Summary of Cutthroat Trout Population Data in the Snake River, Grand Teton National Park, Wyoming (1984-2003)

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Introduction

The Snake River in Grand Teton National Park, Wyoming, is managed cooperatively by the National Park Service and the Wyoming Game and Fish Department (WGFD) under a Memorandum of Understanding. Personnel from the Wyoming Game and Fish Department have periodically sampled fish within a portion of the Snake River in Grand Teton National Park from the Deadman's boat launch to the confluence of Bar BC Spring, approximately five miles downstream. These fish collections have been used to obtain abundance estimates and identify length structure and weight relations of cutthroat trout *Oncorhynchus clarki* spp. in this section of river. Along with investigations of trout populations in the mainstem of the Snake River, WGFD personnel also conduct annual counts of spawning redds in spring stream and side-channel tributaries of the Snake River within the boundary of Grand Teton National Park. The purpose of this USGS effort is to summarize the data provided by the WGFD on cutthroat trout populations in the Snake River within Grand Teton National Park. This information provides a baseline of data to assess the status of this fishery and a gauge for future monitoring and assessment.

Methods

Original data collection

Cutthroat trout in the Snake River were collected using pulsed DC electrofishing with one or two boom-mounded rafts. Sampling was conducted in the fall of each year during low-flow conditions following the complete release of irrigation water from Jackson Lake Dam. Collected fish were measured to the nearest 0.1 inches and weighed (if recorded) to the nearest 0.01 lbs.

Estimates of abundance (fish/mile) were calculated using mark-recapture techniques (e.g. Pine et al. 2003), however, the number of capture and recapture events (1-6) as well as the interval between events (1-14 days) varied among years. Wyoming Game and Fish Department records indicated that estimates obtained pre-1990 were calculated using open population models, while those conducted post-1990 were conducted using closed population models. However, the five mile study reach was utilized to minimize the effects of immigration/emigration, thereby eliminating any migration bias and providing comparable estimates.

Redd counts for tributaries within Grand Teton National Park represent a complete census of redds for each stream. Redd counts were completed by WGFD personnel walking the entire length of a stream segment and visually identifying disturbances to the substrate that are typical of a salmonid redd with an area of excavation and a tailspill.

Data recovery and presentation

Abundance estimates were recovered from hardcopy and electronic data and reports provided by the Wyoming Game and Fish Department on record at the Regional Office in Jackson, Wyoming. When available, population estimates and 95% confidence intervals were obtainable from original calculations provided by the WGFD. However, population estimates and 95% confidence intervals were recalculated using Program

CAPTURE (Rexstad and Burnham 1994) if original calculations were insufficient or lacked summary statistics. Abundance estimates were recovered and calculated for all trout greater than 152 mm TL (6 in. TL), and trout within length categories of: 152-277 mm TL (6-10.9 in TL), 278-378 mm TL (11-14.9 in TL), and greater than 378 mm TL (15 in TL).

Length structure and weight relations of cutthroat trout were calculated using length and weight data of individual fish when available. The length structure of cutthroat trout during each year is presented as incremental relative stock density (RSD; Anderson and Neuman 1996), using length intervals for stock, quality, preferred, memorable, and trophy length cutthroat trout provided by Kruse and Hubert (1997). Mean relative weight (W*r*; Anderson and Neuman 1996) for all cutthroat trout and cutthroat trout within RSD categories were calculated using the standard weight equation for lotic cutthroat trout provided by Kruse and Hubert (1997). Incremental RSDs and relative weights were not calculated using recaptured fish to avoid overlap.

Redd count data were provided by Wyoming Game and Fish Department personnel in electronic format. Redd counts were summarized by individual streams and all streams combined. Data for some years was provided for segments of individual streams, in this case, redd counts were summed to include the entire length of a stream.

