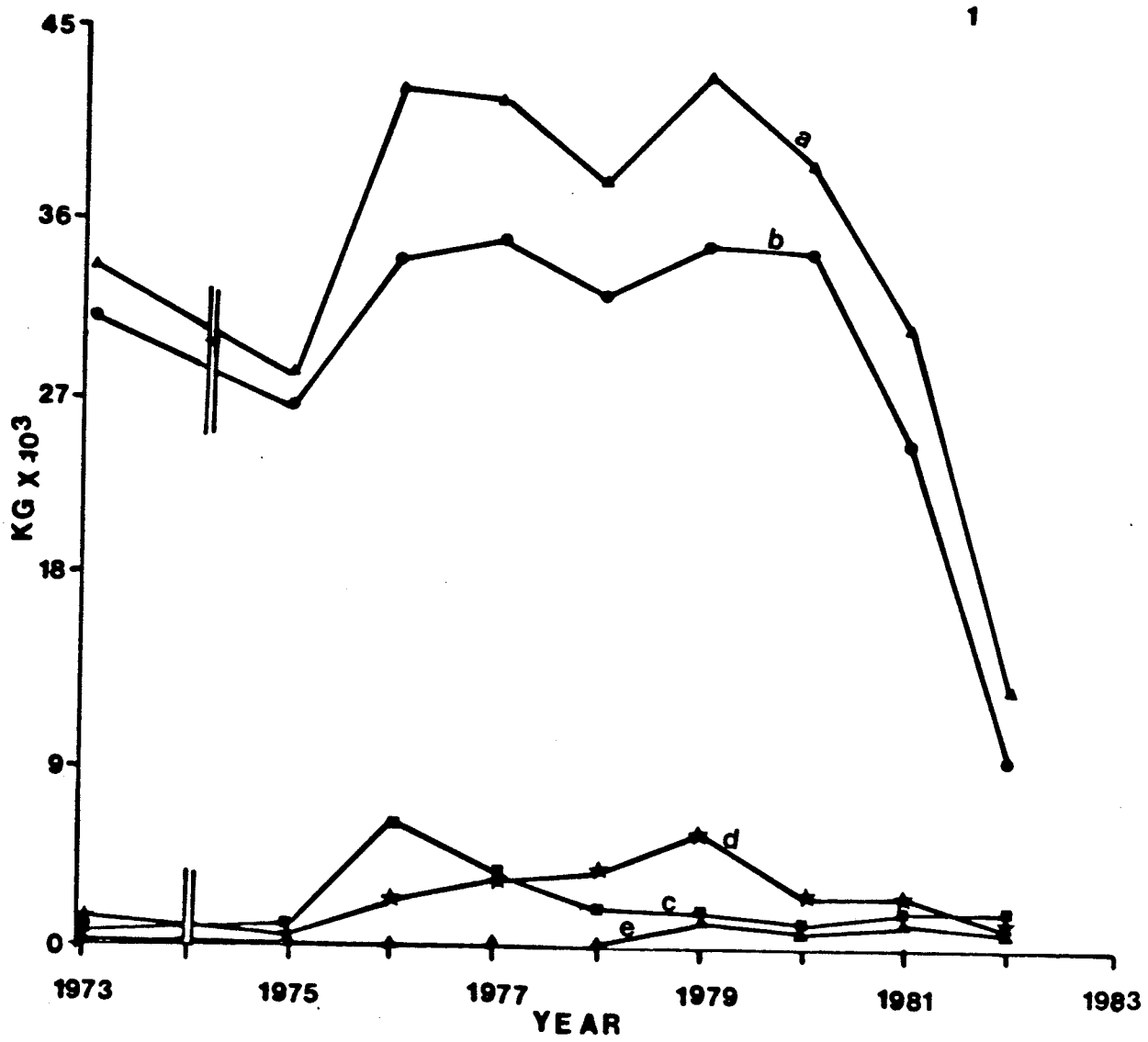
(in marketed weight), 1973-1983

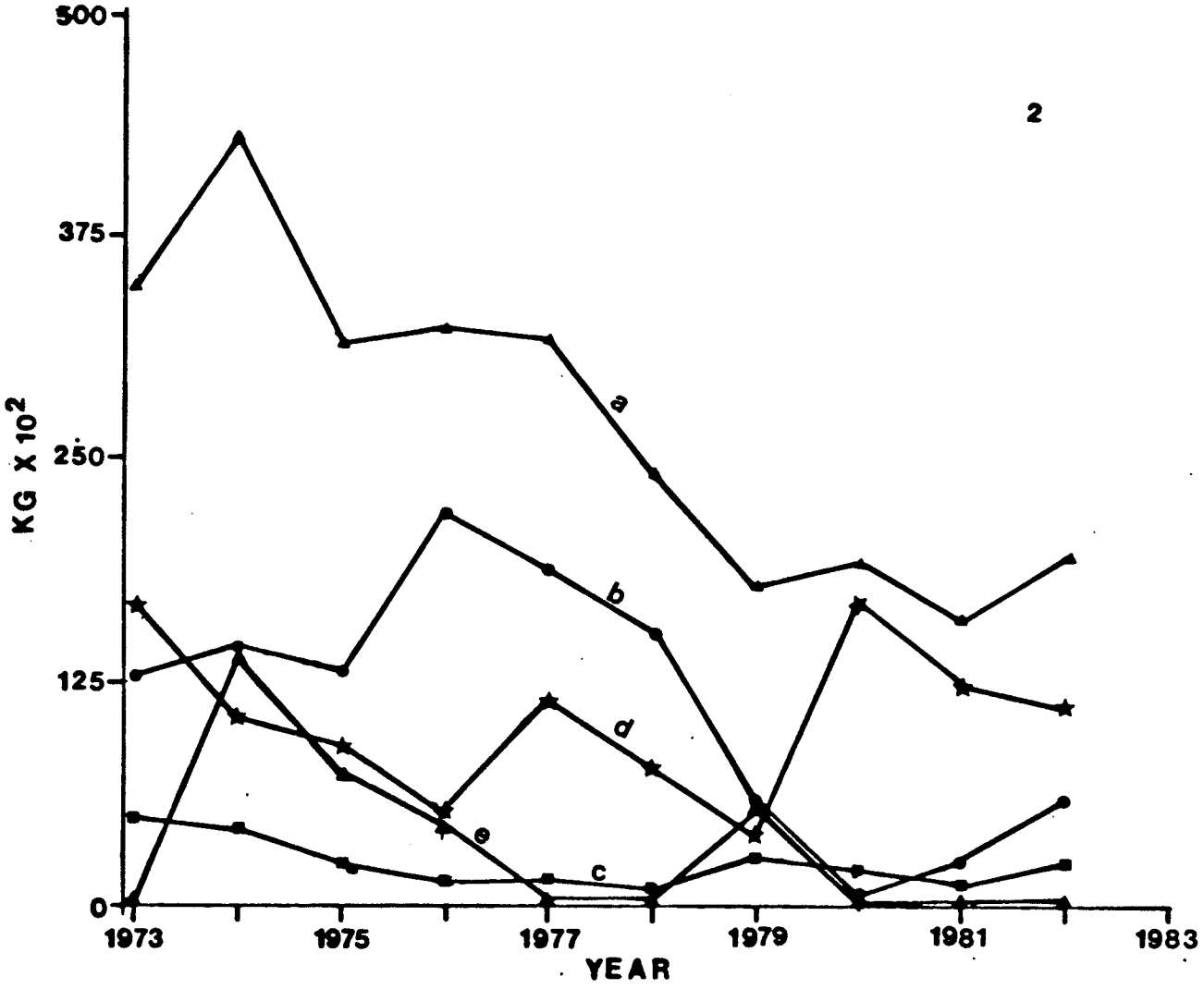
Note: Total yield declined with increasing abundance of T. crassus Forel

Legend

Total yield
Yield of lake whitefish
Yield of walleye
Yield of pike
Yield of other species

1 South Indian Lake
2 Kipahigan Lake


1
45
36
27
18
9
0
KG X 10³
a
b
c
d
e
1973
1975
1977
1979
1981
1983
YEAR


500
375
250
125
0
KG X 10²
2
a
b
c
d
e
1973
1975
1977
1979
1981
1983
YEAR

1973-1980 in five lakes (Setting, Granville, Herblet, Playgreen and St. Martin) (Appendices Q, R). Granville, Herblet and Setting had high abundances of T. crassus, and Playgreen and St. Martin lakes had low abundances of the parasite (Table 3). Setting, Herblet and Playgreen lakes were in the north-central region and St. Martin was in the southern region of the Nelson River watershed. Granville Lake was located in the northern region of Churchill River watershed (Table 4).

Annual total catches progressively declined from 1973-1983 in Guthrie, Halfway, Kiski, Landing, Kipahigan, South Indian, Gods, Bruneau, Pakwa, Patridge Crop and Wekusko (Figure 5; Appendices Q, R). Six of these lakes (Guthrie, Halfway, Pakwa, Patridge Crop, Kiski, Landing) were located in the north-central region of Nelson River watershed, two lakes (South Indian and Kipahigan) were in the north-central region of Churchill watershed and one (Gods Lake) in north-central region of Hayes River watershed. Kiski, Pakwa and Landing had high abundances of T. crassus and Guthrie, Halfway, Patridge Crop, and Wekusko had low abundances of the parasite.

Catch/delivery declined with increasing number of deliveries in 60% (21 lakes) of the lakes studied (Sipiwesk, North Indian, Setting, Dafoe, Witchai, Sabomin, South Indian, Wintering, Wuskwatim, Natawahunan, Patridge Crop, Kisseynew, Gods, Playgreen, St. Martin, Granville, Opachuanau, Pakwa, Guthrie, and Barrington) (Appendix S). Catch/delivery increased with increasing number of deliveries in 17.1% (6

lakes) of the lakes studied (Cedar, Cormorant, Herblet, Kipahigan, Wekusko and Yawningstone). Catch/delivery was irregular in seven lakes (Halfway, Bruneau, Kisseynew, Butterfly, Landing, Walker and Sisipuk).

ii) Lake Parameters:

Twelve of the small lakes (Armstrong, Bruneau, Butterfly, Guthrie, Halfway, Herblet, Natawahunan, Pakwa, Patridge Crop, Witchai, Wuskwatim and Yawningstone) were located in the Nelson River watershed, two lakes (Dafoe and Sabomin) were located in the Hayes River watershed, and three lakes (Granville, Kisseynew and Opachunanau) were located in the Churchill River watershed (Appendix E). The six intermediate size lakes (Kiski, Landing, Setting, Walker, William, Wintering and Wekusko) were in the Nelson River watershed. Four lakes, Barrington, Kipahigan, North Indian and Sisipuk lakes were in the Churchill River watershed. The large lakes, Cedar, Cormorant, Playgreen and Sipiwesk lakes were in the Nelson River watershed. One lake (Gods) was in the Hayes and one lake (South Indian) was in the Churchill River watershed.

The small lakes had a mean surface area of 3,927 ha, mean CUE per unit of surface area of 0.28 (kg/N.D/F/ha), mean effort of 14.3 (N.D/F), mean production for lake whitefish was 68,051 kg; for cisco was 42,317 kg; and for pike was 27,130 kg. The intermediate lakes had a mean surface area of 15,297 ha; mean CUE per unit of surface area of 0.19 (kg/N.D/F/ha); mean effort of 15 (N.D/F); mean production of lake whitefish

was 148,407 kg; mean production of cisco was 16,510 kg and mean production of pike was 50,000 kg. The large lakes had a mean surface area of 95,055 ha; mean CUE per unit of surface area of 0.10 (kg/N.D/F); mean effort of 29 (N.D/F); mean production for lake whitefish was 943,322 kg; mean production of cisco was 25,144 kg; and mean production of pike was 613,173 kg (Appendix E).

iii) Mean Flow Rates for the Month of May as a Factor in Total Production:

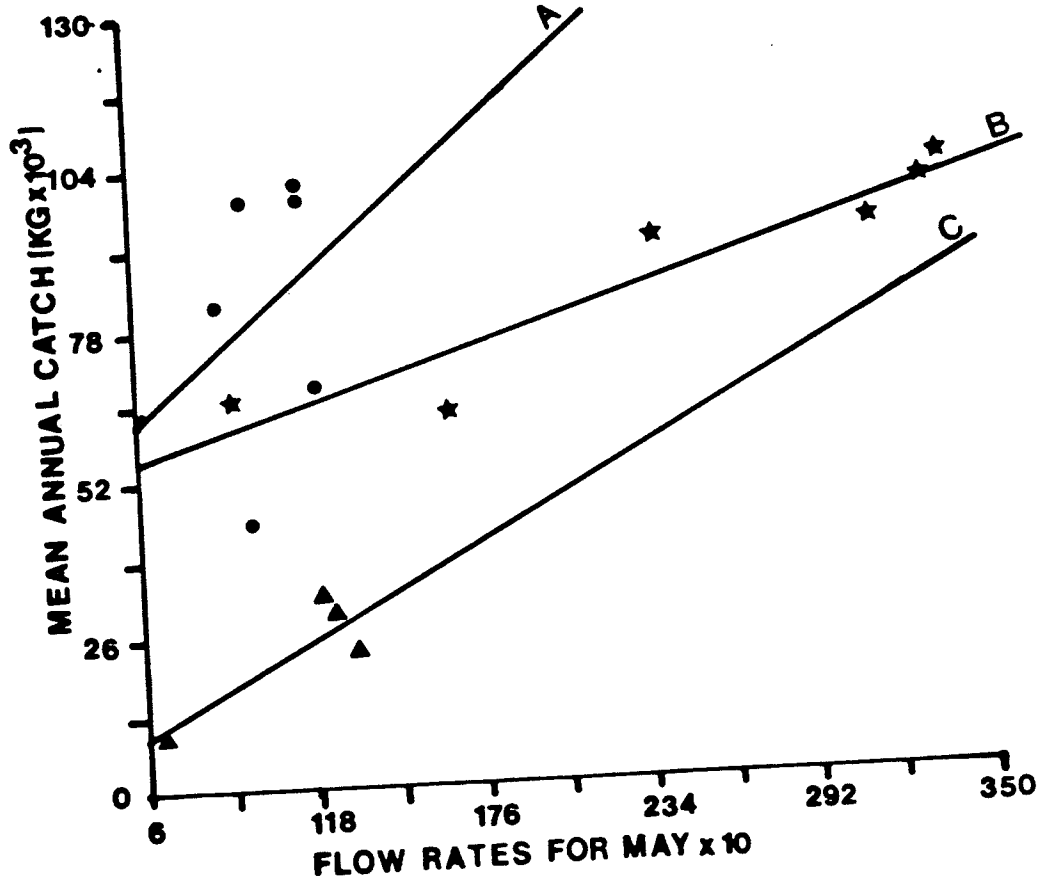
Appendix T gives the flow rates (m^3 sec^{-1}) for May and mean annual yield (kg), 1973-1983, for the Churchill, Hayes and Nelson River watersheds. Mean flow rates for early 1970's were plotted against mean annual catches of the mid 1970's with a five year lag. For example the flow rate for the year 1973 was plotted against the mean annual catch of 1978. This was because most whitefish stocks are recruited into the fishable stock at age 5 (Rackozy, 1983). Appendix U lists regressions for the flow rates of the month of May versus mean annual catches (kg) for the three watersheds, with a five year lag. Figure 6 shows the concomitant changes in annual catches as a function of flow rates [y = f (flow rate)].

Appendix T shows that mean May flow rates were generally higher in the early 1970's. Mean annual catches were correspondingly higher in mid 1970's for all three watersheds.

Regression analysis (y = a+bx) for the three watersheds produced a correlation coefficient of 0.260, F value of 0.29 with (1, 4) degrees of freedom for Churchill River watershed,

Figure 6

Concomitant changes in annual yield (kg) as a function of mean flow rates (m^3 sec^{-1}) for the month of May for Churchill (A), Hayes (B), and Nelson (C)


130
104
78
52
26
0
MEAN ANNUAL CATCH (KG x 10^3)
A
B
C
6
118
176
234
292
350
FLOW RATES FOR MAY x 10

correlation coefficient of 0.851, F value of 5.25 with (1, 2) degrees of freedom for Hayes watershed and a correlation coefficient of 0.933, F value of 26.71 with (1, 4) degrees of freedom for Nelson watershed. The slopes for all three watersheds were positive (Appendix U).

iv) Fishing Effort:

Table 3 lists the lakes used to determine annual fishing effort in this analysis. Appendix V shows temporal changes in fishing effort over time, 1973-1983. Examples of lakes with decreasing, increasing and irregular effort are given in Figures 7, 8 and 9 respectively.

Figure 7 and Appendix V show that effort declined over time in 25.7% of the lakes (Natawahunan, Landing, Patridge Crop, Kiski, Halfway, Bruneau, Sabomin, Wintering and Setting). Natawahunan, Landing, Patridge Crop, Halfway, Bruneau, Wintering, Setting and Kiski lakes were located in the north-central region of the Nelson River watershed and Sabomin was in the north-central region of Hayes River watershed (Table 4). The presence of cisco was correlated with an increase in abundance of T. crassus in four of the lakes (Landing, Kiski, Bruneau, and Setting) (Table 4; Appendix D). Presence of cisco did not effect abundance of T. crassus in four of the lakes (Natawahunan, Halfway, Sabomin and Wintering) (Appendix F; Table 4). Five of the lakes (Bruneau, Natawahunan, Patridge Crop, Halfway and Wintering) were small size and four (Landing, Kiski, Setting and Sabomin) were intermediate size lakes (Appendix E).

Effort increased over time in 11 lakes (Herblet, Kipahigan, Cormorant, Witchai, Wuskwatim, Playgreen, Wekusko, Gods, Dafoe, Sisipuk and Cedar) (Figure 8; Appendix V). In two of these lakes, (Cormorant and Kipahigan), presence of cisco was correlated with an increase in abundance of T. crassus (Appendix D; Table 3). In Wuskwatim, Playgreen, Wekusko, Sisipuk and Cedar, cisco was present but abundance of T. crassus did not change Appendix E; Table 3). In Herblet, Gods and Dafoe, change in abundance of T. crassus occurred in the absence of cisco (Appendix F; Table 3).

Effort was irregular in 42.9% of the lakes (Kisseynew, William, Pakwa, Yawningstone, Armstrong, Guthrie, Butterfly, South Indian, St. Martin, Opachuanau, North Indian, Granville, Barrington, Walker and Sipiwesk) (Figure 9; Appendix V). Pakwa, Armstrong, Guthrie, Butterfly, Walker and Sipiwesk lakes were located in the north-central and Yawningstone and St. Martin in the southern region of the Nelson River watershed. South Indian, North Indian, Opachuanau, Granville, and Barrington were in the northern region and Kisseynew in the southern region of the Churchill River watershed (Table 3). In seven of the lakes (Pakwa, Armstrong, South Indian, Opachuanau, Walker, Kiski and Granville), presence of cisco was correlated with an increase in abundance of T. crassus (Appendix D; Table 3). In four lakes (Guthrie, Butterfly, North Indian and Sipiwesk) cisco was present but abundance of T. crassus did not change (Appendix F; Table 3). Change in abundance of T. crassus occurred in Barrington Lake in the

Figures 7, 8 and 9

Temporal changes in fishing effort (N.D/F), 1973-1983

Figure 7

Setting Lake

Note: Fishing effort increased over time.

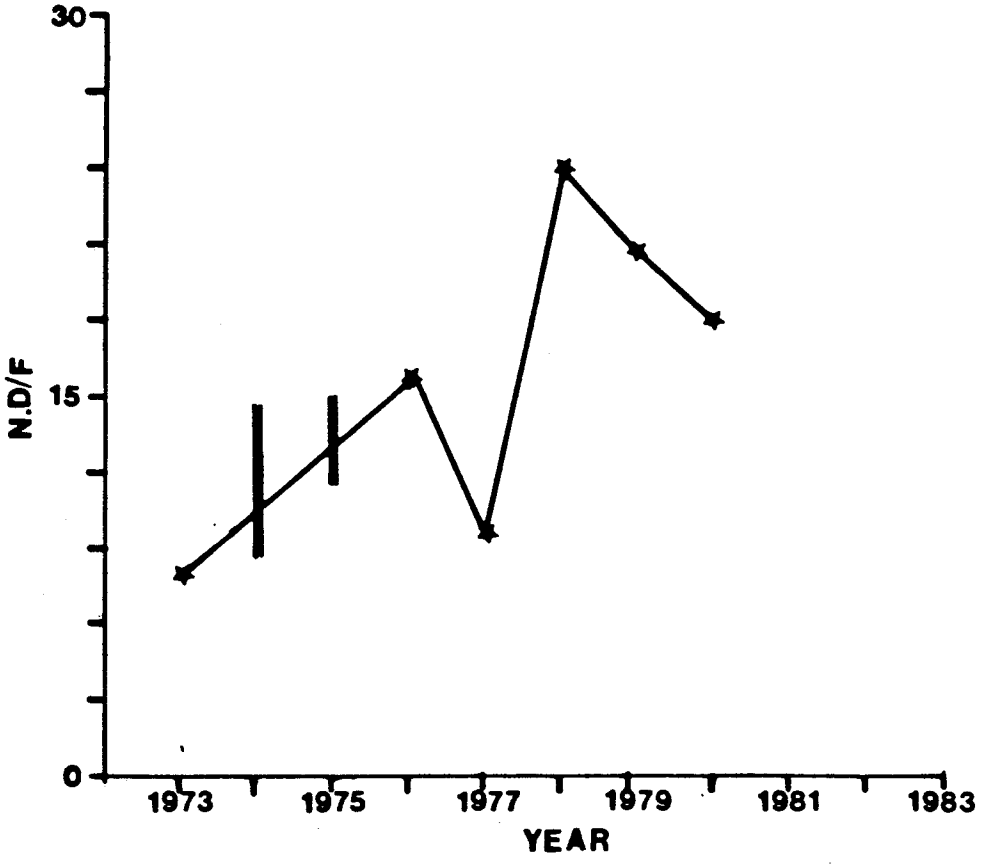

30
15
0
N.D/F
1973
1975
1977
1979
1981
1983
YEAR

Figure 8

Dafoe Lake

Note: Fishing effort decreased over time.

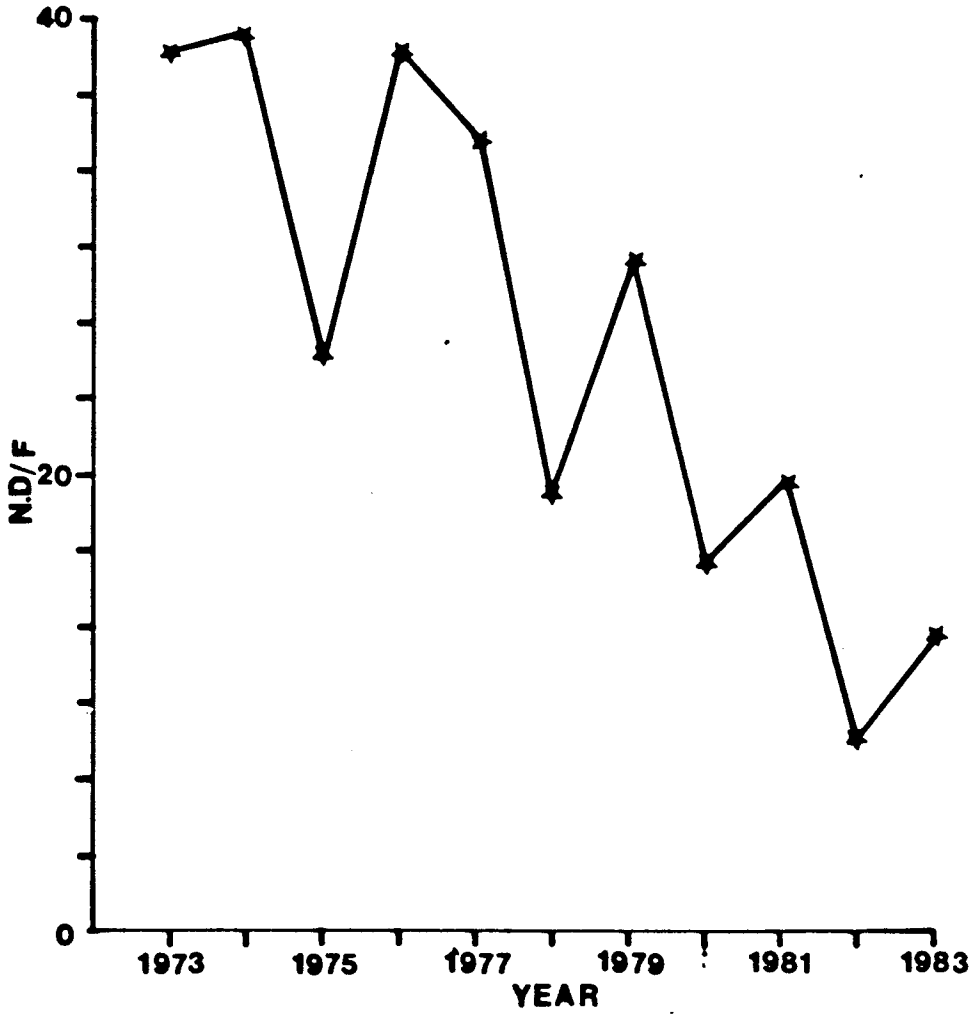

40
20
0
N.D/F
1973
1975
1977
1979
1981
1983
YEAR

Figure 9

Playgreen Lake

Note: Fishing effort was irregular.


40
20
0
N.D/F
1973
1975
1977
1979
1981
1983
YEAR

absence of cisco (Appendix F; Table 3). In two lakes (St. Martin and William), cisco was absent and no change in abundance of T. crassus occurred. Eight of the lakes (Kisseynew, Pakwa, Yawningstone, Armstrong, Guthrie, Butterfly, Opachuanau and Granville) were small size lakes. William, North Indian, Barrington were intermediate size lakes. Sipiwesk and South Indian were large size lakes (Appendix E).

v) Catch Per Unit of Effort (CUE)

Appendix W shows temporal changes in CUE. Examples of lakes with decreasing, increasing and inconsistent fishing efforts are shown in Figures 10, 11 and 12 respectively.

The calculation of CUE was refined by dividing catch/delivery by number of fishermen, to take into account the number of men operating in the fishery in any given year.

CUE decreased over time, 1973-1983, in 40% of the lakes (Butterfly, Cedar, Wuskwatim, Armstrong, Yawningstone, Opachuanau, Playgreen, Pakwa, Sipiwesk, Walker, Cormorant, Gods, South Indian and Kipahigan) (Appendix W; Figure 10). Butterfly, Wuskwatim, Armstrong, Playgreen, Pakwa, Sipiwesk, Walker, Cormorant were in the north-central, Cedar and Yawningstone were in the southern region of the Nelson River watershed (Appendix E). Opachuanau and South Indian lakes were in the northern and Kipahigan Lake in the north-central region of the Churchill River watershed (Table 4). In nine of the lakes (Armstrong, Opachuanau, Playgreen, Pakwa, Walker, Cormorant, Gods, South Indian and Kipahigan)

abundances of T. crassus correlated with presence of cisco (abundance of parasite increased with presence of cisco) (Appendix D; Table 3). In four lakes (Butterfly, Cedar, Wuskwatim and Sipiwesk), presence of cisco did not affect abundance of T. crassus (Table 3; Appendix D). In Yawningstone Lake, no change in abundance of T. crassus occurred and cisco was absent in commercial catches. Nine of those lakes (Opachuanau, Pakwa, Walker, Cormorant, Gods, South Indian, Kipahigan, Armstrong and Wuskwatim) had high abundances of T. crassus (Table 3). Five lakes (Butterfly, Cedar, Yawningstone, Playgreen and Sipiwesk) had low abundances of the parasite (Table 3). Six of the lakes (Butterfly, Wuskwatim, Armstrong, Yawningstone, Opachuanau and Pakwa) were small size lakes (Appendix E). Six others (South Indian, Gods, Sipiwesk, Playgreen, Cedar and Cormorant) were large size lakes (Appendix E). Walker and Kipahigan were intermediate size lakes (Appendix E).

CUE increased over time in 34.3% of the lakes studied (William, Granville, Landing, Wintering, Wekusko, Patridge Crop, Witchai, Sisipuk, Sabomin, Natawahunan, St. Martin and Herblet) (Figure 11; Appendix W). Herblet, Landing, Wintering, Patridge Crop and Natawahunan were in the north-central, St. Martin in the southern, and Witchai and Wekusko in the northern regions of Nelson River watershed (Table 4). Sisipuk was in the north-central and Granville in the northern region of Churchill River watershed (Table 4). Sabomin was in the north-central region of Hayes River

watershed (Table 4). In Granville and Landing, presence of cisco correlated with an increase in abundance of T. crassus. In five lakes (Wintering, Wekusko, Sisipuk, Sabomin and Natawahunan), the presence of cisco did not affect abundance of T. crassus (Appendix F; Table 3). In Herblet Lake, levels of T. crassus fluctuated in the absence of cisco (Appendix G; Table 3). In St. Martin and William, cisco was absent and levels of the parasite remained constant (Appendix H; Table 3). Nine of the lakes (William, Wintering, Wekusko, Patridge Crop, Witchai, Sisipuk, Sabomin, Natawahunan and St. Martin) had low abundances of T. crassus and three (Granville, Landing and Herblet) had high abundances of the parasite (Table 3). Six of the lakes were small size lakes (Granville, Patridge Crop, Witchai, Sabomin, Natawahunan and Herblet) (Appendix E). Five lakes (William, Landing, Wekusko, Wintering and Sisipuk) were intermediate size lakes. The area of St. Martin was not known (Appendix E).

No consistent change in CUE over time, 1973-1983, occurred in 25.7% of the lakes studied (Barrington, Bruneau, Halfway, Guthrie, Setting, Kiski, North Indian, Dafoe and Kisseynew) (Figure 11; Appendix W). In five of these lakes (Bruneau, Setting, Kiski, Kisseynew and Halfway), presence of cisco was correlated with an increase in abundance of T. crassus (Appendix D; Table 3). In Guthrie and North Indian, presence of cisco did not affect the abundance of T. crassus (Appendix F; Table 3). In Dafoe and Kisseynew, abundances of T. crassus changed in the absence of cisco. Of these lakes,

Bruneau, Halfway, Guthrie, Setting and Kiski were located in the north-central region of Nelson River watershed (Table 4). Barrington and North Indian lakes were in the northern and Kisseynew in the southern regions of Churchill River watershed (Table 4). Dafoe was in the north-central region of Hayes River watershed (Table 4).

Five of the lakes (Bruneau, Halfway, Guthrie, Dafoe and Kisseynew) were small size lakes. Four lakes (Barrington, Setting, Kiski and North Indian) were intermediate size lakes. Barrington, Halfway, Bruneau, Setting, Kiski, Dafoe and Kisseynew had high abundances of T. crassus (Table 3). Three lakes (Halfway, Guthrie and North Indian) had low abundances of T. crassus (Table 3).

CUE declined with increasing effort in five lakes (Kipahigan, Cormorant, Wuskwatim, Playgreen and Gods) (Appendices V, W). Cisco was present in all these lakes except in Gods Lake (Appendix C). All these lakes were large size lakes except Wuskwatim Lake (Table 4).

CUE increased with decreasing effort in Landing, Patridge Crop, Natawahunan, Sabomin and Wintering lakes (Appendices V, W). All those lakes had low abundances of T. crassus except Landing Lake (Table 3).

CUE increased with increasing effort in Herblet, Witchai and Wekusko lakes (Appendices V, W). Herblet and Witchai had high abundances of T. crassus and Wekusko had low abundances of the parasite (Table 3).

Figures 10, 11 and 12

Temporal changes in CUE (kg/N.D/F), 1973-1983

Figure 10

Playgreen Lake

Note: CUE decreased over time.

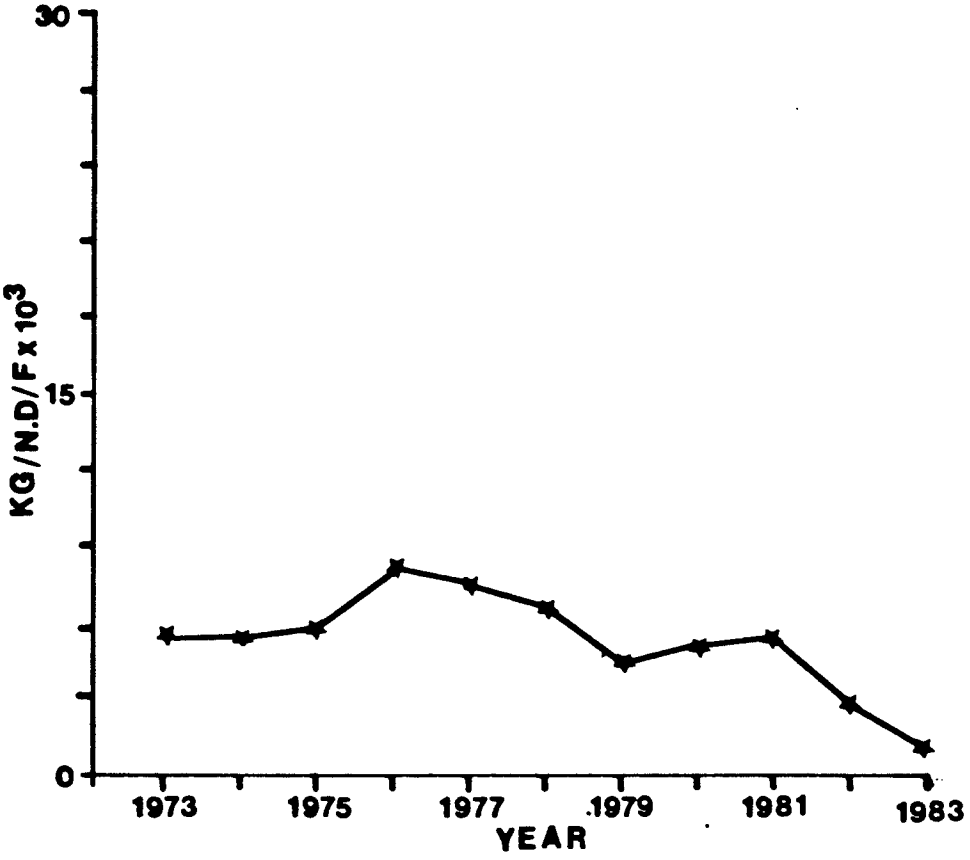

30
15
0
KG/N.D/F x 10^3
1973
1975
1977
1979
1981
1983
YEAR

Figure 11

Sabomin Lake

Note: CUE increased over time.

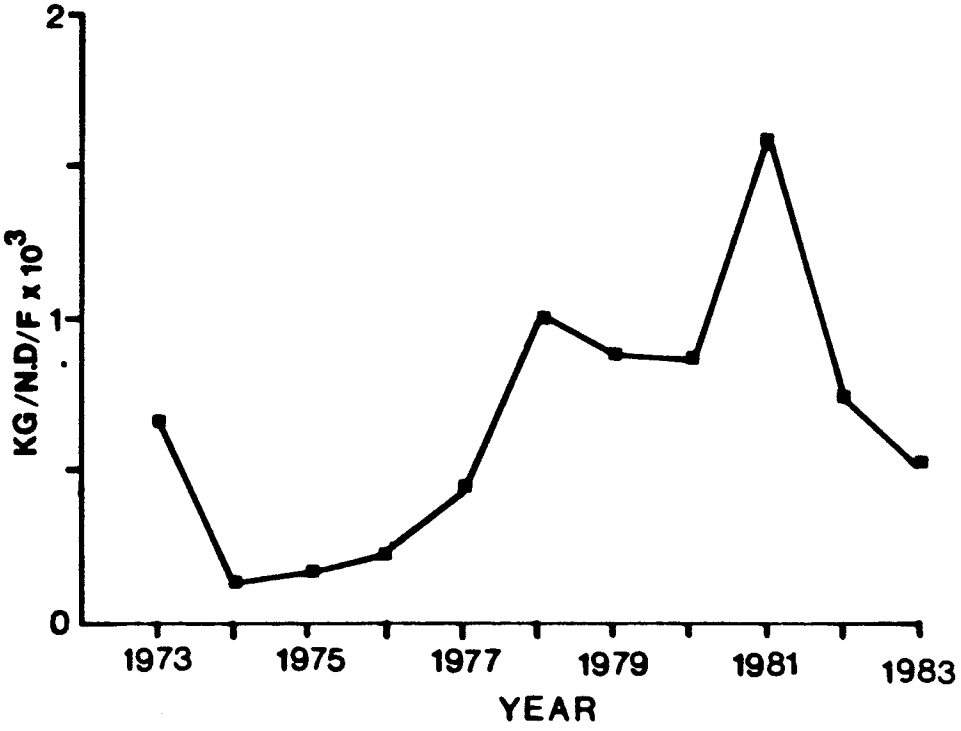
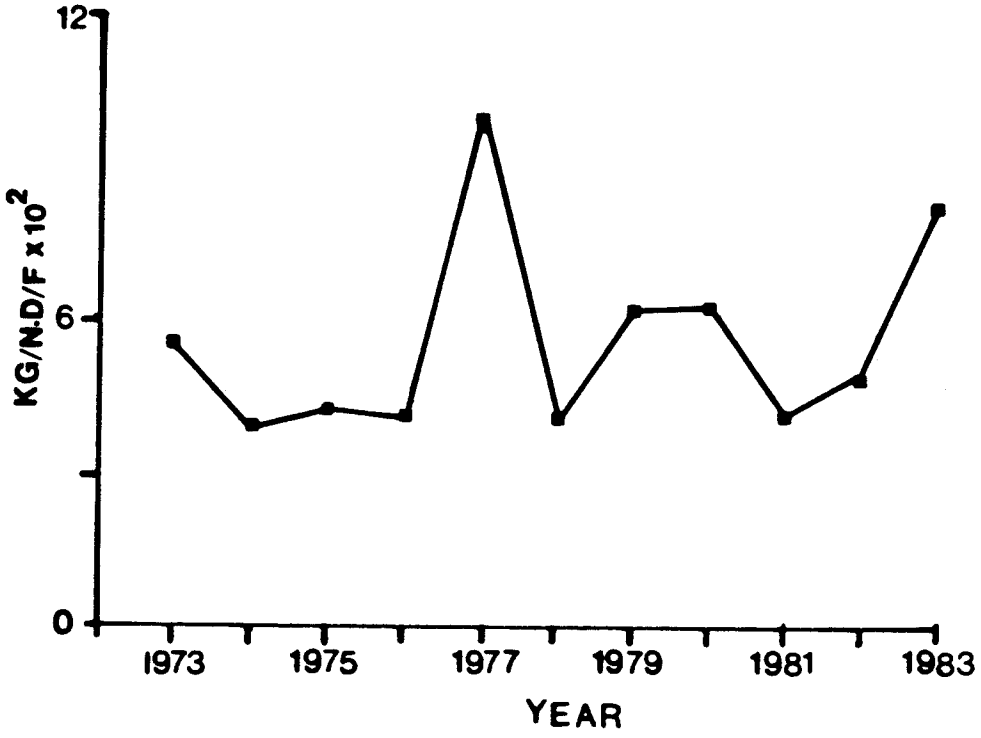

2
1
0
KG/N.D/F x 10^3
1973
1975
1977
1979
1981
1983
YEAR

Figure 12

Patridge Crop Lake

Note: CUE was irregular over time.


12
6
0
KG/N.D/F x10²
1973
1975
1977
1979
1981
1983
YEAR

(d) Temporal Changes in Relative Proportions of Lake Whitefish and Walleyes in Commercial Catches and Landed Values

Appendix Q lists species composition of lake whitefish, walleye, pike and others (in marketed value) for lakes used in this analysis. Appendix R shows temporal changes in yields of the above species over time, 1973-1982. Examples of concomitant changes in lake whitefish and walleye yields in selected lakes are shown in Appendix X. Appendix Y gives regressions of lake whitefish and walleye. Appendix Z lists annual initial summer prices ($/lb.) for the above species offered to fishermen by FFMC.

Appendices X and Y show that there was no consistent correlation between yields of lake whitefish and walleye over time.

Between 1973-1982 the initial summer prices for headless and dressed walleye rose from .49 $/lb. to 1.34 $/lb. (an increase of .85 $/lb.). During the same period the initial summer prices for dressed walleye increased from .44 $/lb. to 1.10 $/lb. (an increase of .66 $/lb.). Prices for export lake whitefish for the same period rose from .29 $/lb. to .43 $/lb. (an increase of .14 $/lb.). The prices for continental lake whitefish rose from .23 $/lb. to .31 $/lb. (an increase of .04 $/lb.). Prices for cutter lake whitefish rose from .15 to .20 $/lb. (an increase of .05 $/lb.).

IV DISCUSSION

a) Species Composition of Cisco, Lake Whitefish, and Pike

Leong and Holmes (1975) noted that the exchange of parasites between species indicated that size of population of other related host species is an important factor in determining the sizes of parasite populations. Interaction of fish species of cisco, lake whitefish and pike has been known to affect abundance of T. crassus levels in lakes (Doan 1945a and b, 1946, 1947 and 1949; Kennedy 1953 and 1954; Kennedy and Doan, 1949; Lawler 1950a, 1950d, 1951a and c, 1952, 1953, 1956, 1957, 1959a, b, and c; Miller 1950 and 1952), primarily because of the nature of the life history of the parasite (Appendix B). Table 5 lists a summary of the major factors studied.

Correlation of presence of cisco in 13 lakes (Appendix C, D; Table 3) with an increase in abundance of T. crassus and lack of correlation between the two variables in the other 13 lakes (Appendix C, F; Table 3) suggests that species composition, though an important factor was not the only possible cause for increased abundance of T. crassus. Perhaps other unknown factors were equally relevant here, considering the wide range of biotic and abiotic features that occur in the lakes.

It is also important to recognize that commercial catch records may not accurately indicate the true species composition in the lakes. Lower grade whitefish and non-quota species (including cisco) are less favourable with fishermen due to poor market prices and could be discarded after being caught (Green and Derksen 1984). This fact could make it difficult to correlate species composition with abundance of T. crassus.

Table 5. Summary of factors in individual lakes, 1973-1983.

Lakes where abundance of T. crassus changed over time, 1973-1983.

