North Platte Comprehensive Fisheries Study: Creel Survey and Stocking Evaluation, 1995-1996

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by

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Larger (>8") fall (walleye)

1-2-3 yrs. after stocking

Pathfinder
1992 K > FRB 20% >50% EL
93 35%.

15 MO. creel survey

Alcova:

1992 Spring EL K ~ 32/31
fall 1" EL > K 1.61 - 1.17
larger FRB 1.12

93 Spring EL > K .81 .51 >50%
fall K > 2X EL 1.74 ~ .7
FRB 1.10 - >50%
6

! Spring stock K return EL
Pathfinder 1994 — large catch. - 25% (241mm) 13%
small - 9% (201) 10%
1995 21% (234) 4.6%
10% (193) 0.5%

Alcova 1994: K large 12% (254mm)
small 3.4% 3X (157mm)
EL " L 37% (249mm)
" S, 1.2% 3X (140mm)
1995 - K 34% (216mm)
19% (203mm)
EL 17% (224mm)
10% (185mm)

of fish stocked in Pathfinder
EL & FRB 3X more
likely to be caught by
anglers than K!

(1)

Sockeye salmon, Oncorhynchus nerka.

Also known as red salmon, or blueback salmon. Freshwater form called kokanee.

underline?

Description: In the ocean, sockeye salmon have ~~a~~ bright silvery sides and a steely-blue dorsal surface. As ~~spawning time~~ sexual maturation approaches and sockeye begin to enter freshwater on their spawning runs, dramatic changes occur. The body becomes bright red with a dark green dorsal surface. ~~Males develop~~ The jaws of male sockeye undergo grotesque changes; the jaws and teeth enlarge and curve in a hook-like fashion (called ~~a~~ a kype). ~~These changes also~~ The body of the male ~~occur in kokanee, but to a lesser degree~~ deepens in back of the head, presenting a humpback profile, comparable to pink salmon. Sexual maturation changes also occur in kokanee, ~~but~~ to a lesser degree. Except for ~~the~~ pink salmon, sockeye salmon ~~are the~~ have the smallest adult size of the five North American species of Pacific salmon. After two or three years of ocean feeding, sockeye returning to spawn typically range from ~~average~~ about four to ~~six~~ seven pounds (1.8 - 3.2 kg). ~~An~~ Average

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Comparison of Creel Returns from Rainbow Trout Stocked at Two Sizes

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Abstract.—Creel returns of stocked rainbow trout *Oncorhynchus mykiss* are often below management objectives. In the Hoover Dam tailwater, Colorado River, predation by striped bass *Morone saxatilis* limits creel returns of stocked rainbow trout. On two occasions, we stocked large (33-cm) and small (21–25-cm) rainbow trout into the tailwater to compare returns to the creel. Angler return rates for the two stockings were 47% and 22% for the large fish and 1% and 2% for the small fish. Costs of large fish returned to the creel were US$6.02 and $12.86 per fish for the two stockings. Costs of small fish returned to the creel were $59.00 and $29.50 per fish for the two stockings. Annual survival of large rainbow trout did not increase compared with small fish. Stocking large rainbow trout is a cost-effective option for the Hoover Dam tailwater and may improve creel returns in other waters where predation limits survival of stocked fish.

Millions of rainbow trout *Oncorhynchus mykiss* are stocked annually in western North American streams. In some streams, few of these fish return to the creel. For example, return rates of rainbow trout (≥21 cm total length, TL) exceeded the management objective of 50% in only 3 of 24 streams evaluated in Wyoming (Wiley et al. 1993a). Our objectives were to (1) compare the return to the creel of large (33-cm) and small (21–25-cm) rainbow trout stocked in the Hoover Dam tailwater, Colorado River, (2) determine if annual survival was higher for the large fish, and (3) determine the costs of fish returned to the creel for each size-group.

Put-and-take rainbow trout stocking has been critically reviewed and biologists have encouraged investigation of options to improve stocking practices (Needham 1959; Haskell 1965; Wiley et al. 1993a, 1993b; Johnson et al. 1995). Creel returns have been improved by stocking catchable (≥21-cm) versus subcatchable (<21-cm) fish (Needham 1959; Cresswell 1981; Wiley et al. 1993a). Creel returns have also been improved by stocking strains that show increased catchability (Moring 1982), stocking during the fishing season (Needham 1959), and raising hatchery-spawned fish in a stream environment prior to release (Miller 1958).

Predation is one factor that limits creel returns of stocked rainbow trout (Deppert and Mense 1980; Wiley et al. 1993a, 1993b). Small fish can be more vulnerable to predation than larger fish (Werner et al. 1983). The return rate for rainbow trout planted in Seminoe Reservoir, Wyoming, increased as larger fish were planted because smaller fish were vulnerable to predation by walleyes *Stizostedion vitreum* (Wiley et al. 1993a). Therefore, stocking large (33-cm) rainbow trout may increase creel returns in systems where predators prey on small (21–25-cm) fish.

Hoover Dam impounds Lake Mead on the Colorado River in northwest Arizona and southeast Nevada. Cold water (maximum 12–14°C) released from the hypolimnion of Lake Mead is suitable for year-round survival of rainbow trout for 42 km downstream from Hoover Dam. Each month, Willow Beach (Arizona) National Fish Hatchery and the Nevada Division of Wildlife release rainbow trout (21–25 cm) into the tailwater. No natural recruitment of rainbow trout occurs. Common carp *Cyprinus carpio*, razorback suckers *Xyrauchen texanus*, channel catfish *Ictalurus punctatus*, and striped bass *Morone saxatilis* are the only other fish species that regularly inhabit the tailwater.

The Hoover Dam tailwater has been managed to provide a put-grow-and-take rainbow trout fishery. During 1994 and 1995, Walters et al. (1996) found that return to the creel of stocked rainbow trout averaged 2.6% (range = 0–15%) and that annual survival of stocked fish was near zero. They also determined that striped bass predation was one factor in this poor survival.

In March 1995, we freeze branded (with liquid nitrogen) 1,770 large (mean TL = 33 cm, SD = 2 cm) and 1,855 small (21 cm, SD = 3 cm) rainbow trout (Mighell 1969; Raleigh et al. 1973; Refstie and Aulstad 1975). The fish were stocked at Willow Beach Marina (18 km downstream from Hoover Dam) in April 1995. In August 1995, we freeze branded 1,023 large (33 cm, SD = 2 cm) and 1,014 small (25 cm, SD = 2 cm) rainbow trout. These fish were stocked in September 1995 at Willow Beach Marina. All four groups of fish were marked

at a unique location on the body. We also held a sample of fish from each group in a hatchery raceway to monitor mark retention.

To monitor angler return rates (proportion of marked fish returned to the creel), we conducted an access point creel survey (Hayne 1991) at Willow Beach Marina from April to December 1995. Willow Beach Marina provides access for most of the anglers who fish in the tailwater (M. Burrell, Nevada Division of Wildlife, personal communication). We measured (total length to nearest centimeter) all creeled rainbow trout and checked them for freeze brands.

To determine if rainbow trout were preyed upon, we collected striped bass stomachs from angler-harvested fish. We took stomachs only from striped bass 40 cm in length and above because smaller fish generally do not prey on the stocked rainbow trout (Walters et al. 1996). We collected striped bass stomachs starting the day marked rainbow trout were stocked until 2 weeks after marked fish were no longer observed in the creel. We analyzed stomachs for the presence of marked rainbow trout and measured the total length of ingested rainbow trout when possible.

