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KOOTENAI RIVER FISHERY INVESTIGATIONS

ANNUAL REPORT

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ABSTRACT

From November 1977 through June 1980, measurements were taken from 165 white sturgeon caught in the Kootenai River. They ranged in size from 50 to 218 cm (20-86 in) with a mean fork length of 115.5 cm (45.5 in) for the 67 fish caught in 1979. Sturgeon caught in 1980 (98) averaged 104.4 cm (41.1 in) in fork length. Only 11.2% of the fish caught from the Kootenai River in Idaho and British Columbia during 1977 through 1980 were less than 102 cm (40 in). Sixty-three of the sturgeon aged ranged from 4 to 41 years of age with 52 (82.5%) of those being in the 15-28 age group.

Of 136 sturgeon tagged in Idaho 12 (8.8%) have been recaptured. Two fish tagged in British Columbia were also caught in Idaho.

We examined the contents of 22 sturgeon stomachs collected in the Kootenai River during 1979. Plant material was found in 86% of the stomachs with chironomid larvae present in 82%. Fish and clams were observed in 13.6% of the stomachs.

Anglers reported catching 387 sturgeon in the Kootenai River during 1979 with 7,285.5 hours of fishing effort. They released 341 (88%) of those fish with a reported harvest of 46. We estimated a total harvest of 52 sturgeon for the river during 1979. Interest in sturgeon fishing in the Kootenai River is increasing with 57% of the anglers having fished for 1 year or less. Ninety-two percent of the anglers resided within 160 km (100 mi) of the Kootenai River.

We electrofished the Kootenai River above Bonners Ferry. Seventy percent of the fish sampled in a 1 km (0.6 mi) section of the river were mountain whitefish. Rainbow and Dolly Varden accounted for less than 3% of the catch while non-game species comprised the rest.

ACKNOWLEDGMENTS

Charles White and Bill Goodnight caught and tagged sturgeon and collected fin ray samples from 1977 through 1979.

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Anna Marie Halpern typed the report.

INTRODUCTION

The Kootenai River originates in southeastern British Columbia, flows through Montana and Idaho and then returns to British Columbia, where it flows through Kootenai Lake and ultimately joins the Columbia River at Castlegar, British Columbia. The Idaho portion of the river is located at the north end of the Idaho Panhandle in Boundary County (Fig. 1). At the international border at Porthill, Idaho, it drains approximately 35,480 sq km (13,700 sq mi) and has an average discharge of 454 m^3/s (16,040 cfs) (USGS 1979). The 106 km (66 mi) of the river which are in Idaho can be divided into two different reaches. The 76 km (47 mi) reach from Porthill to Bonners Ferry is a relatively flat, slow moving and meandering river with diked banks and holes up to 30 m (100 ft) deep. The water level is affected by the level of water in Kootenay Lake, which is 50 km (31 mi) north of Porthill. The 30 km (19 mi) of river upstream from Bonners Ferry to Montana, located in a canyon, are free flowing with an average gradient drop of 0.6 m/km (3 ft/mi).

Completion of Libby Dam in Montana in March 1972 changed the natural seasonal flow and temperature regimes in the Kootenai River. Mean monthly flows during the spring runoff have been reduced by about 50% and low wintertime flows have about trippled (Fig. 2). Average wintertime water temperatures have increased by about 2 C (4 F) (Fig. 3). The warmer winter temperatures have resulted in the river remaining virtually ice-free during the winter instead of freezing over as it did prior to the construction of the dam. Turbidity and nutrient loads in the river have also changed with the completion of the dam.

Presently, the Kootenai River is the only area in the State of Idaho where anglers can catch and keep white sturgeon (Acipenser transmontanus). It is also the only river in Idaho which contains burbot or ling (Lota lota). Additional game fish reported in the Kootenai River drainage are rainbow trout (Salmo gairdneri), cutthroat trout (Salmo clarki), Dolly Varden (Salvelinus malma), brook trout (Salvelinus fontinalis), mountain whitefish (Prosopium williamsoni), kokanee (Oncorhyncus nerka), brown bullhead (Ictalurus nebulosus), yellow perch (Perca flavescens), pumpkinseed (Lepomis gibbosus), largemouth bass (Micropterus salmoides) and black crappie (Pomoxis nigromaculatus) (Simpson and Wallace 1978).

Fishery observations in Montana below Libby Dam have shown an improvement in trout and whitefish populations since the construction of the dam (May and Huston 1979) but little is known regarding the fisheries in Idaho. The Kootenai River research program began 15 October 1979 to document the distribution, movement, sizes and conditions of fish populations in the Kootenai River in Idaho. Particular emphasis has been placed on the white sturgeon due to its unique fishery and the lack of biological information on this species. This report covers the period from 15 October 1979 through 30 June 1980 and incidental information collected by the Idaho Department of Fish and Game from November 1977 through 1979.

OBJECTIVES

This report provides biological information on major game fish species in the Idaho portion of the Kootenai River with emphasis on white sturgeon, burbot, trout and whitefish. A major objective of the project is to assess the effects