Results and Discussion

Abundance estimates of cutthroat trout were completed in the Snake River within Grand Teton National Park during 1984-86, 1988-90, 1999, 2001, and 2003. Estimates were attempted during 1994 and 1997; however, these estimates were not completed due to variable river conditions and catchability. A summary of abundance estimates for all cutthroat trout and individual length categories is provided in Table 1, along with a graphic presentation in Figures 1 and 2. Estimates of abundance for all trout ranged from a low of 325 fish/mile in 1989 and a high of 1505 fish/mile in 1986. Estimates generally consisted of a greater proportion of smaller fish (< 278 mm) during 1984-1990, whereas estimates obtained during 1999-2003 indicate greater numbers of larger cutthroat trout (> 278 mm). It should be noted however, that differences in effort among years might have contributed to variation in abundance estimates.

Incremental RSDs and W*r*'s were calculated for cutthroat trout during 1985-86, 1990, 1994, 1997, 1999, 2001, and 2003, because, data (hardcopy or electronic) for individual trout were not available for 1984, 1988 or 1989. Incremental RSDs for cutthroat trout are summarized for each year in Table 2; a summary of relative weights is provided in Table 3. Incremental RSDs demonstrate a potential shift in length structure of cutthroat trout from 1990 to 1994, indicated by a higher proportion of quality-preferred length trout and a lower proportion of stock-quality length trout post-1990. A change in population structure could have resulted from a change in harvest regulations. However, spot creel and programmed creel surveys conducted by WGFD and National Park Service personnel, from 1985 to 2003 indicated that exploitation rates are particularly low (< 0.2 fish/hr), and have continually declined (data from WGFD Annual Fisheries Progress Reports). Changes in length structure can also indicate changes in recruitment rates or survival; however, it should be considered that changes in length structure might simply be due to changes in effort and sampling efficiency pre- and post-1990 (i.e. size selection and capture events).

Mean relative weight also varied among years and within size classes. Mean relative weight values for all cutthroat trout ranged from a low of 80.8 in 1986 to a high of 86.9 in 2003. Despite an increasing trend in mean relative weight from 1994-2003, mean relative weight was still lower than the 50th percentile relative weight of 97 for lotic cutthroat trout identified by Hyatt (2000). Changes in relative weight can be attributed to multiple factors acting on the growth efficiency of cutthroat trout. Variation in flow rates, temperature regimes, prey availability, or competition could all be contributing to annual variation in relative weight.

The most inclusive data on redd counts is from 1985-2003. This includes counts on Upper Bar BC Spring (1985-2003), Snake River (1986-2002), Cowboy Cabin Creek (1985-2003), and Blacktail Spring (1985-1992, 1994-2003). Individual redd counts for each stream among years are presented graphically in Figure 3. There appears to be little variation in redd counts among years in Cowboy Cabin Creek, and the Snake River. However, redd counts conducted on Upper Bar BC Spring and Blacktail Spring varied considerably among years. There was no relationship between abundance estimates or redd counts, either within length categories or across water bodies (data not presented).

Redd counts for all streams surveyed in Grand Teton National Park were summed to provide an index of adult spawner numbers in the Snake River. An interesting trend is apparent when the total number of redds is compared with the median daily discharge (cfs) for each year (Figure 4). The total number of redds appears to be related to median annual cfs on a three year interval. The average age of spawning cutthroat trout is generally 4 years (Ralph Hudelson, WGFD, personal communication), therefore, it is unlikely that higher flows are affecting survival of age 0 trout. However, the three-year interval may indicate that higher flows affect the survival of age 1 cutthroat trout, resulting in higher recruitment rates and ultimately greater spawner numbers. The possible relationship between median annual cfs and recruitment of age 1 cutthroat trout could be due to a link between higher water levels and increases in juvenile habitats. Water levels may also influence trout recruitment indirectly by affecting water temperature, sediment flushing rates or woody debris recruitment; factors that influence trout recruitment. Ultimately, factors that determine median daily cfs for a particular year may be investigated further to provide additional information regarding cutthroat trout production.