Lake Name	A	B	C	D	E	F	G	H
Armstrong	•	–	+	–	1	+	•	1
Barrington	•	•	•	–	2	+	•	2
Bruneau	–	•	+	•	1	+	•	1
Cormorant	+	–	+	+	3	+	+	2
Dafoe	+	•	•	†	1	+	•	1
Herblet	–	+	•	–	1	+	•	2
Pakwa	•	–	+	†	1	+	•	2
Kiski	–	•	+	•	2	+	•	2
Landing	–	+	+	+	2	+	•	1
Setting	–	•	+	–	2	+	–	2
Walker	•	–	+	–	2	+	•	2
Kipanigan	+	–	+	•	2	+	•	3
Kisseynew	•	+	+	+	1	+	•	3
Granville	•	•	+	–	1	+	•	3
Opachuanau	•	–	+	+	1	+	•	2
South Indian	•	–	+	†	3	+	•	3
Gods	+	–	•	•	3	–	•	3

Table 5 (cont'd). Lakes where abundance of T. crassus did not change over time, 1973-1983.

Lake Name	A	B	C	D	E	F	G	H
Butterfly	•	–	–	†	1	–	•	1
Cedar	+	–	–	–	3	–	+	3
Guthrie	•	•	–	+	1	–	•	2
Halfway	–	•	–	–	1	–	•	2
Natawahunan	–	+	–	–	1	–	•	2
Patridge Crop	–	+	•	+	1	–	•	1
Playgreen	+	–	–	–	3	–	•	2
Sipiwesk	•	–	–	–	3	–	•	3
St. Martin	•	+	•	†	?	•	•	3
Wakusko	+	+	–	–	2	–	•	2
William	•	+	•	•	2	–	•	2
Wintering	–	+	–	+	2	–	•	2
Wuskwatim	+	–	–	+	1	–	•	2
Yawningstone	•	–	•	•	1	–	•	1
Sisipuk	+	+	–	–	2	–	•	2
North Indian	•	–	–	†	2	–	•	3
Sabomin	–	+	–	–	1	–	•	1
Witchai	+	+	•	+	1	–	•	2

Table 5 (cont'd). Legend.

A Changes in Fishing Effort
+ lakes in which effort increased over time
- lakes in which effort decreased over time
° irregular fishing effort

B CUE
+ lakes in which CUE increased over time
- lakes in which CUE decreased over time

C Species composition of lake whitefish, pike, and cisco
+ abundance of T. crassus changed (increased) with presence of cisco
- abundance of T. crassus did not change with presence of cisco
° abundance of T. crassus did not change with absence of cisco
* abundance of T. crassus changed with absence of cisco

D Changes in large and medium size proportions of lake whitefish
+ medium sizes increased with decreasing large sizes
- medium sizes decreased with increasing large sizes
° neither of the size classes changed
† none of the above

E Lake size categories
1 small
2 intermediate
3 large

F Changes in abundance of T. crassus
+ lakes in which changes in abundance occurred
- lakes in which no change in abundance occurred

G Changes in catches of lake whitefish and walleye
+ lake whitefish increased with decreasing walleye
- lake whitefish decreased with increasing walleye
° no relationship

H Mean annual productions of lakes
1 low annual production (below 10,000 ha)
2 intermediate (10,000 - 30,000 ha)
3 high (above 30,000 ha)

However, these lower grade fish were more likely to be discarded since they had greater abundance of T. crassus. Consequently, abundances reported from the catches should not have been affected, in fact, T. crassus would appear lower if wormy fish were discarded. The practice of discarding lower grade whitefish would be unlikely to be a problem in lakes with low levels of the parasite since these lakes would be producing more valuable fish.

Geographical location or lake size did not seem to be important factors influencing the response of abundances of T. crassus with regards to species composition. Of the 13 lakes where presence of cisco correlated with levels of the parasite ten lakes were located in the north and north central regions of the Nelson River Watershed (Table 4). Nine of the 13 lakes which had a positive correlation between presence of cisco and changes in abundance of T. crassus were also in the north and north central region of the Nelson River Watershed. Five of the 13 lakes were small lakes.

b) Spatial and Temporal Change in Annual Catch, Effort, CUE, and Lake Whitefish Size Classes

i) Annual Production

Total production of a fishery has sometimes been used as an index of a species (Smith and Krefting 1954). Hile et al. (1951b) observed that production statistics indicated but did not measure changes in abundance of some stocks of Great Lakes.

In this study, irregular fluctuations occurred in 60% of the lakes (Appendix P, Q). Historical catch records for other fisheries like Lesser Slave Lake (Bell et al., 1977), Lake Winnipeg (Davidoff et al., 1973), Georgia Bay (Cucin and Regier, 1966) and Lake Superior (Rackozy,

1983), also showed that whitefish catches fluctuated dramatically from year to year. The usual explanation is that the age structure was driven towards the younger age with increased exploitation.

Although records prior to 1970 were not available, one may assume that the mean weight of exploited lake whitefish in all the 35 lakes changed over time because of the dominance of medium sizes of the fish and very low or complete absence of jumbo sizes in commercial catches. This is because legal mesh sizes for lake whitefish (4 1/4", 5 1/4" and 5 3/4") have not changed during the period (Anon, 1983). Size selectivity of gillnets could, therefore, be assumed to have unchanged. It is also probable that abundance of lake whitefish or the other species of fish have decreased in these lakes.

Decline in catches with increasing abundances of T. crassus in 16 lakes (Armstrong, Barrington, Cormorant, Dafoe, Granville, Kiski, Kisseynew, Landing, Opachuanan, Pakwa, Setting, Walker, Kipahigan, South Indian, Gods, and Bruneau lakes) may indicate that with a shift to lower grade lake whitefish, effort and consequently total catches declined. There was support for this as all the lakes, except Kisseynew, were located in the north and north-central regions (Table 4) where the exploitation of lower grade lake whitefish is not a viable proposition due to lower market prices and high transportation costs (Green and Derksen 1984; Bruce Popko, personal communication). Furthermore, the four lakes with the highest catches (Cedar, St. Martin, William, Playgreen and South Indian lakes) are lakes with low abundances of T. crassus except South Indian lake where abundance of T. crassus increased in the early 1980's. Fluctuations in annual catches may have also been affected by opportunities or tradition in the north (Gislason et al.,

1982).

If illegal mesh sizes were in wide use in the lakes, as they have been known to be in Lake Winnipeg (Pollard 1976) then it could partly contribute to the fluctuations in annual catches observed. However, there was no information available on use of illegal mesh sizes.

ii) Fishing effort, CUE and lake whitefish size classes

It is generally thought that after initial exploitation of a fish population, the population stabilises at a new lower level (Beverton and Holt 1957; Ricker 1940). Usually the catch, CUE, increases with increasing effort for the initial phase of exploitation, then it levels off and starts to decline with continued increase in effort (Ricker, 1940).

In this study CUE declined from 1973-1983 in 40% of the lakes (Butterfly, Cedar, Wuskwatim, Armstrong, Yawningstone, Opachuanau, Playgreen, Pakwa, Sipiwesk, Walker, Cormorant, Gods, South Indian, and Kipahigan lakes). In Kipahigan, Cormorant, Wuskwatim, Playgreen, and Gods, CUE decreased with increasing effort. CUE decreased with inconsistent fishing effort in the remaining nine lakes (Appendix W). Catch/delivery in relation to numbers of delivery showed similar patterns in the above lakes. These trends, along with inconsistent fluctuations of annual yield, suggest that the lakes have already gone through their profitable phase of exploitation.

Whether overfishing has occurred or not, the lake whitefish fishing in all 35 lakes studied heavily depends on medium sized lake whitefish with little or no jumbo sized whitefish (Appendix H, I). It was also observed that medium sized lake whitefish increased in catch records

with a corresponding decrease in large sized lake whitefish. Medium sized lake whitefish decreased in catch records as large sized lake whitefish increased. These observations suggest that the fish population was compensating in response to exploitation. Perhaps medium sized lake whitefish grew to larger sizes as the fishery recovered from exploitation. As the large sizes are fished out, their numbers decreased in the catches and once again the medium sized lake whitefish increased in numbers.

An increase in growth rate of whitefish following an increase in exploitation is not unusual. It has been documented for Pigeon Lake, Alberta (Miller 1947). In Pigeon Lake whitefish were 5 cm larger at age 4 after an increase in fishing effort (Miller 1947). Healey (1975) observed rapid growth in heavily exploited fish. Trends in Lake Winnipeg whitefish populations towards increased rates of growth and higher annual rates of total mortality (natural and fishing) were believed to be largely the result of progressively intensified fishing effort (Rybicki and Doan 1966). Miller (1947, 1947, 1956, and 1978), Sopuck (1968), and O'Connor (1982) noted that when whitefish were exploited, they grew faster.

From the economic point of view, because natural resources are limited, as the size of a population increases, supplies for individuals decrease. The reverse situation is observed when the population size decreases (Sauvy 1966). The increase and decrease of medium and large sized lake whitefish may be explained by this theory. Perhaps, with a decrease in fishing pressure, the fish population increased as indicated by CUE. Consequently, fewer resources were available per individual fish, which resulted in a decrease in feeding rate. This led to the

dominance of the medium sizes in commercial catches. The decrease in numbers of the medium sized lake whitefish and corresponding increase in large sized lake whitefish could be interpreted as medium sizes growing to larger sizes with an increase in feeding rate. Since maturation is a size specific process rather than an age specific process (Lysack 1980), the fish may have matured at different ages, which in itself could partly explain the irregular fluctuations observed in commercial catch records. However, without age data, this is largely speculation.

Assuming that the plankton on which the fish fed were infected with T. crassus, then a faster rate of feeding of 0-4 year old lake whitefish could increase the risk of infection with the parasite, because of the feeding habit of lake whitefish (Miller 1952). This situation probably occurred in Armstrong, Opachuanan, Sipiwesk, Walker, Cormorant, Gods, South Indian, and Kipahigan Lakes. All eight of these lakes had relatively high proportions of medium size lake whitefish with declining CUE and also had high abundances of T. crassus. However, five of the lakes (Guthrie, Wintering, Patridge Crop, Wuskwatim, and Witchai lakes) had the same conditions, but abundances of T. crassus were low in these lakes.

Lack of a correlation between abundances of T. crassus, lake whitefish sizes and CUE in Butterfly, Cedar, Yawningstone, Playgreen, Pakwa, Sipiwesk, William, Gods, and Kipaligan lakes may be due to lack of sufficient compensatory response on the part of the fish or lack of the fishing pressure that would induce the response.

Errors in the reporting of catches, sampling, the possibility to change catches from different lakes may all add to the [illegible] of statistical agreement in the data. The sampling and inspection of lake

whitefish for T. crassus by DFO are based on the rate of rejection of shipments delivered to FFMC. As a result lake classification may not be based on annual data. For example, Guthrie Lake was last sampled for T. crassus in 1979, Bruneau, Cormorant, Wuskwatim, and Natawahunan in 1980, Patridge Crop in 1976, Sabomin in 1979 and Dafoe in 1981. In Guthrie, Cormorant, Wuskwatim, and Patridge Crop lakes, medium sized lake whitefish increased as large sizes decreased. CUE decreased in four lakes (Wuskwatim, Guthrie and Cormorant Lakes Partridge Crop). It is probable that Wuskwatim and Guthrie (lakes currently classified as quality "A" lakes) may have higher abundances of T. crassus even though shipments from the lakes have not been rejected from 1974-1983. In Sabomin and Natawahunan lakes, mediums decreased as large lake whitefish increased. CUE decreased with decreasing effort in the three lakes indicating probably that overfishing has not occurred in them. This does not mean that abundances of T. crassus did not increase in the two lakes. In addition, cisco, lake whitefish, and pike were present in all the catches of these lakes.

iii) Mean flow rates for the month of May (early 1970's) as a factor in commercial catch levels in the mid 1970's

Studies of factors affecting the abundance of fish populations showed the importance of conditions during the early stages of year classes (Derksen 1966). Correlations obtained between May flow rates in the early 1970's and high yields in the mid 1970's, in the three watersheds are in agreement with other findings. Ricker (1954) noted that contributions of a year class of fish to a fishery could depend upon environmental conditions present during spawning, incubation, and fry stages for that year class. Derksen (1966) correlated discharges

from the Saskatchewan River in May and June 1955 with subsequent yields (six years later) in walleye catches in Cedar and Moose Lakes. Derksen (1966) associated poor catches in 1959 with weak classes in 1953 when discharges were low and concluded that the success of commercial fishery in the two lakes was related to the effect of discharge on year class strength of walleyes.

The effect of flow rates on the success of a year class may depend on the availability of more spawning area (Eschmeyer, 1950), dispersion of juveniles, thus avoiding overcrowding and severe competition for food (Webster, 1954), moderation of water temperatures (Johnson, 1961; Christie, 1963; Lawler, 1965), increase in levels of dissolved oxygen (Derksen, 1966; Stone, 1963). Years of high spring flows may be associated with early ice break-up due to earlier high temperatures (Derksen 1966; Derback, 1947). Hill (1941) suggested that heavy rainfall promoted good first-year growth of rock bass in Nelson Lake, Wisconsin, by necessary organic materials and nutrient salts in the system. These factors favour production, and by increasing the level of production in a year, fish born in that year are favoured.

Although limnological data were not available and it is not sure what caused the high flow rates recorded in the early 1970's in the three watersheds, the positive correlations strongly suggest a hydrological influence on the catches of the mid 1970's.

iv) Lake parameters

The size of a lake is considered to be one measure of island size for fishes and their parentes (Leong, 1975). In this study eight of the 17 small size lakes (lakes with areas less than 10,000 ha) had high

abundances of T. crassus (Appendix E, Table 3). Seven of the ten intermediate size lakes had high abundance of T. crassus and the remaining three lakes had low abundances. It is difficult to determine from this information the role of lake size in determining the abundance of T. crassus.

The higher yield from large size lakes were correlated with higher effort expended in these lakes. Other factors thought to contribute to the better yields in these lakes were their good potential and convenient access (Green and Derksen, 1984). The higher fishing intensity in the small size lakes (Appendix E) was associated with ease in exploitation per unit of surface area (Ryder et al. 1974).

c) Geographical Distribution of Lakes

Oakland (1949) observed significant differences in levels of T. crassus in lake whitefish samples collected nine miles apart. In South Indian Lake, Sunde (1963) observed similar differences in samples collected two miles apart.

Most of the lakes in this study (29 lakes) were located in the north (7) and north-central (22 lakes) regions. The six lakes in the southern region had low levels of T. crassus. The northern lakes comprised 5 lakes with high levels of T. crassus and two with low levels of the parasite. The data showed that north or north-central lakes were more heavily infested, in general. Distribution of lakes according to watershed was not in itself an apparent factor in determining abundance of T. crassus.

d) Differential Value of Lake Whitefish and Walleye

No consistent relationship in the annual yield of lake whitefish

and walleye were observed. This could be due to the fact that lake whitefish stocks responded to a greater extent and faster to exploitation than walleye stocks. Lysack (1982) observed this situation in Cedar Lake. As a result, although walleye may be preferred over lake whitefish as indicated by the price structure (Appendix Z), this did not seem to be the case in the commercial yield of the two species. Other socioeconomic factors such as cost of food, alternate sources of income (construction, hydroelectric developments) and cost of gasoline undoubtedly would have a substantial influence on the intensity of fishing of a lake in a given year. Nevertheless, the most significant effect on fishing effort over the time period analysed appeared to be a shift of lake classification to a lower grade.

V. CONCLUSION AND RECOMMENDATIONS

1. Several factors are involved in determining abundance of Triaenophorus crassus in commercially fished lakes, i.e. size distribution of lake whitefish, fishing effort, annual production levels and species composition of cisco, lake whitefish and pike. Fishing effort was thought to affect size distribution of lake whitefish and annual production levels, which in turn were related to abundance of T. crassus. A decline in fishing effort was correlated with a decline in annual production levels and an increase in T. crassus. Irregular fluctuations in annual production levels were related to infection levels probably as a result of removal of jumbo and large classes of lake whitefish. Medium sized lake whitefish increased as large sized lake whitefish decreased and large sized lake whitefish increased as medium sized lake whitefish decreased. These changes in size structure were correlated to fishing effort and abundances of T. crassus. By changing the size structure in the commercial catches, effort affected abundance of T. crassus. It is recommended that quotes be reduced in lakes with substantial and irregular fluctuations in production and an increase in abundance of T. crassus. This could produce annual production levels and a size structure that could reduce abundance of T. crassus in commercial catches. Cisco is known to be more heavily infected than lake whitefish and it was expected that with large numbers of cisco in commercial catches, abundance of T. crassus would be higher. The data did not confirm this to be the case in commercially fished lakes because the harvesting records for cisco, especially in those

lakes with high abundances of T. crassus, were inaccurate.

2. To further strengthen findings of this study, it is imperative to closely monitor lake classes by sampling lakes more frequently, using standard gangs to determine which size and age classes are acquiring T. crassus. By determining the age structure of the fish, it is possible to determine if the larger sizes are older or simply faster growing younger fish. Since fast growing younger fish may be less heavily infected, i.e. numbers of cysts/unit weight of fish, this information may help explain infection trends and suggest rates of harvesting the different size classes of whitefish.

3. Fishermen generally prefer walleye to lake whitefish in their catch but there is no conclusive evidence that trends in harvesting the two species depends heavily on differences in their values;

4. The general trend was towards a change in lake classification to a lower category of lake whitefish. It is difficult to predict which lakes will change to a lower class, given the current data available and the spotty nature of sampling the commercial catches. It is therefore important to determine the age structure and infection levels according to age groups, at least every 3-5 years in lakes with high value whitefish. This is particularly true for Guthrie, Sabomin, Patridge Crop, Cormorant, and Natawahunan Lakes, which have high productivity. It is difficult to "second guess" what happened in a specific lake after its classification has changed. A careful monitoring of selected lakes (age and size classes of fish and parasite levels) would certainly improve our ability to predict changes. Perhaps altering fishing patterns, either decreasing or increasing the harvest, could dampen fluctuations in parasite abundances that appear to be tied to

proportions of medium and large lake whitefish in a given lake.

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APPENDICES

Appendix A

Taxonomy of *Triaenophorus crassus*

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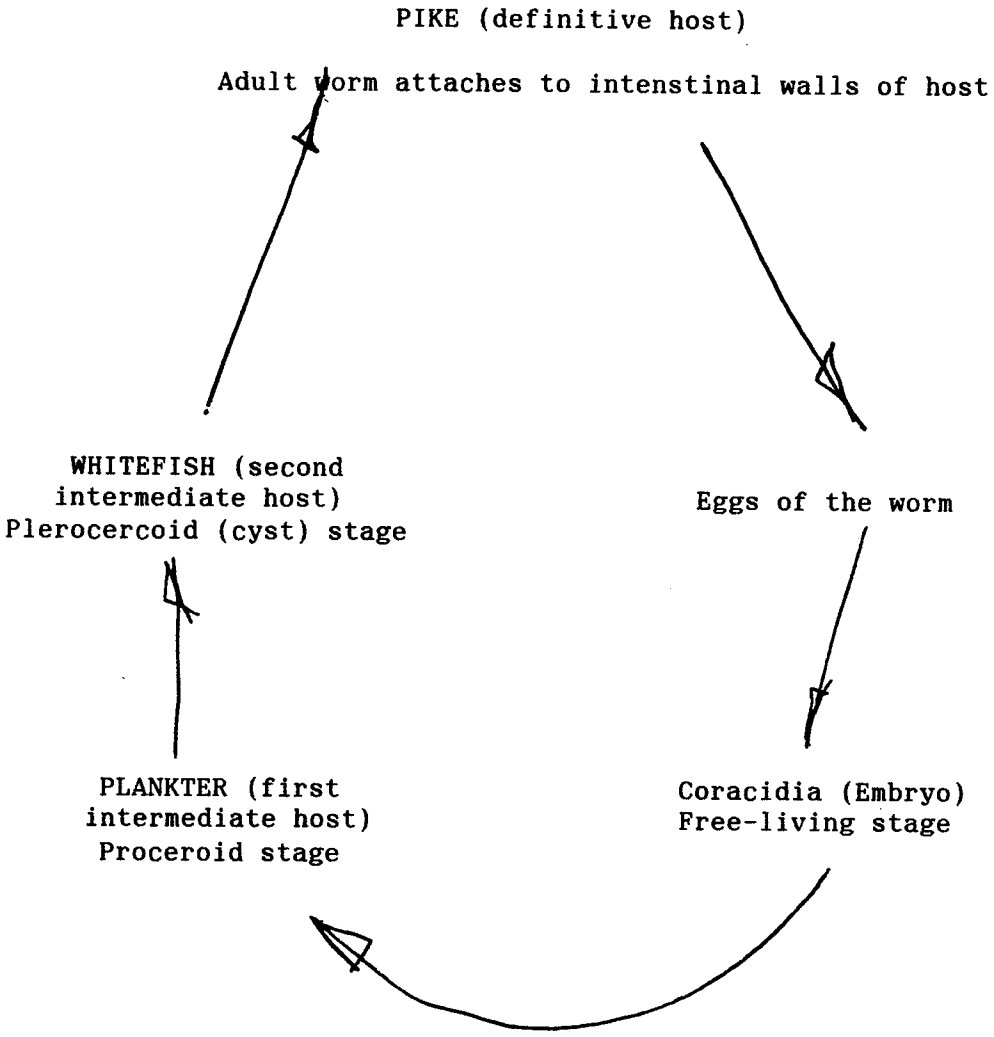
Phylum	Platyhelminthes
Class	Cestoda
Subclass	Eucestoda
Order	Pseudophyllidea
Family	Triaenophoridea Lonnberg, 1889
Genus	*Triaenophorus* Rudolphi, 1793
Syn.	*Tricuspidaria* Rudolphi, 1793
Species	*T. crassus* Forel, 1868
Syn.	*T. robustus* Olsson, 1893
Syn.	*T. tricuspidatus* Morpha megadentatus Warlde, 1932

Appendix B

Life Cycle of *Triaenophorus crassus* Forel



Appendix C

Fish grade composition of lake whitefish, cisco and pike by lake, 1973-1983

Appendix C

Fish grade composition of lake whitefish, cisco, and pike (kg round weight) by lake for the period 1973–1983

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Armstrong	1973, 1973/74	–	6,049	–	–	6,049	–	–	–	–	623
	1974, 1974/75	–	4,569	–	–	4,569	2,374	4,269	–	6,643	2,880
	1975, 1975/76	–	755	–	–	755	–	2,055	–	2,055	850
	1976, 1976/77	–	1,039	–	–	1,039	–	–	2,678	2,678	892
	1977, 1977/78	–	–	–	–	–	–	–	–	–	–
	1978, 1978/79	–	434	–	–	434	–	–	85	85	285
	1979, 1979/80	–	5,071	–	–	5,071	–	–	2,274	2,274	1,370
	1980, 1980/81	–	6,392	–	–	6,392	–	–	2,558	2,558	1,427
	1981, 1981/82	–	4,784	–	–	4,784	–	–	1,689	1,689	2,220
	1982, 1982/83	–	4,855	–	–	4,855	–	–	–	–	1,165
	1983	–	1,974	–	–	1,974	–	–	–	–	7,729
Barrington	1973, 1973/74	–	8,468	22	–	8,490	–	–	–	–	6,512
	1974, 1974/75	–	2,399	–	–	2,399	–	–	–	–	1,261
	1975, 1975/76	1,077	6,316	–	–	7,388	–	–	–	–	3,572
	1976, 1976/77	–	18,028	–	–	18,028	–	–	–	–	3,357
	1977, 1977/78	–	11,866	–	–	11,866	–	–	–	–	2,286
	1978, 1978/79	–	16,853	–	–	16.853	–	–	–	–	6,386
	1979, 1979/80	–	15,675	–	–	15,675	–	–	–	–	3,114
	1980, 1980/81	–	–	9,074	–	9,074	–	–	–	–	9,274

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Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Barrington (cont'd)	1981, 1981/82	–	–	2,961	–	2,961	–	–	–	–	5,160
	1982, 1982/83	–	–	11,503	114	11,614	–	–	–	–	7,216
Bruneau	1973, 1973/74	637	–	–	–	637	–	–	–	–	1,336
	1974, 1974/75	3,456	–	–	–	3,456	–	576	–	576	2,741
	1975, 1975/76	1,449	–	–	–	1,449	–	–	5	728	3,157
	1976, 1976/77	878	–	–	–	878	–	–	5	5	2,866
	1977, 1977/78	296	–	–	–	296	–	–	9	9	2,957
	1978, 1978/79	537	–	–	–	537	–	–	81	81	–
	1979, 1979/80	2,281	–	–	–	2,281	–	–	116	116	1,284
	1980, 1980/81	–	564	–	–	564	–	–	–	–	6,787
	1981, 1981/82	–	876	–	–	876	–	–	50	50	1,071
	1982, 1982/83	–	231	–	–	231	–	73	–	73	3,064
	1983	–	250	–	–	250	–	133	–	133	1,206
Butterfly	1973, 1973/74	–	–	–	–	–	–	–	–	–	–
	1974, 1974/75	–	124	–	–	124	–	97	–	97	856
	1975, 1975/76	–	577	–	–	577	172	–	–	172	824
	1976, 1976/77	–	4,442	–	–	4,442	–	1,657	–	1,657	330
	1977, 1977/78	–	2,037	–	–	2,037	–	575	–	575	157
	1978, 1978/79	220	–	–	–	220	–	–	–	–	291
	1979, 1979/80	1,585	–	–	–	1,585	–	174	–	174	1,247
	1980, 1980/81	395	–	–	–	395	331	–	–	331	664

Continued on page 109

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Butterfly (cont'd)	1981, 1981/82	931	–	–	–	931	6	–	–	6	48
	1982, 1982/83	945	–	–	–	945	–	–	–	–	83
	1983	–	–	–	–	–	–	–	–	–	–
Cedar	1973, 1973/74	97,712	–	–	–	97,712	19,912	56,801	–	75,993	255,009
	1974, 1974/75	87,349	–	–	–	87,349	86,003	15,286	–	101,289	239,045
	1975, 1975/76	56,733	–	–	–	56,733	29,681	901	–	30,582	259,650
	1976, 1976/77	93,547	–	–	–	93,547	77,573	98	–	77,671	358,809
	1977, 1977/78	137,662	–	–	–	137,662	168,840	159	–	168,999	378,018
	1978, 1978/79	202,703	–	–	–	202,703	233,537	–	–	233,537	376,595
	1979, 1979/80	183,175	–	–	–	183,175	171,059	57	–	171,116	396,823
	1980, 1980/81	159,866	–	–	–	159,866	201,106	–	–	201,106	370,523
	1981, 1981/82	71,809	–	–	–	71,809	146,456	–	–	146,456	234,193
	1982, 1982/83	70,886	–	–	96	70,982	105,143	–	–	105,143	265,835
	1983	59,144	–	–	474	59,619	75,165	–	–	75,165	33,651
Cormorant	1973, 1973/74	–	–	10,538	–	10,538	–	127	–	127	2,289
	1974, 1974/75	–	–	2,198	–	2,198	–	3,006	–	3,006	3,041
	1975, 1975/76	–	–	463	–	463	–	–	–	–	2,136
	1976, 1976/77	–	–	2,273	–	2,273	–	390	–	390	2,637
	1977, 1977/78	–	–	906	–	906	–	–	–	–	4,757
	1978, 1978/79	–	7,540	–	–	7,540	–	–	–	–	4,132
	1979, 1979/80	–	12,634	4,506	–	17,140	–	–	–	–	5,985
	1980, 1980/81	–	10,786	8,093	–	18,879	–	–	–	–	4,928

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Appendix C (cont'd)

Lake	Time (year)	Species Composition (kg rouund weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Cormorant (cont'd)	1981, 1981/82	–	2,458	–	–	2,458	–	–	–	–	5,990
	1982, 1982/83	–	3,918	–	–	3,918	664	–	–	664	10,472
	1983	–	–	–	–	–	–	–	–	–	–
Dafoe	1973, 1973/74	–	927	–	–	927	–	759	–	759	785
	1974, 1974/75	–	–	–	–	–	–	–	–	–	–
	1975, 1975/76	–	–	–	–	–	–	–	–	–	–
	1976, 1976/77	–	1,763	–	–	1,763	–	–	–	–	2,223
	1977, 1977/78	–	3,566	–	–	3,566	–	–	–	–	616
	1978, 1978/79	–	4,126	–	–	4,126	–	–	–	–	2,507
	1979, 1979/80	–	3,410	–	–	3,410	–	–	–	–	2,183
	1980, 1980/81	–	4,167	–	–	4,167	–	–	–	–	927
	1981, 1981/82	–	–	–	–	–	–	–	–	–	–
	1982, 1982/83	–	–	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–	–	–
Gods	1973, 1973/74	–	–	–	–	–	–	–	–	–	–
	1974, 1974/75	–	160,691	–	–	160,691	–	–	–	–	1,474
	1975, 1975/76	–	105,922	–	–	105,922	–	–	–	–	709
	1976, 1976/77	–	52,293	–	–	52,293	–	–	–	–	20
	1977, 1977/78	–	84,343	–	–	84,343	–	–	–	–	515
	1978, 1978/79	–	62,476	–	–	62,476	–	–	–	–	1,321
	1979, 1979/80	–	41,563	–	–	41,563	–	–	–	–	3,571
	1980, 1980/81	–	74,714	–	–	74,714	–	–	–	–	8,526

Continued on page 111

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Gods (cont'd)	1981, 1981/82	–	–	–	–	–	–	–	–	–	–
	1982, 1982/83	8,052	6,982	13,795	–	28,829	–	–	–	–	337
	1983	–	–	–	–	–	–	–	–	–	–
Granville	1973, 1973/74	–	15,813	–	–	15,813	–	–	–	–	1,357
	1974, 1974/75	–	8,144	–	–	8,144	–	5	–	5	3,483
	1975, 1975/76	–	18,365	–	–	18,365	–	2	–	2	1,968
	1976, 1976/77	–	37,694	–	–	37,694	–	–	–	–	9,939
	1977, 1977/78	505	56,712	–	–	57,217	–	20	–	20	16,771
	1978, 1978/79	–	19,387	–	–	19,387	–	–	–	–	18,177
	1979, 1979/80	–	35,938	–	–	35,938	–	3,946	–	3,946	27,907
	1980, 1980/81	–	18,334	–	39	18,373	–	2,726	–	2,726	24,386
	1981, 1981/82	–	6,185	–	–	6,185	31	2,655	–	2,686	16,333
	1982, 1982/83	–	30,599	–	721	31,480	–	97	–	97	31,444
	1983	–	1,849	–	–	1,849	–	162	–	162	5,588
Guthrie	1973, 1973/74	–	1,257	–	–	1,257	–	–	–	–	4,124
	1974, 1974/75	–	3,061	–	–	3,061	–	–	–	–	3,907
	1975, 1975/76	–	3,663	–	–	3,663	–	4,046	–	4,046	2,637
	1976, 1976/77	–	10,778	–	–	10,778	–	982	–	982	827
	1977, 1977/78	–	10,730	–	–	10,730	–	6,873	–	6,873	781
	1978, 1978/79	–	1,306	–	–	1,306	–	5,290	–	5,290	7,229
	1979, 1979/80	521	–	–	–	521	1,682	3,062	–	4,744	5,909
	1980, 1980/81	4,824	–	–	–	4,824	–	1,339	–	1,339	4,432
	1981, 1981/82	5,897	–	–	–	5,897	–	–	–	–	2,217

Continued on page 112

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Guthrie (cont'd)	1982, 1982/83	235	–	–	–	235	–	–	–	–	4,357
	1983	1,480	–	–	–	1,480	–	–	–	–	2,675
Halfway	1973, 1973/74	19,531	–	–	–	19,531	5,105	–	–	5,105	1,615
	1974, 1974/75	11,444	–	–	–	11,444	5,439	15,373	–	20,812	1,082
	1975, 1975/76	2,097	–	–	–	2,097	10,527	5,897	–	16,424	1,118
	1976, 1976/77	3,798	–	–	–	3,798	20,458	3,482	–	23,940	4,614
	1977, 1977/78	6,461	–	–	566	6,461	9,402	–	–	9,402	4,273
	1978, 1978/79	867	–	–	–	867	1,289	–	–	1,289	2,112
	1979, 1979/80	4,672	–	–	–	4,672	10,058	–	–	10,058	3,433
	1980, 1980/81	10,863	–	–	20	10,883	2,311	2,653	–	4,964	3,025
	1981, 1981/82	6,358	–	–	–	6,358	6,504	–	–	6,504	1,692
	1982, 1982/83	12,658	–	–	–	12,658	3,774	–	–	3,774	898
	1983	9,758	–	–	–	9,758	6,074	–	–	6,074	675
Herblet	1973, 1973/74	–	3,853	–	–	3,853	–	–	–	–	1,236
	1974, 1974/75	–	4,670	–	–	4,670	–	–	–	–	1,589
	1975, 1975/76	–	6,993	–	–	6,993	–	–	–	–	2,076
	1976, 1976/77	–	9,613	–	–	9,613	–	–	–	–	1,762
	1977, 1977/78	–	7,612	–	–	7,612	–	–	–	–	4,914
	1978, 1978/79	–	9,897	–	–	9,897	–	–	–	–	3,596
	1979, 1979/80	–	6,417	–	–	6,417	–	–	–	–	4,778
	1980, 1980/81	8,830	–	–	–	8,830	–	–	–	–	3,078
	1981, 1981/82	15,230	–	–	–	15,230	–	–	–	–	1,695
	1982, 1982/83	76	–	–	–	76	–	–	–	–	155

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Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Herblet (cont'd)	1983	–	14,116	–	378	14,494	–	–	–	–	956
Kipahigan	1973, 1973/74	–	28,483	–	–	28,483	–	–	–	–	7,022
	1974, 1974/75	–	21,764	–	–	21,764	–	19,564	–	19,564	5,648
	1975, 1975/76	–	22,444	–	–	22,444	–	8,981	–	8,981	3,427
	1976, 1976/77	–	27,548	–	–	27,548	–	5,822	–	5,822	1,900
	1977, 1977/78	–	22,481	–	–	22,481	–	266	–	266	1,728
	1978, 1978/79	–	17,624	–	–	17,624	–	–	–	–	1,041
	1979, 1979/80	–	5,500	–	–	5,500	–	5,342	–	5,342	3,130
	1980, 1980/81	–	–	–	–	–	–	375	–	375	2,542
	1981, 1981/82	–	–	–	–	–	–	–	–	–	1,529
	1982, 1982/83	–	–	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–	–	2,687
Kiski	1973, 1973/74	457	–	–	–	457	–	51	–	51	2,288
	1974, 1974/75	547	–	–	–	547	–	656	–	656	2,108
	1975, 1975/76	142	–	–	–	142	–	–	–	–	1,828
	1976, 1976/77	55	–	–	–	55	–	48	–	48	322
	1977, 1977/78	190	–	–	–	190	–	183	–	183	1,675
	1978, 1978/79	388	–	–	–	388	–	212	–	212	916
	1979, 1979/80	201	–	–	–	201	83	2	–	85	316
	1980, 1981/82	–	–	–	–	–	–	–	–	–	–
	1981, 1981/82	–	757	–	–	757	–	742	–	742	633
	1982, 1982/83	–	–	–	–	–	–	–	–	–	–

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Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Kisiki (cont'd)	1983	–	294	–	–	294	–	344	–	344	1,330
Kisseynew	1973, 1973/74	–	2,630	–	–	2,630	59	5,665	–	5,724	3,336
	1974, 1974/75	–	4,337	–	–	4,337	–	–	–	–	4,927
	1975, 1975/76	–	9,847	–	–	9,847	–	1	–	1	3,246
	1976, 1976/77	–	5,066	–	–	5,066	–	4,865	–	4,865	6,151
	1977, 1977/78	–	17,317	–	–	17,317	–	439	–	439	810
	1978, 1978/79	–	16,344	–	–	16,344	–	2,340	–	2,340	5,903
	1979, 1979/80	–	10,808	–	–	10,808	–	5,885	–	5,885	5,521
	1980, 1980/81	–	4,425	60	–	4,485	–	6,156	–	6,156	6,593
	1981, 1981/82	–	5,066	–	62	5,128	–	–	–	–	3,468
	1982, 1982/83	–	10,225	–	–	10,225	–	433	–	433	7,250
	1983	–	7,024	–	–	7,024	–	–	–	–	4,846
Landing	1973, 1973/74	–	12,964	–	–	12,964	–	–	–	–	7,127
	1974, 1974/75	–	13,865	–	–	13,865	–	–	–	–	5,357
	1975, 1975/76	–	9,477	–	–	9,477	–	–	–	–	4,118
	1976, 1976/77	–	–	–	–	–	–	89	–	89	492
	1977, 1977/78	–	17,354	–	–	17,354	–	–	–	–	–
	1978, 1978/79	–	5,620	–	–	5,620	–	31	–	31	1,452
	1979, 1979/80	–	13,433	–	–	13,433	–	1,188	–	1,188	3,837
	1980, 1980/81	–	3,705	–	–	3,705	–	772	–	772	4,532
	1981, 1981/82	–	4,277	–	–	4,277	–	1,431	–	1,431	7,207
	1982, 1982/83	–	17,598	–	–	17,598	–	3,264	–	3,264	9,079
	1983	–	1,376	–	–	1,376	–	–	–	–	3,264

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Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Natawahunan	1973, 1973/74	321	-	-	-	321	-	-	-	-	-
	1974, 1974/75	5,644	-	-	-	5,644	-	-	-	-	1,618
	1975, 1975/76	3,967	-	-	-	3,967	-	-	-	-	1,033
	1976, 1976/77	4,694	-	-	-	4,694	-	-	-	-	322
	1977, 1977/78	4,669	-	-	-	4,669	-	-	-	-	1,031
	1978, 1978/79	-	-	-	-	-	-	-	-	-	-
	1979, 1979/80	8,962	-	88	-	9,050	-	515	-	515	1,804
	1980, 1980/81	6,988	-	-	-	6,988	-	26	-	26	4,146
	1981, 1981/82	2,204	-	-	-	2,204	-	-	-	-	2,350
	1982, 1982/83	5,058	-	-	-	5,058	-	1	-	1	1,905
	1983	5,793	-	-	-	5,793	229	-	-	229	343
Northern Indian	1973, 1973/74	48,786	-	-	-	48,786	-	-	-	-	47
	1974, 1974/75	6,190	-	-	-	6,190	-	-	-	-	392
	1975, 1975/76	-	913	-	-	913	-	-	-	-	57,374
	1976, 1976/77	40,183	-	-	-	40,183	-	-	-	-	13,092
	1977, 1977/78	-	-	-	-	-	-	-	-	-	-
	1978, 1978/79	45,153	-	-	-	45,153	-	-	-	-	4,208
	1979, 1979/80	3,960	-	-	15	3,975	-	-	-	-	1,252
	1980, 1980/81	-	-	-	-	4,284	-	-	-	-	2,144
	1981, 1981/82	23,511	-	-	-	23,511	16	67	-	83	3,122
	1982, 1982/83	7,767	-	-	204	7,971	-	540	-	540	14,244
	1983	7,332	-	-	-	7,332	-	830	-	830	5,040
Opachuanau	1973, 1973/74	-	5,397	-	-	5,397	-	-	-	-	1,929

Continued on page 116

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Opachuanau (cont'd)	1974, 1974/75	–	–	–	–	–	–	–	–	–	–
	1975, 1975/76	–	7,960	–	–	7,960	–	–	–	–	1,170
	1976, 1976/77	–	9,611	–	–	9,611	–	–	–	–	3,971
	1977, 1977/78	–	16,116	–	–	16,116	–	–	–	–	1,803
	1978, 1978/79	–	18,225	–	–	18,225	–	137	–	137	5,603
	1979, 1979/80	–	5,893	–	–	5,893	–	844	–	844	1,763
	1980, 1980/81	–	10,521	–	–	10,521	–	1,520	–	1,520	6,027
	1981, 1981/82	–	7,341	–	–	7,341	–	1,797	–	1,797	5,842
	1982, 1982/83	–	18,869	–	1,458	20,328	2,104	–	–	2,104	11,917
	1983	–	3,811	–	–	3,811	–	2,017	–	2,017	3,266
Pakwa	1973, 1973/74	–	12,744	–	–	12,744	–	–	–	–	2,140
	1974, 1974/75	–	12,907	–	–	12,907	–	107	–	107	1,737
	1975, 1975/76	–	10,441	–	–	10,441	–	3,372	–	3,372	2,273
	1976, 1976/77	–	8,420	–	–	8,420	–	4,217	–	4,217	1,783
	1977, 1977/78	–	1,879	–	–	1,879	–	4,813	–	4,813	4,162
	1978, 1978/79	–	7,086	–	–	7,086	–	2,190	–	2,190	1,904
	1979, 1979/80	–	4,314	–	–	4,314	–	1,734	–	1,734	1,498
	1980, 1980/81	–	8,302	–	–	8,302	–	2,248	–	2,248	928
	1981, 1981/82	–	6,370	–	–	6,370	–	3,117	–	3,117	2,299
	1982, 1982/83	–	7,886	–	–	7,886	–	4,681	–	4,681	2,398
	1983	–	–	–	–	–	–	–	–	–	–
Patridge Crop	1973, 1973/74	3,671	3,991	–	–	7,662	–	–	–	–	1,526

Continued on page 117

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Patridge Crop (cont'd)	1974, 1974/75	9,893	–	–	–	9,893	–	–	–	–	2,747
	1975, 1975/76	7,167	–	–	–	7,167	–	–	–	–	3,367
	1976, 1976/77	6,690	–	–	–	6,690	–	–	–	–	2,160
	1977, 1977/78	8,300	–	–	–	8,300	–	–	–	–	1,393
	1978, 1978/79	1,350	–	–	–	1,360	–	–	–	–	1,091
	1979, 1979/80	1,571	–	–	–	1,571	–	–	–	–	727
	1980, 1980/81	1,229	–	–	–	1,229	–	–	–	–	937
	1981, 1981/82	519	–	–	–	519	–	–	–	–	724
	1982, 1982/83	–	1,176	–	–	1,176	–	–	–	–	1,585
	1983	2,037	–	–	–	2,037	–	–	–	–	900
Playgreen	1973, 1973/74	9,712	–	180,412	–	190,124	7,250	1,760	–	8,010	12,863
	1974, 1974/75	20,840	–	159,017	–	179,857	–	2,276	–	2,276	21,145
	1975, 1975/76	29,459	–	161,292	–	190,759	–	2,946	–	2,946	7,828
	1976, 1976/77	24,126	183,948	–	–	208,074	7,233	858	–	8,091	15,238
	1977, 1977/78	21,507	200,322	–	–	221,829	–	2,114	–	2,114	6,136
	1978, 1978/79	31,597	208,685	–	–	240,282	790	–	–	790	11,210
	1979, 1979/80	19,883	224,793	–	–	244,676	–	–	–	–	25,894
	1980, 1980/81	14,321	224,793	–	36	239,150	–	–	–	–	–
	1981, 1981/82	–	20,300	–	–	20,300	667	–	–	667	44,642
	1982, 1982/83	19,846	177,603	–	–	197,450	754	–	–	754	37,159
	1983	16,311	224,526	–	–	240,837	5,794	–	–	5,794	47,918
Sabomin	1973, 1973/74	1,837	–	–	–	1,837	–	–	–	–	294

