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A Preliminary Assessment of the Arctic Charr Sport Fishery on the Robertson River (Koluktoo Bay), Northwest Territories, 1979

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Canadian Data Report of
Fisheries and Aquatic Sciences 306

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A PRELIMINARY ASSESSMENT OF THE ARCTIC
CHARR SPORT FISHERY ON THE ROBERTSON RIVER
(KOLUKTOO BAY), NORTHWEST TERRITORIES, 1979

by

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ABSTRACT

Moshenko, R.W. 1981. A preliminary assessment of the Arctic charr sport fishery on the Robertson River (Koluktoo Bay), Northwest Territories, 1979. Can. Data Rep. Fish. Aquat. Sci. 306: iv + 9 p.

During August 1979, a partial creel census and biological sampling program was carried out on the Arctic charr sport fishery at the Robertson River, Northwest Territories. Seventy-seven angler interviews represented 307 h of angling with catch rates of 4.9 charr per angler-trip and 1.4 charr per angler-h. The harvest by the anglers during the entire season was estimated to be 2820 kg (762 fish). Ninety-five percent of anglers were successful (caught at least one charr) and 63% of all charr caught were released. From 90 charr caught, mean values were: age = 17.9 yr, length = 65.9 cm and weight = 3001 g. Values on retained charr were: length = 71.5 cm and weight = 3700 g. Data summaries are presented in tabular form.

Key words: angling; catch/effort; sport fishing; statistics; fishery management; life history; monitoring; *Salvelinus alpinus*.

RESUME

Moshenko, R.W. 1981. A preliminary assessment of the Arctic charr sport fishery on the Robertson River (Koluktoo Bay), Northwest Territories, 1979. Can. Data Rep. Fish. Aquat. Sci. 306: iv + 9 p.

Au mois d'août 1979, on a effectué un recensement et un échantillonnage biologique partiels des ombles chevaliers pris par les pêcheurs sportifs de la Robertson River, dans les Territoires du Nord-Ouest. Les 77 pêcheurs à la ligne interrogés représentent un total de 307 heures de pêche, et ils ont pris en moyenne 1.4 omble par heure et 4.9 ombles par partie de pêche. Leur prise totale pour la saison se chiffrait à 2820 kg (762 poissons). Quatre-vingt-quinze pour cent des pêcheurs ont attrapé au moins un poisson, et 63% de tous les ombles pêchés ont été rejetés à l'eau. Voici les valeurs moyennes sur 90 des ombles pêchés: âge, 17.9 ans; longueur 65.9 cm; et poids 3001 g. Celles sur les ombles retenus: longueur, 71.5 cm; poids, 3700 g. Les résumés des données sont présentés sous forme de tableaux.

Mots-clés: pêche à la ligne; prises/effort; pêche sportive; statistiques; aménagement des pêches; cycle évolutif; contrôle; *Salvelinus alpinus*.

INTRODUCTION

The Arctic charr, *Salvelinus alpinus* (Linnaeus), is an important domestic (subsistence), commercial and sport fish in many streams along the Arctic coast in the Northwest Territories. The Robertson River, on northern Baffin Island, supports an attractive sport fishery primarily due to the availability and size of anadromous Arctic charr in this remote area (Fig. 1).

It is generally known that angling pressure on this fishery has increased somewhat in the last five years or so, and that the trend is likely to continue, especially with increased human activities as a result of non-renewable resource exploration and development in the Baffin and high Arctic islands.

Brief biological sampling of Arctic charr was done on angled fish in 1973 (Peet in prep.) and on gillnetted fish in 1976 (Kristofferson and McGowan 1981) from the Robertson River. In 1979, a preliminary creel census and biological sampling survey was conducted on the Robertson River at Koluktoo Bay. This study was part of an ongoing program of the Department of Fisheries and Oceans, Fish and Marine Mammal Management Division, designed to monitor the exploitation of fish stocks in the Northwest Territories. Specifically, the objects of this preliminary study in 1979 were: 1) to determine the angler success and harvest rates of Arctic charr by the sport fishery; 2) to investigate the biology and population dynamics of Arctic charr, and 3) to provide a basis for future and more detailed studies on this fishery in order that it can be managed more effectively on a biological basis.

This report presents the data collected from the Arctic charr sport fishery on the Robertson River during 1979.

