FISHERY RESEARCH

KOOTENAI RIVER FISHERIES INVESTIGATIONS: RAINBOW AND BULL TROUT RECRUITMENT

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Kootenai River Fisheries Investigations: Rainbow and Bull Trout Recruitment

Project Progress Report

2000 Annual Report

By

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ABSTRACT

Objectives for 2000 were to investigate sources of rainbow trout *Oncorhynchus mykiss* and bull trout *Salvelinus confluentus* recruitment to the Kootenai River, Idaho, upstream of Bonners Ferry; quantify rainbow trout fishing and natural mortality rates; determine rainbow trout and mountain whitefish *Prosopium williamsoni* growth and relative weight; and document relative species abundance of the fish community. Drift nets were used to quantify age-0 trout out-migration to the Kootenai River from four tributaries. The age-0 out-migrant estimates were 3,343 (95% C.I. = 2,827-3,858) rainbow trout for Boulder Creek, 868 (95% C.I. = 372-1,363) for Caboose Creek, 383 (95% C.I. = 260-506) for Debt Creek, and 0 for Curley Creek. No out-migrating bull trout were caught. Age-0 rainbow trout population estimates for August snorkel surveys were 1,123 (95% C.I. = 756-1,490) in Boulder Creek and 65 (95% C.I. = 24-106) in the Moyie River. Fourteen rainbow and three bull trout were implanted with radio tags in 2000 to determine spawning locations. Movements of 11 additional bull trout radio-tagged in 1998 and 1999 were also monitored. One radio-tagged rainbow trout was located in Boulder Creek, Idaho during the spawning season, but no others ascended tributaries in Idaho or Montana. One radio-tagged bull trout ascended O'Brien Creek, Montana during the spawning season where it remained through September. A second bull trout was located in Lake Creek, Montana in early August, but was back in the Kootenai River by the next week. No other radio-tagged bull trout were documented in tributary streams during the spawning season. Anglers exploited 46% of the rainbow trout population (≥225 mm total length) upstream of Bonners Ferry, Idaho in 2000. Fall electrofishing catch per unit effort was highest for mountain whitefish with catches of 261 fish/h and 438 fish/h at the Hemlock Bar and Cow Creek reaches, respectively. No bull trout redds were found in fall 2000, but kokanee *O. nerka* or kokanee redds were identified in Boulder and Curley creeks and the Moyie River. The rainbow trout fishery continues to be limited by recruitment and fishing mortality. Preservation of Idaho's bull trout population will depend on maintaining spawning habitat in O'Brien Creek, Montana.

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INTRODUCTION

The Kootenai River has undergone the recent loss of several once relatively productive fisheries from Idaho, including white sturgeon *Acipenser transmontanus*, burbot *Lota lota*, and kokanee *Oncorhynchus nerka* (Richards 1997). The mountain whitefish *Prosopium williamsoni* population has also declined since the early 1980's (Partridge 1983; Paragamian 1995a, b; Downs 2000; Walters and Downs 2001). Although no rainbow *O. mykiss* or westslope cutthroat trout *O. clarki lewisi* population data exists prior to 1980, these populations appear depressed as well based on angler catch rates. For example, Partridge (1983) estimated catch rates of 0.06 trout/h in 1982 and 1983, while Paragamian (1995a) reported catch rates of 0.03 trout/h in 1993 and 1994. In comparison, Schill (1991) summarized catch rates for a number of Idaho rivers, which ranged from 0.7 to 1.95 trout/hr. Currently, despite low densities and catch rates, rainbow trout provide the most important fishery in the Kootenai River (Paragamian 1995a).

Rainbow trout densities and standing stocks in the Kootenai River are low. Rainbow trout densities of 3, 5, 7, and 7 fish/ha (33, 45, 73, and 63 fish/km) were reported for 1993, 1994, 1998, and 1999 respectively, with standing stocks of 0.67, 1.66, 1.62, and 1.57 kg/ha for the same years (Paragamian 1995a and b; Downs 2000; Walters and Downs 2001). In comparison, rainbow trout densities in the Flower Pipe section of the Kootenai River, Montana were 613, 407, and 800 fish/km for 1993, 1994, and 1999, respectively (J. Dunnigan, Montana Fish, Wildlife and Parks, personal communication). The low densities in Idaho are hypothesized to result from limited juvenile recruitment to the mainstem (Partridge 1983; Fredericks and Hendricks 1997). Partridge (1983) and Paragamian (1994a) suggested the rainbow trout recruitment source is primarily from tributaries. Since their work, recruitment (i.e., number of juvenile out-migrants) has been quantified from Deep and Boundary creeks, both downstream of Bonners Ferry, Idaho (Fredericks and Hendricks 1997; Downs 1999, 2000; Walters and Downs 2001). Recruits from Deep Creek migrate to Kootenay Lake, British Columbia to mature (Downs 2000), and contribute little to Idaho's fishery except when they return to Idaho to spawn. Recruitment from tributaries upstream of Bonners Ferry remains largely unknown.

Decreased productivity of the Kootenai River below Libby Dam may also explain low rainbow trout densities (Paragamian 1995a). Plans are being formulated to test this hypothesis in 2003-2004. The present study will provide important baseline data on the fish community for the testing of the "nutrient limitation" hypothesis.

Columbia River basin bull trout were listed in the Federal Register as Threatened under the Endangered Species Act on June 10, 1998. Little is known about bull trout in the Kootenai River. Tributary surveys have documented few fish, while adults have been caught in the mainstem while sampling for other species. More information, such as documenting bull trout spawning locations and recruitment sources, is needed to help recover this population.

Research goals

1. Provide a management plan to improve the Kootenai River rainbow trout fishery, and

2. Develop recovery criteria for bull trout.

Objectives

1. Determine sources of rainbow and bull trout recruitment to the Idaho reach of the Kootenai River, concentrating on the reach upstream of Bonners Ferry.

2. Determine rainbow trout population characteristics important to management including angler exploitation rate, population size structure, and growth rates.

3. Determine mountain whitefish growth and condition.

4. Determine relative species abundance in the fish community.

To address these objectives, the number of juvenile trout out-migrating from Boulder, Caboose, Curley, and Debt creeks, Kootenai River tributaries upstream of Bonners Ferry, was estimated (Figure 1). Radio-tagged rainbow and bull trout were also monitored to determine potential spawning locations, and rainbow trout were marked with angler reward-tags to determine movement and angler exploitation rate. In September, electrofishing catch per unit effort (CPUE, in h) sampling was conducted to determine fish community structure at two sites on the Kootenai River upstream of Bonners Ferry. Data was also collected on population age structure and condition factors for rainbow trout and mountain whitefish. In October, bull trout redd counts were conducted to identify spawning tributaries.

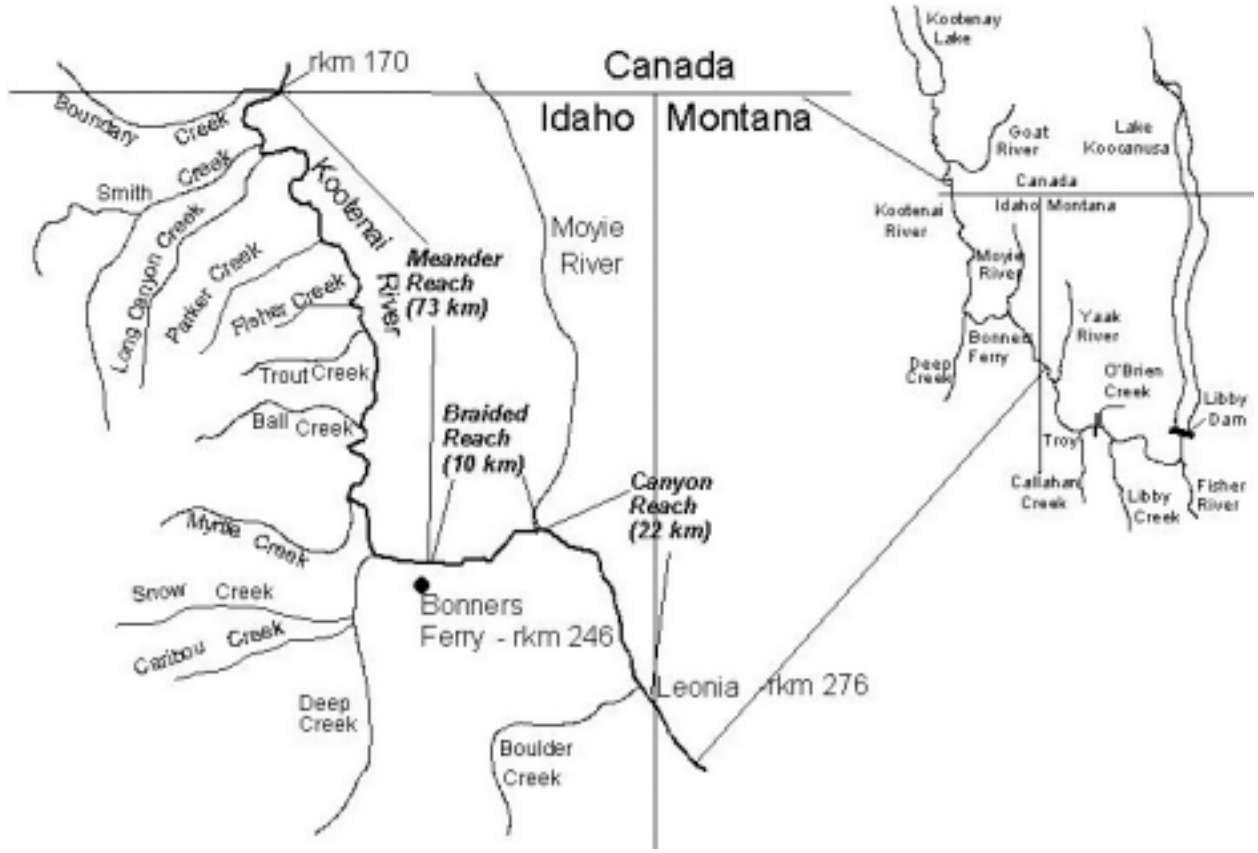

Figure 1. The Kootenai River and major tributaries in Idaho and Montana (modified from Fredericks and Hendricks 1997); rkm = river kilometer.

STUDY AREA

There are approximately 105 km of Kootenai River in Idaho with the following three distinct reaches: 1) the Canyon Reach (22 km) from the Montana border to the Moyie River, 2) the Braided Reach (10 km) from the Moyie River to Bonners Ferry, and 3) the Meandering Reach (73 km) from Bonners Ferry to the Canadian border (Fredericks and Hendricks 1997) (Figure 1). The Meandering Reach has been heavily altered by diking and has substrates consisting mainly of sand, silt, and clays (Partridge 1983). Based on substrate and depth, the reaches above Bonners Ferry (Braided and Canyon reaches) appear to be the most suitable adult fluvial rainbow trout habitat (Partridge 1983). The Kootenai River in Montana up to Kootenai Falls is also accessible to fluvial trout. Kootenai Falls at river kilometer (rkm) 310 is a presumed migration barrier to upstream fish movement (Chapman and May 1986). Major tributaries in Montana downstream of Kootenai Falls include O'Brien and Callahan creeks (Figure 1). Work in 2000 concentrated on the Canyon Reach of the Kootenai River, Idaho and associated tributaries including Boulder, Caboose, Curley, and Debt creeks, and the Moyie River (Figure 2).