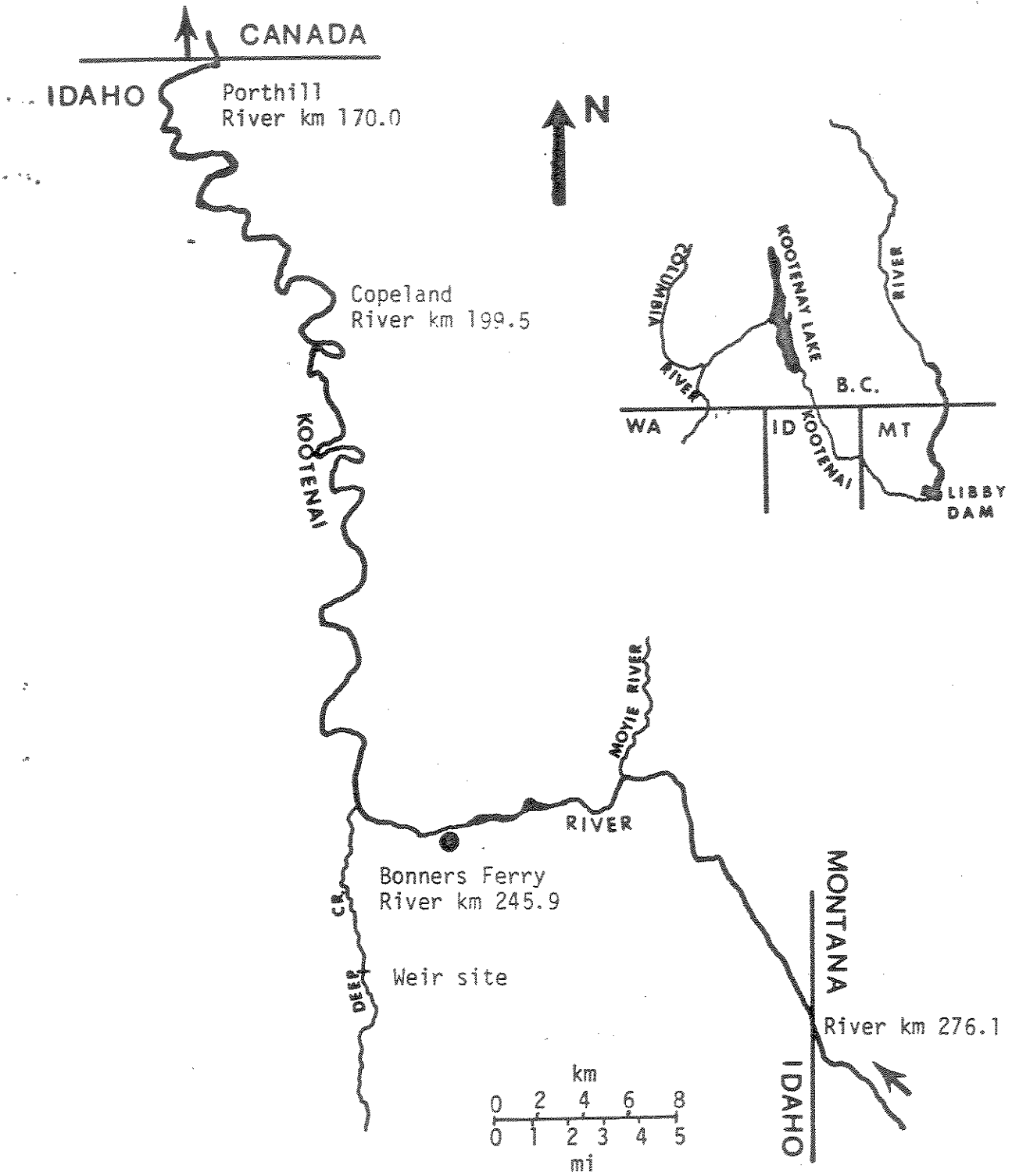

Figure 1. Location of the Kootenai River in the Idaho Panhandle with river distances of major access points.

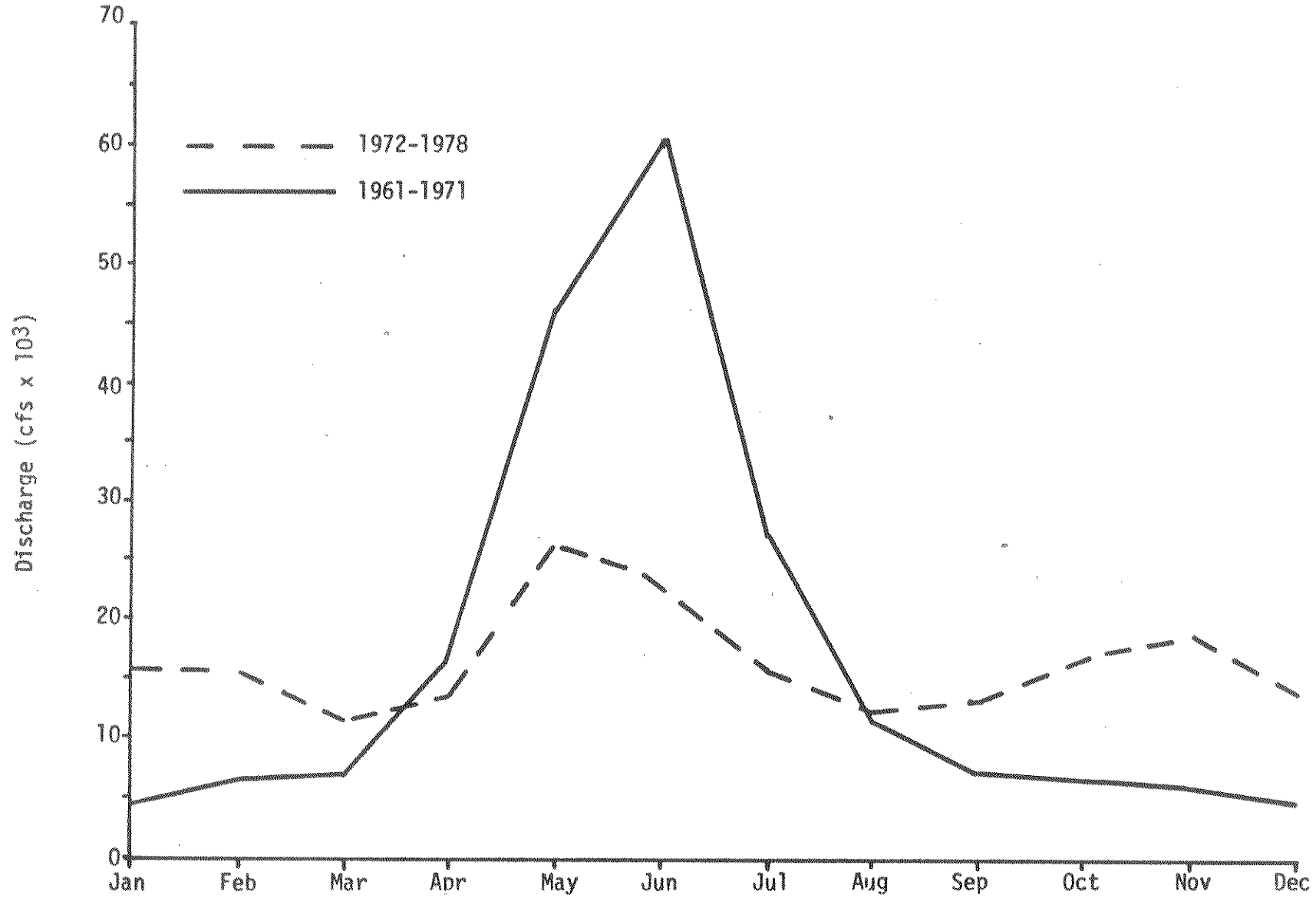

Figure 2. Monthly mean discharge of the Kootenai River at Porthill, ID before and after the completion of Libby Dam in March 1972.