MATERIALS AND METHODS

STUDY AREA

The Robertson River (72°05'N, 81°00'W) located approximately 112 km (70 mi) southwest of Pond Inlet, Baffin Island flows eastward into Koluktoo Bay near the south end of Milne Inlet (Fig. 1). Bissett (1967) describes the river valley as a broad, structured lowland 3-5 km wide consisting of silts and clays from which rock outcrops protrude. The river flows through an elevation area generally >150 m above sea level and has numerous series of small rapids or fast water that are often impassable to boat travel but are no barrier to fish movements. At Koluktoo Bay the river fans into a shallow delta and is greatly influenced by the twice daily tides. The drainage area is primarily the Lancaster Plateaux of the Arctic Lowlands (Douglas 1970). It consists of broad plateau or hill surfaces dissected by valley systems, several major ice fields and tundra polygons, some moderately high hills of sedimentary rock (>600 m above sea level) and broad, shallow valleys. West of Koluktoo Bay, the Krag and Uvajo mountains reach elevations of about 600 m above sea level. To the south and south-east of this

drainage lies the Baffin Uplands of the Shield. It consists of crystalline and granitic rocks generally in relief >500 m. Wilkinson (1970) describes the lowlands as having generally smooth and round surfaces caused by scouring or deposition by glacial ice. The plateaux and ridges are generally sloping southward with pebbles, stones, boulders or shale littering the surfaces.

The soils are generally infertile except around old Inuit hunting camps and decomposed remains. Vegetation is scarce in the clay tills of the uplands area but abundant in the valley floors or sheltered flats with hillock tundra in stagnant places (Bissett 1967). Vegetation, when present, is patchy with flora consisting chiefly of sedges, grasses, numerous Arctic flowers (poppies and saxifrages), Arctic willow and heather. There are many rock-desert communities supporting crustaceous and black foliose lichens, alternating with moss-heather communities.

The climate is generally tundra zone (Wilkinson 1970). July is the warmest month with maximum cloud cover and precipitation. The range of mean daily temperatures for July-August is 1°C to 9°C with a mean of 70 mm of precipitation in the two months. Winds generally blow from the northwest.

THE FISHERY

Arctic charr from the Robertson River have been exploited by sport fishing since the 1960's; however, it was not until 1972 that the Toonoonik-Sahoonik Co-op of Pond Inlet opened a sport fishing camp at Koluktoo Bay. The camp generally operates from mid-August to early September and accommodates 16 persons in "wooden frame" tents. The angler length of stay is primarily a package of 4 or 7 days, however, some one-day itinerant fishing also takes place, especially at the beginning of the season. A private airstrip accommodates Twin Otter-type aircraft. Most anglers come to Koluktoo Camp via Resolute or Nanisivik, both of which are serviced by jet aircraft from the south.

During the first half of the season angling takes place primarily in the bay area several kilometers below the camp (Fig. 1). This consists of a short trip by boat to the site for a period of 3-4 hours (twice daily) about the peak tides. Charr apparently move in and out with the tides feeding on amphipods and small fishes. In the later part of the season (about mid-August), more angling takes place at the falls/rapids (Fig. 1) as charr initiate their upstream movement for the winter.

The fishery is a high catch and release activity with the use of barbless hooks emphasized by lodge policy. Angling is primarily by spin casting off the shoreline using treble-hooked lures. Guides (approximately 1 guide/5 fishermen) pinch back barbs on the hooks and, whenever possible, handle and release the fish. Daily and possession limits are 4 and 7 charr respectively as they are through the Northwest Territories, except Tree River. All charr caught are likely sea-run (anadromous) since they are silver in colour and are caught in brackish and/or salt

water. Most anglers have one or several meals of charr at the camp and at least 75% of anglers retain the maximum limit (7 fish).

Presently, a very small domestic fishery exists here, primarily carried out by the six or so Inuit staff at the camp. However, prior to the early 1960's saputits (fish weirs) were used extensively on the Robertson River system (about 20 km from the sport fish camp) to establish large fish depots or caches for winter use (Bissett 1967). Although no permanent camps existed here, summer fishing camps were common at Koluktoo Bay. Recently, Inuit from Pond Inlet have agreed to leave this area primarily for sport fishing and to concentrate their domestic fisheries in the Tugat River area located some 25 km to the southeast (Fig. 1). In addition, up until 1978 the Robertson River had a commercial quota of 4536 kg (10,000 lb), but it was fished sporadically.

CREEL CENSUS

The creel census was carried out between 11-14 August 1979. The procedure and forms used were adapted from those described by Falk et al. (1974). Anglers were interviewed upon their return to camp as to the number of fish caught, released and retained as well as the number of hours spent fishing. Data were kept separate according to whether angling took place below camp or at the falls/rapids (Table 1).

BIOLOGICAL INVESTIGATION

A random portion of the anglers' catch was sampled for fork length (± 1 mm), round weight (± 50 g), sex and maturity. Maturity was determined from the condition of the gonads and coded as described in Table 4. No charr were observed in the "mature" or "ripe" stage which could indicate spawning during that year; however, a significant number were described as "resting" indicating that they had likely spawned in the past. During this fishery all fish observed and sampled were silver in colour and were thus assumed to be sea-run (anadromous).