The record of data on the cutthroat trout population in the Snake River within Grand Teton National Park provides important long-term information on the abundance, length structure, weight relations, and relative abundance of adult spawners. This data set along with additional information on physical, chemical and biological characteristics of this system can provide valuable insight. The strength of this data set is its long record and its multiple indicators, which when used together provide information on the status of the cutthroat trout fishery. Efforts should continue to update and maintain this data set to identify further opportunities to preserve and enhance such a valuable fishery.

References

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Table 1. Abundance estimates of cutthrout trout in a five-mile section of the Snake River downstream from the Deadman's boat launch, Grand Teton National Park, Wyoming.

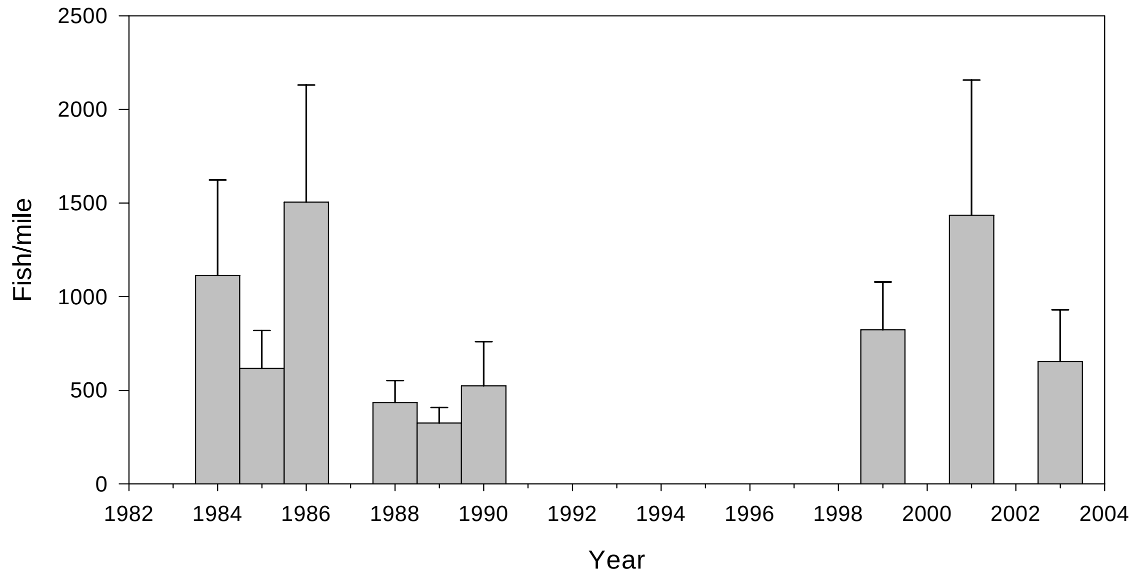
Year	Events	Interval	Length category	Fish/mile	95% Confidence Interval
1984	6	1-14 days	**Total**	**1113**	**603-1623**
			152-277 mm	945	437-1453
			278-378 mm	126	85-167
			> 378 mm	42	28-56
1985	6	1-14 days	**Total**	**617**	**415-819**
			152-277 mm	307	142-472
			278-378 mm	272	156-388
			> 378 mm	38	30-46
1986	6	1-14 days	**Total**	**1505**	**880-2130**
			152-277 mm	1289	666-1912
			278-378 mm	171	116-226
			> 378 mm	45	31-59
1988	Unknown	Unknown	**Total**	**434**	**316-552**
			152-277 mm	260	152-368
			278-378 mm	147	102-192
			> 378 mm	27	17-37
1989	6	1-14 days	**Total**	**325**	**242-409**
			152-277 mm	N/a	N/a
			278-378 mm	193	120-266
			> 378 mm	33	23-43
1990	6	1-7 days	**Total**	**523**	**286-760**
			152-277 mm	344	191-497
			278-378 mm	138	94-182
			> 378 mm	42	24-60
1999	3	1-2 days	**Total**	**822**	**566-1078**
			152-277 mm	320	178-462
			278-378 mm	182	136-228
			> 378 mm	73	52-94
2001	2	1 day	**Total**	**1435**	**713-2157**
			152-277 mm	443	104-782
			278-378 mm	379	215-543
			> 378 mm	128	67-189
2003	3	1-2 days	**Total**	**654**	**378-930**
			152-277 mm	254	77-431
			278-378 mm	160	108-212
			> 378 mm	55	43-67

Table 2. Incremental Relative Stock Density (RSD) values for cutthroat trout collected in the Snake River from the Deadman's boat launch to Moose, Wyoming, 1985-2003 (N = number > stock length, S = stock length, Q = quality length, P = preferred length, M = memorable length, T = trophy length).