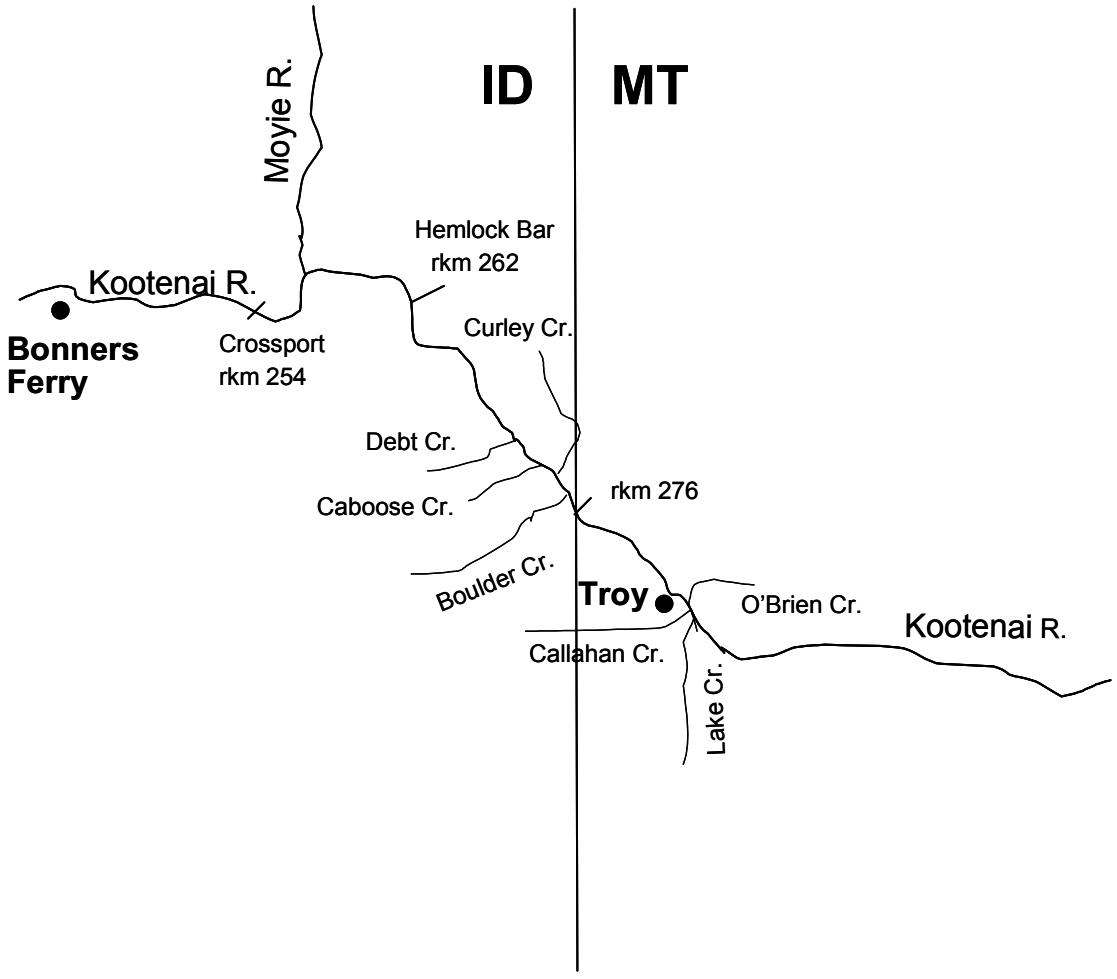

Figure 2. Kootenai River mainstem and tributaries between Bonners Ferry, Idaho and Lake Creek, Montana (rkm = river kilometer).

METHODS

Kootenai River Tributary Recruitment Assessment

A combination of methods was used to quantify tributary recruitment of rainbow and bull trout juveniles, including drift net sampling, electrofishing, snorkeling, and a partial weir. Passive drift net sampling (Muth and Schmulbach 1984) was used to capture juvenile trout out-migrating from Boulder, Caboose, Curley, and Debt creeks in July and August 2000. A four-point bridle assembly terminating in a clip was attached to each net frame. The clip was then slipped over a piece of rebar driven into the stream bottom. Nets were fished with the net frame resting on the substrate. Typically, each stream was sampled two nights per week. Nets were fished from dusk to dawn, as initial sampling indicated no out-migrant movement occurred during the day. On Boulder Creek, two to eight nets, placed at random points (chosen from a random numbers table) across a transect running perpendicular to the flow, were fished each sample night. The transect was approximately 250 m upstream of the mouth. Two net sizes were used on Boulder Creek with rectangular openings of 0.6 m X 0.7 m and 0.23 m X 0.36 m respectively. On the remaining tributaries, one or two of the small nets were fished, because flows were minimal (often there was barely enough flow to fish one net). Nets were fished approximately 20-30 m upstream of the mouth on Caboose, Curley, and Debt creeks.

All trout fry were counted and released. If fish identification was questionable, the sample or a subsample was preserved and later identified in my lab. Rainbow and westslope cutthroat trout are difficult to distinguish as fry (Carl et al. 1959; Martinez 1984). Fry that showed traits of these two species were assumed to be rainbow trout, because no westslope cutthroat trout have been collected from these tributaries (below the migration barriers) in recent surveys (Downs 1999, 2000).

At the beginning of each sample period, depth and current velocity measurements were recorded for each transect following the United States Geological Survey (USGS) midsection method (reviewed in Orth 1983). These measurements were used to calculate total discharge (Q) using the USGS midsection method. Current velocity was measured at 0.6 X depth with a Marsh-McBirney electronic flow meter. The total volume (V, m^3) of water passing the sample transect during that sample period was calculated as:

$$V = Qt$$

where t = the amount of time (s) the nets were fished.

On most sample dates, discharge measurements were also taken at the end of the sample period. In these cases, the mean of the beginning and ending discharge readings was used for volume calculation. Current velocity (C) was measured at the center of the net opening if completely submerged, or at 0.6 X depth if the net was not completely submerged. The volume of water filtered by each net (F_i) was calculated as:

$$F_i = ACt$$

where A = the underwater net opening area for net i.

The number of out-migrants passing the sample transect each sample date (O_s) was estimated as:

$$O_s = V\left(\frac{\sum_{i=1}^{n} M_i}{\sum_{i=1}^{n} F_i}\right)$$

where M_i = the number of out-migrants caught in net *i*
n = the number of nets fished on that sample date.

The out-migration season was divided into strata for each stream, with two sample dates per strata. The mean number of out-migrants per night was then calculated for each strata (G_j) as:

$$G_j = \frac{\sum O_s}{n}$$

where n= the number of sample dates in strata *j*.

The estimated number of out-migrants for each strata (T_j) was calculated as:

$$T_j = G_j d_j$$

where d = the number of days in strata $_j$.

The strata estimates were then summed for a total estimate of out-migrants during the summer sample period.

A Smith-Root Model 11-A battery operated electrofisher was used to survey Curley Creek for juvenile trout on August 9. The sample reach began 100 m upstream from the mouth and continued upstream for 100 m. Three passes were made through the reach. All fish were netted, identified to species, weighed, and measured. Fish were released after all three passes were completed. Electrofishing surveys scheduled for Caboose and Debt creeks were not completed due to low water.

Snorkel surveys were conducted on August 23 and 24 in Boulder Creek and on August 30 in the Moyie River to determine rainbow and bull trout and mountain whitefish densities. Beginning at the stream mouth, a start point was randomly chosen within the first 50 m. From this start point snorkelers sampled the next 50 m, hiked upstream 100 m, and snorkeled the next 50 m. This pattern was repeated until reaching the migration barrier on each stream. Depending on stream width, two or three snorkelers were used so the entire width of each 50 m transect could be surveyed. Snorkelers swam upstream while counting all fish in one direction between themselves and the adjacent snorkeler. Snorkelers nearest the shore also counted all fish between themselves and the nearest bank (Thurow 1994). Trout and mountain whitefish and their estimated sizes (nearest cm) were called out to an assistant on shore. The numbers of other species observed were also counted. Beginning 6-10 days prior to snorkeling, the mean width of each transect was estimated. A random start point was chosen within the first 10 m of each transect and the stream width was measured. Width measurements were then

taken every 10 m for five width measurements per transect. A mean width for each transect was calculated from these five measurements.

Mean densities (r, number of fish/m^2) were estimated using a standard ratio estimator (Scheaffer et al. 1986:128):

$$r = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}$$

where:

y = number of fish counted in transect $_i$
x = transect $_i$ area (m^2)
n = number of transects snorkeled.

Variance ($\hat{V}(r)$) of the ratio was estimated as (Scheaffer et al. 1986:128):

$$\hat{V}(r) = \hat{V}\left(\frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}\right) = \left(\frac{N-n}{nN}\right)\left(\frac{1}{\mu_x^2}\right)\frac{\sum_{i=1}^{n}(y_i - rx_i)^2}{n-1}$$

where:

N = total number of available transects up to the first migration barrier
μ = the mean transect area.

The population estimate ($\hat{\tau}_y$) for each species was estimated as (Scheaffer et al. 1986:131):

$$\hat{\tau}_y = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}(\tau_x) = r\tau_x$$

where:

τ_x = Total stream area (m^2).

The population variance ($\hat{V}(\hat{\tau}_y)$) was estimated as (Scheaffer et al. 1986:131):

$$\hat{V}(\hat{\tau}_y) = (\tau_x)^2\hat{V}(r) = \tau_x^2\left(\frac{N-n}{nN}\right)\left(\frac{1}{\mu_x^2}\right)\frac{\sum_{i=1}^{n}(y_i - rx_i)^2}{n-1}$$

Separate population estimates were calculated for age-0 (≤75 mm TL), age-1 (76-125 mm TL), and age-2 and older (>125 mm TL) rainbow trout. Age groups were separated based on length frequencies and previous research in the Kootenai River drainage, Idaho

(Fredericks and Hendricks 1997). Correction factors (Fredericks and Hendricks 1997) were applied to the number of age-0 and age-1 rainbow trout counted, as snorkeling tends to underestimate fish numbers (e.g. Northcote and Wilkie 1963; Rodgers et al. 1992; but see Zubik and Fraley 1988).

On October 13, a partial weir was installed on Boulder Creek to estimate the number of potential fall out-migrating rainbow trout. The V-shaped weir was placed in the middle of the stream about 250 m upstream from the mouth. The weir covered approximately 70% of the stream width. A trap box was placed at the downstream end.

Optic StowAway® temperature loggers were used to monitor tributary and mainstem water temperatures. Temperature loggers were placed in Curley and Debt creeks on May 14 and in Boulder and Caboose creeks and the Kootenai River on July 9. Water temperatures were recorded through November 3 to establish baseline data and to determine the suitability of tributary streams for rearing based on summer temperatures. Data recorders were placed within 100 m of the mouth of tributary streams, and in the Kootenai River approximately 500 m upstream from the Moyie River confluence. Water temperatures were recorded every 4 h in Boulder and Caboose creeks and the Kootenai River and every 6 h in Curley and Debt creeks.

Radio-Telemetry

Boat electrofishing was conducted on the Kootenai River (rkm 252-275.5) in spring and fall 2000 to collect rainbow and bull trout for radio tagging. The electrofishing setup used was described by Downs (2000). Tagging protocols and surgery procedures followed Downs (2000). Individual fish were selected for radio tagging based on body weight. Radio transmitter weight could not exceed 2% of the fish's body weight in air (Winter 1996). We used the estimated post-spawn weight of females to determine their suitability for tagging (Downs 2000). Eight different transmitter types (Advanced Telemetry Systems, Inc.) were used (Table 1). All transmitters were active for 8 h and off for 16 h each day. Signals were at the rate of 40 pulses per minute (ppm). Telemetry was conducted from 0800-1600 h by fixed-wing aircraft and by boat. Radio-tagged fish were searched about once every one to two weeks. The search area included the South Arm of Kootenay Lake upstream to Kootenai Falls, including Idaho tributaries up to the first migration barrier. Eleven bull trout tagged in 1998 and 1999 (Walters and Downs 2001) were also monitored in 2000.

Table 1. Weights, duty cycle, and tag life expectancy for radio-transmitters implanted into rainbow and bull trout in the Kootenai River drainage.

Tag Weight (g)	Duty Cycle	Tag Life Expectancy (d)
7.35-8.2	90 d on, 90 d off, on ~ 160 d	250
7.8	90 d on, 90 d off, on ~ 160 d	250
7.9-8.2	On every day	200
10.58	On every day	400
10-11	On every day	360
18.36-18.81	On every day	730
20.2	On every day	690
25.1	On every day	1000
25.1-25.3	On every day	912

The objective of radio-tagging rainbow and bull trout was to monitor spawning migrations to document spawning areas. Rainbow trout spawning migration was defined as movement into a tributary stream in spring (late March-June), or an upstream movement of ≥0.5 km in spring relative to the last location in fall or early spring (up to March 22), followed by movement back downstream. Bull trout spawning migration was defined as movement into or out of a tributary stream from June 1-October 30 or an upstream movement of ≥10 km during that same period.

Reward-Tagging

To gain information on angler exploitation, rainbow and westslope cutthroat trout ≥225 mm were marked with $10.00 reward T-bar anchor style tags. Fish were captured by electrofishing in the Kootenai River from Crossport (rkm 254.5) to the Idaho-Montana border (rkm 276) in April and May 2000. Captured fish were weighed, measured, tagged, and had a scale sample removed before being released.