Sagittal otoliths were taken from Arctic charr and stored dry in coin envelopes for later age determination. In the laboratory the convex surface of the otolith was ground on a carborundum stone, if necessary, and immersed in a 3:1 solution of benzyl benzoate and methyl salicylate for clearing. Ages were determined by counting the annuli under a dissecting microscope ($\times 30$) as exposed using a reflected light source against a black background. Fish were aged according to Grainger (1953) counting the dark central core of the otolith as representative of the first year of growth.

Length and weight measurements were obtained on released fish. In addition, lengths were taken on fish retained by anglers to compare size of fish released vs size retained.

DATA ANALYSIS

Data collected during the study were analysed using an IBM 370/168 computer based at the University of Manitoba. The Statistical Analysis System (1972) was used to generate length, weight and age summaries.

Length-weight relationships were determined by sex and sexes combined using the following power equation:

$$\log_{10} W = a + b (\log_{10} L)$$

where: W = weight in grams
 a = Y-intercept
 b = slope of the regression line
 L = fork length in centimetres
 s_b = standard deviation of b

Condition factors (K) were calculated using the formula:

$$K = \frac{W \times 10^5}{L^3}$$

where: W = weight in grams
 L = fork length in centimetres

RESULTS

CREEL CENSUS

During the 1979 season the fishing camp was open from 4 August to 9 September; 107 angler-guests (of which 90 were Canadian) were registered and about 30 itinerant anglers (one day stay) visited the camp (J. Enook, pers. comm.).

Results from the partial creel census are presented in Table 1. A total of 77 angler-interviews representing 307 h of angling showed catch rates of 4.9 charr per angler-trip and 1.4 charr per angler-h. Ninety-five percent of the anglers were successful (caught at least one charr) and released 63% of all charr caught.

The harvest of Arctic charr by anglers from Robertson River in 1979 was estimated as follows:

- a) group anglers:
 - average retained fish was 71.5 cm and 3.7 kg (Fig. 2 and 3).
 - approximately 75% of anglers retained 7 fish, hence average overall retained fish was 5.25 fish/angler.
 - anglers consumed approximately 0.75 fish each during their stay.
 - therefore, each angler harvested $5.25 + 0.75 = 6$ fish.
 - 107 anglers were registered.
 - harvest was: $107 \text{ anglers} \times 6 \text{ fish/angler} \times 3.7 \text{ kg/fish} = 2,375 \text{ kg}$.
- b) itinerant anglers:
 - 30 anglers retaining 4 fish each.
 - harvest was $30 \text{ anglers} \times 4 \text{ fish/angler} \times 3.7 \text{ kg/fish} = 445 \text{ kg}$.

Thus, the estimated total harvest by the sport fishery was 2820 kg charr (762 fish). The domestic fishery harvested about 150 fish \times 3.0 kg/fish =

450 kg. Therefore, the total charr harvest by the sport and domestic fishery for 1979 was estimated to be 3,207 kg (912 fish). This total estimate may be high since data were taken from catches during the best 4 days of angling in 1979 (J. Enook, pers. comm.).

BIOLOGICAL INVESTIGATION

The length-frequency for Arctic charr from the Robertson River is presented in Table 2 and Fig. 2. Mean length of the angled catch in 1979 was 65.9 cm. Male charr had a greater mean length (72.0 cm) than females (62.1 cm). Mean weight of the angled catch was 3001 g with males averaging 3845 g and females 2383 g. Mean length of fish retained was 71.5 cm.

The age-frequency distribution for Arctic charr caught by angling in 1979 is presented in Table 3. Mean age for the combined sample including charr of unknown sex was 17.9 yr. The mean age was 19.2 yr for males and 17.2 yr for females.

The length-weight relationships for Arctic charr caught by angling from the Robertson River in 1979 are as follows:

males (N = 19):
 $\log_{10}W = -1.3553 + 2.6516 (\log_{10}L)$
 females (N = 27):
 $\log_{10}W = -1.3754 + 2.6397 (\log_{10}L)$
 combined (N = 90): (including sex unknown)
 $\log_{10}W = -1.6086 + 2.7829 (\log_{10}L)$

Figure 3 illustrates this length-weight relationship. Less than 5% of the fish caught were "slinks" as described by Peet (In prep.). Most of these were large males, much lighter in weight than others of the same size. A possible explanation is that these fish had spawned in the fall of 1978. All fish were either immature or resting, and those in the "resting stage" were greater than 62 cm in length and older than 17 years of age. Figure 4 shows that fish from the Robertson River exhibit a moderate growth rate compared to other Arctic charr populations.