		RSD			
Year	N	S-Q	Q-P	P-M	M-T
Total	3446	58	41	1	0
1985	528	63	35	2	0
1986	692	67	32	1	0
1990	474	60	37	3	0
1994	76	46	51	3	0
1997	50	46	52	2	0
1999	560	57	42	1	0
2001	602	51	48	1	0
2003	464	47	51	1	0

Table 3. Mean Relative Weight (W*r*) for cutthroat trout collected in the Snake River from the Deadman's boat launch to Moose, Wyoming, 1985-2003 (SS = sub-stock, S = stock, Q = quality, P = preferred, M = memorable).

Year	Length Category	N	W*r*
1985	**Total**	**480**	**83.6**
	SS-S	83	85.7
	S-Q	254	82.8
	Q-P	135	83.5
	P-M	7	86.6
1986	**Total**	**398**	**80.8**
	SS-S	112	77.8
	S-Q	196	82.5
	Q-P	89	80.8
	P-M	1	83.3
1990	**Total**	**644**	**86.3**
	SS-S	171	84.3
	S-Q	284	85.6
	Q-P	175	88.8
	P-M	14	92.0
1994	**Total**	**76**	**81.0**
	SS-S	3	81.0
	S-Q	34	81.8
	Q-P	37	80.5
	P-M	2	74.3
1997	**Total**	**53**	**83.5**
	SS-S	4	81.6
	S-Q	22	83.1
	Q-P	26	84.3
	P-M	1	80.4
1999	**Total**	**657**	**83.1**
	SS-S	135	82.6
	S-Q	295	84.9
	Q-P	225	81.2
	P-M	2	73.7
2001	**Total**	**336**	**86.4**
	SS-S	63	84.8
	S-Q	132	87.8
	Q-P	138	85.6
	P-M	3	99.1
2003	**Total**	**410**	**86.9**
	SS-S	59	86.8
	S-Q	165	88.2
	Q-P	182	85.9
	P-M	4	78.3