Continued on page 118

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Sabomin (cont'd)	1974, 1974/75	2,909	–	–	–	2,909	–	–	–	–	367
	1975, 1975/76	646	–	–	–	646	–	–	–	–	451
	1976, 1976/77	670	–	–	–	670	–	–	–	–	–
	1977, 1977/78	1,615	–	–	–	1,615	–	–	–	–	6
	1978, 1978/79	3,808	–	–	–	3,807	20	7	–	27	59
	1979, 1979/80	5,291	–	–	–	5,291	–	–	–	–	–
	1980, 1980/81	4,106	–	–	–	4,106	–	–	–	–	140
	1981, 1981/82	4,198	–	–	–	4,198	–	2,288	–	2,288	540
	1982, 1982/83	3,957	–	–	–	3,957	–	152	–	152	8
	1983	6,014	–	–	–	6,014	–	–	–	–	325
Setting	1973, 1973/74	–	19,810	–	–	19,810	–	57	–	57	3,208
	1974, 1974/75	–	13,211	–	–	13,211	–	–	–	–	4,860
	1975, 1975/76	–	15,450	–	–	15,450	–	–	–	–	2,784
	1976, 1976/77	–	12,696	–	–	12,696	–	10,347	–	10,347	4,766
	1977, 1977/78	–	11,488	–	–	11,488	–	12,104	–	12,104	5,620
	1978, 1978/79	–	12,552	2,986	–	15,528	–	8,089	–	8,089	6,542
	1979, 1979/80	302	–	13,658	–	13,960	24	13,788	–	13,812	6,940
	1980, 1980/81	–	–	1,428	2	1,430	–	3,795	–	3,795	5,858
	1981, 1981/82	–	–	4,341	–	4,341	–	–	–	–	3,380
	1982, 1982/83	–	–	18	–	18	–	–	–	–	3,985
	1983	–	–	2,258	–	2,258	–	–	97	97	5,667
Sipiwesk	1973, 1973/74	16,465	–	–	–	16,645	–	–	–	–	3,859
	1974, 1974/75	14,388	–	–	–	14,388	299	2,990	–	3,289	16,289

Continued on page 119

Appendix C (cont'd)

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Sipiwesk (cont'd)	1975, 1975/76	17,047	–	–	–	17,047	3,339	2,379	–	5,718	12,232
	1976, 1976/77	16,561	–	–	–	16,561	–	2,198	–	2,198	–
	1977, 1977/78	7,235	–	–	40	7,275	–	94	–	94	658
	1978, 1978/79	17,877	–	–	–	17,877	905	2,253	–	3,158	26,423
	1979, 1979/80	14,193	–	–	–	14,193	3,090	1,704	–	4,794	13,834
	1980, 1980/81	24,150	–	–	–	24,150	7,753	–	–	7,753	27,005
	1981, 1981/82	21,181	–	–	–	21,181	7,485	–	–	7,485	39,471
	1982, 1982/83	–	9,859	–	–	9,859	–	4,096	–	4,096	19,446
	1983	11,829	–	–	–	11,829	–	6,731	–	6,731	13,887
Sisipuk	1973, 1973/74	163	–	–	–	163	–	–	–	–	32
	1974, 1974/75	1,576	–	–	–	1,576	–	–	–	–	1,011
	1975, 1975/76	8,884	–	–	–	8,884	–	–	–	–	–
	1976, 1976/77	–	–	–	–	–	–	–	–	–	8,185
	1977, 1977/78	93	–	–	–	93	–	–	–	–	1,532
	1978, 1978/79	1,393	–	–	–	1,393	–	–	–	–	1,412
	1979, 1979/80	3,085	–	–	–	3,085	–	–	–	–	3,541
	1980, 1980/81	5,782	–	–	–	5,782	157	2,467	–	2,624	18,580
	1981, 1981/82	5,062	–	–	–	5,062	92	–	–	92	20,184
	1982, 1982/83	3,024	–	–	–	3,024	–	129	–	129	3,672
	1983	1,402	–	–	–	1,402	–	–	–	–	11,159
South Indian	1973, 1973/74	298,386	–	–	–	298,386	–	–	–	–	22,865
	1974, 1974/75	–	–	–	–	–	–	–	–	–	–
	1975, 1975/76	328,767	–	–	–	328,767	–	–	–	–	11,218

Continued on page 120

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
South Indian (cont'd)	1976, 1976/77	417,765	2,148	–	–	419,913	–	–	–	–	29,899
	1977, 1977/78	429,302	765	–	–	430,067	–	104	–	104	44,643
	1978, 1978/79	232,053	166,123	–	–	398,176	–	6	–	6	47,278
	1979, 1979/80	152,603	276,093	–	–	428,696	–	15,122	–	15,122	75,043
	1980, 1980/81	271,817	153,209	–	–	425,026	5	8,849	–	8,854	33,713
	1981, 1981/82	13,279	297,473	–	–	310,829	33	13,871	–	13,904	38,283
	1982, 1982/83	134,350	–	–	1,188	135,538	–	566	–	566	13,826
	1983	172,184	–	–	6	172,189	–	3,616	–	3,616	10,015
St. Martin	1973, 1973/74	50,698	–	–	–	50,698	–	4	–	4	26,575
	1974, 1974/75	34,523	–	–	–	34,523	1	–	–	1	46,305
	1975, 1975/76	41,031	–	–	–	41,031	–	1	–	1	46,085
	1976, 1976/77	125,355	–	–	–	125,355	–	–	–	–	66,188
	1977, 1977/78	133,046	–	–	–	133,046	–	–	–	–	50,328
	1978, 1978/79	223,828	–	38	–	223,886	–	–	–	–	55,251
	1979, 1979/80	393,109	–	–	–	393,109	–	–	–	–	64,008
	1980, 1980/81	323,636	–	–	–	323,636	–	–	–	–	56,280
	1981, 1981/82	315,074	–	–	–	315,074	–	–	–	–	45,651
	1982, 1982/83	106,354	–	–	–	106,354	–	–	–	–	10,242
	1983	–	–	–	–	–	–	–	–	–	–
Walker	1973, 1973/74	–	9,328	–	–	9,328	–	–	–	–	–
	1974, 1974/75	–	15,046	–	–	15,046	–	–	–	–	–
	1975, 1975/76	–	2,100	–	–	2,100	–	–	–	–	450

Continued on page 121

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Walker (cont'd)	1976, 1976/77	–	9,200	–	–	9,200	–	–	–	–	1,663
	1977, 1977/78	–	11,301	–	–	11,301	–	49	–	49	15,044
	1978, 1978/79	–	–	–	–	–	–	–	–	–	–
	1979, 1979/80	–	13,617	–	–	13,617	–	–	–	–	4,097
	1980, 1980/81	–	–	29,611	–	29,611	–	309	–	309	16,414
	1981, 1981/82	–	–	–	–	–	–	–	–	–	30,749
	1982, 1982/83	–	–	–	–	–	–	–	–	–	10,984
	1983	–	–	28	–	28	–	–	–	–	3,597
Wekusko	1973, 1973/74	44	–	–	–	44	–	–	–	–	108
	1974, 1974/75	31,458	–	–	–	31,458	678	4,291	–	4,969	5,312
	1975, 1975/76	40,199	–	–	–	40,199	6,260	38	–	6,298	15,451
	1976, 1976/77	31,113	–	–	–	31,113	–	2,631	–	2,631	27,031
	1977, 1977/78	32,545	–	–	–	32,545	–	4,529	–	4,529	21,418
	1978, 1978/79	46,804	–	–	–	46,804	–	2,532	–	2,532	13,960
	1979, 1979/80	42,067	–	–	–	42,067	–	2,455	–	2,455	16,167
	1980, 1980/81	29,990	–	–	–	29,990	–	–	–	–	23,869
	1981, 1981/82	24,834	–	–	–	24,834	–	–	–	–	25,391
	1982, 1982/83	44,517	–	–	–	44,517	–	–	–	–	26,188
	1983	–	–	–	–	–	–	–	–	–	–
Witchai	1973, 1973/74	–	–	–	–	–	–	–	–	–	–
	1974, 1974/75	4,442	–	–	–	4,442	–	–	–	–	667
	1975, 1975/76	9,934	–	–	–	9,934	–	–	–	–	–
	1976, 1976/77	13,334	–	–	–	13,334	–	–	–	–	–

Continued on page 122

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Witchai (cont'd)	1977, 1977/78	10,536	–	–	–	10,536	–	–	–	–	161
	1978, 1978/79	8,815	–	–	–	8,815	–	–	–	–	237
	1979, 1979/80	5,745	–	–	–	5,745	–	–	–	–	165
	1980, 1980/81	12,040	–	–	–	12,040	–	–	–	–	211
	1981, 1981/82	10,233	–	–	–	10,233	–	–	–	–	–
	1982, 1982/83	10,757	–	–	–	10,757	–	–	–	–	324
	1983	412	–	–	–	412	–	–	–	–	64
Wuskwatin	1973, 1973/74	–	5,098	–	–	5,098	–	–	–	–	252
	1974, 1974/75	–	36,329	–	–	36,329	–	–	–	–	47
	1975, 1975/76	–	–	–	–	–	–	–	–	–	–
	1976, 1976/77	–	10,228	–	–	10,228	–	278	–	278	–
	1977, 1977/78	–	10,739	–	–	10,739	–	192	–	192	367
	1978, 1978/79	–	–	–	–	–	–	–	–	–	–
	1979, 1979/80	–	–	–	–	–	–	–	–	–	–
	1980, 1980/81	15,452	–	–	–	15,452	36	–	–	36	2,711
	1981, 1981/82	20,204	–	–	–	20,204	32	–	–	32	730
	1982, 1982/83	–	–	–	–	–	–	–	–	–	–
	1983	11,637	–	–	–	11,637	–	5,052	–	5,052	–
William	1973, 1973/74	52,336	–	–	–	52,336	–	–	–	–	618
	1974, 1974/75	59,346	–	–	–	59,346	–	–	–	–	295
	1975, 1975/76	27,078	–	–	–	27,078	–	–	–	–	28
	1976, 1976/77	33,865	–	–	–	33,865	–	–	–	–	541
	1977, 1977/78	56,301	–	–	791	57,092	–	–	–	–	418

Continued on page 123

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
William (cont'd)	1978, 1978/79	55,355	–	–	–	55,355	–	–	–	–	–
	1979, 1979/80	59,621	–	–	3,947	63,568	–	–	–	–	217
	1980, 1980/81	79,961	–	–	1,333	81,294	–	–	–	–	–
	1981, 1981/82	44,379	–	–	2,547	46,926	–	–	–	–	32
	1982, 1982/83	56,778	–	–	–	56,778	–	795	–	795	839
	1983	54,810	–	–	3,650	58,460	–	–	–	–	124
Wintering	1973, 1973/74	13,244	–	–	–	13,244	–	–	–	–	–
	1974, 1974/75	10,953	–	–	–	10,953	620	–	–	620	6,376
	1975, 1975/76	7,601	–	–	–	7,601	313	1,246	–	1,559	2,649
	1976, 1976/77	5,900	32	–	–	5,932	–	2,233	–	2,233	594
	1977, 1977/78	8,123	–	–	–	8,123	–	–	–	–	97
	1978, 1978/79	4,513	–	–	–	4,513	–	–	–	–	38
	1979, 1979/80	1,122	–	451	–	1,573	–	–	–	–	98
	1980, 1980/81	10,146	–	–	–	10,146	–	3,433	–	3,433	454
	1981, 1981/82	3,312	–	–	–	3,312	–	13,916	–	13,916	6,306
	1982, 1982/83	6,363	–	–	–	6,363	–	18,148	–	18,148	5,379
	1983	6,577	–	–	–	6,577	–	10,263	–	10,263	4,448
Yawningstone	1973, 1973/74	131	–	–	–	131	–	–	–	–	838
	1974, 1974/75	188	–	–	–	188	–	–	–	–	317
	1975, 1975/76	175	–	–	–	175	–	–	–	–	310
	1976, 1976/77	2,404	–	–	–	2,404	–	–	–	–	1,119
	1977, 1977/78	–	–	–	–	–	–	–	–	–	–
	1978, 1978/79	130	–	–	–	130	–	–	–	–	78

Continued on page 124

Appendix C (cont'd)

Lake	Time (year)	Species Composition (kg round weight)									
		Whitefish					Cisco				Pike
		Export	Continental	Cutter	roe	Total	Export	Continental	Cutter	Total	
Yawningstone (continued)	1979, 1979/80	629	-	-	-	629	-	-	-	-	764
	1980, 1980/81	466	-	-	-	466	-	-	-	-	152
	1981, 1981/82	-	-	-	-	-	-	-	-	-	-
	1982, 1982/83	-	-	-	-	-	-	-	-	-	-
	1983	-	-	-	-	-	-	-	-	-	-

Source: Department of Fisheries and Oceans, Winnipeg.

Appendix D

Temporal changes of cisco, pike and lake whitefish, 1973-1983

Note: Changes in fish species composition (presence of cisco) occurred without changes in abundance of *T. crassus*.

Legend

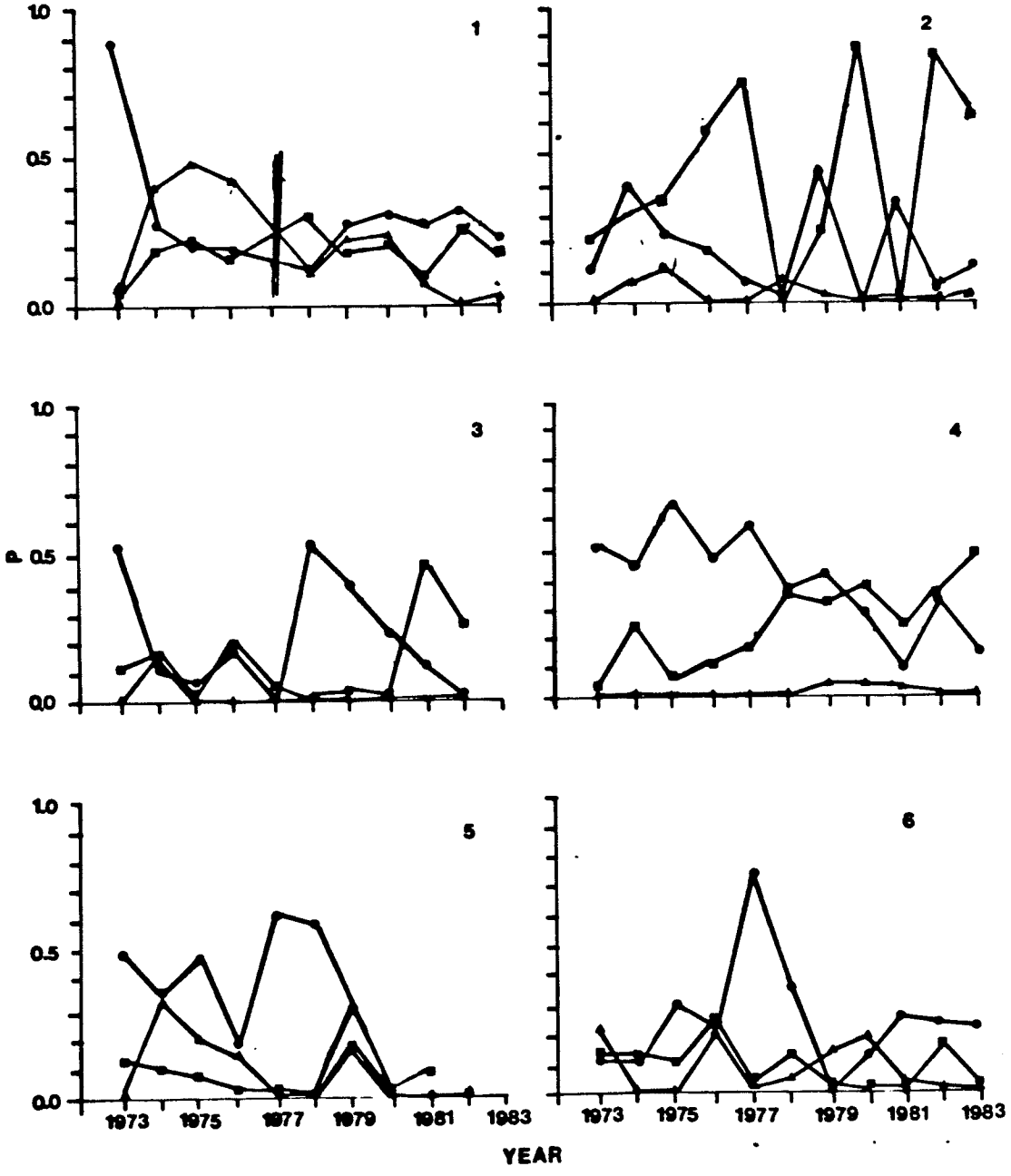
▲ Cisco

● Lake whitefish

■ Pike

List of Lakes in Appendix D

1. Armstrong
2. Bruneau
3. Cormorant
4. Granville
5. Kipahigan
6. Kisseynew
7. Landing
8. Opachuanua
9. Pakwa
10. South Indian
11. Setting
12. Walker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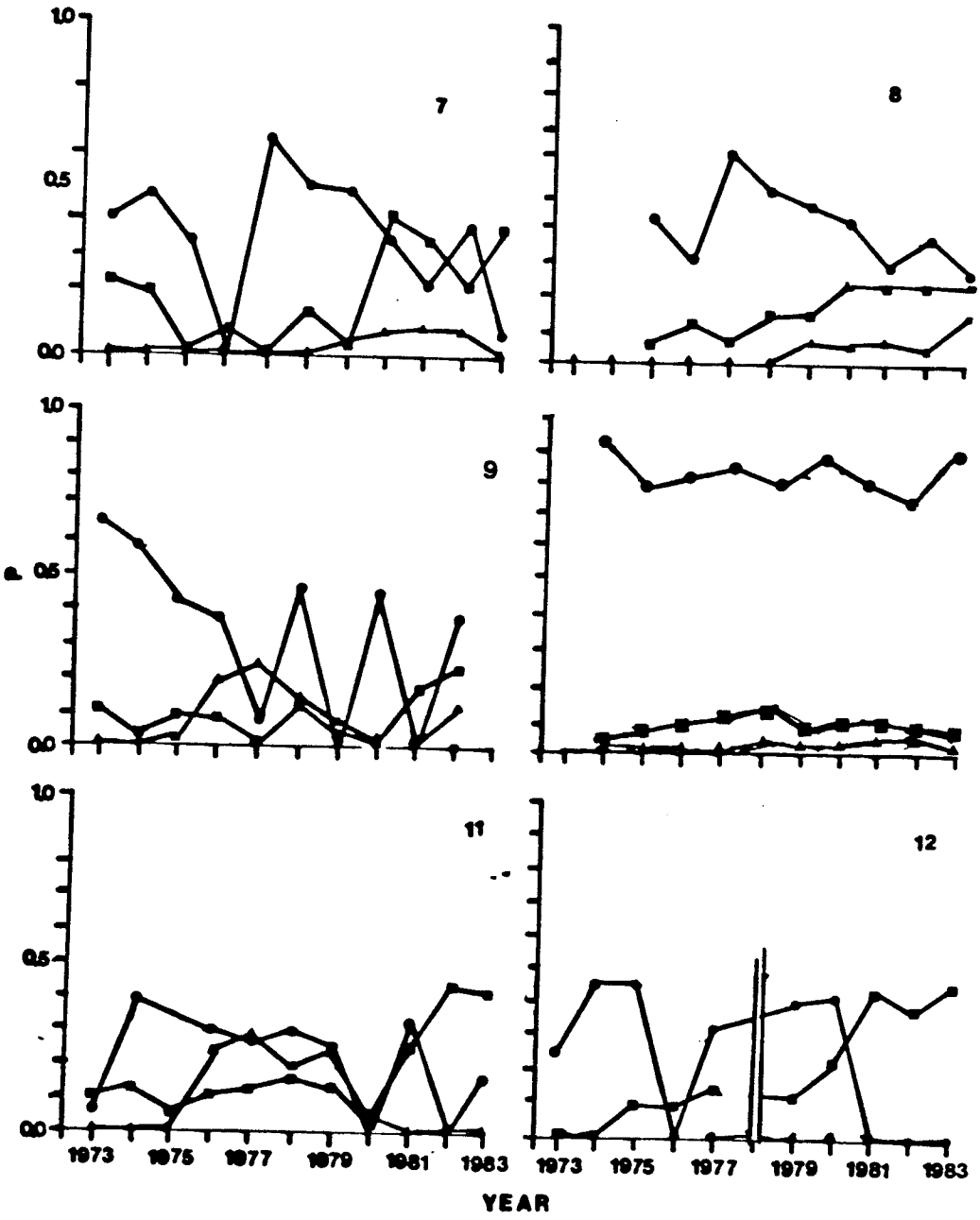
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Appendix E

Lake size categories (ha) average CUE per unit surface area (kg/ND/F)*, production of lake whitefish, cisco and pike (kg) and average effort (ND/F) for individual lakes for the period 1973-1983

Lake Size Category (ha)	Lake Name	Surface Area (ha)	Av. CUE per unit surface area (kg/N.D/F/ha)*	Average Effort (N.D/F)	Production (kg)		
					Lakewhite Fish	Cisco	Pike
Small (`10,000 ha)	Armstrong	2,859	.32	16	35,922	17,982	12,341
	Bruneau	1,452	.31	13.9	11,455	1,655	26,466
	Butterfly	1,855	.23	11.4	11,256	3,021	3,500
	Guthrie	3,508	.44	12.5	43,752	21,592	39,095
	Halfway	2,942	.32	25.2	88,727	108,345	24,537
	Herblet	2,984	.33	9.0	87,685	-	25,962
	Natawahunan	4,516	.21	13.4	48,398	771	14,552
	Pakwa	3,978	.22	20.0	80,398	26,479	23,962
	Patridge Crop	7,389	.07	16.0	47,604	-	17,157
	Witchai	3,574	.15	17.4	86,248	-	1,829
	Wuskwatim	6,465	.12	15.3	109,687	506	4,107
	Yawingstone	1,160	.24	6.09	4,123	-	3,578
	Dafoe	2,460	.12	15.9	17,957	759	9,241
	Sabomin	1,450	.45	8.8	35,050	2,524	2,190
	Granville	4,559	.74	15.3	250,445	9,644	157,353
	Kisseynew	7,662	.25	20.5	93,211	25,843	52,051

Continued on page 130

Appendix E (Cont'd)

Lake size categories (ha) average CUE per unit surface area (kg/ND/F)*, production of lake whitefish, cisco and pike (kg) and average effort (ND/F) for individual lakes for the period 1973-1983

Lake Size Category (ha)	Lake Name	Surface Area (ha)	Av. CUE per unit surface area (kg/N.D/F/ha)*	Average Effort (N.D/F)	Production (kg)		
					Lakewhite Fish	Cisco	Pike
Small (cont'd)	Opachuanau	7,952	.28	12.3	105,203	8,419	43,291
(~10,000 ha)	$\bar{X}$	3,927	.28	14.3	68,051	42,317	27,130
Intermediate	Kiski	21,550	.05	9	3,031	1,977	11,416
(10,000 -	Landing	11,928	.22	8	93,212	25,843	52,051
30,000 ha)	Setting	13,427	.09	26	110,191	48,296	53,610
	Walker	13,755	.18	14	90,231	358	82,998
	William	11,893	.54	8	592,098	795	2,922
	Wintering	10,609	.22	11	78,337	50,172	26,446
	Barrington	16,504	.08	30	9,486	-	4,376
	Kipahigan	10,111	.27	16	145,844	40,350	30,654
	North Indian	20,223	.16	23	184,014	1,453	98,771
	Sisipuk	16,058	.12	8	30,464	2,845	69,308
	Wekusko	22,180	.16	17	295,571	9,516	117,492
	$\bar{X}$	15,294	.19	15	148,407	16,510	50,004

Continued on page 131

Appendix E (Cont'd)

Lake size categories (ha) average CUE per unit surface area (kg/ND/F)*, production of lake whitefish, cisco and pike (kg) and average effort (ND/F) for individual lakes for the period 1973-1983

Lake Size Category (ha)	Lake Name	Surface Area (ha)	Av. CUE per unit surface area (kg/N.D/F/ha)*	Average Effort (N.D/F)	Production (kg)		
					Lakewhite Fish	Cisco	Pike
Large (~30,000 ha)	Cedar	126,147	.27	39	1,129,157	1,387,057	3,030,373
	Cormorant	32,780	.03	24	66,313	4,184	46,367
	Playgreen	68,896	.14	32	2,356,038	31,442	20,912
	Sipiwesk	39,327	.05	28	171,005	44,411	149,839
	Gods	104,763	.04	23	610,831	-	104,763
	South Indian	198,421	.07	29	3,347,587	42,169	326,783
	$\bar{X}$	95,055	.10	29	943,322	25,322	613,173

* kilogram per number of deliveries per fisherman per hectare

Comments:

- Source of data on surface area: Fisheries Branch, Province of Manitoba, Department of Natural Resources
- St. Martin Lake excluded because its area is not available.

Appendix F

Temporal changes of cisco, pike and lake whitefish, 1973-1983

Note: Presence of cisco occurred without change in abundance of *T. crassus*.

Legend

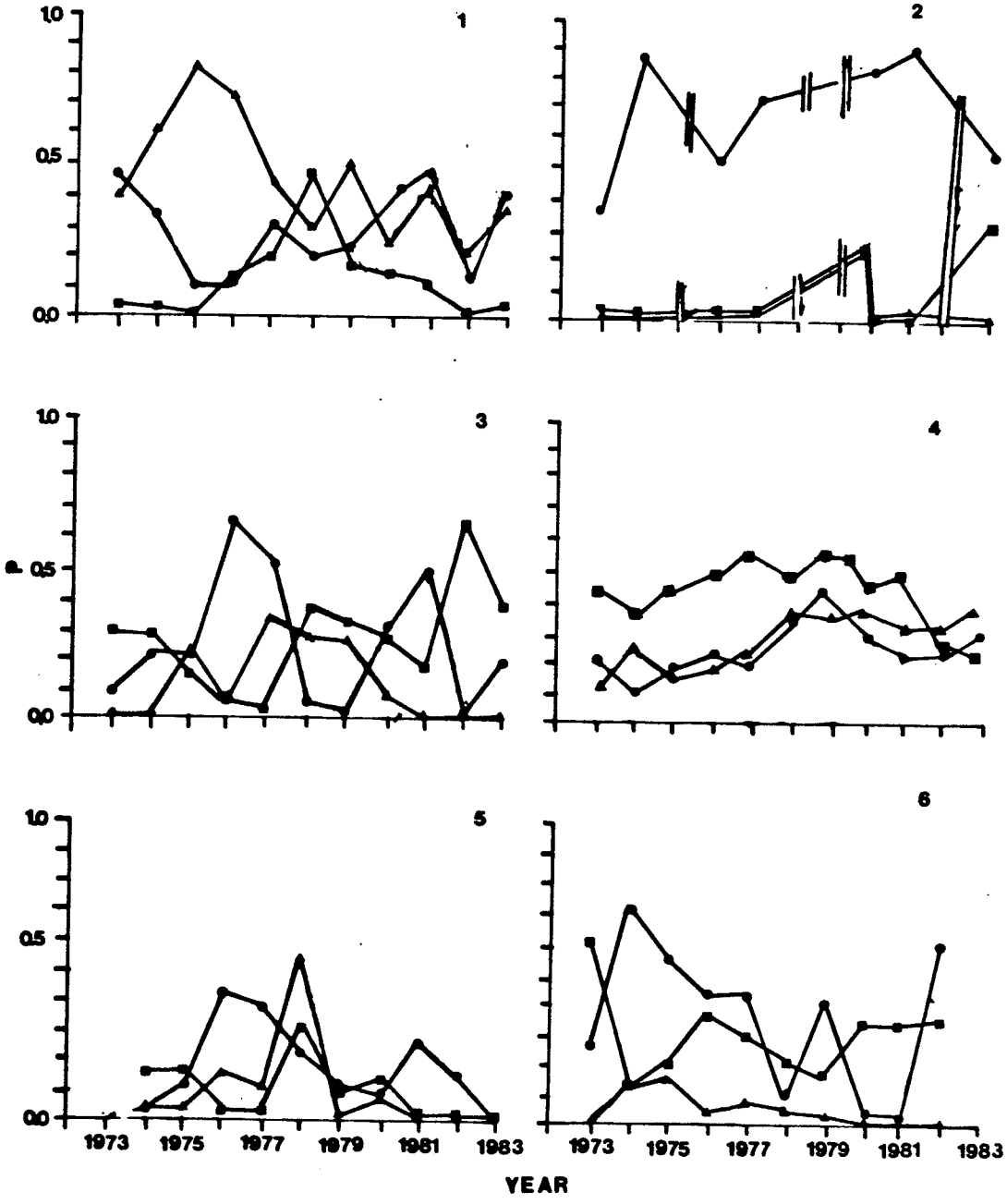
▲ Cisco

● Lake Whitefish

■ Pike

List of Lakes in Appendix F

1. Halfway
2. Wuskwatim
3. Guthrie
4. Cedar
5. Butterfly
6. Wekusko
7. Sipiwesk
8. Natawahunan
9. Sisipuk
10. North Indian
11. Playgreen
12. Wintering
13. Sabomin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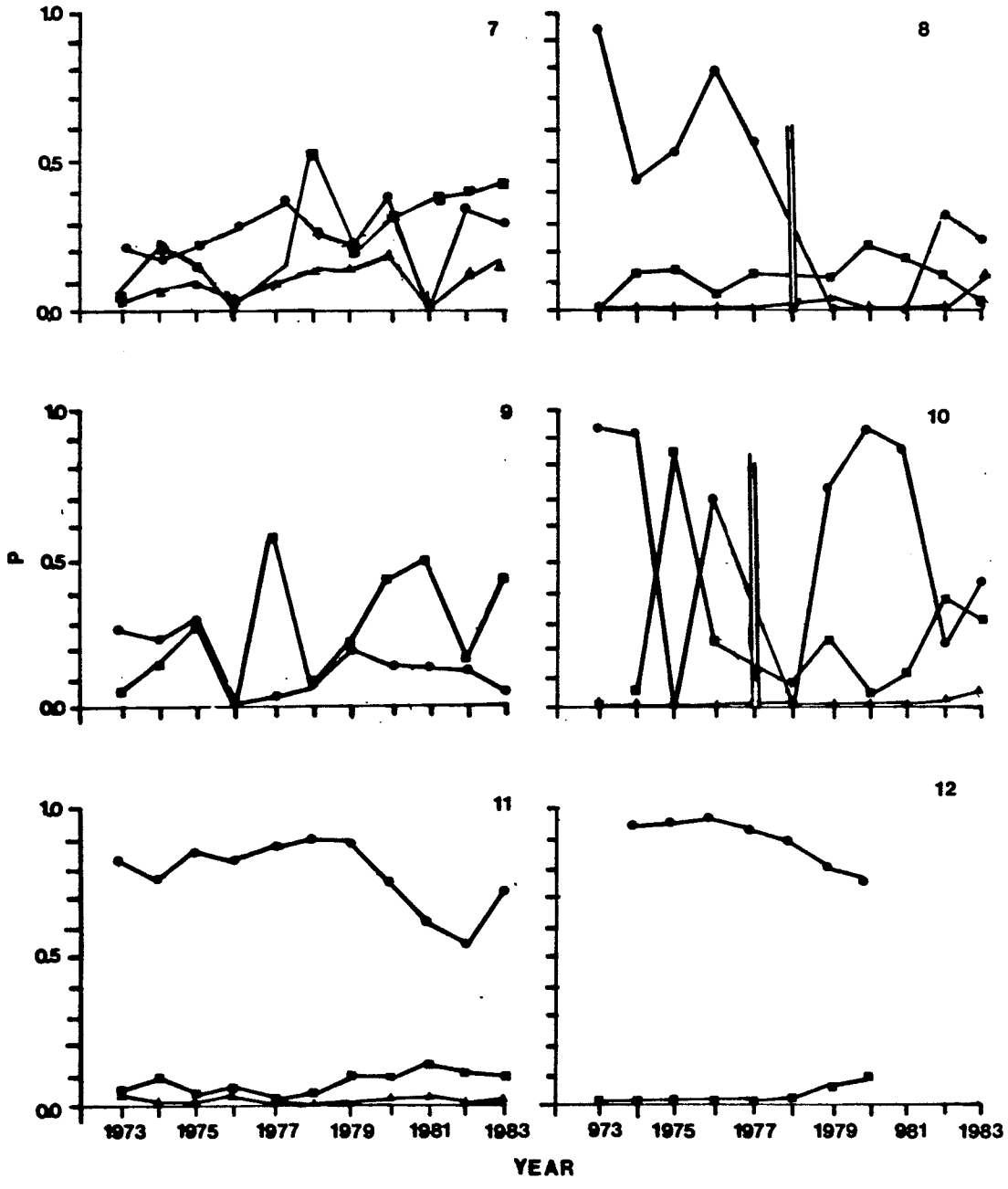
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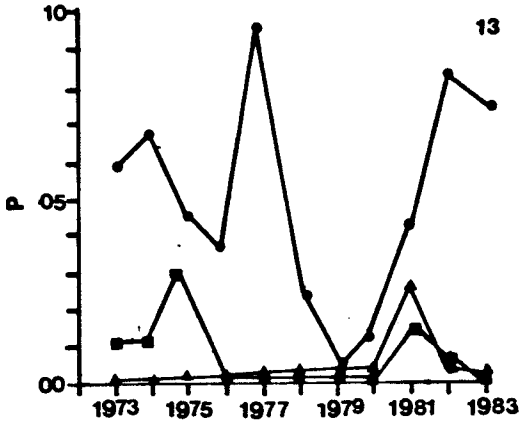
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1981
1983

137

Appendix G

Temporal changes of cisco, pike

and lake whitefish, 1973-1983

Note: Change in abundance of *T. crassus* occurred without presence of cisco.

Legend

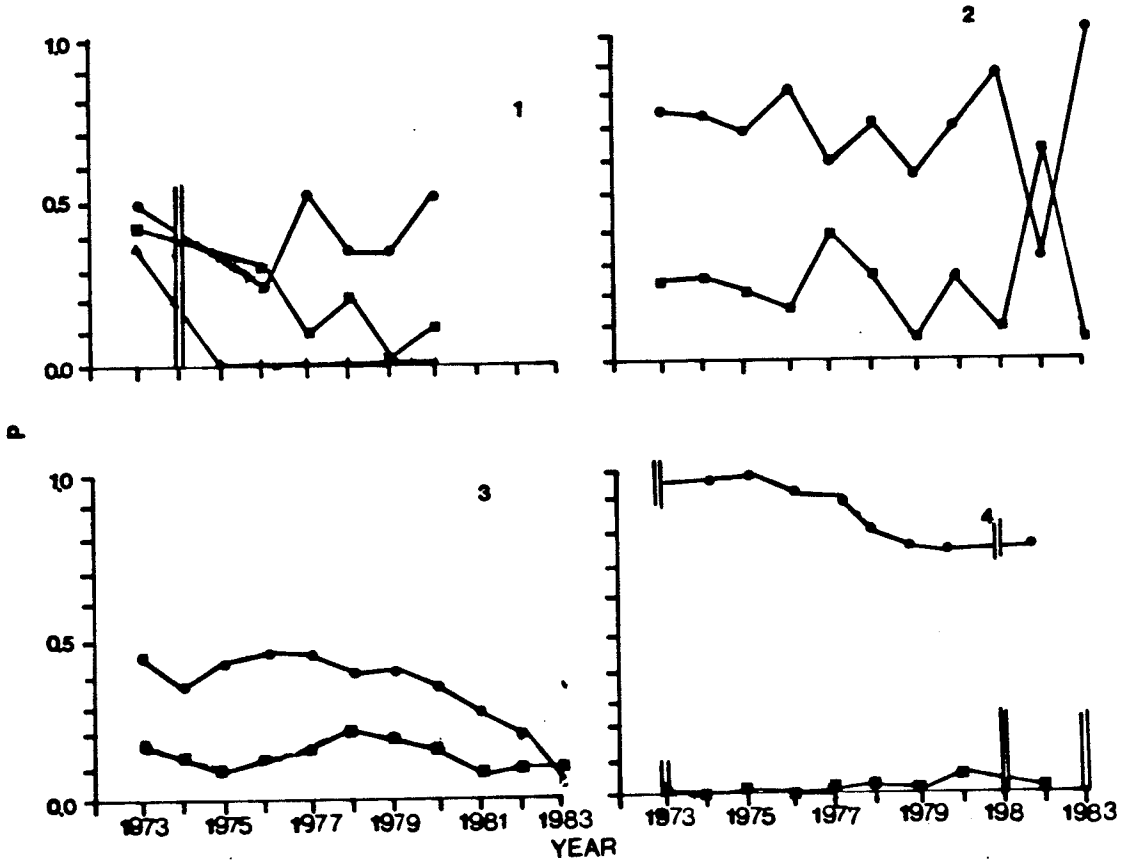
▲ Cisco

● Lake Whitefish

■ Pike

List of Lakes in Appendix G

1. Dafoe
2. Herblet
3. Barrington
4. Gods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1977
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1983
198
YEAR

Appendix H

Temporal changes of cisco, pike

and lake whitefish, 1973-1983

Note: No consistent change in either fish species composition and in abundance of *T. crassus*

Legend

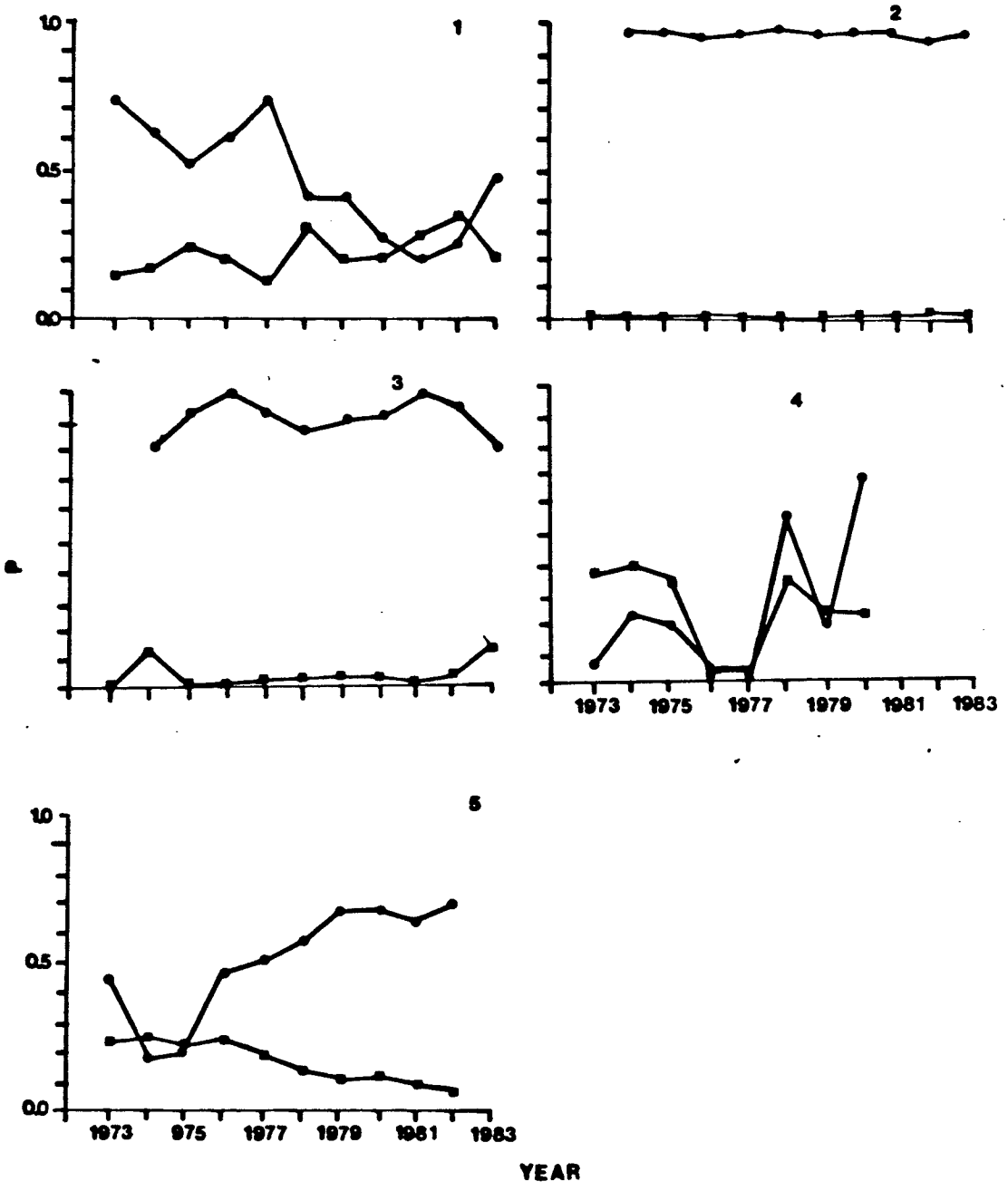
▲ Cisco

● Lake Whitefish

■ Pike

List of Lakes in Appendix H

1. Patridge Crop
2. William
3. Witchai
4. Yawningstone
5. St. Martin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Appendix I

Proportions of lake whitefish size classes

from total catch (kg), 1973-1983

Appendix I

Average CUE (kg/N.D/F) of lake whitefish size categories of jumbo, large, medium and small from total catch (kgs), 1973-1983

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Armstrong	1973, 1973/74	.002	1	.113	60	.783	418	.102	54
	1974, 1974/75	.002	1	.0016	7	.982	430	-	-
	1975, 1975/76	-	-	-	-	1	208	-	-
	1976, 1976/77	-	-	.058	17	.942	270	-	-
	1977, 1977/78	-	-	-	-	-	-	-	-
	1978, 1978/79	-	-	.012	2	.985	189	.002	.4
	1979, 1979/80	-	-	.033	8	.951	224	.029	4
	1980, 1980/81	-	-	.049	13	.950	235	.001	245
	1981, 1981/82	.20	54	.039	7	.731	200	.03	12
	1982, 1982/83	-	-	.008	2	.991	218	-	-
	1983	-	-	-	-	-	-	-	-
Barrington	1973, 1973/74	.002	.7	.078	100	.75	626	.17	441
	1974, 1974/75	-	-	.038	17	.962	424	-	-
	1975, 1975/76	.021	65	.170	461	.769	2,088	.037	101
	1976, 1976/77	.017	19	.104	118	.827	940	.052	59