Willow Beach National Fish Hatchery expended US$0.59 for each 21–25 cm rainbow trout stocked in 1995. Twenty percent ($0.12/fish) of this cost was attributed to feed expenses. The cost to stock 33-cm rainbow trout was estimated at $2.83 per fish of which $0.57 per fish was spent just for feed (J. N. Hanson, Willow Beach National Fish Hatchery, personal communication). We divided stocking cost per fish by the angler return rate to estimate the return-to-creel cost for a large rainbow trout versus a small fish.

Angler return rates of large rainbow trout were 47% and 22% for the April and September stockings, respectively. Return rates for the small fish were 1% and 2% for the April and September stockings, respectively. No marked fish were observed in the creel more than 4 weeks after release, indicating that annual survival of large rainbow trout did not increase compared with small fish. Loss of marks did not affect our estimates because freeze brands were visible on 98% of fish (N = 55) held in hatchery raceways for 58 d following marking. No large rainbow trout were observed in striped bass stomachs (N = 26 stomachs), but 26 small rainbow trout were observed.

The cost of each large fish returned to the creel was $6.02 and $12.86 per fish for the April and September stockings, respectively. The cost of each small fish returned to the creel was $59.00 and $29.50 per fish for the April stockings, respectively.

Large rainbow trout provided t the creel than small fish. Striped was a causative factor for low small fish. Large rainbow trout we susceptible to predation by stripe for increased availability to angler the small fish. Both size-groups may also have been susceptible double-crested cormorants *Phala* These birds can consume rainbo cm in length (Ottenbacher et al present in the Hoover Dam tailwa out the year.

Stocking large rainbow trout i turns, but fewer large fish can small fish because large fish cost These costs are justified for Hoo stockings because the cost of fi creel was less for large rainbow t fish. The success of stocking among hatcheries; therefore the the costs of growing larger fish the creel should be considered basis.

Acknowledgme

Pat Mullane and Jim Hans Wildlife Service) first suggest rainbow trout in the Hoover thank personnel from the Will Fish Hatchery for providing s the rainbow trout for our study comments on earlier drafts of t vided by R. E. Gresswell, J. Maughan, and R. W. Wiley. nanced by Federal Aid in Sp funds.

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Rainbow trout strain	Season stocked	Average length (mm)	Number stocked with CWTs	Number of CWTs recovered	Proportion of CWTs recovered
Pathfinder Reservoir, 1992					
KRB	S	218	14,500	117	0.81
ELR	S	218	7,100	24	0.34
KRB	F	234	12,800	236	1.84
ELR	F	236	25,000	305	1.22
FRB	F	234	24,300	377	1.55
Pathfinder Reservoir, 1993					
KRB	S	239	15,100	115	0.76
ELR	S	254	17,700	53	0.30
KRB	F	226	7,400	132	1.78
ELR	F	249	6,500	50	0.77
FRB	F	229	19,600	261	1.33
Alcova Reservoir, 1992					
KRB	S	213	19,300	62	0.32
ELR	S	226	18,900	59	0.31
KRB	F	218	18,100	212	1.17
ELR	F	241	6,600	106	1.61
FRB	F	234	45,000	540	1.12
Alcova Reservoir, 1993					
KRB	S	236	14,300	73	0.51
ELR	S	241	20,100	163	0.81
KRB	F	264	2,700	47	1.74
ELR	F	254	6,700	47	0.70
FRB	F	244	32,000	352	1.10

>40% advantage

?

60% advantage

for all four evaluations ($P < 0.05$ for all Bonferroni pairwise comparisons, Table 2). Although LC, SC and UC groups of KRB and ELR were requested at identical sizes, in three of eight instances the KRB group was released at a significantly larger average size than the ELR group.

Returns of KRB LC groups stocked during both 1994 and 1995 in Pathfinder Reservoir exceeded returns of ELR LCs and groups stocked at smaller sizes (Table 2). There was low probability ($P <$ 0.1 in all pairwise comparisons) that stocking ELR LC or greater numbers of SC or UC rainbow trout would provide Pathfinder Reservoir anglers with higher catch rates over stocking KRB LCs.

Large-catchable rainbow trout also returned in higher percentages over SC and UC groups from Alcova Reservoir (Table 2). Percent return of 1994 ELR LCs (34%) far exceeded ELR UCs (1.2%) and KRB UCs (3.4%). Use of UCs for spring stocking instead of LCs was highly unlikely to increase angling catch ($P < 0.001$ for both pairwise comparisons). Results of the 1995 size-at-stocking evaluations at Alcova Reservoir indicate that KRB LCs maximized angler catch. The probability that angler catch could be improved by rearing and stocking KRB SCs, in lieu of KRB LCs, was moderate ($P < 0.5$).

Pond Feeding Trials

The higher proportions of 127-mm rainbow trout missing (not present at pond drawdown) from treatment ponds compared with control ponds suggests that this rainbow trout size is highly vulnerable to all three walleye size-classes investigated (Figure 1). There was insufficient evidence ($P > 0.05$) to suggest that 127-mm rainbow trout were more vulnerable to one walleye size-class over any other.

Feeding trials with 178-mm rainbow trout showed that significantly different proportions ($P < 0.001$) of rainbow trout were missing from control trials compared with treatment trials with the two largest walleye size-classes we studied. Walleyes measuring 483–533mm readily ingested 178-mm rainbow trout but 381–432-mm walleyes did not.

Trials with 127-, 178-, and 229-mm rainbow trout showed that these trout sizes were not equally

included large catchables (LC, >208 mm), small catchables (SC, 178–207 mm), and subcatchables (UC, 127–177 mm). These comparisons assume that 1.5 times more SC and 2.7 times more UC can be reared for every LC (see Methods section for details).

Strain and SAS group	Length,[a] mean ± SD (mm)	Numbers stocked with CWTs	Percent return during 15-month creel survey	P^b
Pathfinder Reservoir, 1994				
KRB LC	267 ± 33	17,300	25	
KRB SC	180 ± 28 z	27,300	9	<0.05
ELR LC	236 ± 33	34,200	13	<0.001
ELR SC	180 ± 30 z	7,400	10	<0.005
ELR UC	140 ± 23	30,100	5.6	<0.001
Pathfinder Reservoir, 1995				
KRB LC	241 ± 38 z	29,100	21	
KRB SC	201 ± 30 y	23,400	10	<0.1
ELR LC	234 ± 25 z	28,600	4.6	<0.001
ELR SC	193 ± 25 y	30,000	0.5	<0.001
Alcova Reservoir, 1994				
KRB LC	254 ± 30 z	13,000	12	<0.001
KRB UC	157 ± 30	19,500	3.4	<0.001
ELR LC	249 ± 25 z	18,100	37	
ELR UC	140 ± 20	19,000	1.2	<0.001
Alcova Reservoir, 1995				
KRB LC	216 ± 33 z	19,300	34	
KRB SC	203 ± 36	17,900	19	<0.5
ELR LC	224 ± 30 z	15,700	17	<0.001
ELR SC	185 ± 28	19,700	10	<0.001

[a] Within reservoir and year, groups followed by the same letter had mean sizes that were not significantly different (Bonferroni multiple-comparison procedures, $P > 0.05$).