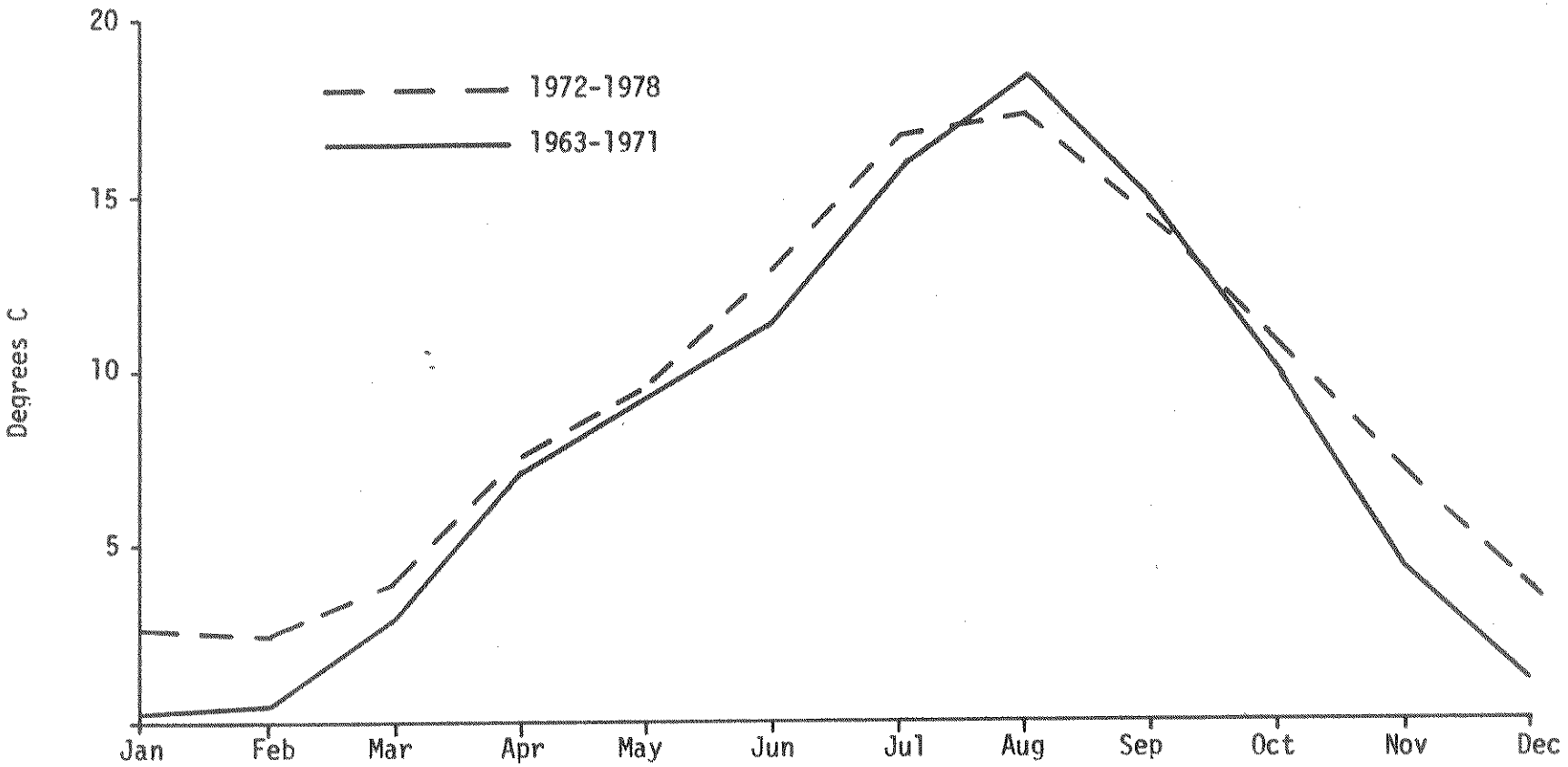

Figure 3. Monthly mean water temperatures of the Kootenai River at Porthill, ID before and after the completion of Libby Dam in March 1972.

of Libby Dam on fisheries in Idaho and provide recommendations for operation of the selective withdrawl system at the dam. The first year of the project was oriented to inventoring the fishery resource in the drainage which is essential for understanding the effects of dam operating procedures on the fisheries. Because of the interest and uniqueness of the sturgeon resource in the river we emphasized sturgeon ecology and behavior. Specific project objectives included:

1. Evaluation of sturgeon population structure, food habits, movement and spawning ecology.

2. Assessment of sturgeon angler effort and success.

3. Assessment of fish species composition in the Kootenai River.

4. Evaluation of the tributaries for trout production.

TECHNIQUES USED

Sturgeon

Capture and Marking

Department personnel captured sturgeon by rod and reel from November 1977 through 1979. Fish were measured for total length and marked. A four digit tattoo was placed either on the pectoral or caudal fin. Beginning in June 1978, fish were also tagged with a numbered Floy tag just forward of the dorsal fin. Fish under 22.7 kg (50 lb) were weighed. In 1980, fish were also caught on portable setlines consisting of six 6/0 or 4/0 hooks on a 9 m (30 ft) line, anchored with rocks at each end with a float line attached. The tattoo was switched to a three digit number located on the rostrum between the barbels and mouth.

Aging

A small section of the first pectoral fin-ray was removed from all fish captured. The ray section was cut from the fin using side-cutters or a fine-toothed hacksaw and sharp knife. Sections were removed from the ray approximately 10-25 mm (0.4-1.0 in) from the point of articulation (depending on the size of fish). When fin-ray sections were taken closer to the articulation point, excessive bleeding occurred. We used a vise and jeweler's saw to make thin transverse sections from each dried pectoral fin-ray section (Coon, Ringe and Bjornn 1977). The proximal end of the fin-ray sections was squared off, polished under water with 600 grit sandpaper until all saw marks were removed, and polished to a high gloss on a damp soft cloth using jeweler's rouge. After polishing, a thin section was cut from the end of the fin-ray. It was not necessary to polish the other side of the fin-ray section. We used both reflected light and transmitted light under a disecting scope to determine the age of the fish. With reflected light, sections were placed on a black watch-glass with a small amount of water. The light caused the translucent annuli to appear dark and stand out. With transmitted light, sections were placed directly on the stage of the scope with a few drops of water. The

translucent annuli transmitted light and appeared illuminated. The latter method seemed to work best. The ages reported in this report are tentative until they can be verified by a second observer.

Stomach Analysis

During 1979, anglers were requested to return the stomachs of any sturgeon killed to the Department of Fish and Game. These stomachs were frozen until they could be examined. The stomachs were thawed in a water bath and the contents removed from the esophagus and stomach. Volumetric weight of stomach contents were determined by water displacement in a graduated cyclinder. We sorted the contents and noted the occurrence of food items.

Angler Survey

In an effort to determine angler use of sturgeon, mandatory sturgeon tags were required in 1979. Names, addresses and telephone numbers of people receiving tags were recorded in order to contact them for information on their angling effort and success. We interviewed each angler by telephone in early 1980. A questionnaire was sent to those anglers who could not be contacted by telephone.

Drift Sampling for Larvae

We selected three river sites to sample for sturgeon larvae in an attempt to determine where and when sturgeon spawn in the Kootenai River. We sampled once a week at the US 95 bridge (rkm 246)[1], Crossport (rkm 255) and Hemlock Bar (rkm 261) from 25 April through 30 June 1980.

We attempted to sample sturgeon larvae with a cone-shaped drift net using techniques described by Kohlhorst (1976). However, due to the current and slightly larger net size, we mounted the drift net on sled runners constructed of 3.8 cm (1.5 in) galvanized iron pipe. Sample time varied from 30 min to 1 hr with one overnight set of 14 hours.

Burbot

Capture Methods

From mid-December 1979 through February 1980, hoop and experimental gill nets were used to sample burbot and other fish in the Kootenai River between Porthill and Bonners Ferry. Double ended hoop nets consisting of two sets of four 0.8 m (33 in) hoops covered with 2.5 cm^2 (1 in^2) mesh netting were used. The sets of hoops were separated by a 6 x 0.9 m (20 x 3 ft) panel. Gill net mesh size varied from 2.5 to 6.4 cm (1.0-2.5 in). Nets were placed in shallow water near the mouths of streams and on the inside of bends in the river. Depending on their condition, burbot were either collected and kept or tagged

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1) rkm = river kilometer.

and released with a numbered Floy tag. We also caught burbot on our sturgeon setlines and by rod and reel. Due to the high mortality rates from hooking, the fish caught on setlines were sampled for age and growth analysis.

Trout and Whitefish

River Electrofishing

Fish populations were sampled in the Kootenai River at night with boat-mounted electrofishing gear. A 1 km (0.6 m) section of the river was sampled to determine the effectiveness of the gear and relative abundance of fish species. Trout and whitefish population estimates will be conducted in September in the canyon area between Bonners Ferry and Montana using methods described by May and Huston (1979).