Continued on page 145

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Barrington (cont'd)	1977, 1977/78	.028	25	.131	114	.781	681	.06	52
	1978, 1978/79	.029	26	.149	135	.771	699	.051	46
	1979, 1979/80	.021	6	.209	58	.751	216	.027	8
	1980, 1980/81	–	–	–	–	–	–	–	–
	1981, 1981/82	–	–	–	–	–	–	–	–
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–
Bruneau	1973, 1973/74	.395	30	.427	33	.178	14	–	–
	1974, 1974/75	.163	107	.555	366	.260	172	.021	14
	1975, 1975/76	.135	62	.317	145	.519	237	.029	13
	1976, 1976/77	.121	12	.248	25	.602	61	.028	3
	1977, 1977/78	.037	2	.318	16	.630	32	.015	.8
	1978, 1978/79	.146	29	.564	111	.290	57	–	–
	1979, 1979/80	.368	98	.265	97	.244	65	.022	6
	1980, 1980/81	.299	18	.292	17	.410	24	.001	6
	1981, 1981/82	.321	374	.364	43	.311	36	.004	12
	1982, 1982/83	–	–	.008	2	.991	218	–	.48
	1983	–	–	–	–	–	–	–	–
Butterfly	1973, 1973/74	–	–	–	–	–	–	–	–
	1974, 1974/75	.600	2	.354	8	.047	1	–	–

Continued on page 146

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories: Jumbo Ratio	Jumbo Av. C.U.E. (kg/ND/F)	Large Ratio	Large Av. C.U.E. (kg/ND/F)	Medium Ratio	Medium Av. C.U.E. (kg/ND/F)	Small Ratio	Small Av. C.U.E. (kg/ND/F)
Butterfly (cont'd)	1975, 1975/76	.840	133	.114	18	.046	7	–	–
	1976, 1976/77	.722	505	.210	146	.064	45	.005	4
	1977, 1977/78	.622	175	.241	68	.135	38	.002	.6
	1978, 1978/79	–	–	.146	18	.085	10	.770	93
	1979, 1979/80	.151	9	.618	37	.230	14	.001	.1
	1980, 1980/81	.387	10	.507	13	.099	3	.005	.1
	1981, 1981/82	.201	19	.733	68	.066	61	–	–
	1982, 1982/83	.099	4	.850	38	.050	2	–	–
	1983	–	–	–	–	–	–	–	–
Cedar	1973, 1973/74	.318	16,937	.413	21,924	.224	11,924	.044	2,351
	1974, 1974/75	.179	24,307	.134	25,337	.569	163,836	.115	7,635
	1975, 1975/76	.348	854	.116	284	.423	1,034	.113	277
	1976, 1976/77	.150	605	.124	502	.471	1,905	.255	1,031
	1977, 1977/78	.021	152	.126	912	.694	5,017	.158	1,144
	1978, 1978/79	.028	308	.196	2,132	.720	7,823	.055	602
	1979, 1979/80	.062	268	.270	177	.530	2,308	.139	2,308
	1980, 1980/81	.098	–	.233	–	.548	–	.121	–
	1981, 1981/82	.106	–	.159	–	.610	–	.125	–
	1982, 1982/83	.277	784	.243	688	.397	1,126	.083	237
	1983	.316	649	.207	424	.442	908	.028	57

Continued on page 147

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories: Jumbo Ratio	Jumbo Av. C.U.E. (kg/ND/F)	Large Ratio	Large Av. C.U.E. (kg/ND/F)	Medium Ratio	Medium Av. C.U.E. (kg/ND/F)	Small Ratio	Small Av. C.U.E. (kg/ND/F)
Cormorant	1973, 1973/74	–	–	–	–	1	2,036	–	–
	1974, 1974/75	–	–	–	–	1	350	–	–
	1975, 1975/76	–	–	–	–	–	–	–	–
	1976, 1976/77	–	–	–	–	–	–	–	–
	1977, 1977/78	–	–	–	–	–	–	–	–
	1978, 1978/79	.028	17	.098	58	.420	248	.454	268
	1979, 1979/80	.001	.3	.029	8	.962	278	.008	29
	1980, 1980/81	–	–	.01	3	.817	210	.172	374
	1981, 1981/82	–	–	.874	65	.035	3	.091	7
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–
Dafoe	1973, 1973/74	.019	5	.437	112	.544	139	–	–
	1974, 1974/75	–	–	–	–	–	–	–	–
	1975, 1975/76	–	–	–	–	–	–	–	–
	1976, 1976/77	.008	2	.177	43	.815	197	–	–
	1977, 1977/78	.040	31	.422	332	.539	424	–	–
	1978, 1978/79	.023	9	.418	158	.555	210	.005	2
	1979, 1979/80	.021	4	.503	75	.469	84	.008	1
	1980, 1980/81	.010	234	.365	80	.592	129	.032	7
	1981, 1981/82	–	–	–	–	–	–	–	–
	1982, 1982/83	–	–	–	–	–	–	1	129
	1983	.010	41	.170	133	.780	197	.041	2

Continued on page 148

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Gods	1973, 1973/74	–	–	–	–	–	–	–	–
	1974, 1974/75	–	–	–	–	–	–	–	–
	1975, 1975/76	.013	228	.069	1,225	.918	16,255	.003	5
	1976, 1976/77	.004	79	.057	1,315	.935	11,800	.004	–
	1977, 1977/78	.006	212	.492	6,368	.491	4,844	–	–
	1978, 1978/79	.003	24	.005	44	.992	8,781	–	–
	1979, 1979/80	.005	28	.039	191	.945	4,822	.01	66
	1980, 1980/81	.005	10	.029	61	.956	1,986	.01	20
	1981, 1981/82	.016	58	.043	159	.938	3,495	.044	14
	1982, 1982/83	–	–	.012	67	.987	539	–	–
	1983	–	–	–	–	–	–	–	–
Halfway	1973, 1973/74	.120	233	.680	1,830	.200	539	–	–
	1974, 1974/75	.121	57	.331	138	.532	221	–	–
	1975, 1975/76	.143	19	.226	31	.624	85	.006	1
	1976, 1976/77	.136	37	.185	50	.671	181	.001	2
	1977, 1977/78	.130	170	.260	340	.610	798	–	–
	1978, 1978/79	.054	12	.150	32	.784	167	.012	2
	1979, 1979/80	.048	5	.253	28	.695	76	.004	.4
	1980, 1980/81	.036	19	.119	60	.820	416	.024	12
	1981, 1981/82	.028	7	.083	50	.896	197	.004	1
	1982, 1982/83	.083	39	.215	101	.702	322	–	–
	1983	.083	116	.149	208	.767	1,069	–	–

Continued on page 149

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories: Jumbo Ratio	Jumbo Av. C.U.E. (kg/ND/F)	Large Ratio	Large Av. C.U.E. (kg/ND/F)	Medium Ratio	Medium Av. C.U.E. (kg/ND/F)	Small Ratio	Small Av. C.U.E. (kg/ND/F)
Herblet	1973, 1973/74	–	–	–	–	1.0	1,416	–	–
	1974, 1974/75	–	–	–	–	1.0	360	–	–
	1975, 1975/76	–	–	–	–	.906	1,270	.094	132
	1976, 1976/77	–	–	–	–	.947	1,672	.053	94
	1977, 1977/78	–	–	.008	17	.992	2,378	–	–
	1978, 1978/79	–	–	–	–	.997	1,450	.003	5
	1979, 1979/80	–	–	.005	3	.892	545	.103	63
	1980, 1980/81	–	–	.798	669	.203	171	–	–
	1981, 1981/82	–	–	–	–	.913	927	.087	882
	1982, 1982/83	–	–	–	–	1.00	76	–	–
	1983	–	–	–	–	.963	1,699	.037	65
Granville	1973, 1973/74	.029	123	.255	1,098	.528	2,273	.183	812
	1974, 1974/75	.007	28	.134	478	.820	2,929	.039	140
	1975, 1975/76	.014	27	.145	279	.732	1,412	.109	209
	1976, 1976/77	.039	16	.125	50	.785	312	.053	20
	1977, 1977/78	.073	381	.200	1,052	.702	3,692	.025	131
	1978, 1978/79	.055	389	.208	1,483	.683	4,863	.055	390
	1979, 1979/80	.039	46	.212	248	.700	820	.049	57
	1980, 1980/81	.090	116	.205	262	.618	790	.087	112
	1981, 1981/82	.071	719	.182	210	.697	805	.05	58
	1982, 1982/83	.028	10	.139	.3	.833	.4	.662	2,230
	1983	.001	.6	.055	34	.881	543	.063	3

Continued on page 150

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Guthrie	1973, 1973/74	–	–	.052	10	.948	175	–	–
	1974, 1974/75	–	–	–	10	–9	182	–	–
	1975, 1975/76	–	–	–	–	1.00	475	–	–
	1976, 1976/77	.004	8	.012	27	.984	2,125	–	–
	1977, 1977/78	.009	52	.002	12	.989	5,851	–	–
	1978, 1978/79	.025	14	–	–	.975	562	–	–
	1979, 1979/80	.004	.2	.470	17	.524	19	.002	–
	1980, 1980/81	.027	12	.091	38	.845	356	.037	16
	1981, 1981/82	.096	15	.578	189	.334	110	.042	14
	1982, 1982/83	.036	–	–	–		13	–	–
	1983	–	–	–	–	.978	161	.022	4
Kipahigan	1973, 1973/74	.0003	1	.032	100	.930	2,934	.037	119
	1974, 1974/75	–	–	–	–	.899	1,602	.101	206
	1975, 1975/76	–	–	.003	–	.862	4,699	.132	732
	1976, 1976/77	–	–	.005	25	.994	4,645	–	–
	1977, 1977/78	–	–	–	–	1.00	2,478	–	–
	1978, 1978/79	.0008	2	–	–	.997	1,937	.002	5
	1979, 1979/80	–	–	.119	52	.881	390	–	–
	1980, 1980/81	–	–	–	–	–	–	–	–
	1981, 1981/82	–	–	–	–	–	–	–	–
	1982, 1982/83	.004	1	.026	22	.970	677	–	–
	1983	–	–	–	–	–	–	–	–

Continued on page 151

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories: Jumbo Ratio	Jumbo Av. C.U.E. (kg/ND/F)	Large Ratio	Large Av. C.U.E. (kg/ND/F)	Medium Ratio	Medium Av. C.U.E. (kg/ND/F)	Small Ratio	Small Av. C.U.E. (kg/ND/F)
Kisseynew	1973, 1973/74	.331	102	.384	119	.284	88	–	–
	1974, 1974/75	.005	8	.505	250	.479	237	–	–
	1975, 1975/76	.110	131	.363	414	.523	598	–	–
	1976, 1976/77	–	–	–	–	.999	697	.002	1
	1977, 1977/78	–	–	–	–	1.000	2,245	–	–
	1978, 1978/79	.030	138	.018	85	.936	4,326	.016	75
	1979, 1979/80	.074	160	.459	992	.465	1,005	.002	5
	1980, 1980/81	.076	10	.246	30	.426	34	.252	33
	1981, 1981/82	–	–	–	–	–	–	1	225
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–
Kiski	1973, 1973/74	.005	1	.145	16	.850	75	–	–
	1974, 1974/75	.009	1	.142	12	.658	53	.190	15
	1975, 1975/76	.05	1	.120	3	.779	18	.188	66
	1976, 1976/77	.041	1	.106	1	.756	9	.100	1
	1977, 1977/78	.012	1	.176	9	.729	38	.083	4
	1978, 1978/79	.069	8	.396	42	.536	65	–	–
	1979, 1979/80	.068	3	.249	13	.643	34	.04	2
	1980, 1980/81	–	–	–	–	–	–	–	–
	1981, 1981/82	.268	25	.133	17	.474	45	.125	16
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	.132	4	.163	5	.722	24	–	–

Continued on page 152

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Landing	1973, 1973/74	.007	22	.061	184	.932	1,593	–	–
	1974, 1974/75	.078	193	.183	454	.739	1,831	–	–
	1975, 1975/76	.006	12	.275	479	.715	1,245	.003	6
	1976, 1976/77	.04	165	.660	2,752	.300	1,252	–	–
	1977, 1977/78	.024	83	.129	447	.848	2,948	–	–
	1978, 1978/79	.067	133	.316	840	.607	1,092	.010	30
	1979, 1979/80	.046	37	.312	444	.547	430	–	–
	1980, 1980/81	.018	10	.185	102	.769	426	.023	16
	1981, 1981/82	.159	2	.112	46	.714	378	.009	4
	1982, 1982/83	–	–	–	–	–	–	1	293
	1983	.018	31	.089	147	.893	1,494	–	–
Natawahunan	1973, 1973/74	–	–	.185	132	.808	576	.007	5
	1974, 1974/75	–	–	.125	28	.874	197	–	–
	1975, 1975/76	.001	4	.199	109	.799	434	–	–
	1976, 1976/77	.101	70	.300	206	.600	414	–	–
	1977, 1977/78	.174	105	.489	296	.337	204	–	–
	1978, 1978/79	–	–	–	–	–	–	–	–
	1979, 1979/80	.324	338	.423	442	.246	256	.006	7
	1980, 1980/81	.141	57	.257	105	.589	239	.020	44
	1981, 1981/82	.051	10	.015	31	.738	152	.059	12
	1982, 1982/83	.010	4	.045	18	.927	334	–	–
	1983	.010	8	.017	14	.967	800	.006	6

Continued on page 153

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Northern Indian	1973, 1973/74	.031	114	.157	580	.812	3,001	–	–
	1974, 1974/75	.005	5	.140	147	.853	895	.002	2
	1975, 1975/76	.002	134	.090	6,087	.854	58,014	.054	3,685
	1976, 1976/77	.0001	4	.013	48	.988	3,789	.004	14
	1977, 1977/78	.020	110	.361	1,998	.600	3,315	.019	107
	1978, 1978/79	.007	3	.229	95	.758	314	.006	3
	1979, 1979/80	.005	.3	.043	24	.777	436	.180	101
	1980, 1980/81	–	–	.017	31	.752	1,359	.231	418
	1981, 1981/82	–	–	.003	5	.770	1,171	.227	345
	1982, 1982/83	–	–	.003	–	.713	201	.284	80
	1983								
Opachuanau	1973, 1973/74	.007	5	.141	327	.852	1,971	–	–
	1974, 1974/75	–	–	–	–	–	–	–	–
	1975, 1975/76	.003	16	.087	510	.909	5,342	–	–
	1976, 1976/77	.005	5	.110	111	.864	872	.021	.21
	1977, 1977/78	.079	284	.3142	1,118	.594	2,115	.012	42
	1978, 1978/79	.106	474	.215	961	.648	2,891	.031	139
	1979, 1979/80	.119	61	.281	144	.590	303	.010	5
	1980, 1980/81	.074	83	.234	257	.670	739	.022	230
	1981, 1981/82	.046	26	.246	151	.690	422	.018	10
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	.120	44	.011	4	.811	31	.060	23

Continued on page 154

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Pakwa	1973, 1973/74	.018	24	.086	115	.873	1,169	.023	30
	1974, 1974/75	.008	7	.035	42	.795	945	.197	234
	1975, 1975/76	.004	4	.014	18	.735	939	.247	316
	1976, 1976/77	.006	5	.028	20	.830	593	.136	97
	1977, 1977/78	.004	1	.038	8	.702	162	.257	59
	1978, 1978/79	.005	13	.036	36	.913	890	.046	60
	1979, 1979/80	–	–	.100	4	.778	294	.212	78
	1980, 1980/81	.007	3	.042	20	.0786	380	.165	80
	1981, 1981/82	.005	1	.013	3	.936	199	.045	10
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	.0134	–	.624	–	.363	–
Patridge Crop	1973, 1973/74	.012	16	.449	614	.526	719	.018	18
	1974, 1974/75	.041	14	.471	158	.016	6	.471	151
	1975, 1975/76	.057	28	.499	246	.436	215	.008	4
	1976, 1976/77	.110	56	.540	285	.347	163	.007	4
	1977, 1977/78	.067	112	.321	533	.612	1,081	–	–
	1978, 1978/79	.023	9	.294	110	.683	256	–	–
	1979, 1979/80	.179	49	.396	109	.421	116	.002	1
	1980, 1980/81	.036	5	.204	38	.757	139	.011	2
	1981, 1981/82	.072	6	.242	21	.677	59	.009	1
	1982, 1982/83	.012	2	.138	18	.850	22	–	–
	1983	.048	20	.024	10	.928	378	–	–

Continued on page 155

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Playgreen	1973, 1973/74	.016	121	.097	731	.743	5,615	.144	1,092
	1974, 1974/75	.184	224	.816	996	–	–	–	–
	1975, 1975/76	.056	981	.098	1,725	.808	14,158	.038	30
	1976, 1976/77	.043	1,032	.091	2,198	.793	19,146	.073	1,736
	1977, 1977/78	.018	455	–	–	.912	23,113	.078	1,915
	1978, 1978/79	.019	420	.091	2,031	.779	17,185	.112	2,463
	1979, 1979/80	.012	70	.087	496	.820	4,680	.081	464
	1980, 1980/81	.018	127	.080	569	.860	615	.042	301
	1981, 1981/82	.040	457	.480	5,592	.445	5,193	.034	400
	1982, 1982/83	–	–	.09	26	.396	272	.514	352
	1983	.0124	–	.042	–	.890	–	.055	–
Sabomin	1973, 1973/74	.005	4	.082	65	.914	740	–	–
	1974, 1974/75	–	–	.161	23	.839	122	–	–
	1975, 1975/76	–	–	.236	412	.764	136	–	–
	1976, 1976/77	.004	1	.245	40	.751	123	–	–
	1977, 1977/78	.075	67	.396	353	.529	471	–	–
	1978, 1978/79	.031	65	.407	854	.562	183	–	–
	1979, 1979/80	.014	12	.204	161	.795	582	.047	37
	1980, 1980/81	.003	3	.102	87	.891	766	.004	3
	1981, 1981/82	.006	1	.031	22	.968	677	–	–
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–

Continued on page 156

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Setting	1973, 1973/74	.006	7	.044	278	.924	5,672	.025	156
	1974, 1974/75	–	–	.244	60	.241	59	.515	127
	1975, 1975/76	.007	10	.025	37	.778	1,149	.192	285
	1976, 1976/77	.007	5	.023	15	.800	533	.770	113
	1977, 1977/78	.001	1	.004	4	.626	511	.368	300
	1978, 1978/79	.002	3	.020	32	.858	1,397	.120	195
	1979, 1979/80	.012	10	.035	107	.834	731	.120	105
	1980, 1980/81	–	–	–	–	–	–	–	–
	1981, 1981/82	–	–	–	–	–	–	1	219
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–
Sipiwesk	1973, 1973/74	.462	653	.107	152	.431	610	–	–
	1974, 1974/75	.075	88	.280	321	.644	756	.001	1
	1975, 1975/76	.038	134	.168	442	.780	2,696	.031	46
	1976, 1976/77	.094	180	.312	599	.580	1,114	.051	29
	1977, 1977/78	.165	39	.41	106	.426	262	–	–
	1978, 1978/79	.205	473	.414	1,013	.376	919	.004	12
	1979, 1979/80	.274	127	.433	201	.225	128	.018	7
	1980, 1980/81	.247	199	.306	235	.413	316	.034	26
	1981, 1981/82	.149	584	.109	42	.686	392	.057	33
	1982, 1982/83	.129	30	.177	43	.688	165	.012	3
	1983	.112	40	.255	91	.594	213	.040	14

Continued on page 157

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Sisipuk	1973, 1973/74	–	–	–	–	–	–	–	–
	1974, 1974/75	–	–	–	–	.80	286	.20	72
	1975, 1975/76	.038	10	.05	70	.702	86	.232	285
	1976, 1976/77	–	–	–	–	–	–	–	–
	1977, 1977/78	.113	450	.257	260	.616	2,457	.014	57
	1978, 1978/79	.006	18	.108	54	.517	266	.374	21
	1979, 1979/80	.049	16	.149	48	.742	240	.060	192
	1980, 1980/81	.500	82	.067	100	.389	590	.04	78
	1981, 1981/82	.018	12	.321	203	.579	418	.082	52
	1982, 1982/83	.096	21	.889	19	.015	17	–	–
	1983	.009	17	.802	141	.189	33	–	–
South Indian	1973, 1973/74	.017	509	.056	165	.645	19,054	.282	8,349
	1974, 1974/75	–	–	–	–	–	–	–	–
	1975, 1975/76	.007	146	.056	1,255	.931	24,351	.006	27
	1976, 1976/77	.011	269	.057	1,434	.879	7,496	.053	522
	1977, 1977/78	.003	88	.100	3,045	.868	26,798	.030	934
	1978, 1978/79	.009	99	.061	1,676	.947	24,882	.009	426
	1979, 1979/80	.022	320	.170	2,508	.760	11,200	.048	706
	1980, 1980/81	.005	154	.036	488	.903	2,206	.050	668
	1981, 1981/82	.165	168	.047	484	.753	7,664	.035	352
	1982, 1982/83	.629	24	.086	3	.280	10	.006	.2
	1983	.005	48	.030	305	.888	8,993	.077	783

Continued on page 158

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
St. Martin	1973, 1973/74	–	–	.002	2	.873	8,610	.124	1,626
	1974, 1974/75	.002	1	.007	33	.917	4,563	.076	380
	1975, 1975/76	.001	12	.049	969	.502	8,049	.448	25,520
	1976, 1976/77	.0002	1	.028	285	.233	18,867	.739	5,291
	1977, 1977/78	.0009	1	.012	321	.772	19,355	.216	16,523
	1978, 1978/79	.0002	1	.0009	137	.588	1,060	.402	7,972
	1979, 1979/80	.0008	5	.007	345	.567	14,309	.462	11,412
	1980, 1980/81	.0002	1	.013	75	.549	11,271	.438	11,912
	1981, 1981/82	.00082	.4	.003	1	.485	9,951	.512	11,319
	1982, 1982/83	–	–	–	–	.468	–	.532	–
	1983	–	–	–	–	–	–	–	–
Walker	1973, 1973/74	.047	250	.215	1,150	.744	3,971	–	–
	1974, 1974/75	.046	53	.400	463	.552	639	.002	2
	1975, 1975/76	.109	245	.805	1,814	.086	194	–	–
	1976, 1976/77	.191	396	.490	1,017	.318	289	.001	–
	1977, 1977/78	–	–	–	–	–	–	–	–
	1978, 1978/79	–	–	–	–	–	–	–	–
	1979, 1979/80	.218	164	.781	589	.0004	.3	–	–
	1980, 1980/81	–	–	–	–	–	–	–	–
	1981, 1981/82	–	–	–	–	–	–	–	–
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–

Continued on page 159

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Wekusko	1973, 1973/74	–	–	–	–	1.0	98	–	–
	1974, 1974/75	–	–	.143	712	.740	3,666	.116	576
	1975, 1975/76	.004	16	.192	775	.716	2,884	.088	350
	1976, 1976/77	–	–	.140	639	.777	3,554	.084	380
	1977, 1977/78	–	–	.442	551	.392	401	.166	299
	1978, 1978/79	–	–	.014	74	.703	3,627	.015	789
	1979, 1979/80	–	–	.028	376	.836	1,886	.136	308
	1980, 1980/81	–	–	.094	113	.736	889	.170	205
	1981, 1981/82	–	–	.023	31	.745	974	.239	303
	1982, 1982/83	–	–	.076	179	.721	1,689	.203	475
	1983	–	–	–	–	–	–	–	–
William	1973, 1973/74	–	–	.021	349	.978	16,127	.0004	5
	1974, 1974/75	–	–	.008	236	.992	2,596	–	–
	1975, 1975/76	–	–	.012	89	.988	6,554	–	–
	1976, 1976/77	.0005	4	.008	74	.990	9,271	.002	17
	1977, 1977/78	–	–	.0006	2	.999	30,768	–	–
	1978, 1978/79	–	–	–	–	1.00	12,203	–	–
	1979, 1979/80	–	–	–	–	1.00	21,907	–	–
	1980, 1980/81	–	–	.034	686	.954	20,248	–	–
	1981, 1981/82	–	–	–	–	1.00	2,845	–	–
	1982, 1982/83	–	–	–	–	1.00	4,368	–	–
	1983	–	–	.144	494	.856	2,932	–	–

Continued on page 160

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Wintering	1973, 1973/74	.0014	2	.050	87	.941	1,617	.006	10
	1974, 1974/75	–	–	.031	34	.969	1,051	–	–
	1975, 1975/76	.005	6	.052	54	.943	988	–	–
	1976, 1976/77	.005	6	.082	107	.913	1,187	–	–
	1977, 1977/78	.005	58	.061	733	.937	551	–	–
	1978, 1978/79	.021	52	.154	384	.825	2,052	–	–
	1979, 1979/80	.500	342	.047	32	.450	308	–	–
	1980, 1980/81	.500	37	.126	9	.374	28	–	–
	1981, 1981/82	.002	0.8	.056	28	.940	422	.022	2
	1982, 1982/83	.0002	2	.062	50	.932	32,316	–	–
	1983	.0002	–	.002	–	.998	–	–	–
Witchai	1973, 1973/74	–	–	–	–	–	–	–	–
	1974, 1974/75	–	–	.047	65	.953	1,321	–	–
	1975, 1975/76	–	–	.297	652	.703	1,539	–	–
	1976, 1976/77	.002	3	.073	102	.924	1,294	.0002	–
	1977, 1977/78	.002	3	.160	169	.837	884	.0004	521
	1978, 1978/79	.0005	1	.252	377	.745	1,114	.002	3
	1979, 1979/80	.102	47	.678	314	.220	102	–	–
	1980, 1980/81	.0007	1	.135	131	.858	832	.006	6
	1981, 1981/82	.001	1	.196	118	.810	630	.004	3
	1982, 1982/83	–	–	.174	73	.824	346	.002	1
	1983	.002	1	.022	7	.964	289	.01	3

Continued on page 161

Appendix I (cont'd)

Lake	Time (Year)	Whitefish Size Categories							
		Jumbo		Large		Medium		Small	
		Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)	Ratio	Av. C.U.E. (kg/ND/F)
Wuskwatim	1973, 1973/74	.004	5	.019	216	.973	10,822	.006	72
	1974, 1974/75	–	–	.014	278	.828	16,572	.156	3,173
	1975, 1975/76	–	–	–	–	–	–	–	
	1976, 1976/77	–	–	.003	3	.983	1,068	.016	816
	1977, 1977/78	–	–	–	–	–	–	–	–
	1978, 1978/79	–	–	.25	8	.50	16	.25	8
	1979, 1979/80	–	–	–	–	–	–	–	–
	1980, 1980/81	.010	6	.740	149	.240	469	.010	7
	1981, 1981/82	.003	2	.170	47	.920	620	.006	4
	1982, 1982/83	.001	–	.161	–	.835	–	.003	–
	1983	.011	12	.097	94	.892	865	–	–
Yawningstone	1973, 1973/74	–	–	.459	22	.542	26	–	–
	1974, 1974/75	–	–	–	–	–	–	–	–
	1975, 1975/76	.040	10	.058	6	.924	247	–	–
	1976, 1976/77	.085	40	.229	122	.67	356	.012	7
	1977, 1977/78	.002	–	.071	–	.840	–	.088	–
	1978, 1978/79	–	–	.25	36	.500	725	.25	36
	1979, 1979/80	–	–	.078	6	.922	66	–	–
	1980, 1980/81	–	–	.051	4	.805	66	.144	12
	1981, 1981/82	–	–	–	–	–	–	–	–
	1982, 1982/83	–	–	–	–	–	–	–	–
	1983	–	–	–	–	–	–	–	–

Appendix J

Temporal changes of lake whitefish size classes, percent frequency (% F) of jumbo, large, medium and small, 1973-1983, for all lakes.

Legend

Jumbo size class

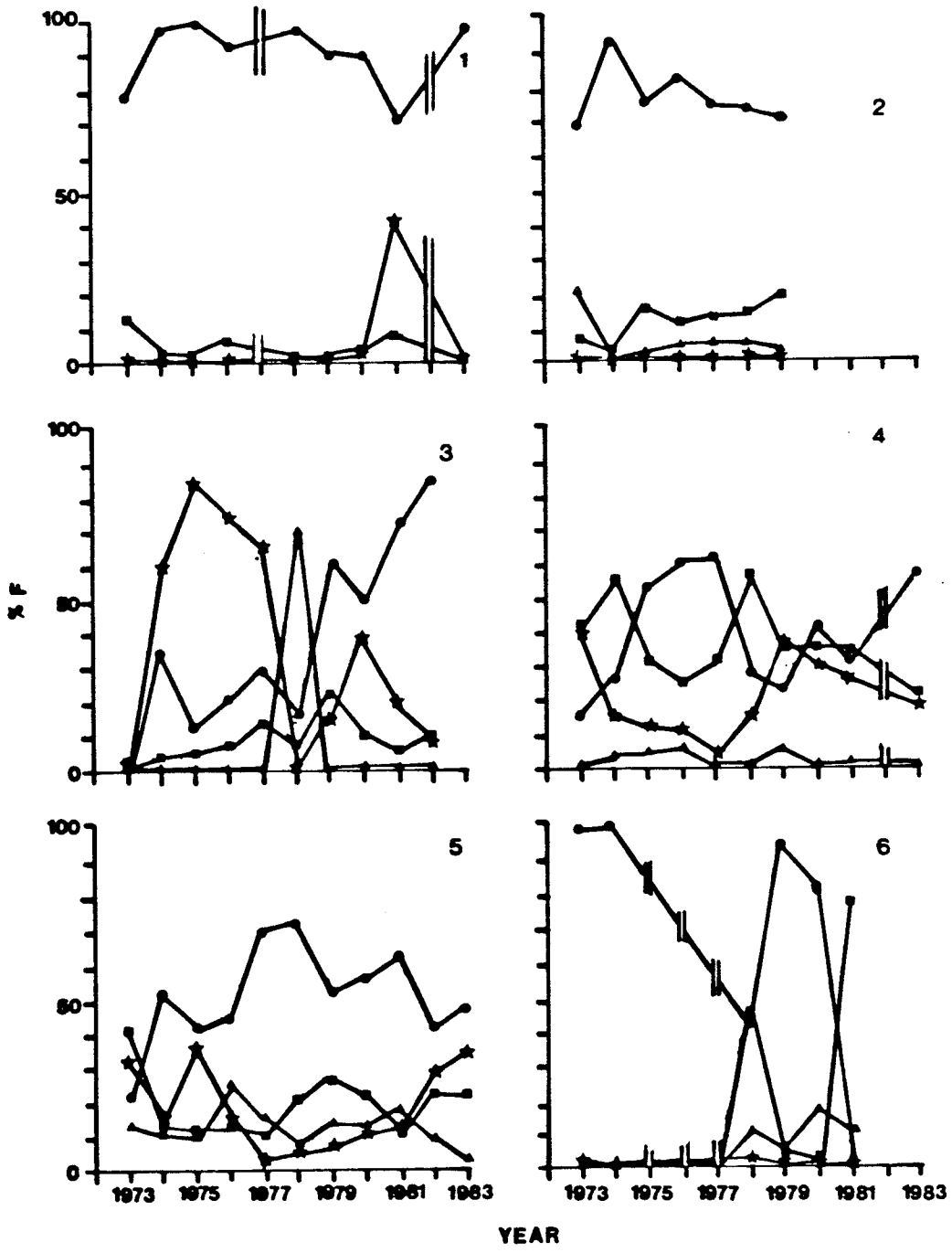
Large size class

Medium size class

Small size class

List of Lakes in Appendix J

1. Armstrong
2. Barrington
3. Butterfly
4. Bruneau
5. Cedar
6. Cormorant
7. Opachuanau
8. Pakwa
9. Patridge Crop
10. Playgreen
11. Sabomin
12. Setting
13. Kipahigan
14. Kiski
15. Kisseynew
16. Landing
17. Natawahunan
18. North Indian
19. Dafoe
20. Gods
21. Granville
22. Guthrie
23. Halfway
24. Herblet
25. Sisipuk
26. Sipiwesk
27. South Indian
28. St. Martin
29. Walker
30. Wekusko
31. Willima
32. Wintering
33. Witchai
34. Wuskwatim
35. Yawningstone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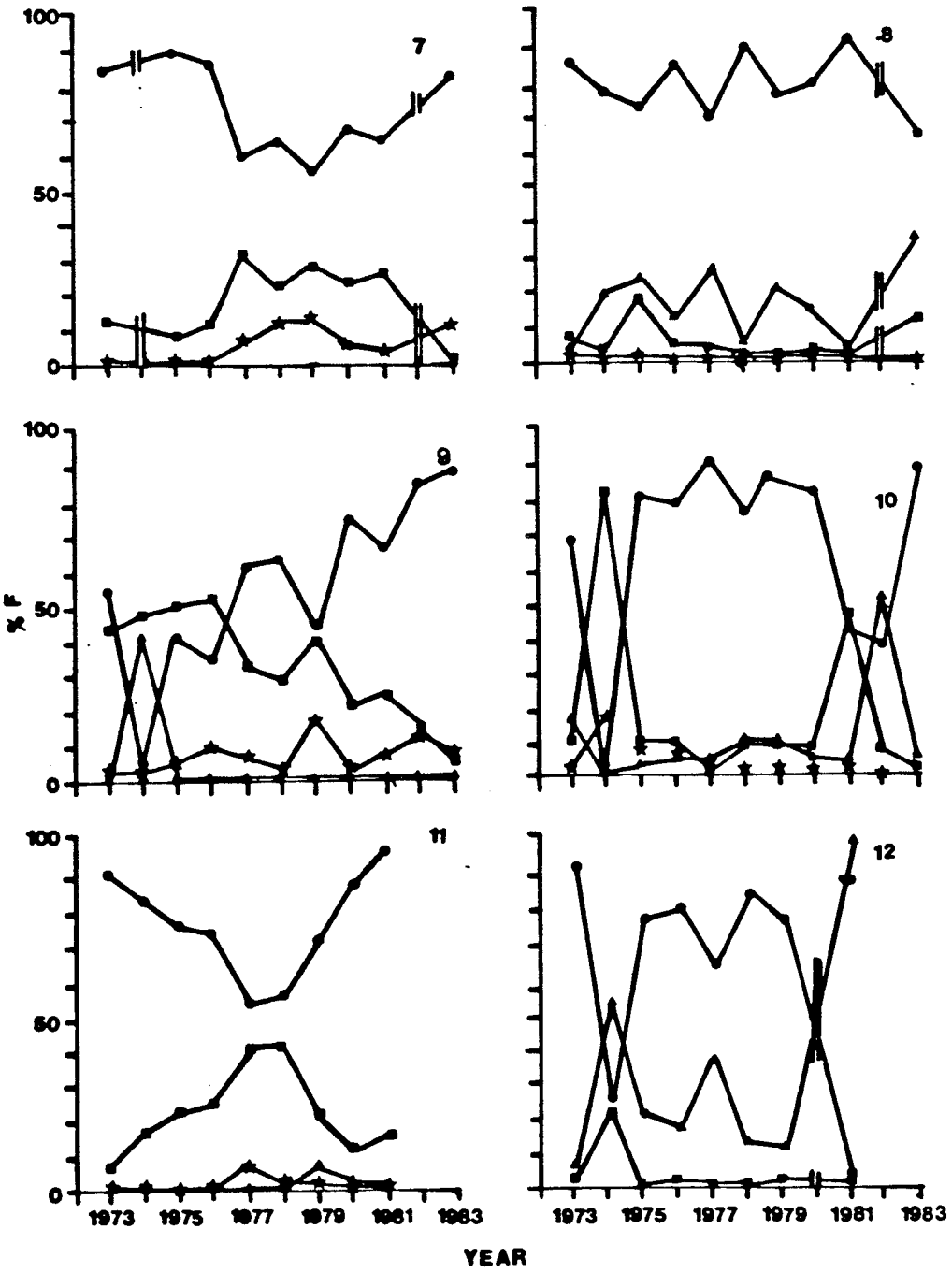
1
2
3
4
5
6
% F
1973
1975
1977
1979
1981
1983
YEAR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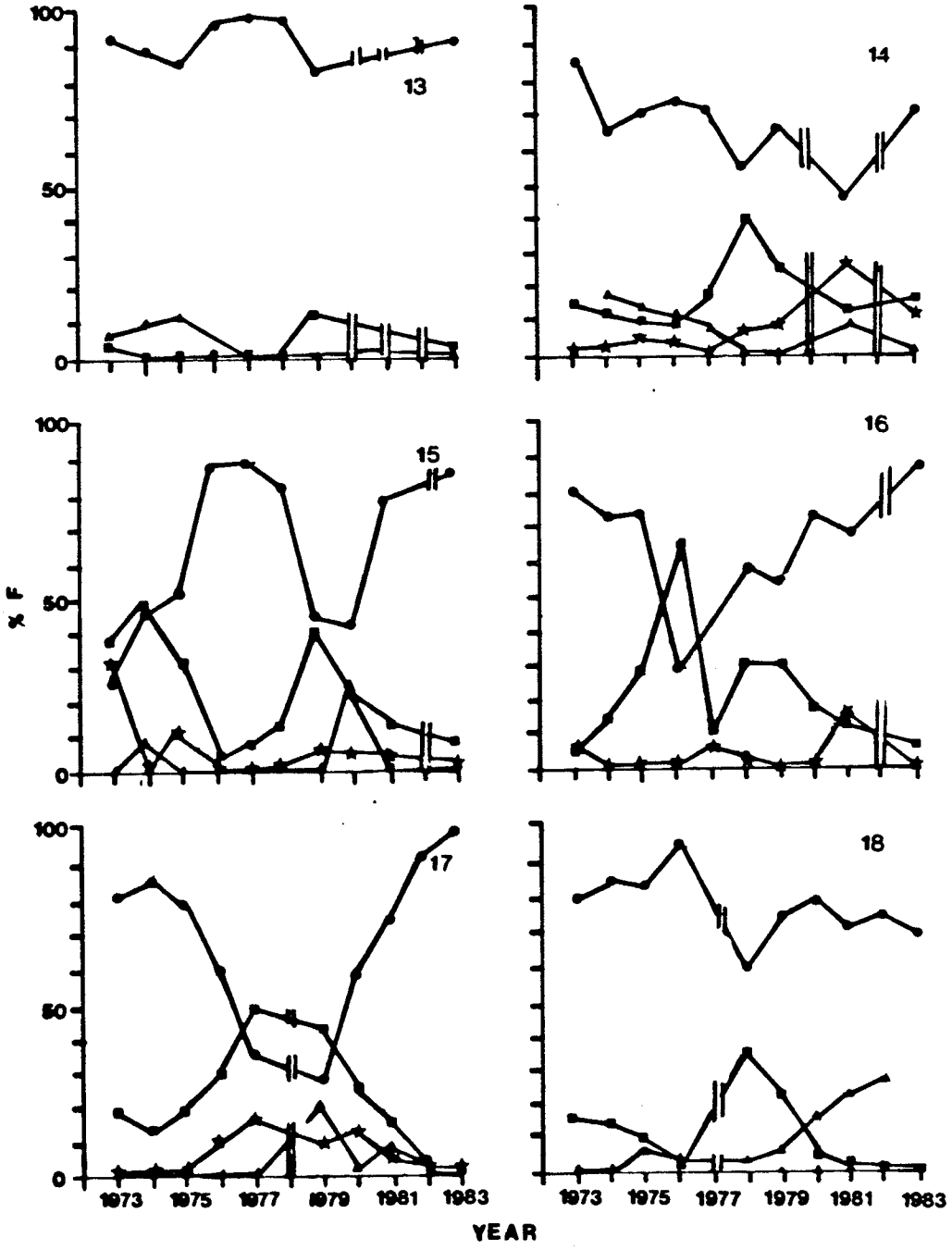
0
7
8
9
10
11
12
% F
1973
1975
1977
1979
1981
1983
YEAR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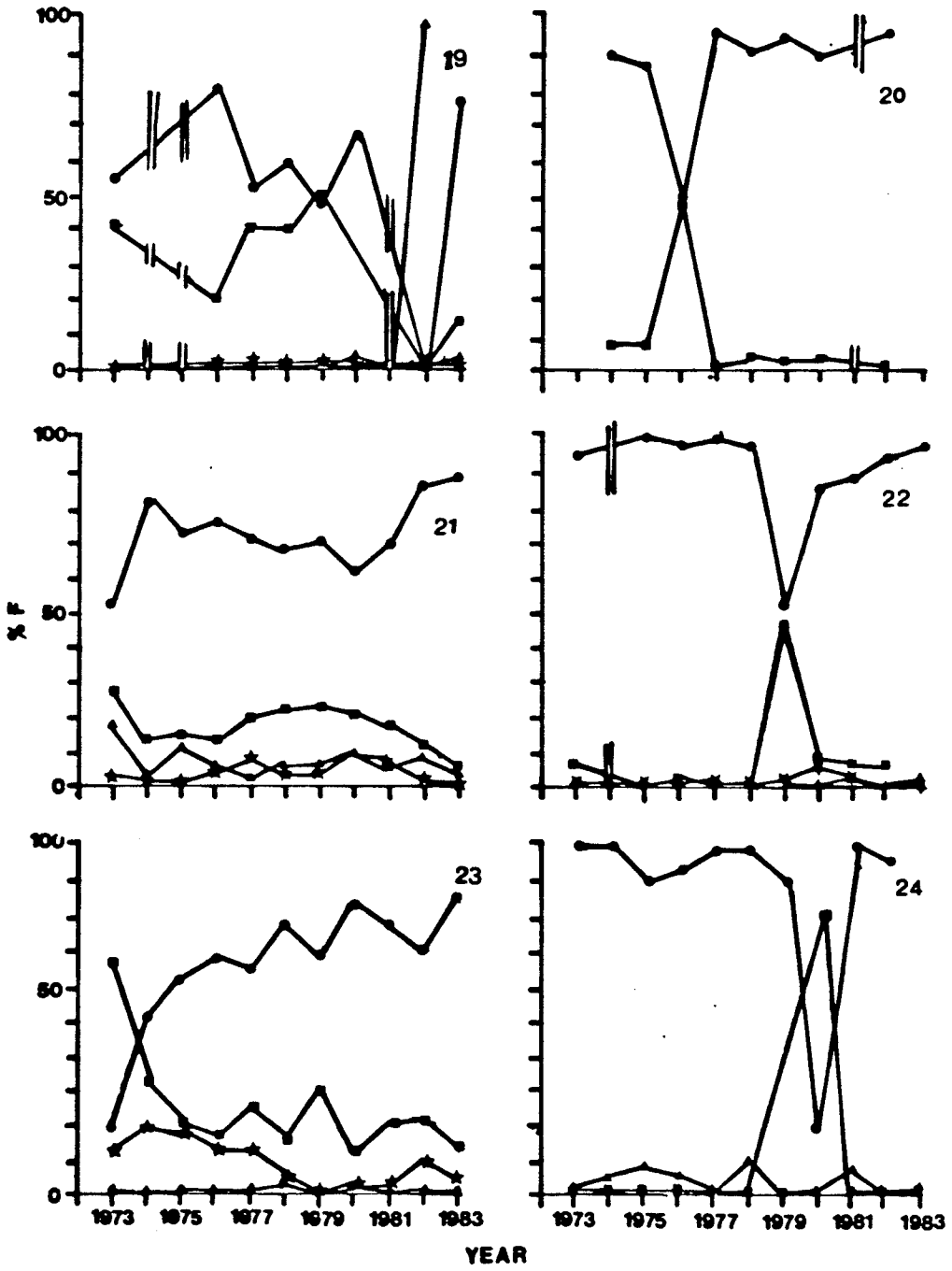
50
0
13
14
15
16
17
18
% F
1973
1975
1977
1979
1981
1983
YEAR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23
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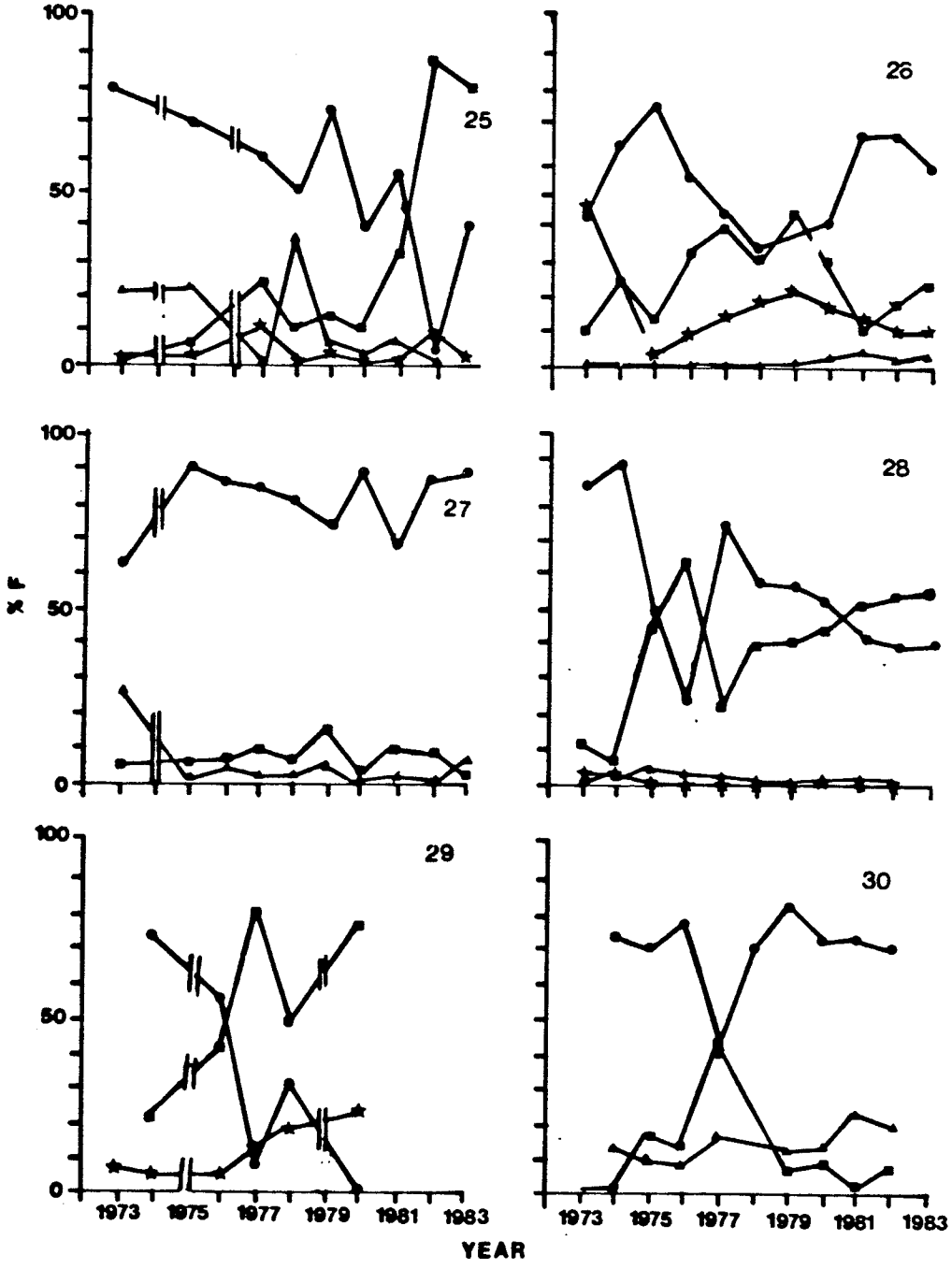
1973
1975
1977
1979
1981
1983
YEAR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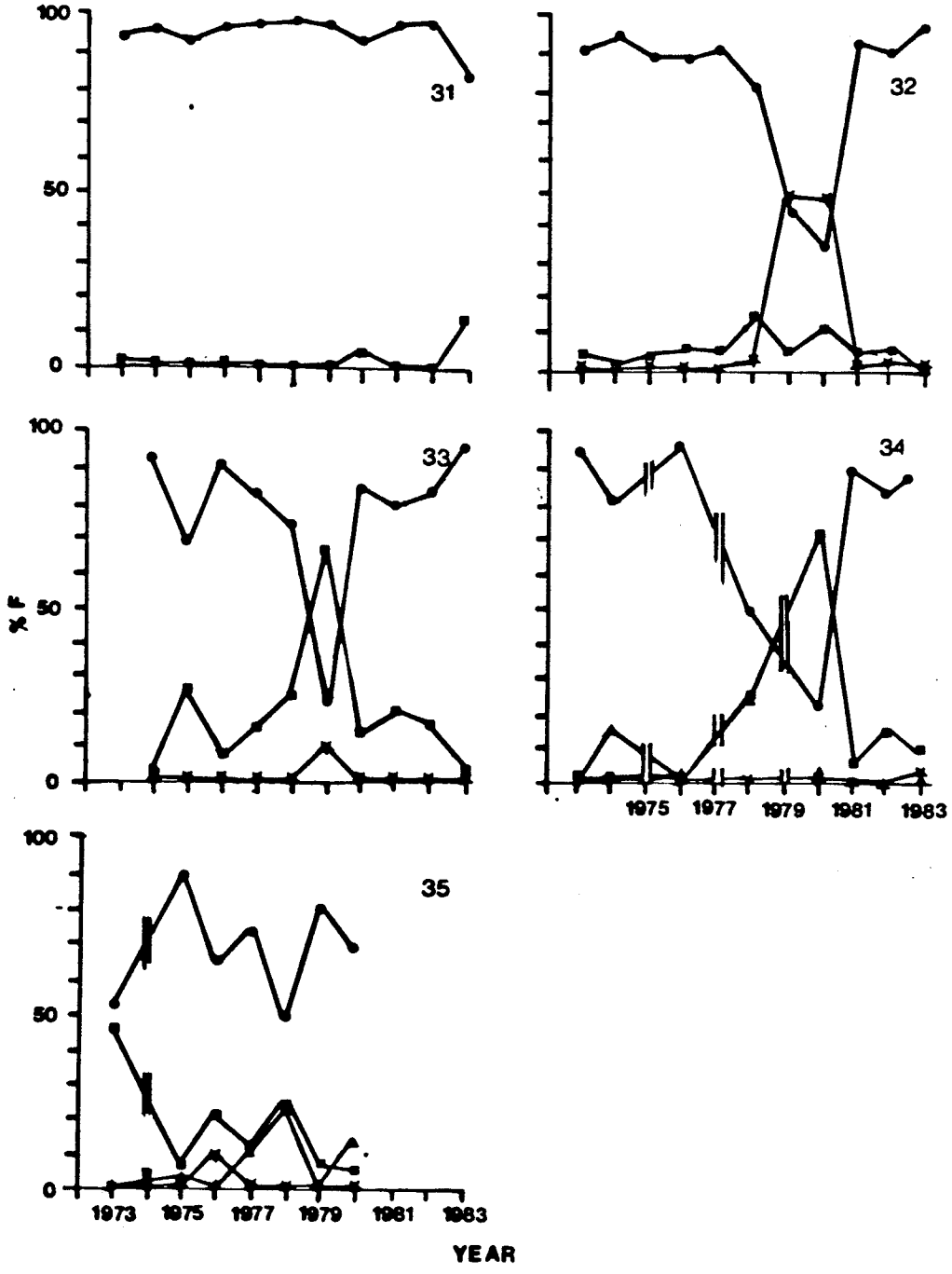
1973
1975
1977
1979
1981
1983
YEAR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31
32
33
34
35
% F
1975
1977
1979
1981
1983
1973
YEAR