[b] Probability that stocking greater numbers of SC or UC would have increased angler catch over the LC group with the highest return.

vulnerable to predation by walleyes measuring 483–533 mm ($P < 0.001$). Most of the heterogeneity in this data is explained by a lower proportion of 229-mm rainbow trout missing from treatment ponds (0.07) compared with 178-mm (0.81) and 127-mm (1.0) rainbow trout. The 483–533-mm walleyes readily ingested 127-mm and 178-mm rainbow trout but consumed few 229-mm trout.

Discussion

Walleye introductions to the western United States have negatively affected a number of salmonid fisheries (McMahon and Bennett 1996). Because fishing opportunities are limited in central Wyoming, walleye invasion of the UNPR was particularly deleterious. With limited natural recruit-

Piscivores are capa
siform fishes than de
1977; Tonn and Pas
1991). Predators also
spiny-rayed species (W
cause juvenile rainbow
soft-rayed, they are h
McMillan (1984) show
deter loss of rainbow
but because hatchery
ducing larger trout m
This study was condu
ited hatchery resourc
strain, season of stoc
The strain evaluat
demonstrated superio
pared with ELR; th
mediate utility. A sim
Miracle Mile, i.e., th
above Pathfinder R
stocked into Pathfin
41% of the rainbow t
ELR and FRB strain
likely to be caught b
pared with KRB (M
cause FRB were im
glers and to anglers a
eries managers chose
From Alcova Reserv
stream emigration, t
ilarly. With no clea
strain over others i
managers opted to s
Use of FRB bene
section. Because the
hatchery, egg produ
sures are taken to p
KRB and ELR broo
reservoirs). Also, FI
ing to LC sizes in
are unavailable for
reared for 16 month
ing challenges (Ma
Returns of fall-s
reservoirs were n
stocked trout. Alth
signed to determin
survival of fall-sto
mechanisms based
literature.

– no clear advantage one strain over the other in Alcova!

size l/wt mo. after stocking

- returns: 6 - 12 - 15 - 18 - 24 - -

if 90% of A returns in 6 mo., 100% w/in 12.

" 90% B " " 18 " - 36 -

all trophy fish + biomass return can be greater w/ less total return

- habitat use - littoral, limnetic,

food - ~~habit~~ niche delineation

- ecological, segregation selective

- see T & B 74

~

- not even speculation to suggest explanations for weird results! - sampling error? - how fish raised? - spatial / temporal dif. in stocking?

Miracle Mile

Pathfinder fish - fishery regulations

big news!

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Growth, Smoltification, and Smolt-to-Adult Return of Spring Chinook Salmon from Hatcheries on the Deschutes River, Oregon

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Abstract.—The relationship between smoltification and smolt-to-adult return (SAR) of spring chinook salmon *Oncorhynchus tshawytscha* from the Deschutes River, Oregon, was examined for four release groups in each of three successive years. Fish were reared, marked with coded wire tags, and released from Round Butte Hatchery, Pelton Ladder rearing facility, and Warm Springs

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National Fish Hatchery. Smolt releases occurred in nearly the same place at similar times, allowing a direct comparison of SAR to several characters representing smolt quality. Return rates varied significantly among facilities, varying over an order of magnitude each year. The highest average SAR was from Pelton Ladder, the lowest was from Warm Springs. Each of the characters used as metrics of smoltification—fish size, spring growth rate (February–April), condition factor, plasma hormone concentration (thyroxine, cortisol, and insulin-like growth factor-I [IGF-I]), stress challenge, gill Na^+,K^+-ATPase activity, and liver glycogen concentration—varied significantly among facilities and seasonally within hatchery groups. However, only spring growth rate, gill ATPase activity, and plasma IGF-I concentration showed significant relationships to SAR. These characters and SAR itself were consistently lower for fish released from Warm Springs Hatchery than for fish from Round Butte Hatchery and Pelton Ladder. This demonstrates that differences in the quality of fish released by facilities may have profound effects on subsequent survival and suggests that manipulations of spring growth rate may be used to influence the quality of smolts released from facilities.

The role of hatchery-produced salmon *Oncorhynchus* spp. in ecosystems of the Pacific Coast of North America is currently being debated (Hilborn 1992; Meffe 1992). Some people have suggested that salmon produced by hatcheries are behaviorally dysfunctional, physiologically compromised, and disease prone—traits leading to poor postrelease survival and deleterious effects on wild fish (Steward and Bjornn 1990; Maynard et al. 1995; NRC 1996). These considerations, plus other concerns about hatchery practices and management, have led to a number of proposals for decreasing, altering, or eliminating hatchery production (NMFS 1995; NRC 1996). The controversy over the role of hatcheries so far has not acknowledged that hatcheries may differ in physical characteristics and rearing practices, that they may thus produce fish of differing quality, and that their ecological costs and benefits may therefore differ. Hatcheries that perform poorly might be closed. Alternatively, poorly performing hatcheries might be improved to mimic those that perform well. Both of these alternatives require accurate assessment of relative hatchery success.

Appraising the success of hatcheries is a task that has been attempted infrequently (Hilborn and Winton 1993; Winton and Hilborn 1994). It can be technically difficult and expensive, and the results may be inconclusive. The most widely used measure of hatchery success involves determining the percentage of fish released that return as adults or are caught in a fishery (the smolt-to-adult return, SAR). Although it may be the most accurate indicator of hatchery success, SAR is influenced by a variety of factors that may make direct comparison of rates between hatcheries difficult. This is especially true in the Columbia River basin, where hatcheries are distributed from near the estuary to tributaries such as the Salmon River, 1,200 km from the ocean. Fish that must travel from the Salmon River to the ocean, traversing eight mainstem dams and reservoirs with their resident predators, may suffer greater mortality than fish released close to the estuary (Raymond 1979, 1988). Upper-river hatcheries thus might have a lower SAR than a lower-river hatchery even if the hatcheries produce similar fish. Ideally, one needs an index at the time of release which is predictive of the ability of fish to perform in the natural environment.

Spring chinook salmon *O. tshawytscha* are typically released from hatcheries as yearling fish called smolts. Smolts are expected to migrate rapidly downriver, adapt to seawater, and then forage and grow in marine waters (Hoar 1976; Bern 1982). Several attempts have been made to quantify a "smolt quality index" based on smolt characters measured before release (Ewing and Birks 1982; Ewing et al. 1985; Zaugg 1989; Zaugg and Mahnken 1991; Farmer 1994). A general finding has been that fish released from a hatchery before they have begun smoltification (the parr stage) or while they are in early stages of smoltification have a lower likelihood of return than fish released further along in this physiological process (Wahle and Zaugg 1982; Zaugg 1989; Zaugg and Mahnken 1991). However, more rigorous attempts to compare smolt quality and SAR between hatcheries have been problematic, perhaps because smolt quality indices were inadequate. An accurate smolt quality index would allow direct comparisons between fish produced by different hatcheries or between fish reared under different conditions at the same hatchery. For the purposes of this paper, we define a smolt quality index as a variable measured on juvenile salmon during smoltification that shows a significant correlation with SAR. In contrast, a smolt character is simply some attribute that changes during smoltification.