Tributary Spawning Runs

Monitoring of spawning runs in Deep Creek was attempted by placing a weir with a V-box trap in the stream. Depending on stream flows, the wings blocked part or all of the stream. Spacing of the vertical tubing in the wings ranged from 1.3 to 2.5 cm (0.5 to 1 in). Most fish sampled were measured, weighted, tagged and released. Scale samples were taken to determine age and growth rates.

RESULTS

Sturgeon

Length and Age

From November 1977 through 30 June 1980, 165 white sturgeon have been measured in the Kootenai River in Idaho (Appendix A). Mean fork length of the 39 fish sampled from 1977 through 1979 and 28 fish turned in by anglers in 1979 measured 115.5 cm (45.5 in). They ranged in total length from 51 to 218 cm (20-86 in) (Fig. 4). Mean fork length of the 98 sturgeon sampled in 1980 was 104.4 cm (41.1 in). They ranged from 50 to 178 cm (20-70 in). From 1977 through 1979 the British Columbia Fish and Wildlife Branch sampled 129 white sturgeon in the Kootenai River above the inlet to Kootenay Lake. Fork length measurements ranged from 81 to 203 cm (32-80 in) with a mean of 127.0 cm (50.0 in) (Les Fleck and Harvey Andrusak, personal communication). Only 33 (11.2%) of these 295 sturgeon caught in Idaho and British Columbia were less than 102 cm (40 in) in length.

We aged sixty-three sturgeon caught in the Kootenai River in Idaho in 1977-1979. Tentative ages ranged from 4 to 41 years (Table 1). Fifty-two (82.5%) fish were in the 15-28 age group. These fish ranged in size from 94 to 190 cm (37-75 in) (Fig. 5). Twenty-four fish in this age group were caught by anglers who were only allowed to keep fish between 91.4 and 182.9 cm (36-72 in). Even excluding angler caught fish, 75.7% of the fish sampled were in the 15-28 age group. The seven sturgeon which were less than 79 cm (31 in) in length were from 4 to 8 years old.

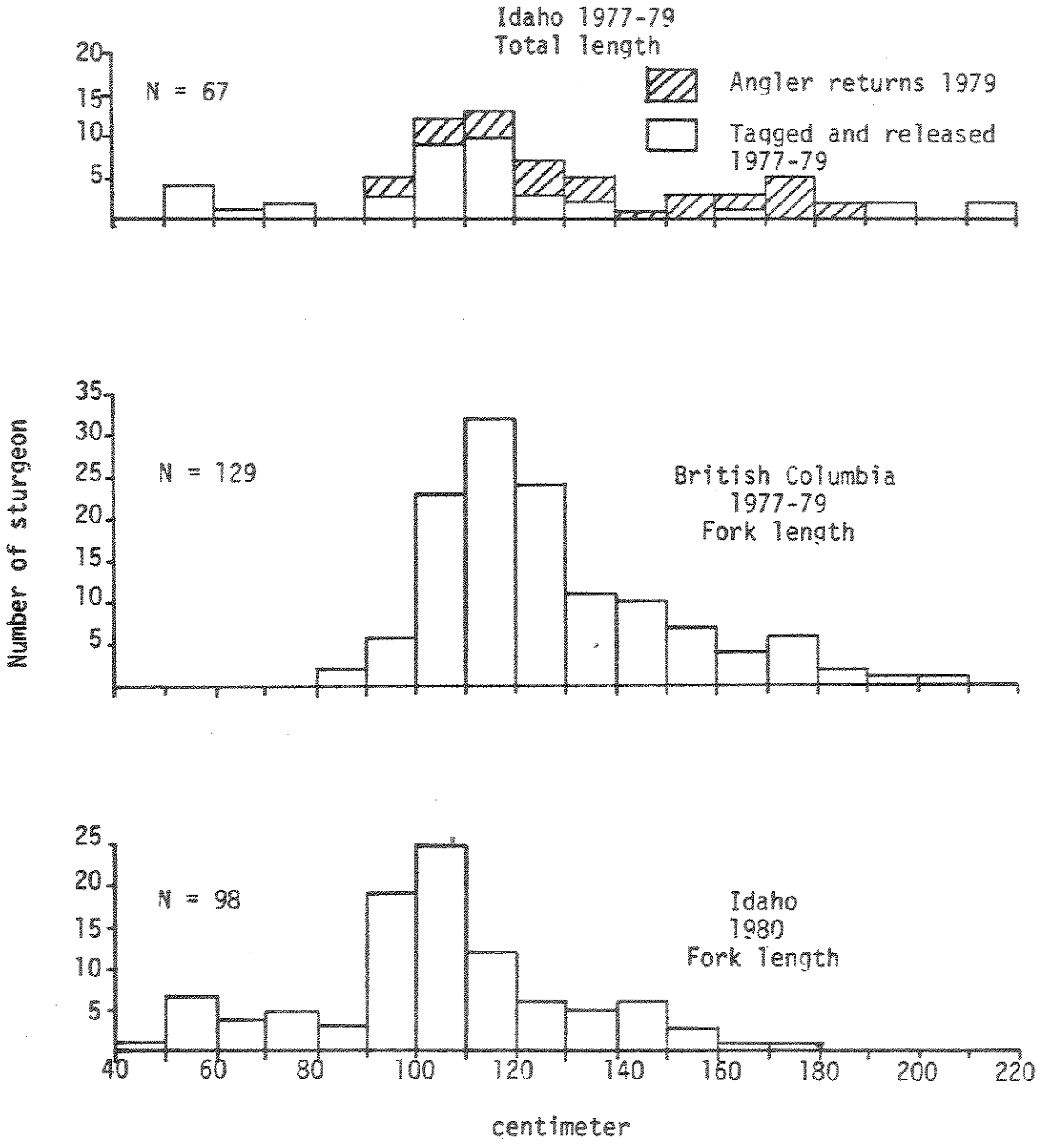

Figure 4. Length frequency of sturgeon tagged and released in the Kootenai River in Idaho and British Columbia from 1977 to 30 June 1980 and fish caught by Idaho anglers during 1979.

Table 1. Age, mean length and mean weight of white sturgeon captures in the Kootenai River, 1977-79 by Idaho Fish and Game personnel and anglers.

Age	Number of fish	Total length (cm) Mean	Range	Mean weight (kg)
4	4	54.0	51-57	0.95*
5	0			
6	1	64.0		1.80
7	0			
8	2	76.5	76-77	2.30
9-14	0			
15	3	116.3	99-132	10.87
16	4	105.2	99-112	6.80**
17	9	112.3	103-140	8.64*,**
18	6	106.0	91-122	7.18
19	4	111.5	103-117	8.50
20	7	126.4	109-155	13.60**
21	6	138.7	121-162	15.42*
22	4	145.8	123-170	19.80**
23	1	119.0		13.60
24	2	170.0		28.80*
25	1	157.0		29.80*
26	1	198.0		47.90*
27	2	171.0	169-173	37.95*
28	2	184.0		29.00*
29-31	0			
32	1	183.0		33.6
33	1	218.0		71.4*
34-35	0			
36	1	183.0		
37-40	0			
41	1	218.0		71.5*

*Includes estimated weights.
**One fish not weighed.