Appendix K

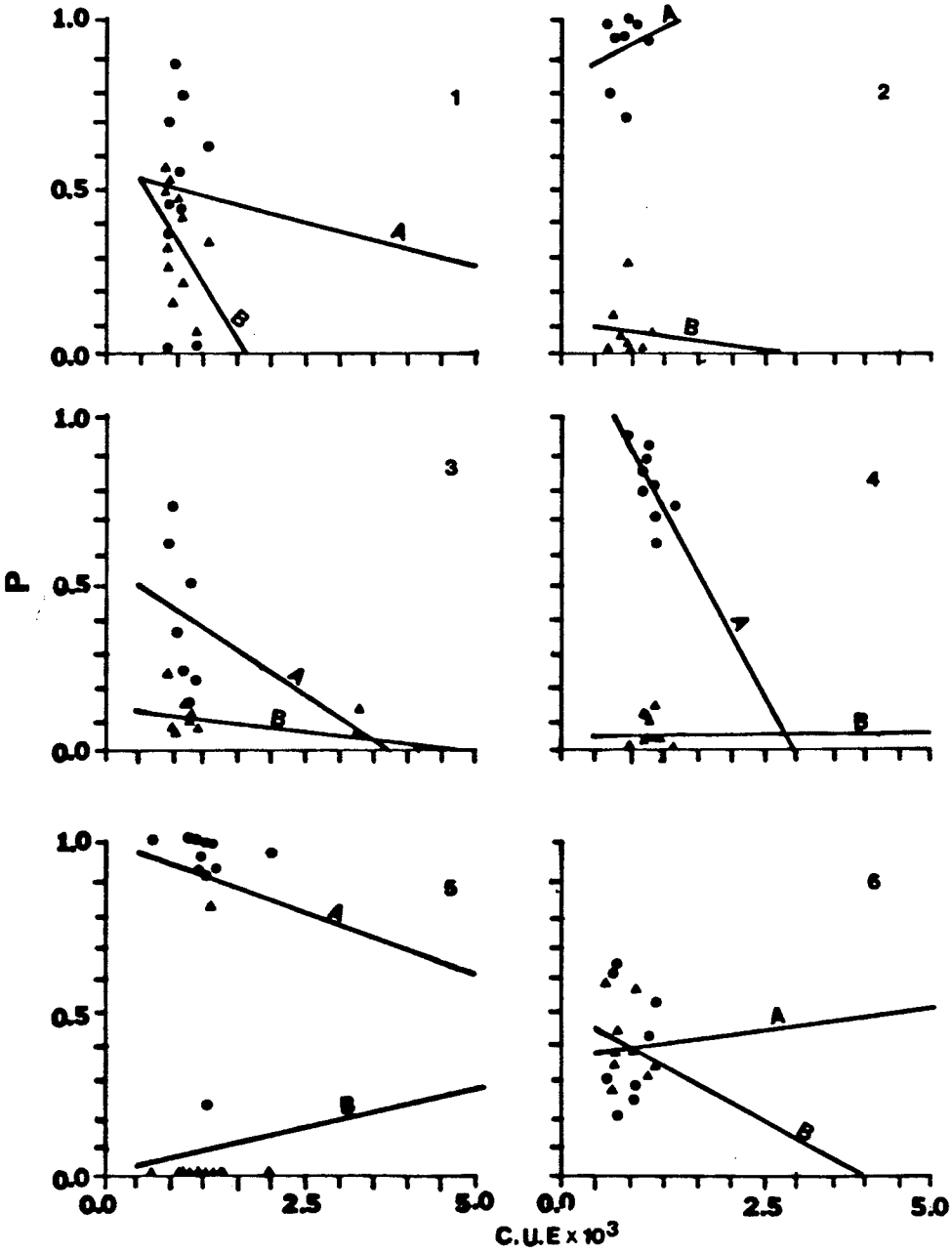
Concomitant changes in proportions of medium and large sized lake whitefish as a function of CUE (kg/N.D/F)

Legend

A medium size lake whitefish
B large size lake whitefish

List of Lakes in Appendix K

1. Patridge Crop
2. Armstrong
3. Butterfly
4. Pakwa
5. Herblet
6. Bruneau
7. South Indian
8. Wekusko
9. Playgreen
10. North Indian
11. William
12. St. Martin
13. Wuskwatim
14. Setting
15. Landing
16. Walker
17. Natawahunan
18. Barrington
19. Yawningstone
20. Opachuanau
21. Witchai
22. Kipahigan
23. Dafoe
24. Wintering
25. Cormorant
26. Sisipuk
27. Halfway
28. Cedar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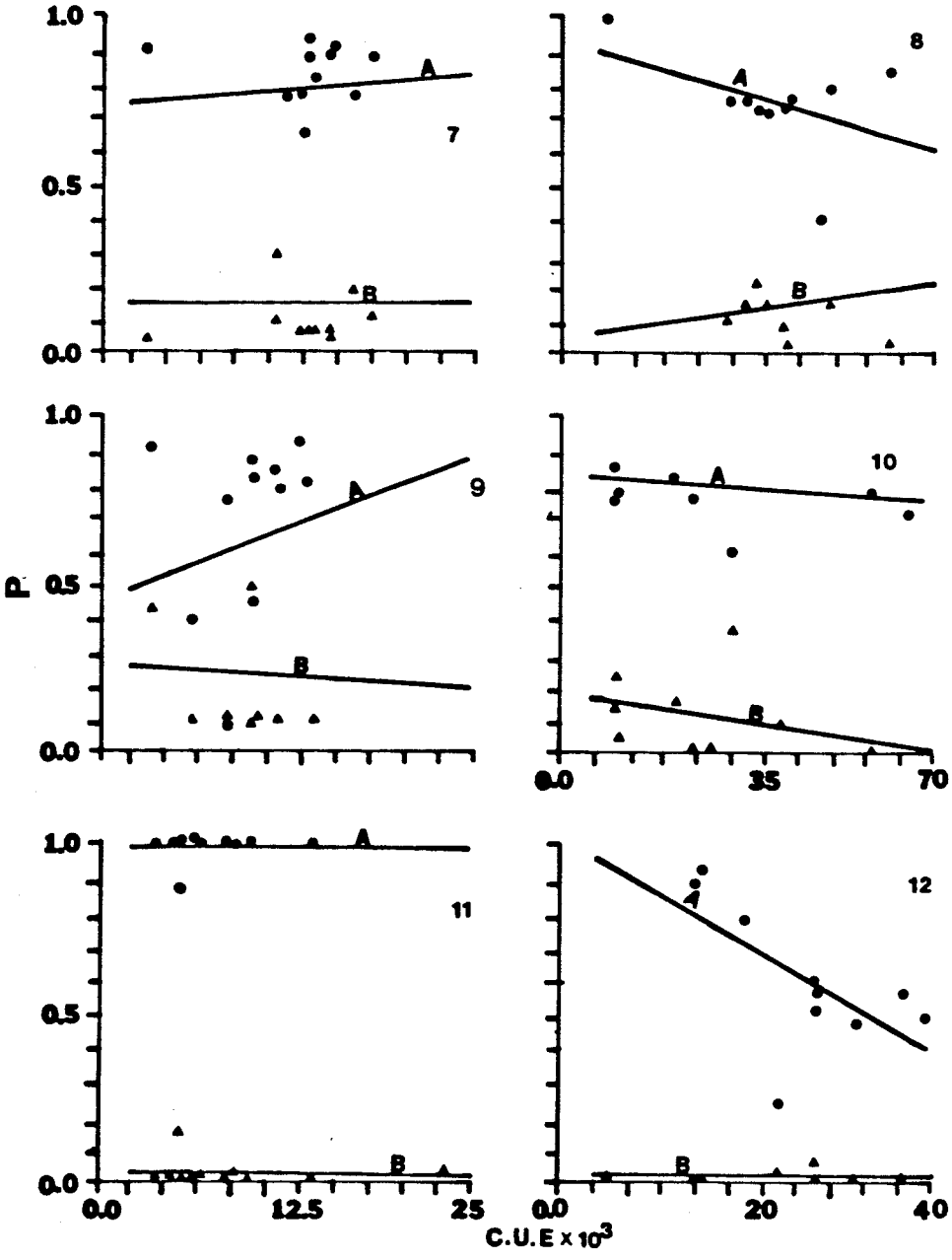
5.0
C.U.E x 10³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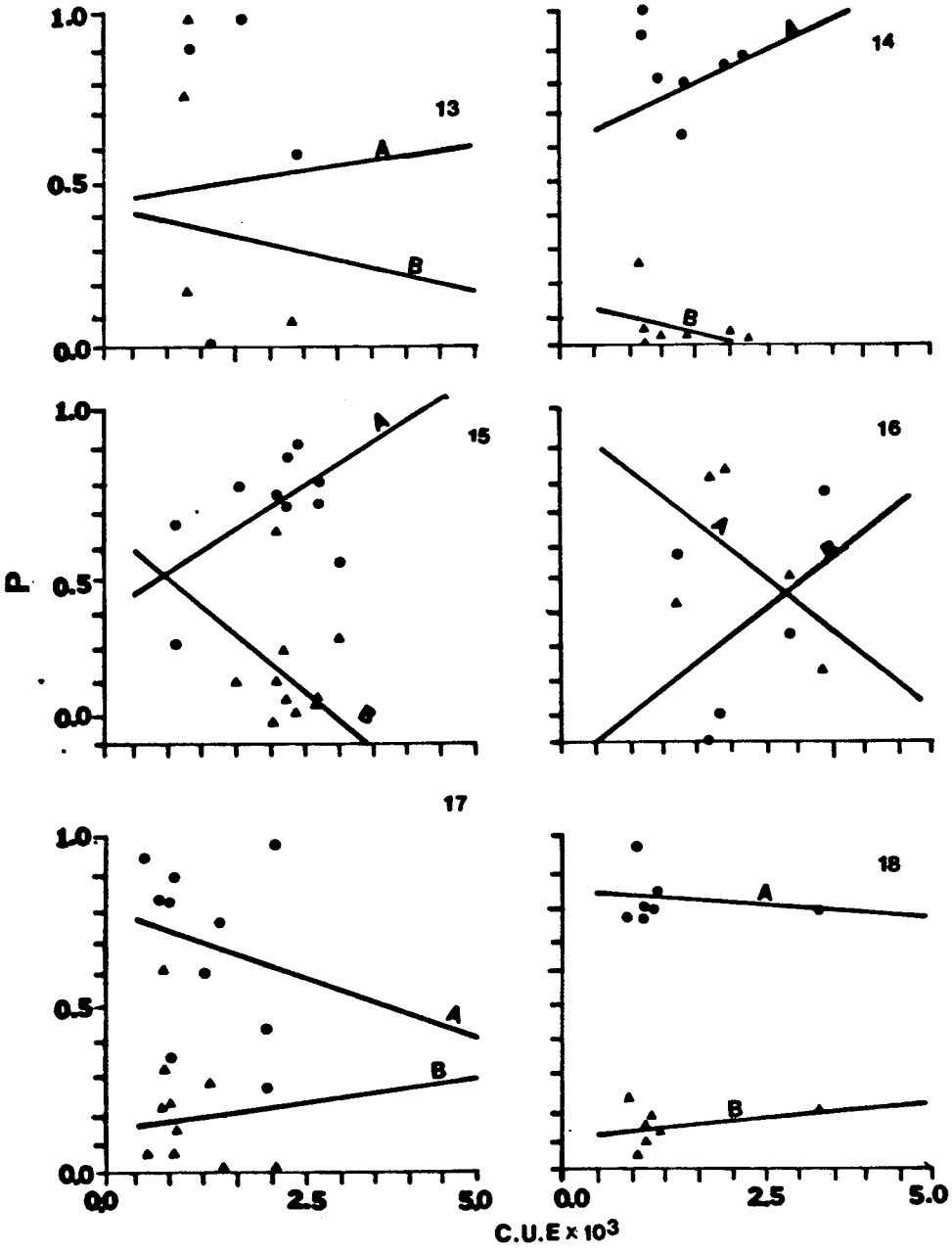
25
20
40
C.U.E x 10³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B
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A
B
15
A
B
16
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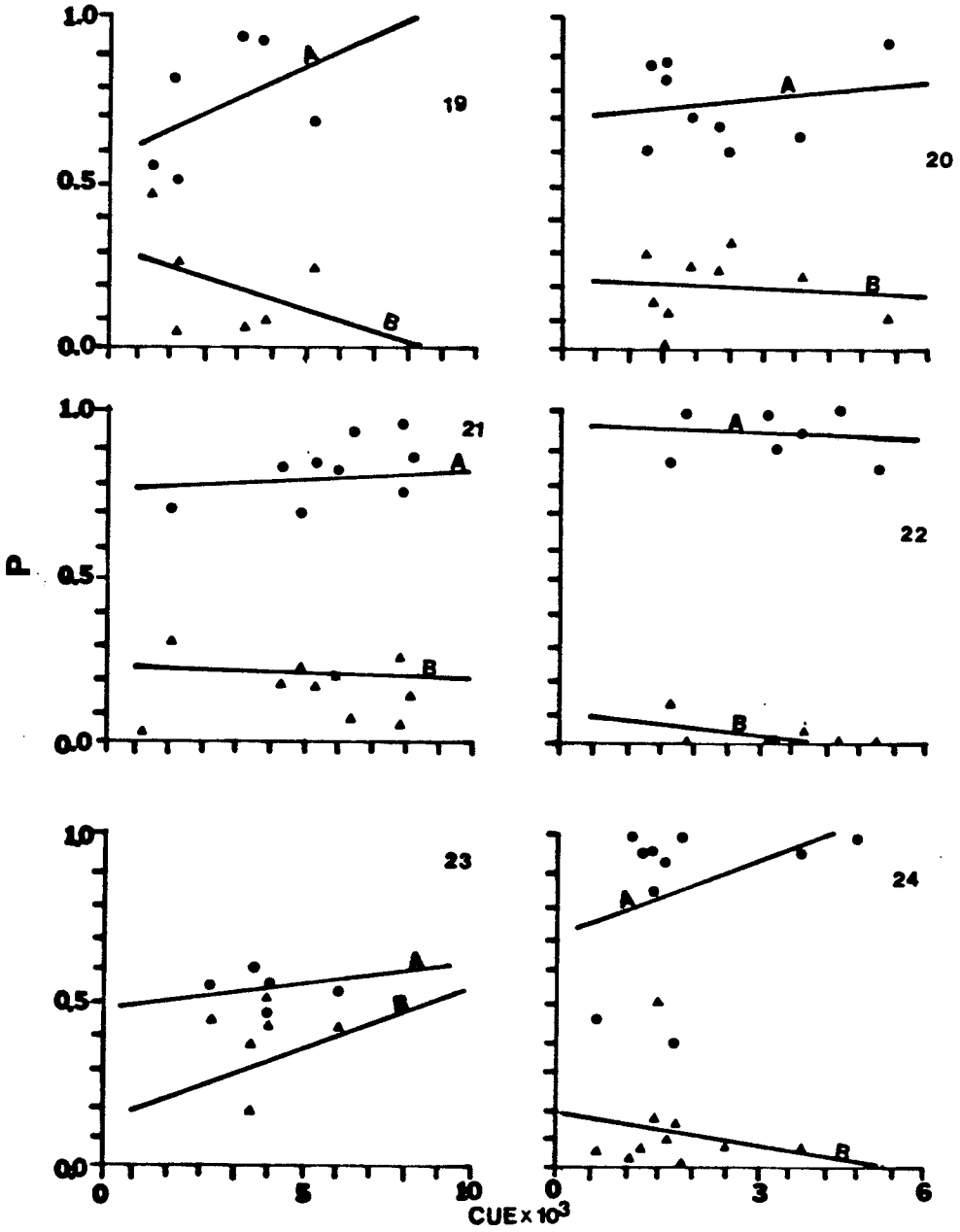
A
B
P
0.0
2.5
5.0
C.U.E x 10³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0.0
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B
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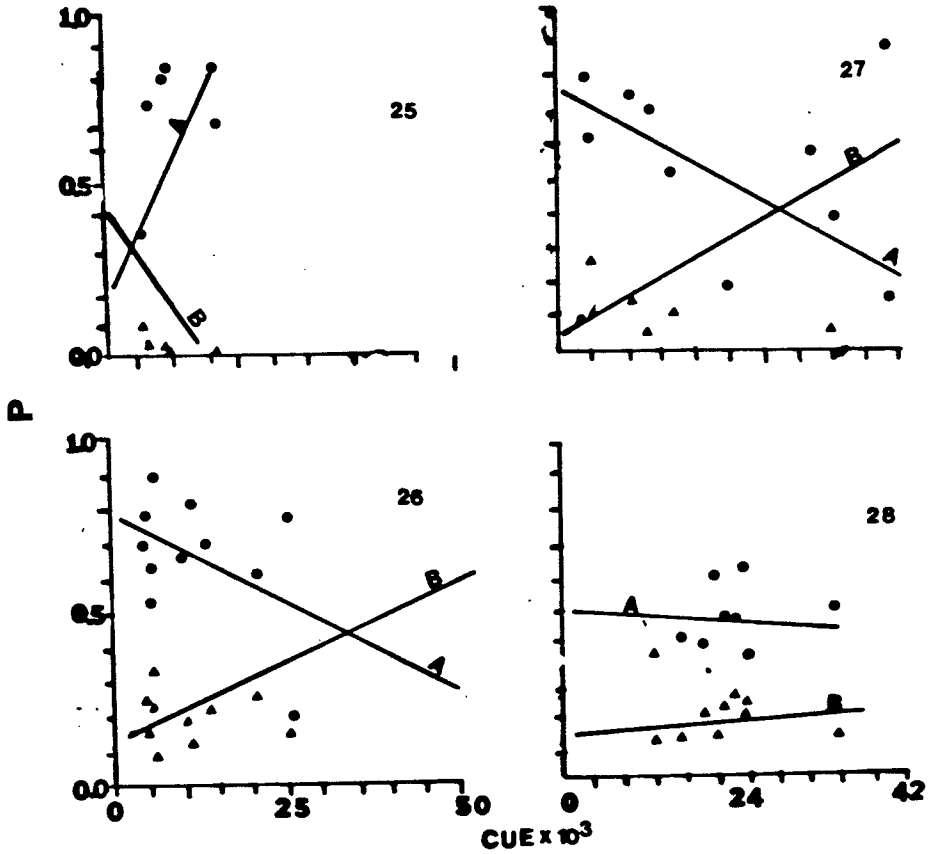
20
21
22
23
24
P
0
5
10
3
6
CUE x 10^3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B
27
B
A
P
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0.0
26
B
A
28
A
B
0
25
50
0
24
42
CUE x 10^3

Appendix L

Regressions of change in proportions of large and medium versus catch per unit effort (kg/N.D/F)+ in the Nelson, Churchill and Hayes River watersheds

Watershed	Lake Name	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and
Nelson	Armstrong	1. Y=0.083-272909X	0.066	0.03 (1,6)
		2. Y=0.862+993349x	0.20	0.25 (1,6)
	Bruneau	1. Y=0.434-10807X	0.242	0.43 (1,7)
		2. Y=0.368+2.75658X	0.041	0.01 (1,7)
	Butterfly	1. Y=0.498-13224X	0.541	2.49 (1,6)
		2. Y=0.122-2.57247X	0.394	1.10 (1,6)
	Cedar	1. Y=.146+0X	.799	14.5 (1,8)
		2. Y=.577-0X	.24	5.11 (1,8)
	Cormorant	1. Y=.522-0X	0.484	1.22 (1,4)
		2. Y=.199+0X	.610	2.37 (1,4)
	Guthrie	1. Y=0.103-196001X	0.199	.33 (1,8)
		2. Y=0.776-486346X	0.34	.82 (1,8)
	Halfway	1. Y=0.131+909831X	0.463	2.45 (1,9)
		2. Y=0.788-102912X	0.458	2.38 (1,9)
	Herblet	1. Y=0.228+46521X	0.060	0.06 (1,9)
		2. Y=0.962-707813X	0.127	.15 (1,9)
	Kiski	1. Y=0.160+211802X	0.172	.21 (1,7)
		2. Y=05.99+358072X	0.111	0.09 (1,7)
	Landing	1. Y=0.577-16829.4X	0.654	5.99 (1,8)
		2. Y=0.447+12842X	.199	.33 (1,8)
	Pakwa	1. Y=.051+1742370X	.007	0.0 (1,8)
		2. Y=1.126-37472X	.668	6.44 (1,8)

Continued on page 178

Appendix L (cont'd)

Regressions of change in proportions of large and medium versus catch per unit effort (kg/N.D/F)+ in the Nelson, Churchill and Hayes River watersheds

Watershed	Lake Name	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and
Nelson	Patridge Crop	1. Y=0.509-32497X	.421	1.93 (1,9)
		2. Y=0.515-518219X	.039	.01 (1,9)
	Playgreen	1. Y=0.251-2481720X	0.207	.40 (1,9)
		2. Y=0.478+1.551X	0.161	.24 (1,9)
	Setting	1. Y=0.110-499076X	.375	.98 (1,6)
		2. Y=0.644+933928X	.238	.36 (1,6)
	Sipiwesk	1. Y=0.266+150920X	.013	0.0 (1,9)
		2. Y=0.465+4106270X	0.021	0.0 (1,9)
	St. Martin	1. Y=0.01+770,347,000X	0.005	0.0 (1,8)
		2. Y=0.948-141532X	.398	.398 (1,8)
	Wekusko	1. Y=.049+219285X	.266	.61 (1,8)
		2. Y=.881-407755X	.430	1.82 (1,8)
	William	1. Y=0.023-3400160X	.049	0.02 (1,9)
		2. Y=0.979-15,314,100	.022	0 (1,9)
	Wintering	1. Y=.164-2583580X	.253	.62 (1,9)
		2. Y=.696+6202940X	.388	1.59 (1,9)
	Witchai	1. Y=.223-3765470X	.056	.02 (1,8)
		2. Y=.758+487260X	.063	.03 (1,8)
	Walker	1. Y=0.8653-15124X	.534	1.2 (1,3)
		2. Y=-1145+1570X	.452	.77 (1,3)
	Wuskwatim	1. Y=.393-448042X	.381	.85 (1,5)
		2. Y=.440+331825X	.266	.38 (1,5)

Continued on page 179

Appendix L (cont'd)

Regressions of change in proportions of large and medium versus catch per unit effort (kg/N.D/F)+ in the Nelson, Churchill and Hayes River watersheds

Watershed	Lake Name	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and
Nelson	Yawingstone	1. Y=.268-32774X	.384	.69 (1,4)
		2. Y=.614+45998X	.463	1.09 (1,4)
Churchill	Barrington	1. Y=.107+0.00X	.304	.51 (1,5)
		2. Y=.854-0X	.305	.51 (1,5)
	Granville	1. Y=.1062+214713X	.491	2.55 (1,8)
		2. Y=.823-355071X	.467	2.23 (1,8)
	Kipahigan	1. Y=.083-185814X	.568	2.38 (1,5)
		2. Y=.947-5839020X	.111	.06 (1,5)
	Kisseynew	1. Y=.263-199460X	.135	.13 (1,7)
		2. Y=.623+246996X	.122	.11 (1,7)
	N. Indian	1. Y=.163-212993X	.384	1.39 (1,8)
		2. Y=.814-9,860,300X	.208	.36 (1,8)
	Opachuanau	1. Y=.196-6,023,870X	.086	.086 (1,7)
		2. Y=.701+159,609X	.186	.25 (1,7)
	Sisipuk	1. Y=.041+819094X	.557	3.5 (1,7)
		2. Y=.763-784699X	.752	9.1 (1,7)
	S. Indian	1. Y=.139+19,083,900X	.004	0.0 (1,8)
		2. Y=.728+3441290X	.081	.05 (1,8)
Hayes	Dafoe	1. Y=.130+380698X	.233	.35 (1,6)
		2. Y=.469+14136X	.061	.02 (1,6)
	Gods	1. Y=.0945+8446860X	.011	0.0 (1,6)
		2. Y=.805+5359870X	.054	.02 (1,6)

Continued on page 180

Appendix L (cont'd)

Regressions of change in proportions of large and medium versus catch per unit effort (kg/N.D/F)+ in the Nelson, Churchill and Hayes River watersheds

Watershed	Lake Name	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and
Hayes	Sabomin	1. Y=.256-414151X	.127	.11 (1,7)
		2. Y=.723+421529X	.117	.10 (1,7)

1.) Regression equation for proportions of large versus CUE.

2.) Regression equation for proportions of medium versus CUE.

\+ kg/ND/F. Kilograms per number of deliveries per fisherman.

Appendix M

Mean proportions of large and medium lake whitefish proportions in commercial catches from lakes in the Hayes, Churchill and Nelson River watersheds, 1973-1983

Appendix M

Mean Proportions of large and medium sized lake whitefish in commercial catches from lakes in the Churchill, Nelson and Hayes River watershed, 1973-1983

Watershed	Time (year) *	Proportions +	
		Large	Medium
Hayes	1973	0.260	0.729
	1974	0.115	0.879
	1975	0.168	0.828
	1976	0.303	0.685
	1977	0.274	0.687
	1978	0.288	0.687
	1979	0.245	0.720
	1980	0.170	0.807
	1981	0.031	0.968
	1982	0.012	0.987
	1983	0.170	0.780
	x	0.185	0.796
Churchill	1973	0.171	0.681
	1974	0.200	0.773
	1975	0.160	0.756
	1976	0.052	0.917
	1977	0.131	0.811
	1978	0.124	0.763
	1979	0.225	0.711
	1980	0.095	0.631
	1981	0.093	0.592
	1982	0.122	0.133
	1983	0.212	0.606
	x	0.144	0.667
Nelson	1973	0.172	0.676
	1974	0.172	0.563
	1975	0.144	0.657
	1976	0.188	0.654
	1977	0.170	0.575
	1978	0.160	0.633
	1979	0.268	0.555
	1980	0.246	0.567
	1981	0.190	0.572
	1982	0.089	0.418
	1981	0.090	0.489
	x	0.172	0.578

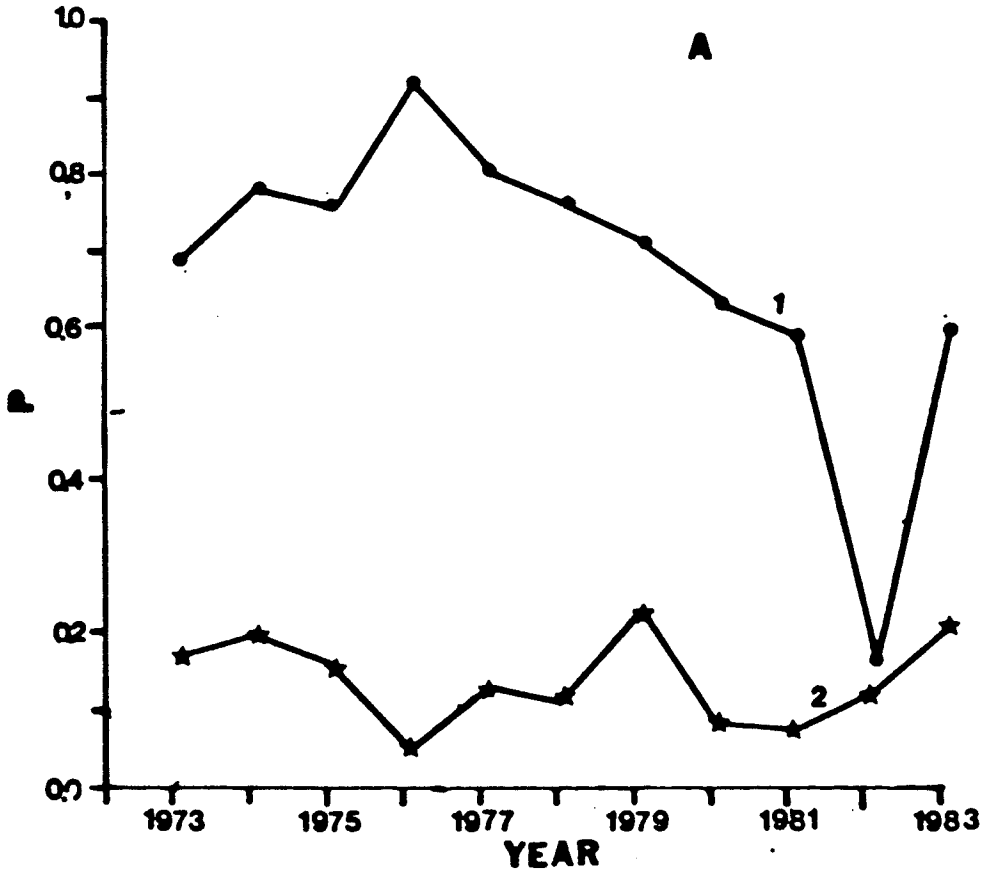
* Time = X + Proportions = Y

Appendix N

Temporal changes in medium and large classes of lake whitefish in commercial catches from lakes in the Churchill (A), Nelson (B) and Hayes (C) River watersheds

Legend

1 medium classes of lake whitefish
2 large classes of lake whitefish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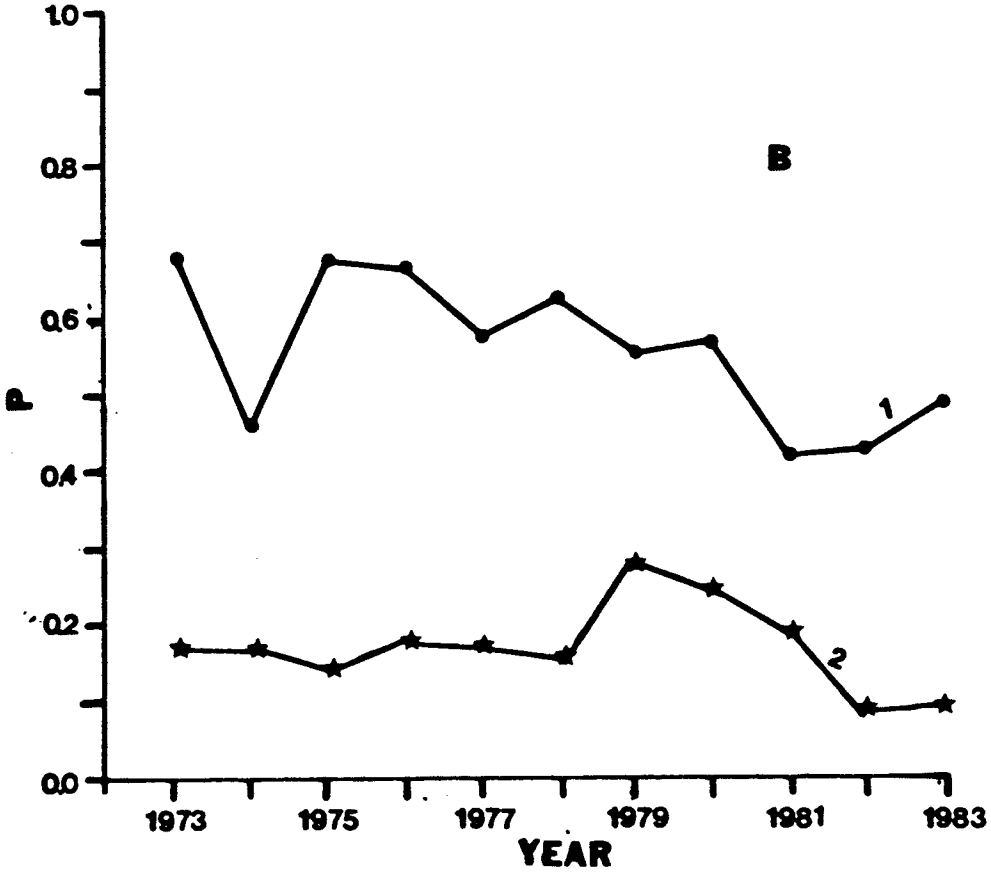
P
1
2
1973
1975
1977
1979
1981
1983
YEAR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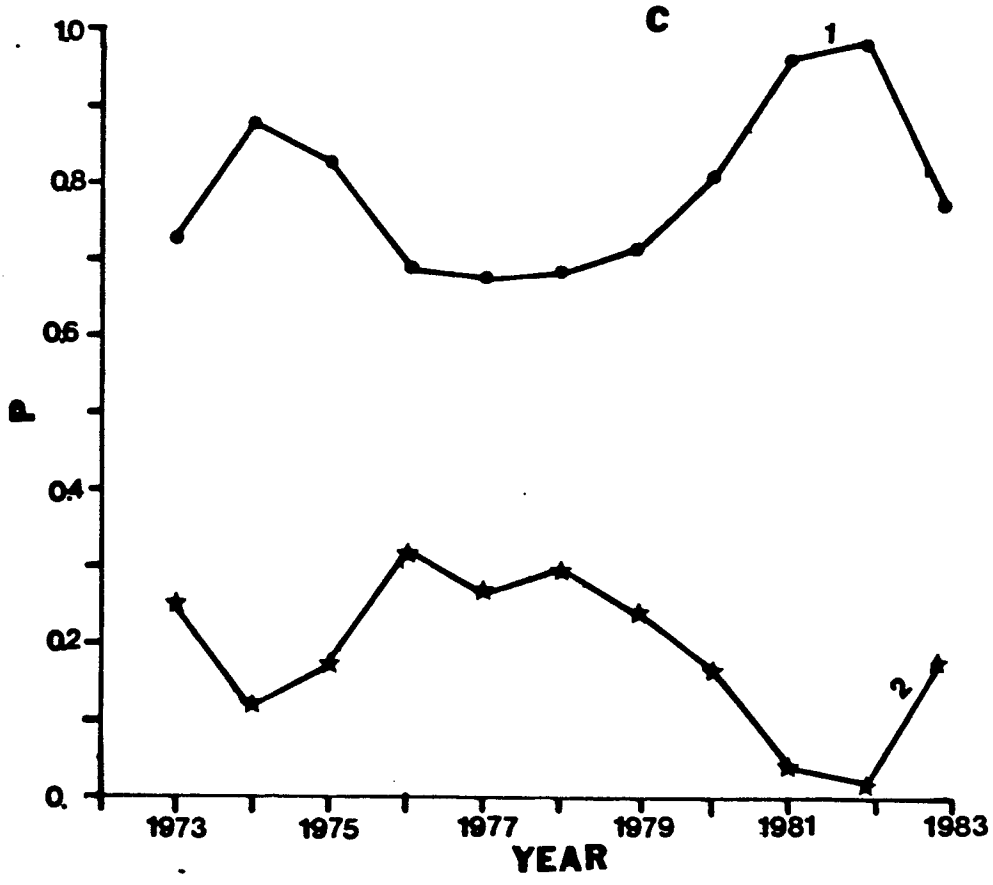
0.4
0.2
0.0
P
B
1
2
1973
1975
1977
1979
1981
1983
YEAR