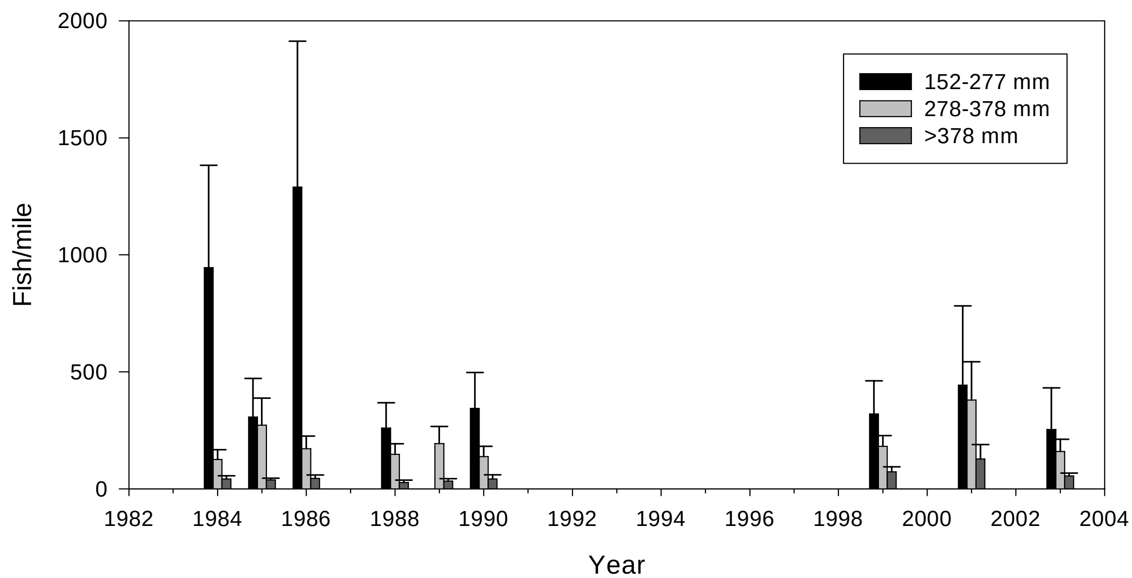


Figure 1 (top). Abundance estimates (bars = 95 % confidence intervals) of cutthroat trout in the Snake River, Grand Teton National Park, Wyoming.

Figure 2 (bottom). Abundance estimates (bars = 95% confidence intervals) of cutthroat trout in the Snake River, Grand Teton National Park, Wyoming, within length categories.