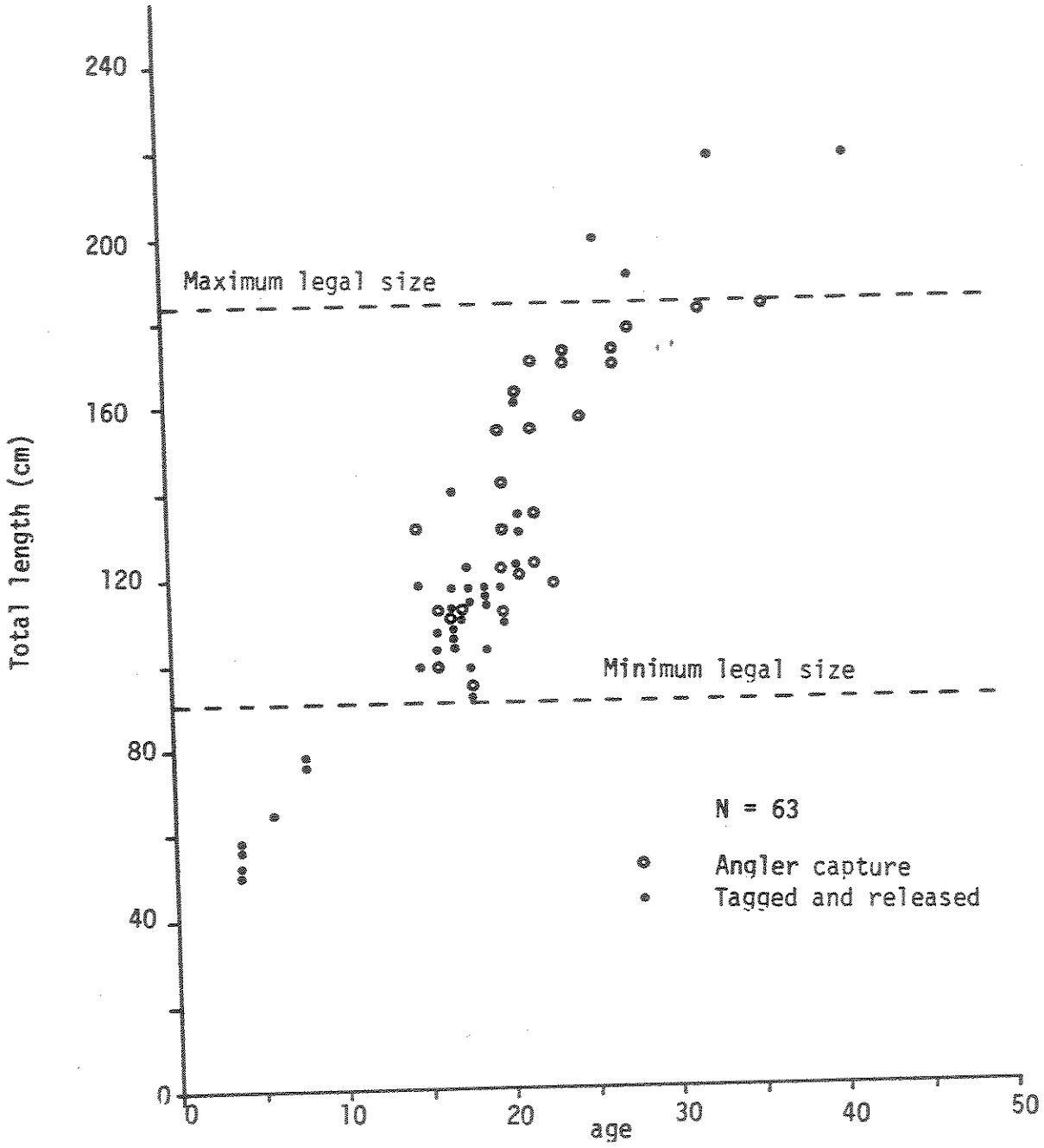

Figure 5. Length and ages of white sturgeon caught in the Kootenai River, Idaho 1977-79.

Movement

A total of 136 sturgeon were marked and released in the Kootenai River in Idaho through 30 June 1980. Nine fish were recaptured and anglers returned tags from four fish (Table 2). Two fish that were tagged in British Columbia were also caught by Idaho anglers. Only two of the fish were recaptured in the same location that they were tagged, but both of these fish showed some movement in the river. One was released 7.6 km (4.7 mi) downstream from the original capture location and recaptured at the original site 12 days later. The second fish, which was originally marked on 16 August 1978 was recaptured 620 days later (27 April 1980) at the same spot, then recaptured again 14.0 km (8.7 mi) down river on 10 June 1980. Five fish have moved from 4-14 km (3-9 mi) down river and were recaptured 1 to 230 days after release, while five fish have moved from 3-18 km (2-11 mi) upriver in 3 to 807 days. The two British Columbia fish were captured 96 and 100 km (59 and 62 mi) upriver from their tagging location.

Stomach Analysis

In 1979, anglers turned in 22 sturgeon stomachs. Twenty of the stomachs contained some food items and two were empty (Table 3). The mean volume of food in the 20 stomachs was 51.2 ml. The most common item found in the stomachs was plant material which occurred in 19 of the 22 stomachs examined. Chironomid larvae occurred in all but one of the stomachs containing plant material. Fish parts consisting of scales and bones were found in three stomachs. Minute clams were found in 3 stomachs, leeches in 1, and numerous Ephemeroptera and Plecoptera larvae were found in 1 stomach.

Angler Survey

Ninety percent (225) of the 1979 sturgeon tag holders were contacted. Seventy-three percent (165) of these tag holders made at least one trip to fish for sturgeon in the Kootenai River in 1979 (Table 4). The majority of these anglers were local residents and lived either in Boundary County (65%) or Bonner and Kootenai Counties (27%). Nonresidents (7%) came mainly from Washington. The majority of the anglers had only recently started fishing for sturgeon with 57% having started in 1979. Only 18% of the fishermen had 4 or more years of experience sturgeon fishing on the Kootenai River.

The anglers contacted reported a total catch of 387 sturgeon with 46 being harvested and 341 released (Table 5). Assuming that the harvest rate of fish was the same for both contacted and non-contacted anglers, the estimated harvest of sturgeon in the Kootenai River in 1979 was 52 fish. Ninety-five percent of the anglers fished for sturgeon with rod and reel and caught 97% of the fish. Rod and reel fishermen, who fished mainly with nightcrawlers, reported fishing 3,322.5 hours in 1979 and averaged 8.9 hours per sturgeon caught. Ten percent of the anglers used setlines (5% used both methods) and fished 3,963 hours in 1979. Setline fishermen generally used live fish for bait and caught one sturgeon for every 330.2 hours of effort.

Thirty-nine percent (65) of the anglers were successful in catching sturgeon (Table 6). An equal number of successful fishermen (35%) either kept

Table 2. Location, dates and movement of recaptured white sturgeon in the Kootenai River, Idaho. River kilometers increase in an upstream direction.