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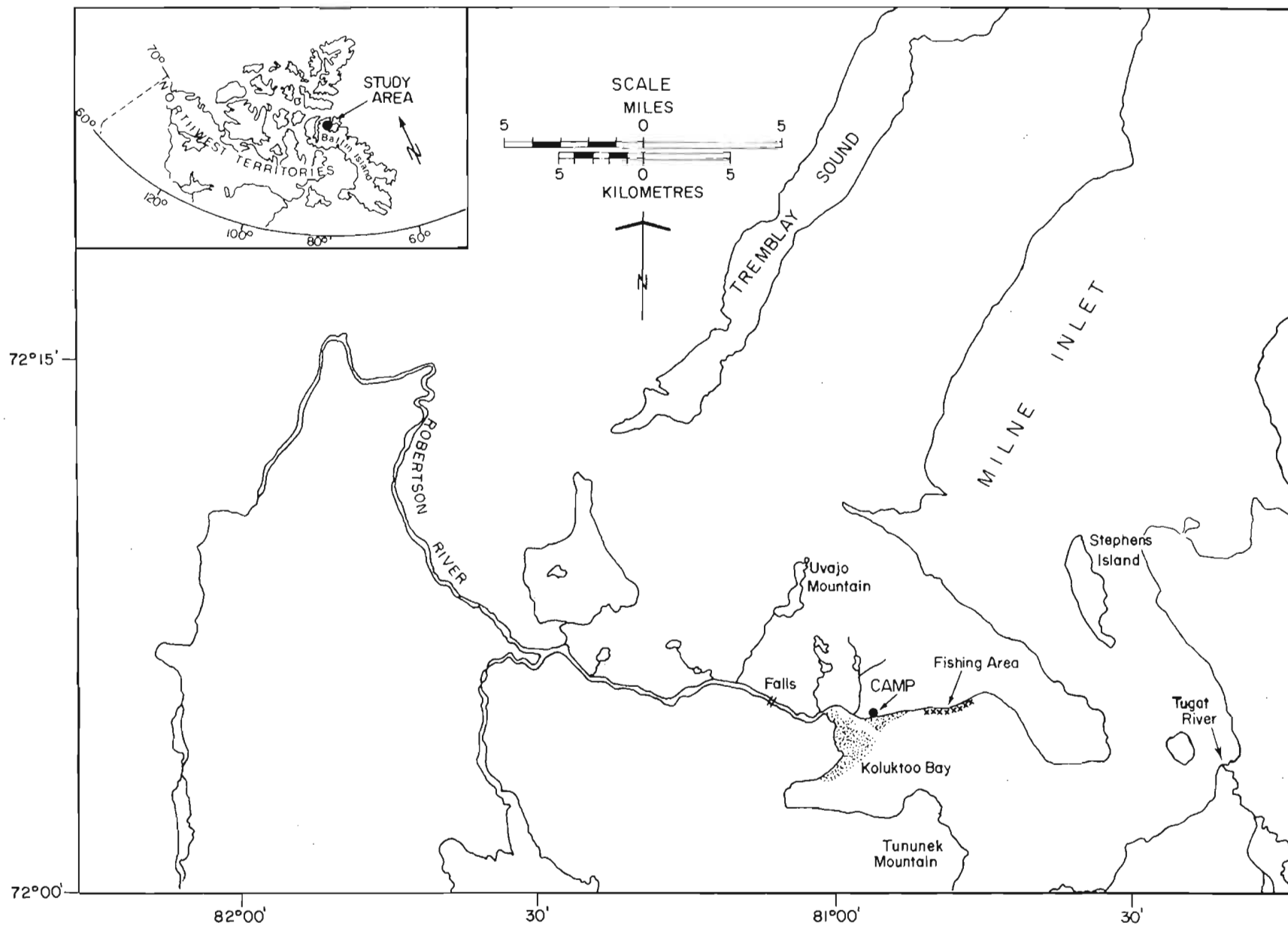


Fig. 1. Map of the Robertson River showing the location of the sport fishing camp.