Several biochemical methods have been used to

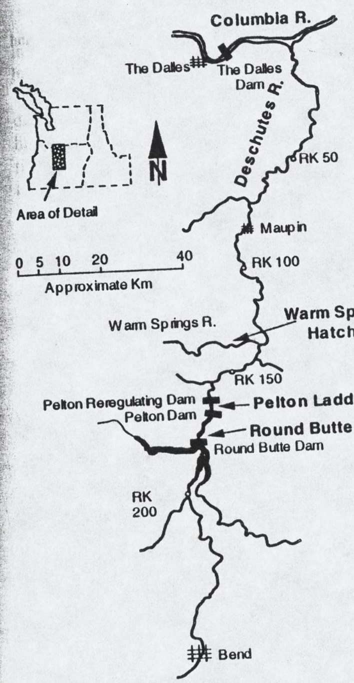


FIGURE 1.—Map of the Deschutes River, Oregon. Spring chinook salmon rearing facilities are designated with arrows. Distances upstream (in river kilometers, RK) from the Columbia River confluence are indicated.

measure smoltification (Folmar and Dickhoff 1980; Wedemeyer et al. 1980; McCormick and Saunders 1987), but they have been little tested for efficacy as smolt quality indices. Accordingly, we designed a study to relate smolt quality to adult returns covering 3 years of hatchery releases of spring chinook salmon. The facilities chosen were in close geographic proximity, on or near the Deschutes River, Oregon, a tributary of the Columbia River. These facilities released fish at nearly the same time in nearly the same place, and they reared genetically similar fish. The environmental challenges faced by fish released from these facilities were thus similar; any differences in SAR between fish released from these facilities should be due to the relative attributes of fish released from each facility. We tested for differences in smolt characters among facilities and whether these related to SAR. The study comprised a comparison of SAR, an evaluation of smoltification based on

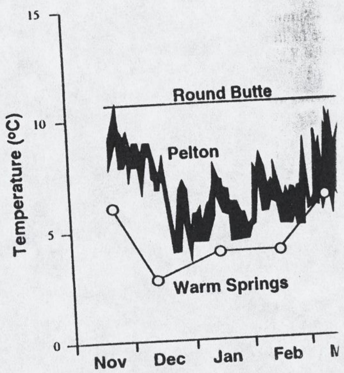


FIGURE 2.—Seasonal temperatures at W
Hatchery and temperature ranges at Round
ery and Pelton Ladder, 1988–1989.

physiology and morphology, and an
the relation of smolt physiology and
to SAR.

Methods

Facilities and chinook salmon p
Chinook salmon were examined at
National Fish Hatchery, Round B
(Oregon Department of Fish and Wil
and Pelton Rearing Ladder (ODFW
Deschutes River and Warm Spring
netically similar and are closely rel
group of Columbia River spring ch
(Utter et al. 1989; Matthews and
Round Butte and Warm Springs hatc
operations, and broodstock origins
were described by Howell et al. (
et al. (1989), and Olson et al. (199
der is an abandoned fish passage f
tends downstream from Pelton D
Reregulating Dam. The lower 0.5 k
is now used as a satellite rearing fa
Butte Hatchery.

At Warm Springs Hatchery, egg
in mid-November, fry were trans
fiberglass tanks in late December,
occurred in early January. Fry we
outside concrete raceways in ea
were reared in river water at temp
of those shown in Figure 2. They
five times per day with a comme
moist diet). Fish were graded in
all fish longer than 140 mm we
proximately 40% of the total) and

— cultural biologues
— education — ziunurks

— NH
Minicte Mile
74%. non res
wild
..
H
—H. 7%. FD 75%
Mod —

— RB / Brown ?
6:1
— use of hatch.
— recycle
— relech coded Test

— N.H. — New E. Any state.

— Awareness?
— Business Competition

— Fish Mgt. — Ford Model T —

— p. 114 "River Run RB"? wild f—

Eagle L.

Kamloops

1994 Apr. 19 —

FRB (fall spawning) — most donate — hatch

Alcova EL 1995 — Mar. 17 15,800 9" 3.1/lb.
20,400 7" 5.0/lb.

1996 Apr. 4 9,800 8.5" 3.4/lb.

K 95 1994 Apr. 19
1995 Mar. 21 19,400 3.0/lb.
Mar. 14 18,800 4.8/lb.
'96 — Apr. 9 — 24,300 3.8/lb.

FRB
94 — Sept. 15 — 16,674 lb. — 2
1995 — Sept. 22 — 47,800 3.9/lb.

94/95 2-3-4 yrs. etc.

ELR
1994 — Apr. 19: 18,600 2.3/lb. — 8087 lb.
19,400 13.5/lb. — sub catch

1995 — Mar 17: — 5110 lbs 3.1/lb
+ 4070 lb. 5/lb.

? Table A14 vs A15
8087 94
5110
13197 lb. vs. 6599

K — 94 5601 lb.
6480
12081 lb. vs. 6041 lb.

Pathfinder

EL - 94	Apr. 18	2.9/lb	K		Apr. 18	2.8
		6.1 "				6.8
	June 3	15.3/				
95	Apr. 20	3.2/		95	Apr. 20	2.9
		5.4/				4.5
FRB 94	Sept. 21	3.6				
95	Sept. 18	3.5	FRB	best		

Seminoe

$\bar{x}$ size 15.1" 9-22" 4.3/acre

> 7 lb./yr

p. 158

Fall stocked fish 2.71 X better than spring stocked

26% catch = Walleye 1.7/acre

2 lb.

categories

3.14 3.1

5.1 | 16.13

153 830 220

I	92-95	FRB	catchable 16,125	5,089 lb	
II	92-95	ELR	31,550	9,743 lb.	3.3
	92-95	KRB	31,350	8,924 lb.	

smallest 3.5/lb.

3.27 3.9

.971 | 316

291

250

194

560

3.5

.891 | 314

267

470

KRB - best, but no longer available

* S.RC - 5.7/lb.

5.7 called catchables

31.81 | 1800

1575

2250

Cr.

water temp indicators - zoopl.

p. 158

clear planktivore food? - benthic - pelagic - surface

table 515 p. 84

FRB

I	1992:	Oct. 6	8,800 no	3145 lb.	2.8/lb.
	1993:	Sept. 21:	18,000	5,990	3.0/lb.
	1994:	Sept. 12:	9,800	3,750	2.6/lb.
	1995	Sept. 20:	27,900	7,470	3.7 lb.

X/m

64,500 ÷ 4

ELR

II	1992	Apr. 28 - 19,800		3.1/lb.
	1992	Sept. 2	9,700	2.5/lb.
	1993	~~Sept. 21~~	~~8,600~~	~~2.4~~/lb.
		~~Sept.~~ Apr. 22 - 20,000		3/lb.
		Sept. 21	8,600	2.4/lb.
	1994	Sept. 12	31,400	4.1/lb.
	1995	Apr. 24	8,200	3.0/lb.
		Sept. 20	28,500	3.5/lb.

132,200

84,200 Sept. 48,000 Apr.

84 200

III K	1992	15,800	3.8/lb.	Apr. 28
	1992	7,100	3.9/lb.	Sept. 2
	1993	~~15~~,900	2.7/lb.	Apr. 23
	1994	42,700	3.6	Sept. 12
	1995	45,900	3.6	Sept. 20

132,700

29,700 - April 2

103,000 Sept

GENERAL INTRODUCTION

This report details results of the 15 month creel survey of the Upper North Platte System (UNPS) conducted April 1995 through June 1996. Its purpose was to obtain estimates of angler pressure, catch and harvest by fishery. The information is critical in evaluating current fishery management practices, including fish stocking. This evaluation will help define management changes that will improve or maintain angler success while optimizing the use of hatchery fish.