Tattoo number	Marked			Recapture		Movement[a] (km)
	Location (rkm)	Date	Total length (cm)	Location (rkm)	Date	
0007	215.6	3/23/78	134.6	204.7	6/17/78[b]	d-10.9
0011	207.9	3/30/78	99.0	213.4	6/14/80	u- 5.5
0016	207.9	4/25/78	105.4	225.1	6/19/79	u-17.2
1003	207.9	6/20/78	52.1	203.6	7/11/78	d- 4.3
1011	207.9	8/16/78	63.5	225.1	9/15/78	u-17.2
1012	207.1	8/16/78	55.8	207.1	4/27/80	--
1012	207.1	8/16/78	55.8	193.1	6/10/80	d-14.0
1014	225.1	9/15/78	110.5	215.6	5/3/79[b]	d- 9.5
1019	225.1	6/19/79	116.8	215.6	7/7/79[b]	d- 9.5
009	207.1	2/28/80	152.0	225.1	5/31/80[b]	u-18.0
011	207.1	3/14/80	111.0	207.1	3/26/80	--[c]
063	190.0	6/11/80	100.0	193.1	6/21/80	u- 3.1
076	182.0	6/18/80	115.5	176.2	6/19/80	d- 5.8
00719[d]	120	2/8/77	149.9[e]	215.6	4/8/79[b]	u-95.6
06020[d]	120	7/13/77	156.2[e]	219.5	5/5/80[b]	u-99.5

a) d-downriver, u-upriver.
b) Angler returned tag.
c) Fish released at river kilometer 199.5, returned u-7.6.
d) British Columbia tag.
e) Fork length.

Table 3. Frequency of occurrence of food items in the esophagus and stomachs of white sturgeon caught by anglers in the Kootenai River, Idaho, 1979.

Food item	Spring (15 fish)	Summer (4 fish)	Fall (3 fish)	Total (22 fish)
Plant material	80.0	100.0	100.0	86.4
Chironomidae	73.3	100.0	100.0	81.8
Plecoptera				
Claasseni	6.7			4.6
Isogenus	6.7			4.6
Ephemeroptera				
Rhithrogena hageni	6.7			4.6
Ameletus	6.7			4.6
Leech	6.7			4.6
Clams	20.0			13.6
Fish	13.3	25.0		13.6
Empty	13.3			9.1
Volume (ml) mean	41.5	37.5	84	46.6
Range	0-207	15-46	32-113	0-207

Table 4. Number, residence and experience of sturgeon anglers on the Kootenai River, Idaho, 1979.

	Total tag holders	Total contacted	Fished in 1979		Areas of residence of 1979 anglers					Years sturgeon[1] fishing the Kootenai River			
			Yes	No	Boundary county	Kootenai Bonner counties	Other Idaho counties	Washington	Other states	1	2	3	4+
Number	251	225	165	60	107	45	2	6	5	105	33	13	33
Percent	--	89.6	73.3	26.7	64.8	27.3	1.2	3.6	3.0	57.1	17.9	7.1	17.9

[1]Includes anglers who had previously fished for sturgeon in the Kootenai River, but did not fish in 1979.

Table 5. Methods, effort and success of rod and set line anglers on the Kootenai River, Idaho, 1979.

Methods used by anglers			Effort				Success			
							Sturgeon caught			
Rod only	Set line only	Both	Method	Days fished	Hours fished	Ave. hour per day	Kept	Released	Total	Ave. hour per sturgeon caught
147	9	9	rod	632	3322.5	5.25	43	332[1]	375	8.9[1]
89.1	5.4	5.4	set line	179	3963.0	22.14	3	9	12	330.2
			Total	811	7285.5	8.98	46	341	387	18.8

[1]Numbers reported are exaggerated since some individual party anglers reported total party releases.

or released all the sturgeon they caught, while 29% of the anglers kept and released fish. Only 4 fishermen reported keeping the yearly limit of 2 sturgeon, while 38 reported keeping 1 fish.

Table 6. Tendancy of successful sturgeon anglers to keep or release fish and numbers of anglers keeping one or more sturgeon per year (total anglers = 158).

Total successful anglers	Kept all fish caught	Released all fish caught	Kept and released fish	Kept one fish	Kept two fish
65	23	23	19	38	4
39.4%	35.4%	35.4%	29.2%		

Larvae

As of 30 June 1980, we did not collect any sturgeon larvae in the Kootenai River drift samples (Table 7). Two burbot fry were caught at US 95 bridge and one at Crossport on 4 May 1980. They ranged in size from 15 to 18 mm (0.6-0.7 in). Since 22 May 1980 unidentified fish eggs have been picked up at all sites. These eggs are probably from non-game species, such as peamouth and northern squawfish. One overnight sample on 30 June collected 5 peamouth fry and 39 fish larvae ranging in size from 8 to 15 mm (0.3-0.6 in), which are most likely northern squawfish. One additional larvae was also collected at Hemlock Bar on 30 June.

Although sturgeon will spawn in waters cooler than 12 C (54 F) (Kohlhorst 1976), the preferred temperature range is from 12-18 C (54-64 F) (Doroshov and Lutes, UC Davis, personal communication). Surface water temperatures taken during the drift sampling did not rise above 12 C until 9 June. They remained above 12 C through 30 June except on 24 June when they dropped to 10 C (50 F).

Burbot

Sampling fish with hoop nets was mostly unsuccessful. From mid-December 1979 through January 1980, hoop nets were fished a total of 129 net days in the Kootenai River and caught 8 burbot, 1 whitefish and 1 rainbow trout. During the same period, 4 Dolly Varden, 2 burbot, 13 squawfish, 6 peamouth and 8 suckers were collected with an experimental gill net fished for 11 nights.

Sturgeon setlines caught 25 burbot from January through June and 1 burbot was caught by rod and reel. Total length of the 36 burbot ranged from 375-813 mm (14.8-32.0 in) with a mean of 562 mm (22.1 in). Mean weight was 1.07 kg (2.36 lb). One of the 8 burbot that were tagged and released was caught by and angler 10 days later (29 February 1980) at Copeland, 29.5 km (18.4 mi) upriver from the release point at Porthill.

Table 7. Date, water temperature and results of larval drift samples taken on the Kootenai River.

Date	Water temperature (°C)	US 95 Sample duration (min)	US 95 Fish & eggs caught	Crossport Sample duration (min)	Crossport Fish & Eggs caught	Hemlock Bar Sample duration (min)	Hemlock Bar Fish & eggs caught
4/25/80	7.5	30	0	--	--	--	--
5/4/80	--	30	2 burbot	30	1 burbot	30	0
5/10/80	7.5	30	1 egg*	30	0	30	0
5/22/80	10.0	30	1 egg	30	2 eggs	30	1 egg
5/29/80	--	30	1 whitefish fry 3 eggs	30	2 eggs	30	3 eggs
6/9/80	13.5	60	3 eggs	30	1 egg	30	3 eggs
6/16/80	15.0	60	2 eggs	30	6 eggs	30	20 eggs
6/24/80	10.0	30	0	30	2 eggs	--	--**
6/30/80	14.5	14 hr	5 peamouth fry 39 squawfish? 3 eggs	60	0	60	1 squawfish?

*Eggs are unidentified, but are most likely non-game species.
**Not sampled due to high flows.

Trout and Whitefish

One kilometer (0.6 mi) of the Kootenai River at Hemlock Bar (rkm 262) was electrofished at night on 16 April 1980. Three game fish species and four non-game species were sampled with mountain whitefish being the most abundant species present (70% of the catch) (Table 8). Rainbow and Dolly Varden accounted for less than 3% of the catch. Largescale suckers were the most abundant non-game species and accounted for 19% of the catch and 48% of the total fish biomass sampled. Peamouth, northern squawfish and redside shiner were also sampled.