Angler exploitation was quantified through angler returns of the reward tags. The reward tag program was advertised by posting signs at fishing access sites on the Kootenai River in Idaho and Montana. In addition, press releases were published in local newspapers. Angler exploitation was estimated as the number of reward tags returned divided by the number of reward tags available in the fishery. The number of reward tags available was corrected for tag loss according to a previous tag retention study (Walters and Downs 2001). The number of reward tags returned was corrected for non-response by utilizing a linear-logistic model developed for estimating band reporting rates of mallard ducks *Anas platyrhynchos* (Nichols et al. 1991) as:

$$\lambda_i = \exp(-0.0045 + 0.0283i) / [1 + \exp(-0.0045 + 0.0283i)]$$

where:

λ_i = estimated reporting rate for reward dollar amount i
i = reward dollar amount.

Kootenai River Population Assessment

I used electrofishing catch per unit effort (CPUE) at the Hemlock Bar (September 6, 2000) and Cow Creek (September 7, 2000) reaches of the Kootenai River to index relative species abundance and to gather information on age, growth, and condition of rainbow trout and mountain whitefish. This data will be added to a long-term database to document trends in the fish community and as pretreatment data for the proposed nutrient enhancement of the Kootenai River (Paragamian 2000).

At the Hemlock Bar reach, a single, downstream electrofishing pass was conducted along each shoreline for 1 km beginning at rkm 264.5. At the Cow Creek reach, single passes were shocked for 1,700 m down the left-hand shore and 1,865 m down the right-hand shore beginning at rkm 251. Two netters were used at all times, and all possible fish were netted regardless of species or size. All captured fish were identified and measured, and a subsample of each species was weighed. Scale samples were collected from mountain whitefish and rainbow trout for aging.

Relative weights (W_r) and proportional stock density (PSD) were calculated to assess rainbow trout condition and population size structure, respectively (Anderson and Neumann 1996). Proportional stock density was estimated from the marking sample and separated into two classes; proportion >305 mm and the proportion >406 mm (quality stock density) using 200 mm TL as stock length (Schill 1991).

Rainbow trout and mountain whitefish scales were impressed onto plastic slides and viewed on a microfiche reader at 42X. A regression of TL at capture on scale radius was used with a refined Whitney and Carlander (1956) "body proportional" method (Francis 1990) to back-calculate TL at age. The Francis (1990) method uses:

$$L_i = \left[\frac{\left(c + dS_i\right)}{c + dS_c} \right] L_c$$

where:

L_i = TL at age i
S_i = radius measurement at time of formation of the *i*th annulus
L_c = the TL at capture
S_c = total scale radius
c = the y-intercept from the regression equation
d = slope derived from the regression equation.

Mean length at age and annual growth increments were estimated from the back-calculation data. The total electrofishing catch of rainbow trout for 1998-2000 was pooled. A catch curve was then constructed to calculate mortality rate (Ricker 1975). Using the exploitation data, mortality was partitioned into fishing and natural mortality.

Redd Surveys

In the fall, redd surveys were conducted on Kootenai River tributaries in Idaho where bull trout have been documented in previous years (Partridge 1983; Paragamian 1994, 1995a; Downs 2000; Table 2). Stream transects were hiked during mid-day to search for redds. Sightings of kokanee and their redds were also recorded, as the numbers of kokanee that spawn in Idaho have declined since the 1980's (Partridge 1983; S. Ireland, Kootenai Tribe of Idaho, personal communication). Also, kokanee have not been documented recently in tributaries upstream of Bonners Ferry. Parker and Boundary Creeks were surveyed for kokanee and bull trout redds because these streams historically had kokanee runs and areas of gravel substrate (Partridge 1983).

Table 2. Streams surveyed for bull trout and kokanee redds, fall 2000. Distances to migration barriers are taken from Partridge (1983) and Downs (2000).

Date	Stream	Begin Point	End Point
10/4/00	Boulder Cr.	Mouth	Falls 1.9 km upstream of mouth
10/18/00	Boulder Cr.	Mouth	Cascade just below the falls
9/27/00	Boundary Cr.	~ 100m downstream from mouth of side channel (on Boundary Creek Wildlife Management Area)	~100m upstream of water diversion for Boundary Creek Wildlife Management Area
10/2/00	Boundary Cr.	~ 100m upstream of water diversion	Second island with trees
10/6/00	Boundary Cr.	End point of 10/2 survey	About 1.6 km upstream of begin point
10/19/00	Caribou Cr.	~100m downstream of railroad bridge that crosses confluence of Caribou and Snow Cr.	Log jam barrier near old public water supply 1.2 km upstream of mouth
10/4/00	Curley Cr.	Mouth	Falls (237 m upstream of mouth)
10/5/00	Long Canyon Cr.	Bridge on Westside Rd.	Cascades and falls 2 km upstream of mouth
10/11/00	Long Canyon Cr.	Bridge on Westside Rd.	Cascades and falls 2 km upstream of mouth
10/3/00	Moyie River	Mouth	Moyie Falls 2.4 km upstream of mouth
10/16/00	Moyie River	Mouth	Moyie Falls 2.4 km upstream of mouth
9/20/00	Myrtle Cr.	Slack water ~ 200m below bridge at Kootenai National Wildlife Refuge	Myrtle Falls
10/5/00	Parker Cr.	Bridge on Westside Rd.	Cascades 1.5 km from mouth
10/19/00	Snow Cr.	Confluence with Caribou Cr.	Falls 1.8 km upstream of mouth

RESULTS

Kootenai River Tributary Recruitment Assessment

Estimated numbers of age-0 rainbow trout out-migrating from tributary streams in summer are given in Table 3. A single bull trout (120 mm TL) was collected from Boulder Creek. By the end of July, the flow (0.007 m^3/s) in Debt Creek was subterranean just above the mouth, preventing potential out-migrants from reaching the Kootenai River. By mid-August, the flow

(0.007 m^3/s) was also subterranean at the mouth of Caboose Creek, while the catch in Boulder Creek had decreased to three rainbow trout on August 10. Therefore, I assumed there were no out-migrants from Debt Creek after July 29 or from Caboose Creek after August 11 for the remainder of the year. A summary of the non-target species caught in drift nets is given in Table 4.

Table 3. Number of rainbow trout out-migrants caught in drift nets in Kootenai River, Idaho tributaries, by stream and sample date, and the estimated total number of out-migrants for summer, 2000.

	Sample Date									Estimated Number of	Lower 95% Confidence	Upper 95% Confidence
Stream	7/11	7/13	7/17	7/20	7/25	7/27	7/31	8/3	8/10	Out-migrants	Limit	Limit
Boulder Cr.	38	14	13	211	157	119	163	127	31	3,343	2,827	3,858
Caboose Cr.	ns[a]	4	41	15	136	57	11	2	0	868	372	1,363
Debt Cr.	ns[a]	ns[a]	14	39	11	20	sf[b]	sf[b]	sf[b]	383	260	506
Curley Cr.	ns[a]	ns[a]	0	ns[a]	ns[a]	ns[a]	ns[a]	0	0	0	—	—

[a] ns = not sampled
[b] sf = flow was subterranean at the stream mouth, preventing out-migration to the Kootenai River

Table 4. Non-target species caught in drift nets in Kootenai River tributaries, summer 2000. Unidentified larval fish were also caught in Boulder Creek.

Species	Boulder Cr.	Caboose Cr.	Curley Cr.	Debt Cr.
Mountain whitefish *Prosopium williamsoni*	X			
Longnose dace *Rhinichthys cataractae*	X	X	X	
Northern pikeminnow *Ptychocheilus oregonensis*	X			
Torrent sculpin *Cottus rhotheus*			X	X
Unidentified sculpin *Cottus spp.*	X	X		
Garter snake *Thamnophis spp.*	X	X		
Tailed frog tadpoles *Ascaphus truei*		X		X
Western toad *Bufo boreas*	X			

Snorkel population estimates and densities of rainbow trout and mountain whitefish are given in Table 5. Additional fish taxa observed while snorkeling Boulder Creek included longnose dace *Rhinichthys cataractae* and one bull trout (approximately 170 mm TL). Additional taxa observed while snorkeling the Moyie River included longnose dace, unidentified Cyprinidae, unidentified *Catostomus spp*., and unidentified *Cottus spp*.

Table 5. Rainbow trout and mountain whitefish population estimates and densities based on snorkel transects, Boulder Creek and Moyie River, Idaho, August 2000.

Stream	Area (m^2)	Species	Age	Population Estimate	± 95% Confidence Interval	Density ($n/100m^{2)}$	± 95% Confidence Interval
Boulder Creek	22924	Rainbow trout	0	1,123	367	4.90	1.60
			1	59	44	0.26	0.19
			≥ 2	66	48	0.29	0.21
		Mountain whitefish	all ages	114	37	0.50	0.16
Moyie River	55657	Rainbow trout	0	65	41	0.12	0.07
			1	40	31	0.07	0.06
			≥ 2	131	102	0.24	0.18
		Mountain whitefish	all ages	458	211	0.82	0.38

Rainbow trout was the most common species collected by electrofishing in Curley Creek (Table 6). Electrofishing effort was unequal among passes, so depletion estimates could not be calculated.

The Boulder Creek weir was fished October 13-19, but was inefficient because leaves collected on the pickets, blocking flow. The weir was installed again on November 6 but froze up most nights, again affecting efficiency. The weir was removed on November 11. Four juvenile rainbow trout were caught in the weir trap box. Their sizes ranged from 48 to 59 mm TL. One mountain whitefish and 41 longnose dace were also caught at the weir. No out-migrant estimate could be calculated due to the low sample size of rainbow trout.

Table 6. Density indices for Curley Creek, tributary of Kootenai River, Idaho, August 9, 2000.

Species	Number Caught On First Pass	Total Number Caught	Area Sampled (m^2)	% Age 0	CPUE[a] (n/m^2)
Rainbow trout	15	32	472	59	0.03
Mountain whitefish	0	1	472	100	0
Bull trout	0	1	472	0	0
Brook trout *Salvelinus fontinalis*	5	15	472	36	0.01

[a] CPUE = catch per unit effort, for first pass only

Mean weekly water temperatures peaked the last week of July and first week of August (Table 7). Mean temperatures remained below 18°C for all streams surveyed, but daily maximum temperatures approached 20°C on Boulder and Curley creeks.

Table 7. Mean weekly water temperatures measured on the Kootenai River, Idaho and tributaries, summer and fall 2000.

	Mean Weekly Temperature (°C)				
Week	**Boulder Cr.**	**Caboose Cr.**	**Curley Cr.**	**Debt Cr.**	**Kootenai R.**
5/14/00			12.66	6.62	
5/21/00			12.57	6.94	
5/28/00			11.14	6.95	
6/4/00			13.30	9.05	
6/11/00			12.64	8.58	
6/18/00			14.13	10.14	
6/25/00			15.66	11.25	
7/2/00			13.82	10.43	
7/9/00	14.71	12.45	16.25	11.75	15.91
7/16/00	15.19	12.46	16.92	12.14	15.77
7/23/00	15.79	13.04	16.54	12.23	15.85
7/30/00	17.33	14.11	17.54	12.59	16.55
8/6/00	17.08	14.16	16.90	13.46	16.50
8/13/00	14.20	11.75	13.68	12.34	15.69
8/20/00	13.53	11.17	13.04	12.07	14.96
8/27/00	12.70	10.87	11.98	11.74	14.69
9/3/00	11.23	10.20	10.80	11.26	14.02
9/10/00	11.22	9.96	11.25	11.33	13.87
9/17/00	9.83	9.57	9.62	10.55	13.48
9/24/00	7.33	6.69	8.09	9.50	12.64
10/1/00	6.19	6.34	6.91	8.82	11.16
10/8/00	6.25	5.73	7.19	8.61	11.50
10/15/00	6.91	6.68	7.88	8.65	10.94
10/22/00	3.95	4.35	5.16	7.39	9.64
10/29/00	3.83	4.32	5.13	7.10	9.41
Maximum[a]	19.66	15.44	19.87	16.49	18.07

[a] Maximum daily recorded temperature for each stream

Radio Telemetry

Fourteen rainbow trout collected by electrofishing were large enough to radio tag, including seven each in spring and fall 2000 (Table 8, Appendix A). Three of the rainbow trout tagged in spring are not included in my analyses, because contact was lost within one week of tagging. One rainbow trout was located in Boulder Creek on May 16 and 23. This fish was not located again until July 5 at rkm 200.5. No apparent spawning movements were identified for the other rainbow trout. The seven rainbow trout tagged in the fall will be monitored for spawning movement in spring 2001.