The General Introduction includes: 1) a description of the UNPS, 2) an overview of the objectives of the North Platte River Comprehensive Fisheries Study, 3) history of the sport fisheries in the UNPS, 4) a description of the sport fish regulations at the time of the creel survey, 5) rationale for the use of coded-wire tags for this system-wide study, 6) a description of methods used to mark hatchery trout and recover coded-wire tags, 7) rationale for extending the creel survey from 12 months to 15 months, 8) criteria used to evaluate the success of the North Platte stocking program, 9) and a description of the format of subsequent chapters where we document angler characteristics, fishing pressure, catch and harvest of sport fish from the six major fisheries of the UNPS.

Description of the Upper North Platte System

The 15 month creel survey encompassed the UNPS from the Interstate 80 (I-80) crossing of the North Platte River near Sinclair, WY, to Robertson Road Bridge on the west side of the City of Casper (Figure 1). This includes three mainstem impoundments of Seminoe, Pathfinder, and Alcova that were constructed primarily for irrigation water storage, hydroelectric power production, and flood control. The North Platte River is classified as alkaline, hard, and relatively saline (Sartoris et al. 1981). Two smaller reservoirs, Kortes (downriver of Seminoe Reservoir) and Gray Reef (downriver of Alcova Reservoir) were not part of this study. Kortes Reservoir was built for hydropower generation and Gray Reef Reservoir is used as a regulatory facility to dampen water fluctuations associated with hydroelectric power production from Alcova Dam. Kortes Reservoir is typified by short retention times (approximately 2 days), while the elevation of Gray Reef Reservoir can fluctuate drastically on a daily basis; thus, significant fisheries have never been established in either water. River sections studied include the unregulated section from I-80 to Seminoe Reservoir (Upper River), the regulated tailwater between Kortes and Pathfinder Reservoir (Miracle Mile), and the regulated tailwater below Gray Reef Dam to Casper (Lower River).

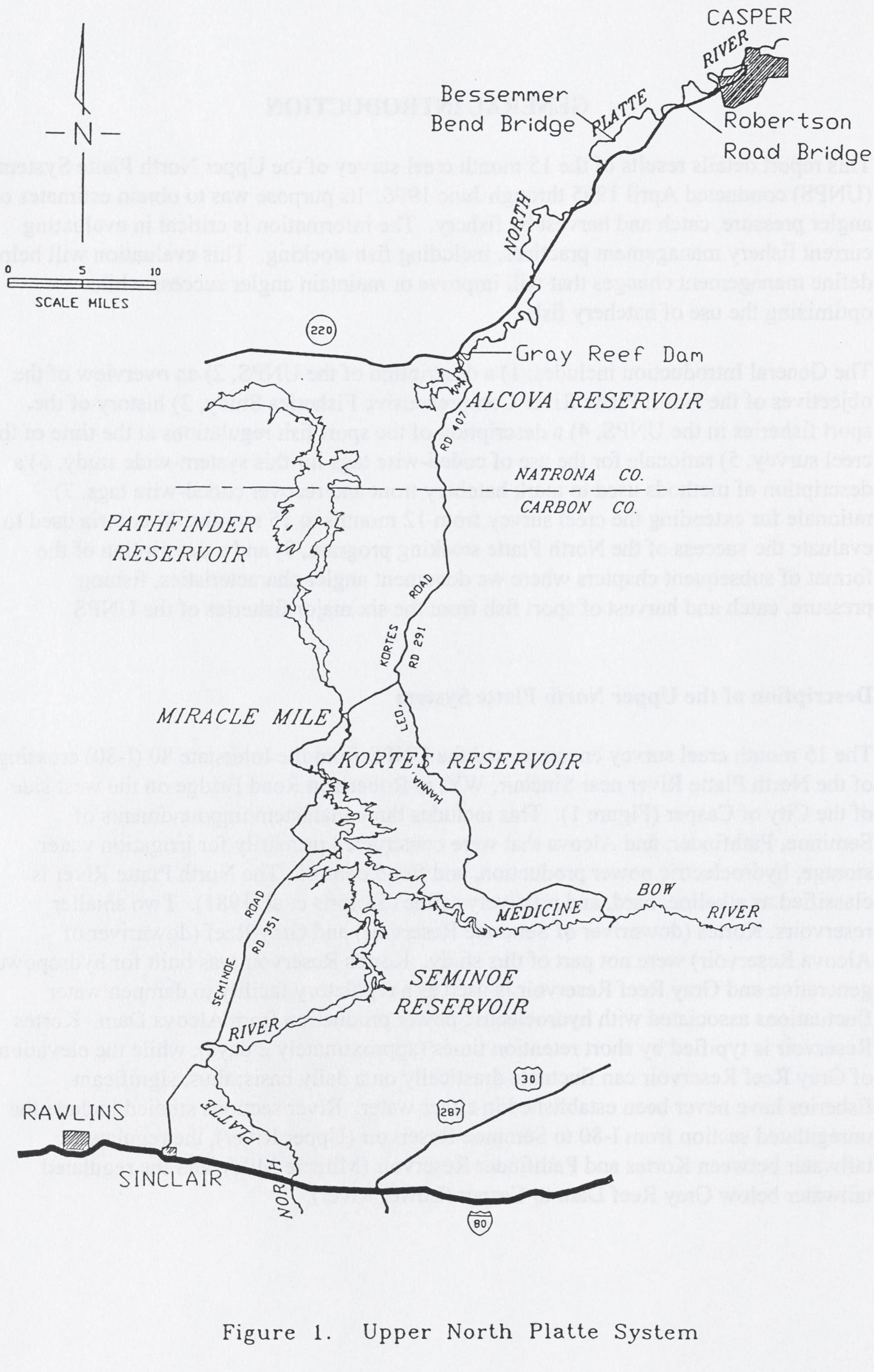


Figure 1. Upper North Platte System

Overview of the Objectives of the North Platte River Comprehensive Fisheries Study

Proximity to a major portion of Wyoming's population, as well as the State of Colorado, continues to place increased demands for fishing opportunities on the North Platte fisheries. It was anticipated that the invasion of walleye, and the subsequent change from stocking numerous fingerling trout to fewer catchables, would diminish the quality of trout fishing on the North Platte Reservoirs. The quality of trout fishing on the Lower River is declining owing to reductions in habitat for juvenile trout, suitable spawning areas (Wenzel 1993) and invertebrate production (Conder 1989) following increased sediment load in recent years.

In 1991, eight primary objectives of the North Platte Comprehensive Fisheries Study were identified and prioritized. Prioritized objectives (and specific questions to be addressed) included:

1) **Determine contribution of wild trout to each fishery.**
   - What proportion of the creel do wild fish constitute by fishery and by year?
   - What proportion of the fish captured in biological sampling by fishery and by year are wild?
2) **Evaluate species and strain contributions to each fishery.**
   - Which species and strains have the highest survival rates by fishery?
   - Which species and strains have the highest return to the creel by fishery?
3) **Refine trout stocking programs for best utilization of fish.**
   - What changes in stocking programs can be made to maximize creel return of hatchery fish?
   - Which species and strains should be targeted for a fishery to maximize returns?
4) **Determine contribution of drift and upstream migration to fisheries.**
   - What proportion of the fish that return to the creel in a fishery were stocked either downstream or upstream of that fishery?
   - What effect do changes in stocking programs of a fishery have on fisheries downstream or upstream?
5) **Evaluate size-at-stocking and survival/contribution to each fishery.**
   - Given production constraints, would stocking fewer large fish or small fish maximize creel returns?
6) **Culture experimentation.**
   - What measures can we take to produce fish more likely to survive in the wild?
7) **Evaluate fish distribution methods.**
   - Does dispersing hatchery fish in a receiving water result in higher survival and creel return rates? Is one fish distribution method more successful than others?