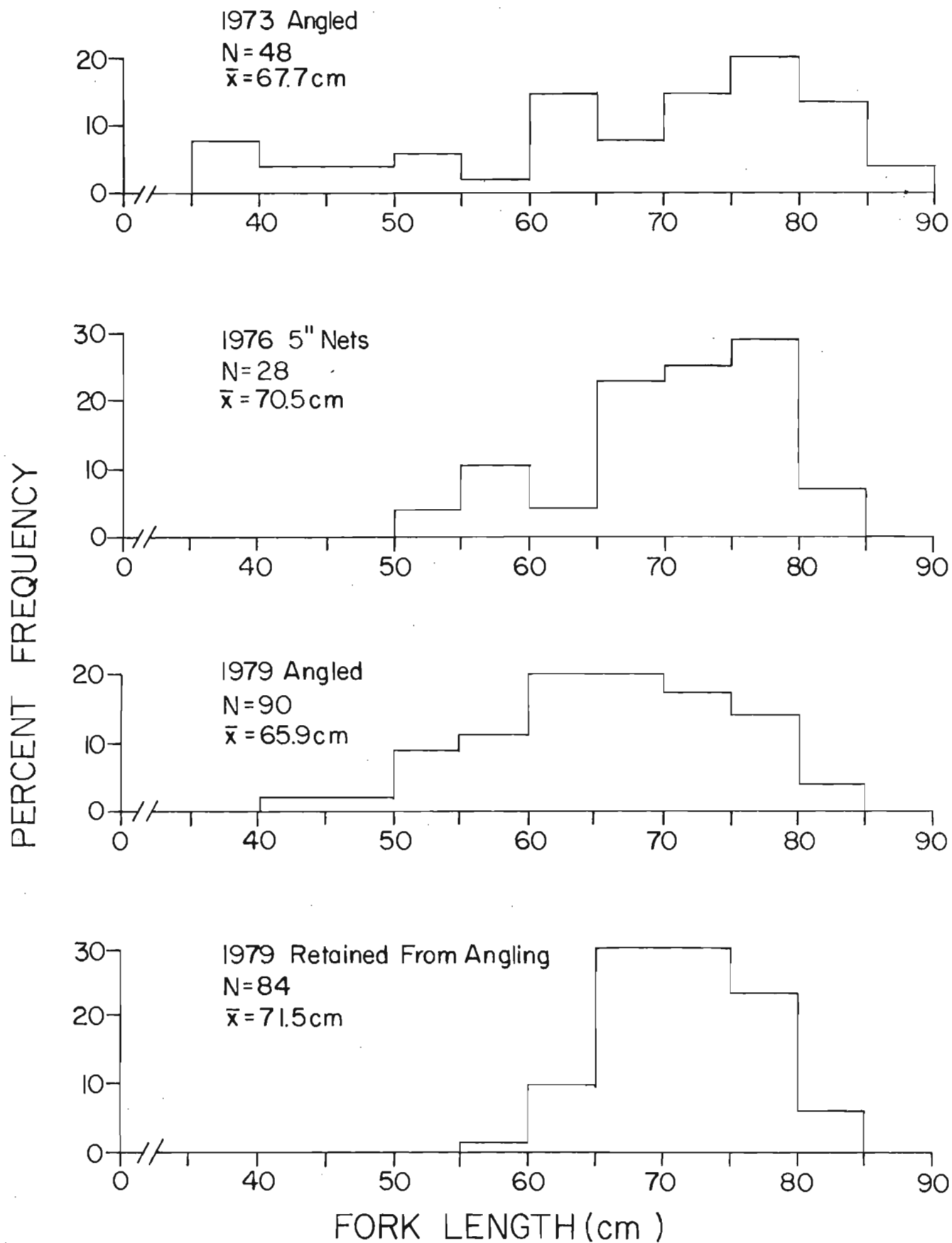


Fig. 2. Length-frequency distributions for Arctic charr from the Robertson River for the various years.