C
1
2
1.0
0.8
0.6
0.4
0.2
0.
P
1973
1975
1977
1979
1981
1983
YEAR

Appendix O

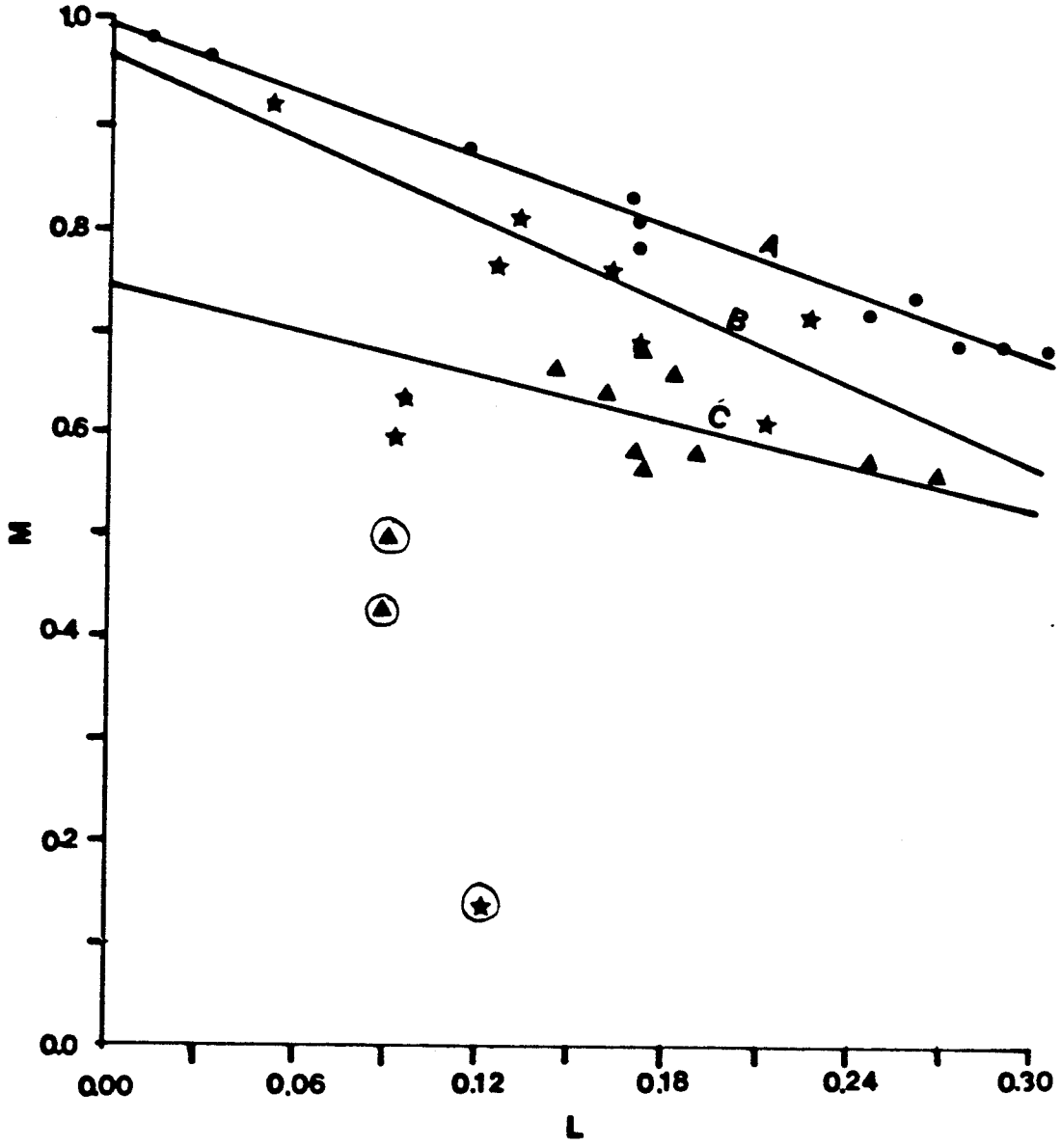
Concomitant changes in proportions of

medium and large size lake whitefish for

Churchill (A), Nelson (B) and Hayes (C) River watersheds

Legend

(A) Churchill River watershed
(B) Nelson River watershed
(c) Hayes River watershed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0.2
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M
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0.06
0.12
0.18
0.24
0.30
L
A
B
C

APPENDIX P

Appendix P

Regressions of proportions of large and medium size lake whitefish for Churchill, Nelson and Hayes watersheds, 1973-1983

Watershed	Regression Equation (Y = A + BX)	Correlation Coefficient	Test F value at dxf
Hayes	Y = 0.742 - .720 X	0.610	504.62 (1,9)
Nelson	Y = 0.742 - .720 X	0.610	1.38 (1,9) +
Churchill	Y = .966 - 1.341 X	0.826	12.85 (1,6)

Y = Proportions of medium

X = Proportions of large

+ = Non significant at P = 0.05

Appendix Q

Fish species composition (kg marketed weight) by lake, 1973-1983

Lake	Time (year)	Species Composition (kgs)					
		WF	Walleye	Pike	Lake Trout	Others	Total
Armstrong	1973, 1973/74	5,091	474	214	-	-	8,449
	1974, 1974/75	3,802	3,620	2,181	-	5,544	15,148
	1975, 1975/76	577	784	587	55	1,452	3,455
	1976, 1976/77	863	2,423	739	-	2,235	6,260
	1977, 1977/78	-	-	-	-	-	-
	1978, 1978/79	362	327	236	-	189	1,114
	1979, 1979/80	4,226	2,019	1,132	-	1,895	9,272
	1980, 1980/81	5,327	390	1,133	-	3,153	6,850
	1981, 1981/82	3,859	63	1,741	-	1,408	7,071
	1982, 1982/83	3,468	792	973	-	-	5,233
Barrington	1973, 1973/74	6,274	3,212	4,556	896	-	14,938
	1974, 1974/75	1,999	2,578	919	179	-	6,171
	1975, 1975/76	5,260	4,672	2,662	192	-	12,800
	1976, 1976/77	15,023	3,849	2,742	2,638	-	24,284
	1977, 1977/78	9,889	4,533	1,891	1,227	-	17,540
	1978, 1978/79	14,044	3,503	5,314	3,962	-	26,822
	1979, 1979/80	13,063	3,338	2,400	2,516	-	21,317
	1980, 1980/81	6,482	1,433	7,395	138	-	15,448
	1981, 1981/82	2,115	768	4,292	30	-	7,204
	1982	8,299	4,240	5,626	1,568	-	15,571

Continued on page 192

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Butterfly	1973, 1973/74	–	–	–	–	–	–
	1974, 1974/75	617	4,477	432	–	–	5,526
	1975, 1975/76	471	3,137	383	–	–	4,166
	1976, 1976/77	3,418	3,165	237	–	–	8,178
	1977, 1977/78	1,698	2,193	130	–	481	4,495
	1978, 1978/79	183	394	242	1	–	820
	1979, 1979/80	1,321	2,990	946	–	5,749	11,006
	1980, 1980/81	330	3,258	498	–	285	4,371
	1981, 1981/82	776	2,454	39	–	5	3,274
	1982	788	4,327	63	–	5	5,183
Bruneau	1973, 1973/74	529	3,064	1,044	–	–	4,642
	1974, 1974/75	2,772	765	519	–	77	5,133
	1975, 1975/76	1,144	662	2,438	–	618	4,867
	1976, 1976/77	561	1,620	825	–	4	3,572
	1977, 1977/78	247	507	2,342	–	8	3,110
	1978, 1978/79	488	294	–	–	74	817
	1979, 1979/80	1,901	996	946	–	97	3,940
	1980, 1980/81	471	456	4,874	–	–	5,800
	1981	1,020	460	942	–	55	2,485
	1982	165	134	2,219	–	121	2,640
Cedar	1973, 1973/74	79,452	101,418	200,967	–	85,528	467,365
	1974, 1974/75	75,395	189,864	179,408	–	105,663	550,331
	1975, 1975/76	48,009	173,211	199,569	–	49,892	470,681
	1976, 1976/77	78,520	210,010	267,965	–	666,798	1,221,176
	1977	114,716	126,876	288,495	–	142,663	672,750

Continued on page 193

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Cedar (cont'd)	1978, 1978/79	168,708	113,337	288,405	–	198,597	765,047.6
	1979, 1979/80	152,848	184,646	300,755	–	157,447	795,695
	1980, 1980/81	132,877	235,815	279,495	–	181,818	830,006
	1981, 1981/82	59,840	364,754	174,239	50	134,395	733,229.9
	1982	57,200	406,867	193,867	–	36,915	763,328
Cormorant	1973, 1973/74	7,585	7,399	187	–	–	16,856
	1974, 1974/75	3,038	7,188	2,067	–	3,383	15,660
	1975, 1975/76	335	4,881	2,506	–	449	8,163
	1976, 1976/77	1,771	7,229	1,883	–	325	11,207
	1977, 1977/78	648	6,267	3,640	–	727	11,287
	1978, 1978/79	6,183	2,334	3,129	–	–	11,647
	1979, 1979/80	13,748	3,128	4,645	–	–	23,333.8
	1980, 1980/81	14,7701	6,283	3,706	–	3,426	28,185.8
	1981, 1981/82	1,788	5,457	4,538	–	5,585	17,368
	1982, 1982/83	3,265	7,346	8,008	–	17,199	35,818
Dafoe	1973, 1973/74	652	110	557	–	416	1,734
	1974, 1974/75	–	–	–	–	–	–
	1975, 1975/76	–	–	–	–	–	–
	1976, 1976/77	1,466.7	2,168	1,789	–	898	6,322
	1977, 1977/78	2,972	2,165	510	–	–	5,649
	1978, 1978/79	3,438	1,879	2,041	–	2,595	9,855
	1979, 1979/80	2,842	644	1,696	–	2,978	8,160
	1980, 1980/81	3,473	1,631	737	–	1,026	6,868
	1981, 1981/82	–	–	–	–	–	–
	1982, 1982/83	108	33	145	–	118	404

Continued on page 194

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Granville	1973, 1973/74	13,583	9,941	1,083	-	-	24,607
	1974, 1974/75	7,180	1,806	2,810	-	12	11,809
	1975, 1975/76	16,020	6,202	1,444	-	-	23,673
	1976, 1976/77	32,188	24,333	7,344	-	64	63,865
	1977, 1977/78	476,829	17,293	13,137	-	17	78,137
	1978, 1978/79	16,150	11,276	14,991	-	-	42,426
	1979, 1979/80	29,949	14,223	21,699	-	3,294	69,165
	1980, 1980/81	15,278	12,349	18,278	-	2,272	48,182
	1981, 1981/82	13,127	23,040	13,333	-	2,239	51,744
	1982, 1982/83	22,486	22,458	44,596	-	160	89,700
Guthrie	1973, 1973/74	1,052	7,284	3,356	-	-	11,692
	1974, 1974/75	2,553	5,580	3,174	-	-	11,295
	1975, 1975/76	3,253	5,937	2,203	-	3,208	14,586
	1976, 1976/77	8,979	3,157	683	-	834	13,652
	1977, 1977/78	8,988	1,520	686	-	5,728	16,921
	1978, 1978/79	1,089	4,454	5,634	-	4,409	15,586
	1979, 1979/80	434	5,702	4,504	-	3,955	14,595
	1980, 1980/81	4,020	4,264	3,395	-	1,116	12,796
	1981, 1981/82	4,915	3,151	1,643	-	-	9,709
	1982, 1982/83	196	1,602	3,321	-	-	5,1190
Halfway	1973, 1973/74	12,852	-	1,292	-	17,357	31,500
	1974, 1974/75	9,834	-	986	-	17,357	28,177
	1975, 1975/76	1,873	-	827	-	12,906	15,606
	1976, 1976/77	3,174	-	3,307	-	9,998	26,452
	1977, 1977/78	4,990	-	3,065	-	7,835	16,226

Continued on page 195

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Halfway (cont'd)	1978, 1978/79	723	13	1,561	-	1,095	3,392
	1979, 1979/80	3,894	-	2,543	-	9,218	15,656
	1980, 1980/81	9,052	-	2,266	-	10,608	16,131
	1981, 1981/82	5,229	-	1,309	-	5,473	12,080
	1982, 1982/83	10,548	-	658	-	3,292	14,449
Herblet	1973, 1973/74	3,803	-	1,546	-	-	5,349
	1974, 1974/75	3,895	-	1,285	-	-	5,179
	1975, 1975/76	5,829	-	1,664	-	-	8,119
	1976, 1976/77	8,014	-	1,436	-	-	9,450
	1977, 1977/78	9,896	-	5,359	-	-	15,255
	1978, 1978/79	8,248	-	2,930	-	-	11,178
	1979, 1979/80	5,348	-	3,876	-	-	9,224
	1980, 1980/81	7,359	-	2,499	-	-	9,858
	1981, 1981/82	12,692	-	1,339	-	-	14,031
	1982	63	-	35	-	-	98
Kipahigan	1973, 1973/74	12,742	16,921	4,869	-	-	34,533
	1974, 1974/75	14,516	10,529	4,290	-	13,996	43,331
	1975, 1975/76	13,026	8,967	2,238	-	7,147	31,463
	1976, 1976/77	22,013	5,032	1,299	-	4,123	32,468
	1977, 1977/78	18,735	11,423	1 441	-	222	31,820
	1978, 1978/79	15,544	7,629	868	-	-	24,041
	1979, 1979/80	5,947	3,723	8,725	-	5,361	17,756
	1980, 1980/81	-	17,080	1,819	-	313	19,212
	1981, 1981/82	2,445	12,316	1,132	-	10	15,903
	1982	5,992	11,190	2,442	-	-	19,624

Continued on page 196

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Kiski	1973, 1973/74	383	3,408	1,460	-	525	5,251
	1974, 1974/75	454	3,195	1,598	-	2,310	7,572
	1975, 1975/76	119	3,624	1,334	-	358	5,426
	1976, 1976/77	48	3,082	231	-	51	3,394
	1977, 1977/78	159	3,409	1,222	-	2	4,944
	1978, 1978/79	324	2,574	682	-	4	3,761
	1979, 1979/80	168	1,399	236	-	4,861	6,664
	1980, 1980/81	-	-	-	-	-	-
	1981, 1981/82	341	831	308	-	1,431	2,910
	1982, 1982/83	-	-	-	-	-	-
Kisseynew	1973, 1973/74	1,298	11,621	2,809	-	5,555	21,284
	1974, 1974/75	3,017	6,159	3,702	-	18,229	31,107
	1975, 1975/76	8,220	4,862	2,525	-	11,283	26,863
	1976, 1976/77	4,152	6,823	4,991	-	3,509	19,494
	1977, 1977/78	14,486	1,722	642	-	2,353	19,203
	1978, 1978/79	13,620	6,470	4,864	-	11,385	36,339
	1979, 1979/80	9,684	7,257	2,992	-	10,949	30,881
	1980, 1980/81	2,887	5,766	4,460	-	10,554	23,668
	1981, 1981/82	10,049	4,643	2,773	-	-	17,465
	1982, 1982/83	7,755	6,939	5,585	-	11,724	31,575
Landing	1973, 1973/74	10,536	7,608	5,832	-	-	23,995
	1974, 1974/75	11,705	6,374	4,605	-	-	22,684
	1975, 1975/76	7,812	10,220	2,911	-	-	20,944
	1976, 1976/77	11,616	7,787	1,291	-	465	21,159
	1977, 1977/78	14,462	6,045	-	-	-	20,506

Continued on page 197

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Landing (cont'd)	1978, 1978/79	4,682	2,558	1,072	–	137	962
	1979, 1979/80	10,598	5,311	2,658	–	221	18,789
	1980, 1980/81	3,088	856	2,963	–	715	7,622
	1981, 1981/82	3,475	5,462	5,463	–	1,193	15,613
	1982	12,570	8,035	7,563	–	2,720	30,888
Natawahunan	1973, 1973/74	268	10	–	–	–	278
	1974, 1974/75	4,705	4,040	1,159	–	–	9,903
	1975, 1975/76	3,306	1,716	737	–	–	5,759
	1976, 1976/77	3,913	513	238	–	–	4,664
	1977, 1977/78	3,891	2,508	813	–	–	7,213
	1978, 1978/79	–	–	–	–	–	–
	1979, 1979/80	7,543	4,377	1,438	–	431	13,791
	1980, 1980/81	5,824	6,022	3,173	–	46	15,065
	1981, 1981/82	1,837	7,193	1,822	–	6	10,858
	1982, 1982/83	4,222	7,390	2,127	–	42	13,781
Pakwa	1973, 1973/74	10,624	1,982	1,433	–	14	14,053
	1974, 1974/75	10,849	2,212	1,269	–	1,936	16,266
	1975, 1975/76	7,104	5,247	1,780	–	1,362	15,477
	1976, 1976/77	7,021	4,384	1,278	–	3,494	16,178
	1977, 1977/78	1,566	5,553	3,312	–	4,302	14,734
	1978, 1978/79	5,905	1,978	1,503	–	4,080	11,237
	1979, 1979/80	3,595	1,355	1,123	–	1,648	7,721
	1980, 1980/81	7,229	640	683	–	4,843	13,391
	1981, 1981/82	5,309	3,332	1,725	–	3,635	14,001
	1982	5,633	2,200	1,790	–	4,525	14,148

Continued on page 198

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Patridge Crop	1973, 1973/74	6,386	844	1,128	-	-	8,358
	1974, 1974/75	8,154	2,421	1,970	-	-	12,545
	1975, 1975/76	7,470	2,583	2,418	-	272	12,726
	1976, 1976/77	5,947	1,571	1,562	-	-	9,080
	1977, 1977/78	6,917	1,184	1,156	-	-	9,261
	1978, 1978/79	1,134	692	840	-	-	2,666
	1979, 1979/80	1,310	1,211	604	-	-	3,129
	1980, 1980/81	1,025	2,204	670	-	-	3,913
	1981, 1981/82	898	1,055	724	-	-	2,723
	1982	1,543	1,518	1,431	-	-	4,531
Playgreen	1973, 1973/74	155,341	11,398	9,192	-	7,537	183,835
	1974, 1974/75	146,774	20,106	13,891	-	1,827	182,782
	1975, 1975/76	158,562	13,906	5,780	-	2,528	180,595
	1976, 1976/77	172,819	12,695	11,262	-	8,191	204,762
	1977, 1977/78	185,751	15,175	4,390	-	1,768	207,084
	1978, 1978/79	205,322	10,106	8,041	-	651	224,127
	1979, 1979/80	177,207	23,440	19,473	-	-	220,120
	1980, 1980/81	200,178	28,434	20,219	-	3,499	252,334
	1981, 1981/82	176,429	44,591	32,993	-	557	254,509
	1982, 1982/83	164,540	56,675	27,720	-	629	249,764
Sabomin	1973, 1973/74	1,485	680	246	-	-	2,411.0
	1974, 1974/75	2,427	610	279	-	-	3,316
	1975, 1975/76	614	302	254	-	-	1,170
	1976, 1976/77	673	905	64	-	-	1,642
	1977, 1977/78	1,347	27	5	-	13	1,391

Continued on page 199

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Sabomin (cont'd)	1978, 1978/79	3,172	112	50	–	23	3,357
	1979, 1979/80	4,410	607	–	–	–	5,071
	1980, 1980/81	3,422	34	100	–	–	3,557
	1981, 1981/82	3,499	2,190	409	–	1,907	8,005
	1982, 1982/83	3,313	188	7	–	127	3,635
Northern Indian	1973, 1973/74	39,846	1,065	–	41	–	40,952
	1974, 1974/75	5,605	–	138	–	–	5,743
	1975, 1975/76	179,972	5,300	44,705	231	31	230,439
	1976, 1976/77	34,177	2,434	11,074	48	–	47,733
	1977, 1977/78	–	–	–	–	–	–
	1978, 1978/79	37,628	2,097	3,374	26	5	43,730
	1979, 1979/80	3,300	22	1,010	58	–	4,390
	1980, 1980/81	35,728	232	1,614	111	23	37,709
	1981, 1981/82	20,200	24	587	–	98	21,615
	1982	9,048	4,531	11,823	–	482	25,884
Opachuanau	1973, 1973/74	5,397	7,510	2,084	–	–	14,991
	1974, 1974/75	–	–	–	–	–	–
	1975, 1975/76	6,013	8,621	706	–	–	15,340
	1976, 1976/77	7,600	9,775	2,947	–	–	20,322
	1977, 1977/78	13,430	3,895	1,349	–	–	18,674
	1978, 1978/79	15,188	5,989	4,340	–	115	25,632
	1979, 1979/80	4,912	2,195	1,394	–	704	9,204
	1980, 1980/81	8,768	3,251	4,593	–	1,266	17,880
	1981, 1981/82	6,259	6,485	4,694	–	1,523	18,959
	1982, 1982/83	14,519	9,811	9,200	–	1,834	35,364

Continued on page 200

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Setting	1973, 1973/74	16,496	4,246	2,427	–	163	23,332
	1974, 1974/75	11,192	8,117	3,425	–	4,234	26,968
	1975, 1975/76	12,886	8,427	1,907	–	7,566	30,754
	1976, 1976/77	10,567	9,126	3,426	–	8,890	32,021
	1977, 1977/78	9,574	8,617	4,302	–	10,366	32,864
	1978, 1978/79	12,572	5,992	5,208	–	7,098	30,889
	1979, 1979/80	11,130	6,098	6,195	–	18,326	40,750
	1980, 1980/81	710	2,895	4,228	–	1,241	9,072
	1981, 1981/82	3,101	3,438	2,806	–	493	9,839
	1982	12	3,712	2,858	–	–	6,583
Sipiwesk	1973, 1973/74	13,428	1,770	3,010	37	–	18,245
	1974, 1974/75	11,988	23,131	11,830	581	5,281	52,812
	1975, 1975/76	13,982	23,568	9,215	1,695	4,555	52,962
	1976, 1976/77	13,199	–	–	696	1,578	15,473
	1977, 1977/78	6,058	–	623	268	210	7,130
	1978, 1978/79	14,801	8,579	1,680	819	351	48,390
	1979, 1979/80	11,819	19,550	10,893	2,634	7,880	52,784
	1980, 1980/81	20,126	13,908	20,210	3,263	12,437	70,005
	1981, 1981/82	18,307	34,046	29,923	3,043	6,961	92,283
	1982	8,216	20,991	14,118	1,328	4,146	48,799
Sisipuk	1973, 1973/74	2,243	9,309	3,108	–	–	14,659
	1974, 1974/75	2,147	972	573	–	–	3,696
	1975, 1975/76	5,404	7,875	4,498	–	–	17,777
	1976, 1976/77	–	–	–	–	–	–
	1977, 1977/78	78	836	1,820	–	–	2,735

Continued on page 201

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Sisipuk (cont'd)	1978, 1978/79	2,012	20,552	2,745	-	-	25,310
	1979, 1979/80	2,533	6,662	2,440	-	-	11,637
	1980, 1980/81	4,819	11,585	13,990	-	-	32,583
	1981, 1981/82	4,767	15,248	20,619	-	-	40,746
	1982	2,520	15,610	16,630	-	-	34,868
Southern Indian	1973, 1973/74	319,086	12,880	11,850	-	-	343,816
	1974, 1974/75	-	-	-	-	-	-
	1975, 1975/76	275,593	8,255	5,792	-	-	289,641
	1976, 1976/77	349,928	63,144	23,379	-	-	436,451
	1977, 1977/78	359,601	37,069	34,239	66	84	431,059
	1978, 1978/79	331,854	18,940	36,878	33	5	287,710
	1979, 1979/80	357,247	16,739	57,325	20	12,339	443,669
	1980, 1980/81	354,195	11,913	25,212	-	7,376	398,700
	1981, 1981/82	256,773	18,615	26,275	-	11,566	315,171
	1982, 1982/83	96,457	16,820	10,329	-	778	131,437
St. Martin	1973, 1973/74	47,212	11,803	23,699	-	10,223	92,937
	1974, 1974/75	29,856	38,749	42,863	-	21,232	132,702
	1975, 1975/76	31,352	61,549	28,029	-	28,029	148,959
	1976, 1976/77	104,427	53,674	48,733	-	17,742	224,959
	1977, 1977/78	112,356	50,401	28,127	-	8,189	199,075
	1978, 1978/79	176,920	73,601	32,422	-	11,106	294,050
	1979, 1979/80	338,895	46,615	41,855	-	40,729	468,094
	1980, 1980/81	273,491	60,679	39,264	-	27,429	400,863
	1981, 1981/82	69,830	13,632	18,222	-	22,859	124,543
	1982	86,717	10,183	6,841	-	18,963	122,704

Continued on page 202

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Walker	1973, 1973/74	7,787	21,160	–	–	–	28,947
	1974, 1974/75	12,547	12,103	–	–	–	24,650
	1975, 1975/76	1,750	1,304	351	–	–	3,405
	1976, 1976/77	5,532	3,270	1,386	–	–	10,188
	1977, 1977/78	9,418	4,007	11,751	–	–	25,256
	1978, 1978/79	–	–	–	–	–	–
	1979, 1979/80	11,348	10,914	3,381	–	104	25,748
	1980, 1980/81	21,151	15,201	12,003	–	48	48,402
	1981, 1981/82	–	27,114	23,111	–	48	50,273
	1982, 1982/83	–	12,978	8,413	–	11	21,402
Wekusko	1973, 1973/74	20,003	10,485	9,567	–	8,262	48,317
	1974, 1974/75	41,390	3,562	9,948	–	7,799	61,410
	1975, 1975/76	33,710	9,478	11,508	–	12,968	67,693
	1976, 1976/77	29,560	12,054	20,270	–	14,895	76,780
	1977, 1977/78	27,469	12,498	16,517	–	10,772	67,255
	1978, 1978/79	39,363	6,067	10,943	–	3,135	59,507
	1979, 1979/80	35,228	10,652	12,533	–	31,437	89,851
	1980, 1980/81	25,462	14,371	18,574	–	1,950	60,358
	1981, 1981/82	20,443	14,856	18,839	–	7,119	61,450
	1982	37,098	2,712	17,007	–	207	57,024
William	1973, 1973/74	44,717	–	–	–	–	44,717
	1974, 1974/75	49,072	–	245	–	–	49,319
	1975, 1975/76	22,573	–	23	–	–	22,596
	1976, 1976/77	28,913	–	410	–	–	29,323
	1977, 1977/78	46,919	–	338	–	–	47,257

Continued on page 203

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
William (cont'd)	1978, 1978/79	46,130	–	–	–	–	46,130
	1979, 1979/80	49,685	–	181	–	–	49,866
	1980, 1980/81	66,635	–	–	–	–	66,635
	1981, 1981/82	36,983	–	27	–	–	37,010
	1982	47,315	–	642	–	–	47,957
Wintering	1973, 1973/74	10,120	7,467	4,106	–	–	22,193
	1974, 1974/75	9,190	8,378	4,572	–	1,091	23,230
	1975, 1975/76	6,286	13,084	2,031	–	–	21,380
	1976, 1976/77	5,044	10,637	354	–	1,681	17,699
	1977, 1977/78	6,769	9,540	–	–	–	16,393
	1978, 1978/79	3,761	2,484	32	–	–	6,276
	1979, 1979/80	1,258	1,194	70	–	–	2,523
	1980, 1980/81	8,456	41	357	–	2,861	11,716
	1981, 1981/82	2,761	2,148	5,086	–	11,604	40,932
	1982	5,662	9,986	4,132	–	16,184	35,964
Witchai	1973, 1973/74	–	–	–	–	–	–
	1974, 1974/75	3,700	463	557	–	–	4,719
	1975, 1975/76	8,283	1,055	–	–	–	9,338
	1976, 1976/77	11,112	320	–	–	–	11,432
	1977, 1977/78	8,780	819	131	–	8	9,738
	1978, 1978/79	7,346	1,043	195	–	5	8,589
	1979, 1979/80	4,708	443	139	–	–	5,371
	1980, 1980/81	10,034	937	172	–	43	11,193
	1981, 1981/82	8,528	6	1	–	–	8,535
	1982, 1982/83	9,798	206	257	–	–	10,261

Continued on page 204

Appendix Q (cont'd)

Lake	Time (year)	Species Composition (kgs) WF	Walleye	Pike	Lake Trout	Others	Total
Walker	1973, 1973/74	4,738	6,392	204	-	-	11,334
	1974, 1974/75	15,354	1,823	17	-	-	17,194
	1975, 1975/76	-	-	-	-	-	-
	1976, 1976/77	8,521	7,729	-	-	404	15,549
	1977, 1977/78	8,950	2,524	291	-	187	11,950
	1978, 1978/79	-	-	-	-	-	-
	1979, 1979/80	-	-	-	-	-	-
	1980, 1980/81	12,877	2,539	197	-	39	15,654
	1981, 1981/82	16,837	704	569	-	30	18,206
	1982, 1982/83	6,315	805	1,714	-	36	8,870
Yawningstone	1973, 1973/74	109	1,304	560	-	-	2,012
	1974, 1974/75	158	315	231	-	-	703
	1975, 1975/76	146	429	227	-	-	802
	1976, 1976/77	1,976	1,583	845	-	441	4,410
	1977, 1977/78	-	-	-	-	-	-
	1978, 1978/79	119	20	79	-	-	193
	1979, 1979/80	524	310	610	-	1,653	3,099
	1980, 1980/81	389	59	124	-	-	572
	1981, 1981/82	-	-	-	-	-	-
	1982	-	-	-	-	-	-

Appendix R

Temporal changes in total yield (kg) (marketed weight)

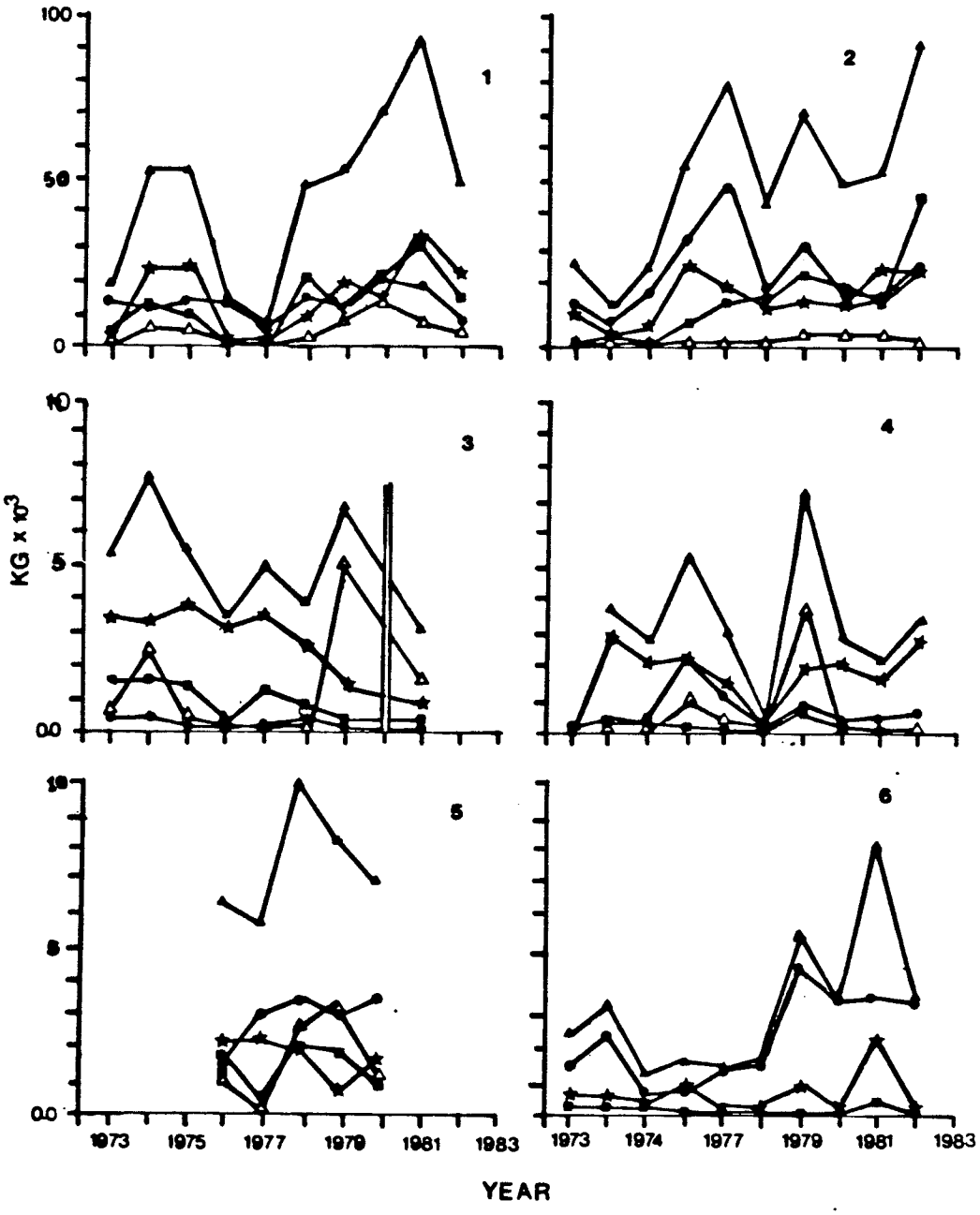
by species by lake, 1973-1983

Legend

▲ Total yield
● Yield of lake whitefish
■ Yield of walleye
* Yield of pike
o Yield of other species