8) **Supplementary information we hope to obtain from this research.**
   - What role do anglers play in determining the numbers and size-structure of fish populations by fishery on the North Platte?
   - How do the configuration and operation of the respective dams in the study area influence drift?
   - At what level would the North Platte fisheries have to be stocked, to achieve Fish Division goals for angler success?

As was expected, time constraints limited which goals and questions would receive most attention. To date, goals 1, 2, 4, 5, and 7 have been emphasized. The results of the 15 month creel survey in concert with biological field collection of coded-wire tags will lead to fulfillment of Objective 3, "Refine trout stocking program for best utilization of fish".

History of the Sport Fisheries Management in the Upper North Platte System

Fish species composition in the North Platte Drainage began changing in the late 1800s with introductions of salmonids and carp (Wiley 1993). Within the drainage habitats could be characterized as "clear water" and "turbid water" (Baxter and Stone 1995). The clear-water habitats in the upper reaches of the drainage and foothill tributaries favored introduced salmonids. The mainstem North Platte River in the study area was probably a transition zone from the clear-water to turbid-water habitat. Prior to the salmonid introductions, native sauger, channel catfish and perhaps shovelnose sturgeon were the only sport species in the study area by today's definition (Baxter and Stone 1995).

The completion of Pathfinder Dam in 1909 marked the beginning of drastic changes in fish habitat in this river segment. The dam building period on the UNPS (1909 to 1961) transformed approximately 146.3 miles of river into 44,965 surfaces acres (at capacity) of reservoir (Seminoe, Kortes, Pathfinder, Alcova and Gray Reef reservoirs) and 53.8 miles of tailwater habitat (Miracle Mile and Gray Reef to Casper) all of which is cold water habitat. The stream reach from I-80 to Seminoe Reservoir (25.5 miles) is the only remaining unregulated river segment in the study area.

In 1955, the Wyoming Game and Fish Commission established a two-man reservoir crew to manage the North Platte Reservoirs (Wiley 1993). With this mission, early investigators used gillnets, creel checks, and limnological data to conduct the first fisheries study of the UNPS (Peterson and Leik 1956). Their conclusions and recommendations included: 1) all four reservoirs were suitable trout habitat, 2) trout in the reservoirs were healthy and in good condition, 3) an effort should be made to establish a migratory spawning run of rainbow trout in some of the tributaries to Pathfinder and Seminoe Reservoirs by stocking fish in these tributaries, and 4) fish be distributed in all reservoirs by boat.

Reservoir Management Program

Completion of Dan Speas Rearing Station in 1958 provided increased hatchery production for the UNPS and other waters in Wyoming. For example, between 1939 and 1957 during the first evolution of sport fishery management in the UNPS, Alcova Reservoir was stocked with an average of 45,500 fingerling trout per year. In the ten years following completion of Speas, Alcova Reservoir was stocked with an average of 553,500 fingerling trout per year. Over this same decade both angler days and trout harvest on Alcova Reservoir tripled (Peterson 1971). From 1958 to 1981, between 2.2 and 4.4 million fingerling trout, most of which were raised at Speas, were stocked into the North Platte Reservoirs of Seminoe, Pathfinder, and Alcova annually (WGFD, Fish Culture Completion Reports).

The first documented catch (1961) of a walleye in Seminoe Reservoir marked the start of the second evolution of sport fish management in the UNPS. Walleye in the UNPS were not stocked by the Wyoming Game and Fish Department, and the events that led to their invasion have never been fully determined. Three possibilities have been cited: 1) illegal transplants by anglers; 2) drift out of the upper North Platte River drainage in Colorado; or 3) escapement from the Como Bluff Fish Hatchery where walleye were hatched in 1960 and 1961. Any escapement from Como Bluff could have reached Seminoe Reservoir via Rock Creek and the Medicine Bow River (McMillan 1984).

An exhaustive study began on Seminoe Reservoir to develop a management approach that would maintain fishable trout populations with expanding walleye populations in the reservoirs. Management options ranged from no management, let nature run its course, to chemical eradication of walleye (McMillan 1984). A management plan of stocking larger but fewer trout and the introduction of additional forage species (emerald shiner and gizzard shad) was adopted. The change in management reversed the declining trend of the trout fishery and successfully maintained a good trout fishery in Seminoe Reservoir (McMillan 1984). As the walleye population expanded from Seminoe Reservoir (1961) to Pathfinder Reservoir (1976) then Alcova Reservoir (1985), the successful management program developed in Seminoe Reservoir was adopted for these reservoirs with the introduction of spottail shiner to the forage base in Pathfinder and Alcova reservoirs. Good trout fisheries were maintained in each reservoir, but not without costs.

Data from the 1974 stocking evaluation offers the best snapshot of the pre-walleye reservoir management. In 1974, 2.55 million fingerling trout were stocked in the 3 reservoirs (Table 1). Trout harvest was estimated at 343,915 with 165,178 angler days (WGFD, 1975 Progress Report). However, under the 1974 management program, the trout fishery in Seminoe Reservoir had already been severely impacted by the expanding walleye population (McMillan 1984). As management shifted from stocking fingerling to subcatchable, then catchable-sized trout for 3 large reservoirs, the demand for production (pounds) from the Culture Section increased dramatically (Table 1).

Table 1. Increasing the size of stocked trout to reduce walleye predation greatly increased the pounds of fish requested as walleye populations expanded to all 3 reservoirs.

Year	Number Requested	Pounds Requested	Comments
1974	2,550,000	29,000	Pre- walleye
1981	1,835,000	54,000	Seminoe Shift in Management
1982	1,280,000	72,000	Pathfinder Shift in Management
1988	520,000	95,000	Alcova Shift in Management
1992	390,000	130,000	Start of CWT

Increasing demand for larger fish is taxing the Culture System. Desire to improve the quality of hatchery product and the banning of prophylactic drugs for fish culture use has also impacted the hatchery production. The Fish Division is working to resolve the approaching shortages in hatchery capacity by developing an allocation process for the hatchery product.

The North Platte Comprehensive Fisheries Study began the third evolution of management for the UNPS reservoirs. Management has provided good trout fisheries in reservoirs with mature walleye populations. Future changes in management will be directed at meeting angler desires within the constraints of resources available to manage the reservoirs.

River Management Program

Dam construction not only greatly reduced the number of river miles, but also modified the tailwater habitat. The reservoirs reduced turbidity by acting as sediment traps, modified the hydrograph, and hypolimnetic releases cooled summer water temperatures. Releases from the dams reduced peak flows and augmented summer flows, but hydropower operations resulted in drastic fluctuations in releases. Tailwater releases were literally turned on and off based on irrigation and power demands.

Construction of Gray Reef Reservoir in 1961, and the agreement to a minimum release of 330 cfs in 1962, greatly enhanced habitat in the tailwater from Gray Reef to Casper. A Congressional Act in 1971, established a minimum instream flow of 500 cfs below Kortes Reservoir (Miracle Mile). Here too, establishing a minimum flow greatly enhanced the tailwater habitat.