Fifteen radio-tagged bull trout were monitored in 2000 (Table 8). Eleven bull trout were monitored during the spawning season; three fish were not tagged until after the spawning season, and one fish's transmitter failed by the beginning of 2000. Six of the 11 bull trout showed movements during the spawning season (Appendix A). Two of these fish, originating in Montana, moved upstream in June, but had moved back downstream by August 1 and showed no movement after that. The other four bull trout moved upstream into Montana from Idaho. One of these four (radio frequency 30.452) ascended O'Brien Creek by the end of June where it remained through the end of September (Figure 3). The second fish (radio frequency 30.474) ascended Lake Creek in early August, then moved near the O'Brien Creek confluence by August 8 where it remained through October (Figure 4). The third fish (radio frequency 30.241) moved to the O'Brien Creek confluence by mid-July but moved back downstream about 7 km by mid-September (Figure 5). The fourth bull trout moved up to rkm 295 by August 1 but was back down in Idaho near Boulder Creek by mid-August. Four bull trout, tagged in O'Brien Creek in October 1999, remained in the Kootenai River downstream of Bonners Ferry throughout 2000 with no movement detected. These fish are probably mortalities or shed their tags.

Following post-spawn movements back to apparent home territories, bull trout movement in the winter was generally minimal, with most fish traveling <1 km (Appendix A, Figures 3-5). Most fish were located in the deeper pools in the Kootenai River throughout the winter and spring.

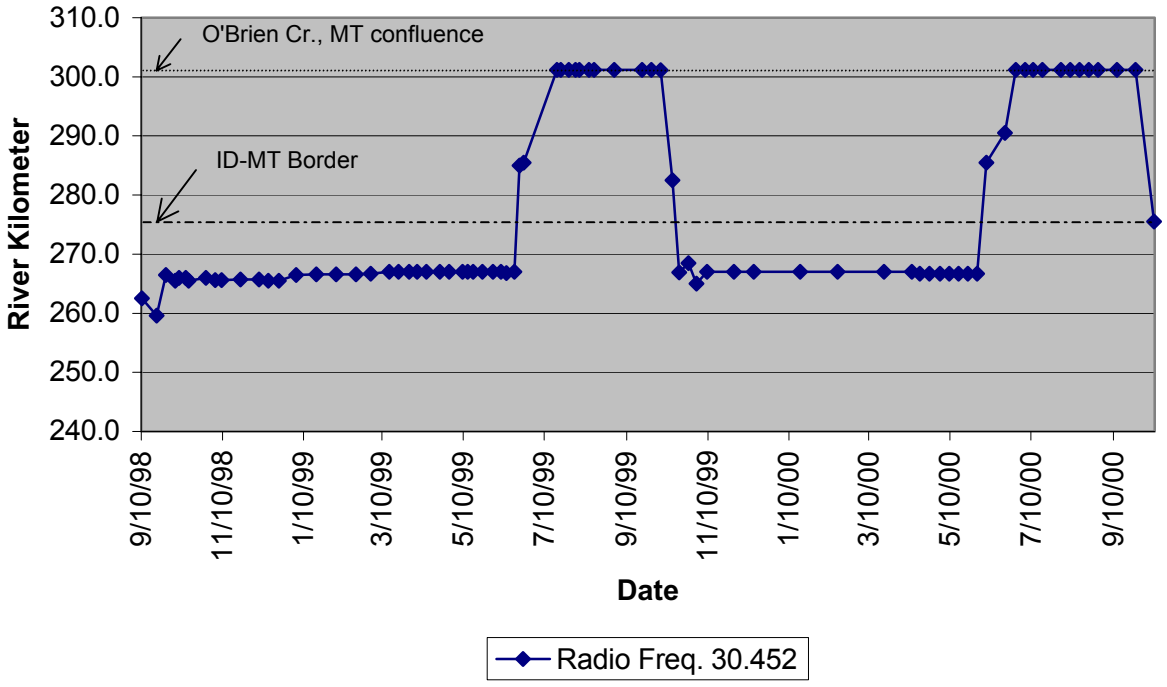

Figure 3. Movements of bull trout 30.254 in the Kootenai River, Idaho and Montana, September 1998 to October 2000.

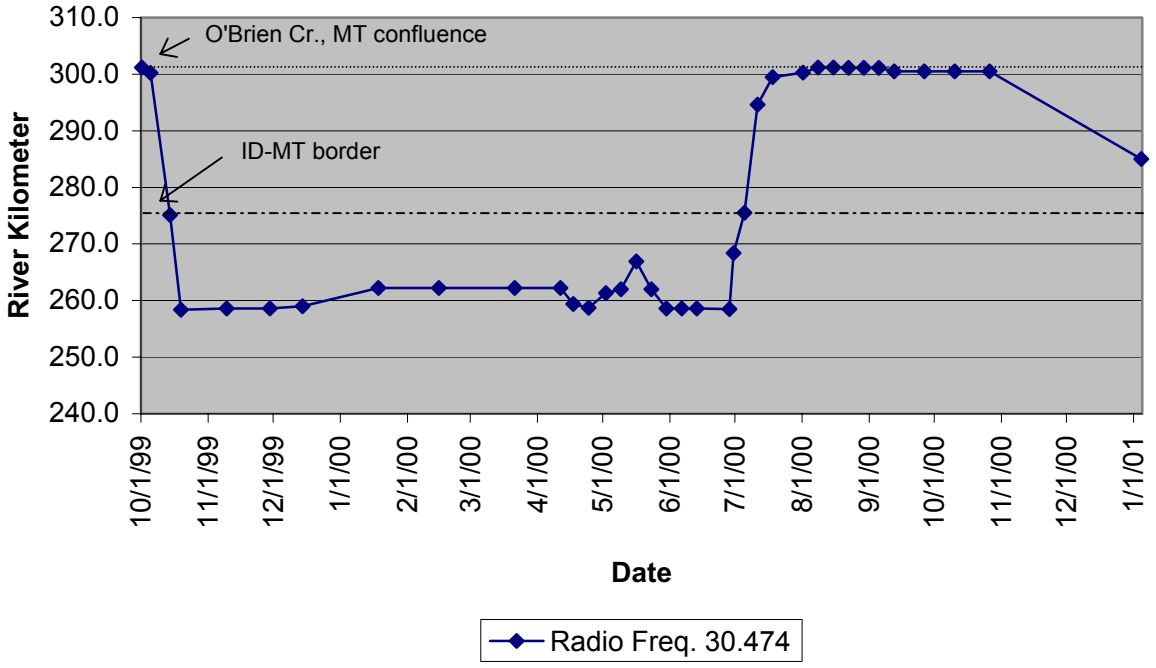

Figure 4. Movements of bull trout 30.474 in the Kootenai River, Idaho and Montana, October 1999 to January 2001.

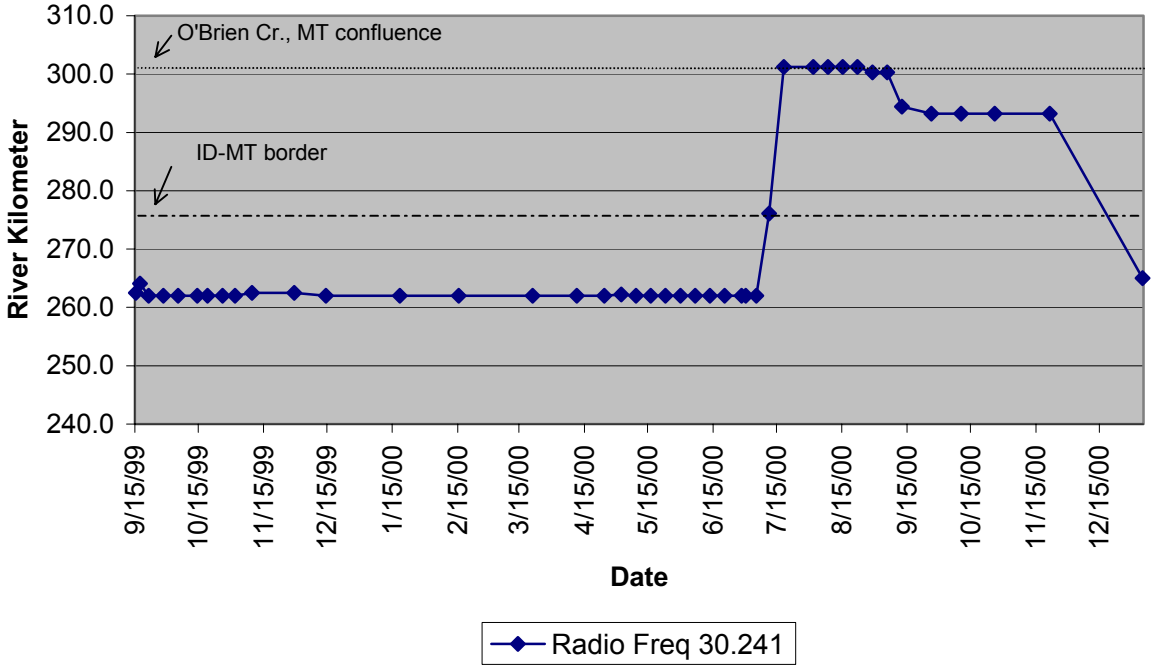

Figure 5. Movements of bull trout 30.241 in the Kootenai River, Idaho and Montana, September 1999 to January 2001.

Reward Tagging

Seventy-five rainbow and five westslope cutthroat trout (including one westslope cutthroat X rainbow trout hybrid) were marked with angler reward tags in spring 2000. Anglers reported harvesting 15 tagged rainbow trout between Crossport and Boulder Creek within one year of tagging. In addition, three tagged fish were reported caught, their tags removed, then released again. When adjusting for tag loss and tag removal, the minimum annual angler exploitation rate was 26%. When applying the 57% non-reporting factor, the estimated annual angler exploitation rate was 46%. Six tagged fish were caught and released (including the three with their tags removed). When applying the same correction factors as above, an estimated 62% of the tagged fish were handled (harvested or caught and released) by anglers. The numbers of reward-tagged fish harvested each month were as follows: March-2, April-1, June-3, July-3, August-3, September-2, and October-1. Two of the westslope cutthroat trout were harvested within one year of tagging.

Rainbow trout movements based on tag returns were minimal, with most fish caught within 4 km of where they were tagged. However, one fish tagged at rkm 256 was harvested at rkm 275.5 (near Boulder Creek), while a second fish tagged at rkm 274 was harvested in Montana near rkm 291. Both of these fish were tagged in May and harvested in August.

Kootenai River Fish Population Assessment

Eight fish species were caught during fall electrofishing of the Hemlock Bar reach, while 11 species were caught at the Cow Creek reach (Table 9). A total of 5,147 s and 4,472 s of electrofishing effort were expended at the Hemlock Bar and Cow Creek reaches, respectively. Relative weights (W_r) did not differ between rainbow trout sampled at Hemlock Bar and the Cow Creek reach, so were combined (t-test; P = 0.78 for the 201-305 mm size group, and P = 0.68 for the 306-406 mm size group). The relative weights for size groups 201-305 mm TL, 306-406 mm TL, and >406 mm TL were 86 (SE = 2; n = 33), 79 (SE = 2; n = 21), and 82 (n = 1), respectively. Rainbow trout proportional stock and quality stock densities were 39% and 2%, respectively.

Rainbow trout age and growth data from fish sampled in the spring 2000 are shown in Table 10. The total length vs. scale radius regression equation for rainbow trout was: $Y = 4.3(X) + 45.9$ ($R^2 = 0.91$, $P < 0.001$).

Mountain whitefish age and growth data from fish sampled in fall 2000 are shown in Table 11 ages. The total length vs. scale radius regression equation for mountain whitefish was: $Y = 2.4(X) + 43.2$ ($R^2 = 0.95$, $P < 0.001$).

Based on catch curve analysis, the rainbow trout total annual mortality rate (M) is 0.54 for fish age-2 and older. The average annual exploitation rate (fishing mortality, f) for 1999-2000 was 0.52. Therefore, natural mortality (n) was 0.02.

Table 8. Summary of telemetry data and physical characteristics for rainbow (Rbt) and bull (Bullt) trout with active radio tags in the Kootenai River, Idaho, 2000.