List of Lakes in Appendix R

1. Sipiwesk
2. Granville
3. Kiski
4. Butterfly
5. Dafoe
6. Sabomin
7. Pakwa
8. Guthrie
9. Herblet
10. Natawahunan
11. Armstrong
12. Patridge Crop
13. Cormorant
14. Opachuanau
15. Bruneau
16. Yawningstone
17. Kisseynew
18. St. Martin
19. Walker
20. Kipahigan
21. Cedar
22. Wekusko
23. William
24. Sisipuk
25. Setting
26. South Indian
27. Barrington
28. Halfway
29. Landing
30. Witchai
31. North Indian
32. Playgreen
33. Gods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4
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5
0.0
5
6
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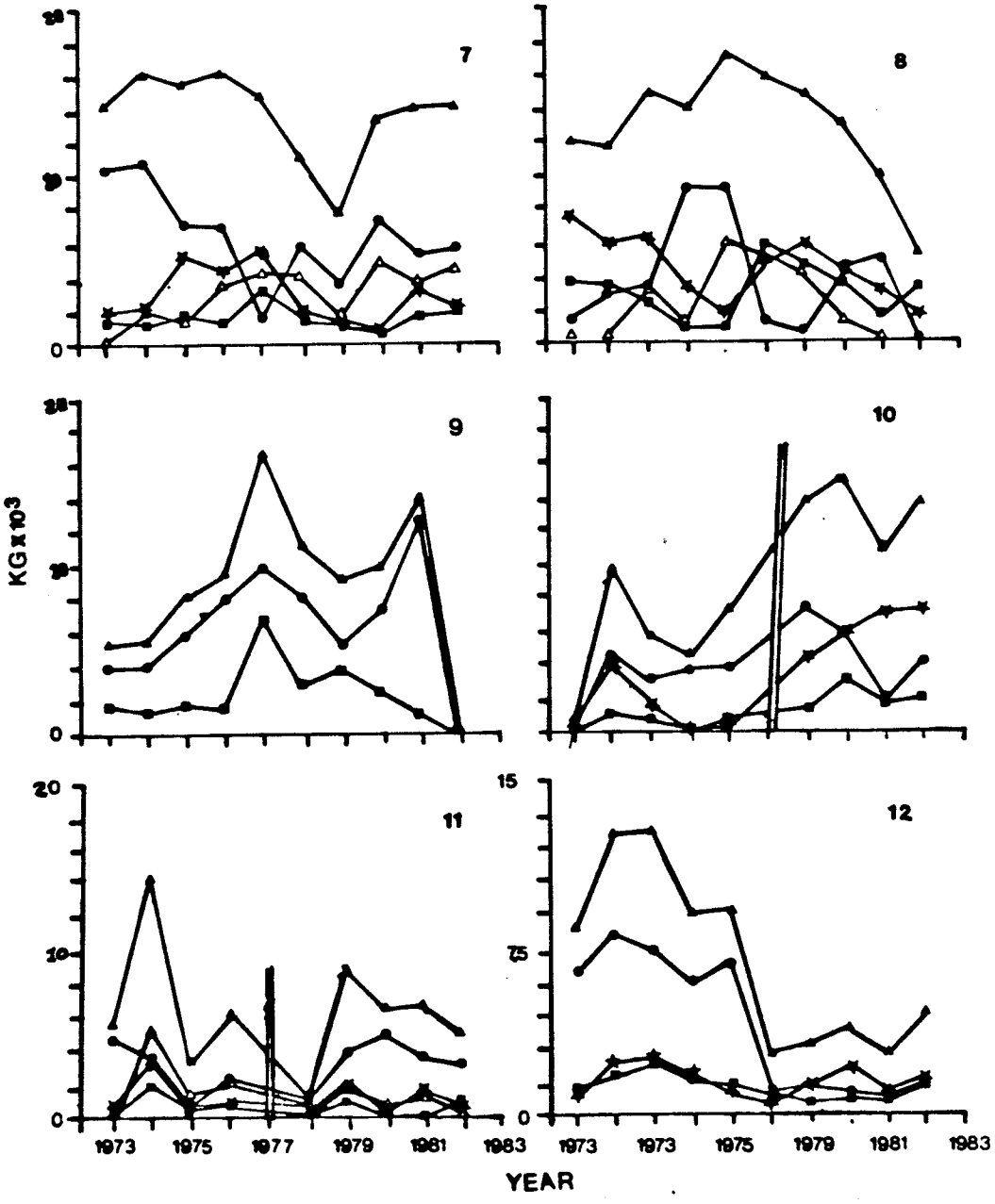
1975
1977
1979
1981
1983
1973
1974
1977
1979
1981
1983
YEAR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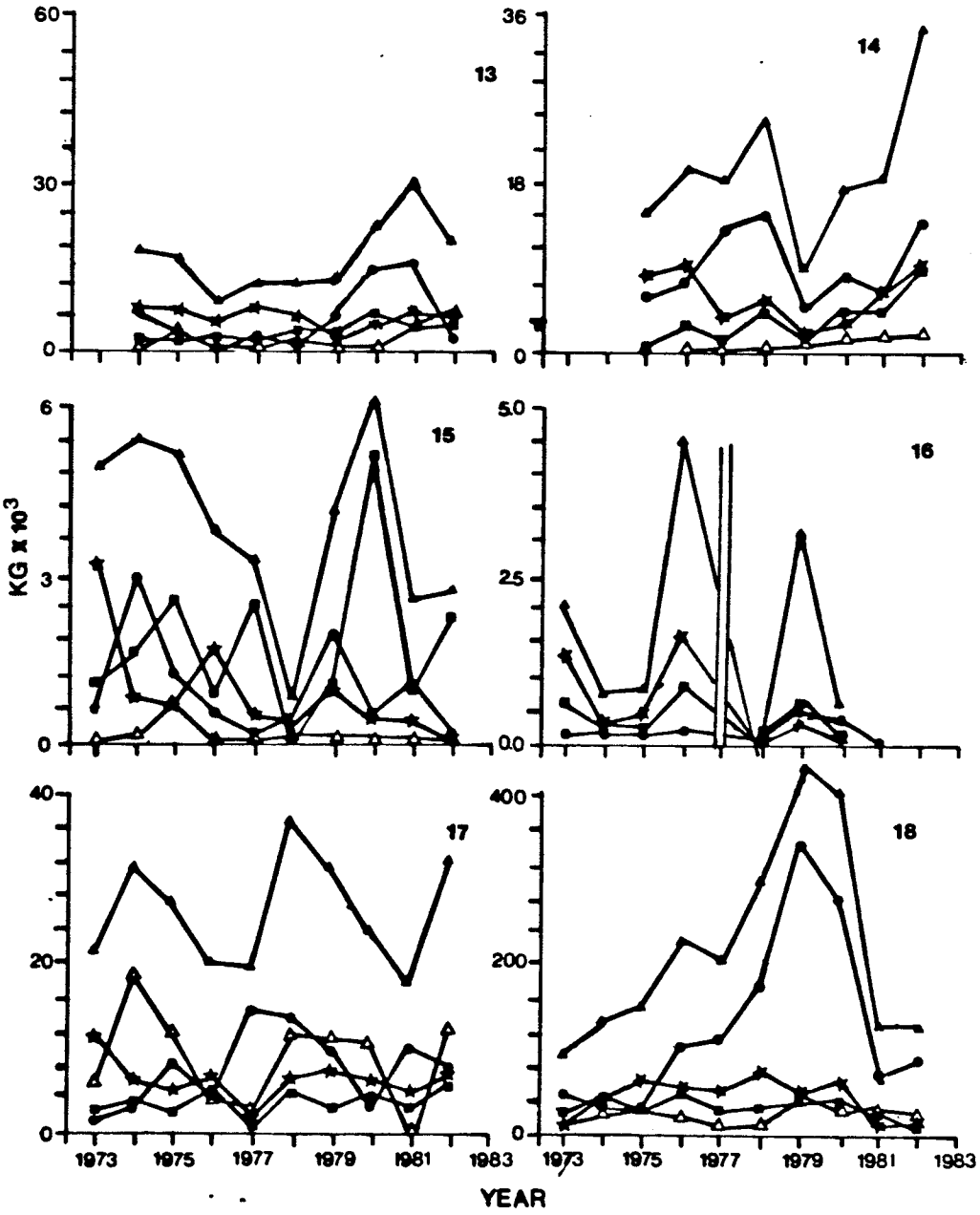
1977
1979
1981
1983
YEAR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14
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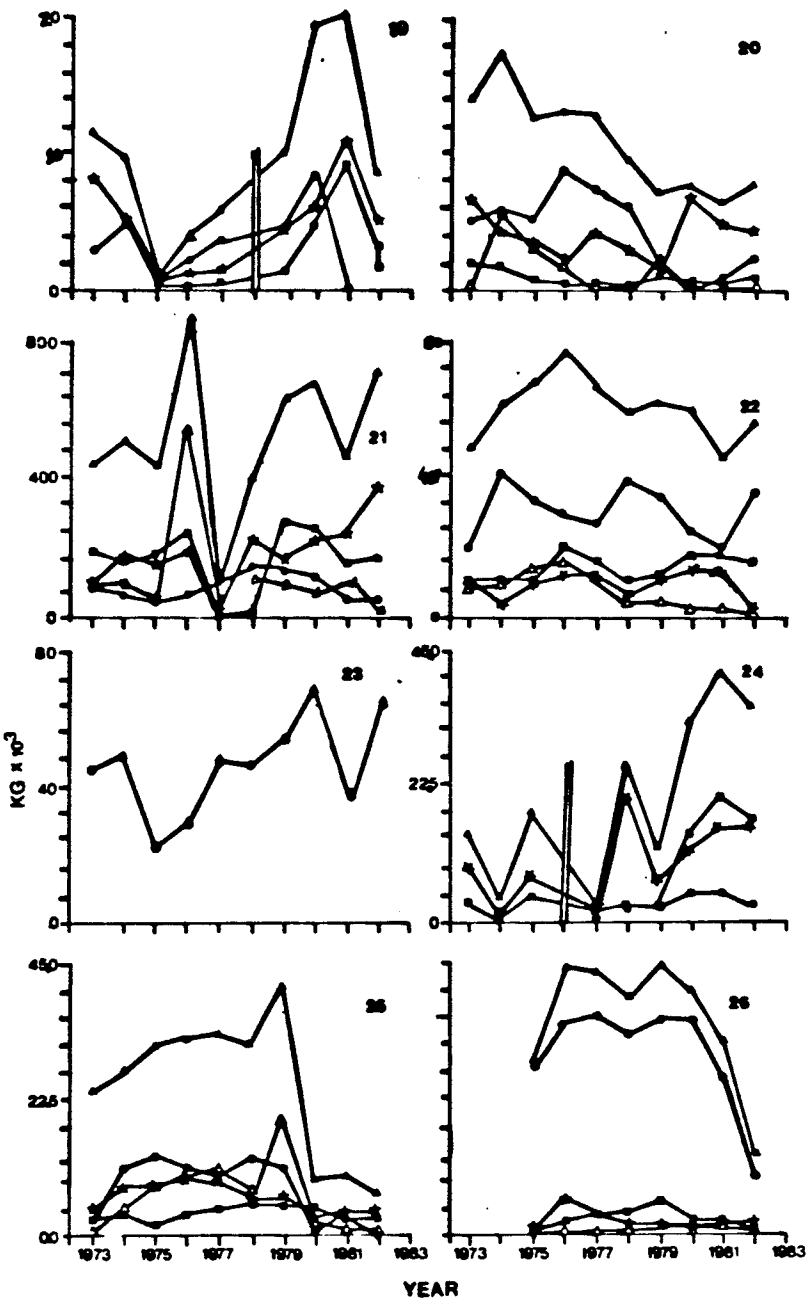
16
17
18
KG x 10^3
YEAR
1973
1975
1977
1979
1981
1983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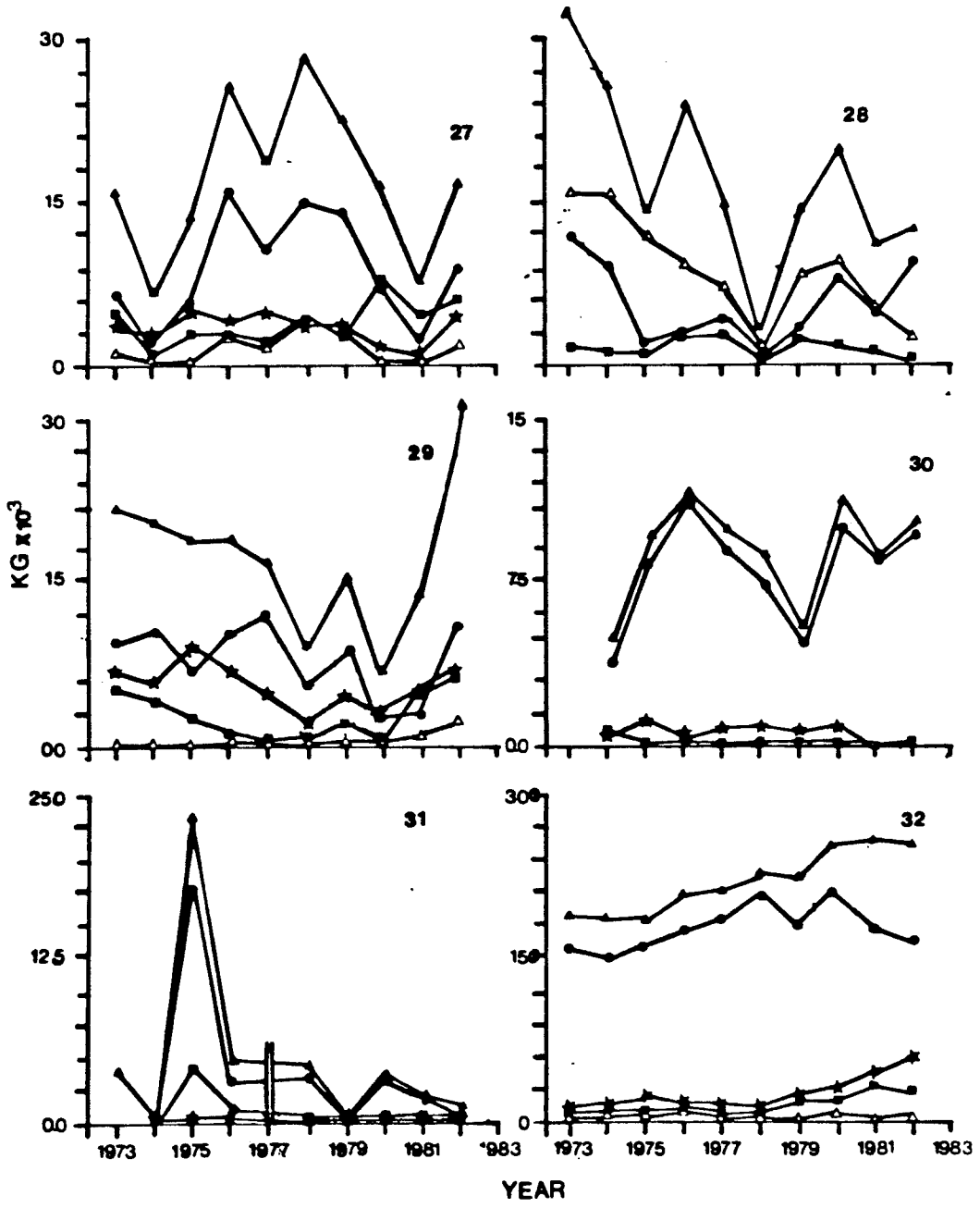
25
26
KG x 10³
YEAR
1973
1975
1977
1979
1981
1983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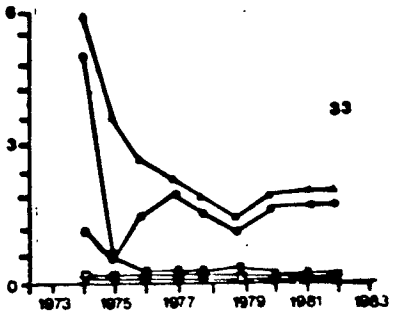
31
32
KG x10³
YEAR
1973
1975
1977
1979
1981
1983

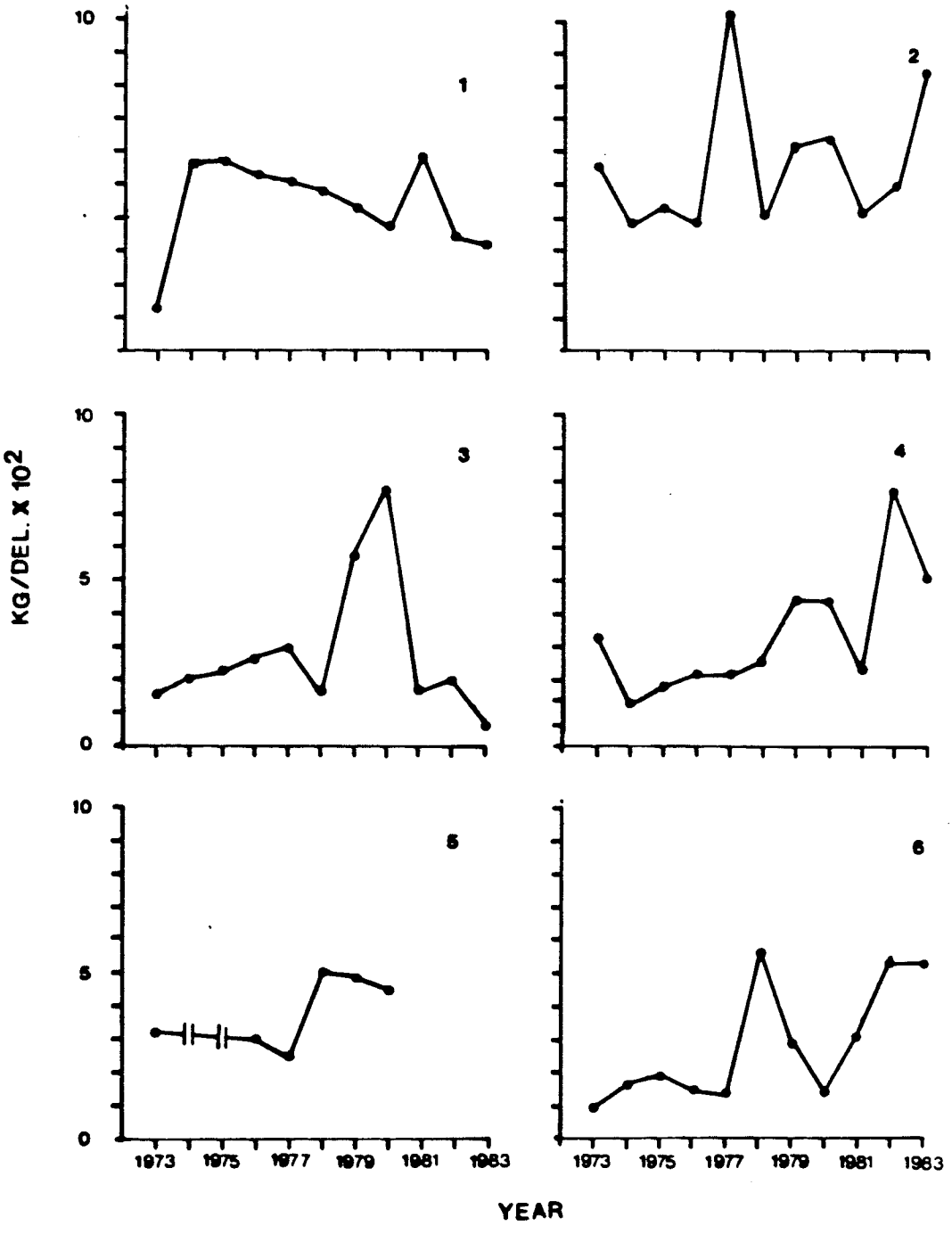

6
3
0
33
1973
1975
1977
1979
1981
1983

Appendix S

Temporal changes in catch/number of deliveries (kg/N.D) for all lakes, 1973-1983

List of Lakes in Appendix S

1. Halfway
2. Patridge Crop
3. Bruneau
4. Sabomin
5. Dafoe
6. Kisseynew
7. Sipiwesk
8. Cedar
9. Kiski
10. Armstrong
11. Granville
12. St. Martin
13. Cormorant
14. William
15. Herblet
16. Barrington
17. Kipahigan
18. Wekusko
19. Opachuanau
20. Gods
21. Yawningstone
22. South Indian
23. Playgreen
24. Pakwa
25. Wuskwatim
26. Natawahunan
27. Wintering
28. Sisipuk
29. Walker
30. Witchai
31. Guthrie
32. Setting
33. Butterfly
34. North Indian
35. Landing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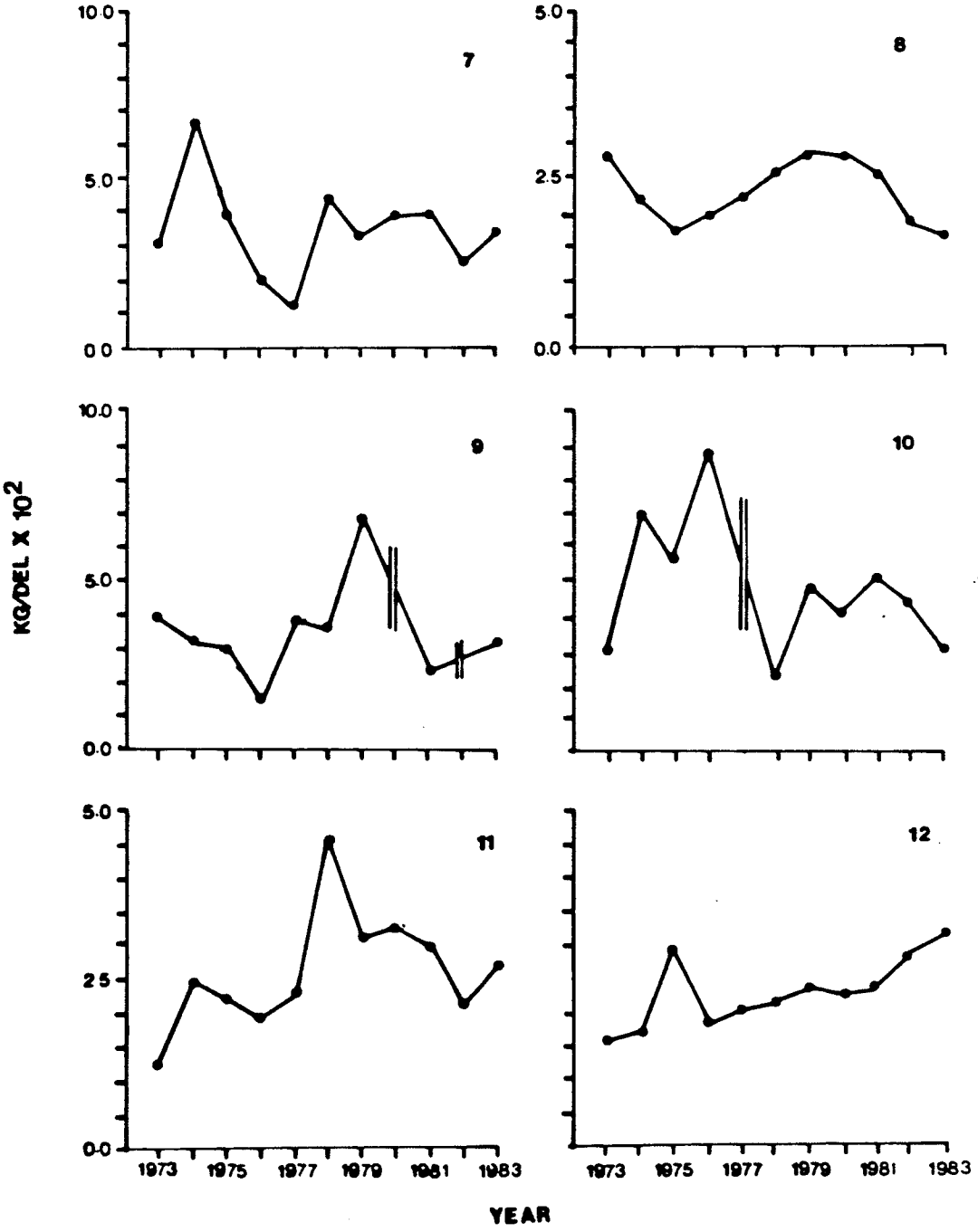
5
0
1
2
3
4
5
6
KG/DEL. X 10²
1973
1975
1977
1979
1981
1983
YEAR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1973
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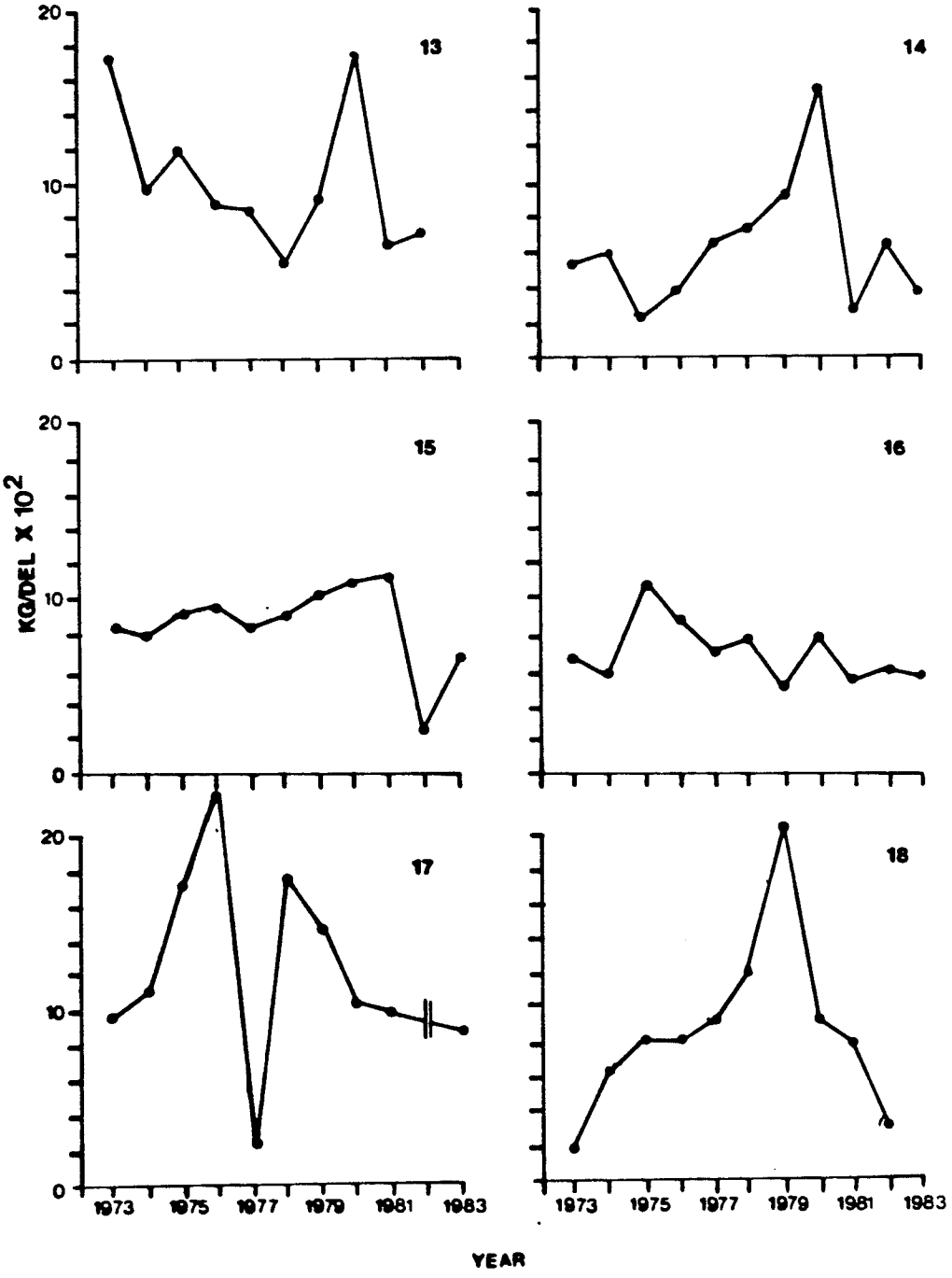
1977
1979
1981
1983
KG/DEL X 10²
YEAR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KG/DEL X 10²
YEAR
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1981
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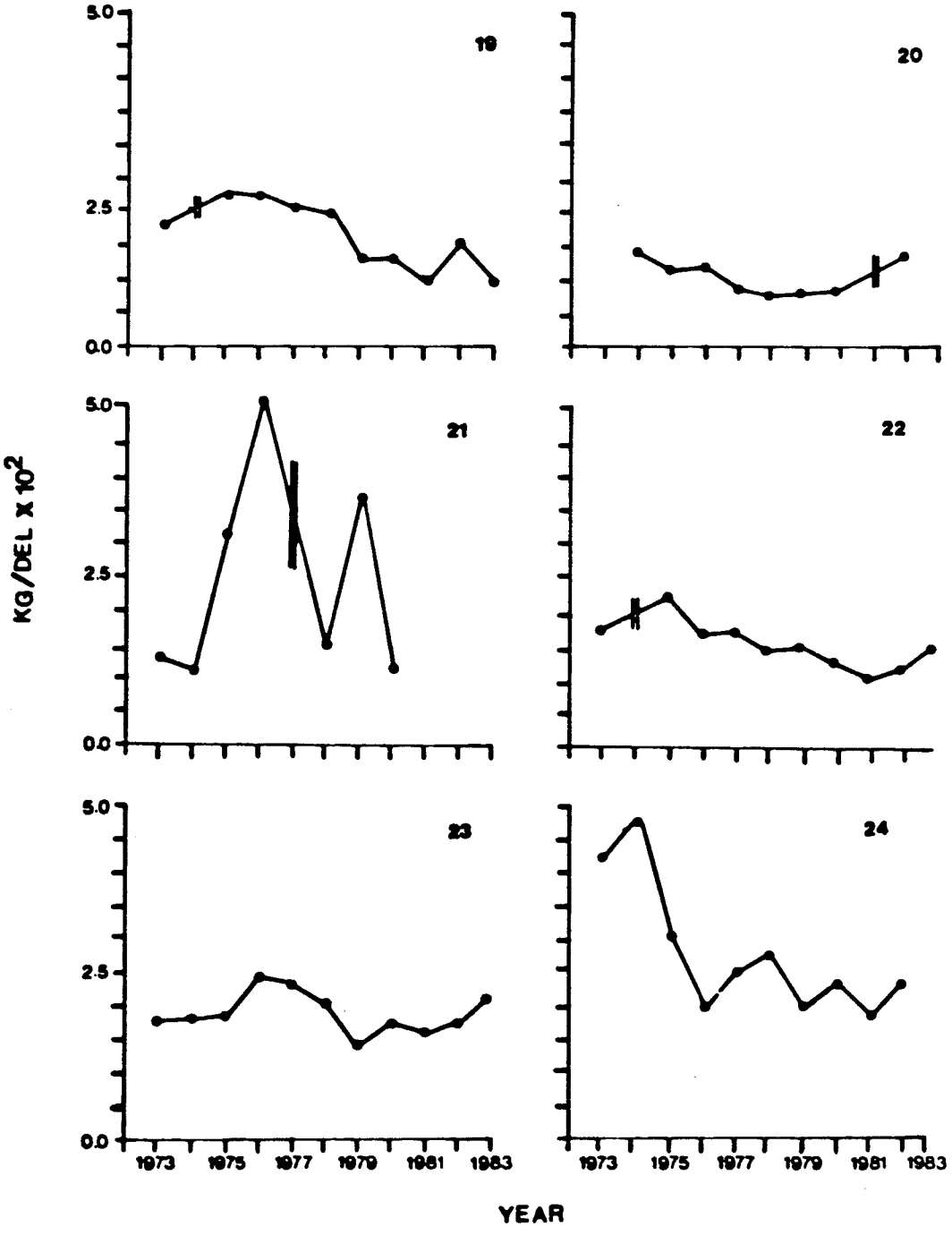
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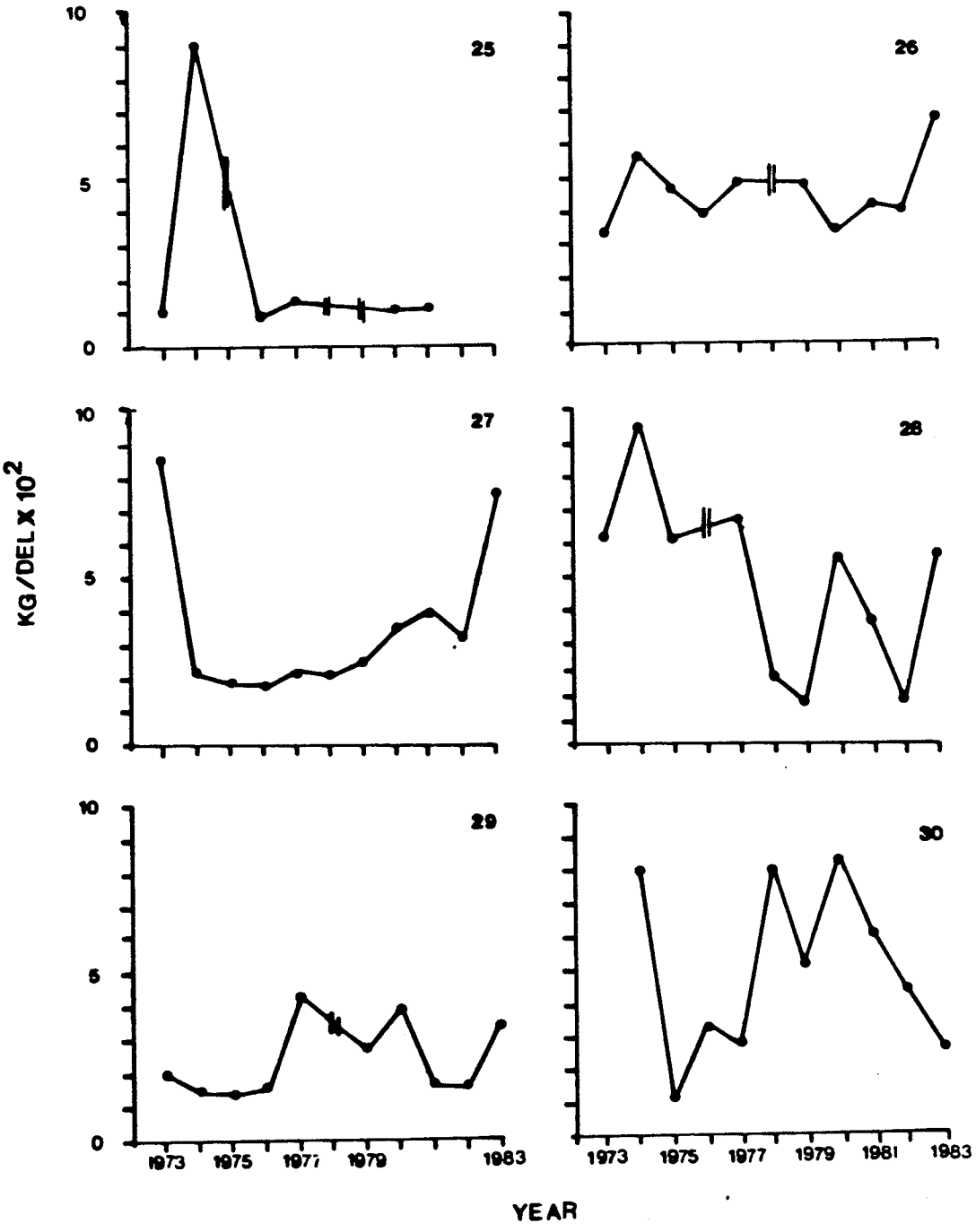
24
KG/DEL X 10²
1973
1975
1977
1979
1981
1983
YEAR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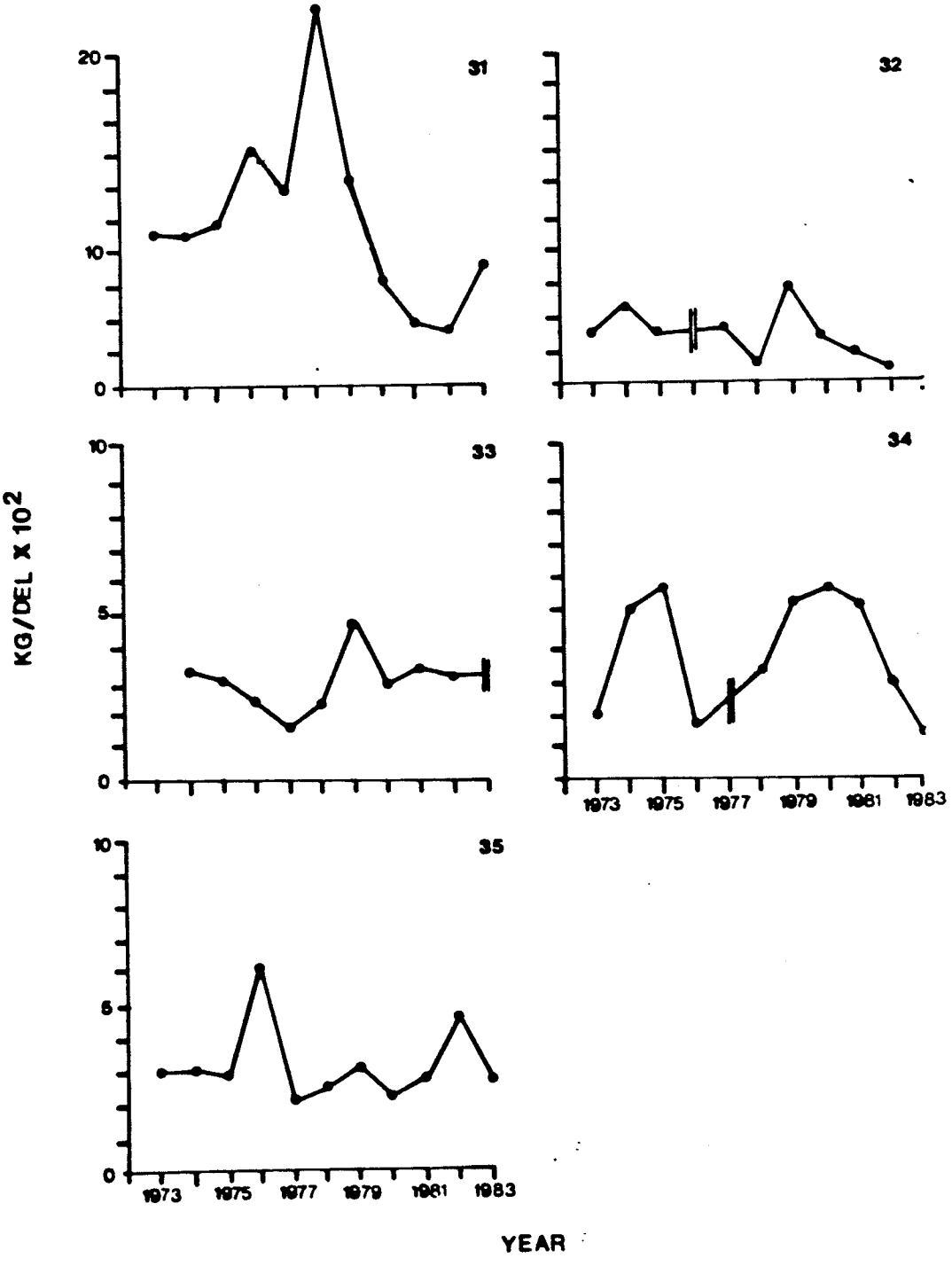
27
28
29
30
10
5
0
KG/DEL X 10²
1973
1975
1977
1979
1981
1983
YEAR


31
32
33
34
35
20
10
0
5
6
1973
1975
1977
1979
1981
1983
KG/DEL X 10²
YEAR

Appendix T

Mean flow rates (m^3 sec^{-1}) for the month of May and mean annual yield (kg) for the Churchill, Hayes and Nelson watersheds for the period 1973-1983

Yield = f (flow rate) 5 year lag*

Watershed	Time (Year)	Mean Flow Rate for May (m^3 sec^{-1})	Mean Annual Yield (kg)
Churchill	1973	985	15,664
	1974	1,190	18,967
	1975	1,180	76,761
	1976	885	128,885
	1977	1,220	117,754
	1978	979	98,505
	1979	963	100,618
	1980	1,010	99,909
	1981	888	81,234
	1982	783	67,172
	1983	783	44,374
Hayes	1973	-	2,805
	1974	1,250	85,468
	1975	1,320	55,702
	1976	-	20,935
	1977	650	32,891
	1978	1,210	28,514
	1979	1,360	22,499
	1980	1,020	36,817
	1981	1,390	9,653
	1982	1,880	31,784
	1983	1,450	6,710
Nelson	1973	2,400	58,451
	1974	3,330	65,847
	1975	3,380	60,915
	1976	3,150	67,959
	1977	922	77,214
	1978	1,680	90,465

Continued on page 222

Appendix T (cont'd)

Mean flow rates (m^3 sec^{-1}) for the month of May and mean annual yield (kg) for the Churchill, Hayes and Nelson watersheds for the period 1973-1983

Yield = f (flow rate) 5 year lag*

Watershed	Time (Year)	Mean Flow Rate for May (m^3 sec^{-1})	Mean Annual Yield (kg)
Nelson	1979	3,490	98,916
	1980	1,160	101,213
	1981	1,040	92,653
	1982	1,770	65,589
	1983	2,160	62,226

* 1973-1978 Mean May flow rates were plotted against 1978-1983 Mean annual yield (see Figure 8).

Appendix U

Regressions of mean flow rates for the month of May versus mean annual catches (kg) of all lakes in each watershed per year, with a 5-year lag

Watershed	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and d.f.
Nelson	Y=46185.458+15.741X	.9333	26.71 (1,4)
Churchill	Y=36905.223+41.991X	.260	.29 (1,4)+
Hayes	Y=6725.827+26.942X	.851	5.25 (1,2)

+ Non-significant at P=0.05

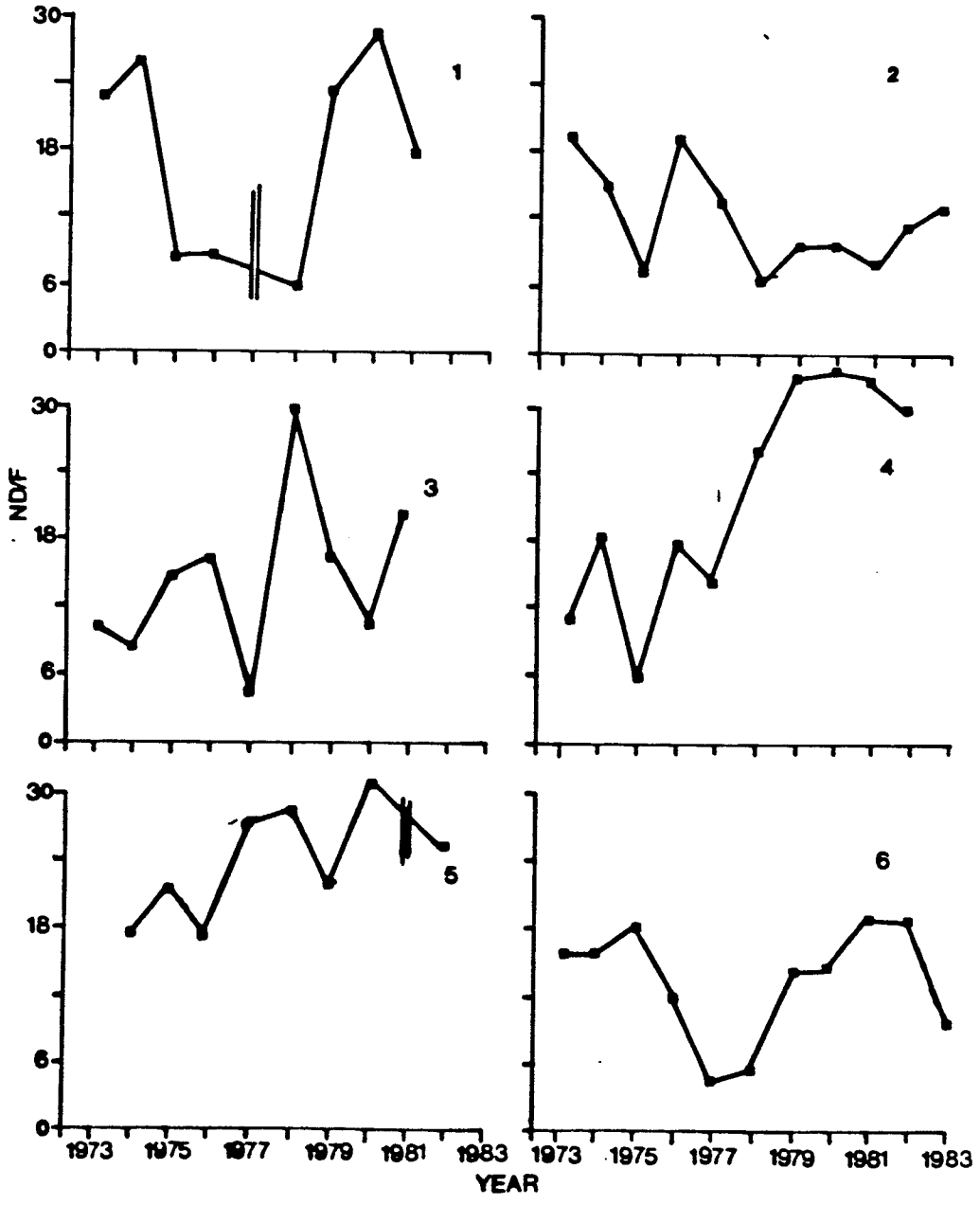
Appendix V

Temporal changes in fishing effort (N.D/F)