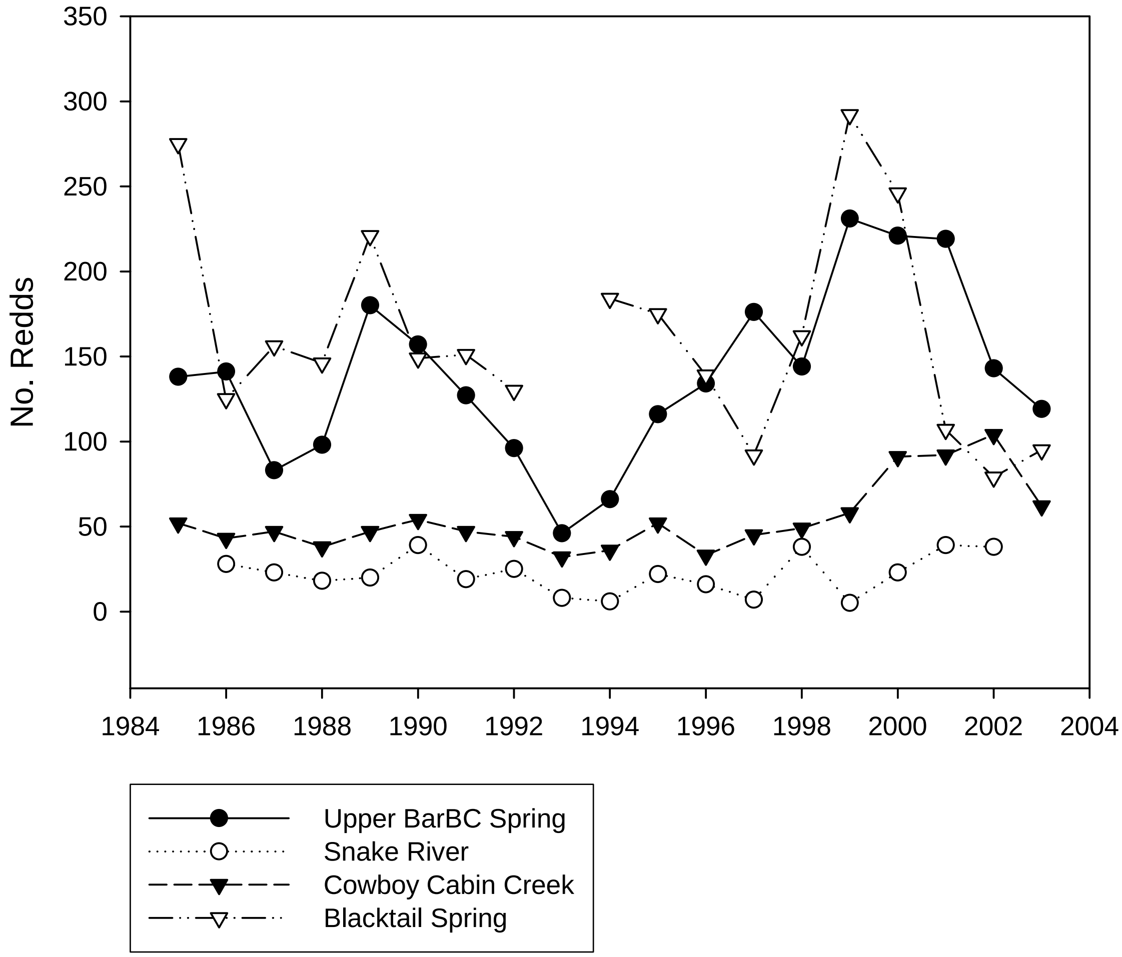


Figure 3. Redd counts in tributaries to the Snake River, Grand Teton National Park, Wyoming.

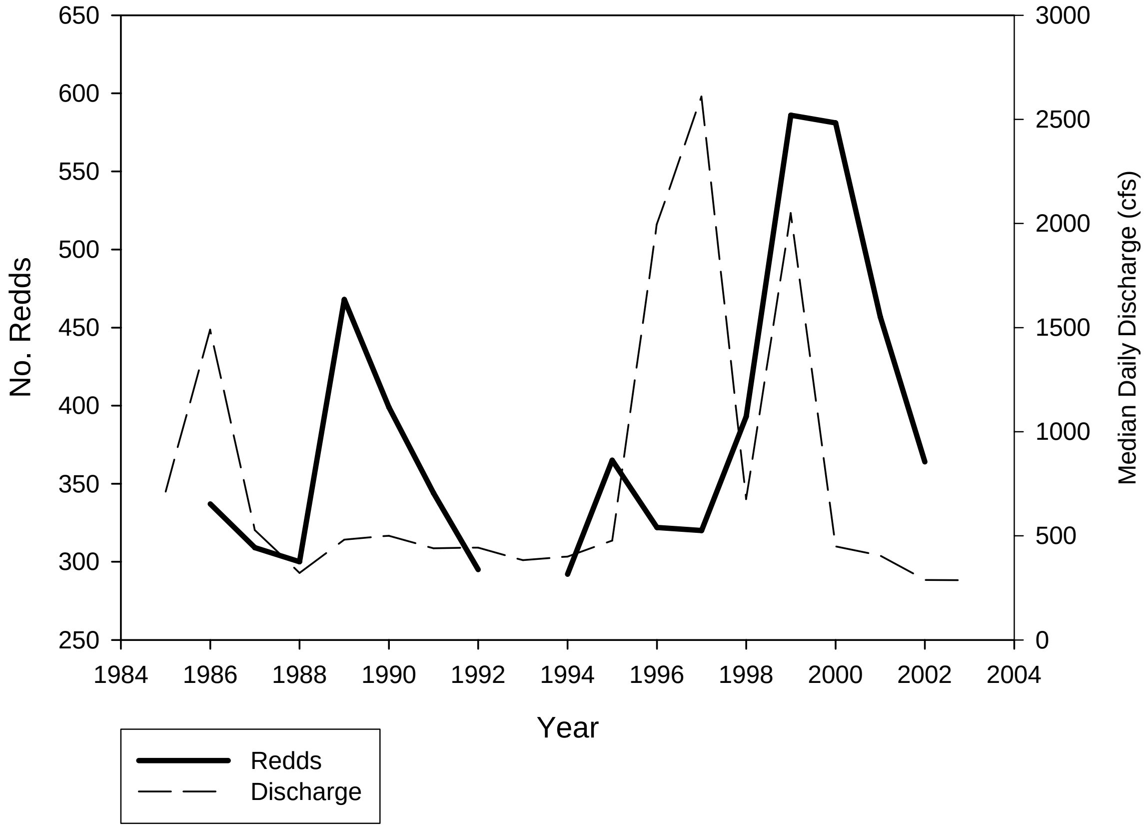


Figure 4. Plot of the total number of redds in tributaries to the Snake River in Grand Teton National Park, Wyoming, and median daily discharge (data from USGS Water Resources) measured at Moran, Wyoming.