Brown trout established wild populations in each river segment. Management efforts centered largely on the establishment and maintenance of rainbow and cutthroat trout strains in the river reaches to enhance angling and establish spawning runs from the reservoirs. Approximately 100,000 to 150,000 advanced fingerlings were requested annually for the Miracle Mile and the reach below Gray Reef. The reach above Seminoe Reservoir received about 50,000 sub-catchables annually.

Excellent fisheries developed in each reach, with the Miracle Mile and below Gray Reef classified as Blue Ribbon (Class 1; fisheries of national importance). The reach above Seminoe Reservoir is a Class 2 stream (fisheries of statewide importance). However, little was known about the source of trout recruitment into the fisheries. Previous studies had indicated considerable numbers of trout drifted downstream from the reservoirs into tailwater reaches. With changes in stocking programs in the reservoirs (larger fish but greatly reduced numbers), no information was available to assess potential impacts to the tailwater fisheries with the changes. The contribution from the river stocking programs and the contribution from wild trout were also largely unknown.

Description of the Sport Fish Regulations in Effect at the Time of the 1995-6 Creel Survey

During the open water portion of the creel survey, reservoir anglers were allowed to fish with two poles and had to abide by the statewide regulation of six trout in the daily creel or in possession, only one of which may exceed 20 inches. During ice-cover, the North Platte Reservoirs were included under the "Special Winter Ice Fishing Regulation"; anglers could fish legally with hand lines, set lines, poles, or tip-ups provided none used more than six lines and that each line had no more than one hook.

Regulations allowed anglers to harvest six walleye of any size in the daily creel or in possession on waters below Seminoe Dam. Anglers at Seminoe Reservoir and the river section from I-80 to Seminoe Reservoir could legally creel or possess up to 20 walleye of any size.

The statewide regulation for trout was also in effect on the river above Seminoe Reservoir to I-80, while anglers on the Miracle Mile were allowed to harvest two trout and only one of which could exceed 20 inches. The Miracle Mile was also closed to night fishing during the month of April. People fishing the Lower River from Gray Reef Dam to Bessemer Bend Bridge were allowed to harvest two trout, but only one over 20 inches. The statewide regulation was in effect downriver of Bessemer Bend Bridge to Casper.

Rationale for the Use of Coded-wire Tags

The six Upper North Platte fisheries are typically stocked with up to 30 unique strain/water combinations of trout annually. These groups include up to four strains of rainbow (Eagle Lake (ELR), Kamloops (KRB), Fall (FRB), and River Run (RRB)), two strains of Snake River cutthroat (Bar BC and Auburn), and brown trout (BNT). Studies in the 1970s indicated that fish were able to survive downstream movement through all of the dams. Trout marked and stocked into Seminoe Reservoir were recovered as far downstream as Glendo Reservoir (McMillan 1984). The successful completion of a long term study of hatchery trout survival and angling return on the North Platte System was predicated on the ability to identify when and where the trout were stocked into the system. Coded-wire tags (CWTs) were selected as the marking tool. CWTs have an advantage over mutilation clips in that thousands of different groups can be uniquely marked. If tags are properly placed in the snout, long-term retention can be extremely high (>98%, personal communication, Rodney Duke, Idaho Department of Fish and Game). Although tag retention can be excellent, it is difficult to inspect specimens and determine if they are tagged without the use of a hand held field detector. To educate anglers about the study, and to have the ability to quickly sort hatchery from wild trout, all trout receiving CWTs were adipose clipped.

Description of Methods to Mark Hatchery Trout and Recovery of Coded-Wire Tags

The vast majority of fish for the North Platte System were marked at Speas Rearing Station in a custom built coded-wire tag trailer. The tag trailer was designed by Steve Gnagy, former Hatchery Superintendent at Speas. The trailer frame and shell were constructed by Custom Fiberglass of Casper. A furnace/AC unit allowed workers to comfortably mark fish throughout the year. Generally, fish stocked into the UNPS reservoirs at catchable-size in spring were tagged during the preceding fall and winter. Fish stocked into the river sections during June and July, and fall reservoir stocks were marked during the preceding April and May. In 1995 and 1996, a limited number of trout was marked at Clarks Fork Hatchery north of Cody. At Clarks Fork, fish were brought into the hatchery building and marked at temporary work stations.

At Speas, trout were carried into the tag trailer by net and held in a large tank near the rear of the trailer. The holding tank safely supported up to 400 pounds of trout. Fish were moved as needed from the holding tank to a marking trough so they were easily accessible to fish markers. Fifty to 100 fish at a time were anesthetized in a MS-222 bath. Once sedated, fish were given an adipose fin clip and a coded-wire tag was injected into their snout with Northwest Marine Technology (NMT) Mark IV tag injectors. Fish were then passed through a NMT Quality Control Device (QCD) to validate that the fish was marked. Tagged fish left the trailer to a raceway through a 4 inch diameter Plexiglas tube. Unmarked fish were passed through the QCD a second time and, if necessary, re-tagged. The number of fish tagged was recorded for each strain/water combination (group).

Each group of fish received a unique batch mark. CWTs are 1.1 mm long, 0.25 mm in diameter, and carry four data words or numbers. The first word, or master, is a template for decoding the remaining words. The second carries information about the location and year the group was stocked. The third, or agency code, was assigned by NMT as 17. The fourth word was used to identify the specific group number assigned to the fish by the hatchery system and the exact date of stocking. Information about the numbers, and location of stocking was stored in a database.

At least 30 days after tagging, a random sample of fish was checked for tag retention. Samples of 200 fish allowed estimation of retention rates within a 3% margin of error ($\propto = 0.05$). Retention rates generally exceeded 95%.

Number and pounds of fish stocked was estimated at the time of stocking. Fish distribution trucks were weighed to the nearest 10 pounds before and after fish were loaded. Fish were loaded by the use of a fish pump The number of fish per pound was sampled two or three times per raceway to derive a mean before loading.

Tag recovery required snouts from adipose clipped fish to be removed, placed in numbered plastic bags and frozen. Information on recovery location, date of recovery, type of recovery (biological method or boat, bank, or ice angling) and fish length were recorded on field sheets. Field data were entered into a database, and records for 20 trout were printed to create a recovery form. Eventually, numbered plastic bags were stapled to the appropriate Recovery form and transported to the Wyoming Game and Fish Lab in Laramie, where tags were excised and decoded. Satake (1996) describes lab processes for handling coded-wire tags.

Once excised and decoded, coded-wire tags were taped to the appropriate Recovery sheet. Originals were filed at the lab, while photocopies were mailed to Casper where the data were entered into a database. Once the tag code, recovery location and date had been entered, the database performed error checks to identify if the recovery location and date were possible. Tags indicating trout recovered prior to release, or upstream of a dam, were reread to insure data integrity.

Rationale for Extending the Creel Survey from 12 months to 15 months

The spring of 1995 was one of the coldest and wettest springs on record for central Wyoming (Table 2A). During May the Casper airport received 6.3 inches of precipitation and had a monthly high mean temperature of 59.1° F, nearly 4 inches above and 7° below normal, respectively. These figures represent the second coldest and wettest May on record since 1949. At the Rawlins airport, May 1995 was the coldest and wettest on record since 1951, while June 1995 was the wettest and third coldest (Wyoming Water Resources Center, unpublished data).

Table 2. Historical weather data for Spring (**A**) 1995 and (**B**) 1996.