Species	Radio Frequency	Tagging Date	Tagging Location (rkm)	Total Length (mm)	Weight[a] (g)	Sex[b]	Age[b]	Expected Tag Expiration Date
Rbt	30.801	3/22/00	266.5	440	811	u	u	5/22/01
Rbt	30.010	4/11/00	263.0	410	nm	u	u	9/1/00
Rbt	30.782	4/11/00	263.0	421	nm	f	u	4/11/01
Rbt	30.090	4/20/00	270.6	417	581	u	4	12/31/00
Rbt	30.180	5/22/00	270.0	375	489	u	5	4/22/02
Rbt	30.211	5/22/00	273.0	402	620	u	u	11/22/00
Rbt	30.261	5/22/00	274.0	391	554	u	3	11/22/00
Rbt	31.202	9/21/00	270.5	361	461	u	3	8/28/01
Rbt	31.212	9/28/00	268.5	387	598	u	4	9/5/01
Rbt	31.222	9/28/00	268.5	379	525	u	4	9/5/01
Rbt	31.262	9/28/00	268.5	406	596	u	3	9/5/01
Rbt	31.293	9/28/00	266.5	384	517	u	u	9/5/01
Rbt	31.232	10/10/00	252.5	424	700	u	4	9/20/01
Rbt	31.282	10/10/00	252.5	448	759	u	4	9/20/01
Bullt	30.452	9/10/98	262.5	458[c]	1,021	u	u	9/5/99
Bullt	30.623	9/24/98	256.0	580[c]	2,438	u	u	9/19/99
Bullt	30.711	10/1/98	275.5	750[c]	5,500	u	u	9/26/99
Bullt	30.241	9/15/99	262.5	459	1,077	u	u	9/15/01
Bullt	30.474	10/1/99	301.2[d]	690	nm	u	u	4/1/02
Bullt	30.654	10/1/99	301.2[d]	711	nm	f	u	4/1/02
Bullt	30.031	10/8/99	301.2[d]	705	nm	m	u	10/8/01
Bullt	30.191	10/8/99	301.2[d]	800	nm	m	u	10/8/01
Bullt	30.251	10/8/99	301.2[d]	737	nm	m	u	10/8/01
Bullt	30.333	10/8/99	301.2[d]	762	nm	f	u	4/8/02
Bullt	30.394	10/8/99	301.2[d]	775	nm	m	u	4/8/02
Bullt	31.423	10/8/99	301.2[d]	838	nm	m	u	5/8/02
Bullt	30.140	9/21/00	270.5	495	1,022	u	u	11/21/02
Bullt	30.150	10/10/00	252.5	524	1,418	u	u	12/10/02
Bullt	30.170	12/12/00	173.0	562	1,400	u	u	9/13/03

[a] nm = not measured
[b] u = unknown, f = female, m = male
[c] Fork Length
[d] Tagged and released in O'Brien Creek, Montana

Table 9. Summary of electrofishing results for the Hemlock Bar and Cow Creek reaches of the Kootenai River, Idaho, fall 2000

	Rkm 265 (Hemlock Bar)			Rkm 251 (Cow Creek)		
Species	Number Caught	Catch Per Unit Effort (n/h)	Mean Weight (g)	Number Caught	Catch Per Unit Effort (n/h)	Mean Weight (g)
Kokanee	97	68	147	107	86	137
Mountain whitefish	373	261	132	544	439	73
Westslope cutthroat trout	0	0	—	2	2	242
Rainbow trout	45	31	195	33	27	169
Bull trout	0	0	—	1	1	396
Peamouth *Mylocheilus caurinus*	0	0	—	2	2	18
Northern pikeminnow	8	6	150	15	12	160
Longnose dace	1	1	6	1	1	—
Redside shiner *Richardsonius balteatus*	9	6	7	13	10	6
Largescale sucker *Catostomus macrocheilus*	27	19	573	34	27	411
Torrent sculpin	1	1	4	1	1	2

Table 10. Back-calculated total length (TL, mm) and standard error (SE) at age for rainbow trout caught while electrofishing the Kootenai River, Idaho, spring 2000.

Rainbow Trout Age @ Capture	n	Mean TL (mm) at Capture	S.E.	TL Range at Capture		Mean Back Calculated Total Length (mm) at:												
				Min	Max	Age-1	Age-1 S.E.	Age-2	Age-2 S.E.	Age-3	Age-3 S.E.	Age-4	Age-4 S.E.	Age-5	Age 5 S.E.	Ag- 6	Age-6 S.E.	Age-7
1	26	111	3	86	133	105	3											
2	35	227	8	120	318	113	4	223	7									
3	30	302	8	206	391	114	3	203	9	299	7							
4	19	338	10	260	417	107	3	186	9	277	10	334	9					
5	5	382	3	375	392	103	10	161	14	286	18	342	14	379	4			
6	0																	
7	1	470				114		176		239		339		423		449		470
				Weighted mean		110		205		289		336		386				470
				Increment		110		94		85		47		51				
				n		116		90		55		25		6				1

Table 11. Back-calculated total length (TL, mm) and standard error (SE) at age for mountain whitefish caught while electrofishing the Kootenai River, Idaho, fall 2000.

Mountain Whitefish Age @ Capture	n	Mean TL (mm) at Capture	S.E.	TL Range at Capture		Mean Back Calculated Total Length (mm) at:														
				Min	Max	Age-1	Age-1 S.E.	Age-2	Age-2 S.E.	Age-3	Age-3 S.E.	Age-4	Age-4 S.E.	Age-5	Age-5 S.E.	Age-6	Age-6 S.E.	Age-7	Age-8	Age-9
0	39	101	2	77	121															
1	49	185	3	122	228	124	3													
2	40	235	3	190	293	118	2	191	3											
3	30	267	4	213	304	115	3	188	5	240	4									
4	15	295	3	270	311	125	4	200	3	250	5	274	4							
5	11	317	10	290	410	123	6	198	7	244	6	274	6	301	9					
6	2	340	44	296	384	126	5	200	5	239	14	264	13	297	31	316	34			
7	1	328				108		137		183		220		240		287		318		
8	1	482				129		224		282		345		385		421		442	469	
9	1	480				175		249		298		350		399		424		448	469	480
				Weighted mean		121		193		244		276		308		353		403	469	480
				Increment		121		72		51		33		32		45		50	66	11
				n		150		101		61		31		16		5		3	2	1

Redd Surveys

No bull trout or bull trout redds were observed during 2000 redd surveys. However, kokanee and their redds were observed in some tributaries (Table 12).

Table 12. Redd surveys conducted on Kootenai River tributaries in Idaho, fall 2000. No bull trout or their redds were seen.

Date	Stream	Number of New Kokanee Redds	Number of Possible Kokanee Redds	Number of Live Kokanee Seen	Number of Kokanee Carcasses
10/4	Boulder Cr.	19	2	21	1
10/18	Boulder Cr.	0	8	3	0
9/27	Boundary Cr.	13	9	15	1
10/2	Boundary Cr.	0	0	0	0
10/6	Boundary Cr.	0	0	0	0
10/19	Caribou Cr.	0	0	0	0
10/4	Curley Cr.	9	4	46	2
10/5	Long Canyon Cr.	0	0	0	0
10/11	Long Canyon Cr.	0	0	0	0
10/3	Moyie River	0	5	0	1
10/16	Moyie River	0	0	3	0
9/20	Myrtle Cr.	0	0	0	0
10/5	Parker Cr.	0	0	0	0
10/19	Snow Cr.	0	0	0	0

DISCUSSION

In Idaho, Boulder Creek is the largest source of rainbow trout recruits (3,343 summer out-migrants) to the Kootenai River upstream of Bonners Ferry. The Moyie River may be an additional source of recruits, as some age-0 rainbow trout were seen there during the August snorkel survey. However, the August age-0 rainbow trout population estimate for the Moyie River was 6% of the estimate for Boulder Creek, which may indicate relative production in the Moyie River is lower. In addition, the Moyie River has almost no suitable spawning gravel (Partridge 1983; personal observation). Summer out-migrant sampling was not attempted on the Moyie River, as it was too deep and swift to deploy drift nets.

Caboose and Debt creeks, although intermittent, also provided rainbow trout recruits to the Kootenai River, but their total (1,251 summer out-migrants) was only a third of Boulder Creek. Additional rainbow trout could out-migrate from these intermittent streams in fall or winter if freshets reconnect the streams to the Kootenai River. The potential contribution of even intermittent streams should not be overlooked. Erman and Hawthorne (1976) estimated that 39-47% of adult rainbow trout in Sagehen Creek, California spawned in Kiln Meadow Tributary,

an intermittent stream. This stream produced at least 1,010 out-migrant age-0 rainbow trout in 1973 (Erman and Leidy 1975).

Snorkel surveys showed that not all age-0 rainbow trout emigrated from Boulder Creek or the Moyie River by late August. It is possible that at least a portion of the fish remaining in the tributaries eventually out-migrated to the Kootenai River in fall or the following spring. Because the weir I placed in Boulder Creek was ineffective, I could not document out-migration during the fall.

The relationship between the number of age-0 recruits and subsequent densities of age-2 and older rainbow trout in the Kootenai River remains unknown. Smith and Griffith (1994) estimated average survival of wild stream salmonids during their first winter was 49.8%, based on a literature review. Applying this over-winter survival rate to the 5,782 potential rainbow trout recruits from Idaho tributary streams in 2000 (including age-0 fish still in the tributaries by the end of August), would result in 2,879 age-1 recruits (96/km) to the river upstream of Bonners Ferry (rkm 246-276). Assuming that this age-1 recruitment rate was constant from year to year, and that annual survival was 46% for age-1 and older fish, it would result in a population density of 79 age-2 and older rainbow trout/km. In comparison, Downs (2000) and Walters and Downs (2001) estimated rainbow trout densities of approximately 68 and 64 fish/km at the Hemlock bar reach for 1998 and 1999, respectively. Their density estimates were for fish ≥180 mm TL, approximately equal to age-2 and older fish.

Additional rainbow trout recruitment from fish spawned in Montana is still probable (Downs 2000; Walters and Downs 2001), even though no radio-tagged fish were located in Montana in 2000. My sample size of radio-tagged rainbow trout for 2000 may have been too small to represent the populations' spawning migrations.

Regardless of where rainbow trout recruits originate, densities remain low, in part due to limited spawning habitat (Partridge 1983). Therefore, any spawning habitat enhancement in Idaho tributaries would benefit the rainbow trout population. For example, an estimated 0.2 km of fair spawning habitat in Caboose Creek may be inaccessible to spawning trout due to a culvert barrier 37 m from the mouth (Partridge 1983; Downs 2000). Replacement of the old culvert with a bridge or new culvert of more suitable design would allow rainbow trout adults access to spawning habitat upstream. Removal of some alluvial deposits at the mouths of Caboose and Debt creeks may provide a year-round connection to the Kootenai River allowing more juvenile rainbow trout to out-migrate. Partridge (1983) noted that high spring river velocities and a lack of suitable-size gravels limited spawning habitat on the Moyie River. Construction of a spawning side-channel on the Moyie River is an option for increasing spawning habitat there.

Return of angler reward tags indicates that the angler exploitation rate of 46% for rainbow and westslope cutthroat trout ≥225 mm is high, though lower than the 58% rate of 1999 (Walters and Downs 2001). Also, my catch curve analysis showed that almost all mortality is attributable to fishing mortality (52%). High exploitation along with limited recruitment will keep the trout population low, possibly causing a further decrease in densities (6.5/ha in 1999, Walters and Downs 2001), especially if fishing pressure increases.

No radio-tagged bull trout were located in Idaho tributaries during the spawning season, indicating that recruitment to Idaho may be dependent on Montana tributaries. Six bull trout showed movements during the spawning season, but only one remained in a tributary stream (O'Brien Creek, MT) during September or October, the primary time when bull trout spawn in

the Intermountain West (Pratt 1992). The bull trout located in Lake Creek in early August probably did not spawn there as it had moved back to the Kootenai River by a week later. A larger sample size of radio-tagged fish may help determine sources of recruitment to the Idaho population.

The lack of bull trout observed during drift net sampling, snorkeling, and redd surveys also indicates that bull trout recruitment from Idaho tributaries is nearly nonexistent. Past studies have documented few juvenile bull trout in the Kootenai River and tributaries in Idaho, (i.e., ≤5 juveniles collected per year) (Partridge 1983; Paragamian 1994, 1995a; Downs 2000; Walters and Downs 2001). However, bull trout representing numerous sizes from 62-818 mm TL have been collected from the Kootenai River, Idaho from 1998-2000, indicating at least sporadic recruitment (unpublished data). Spawning and rearing locations in Idaho (if they exist) remain largely unknown.

In fall 2000, I initiated electrofishing catch per unit effort (CPUE) as a means to monitor fish community composition. Electrofishing CPUE was highest at the Cow Creek reach (607 fish/h), in the braided river section. This reach has a higher percentage of shallower water and riffle areas that may permit higher primary production relative to the canyon reach. Electrofishing will be conducted annually in the fall to monitor changes in fish community composition.