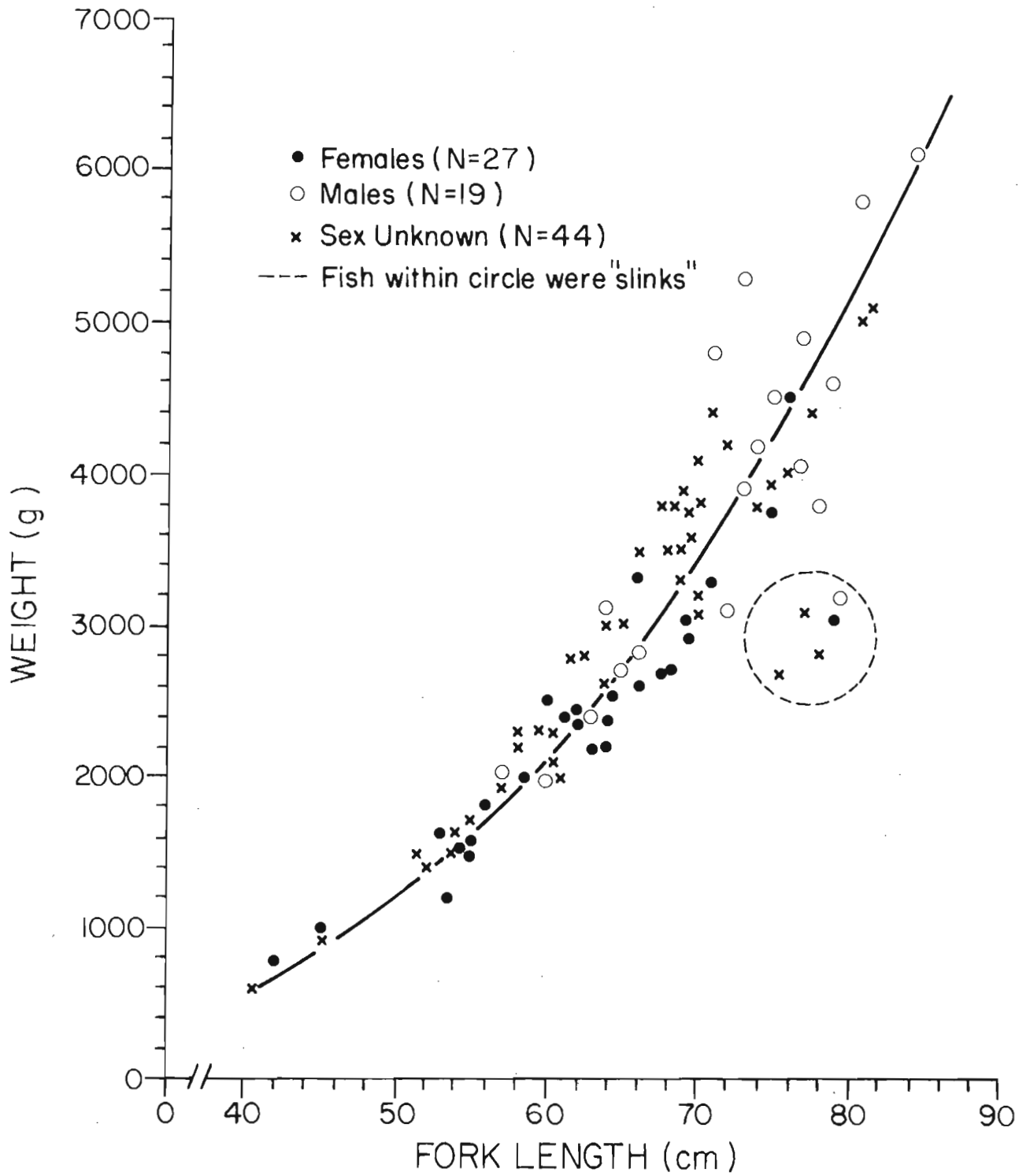


Fig. 3. Length-weight relationship for Arctic charr from the Robertson River, 1979.