The tributary weir that was placed in Deep Creek at Moravia was inadequate to handle the high flows present during spring runoff. The weir was in operation 42 days from 26 February through 14 April with partial wings up 30 days and complete wings 12 days. Two female rainbow were caught (1 and 6 April) before the trap washed out. Their mean length was 571.5 mm (22.5 in) and mean weight was 1.45 kg (3.2 lb).

Ten mountain whitefish, 268-376 mm (10.6-14.8 in), and one 252 mm (9.9 in) Dolly Varden were also caught between 17 March and 13 April.

DISCUSSION

White sturgeon in the Kootenai River are able to move freely from Kootenay Lake in British Columbia upstream into Idaho and Montana to Kootenai Falls. Recapture data show that the fish move from hole to hole in the river and that fish from the area just above Kootenay Lake migrate upriver into Idaho. Recapture of fish tagged in British Columbia and size frequencies of fish in Idaho and British Columbia indicate that this population of sturgeon is accessible to anglers in both Idaho and British Columbia.

The white sturgeon population in the Kootenai River between Bonners Ferry and Kootenay Lake appears to be comprised of mid-size and large fish. Only 11.2% (33) of fish sampled in Idaho and British Columbia were less than 102 cm (40 in) while 86% (765) of white sturgeon sampled in the mid-Snake River were less than 91 cm (36 in) (Coon, Ringe and Bjornn 1977). It may be possible that the hook size used was too large for the smaller fish, although a small hook was used in British Columbia with no success for smaller fish (Fleck and Andrusak, M.S. 1977). It is possible that small fish are not present in the holes that are currently being fished. They may be using shallower areas of the river, the river in the canyon above Bonners Ferry or be in Kootenay Lake.

Plant material was the main item found in the sturgeon stomachs but is probably not a major nutrient source, as most of the plant material appeared to be passing through the intestines without being visibly digested. Plant material is apparently ingested to obtain the insect larvae that are living in it. Food availability is probably the most important factor in determining what sturgeon eat. In an estaurine environment, with an abundance of benthic invertebrates, the diet of white sturgeon consisted mainly of crustuceans and molluscs with plant material being rarely found (McKechnie and Fenner 1971). In the Fraser River, British Columbia, the major food items were fish, mainly eulachons (Thaleichthys pacificus) which may have been either captured alive or scavenged from the bottom after they had spawned and died (Semakula and Larkin 1968).

Table 8. Number, species composition, mean size and total biomass of fish sampled by electrofishing on 16 April 1980 in the Hemlock Bar area of the Kootenai River.

Species	Number	Percent	Mean length cm	(in)	Mean weight g	(lb)	Total biomass kg	(lb)	Percent of total biomass
Mountain whitefish	340	70.1	262.6	(10.3)	171.0	(0.38)	58.150	(128.1)	42.4
Rainbow	13	2.7	309.2	(12.2)	348.1	(0.77)	4.525	(10.0)	3.3
Dolly Varden	1	0.2	356	(14.0)	400	(0.88)	0.400	(0.9)	0.3
Largescale sucker	90*	18.6	402.2	(15.8)	740.1	(1.63)	66.610	(146.7)	48.5
Peamouth	34	7.0	270.9	(10.7)	181.6	(0.40)	6.175	(13.6)	4.5
Northern squawfish	6	1.2	307.2	(12.1)	225.0	(0.50)	1.350	(3.0)	1.0
Redside shiner	1	0.2	--	--	75	(0.16)	0.075	(0.2)	0.1

*Only 48 weighed and measured.

The high percentage of sturgeon anglers (75%) who have fished for only 1 or 2 years on the Kootenai River suggest that there is a recent increase in the popularity of sturgeon fishing in northern Idaho. The increase in fishing pressure is mainly due to the increase of rod and reel anglers with the number of traditional setline fishermen remaining about the same.

The increase of rod and reel anglers can probably be attributed to three major reasons: (1) rod and reel fishing is considerably more successful than setline fishing for the amount of effort; (2) along with increased success, there is an increase in publicity and public knowledge which generates more interest in the fishery; (3) and the decrease of spring runoff flows with the completion of Libby Dam in 1972 has increased river accessibility, especially during a time of the year when many of the local residents have most of their free time due to the spring lull in logging. So far this increase in fishing pressure is due mostly to an influx of local anglers, with 92% of the anglers residing within a 160 km (100 mi) of the Kootenai River.

The increased pressure has resulted in a harvest of at least 52 sturgeon in 1979, five times more than were estimated taken a few years ago. So far anglers are releasing a high percentage (88%) of the fish reported caught. If the fishing pressure and harvest of sturgeon continues to increase, I feel that the maximum sustained yield will soon be reached if it has not already been surpassed. It may be necessary to further restrict harvest of sturgeon by reducing bag limits or by a reduction in the length of the fishing season.

Fish populations in the canyon area of the Kootenai River above Bonners Ferry seem to be similar to those found below Kootenai Falls in Montana by May and Huston (1979). Mountain whitefish are the most numerous fish present followed by largescale suckers. The high percentage (70%) of mountain whitefish found may be due more to the size and location of the sample site than actual species composition throughout the canyon section of the river. The site selected was composed mainly of one long riffle. The future population estimates which will be taken in late summer over a larger portion of the river should give a more accurate species composition for this section of the river.

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Appendix A. Lengths, girths, weights, ages and marks of sturgeon sampled from the Kootenai River, November 1977 - June 1980 by department personnel and anglers.

Tattoo[1] number	Tag number	Total length (cm)	Fork length (cm)	Front girth (cm)	Rear girth (cm)	Weight (kg)	Age
		NOVEMBER 1977 - DEPARTMENT PERSONNEL					
0001	--	218	--	84	70	71.4*	33
0002	--	117	--	43	39	10.9*	19
0003	--	122	--	39	37	9.1	18
0004	--	103	--	39	34	6.8	19
		1978 - DEPARTMENT PERSONNEL					
0005	--	122	--	40	36	9.5	21
0006	--	112	--	37	34	7.3	--
0007	--	135	--	44	39	11.8	21
0008	--	117	--	36	34	7.7	20
0009	--	107	--	34	30	5.4	16
0010	--	130	--	42	41	10.9	21
0011	--	99	--	33	30	5.4	15
0012	--	77	--	25	23	2.3	8
0013	--	190	--	70	60	27.2*	28
0014	--	162	--	58	52	21.3	21
0015	--	218	--	84	70	71.5*	41
0016	--	105	--	37	33	6.4	17
0017	--	140	--	50	47	16.3	17
0018	--	108	--	37	34	7.3	17
0019	--	113	--	37	36	7.7	19
0020	--	113	--	38	37	8.6	19
1003	Y00003	52	--	18	15	0.5*	4
1004	Y00004	51	--	18	14	0.5*	4
1005	Y00005	76	--	25	22	2.3	8
1006	Y00006	103	--	37	34	6.8	17
1007	Y00007	117	--	43	38	10.9	17
1008	Y00008	198	--	69	64	47.9*	26
1009	Y00009	109	--	41	34	8.2	20
1010	Y00010	103	--	36	33	6.4	16
1011	Y00011	64	--	20	19	1.8	6
1012	Y00012	56	--	20	18	1.4	4
1013	Y00013	57	--	20	18	1.4	4
1014	Y00014	110	--	39	36	7.7	17

Appendix A. Continued.