Rainbow trout W_r's of 86, 79, and 82 for 201-305 mm TL, 306-406 mm TL, and >406 mm TL size groups, respectively, were lower than in 1999 but similar to 1998 (Downs 2000; Walters and Downs 2001). Rainbow trout proportional stock and quality stock densities (39% and 2%, respectively) were lower compared to 1998 and 1999 (Downs 2000; Walters and Downs 2001). However, none of these changes were extreme enough to indicate any trends in the rainbow trout stock structure.

In summary, the rainbow trout population appears to be affected by low recruitment and high fishing mortality. Recruitment may be limited by primary and secondary productivity as well (Snyder and Minshall 1996). Woods (1982) reported that 63% of total phosphorus and 25% of total nitrogen in the Kootenai River system never pass through Libby Dam. Thus, Lake Koocanusa, the impoundment formed by Libby Dam, acts as a nutrient sink. Options to increase recruitment, such as spawning habitat and nutrient enhancement, should be investigated. In the meantime, more restrictive fishing regulations may be warranted to prevent a further decline of the rainbow trout population. The sport fishery should also be monitored to determine effort and harvest rates and compare with the previous creel surveys from 1980 and 1994 (Partridge 1983; Paragamian 1995a). Increased access to the canyon section of the river may have increased fishing pressure since 1994 (personal observation).

Quantifying the bull trout population is difficult due to apparent low densities and difficulty in sampling them, but it appears the population is receiving some recruitment. Most of this recruitment is from O'Brien Creek, Montana due to limited spawning and rearing habitat in Idaho. However, fluvial bull trout (based on sizes >508 mm) have been observed in North Callahan Creek, Idaho in the fall, presumably to spawn (G. Johnson, Idaho Department of Fish and Game, personal communication). Preservation of the Kootenai River, Idaho bull trout population will be dependent on maintaining these spawning habitats.

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APPENDICES

Appendix A. Telemetry locations for radio-tagged bull trout (Bullt) and rainbow trout (Rbt), Kootenai River drainage, 2000.

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
Bullt	705	m	30.031	D	10/8/01	10/8/99	301.2	Capt @ O'Brien
						10/14/99	300.9	Above Lake Ck., in KR
						10/19/99	300.5	Above Lake Ck., in KR
						10/26/99	205.7	Below Fisher Creek confl, in KR
						11/1/99	173.0	Bend upstrm from Porthill
						11/9/99	173.0	Bend upstrm from Porthill
						11/29/99	173.0	Bend upstrm from Porthill
						12/14/99	173.0	Bend upstrm from Porthill
						1/18/00	173.0	Bend upstrm from Porthill
						2/15/00	173.0	Bend upstrm from Porthill
						3/21/00	173.0	Bend upstrm from Porthill
						5/9/00	173.0	Bend upstrm from Porthill
						6/13/00	173.0	Bend upstrm from Porthill
						6/20/00	173.0	Bend upstrm from Porthill
						6/28/00	173.0	Bend upstrm from Porthill
						7/5/00	173.0	Bend upstrm from Porthill
						7/18/00	173.0	Bend upstrm from Porthill
						8/1/00	173.0	Bend upstrm from Porthill
						8/15/00	173.0	Bend upstrm from Porthill
						11/28/00	173.0	Bend upstrm from Porthill
Bullt	495	u	30.140	F	11/21/02	9/21/00	270.5	Caboose Ck
						9/26/00	272.3	Below Curley Ck
						10/10/00	271.5	Below Curley Ck
						10/17/00	272.6	Above Curley; boat locn
						10/26/00	271.0	Below Curley Ck
						11/21/00	271.0	Below Curley Ck
Bullt	524	u	30.150	F	12/10/02	10/10/00	252.5	Capt/rel @ lower Crossport; not located since tagging
Bullt	562	u	30.170	G	9/13/03	12/12/00	173.0	Capt during burb hn effts, 40 ft deep; not located since tagging
						12/13/00	151.0	Release/tagging
Bullt	800	m	30.191	D	10/8/01	10/8/99	301.2	Capt @ O'Brien
						10/14/99	304.8	Throop Lake
						10/19/99	305.1	Throop Lake; weak signal
						10/26/99	305.1	Throop Lake; weak signal
						11/1/99	305.8	Upstrm from Throop L
						11/9/99	305.8	Upstrm from Throop L
						11/29/99	304.5	Throop Lake
						12/14/99	304.5	Throop Lake
						1/18/00	304.7	Dwnstrm end of island
						2/15/00	304.7	Dwnstrm end of island
						3/21/00	304.7	Dwnstrm end of island
						4/11/00	305.1	Upstrm end of island
						4/24/00	305.1	Upstrm end of island
						5/2/00	305.1	Upstrm end of island
						5/9/00	305.2	Upstrm end of island
						5/16/00	305.2	Upstrm end of island
						5/23/00	305.2	Upstrm end of island
						5/30/00	305.2	Upstrm end of island
						6/6/00	305.2	Upstrm end of island
						6/20/00		No location
						6/28/00	307.5	Moved into canyon
						7/5/00	305.1	Upstrm end of island
						7/11/00	309.5	Into canyon
						7/18/00	305.1	Upstrm end of island
						8/1/00	305.1	Upstrm end of island
						8/8/00	305.1	Upstrm end of island

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						8/15/00	305.1	Upstrm end of island
						8/22/00	305.1	Upstrm end of island
						8/29/00	305.1	Upstrm end of island
						9/5/00	305.1	Upstrm end of island
						9/12/00	305.1	Upstrm end of island
						9/26/00	305.1	Upstrm end of island
						10/26/00	304.7	Dwnstrm end of island
						11/21/00	304.7	Dwnstrm end of island
Bullt	459	u	30.241	D	9/15/01	9/15/99	262.5	Capt @ Hemlock Bar
						9/17/99	264.1	Powerline above bar
						9/21/99	262.0	@ bend below Hemlock Bar
						9/28/99	262.0	Bend below Hemlock Bar
						10/5/99	262.0	Bend below Hemlock Bar
						10/14/99	262.0	Bend below Hemlock Bar
						10/19/99	262.0	Bend below Hemlock Bar
						10/26/99	262.0	Bend below Hemlock Bar
						11/1/99	262.0	Bend below Hemlock Bar
						11/9/99	262.5	@ Hemlock Bar
						11/29/99	262.5	@ Hemlock Bar
						12/14/99	262.0	Bend below Hemlock Bar
						1/18/00	262.0	Bend below Hemlock Bar
						2/15/00	262.0	Bend below Hemlock Bar
						3/21/00	262.0	Bend below Hemlock Bar
						4/11/00	262.0	Bend below Hemlock Bar
						4/24/00	262.0	Bend below Hemlock Bar
						5/2/00	262.2	Bend below Hemlock Bar
						5/9/00	262.0	Bend below Hemlock Bar
						5/16/00	262.0	Bend below Hemlock Bar
						5/23/00	262.0	Bend below Hemlock Bar
						5/30/00	262.0	Bend below Hemlock Bar
						6/6/00	262.0	Bend below Hemlock Bar
						6/13/00	262.0	Bend below Hemlock Bar
						6/20/00	262.0	Bend below Hemlock Bar
						6/28/00	262.0	Bend below Hemlock Bar
						6/30/00	262.0	Bend below Hemlock Bar
						7/5/00	262.0	Bend below Hemlock Bar
						7/11/00	276.1	Above Leonia Bridge
						7/18/00	301.2	O'Brien Ck confl-in KR
						8/1/00	301.2	O'Brien Ck confl-in KR
						8/8/00	301.2	O'Brien Ck confl-in KR
						8/15/00	301.2	O'Brien Ck confl-in KR
						8/22/00	301.2	O'Brien Ck confl-in KR
						8/29/00	300.3	Below O'Brien Ck confl
						9/5/00	300.3	Below O'Brien Ck confl
						9/12/00	294.4	Just above hwy bridge
						9/26/00	293.2	Brush Ck, in KR
						10/10/00	293.2	Brush Ck, in KR
						10/26/00	293.2	Brush Ck, in KR
						11/21/00	293.2	Brush Ck, in KR
Bullt	737	m	30.251	D	10/8/01	10/8/99	301.2	Capt @ O'Brien
						10/14/99	222.0	Pump station
						10/19/99	226.0	Just above Flemming Ck.
						10/26/99	226.3	Up slightly from 10/19
						11/1/99	226.3	Upstrm from Flemming Ck
						11/9/99	226.3	Upstrm from Flemming Ck
						11/29/99	226.3	Upstrm from Flemming Ck
						12/14/99	226.3	Upstrm from Flemming Ck
						1/18/00	226.3	Upstrm from Flemming Ck
						2/15/00	226.3	Upstrm from Flemming Ck
						3/21/00	226.3	Upstrm from Flemming Ck
						4/11/00	226.3	Upstrm from Flemming Ck
						4/24/00	226.3	Upstrm from Flemming Ck

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						5/9/00	226.3	Upstrm from Flemming Ck
						6/13/00	226.3	Upstrm from Flemming Ck
						6/20/00	226.3	Upstrm from Flemming Ck
						6/28/00	226.3	Upstrm from Flemming Ck
						7/5/00	226.3	Upstrm from Flemming Ck
						7/11/00	226.3	Upstrm from Flemming Ck
						7/18/00	226.3	Upstrm from Flemming Ck
						8/1/00	226.3	Upstrm from Flemming Ck
						8/15/00	226.3	Upstrm from Flemming Ck
						8/22/00	226.3	Upstrm from Flemming Ck
						8/29/00	226.3	Upstrm from Flemming Ck
						9/26/00	226.3	Upstrm from Flemming Ck
						10/10/00	226.3	Upstrm from Flemming Ck
						11/28/00	226.3	Upstrm from Flemming Ck
Bullt	762	f	30.333	E	4/8/02	10/8/99	301.2	Capt @ O'Brien
						10/14/99	301.3	Just above O'Brien Ck, in KR
						10/19/99	302.0	Bend above O'Brien, in KR
						10/26/99	300.3	@ Lake Ck, in KR
						11/1/99	306.0	Upstrm from Throop L
						11/9/99		Not located
						11/29/99	304.7	Throop Lake
						12/14/99	304.7	Throop Lake
						1/18/00	305.1	Upstrm end of island
						2/15/00	306.5	Up canyon
						3/21/00	306.5	Up canyon
						4/11/00	307.0	Up canyon
						4/24/00	307.0	Up canyon
						5/2/00	307.0	Up canyon
						5/9/00	307.0	Up canyon
						5/16/00	307.2	Up canyon
						5/23/00	306.5	Up canyon
						5/30/00	306.5	Up canyon
						6/6/00	306.5	Up canyon
						6/13/00		Didn't search
						6/20/00		No location
						6/28/00	309.5	@ Base of falls
						7/5/00	309.7	Mid-falls
						7/11/00	309.8	Upper falls
						7/18/00	309.6	Upper falls
						8/1/00	296.1	Downriver to Lower Scott Is.
						8/8/00	296.3	Lower Scott Is. Area
						8/15/00	296.3	Lower Scott Is. Area
						8/22/00	296.3	Lower Scott Is. Area
						8/29/00	296.3	Lower Scott Is. Area
						9/5/00	296.3	Lower Scott Is. Area
						9/12/00	296.3	Lower Scott Is. Area
						9/26/00	296.3	Lower Scott Is. Area
						10/10/00	296.3	Lower Scott Is. Area
						10/26/00	296.3	Lower Scott Is. Area
						11/21/00	296.3	Lower Scott Is. Area
Bullt	775	m	30.394	E	4/8/02	10/8/99	301.2	O'Brien (Cranbrook, tag #0048)
						10/14/99	301.2	O'Brien Ck., 1.15 mi up
						10/19/99	300.5	Above Lake Ck.; in KR
						10/26/99	299.5	@ Callahan, in KR; quiet signal
						11/1/99	299.5	@ Callahan; in KR
						11/9/99	299.5	@ Callahan; in KR
						11/29/99	299.5	@ Callahan; in KR
						12/14/99	299.5	@ Callahan; in KR
						1/18/00	302.0	Bend above Callahan
						2/15/00	301.6	Bend above Callahan
						3/21/00	301.1	Bend above Callahan
						4/11/00	301.6	Bend above Callahan