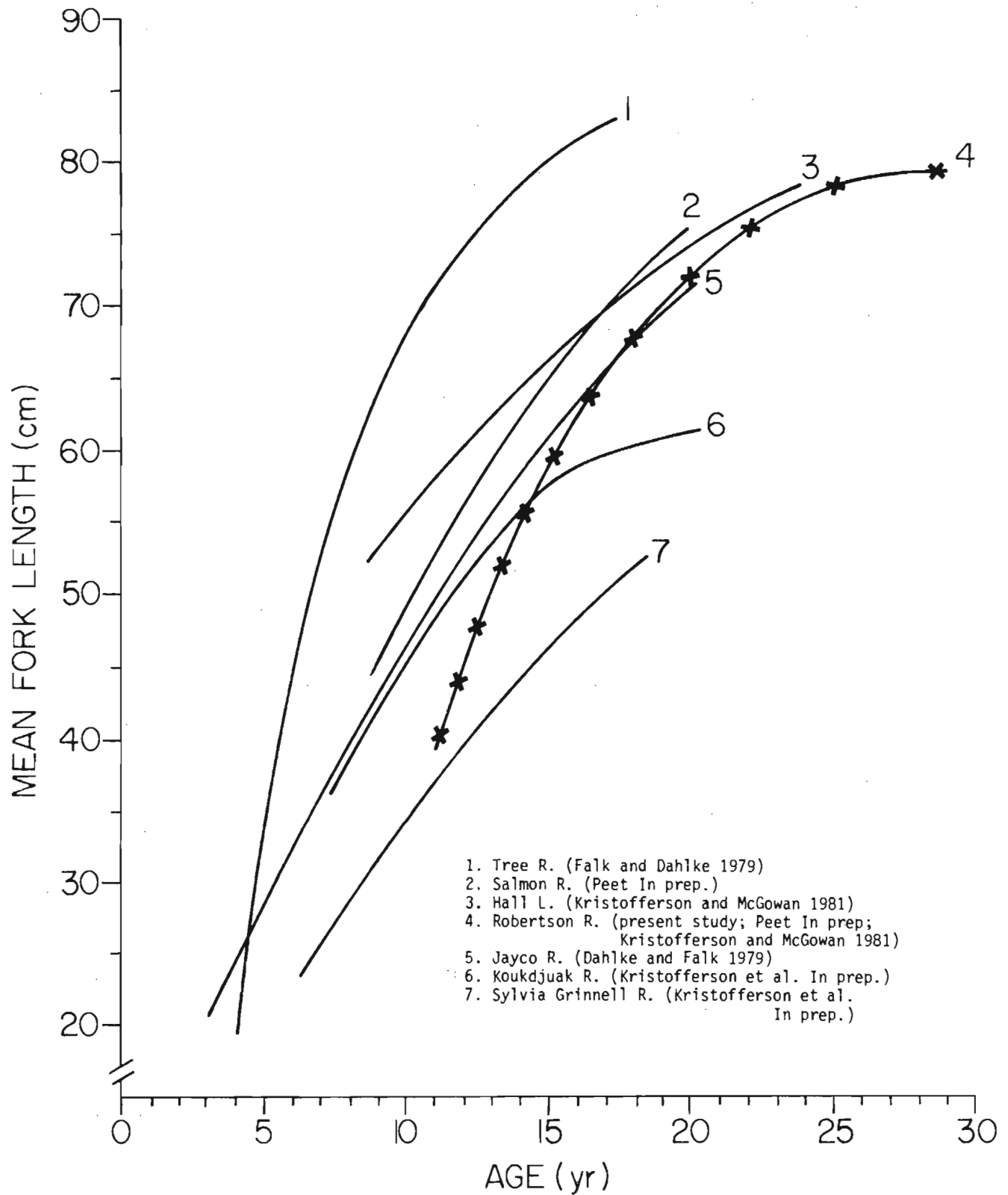


Fig. 4. Comparison of mean growth rates (curves fitted by eye) for Arctic charr from the Robertson River with those in other locations in the Northwest Territories.

Table 1. Summary of the creel census for the Arctic charr sport fishery on the Robertson River, 1979.

Date	Location	No. of Angler-interviews	Angler's Successful		Arctic charr						Total Hours Fished	No. of Fish Caught	
					No. Caught	Released		Retained		No./Angler-trip		/Angler-hour	/Angler-trip ^d
			No.	%		No.	%	No.	%				
11 August	below camp	17	15	88	83	38	46	45	54	2.7	72.5	1.1	4.9
12 August-AM	below camp	12	11	92	37	20	54	17	46	1.4	40.0	0.9	3.1
-PM	rapids	10	10	100	61	49	80	12	20	1.2	34.0	1.8	6.1
13 August-AM	below camp	6	6	100	38	30	79	8	21	1.3	12.0	3.2	6.3
-PM	rapids	12	12	100	62	49	79	13	21	1.1	60.0	1.0	5.0
-PM	below camp	10	10	100	44	22	50	22	50	2.2	48.5	0.9	4.4
14 August-PM	rapids	10	9	90	43	25	58	18	42	1.8	40.0	1.1	4.3
Total		77	73	95	368	233	63	135	37	-	307.0	-	-
Mean		-	-	-	-	-	-	-	-	1.7	-	1.4	4.9

^a Most anglers (~80%) participated in 2 angler-trips/24 h period (e.g. at each peak high tide).

Table 2. Number, fork length, round weight, condition factor (K), % resting maturity stage and sex ratio by length interval for angled Arctic charr from the Robertson River, 1979.

Length Interval (cm)	Males							Females							Combined							F/M Ratio	No. Sex Unknown
	Length(cm)			Weight(g)		K	% Resting ^a	Length(cm)			Weight(g)		K	% Resting ^a	Length(cm)			Weight(g)		K	% Resting ^a		
	N	Mean	SD	Mean	SD			N	Mean	SD	Mean	SD			N	Mean	SD	Mean	SD				
40.0-44.9	-	-	-	-	-	-	-	1	42.8	-	800	-	1.02	0	2	41.7	-	700	141	0.96	0	-	1
45.0-49.9	-	-	-	-	-	-	-	1	45.0	-	1000	-	1.10	0	2	45.1	-	950	71	1.04	0	-	1
50.0-54.9	-	-	-	-	-	-	-	4	53.8	-	1463	189	0.94	0	8	53.3	-	1488	133	0.99	0	-	4
55.0-59.9	2	58.3	-	2000	-	1.01	0	3	56.5	-	1800	200	0.99	0	10	57.4	-	1990	232	1.05	0	1.5	5
60.0-64.9	3	63.8	-	2733	351	1.05	0	8	62.4	-	2413	113	1.00	25	18	62.5	-	2503	294	1.03	18	2.7	7
65.0-69.9	1	66.3	-	2800	-	0.96	0	6	67.6	-	2883	271	0.94	83	18	67.9	-	3311	442	1.06	71	6.0	11
70.0-74.9	5	72.5	-	4250	846	1.12	40	2	72.3	-	3550	354	0.94	100	15	71.9	-	3843	695	1.04	57	0.4	8
75.0-79.9	6	77.6	-	4150	599	0.89	100	2	77.9	-	3800	990	0.82	100	13	77.3	-	3904	663	0.85	100	0.3	5
80.0-84.9	2	82.7	-	5950	212	1.06	100	-	-	-	-	-	-	-	4	81.8	-	5475	562	1.00	100	-	2
Total	19	-	-	-	-	-	53	27	-	-	-	-	-	22	90	-	-	-	-	-	46	1.4	44
Mean	-	72.0	7.7	3845	1220	1.01	-	-	62.1	8.7	2383	851	0.96	-	-	65.9	9.3	3001	1151	1.01	-	-	-

^a Percent in resting maturity stage - see materials and methods, and Table 4.

Table 3. Number, fork length, round weight, condition factor (K), % resting maturity stage and sex ratio by age for angled Arctic charr from the Robertson River, 1979.