Tattoo[1] number	Tag number	Total length (cm)	Fork length (cm)	Front girth (cm)	Rear girth (cm)	Weight (kg)	Age
			1979 DEPARTMENT PERSONNEL				
1015	Y00015	98	--	33	32	5.4	18
1016	Y00016	91	--	34	29	5.0	18
1017	Y00017	114	--	41	37	9.1	18
1018	Y00018	109	--	37	34	7.7	--
1019	Y00019	117	--	38	34	9.1	18
1020	Y00020	118	--	46	42	11.3	15
1021	Y00021	107	--	37	33	7.3	17
			1979 - ANGLERS RETURNS				
		155	--	--	--	24.9	20
		170	--	58	55	30.8*	24
		162	--	--	--	27.2*	21
		157	--	61	56	29.8*	25
		169	--	69	58	37.8*	27
		155	--	58	53	21.8	22
		170	--	56	51	26.8	24
		173	--	61	60	38.1	27
		142	--	52	47	17.7	20
		178	--	62	56	30.8	28
		183	--	64	60	33.6	32
		112	--	38	36	8.6	16
		109	--	--	--	6.4*	17
		132	--	48	49	15.9	15
		131	--	--	--	12.2	20
		122	--	--	--	10.9	20
		170	--	--	--	24.9	22
		119	--	--	--	13.6	23
		135	--	--	--	--	22
		121	--	--	--	11.8	21
		123	--	46	41	12.7	22
		94	--	--	--	5.4	18
		183	--	--	--	--	36
		109	--	--	--	--	20
		99	--	--	--	--	16
		112	--	--	--	--	17
		103	--	--	--	--	--
		124	--	--	--	--	--

Appendix A. Continued.

Tattoo[1] number	Tag number	Total length (cm)	Fork length (cm)	Front girth (cm)	Rear girth (cm)	Weight (kg)	Age
			JANUARY-JUNE 1980 - DEPARTMENT PERSONNEL				
001	--	93	83	34	28	5.4	--
002	--	120	107	40	37	10.4	--
003	--	152	134	56	56	26.4*	--
004	--	122	112	42	36	11.4	--
005	--	138	122	49	42	15.5*	--
006	--	156	147	57	51	24.4*	--
1022	Y00022	131	118	44	39	13.2	--
1023	Y00023	127	114	44	40	14.1	
007	Y00024	149	136	--	--	20.4	
008	Y00026	135	130	52	46	18.2	
009	Y00027	152	134	51	45	20.5	
010	Y00030	148	133	52	49	20.9	
--	--	174	166	62	59	34.1	
011	Y00031	111	102	39	36	8.6	
012	Y00034	134	125	47	40	13.2	
013	Y00035	118	109	40	35	8.2	
014	Y00038	165	152	55	50	22.7	
015	Y00042	85	76	26	25	2.8	
--	Y00043	50	45	16	14	0.4	
016	Y00044	128	114	47	43	12.7	
017	Y00045	68	61	21	18	1.2	
018	Y00046	80	72	29	26	2.8	
019	Y00047	158	153	49	42	17.3	
020	Y00048	109	98	37	34	6.8	
021	Y00049	109	99	35	32	6.8	
022	Y00050	193	178	70	65	43.0	
023	B00199	97	88	32	27	4.5	
024	B00200	113	104	39	37	8.6	
025	G03712	137	123	52	48	15.2	
026	G03713	112	99	36	33	7.3	
027	G03714	124	113	39	36	9.1	
028	G03715	112	101	37	35	7.3	
029	G03717	155	141	55	48	20.4	
030	G03718	110	102	38	35	7.7	
031	G03719	123	114	47	40	12.7	
032	G03720	114	104	41	39	9.1	
033	G03721	158	143	56	50	24.1	
034	G03722	167	153	62	53	30.9	
035	G03724	109	101	40	32	6.8	
036	Y00039	63	53	20	18	1.0	

Appendix A. Continued.

Tattoo[1] number	Tag number	Total length (cm)	Fork length (cm)	Front girth (cm)	Rear girth (cm)	Weight (kg)	Age
037	Y00040	115	103	38	35	7.7	
038	G03726	102	92	35	30	5.4	
039	G03727	108	100	37	32	6.6	
040[2]	G03728	106	96	34	29	5.9	
041	G03729	129	116	47	43	13.6	
042	G03720	68	61	23	19	1.8	
043	G03731	169	144	62	56	23.2	
044	G03732	101	93	34	32	5.9	
045	G03733	63	55	20	18	0.9	
046	G03734	64	56	21	19	1.2	
047	G03735	105	97	36	32	6.1	
048	G03736	114	104	39	36	8.3	
049	G03737	114	103	42	37	8.6	
050	G03738	75	66	26	23	2.0	
051	G03739	112	101	38	37	8.0	
052	G03740	131	118	44	40	10.5	
053	G03741	110	97	37	34	7.0	
054	G03742	95	87	32	30	5.1	
055	G03743	96	91	33	27	4.8	
056	G03744	99	90	34	30	5.5	
057	G03745	142	126	60	45	15.0	
058	G03747	108	100	37	34	7.3	
059	G03748	68	59	23	20	1.3	
060	G03749	112	104	40	38	8.2	
061	G03750	107	98	39	35	7.5	
062	G03751	110	102	41	36	8.6	
063	G03752	100	91	36	31	5.5	
064	G03753	155	142	60	55	25.0	
065	G03754	100	90	34	29	5.2	
066	G03755	106	97	39	33	6.8	
067	G03756	122	104	46	39	11.1	
068	G03757	112	102	41	35	8.3	
069	G03758	105	96	35	32	6.4	
070	G03759	110	96	39	36	7.3	
071	G03760	134	121	50	45	15.9	
072	G03761	120	113	46	40	10.6	
073	G03762	114	105	40	35	7.7	
074	G03763	137	126	50	45	15.2	
075	G03764	86	77	28	26	3.0	
076	G03765	116	108	41	34	8.4	

Appendix A. Continued.

Tattoo[1] number	Tag number	Total length (cm)	Fork length (cm)	Front girth (cm)	Rear girth (cm)	Weight (kg)	Age
077	G03766	131	119	46	41	12.3	
078	G03767	58	52	20	16	0.8	
079	G03768	155	141	55	48	21.4	
080	G03769	72	66	24	21	1.5	
081	G03770	114	104	39	38	8.2	
082	G03771	104	94	37	33	6.8	
083	G03772	118	109	41	37	9.1	
084	G03773	79	72	27	23	2.2	
085	G03775	116	105	40	36	9.1	
086	G03776	118	105	40	36	8.4	
087	G03778	117	105	40	36	8.4	
088	G03779	126	116	46	39	11.4	
089	G03780	128	116	45	40	12.3	
090	G03781	109	100	42	36	8.0	
091	G03782	63	56	21	18	0.8	
092	G03783	87	80	32	28	3.5	
093	G03784	118	107	40	38	9.1	
094	G03785	105	96	37	32	6.8	

[1]Tattoo on pectoral or caudal fin in 1977-1979. Tattoo on rostrum in 1980.

[2]Previous tattoo 0011.

*Weight estimated.