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						4/24/00	301.5	Bend above Callahan
						5/2/00	301.5	Bend above Callahan
						5/9/00	301.8	Bend above Callahan
						5/16/00	301.7	Bend above Callahan
						5/23/00	301.7	Bend above Callahan
						5/30/00	301.7	Bend above Callahan
						6/6/00	301.5	Bend above Callahan
						6/13/00		Didn't search
						6/20/00	301.5	Bend above Callahan
						6/28/00	301.5	Bend above Callahan
						7/5/00	302.0	Upper part of bend
						7/11/00	302.5	Above bend
						7/18/00	302.5	Above bend
						8/1/00	302.5	Above bend
						8/8/00	302.5	Above bend
						8/15/00	302.5	Above bend
						8/22/00	302.5	Above bend
						8/29/00	302.5	Above bend
						9/5/00	302.5	Above bend
						9/12/00	302.2	Above bend
						9/26/00	302.2	Above bend
						10/10/00	302.2	Above bend
						11/21/00	302.2	Above bend
Bullt		u	30.452	C	9/5/99	9/10/98	262.5	Tagged; Fork Length = 458 mm
						9/21/98	259.6	
						9/28/98	266.5	
						10/5/98	265.5	
						10/8/98	266.0	
						10/13/98	266.0	
						10/15/98	265.5	
						10/28/98	266.0	
						11/4/98	265.6	Slightly lower; lower bend
						11/9/98	265.6	Same
						11/23/98	265.7	Slightly up
						12/7/98	265.7	Same
						12/14/98	265.5	Lower bend above Hemlock
						12/22/98	265.5	Lower bend above Hemlock
						1/4/99	266.5	Between bends
						1/19/99	266.6	Up slightly toward upper bend
						2/3/99	266.6	Between bends
						2/18/99	266.6	Between bends
						3/1/99	266.7	Above 1st bend above Hemlock
						3/15/99	267.0	2nd bend above Hemlock
						3/22/99	267.0	2nd bend above Hemlock
						3/30/99	267.0	2nd bend above Hemlock
						4/5/99	267.0	2nd bend above Hemlock
						4/12/99	267.0	2nd bend above Hemlock
						4/22/99	267.0	2nd bend above Hemlock
						4/29/99	267.0	2nd bend above Hemlock
						5/9/99	267.0	2nd bend above Hemlock
						5/13/99	267.0	2nd bend above Hemlock
						5/17/99	267.0	2nd bend above Hemlock
						5/24/99	267.0	2nd bend above Hemlock
						6/1/99	267.0	2nd bend above Hemlock
						6/7/99	267.0	2nd bend above Hemlock
						6/11/99	266.8	2nd bend above Hemlock
						6/17/99	267.0	2nd bend above Hemlock
						6/21/99	285.0	Below confl. Yaak
						6/24/99	285.5	Confl. Yaak
						7/19/99	301.2	Up canyon, below falls-10 mi up O'Brien
						7/22/99	301.2	Up canyon, below falls-10 mi up O'Brien
						7/28/99	301.2	2.6 mi up O'Brien
						8/2/99	301.2	~1.6 mi up O'Brien

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						8/5/99	301.2	~1.6 mi up O'Brien
						8/12/99	301.2	~1.6 mi up O'Brien
						8/16/99	301.2	~1.6 mi up O'Brien
						8/31/99	301.2	~1.5 mi up O'Brien
						9/21/99	301.2	1.5 mi up O'Brien Ck
						9/28/99	301.2	1.6 mi up O'Brien Ck, @ Lynx Ck
						10/5/99	301.1	Just below O'Brien Ck, in KR
						10/14/99	282.5	Bend below Yaak
						10/19/99	266.9	Bend below Curley Ck.
						10/26/99	268.5	@ John Crown Ck, in KR
						11/1/99	265.0	@ Katka Ck, in KR
						11/9/99	267.0	Bend below Curley Ck.
						11/29/99	267.0	Bend below Curley Ck.
						12/14/99	267.0	Bend below Curley Ck.
						1/18/00	267.0	Bend below Curley Ck.
						2/15/00	267.0	Bend below Curley Ck.
						3/21/00	267.0	Bend below Curley Ck.
						4/11/00	267.0	Bend below Curley Ck.
						4/17/00	266.7	Bend below Curley Ck.
						4/24/00	266.7	Bend below Curley Ck.
						5/2/00	266.7	Bend below Curley Ck.
						5/9/00	266.7	Bend below Curley Ck.
						5/16/00	266.7	Bend below Curley Ck.
						5/23/00	266.7	Bend below Curley Ck.
						5/30/00	266.7	Bend below Curley Ck.
						6/6/00	285.5	Up to Yaak confl.
						6/13/00		No location
						6/20/00	290.5	Below Ruby Ck.
						6/28/00	301.2	Up O'Brien ~ .7 mi
						7/5/00	301.2	Up O'Brien ~ .7 mi
						7/11/00	301.2	Up O'Brien ~ .7 mi
						7/18/00	301.2	Up O'Brien ~ .6 mi
						8/1/00	301.2	Up O'Brien ~ .5 mi
						8/8/00	301.2	Up O'Brien ~ .5 mi (@ pwrline)
						8/15/00	301.2	Up O'Brien ~ .5 mi (@ pwrline)
						8/22/00	301.2	Up O'Brien ~ .5 mi (@ pwrline)
						8/29/00	301.2	Up O'Brien ~.7 mi(above pwrline)
						9/12/00	301.2	Up O'Brien ~1 mi(above pwrline)
						9/26/00	301.2	Up O'Brien ~1 mi(above pwrline)
						10/10/00	275.5	Confl. Boulder ck.
Bullt	690	u	30.474	E	4/1/02	10/1/99	301.2	Capt @ O'Brien
						10/5/99	300.2	@ Lake Ck, in KR
						10/14/99	275.1	Just below Boulder Ck
						10/19/99	258.4	Just below Moyie River
						10/26/99		Not located
						11/1/99		Not located
						11/9/99	258.6	Up Moyie ~ 1/8 mi
						11/29/99	258.6	Up Moyie ~ 1/8 mi
						12/14/99	259.0	In KR above Moyie
						1/18/00	262.2	Below Hemlock
						2/15/00	262.2	Below Hemlock
						3/21/00	262.2	Below Hemlock
						4/11/00	262.2	
						4/17/00	259.4	
						4/24/00	258.7	Moyie confl.
						5/2/00	261.3	
						5/9/00	262.0	Bend below Hemlock
						5/16/00	266.9	Bend below Curley C
						5/23/00	262.0	
						5/30/00	258.6	@ Moyie confl.
						6/6/00	258.6	Up Moyie ~ 1/2 mi.
						6/13/00	258.6	Up Moyie ~ 1/2 mi.
						6/20/00		No location

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						6/28/00	258.5	@ Moyie, in Kootenai
						6/30/00	268.4	
						7/5/00	275.5	Confl. Boulder, in KR
						7/11/00	294.6	Above Hwy bridge
						7/18/00	299.5	Callahan Ck confl
						8/1/00	300.3	In Lake Ck, above Hwy
						8/8/00	301.2	Confl of O'Brien Ck.
						8/15/00	301.2	Confl of O'Brien Ck.
						8/22/00	301.1	Confl of O'Brien Ck.
						8/29/00	301.1	Confl of O'Brien Ck.
						9/5/00	301.1	Confl of O'Brien Ck.
						9/12/00	300.5	Below confl of O'Brien Ck.
						9/26/00	300.5	Below confl of O'Brien Ck.
						10/10/00	300.5	Below confl of O'Brien Ck.
						10/26/00	300.5	Below confl of O'Brien Ck.
Bullt		u	30.623	C	9/19/99	9/24/98	256.0	Capt @ bend above Crossport; FL = 580
						10/13/98	212.5	
						10/15/98	239.5	
						10/19/98	239.1	
						10/27/98	235.5	
						11/4/98	234.6	
						11/9/98	234.6	
						11/23/98	234.6	Up Myrtle Creek?
						12/14/98	234.6	0.5 km up Myrtle Creek
						12/22/98	234.6	At mouth of Myrtle Creek
						1/4/99	239.2	
						1/19/99	236.7	
						2/3/99	240.9	
						2/18/99	242.3	
						3/1/99	242.3	
						3/15/99	236.8	
						3/22/99	237.0	
						3/30/99	236.0	
						4/5/99	236.0	
						4/12/99	241.0	
						4/20/99	240.5	
						4/22/99	240.0	
						4/26/99	249.6	
						4/29/99	256.0	
						5/3/99	256.5	
						5/6/99	256.5	
						5/11/99	258.5	
						5/13/99	258.5	
						5/17/99	258.5	
						5/24/99	258.5	
						5/27/99	258.0	
						6/1/99	258.2	
						6/7/99	258.6	
						6/11/99	258.6	
						6/14/99	258.6	
						6/17/99	258.6	
						6/21/99	258.6	Up the Moyie River
						6/24/99	258.6	
						7/12/99	265.5	
						7/15/99	285.6	
						7/19/99	298.1	
						7/22/99	299.0	
						7/28/99	299.5	
						8/2/99	299.4	
						8/5/99	299.4	
						8/9/99	299.5	
						8/12/99	299.5	
						8/16/99	299.4	

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						8/23/99	299.4	
						8/31/99	299.4	
						9/7/99	299.4	
						9/14/99	299.5	
						9/17/99	299.5	
						9/21/99	299.5	Below confl Callahan
						9/28/99	299.3	Below confl Callahan
						10/5/99	299.5	Below confl Callahan
						10/14/99	299.5	Below confl Callahan
						10/19/99	299.4	Below confl Callahan
						10/26/99	305.0	Up to Throop Lake area
						11/1/99	234.5	@ Myrtle Ck, in KR
						11/9/99	234.5	@ Myrtle Ck, in KR
						11/29/99	234.5	@ Myrtle Ck, in KR
						12/14/99		No locn 12/14
						1/18/00		No locn 1/18
						2/15/00		No locn 1/19; assume tag dead
Bullt	711	f	30.654	E	4/1/02	10/1/99	301.2	Capt @ O'Brien
						10/5/99	293.1	@ confl Brush Ck, in KR
						10/14/99	217.5	Trout Ck, in KR
						10/19/99	216.5	Above Rock Ck
						10/26/99	216.5	Above Rock Ck
						11/1/99	216.5	Above Rock Ck
						11/9/99	216.5	Above Rock Ck
						11/29/99	216.0	@ Rock Ck
						12/14/99	216.0	@ Rock Ck
						1/18/00	216.0	@ Rock Ck
						2/15/00	216.0	@ Rock Ck
						3/21/00	216.0	@ Rock Ck
						4/11/00	216.0	@ Rock Ck
						4/24/00	216.0	@ Rock Ck
						5/9/00	216.0	@ Rock Ck
						6/13/00	216.0	@ Rock Ck
						6/20/00	216.0	@ Rock Ck
						6/28/00	216.0	@ Rock Ck
						7/5/00	216.0	@ Rock Ck
						7/11/00	216.0	@ Rock Ck
						7/18/00	216.0	@ Rock Ck
						8/1/00	216.0	@ Rock Ck
						8/15/00	216.0	@ Rock Ck
						8/22/00	216.0	@ Rock Ck
						8/29/00	216.0	@ Rock Ck
						9/26/00	216.0	@ Rock Ck
						10/10/00	216.0	@ Rock Ck
						11/28/00	216.0	@ Rock Ck
Bullt		u	30.711	C	9/26/99	10/1/98	275.5	Capt IDFG; Fork Length = 750
						10/5/98	275.5	
						10/8/98	262.0	
						10/13/98	203.4	
						10/15/98	203.4	
						10/19/98	234.0	
						10/28/98	253.0	
						11/4/98	253.0	
						11/9/98	254.0	
						11/16/98	254.0	
						11/23/98	254.0	
						12/7/98	253.5	
						12/14/98	252.5	
						1/4/99	253.0	
						1/19/99	253.5	
						2/3/99	262.0	
						2/18/99	262.0	