Age (yr)	Males							Females							Combined							F/M Ratio	No. Sex Unknown	
	Length(cm)			Weight(g)		K	% Resting ^a	Length(cm)			Weight(g)		K	% Resting ^a	Length(cm)			Weight(g)		K	% Resting ^a			
	N	Mean	SD	Mean	SD			N	Mean	SD	Mean	SD			N	Mean	SD	Mean	SD					
11	-	-	-	-	-	-	-	1	45.0	-	1000	-	1.10	0	1	45.0	-	1000	-	1.10	-	-	-	
12	-	-	-	-	-	-	-	1	58.4	-	2000	-	1.00	0	1	58.4	-	2000	-	1.00	-	-	-	
13	-	-	-	-	-	-	-	2	53.7	1.0	1575	106	1.02	0	3	54.3	1.3	1633	126	1.02	-	-	1	
14	1	71.0	-	4800	-	1.34	100	1	53.3	-	1200	-	0.79	0	3	59.4	10.0	2533	1973	1.05	50	1.0	1	
15	1	62.7	-	2400	-	0.97	0	2	52.2	13.3	1600	1131	1.02	0	3	55.7	11.2	1867	924	1.01	0	2.0	-	
16	1	64.5	-	2700	-	1.01	0	2	55.2	0.9	1650	212	0.98	0	4	59.7	5.3	2250	714	1.03	0	2.0	1	
17	3	67.2	8.8	3467	1680	1.10	33	1	62.5	-	2400	-	0.98	0	4	66.0	7.6	3200	1472	1.07	25	0.3	-	
18	4	66.5	6.9	2975	826	1.00	25	4	61.2	4.8	2250	480	0.98	25	8	63.8	6.2	2613	736	0.99	25	1.0	-	
19	3	76.3	3.1	4433	473	1.00	67	1	79.5	-	3100	-	0.62	100	4	77.1	3.0	4100	770	0.90	75	0.3	-	
20	-	-	-	-	-	-	-	1	69.5	-	2900	-	0.86	100	1	69.5	-	2900	-	0.86	100	-	-	-
21	1	80.5	-	5800	-	1.11	100	1	68.0	-	2700	-	0.86	100	2	74.3	8.8	4250	2192	0.98	100	1.0	-	
22	2	77.0	1.4	4150	495	0.91	100	1	66.0	-	2600	-	0.90	0	3	73.3	6.4	3633	961	0.91	67	0.5	-	
23	1	84.8	-	6100	-	1.00	100	1	76.2	-	4500	-	1.02	100	2	80.5	6.1	5300	1132	1.01	100	1.0	-	
24	1	74.0	-	4150	-	1.02	0	1	74.1	-	3800	-	0.93	100	2	74.1	0.1	3975	248	0.97	50	1.0	-	
28	1	79.5	-	3200	-	0.64	100	-	-	-	-	-	-	1	79.5	-	3200	-	0.64	100	-	-	-	
Unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	66.0	8.6	3038	992	1.02	71	-	41	
Total	19	-	-	-	-	-	53	27	-	-	-	-	-	22	90	-	-	-	-	-	46	1.4	44	
Mean	19.2 ^b	72.0	7.7	3845	1220	1.01	-	17.2 ^b	62.1	8.7	2383	851	0.96	-	17.9 ^b	65.9	9.3	3001	1151	1.01	-	-	-	

^a Percent in resting maturity stage - see materials and methods, and Table 4.^b Mean age.

Table 4. Description of the relative stages of maturity based on examination of the fish gonads.

Maturity Stage	Code	Female	Code	Male
Immature (virgin)	1	-Ovaries granular in texture -hard and triangular in shape -up to full length of body cavity -membrane firm -eggs distinguishable	6	-Testes long and thin -tubular and scalloped shape -up to full body length -putty like firmness
Mature	2	-Current year spawner -ovary fills body cavity -eggs near full size but not loose -not expelled by pressure	7	-Current year spawner -testes large and lobate -white to purplish color -centers may be fluid -milt not expelled by pressure
Ripe	3	-Ovaries greatly extended & fill body cavity -eggs full size and transparent -expelled by slight pressure	8	-Testes full size -white and lobate -milt expelled by slight pressure
Spent	4	-Spawning complete -ovaries ruptured and flaccid -seed eggs visible -some retained eggs in body cavity	9	-Spawning complete -testes flaccid with some milt -blood vessels obvious -testes violet-pink in color
Resting	5	-Ovary 40-50% of body cavity -membrane thin, loose, & semi-transparent -healed from spawning -seed eggs apparent with few atretic eggs -some eggs may be retained in body cavity	10	-Testes tubular, less lobate -healed from spawning -no fluid in center -usually full length -mottled and purplish in color
Unknown (Virgin)	0	-cannot be sexed -gonads long or short & thin -transparent or translucent		
Unknown (non-virgin)	11	-resting fish -has spawned but gonads regenerated -sexing not possible		