for individual lakes, 1973-1983

List of Lakes in Appendix V

1. Armstrong
2. Bruneau
3. Butterfly
4. Cormorant
5. Gods
6. Guthrie
7. Halfway
8. North Indian
9. Kiski
10. Opachuanau
11. Playgreen
12. Sabomin
13. Sisipuk
14. Cedar
15. Witchai
16. Wuskwatim
17. Yawningstone
18. St. Martin
19. South Indian
20. Kisseynew
21. Kipahigan
22. Natawahunan
23. Patridge Crop
24. Pawka
25. Dafoe
26. Wekusko
27. Wintering
28. Setting
29. Sipiwesk
30. Walker
31. William
32. Herblet
33. Landing
34. Barrington
35. Granville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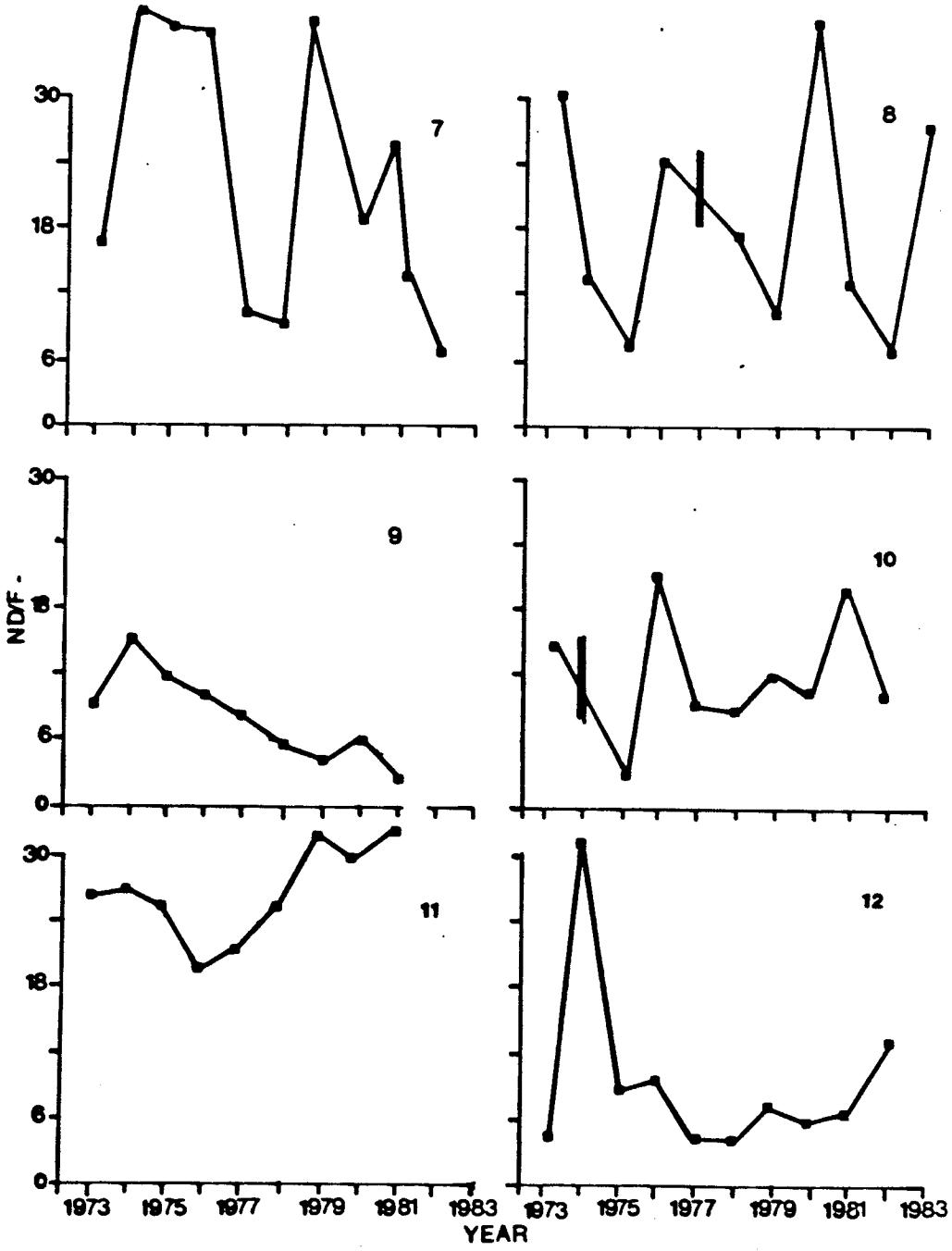
18
6
0
1
2
3
4
5
6
NDVI
1973
1975
1977
1979
1981
1983
YEAR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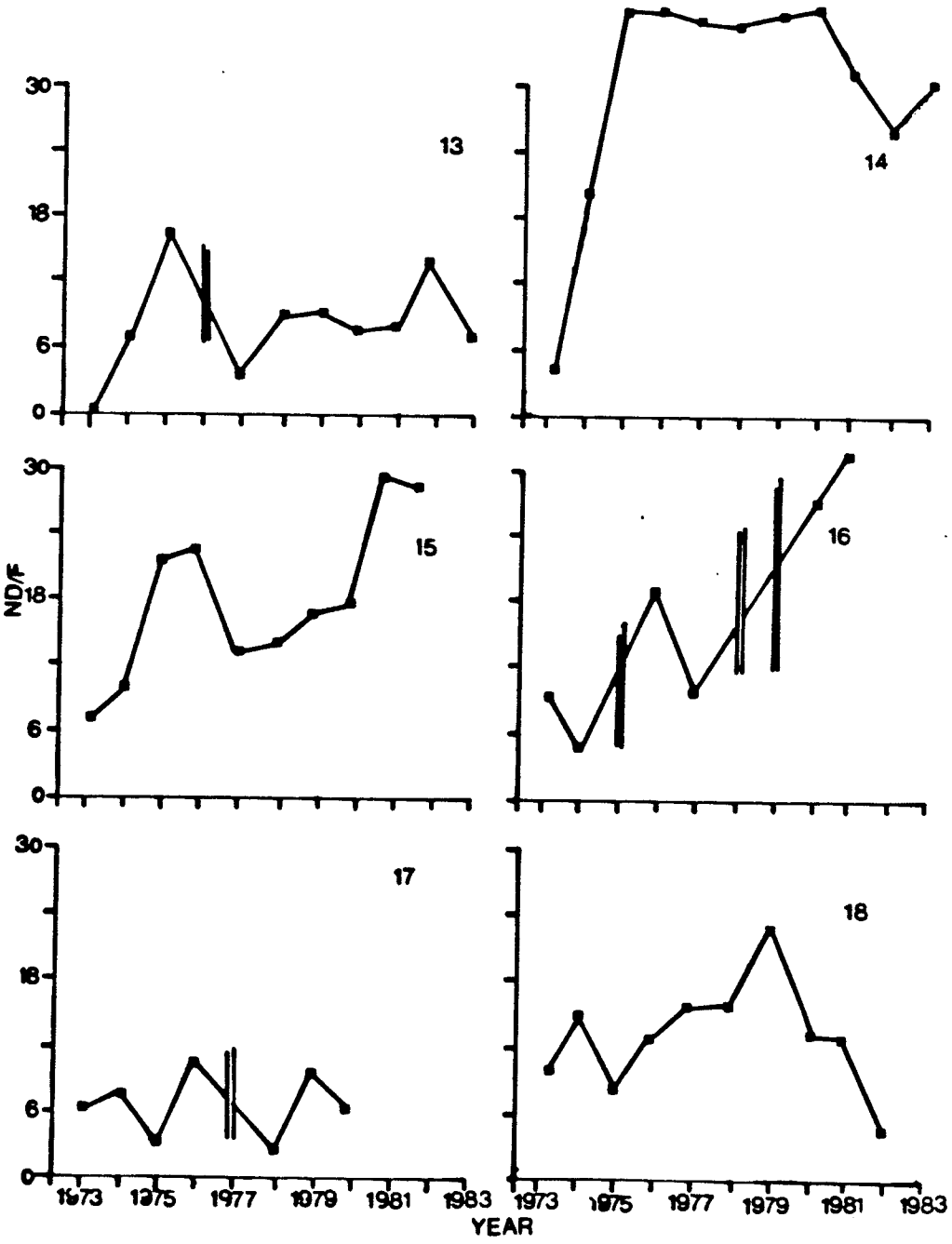
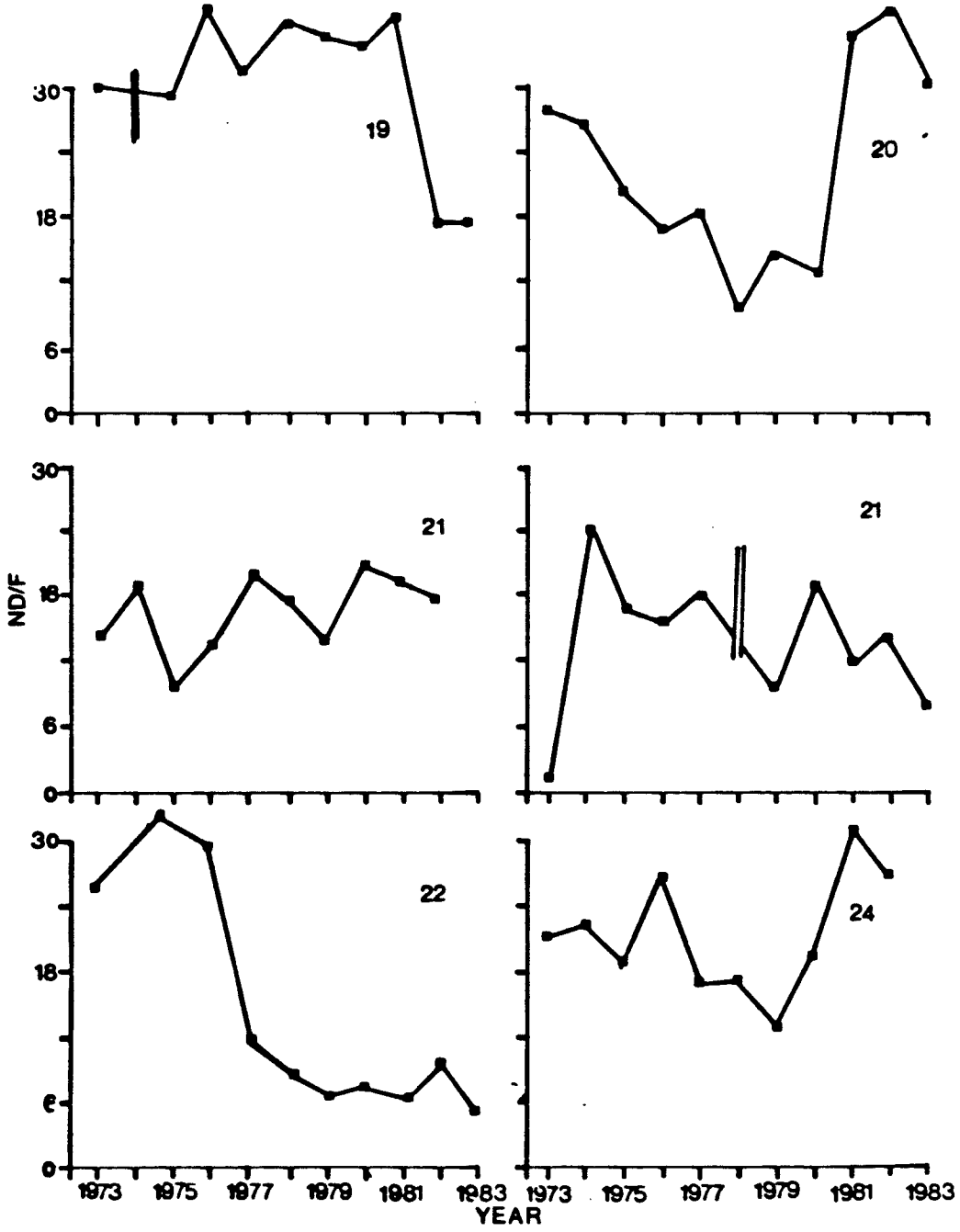
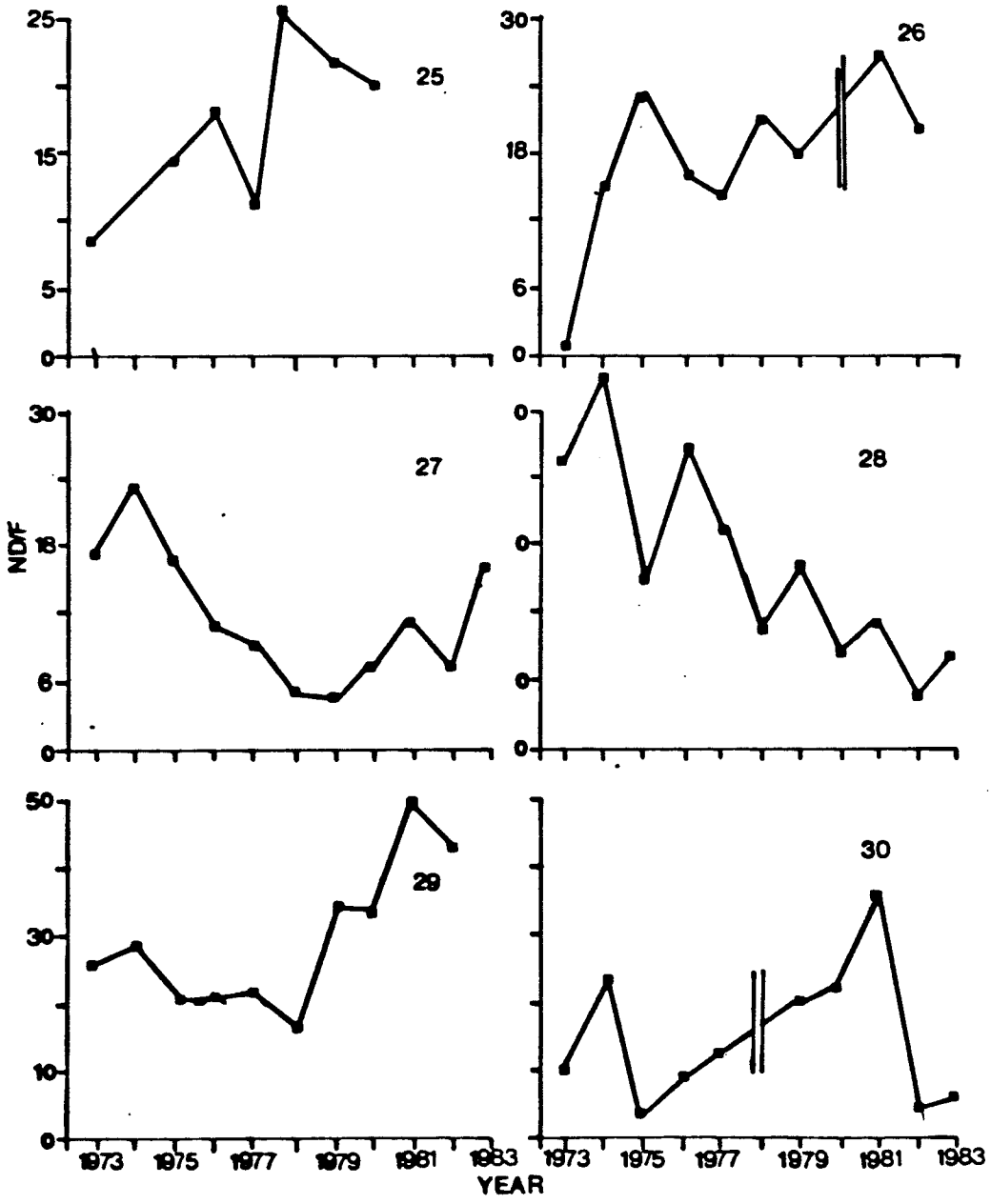
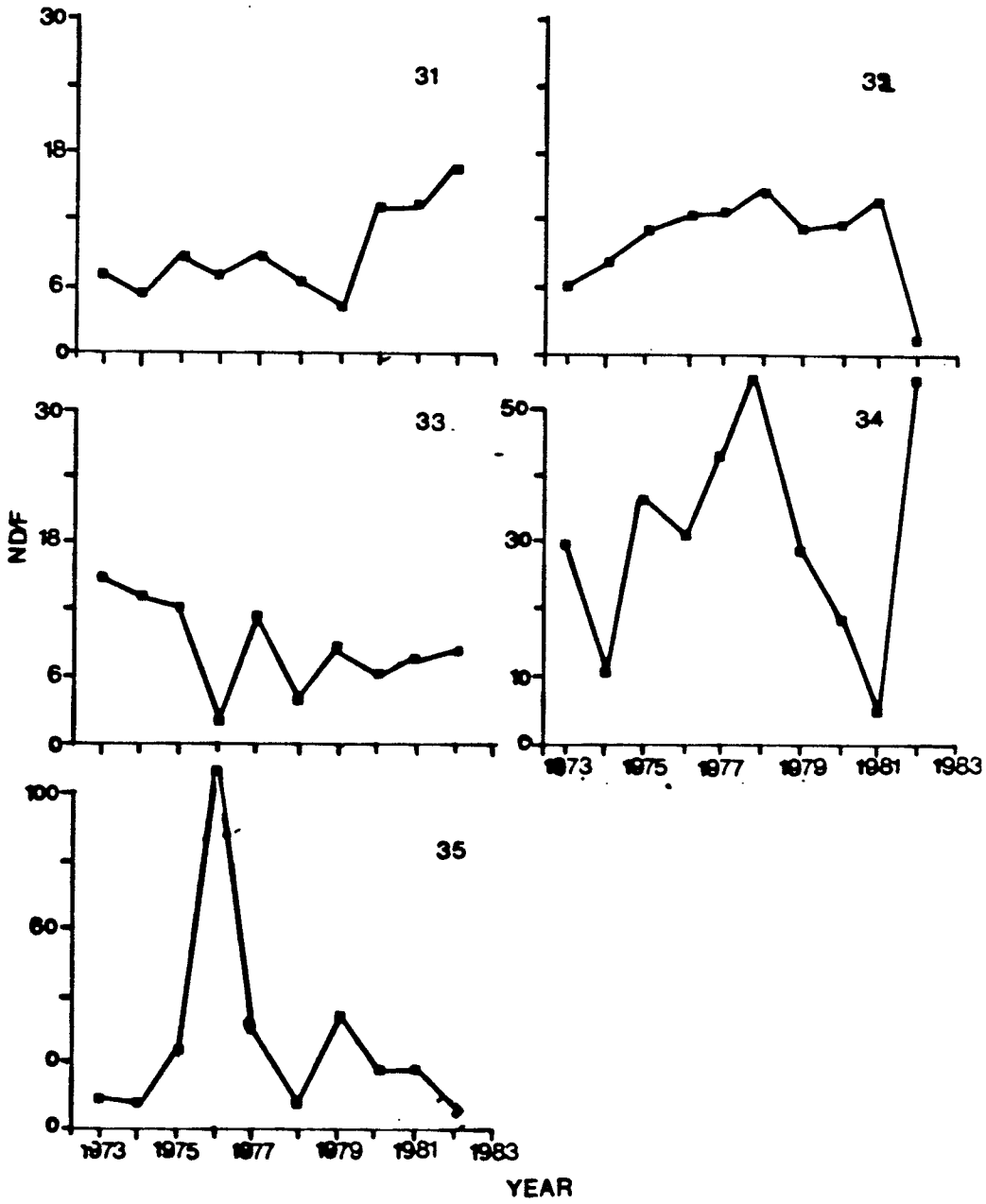
8
9
10
11
12
30
18
6
0
NDVF -
1973
1975
1977
1979
1981
1983
YEAR


30
18
6
0
13
14
15
16
17
18
ND/F
1973
1975
1977
1979
1981
1983
YEAR


30
18
6
0
19
20
21
21
22
24
ND/F
1973
1975
1977
1979
1981
1983
YEAR


25
30
26
18
15
6
5
0
27
28
NDF
29
30
10
1973
1975
1977
1979
1981
1983
YEAR


31
32
33
34
35
NDF
YEAR
1973
1975
1977
1979
1981
1983

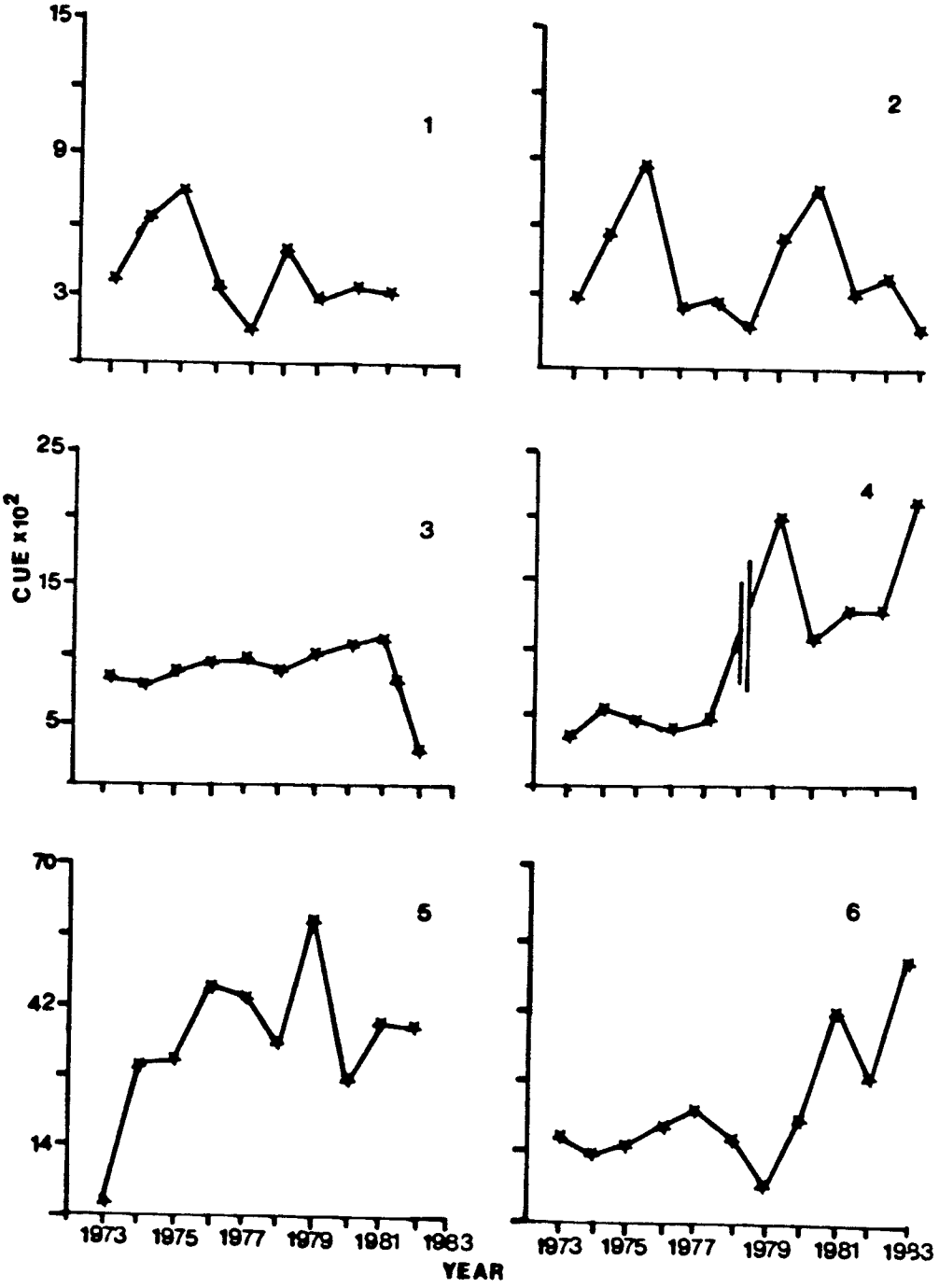
Appendix W

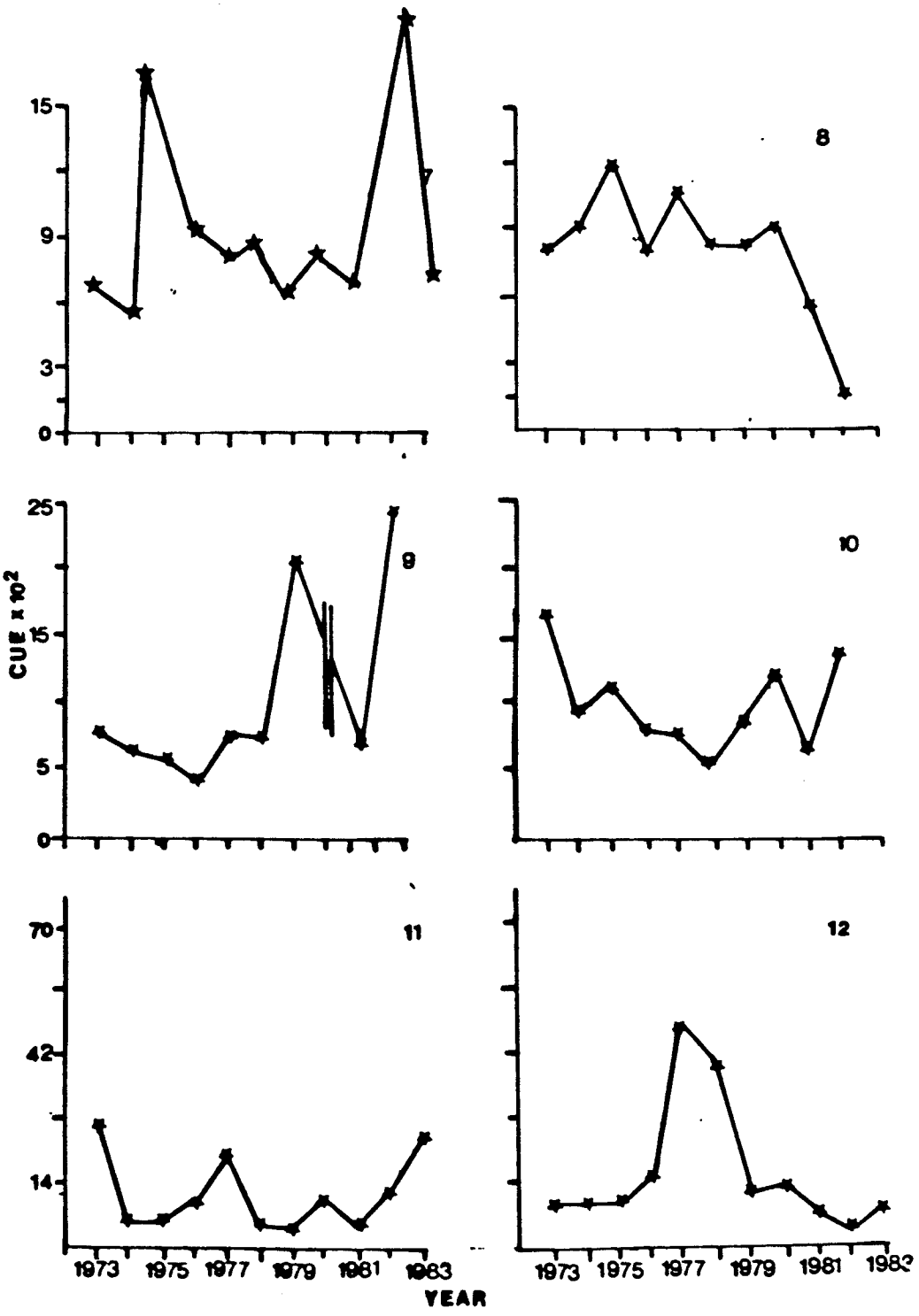
Temporal changes in CUE (kg/N.D/F)

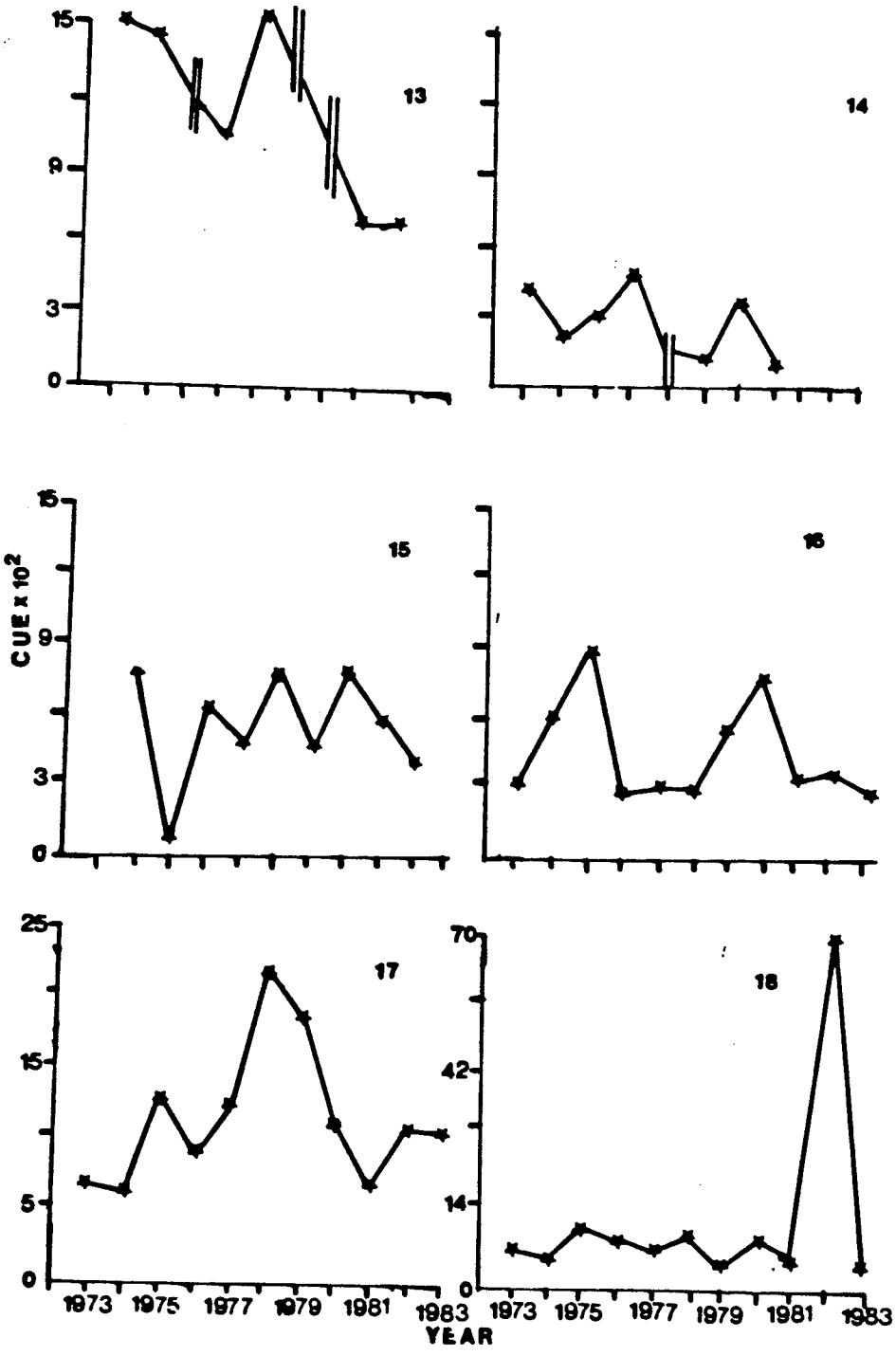
in individual lakes, 1973-1983

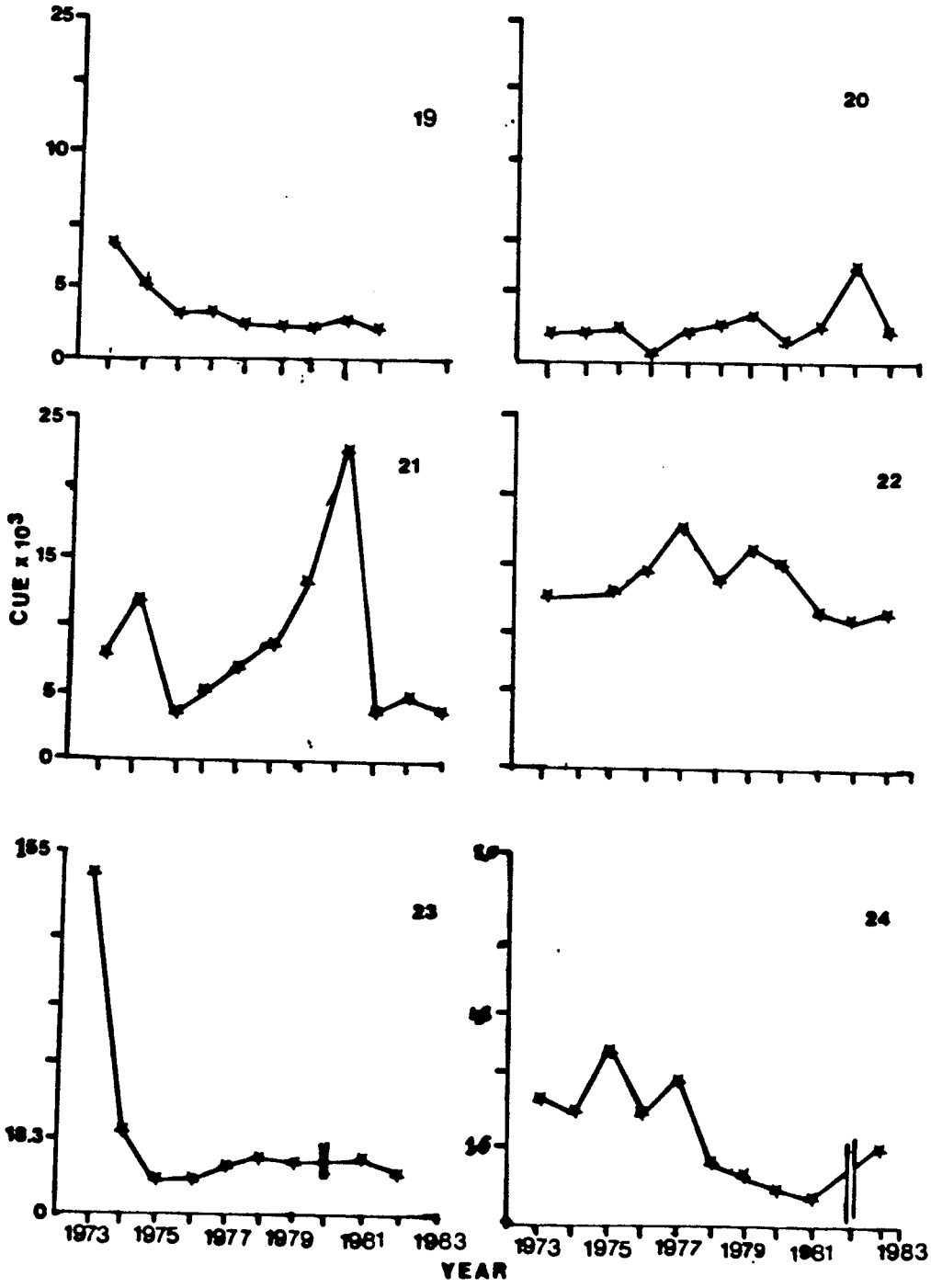
List of Lakes in Appendix W

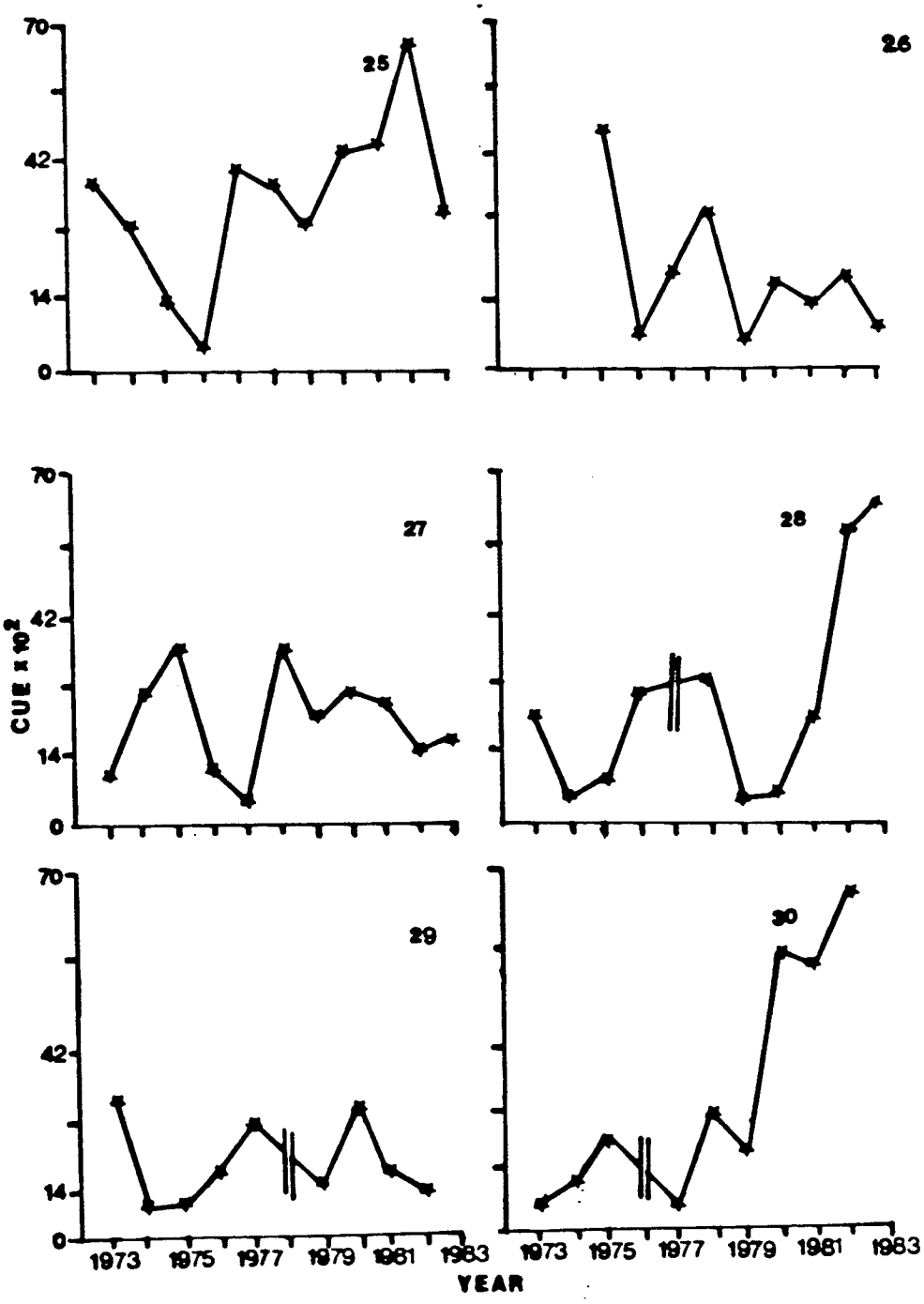
1. Butterfly
2. Bruneau
3. Herblet
4. Natawahunan
5. Wekusko
6. Wintering
7. Barrington
8. Pakwa
9. Kiski
10. Cormorant
11. Halfway
12. Guthrie
13. Wuskwatim
14. Yawningstone
15. Witchai
16. Armstrong
17. Setting
18. Barrington
19. Gods
20. Landing
21. William
22. South Indian
23. Cedar
24. Kipahigan
25. Granville
26. Opachuanau
27. Sipiwesk
28. North Indian
29. Walker
30. Sisipuk
31. Kisseynew
32. St. Martin


15
9
3
1
2
25
15
5
CUE x10²
3
4
70
42
14
5
6
1973
1975
1977
1979
1981
1983
YEAR


15
9
3
0
8
25
15
5
0
9
10
CUE x 10²
70
42
14
11
12
1973
1975
1977
1979
1981
1983
YEAR


13
14
15
16
17
18
CUE x 10²
YEAR
1973
1975
1977
1979
1981
1983


19
20
21
22
23
24
CUE x 10³
YEAR
1973
1975
1977
1979
1981
1983


25
26
27
28
29
30
70
42
14
0
CUE x 10²
1973
1975
1977
1979
1981
1983
YEAR

Appendix X

Examples of concomitant changes

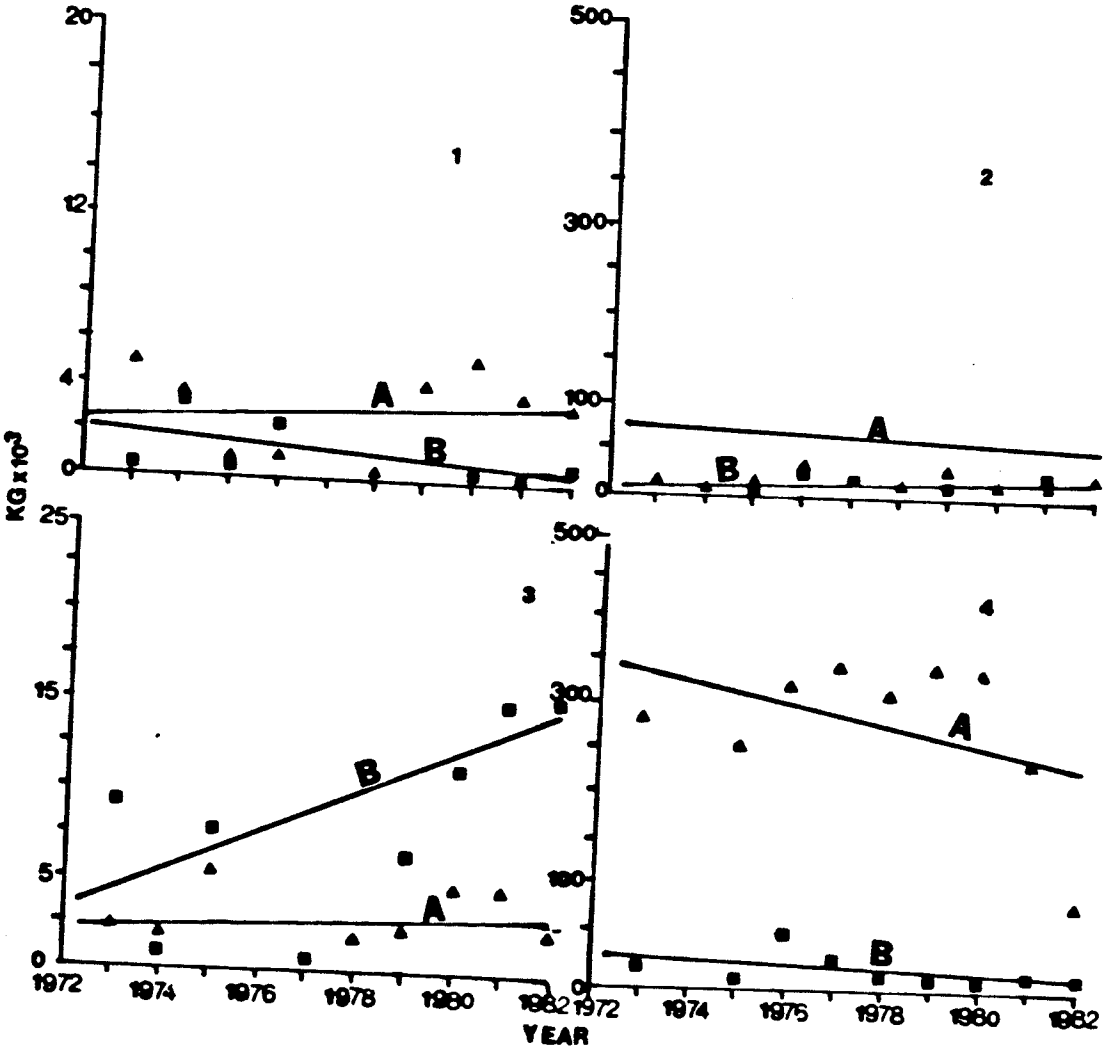
in lake whitefish and walleye, 1973-1983

Legend

(A) Yield of lake whitefish
(B) Yield of walleye

List of Lakes in Appendix X

1. Armstrong
2. Butterfly
3. Cedar
4. Granville
5. Sisipuk
6. South Indian


KG x 10³
1
2
3
4
A
B
YEAR
1972
1974
1976
1978
1980
1982

Appendix Y

Regressions of lake whitefish and walleye yields, 1973-1983

Lake	Linear Regression (Y=a+bx)	Correlation Coefficient	Test F Value and d.f.
Armstrong	1. Y=-4920.246+102.947X	.170	.21 (1,7)
	2. Y=13520.595-158.730X	.423	1.52 (1,7)
Granville	1. Y=228367.6364-2117.273X	.044	.02 (1,8)
	2. Y=105799.5515+1549.570X	.626	5.14 (1,8)
South Indian	1. Y=1227835.558-11966.621X	.419	1.49 (1,7)

1. Regression equation for lake whitefish over time.

2. Regression equation for walleye over time.

Appendix Z

Initial price per pound ($/lb.) for
lake whitefish and walleye, 1973-1983

Species	Size Category	Price per pound ($/lb.) per year '73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83
Lake Whitefish												
	Export:											
	Small	.15	.18	.22	.23	.25	.18	.28	.30	.30	.27	.25
	Medium	.26	.27	.31	.35	.37	.30	.38	.40	.40	.37	.39
	Large	.35	.37	.41	.45	.47	.40	.48	.48	.48	.42	.38
	Jumbo	.40	.42	.46	.55	.57	.50	.58	.55	.55	.47	.39
	X	.29	.31	.35	.40	.42	.35	.43	.43	.43	.38	.35
	Continental:											
	Small	.12	.15	.18	.19	.19	.15	.21	.26	.26	.30	.25
	Medium	.22	.24	.27	.29	.29	.25	.31	.31	.31	.30	.28
	Large	.26	.27	.30	.29	.29	.25	.31	.31	.31	.30	.28
	Jumbo	.30	.32	.35	.39	.39	.35	.41	.36	.31	.30	.28
	X	.23	.25	.28	.29	.29	.25	.31	.31	.31	.30	.27
	Cutter:	.15	.15	.16	.16	.10	.13	.20	.20	.20	.22	.22
Walleye												
	Dressed:											
	Small	.41	.41	.44	.61	.73	.62	.62	.63	.97	.76	.71
	Medium	.46	.46	.49	.61	.73	.62	.78	.77	1.17	.82	.77
	Large	.46	.46	.49	.61	.73	.62	.83	.77	1.17	.82	.71
	X	.44	.44	.47	.61	.73	.62	.74	.72	1.10	.80	.73
	Headless and dressed:											
	Small	.44	.44	.47	.71	.85	.72	.80	.80	1.14	.85	.88
	Medium	.51	.51	.54	.71	.85	.72	.90	.98	1.44	1.00	.95
	Large	.51	.51	.54	.71	.85	.72	.95	.98	1.44	1.00	.88
	X	.49	.49	.50	.71	.85	.72	.88	.92	1.34	.98	.90