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						3/1/99	262.5	
						3/15/99	268.5	
						3/22/99	273.5	
						3/30/99	274.2	
						4/5/99	274.1	
						4/12/99	275.4	
						4/19/99	274.3	
						4/22/99	274.3	
						4/26/99	274.3	
						4/29/99	274.3	
						5/3/99	274.3	
						5/6/99	273.5	
						5/11/99	273.0	
						5/13/99	272.3	
						5/17/99	272.3	
						5/20/99	270.6	
						5/24/99	270.6	
						5/27/99	270.7	
						6/1/99	270.7	
						6/7/99	272.7	
						6/11/99	272.7	
						6/14/99	275.0	
						6/17/99	275.1	
						6/21/99	273.5	
						6/24/99	275.6	
						7/12/99	305.1	
						7/15/99	306.5	
						7/19/99	306.8	
						7/22/99	308.2	
						7/28/99	308.2	
						8/2/99	301.2	
						8/5/99	301.2	
						8/9/99	301.1	
						8/12/99	301.2	
						8/16/99	289.4	
						8/23/99	275.5	
						8/31/99	275.6	
						9/7/99	275.7	
						9/14/99	275.7	
						9/17/99	275.5	
						9/21/99	275.5	@ Boulder Ck, in KR
						9/28/99	275.5	@ Boulder Ck, in KR
						10/5/99	275.5	@ Boulder Ck, in KR
						10/14/99	275.5	@ Boulder Ck, in KR
						10/19/99	275.5	@ Boulder Ck, in KR
						10/26/99	275.5	@ Boulder Ck, in KR
						11/1/99	275.5	@ Boulder Ck, in KR
						11/9/99	275.5	@ Boulder Ck, in KR
						11/29/99	275.5	@ Boulder Ck, in KR
						12/14/99	275.5	@ Boulder Ck, in KR
						1/18/00	275.5	@ Boulder Ck, in KR
						2/15/00	275.4	Below Boulder Ck, in KR
						3/21/00	275.4	Below Boulder Ck, in KR
						4/11/00	275.6	Below Boulder Ck, in KR
						4/24/00	275.6	Below Boulder Ck, in KR
						5/2/00	275.6	Below Boulder Ck, in KR
						5/9/00	275.6	Below Boulder Ck, in KR
						5/16/00	279.2	In KR @ Pine Ck
						5/23/00	294.6	Above Hwy 2 bridge
						5/30/00	294.6	Above Hwy 2 bridge
						6/6/00	285.5	Below Yaak
						6/13/00		Didn't search
						6/20/00		No location
						6/28/00		No location

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						6/30/00	269.6	Boat locn
						7/5/00	275.5	Confl Boulder, in KR
						7/11/00	275.8	Above confl Boulder
						7/18/00	286.7	Above Yaak
						8/1/00	295.2	Below Scott Is.
						8/8/00	285.7	Just above Yaak
						8/15/00	275.3	@ Confl. Boulder Ck, in KR
						8/22/00	275.3	@ Confl. Boulder Ck, in KR
						8/29/00	275.3	@ Confl. Boulder Ck, in KR
						9/5/00	275.5	Above confl. Boulder Ck, in KR
						9/12/00	275.5	Above confl. Boulder Ck, in KR
						9/26/00	275.5	Above confl. Boulder Ck, in KR
						10/10/00	275.5	Above confl. Boulder Ck, in KR
						11/1/00	275.0	Below Boulder Ck, in KR; boat locn.
Bullt	838	m	31.423	E	5/8/02	10/8/99	301.2	Capt @ O'Brien
						10/14/99		Not located
						10/19/99		Not located
						10/26/99	207.5	Down to Lower Krause Hole
						11/1/99	207.5	Lower Krause hole
						11/9/99	207.5	Lower Krause hole
						11/29/99	120.0	Shallows east of delta
						12/14/99		No location 12/14
						1/18/00	207.7	Above Lower Krause (near Fischer Ck)
						2/15/00	207.7	Above Lower Krause (near Fischer Ck)
						3/21/00		Not located
						4/11/00	207.7	Above Lower Krause (near Fischer Ck)
						4/24/00	207.7	Above Lower Krause (near Fischer Ck)
						5/9/00	207.7	Above Lower Krause (near Fischer Ck)
						6/13/00	207.7	Above Lower Krause (near Fischer Ck)
						6/20/00	207.7	Above Lower Krause (near Fischer Ck)
						6/28/00	207.7	Above Lower Krause (near Fischer Ck)
						7/5/00	207.7	Above Lower Krause (near Fischer Ck)
						7/11/00	207.7	Above Lower Krause (near Fischer Ck)
						7/18/00	207.7	Above Lower Krause (near Fischer Ck)
						8/1/00	207.7	Above Lower Krause (near Fischer Ck)
						8/15/00	207.7	Above Lower Krause (near Fischer Ck)
						8/22/00	207.7	Above Lower Krause (near Fischer Ck)
						8/29/00	207.7	Above Lower Krause (near Fischer Ck)
						9/26/00	207.7	Above Lower Krause (near Fischer Ck)
						11/28/00	207.7	Above Lower Krause (near Fischer Ck)
Rbt	410	u	30.010	H	9/1/00	4/11/00	263.0	Capt @ Hemlock; not weighed
						6/13/00		No locns since tagging
Rbt	417	u	30.090	H	12/31/00	4/21/00	270.6	Caboose Ck
						5/2/00	271.6	Caboose Ck
						5/9/00	270.6	Caboose Ck
						5/16/00	270.6	Caboose Ck
						5/23/00	272.5	
						5/30/00	272.0	
						6/6/00	271.5	
						6/13/00	271.5	
						6/28/00	271.3	Below Curley Ck.
						6/30/00	271.5	Below Curley Ck.
						7/5/00	271.5	Below Curley Ck.
						7/11/00	271.8	Below Curley Ck.
						7/18/00	271.8	Below Curley Ck.
						8/1/00	271.4	Below Curley Ck.
						8/8/00	271.5	Above Caboose Ck.
						8/15/00	271.5	Above Caboose Ck.
						8/22/00	271.5	Above Caboose Ck.
						8/29/00	271.5	Above Caboose Ck.
						9/5/00	271.5	Above Caboose Ck.

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						9/12/00	271.5	Above Caboose Ck.
						9/26/00	272.5	Above Caboose Ck.
						10/10/00	271.5	Above Caboose Ck.
						10/26/00	271.3	Above Caboose Ck.
						11/21/00	271.3	Above Caboose Ck.
Rbt	375	u	30.180	?	?	5/22/00	270.0	Capture
						5/23/00	274.2	
						6/1/00	273.5	
						6/6/00	273.5	
						6/13/00	273.5	
						6/20/00	273.5	
						6/28/00	273.5	Below Boulder Ck.
						6/30/00	273.5	Below Boulder Ck.
						7/5/00	273.5	Below Boulder Ck.
						7/11/00	273.9	Below Boulder Ck.
						7/18/00	273.9	Below Boulder Ck.
						8/1/00	273.8	Below Boulder Ck.
						8/8/00	273.8	Below Boulder Ck.
						8/15/00	273.8	Below Boulder Ck.
						8/22/00	273.8	Below Boulder Ck.
						8/29/00	273.8	Below Boulder Ck.
						9/5/00	274.0	Below Boulder Ck.
						9/12/00	273.8	Below Boulder Ck.
						9/26/00	273.8	Below Boulder Ck.
						10/10/00	273.8	Below Boulder Ck.
						10/26/00	273.5	Below Boulder Ck.
Rbt	401	u	30.211	?	?	5/22/00	273.0	Capture; removed old radio-tag 30.742
						5/23/00	274.1	Below Boulder Ck.
						6/1/00	273.5	Below Boulder Ck.
						6/6/00	274.0	Below Boulder Ck.
						6/13/00	273.5	Below Boulder Ck.
						6/20/00	273.5	Below Boulder Ck.
						6/28/00	273.6	Below Boulder Ck.
						6/30/00	273.5	Below Boulder Ck.
						7/5/00	273.5	Below Boulder Ck.
						7/11/00	273.8	Below Boulder Ck.
						7/18/00	273.8	Below Boulder Ck.
						8/1/00	273.8	Below Boulder Ck.
						8/8/00	273.9	Below Boulder Ck.
						8/15/00	274.0	Below Boulder Ck.
						8/22/00	274.0	Below Boulder Ck.
						8/29/00	273.0	Below Boulder Ck.
						9/5/00	274.0	Below Boulder Ck.
						9/12/00	273.8	Below Boulder Ck.
						9/26/00	273.8	Below Boulder Ck.
						10/10/00	273.8	Below Boulder Ck.
						10/26/00	273.8	Below Boulder Ck.
						10/31/00	273.0	Below Boulder Ck.; boat locn
Rbt	391	u	30.261	?	?	5/22/00	274.0	Capture
						5/23/00	273.0	
						6/1/00	270.5	
						6/6/00	270.5	Below Curley Ck.
						6/13/00		No location
						6/20/00		No location
						6/28/00		No location
						7/5/00		No locn-searched Lake to Falls
						7/11/00		No locn 245 to 310 or tribs
						7/18/00		No locn 170 to 310
						8/1/00		No locn 170 to 310
Rbt	422	f	30.782	C	4/11/01	4/11/00	263.0	Hemlock Bar; no weight taken; ripe female

Appendix A. (Continued.)

Species	Total Length (mm)	Sex[a]	Radio Frequency	Transmitter Type[b]	Expected Tag Expiration Date	Date	Location[c] (rkm)	Notes
						4/17/00	263.8	
						4/24/00	275.3	Below Boulder Ck
						5/2/00	275.2	Below Boulder Ck
						5/9/00	275.2	Below Boulder Ck
						5/16/00	275.4	Up Boulder ~ 1 mile
						5/23/00	275.4	Up Boulder ~ 1 mile
						5/30/00		No location
						6/6/00		No location
						6/13/00		No location
						6/20/00		No location
						6/28/00		No location
						7/5/00	200.5	Just above Copeland
						7/11/00	200.5	Just above Copeland
						7/18/00	200.5	Just above Copeland
						8/1/00	200.5	Just above Copeland
						8/15/00	200.5	Just above Copeland
						8/22/00	200.5	Just above Copeland
						8/29/00	200.5	Just above Copeland
						11/28/00	200.5	Just above Copeland
Rbt	439	u	30.801	I	5/22/01	3/22/00	266.5	Below Curley Ck; fungus on pectorals and caudal; no location since tagging
						6/13/00		No locations since tagging; searched for ~ weekly
Rbt	361	u	31.202	H	8/28/01	9/21/00	270.5	Capt @ Caboose Ck; tag on @ 8:00
						9/26/00	270.5	Caboose Ck
						10/10/00	270.5	Caboose Ck
						10/26/00	270.7	Caboose Ck
						11/21/00	270.7	Caboose Ck
Rbt	386	u	31.212	H	9/5/01	9/28/00	268.5	Capture
						10/17/00	269.0	Debt Creek (boat locn)
						11/1/00	269.0	Debt Creek (boat locn)
						11/21/00	269.0	Debt creek
Rbt	378	u	31.222	H	9/5/01	9/28/00	268.5	Capture
						10/17/00	268.5	Debt Creek (boat locn)
						10/26/00	268.5	Debt Creek
						11/21/00	268.5	Debt Creek
Rbt	424	u	31.232	H	9/20/01	10/10/00	252.5	Capt/rel @ lower Crossport; some bleeding, slow recovery
						10/17/00	252.2	Lower Crossport (boat locn)
						10/26/00	253.3	Lower Crossport
						11/1/00	253.5	Lower Crossport (boat locn)
						11/21/00	253.5	Lower Crossport
Rbt	406	u	31.262	H	9/5/01	9/28/00	268.5	Capture; tag on @ 7:35
						10/17/00	268.5	Debt Cr. (boat locn)
						10/26/00	268.4	Debt Cr.
						10/31/00	268.5	Debt Cr. (boat locn)
						11/21/00	268.9	Debt Cr.
Rbt	448	u	31.282	H	9/20/01	10/10/00	252.5	Capt/rel @ lower Crossport, open incision got submerged
						11/28/00	244.6	Above Ambush Rock
Rbt	384	u	31.293	H	9/5/01	9/28/00	266.5	Capture; tag on @ 7:35
						10/17/00	267.3	Boat locn
						10/26/00	267.0	Bend below Debt Cr.
						11/21/00	267.0	Bend below Debt Cr.

[a] For sex: m = male, f = female, u = unknown

[b] A = tag wt 7.35-8.2 g, 90 on/90 off/160 on duty cycle, life of 250 d;
B = tag wt 7.9-8.2 g, life of 200 d;
C = tag wt 10-11 g, life of 360 d;
D = tag wt 18.36-18.81 g, life of 730 d;
E = tag wt 25.1-25.31 g, life of 912 d;
F = tag wt 20.2 g, life of 690 days;
G = tag wt 25.1 g, life of 1000 days;
H = tag wt 7.8 g, 90 d on/90 d off/ on until tag dead, life of 250 days;
I = tag wt 10.58 g, life of 400 days

[c] The first location listed for each fish is the release location.

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