	Casper Airport (48 yrs on record)		Rawlins Airport (46 yrs on record)	
A	Precipitation	Mean High Temp.	Precipitation	Mean High Temp.
April 1995	14th wettest	13th coldest	16th wettest	20th coldest
May 1995	2nd wettest	2nd coldest	1st wettest	1st coldest
June 1995	5th wettest	6th coldest	1st wettest	3rd coldest
B				
April 1996	13th wettest	27th coldest	7th wettest	34th coldest
May 1996	33rd wettest	15th coldest	3rd wettest	21st coldest
June 1996	30th wettest	40th coldest	34th wettest	41st coldest

This unseasonably cold and wet spring led to concern over how weather may have influenced angler behavior and success. Angling success on the Lower River may have been poor owing to abnormally high flows and turbid conditions of the river. The creel survey was extended through June 1996 to obtain estimates of fishing effort and success during a spring when climatic conditions approximated the long-term averages for rainfall and temperature.

During April-June 1996, both regional precipitation and mean high temperatures were near normal (Table 2B). The three month extension of the creel survey appears to have included more "normal" spring climatic conditions.

Criteria Used to Evaluate the Success of the North Platte Stocking Program

Catchable-size trout are stocked into the North Platte Reservoirs to avoid walleye predation, not necessarily for immediate harvest. By virtue of their large size (~9 inches), some anglers harvested them immediately after stocking. Thus, the decision was made to evaluate the NPR stocking programs using statewide criteria for fisheries managed both under the "Put & Take" and "Basic Yield" fisheries management concepts. Since coded-wire tags can be used to partition the creel derived estimates of annual harvest and catch to strain, the determination of success was defined *a priori* at the strain level for each fishery investigated.

Four criteria were defined and prioritized as follows:

1) At least 50% of the catchable-size trout stocked must be harvested by anglers
2) At least 100% of the weight of catchable, sub-catchable, and advanced fingerling trout stocked must be harvested by anglers
3) At least 50% of the catchable-size trout stocked must be caught (harvested + released) by anglers, and
4) At least 100% of the weight of catchable, sub-catchable, and advanced fingerling trout stocked must be caught by anglers.

A particular strain must exceed at least one of the above criteria to be considered a successful stocking. Because creel surveys provide only estimates of catch and not absolute numbers, stocks that fall short but are within 10% of criteria were also considered successful. It is recommended that stocks that fail to meet one of the four criteria be discontinued, but exceptions can be made following written justification and subsequent approval by Fish Administration.

Description of the Format of Subsequent Chapters

This report will be structured in a chapter format. Each chapter will represent a specific water (e.g., Alcova Reservoir). General Methods will apply to each chapter unless exceptions are explained in chapter Methods sections. A General Discussion section will conclude the report.

GENERAL METHODS

A 15 month (April 1995 - June 1996) stratified random two-stage creel survey yielded estimates of angler catch and effort. Eight randomly selected days, split into four weekdays and four weekend days (holidays were excluded from the pool of potential days) were sampled April through October on all waters. During the period from November to March, four randomly selected days split into two weekdays and two weekend days were sampled.

The creel survey was two parts, conducted simultaneously. Part 1 consisted of instantaneous angler counts from an airplane on all waters. In addition to the pilot, a creel clerk was present in the plane to count anglers. Aerial counts were made each scheduled sampling day the ground clerks were out, with the exception of days when the plane could not fly due to weather or mechanical problems. Instantaneous angler counts were conducted twice daily in random starting directions (north to south or vice versa), at random starting times between sunrise and sunset. Anglers were classified as either boat or bank anglers and only boats that appeared to the clerk to be fishing were counted; recreational boats were not counted.

Part 2 consisted of creel clerks on the ground who contacted anglers. These clerks typically covered up to two waters due to personnel shortages. The majority of the interviews were from the six major waters. Number of anglers in each boat was recorded by ground clerks to estimate the average number of anglers per boat. During angler interviews, clerks collected information on hours fished, completed trip (yes or no), bank or boat angling, number of poles, residency, terminal tackle, species sought, number and species of fish harvested and released, and length and mark of harvested fish. Snouts were removed from adipose-clipped trout and placed in numbered bags for retrieval of CWTs. Index Counts were also recorded for each water at specific locations and times for use in correlating counts and pressure. Analysis of Index Counts will be addressed in a future report.

Given the scope of the creel survey and the amount of anticipated data, detailed information on angler residency, nongame fish and recreational use of the resource was not collected. Anglers were classified as either resident (possessing a resident license) or nonresident. Information on recreational use of the resource, other than angling, was not recorded. If a fishing tournament was being conducted on a scheduled creel day, clerks were instructed to continue randomly sampling anglers and rather than concentrating solely on tournament anglers.

Each reservoir and river portion was divided into sections. All sections were counted by the aerial clerk twice each sampling day. Ground clerks recorded sections that anglers fished during the interview.

The 30 year mean was used as the average surface acres for all per acre calculations for the three main reservoirs. Average acres for the river sections were calculated using historical width and length measurements.

Past creel data showed significant ice fishing pressure on Alcova (Peterson 1986). During the 1995-6 survey, ice conditions were poor and during the short periods when ice was safe to fish, very cold temperatures and strong winds contributed to low angling pressure. In winter months, many sample days found ice and bank anglers fishing different sections of the reservoir. The clerk doing instantaneous counts from the airplane could not always distinguish between ice and bank anglers. Since the ice component was very small, ice anglers were classified as bank anglers for estimates of pressure and catch. Data for ice anglers is available from interview summaries and limited information will be presented within chapters.

Creel clerks did not record fish weights during surveys. Total weight of the catch was determined using biological information (gill nets, purse seine and electrofishing) collected during the creel survey to derive length-weight relationships. Regression equations specific to strain (where sample sizes allowed) and body of water were developed. This average weight was used to estimate total pounds caught and harvested by strain by water.

To simplify the analysis of strain performance with respect to each water, stocked trout were combined into groups. These groupings were generally defined at the strain level across time. For example, performance of Eagle Lake rainbow stocked into Pathfinder between 1992 and 1995 was evaluated as one group, and not year specific. Every attempt was made to keep these groups consistent across waters. However, because trout in some waters generally return to anglers more quickly than others, some inconsistencies across waters were inevitable. Small sample size of tag returns played a minor role in group delineation. For some waters we define an "Other Waters" category, which typically included tag returns of fish stocked upstream or downstream of the water of interest. A thorough description of defined groups is found in the Results section of each chapter.

Terms which were used throughout the body of the report include: total catch, harvest, RBT AD, and 12 month average. Total catch refers to all the fish estimated caught (harvested + released). Kept fish were harvested and AD refers to an adipose clip indicating a stocked fish. Average annual creel statistics were based on a mean of the first 12 months (April 1995 - March 1996) and the last 12 months (July 1995 - June 1996) The 12 month average was used to facilitate the comparison to annual stocking and other creel surveys.

For all statistical analyses, an alpha (α) of 0.05 (95%) was used to determine statistical significance.

Alcova Reservoir

INTRODUCTION

Alcova Reservoir, located 29 miles southwest of the City of Casper, was impounded by Alcova Dam on the North Platte River in 1938 (Figure A1). Electric power generation facilities were added in 1955. At capacity, the reservoir has a surface area of 2,470 acres and a mean depth of 79 feet. It is characterized by a steep-sided shoreline with relatively small littoral zone and limited rooted macrophytes.

Alcova Reservoir is maintained at stable levels during the summer to deliver water to the Casper Canal for irrigation (Figure A2). Primary inflow comes from Pathfinder Reservoir via a tunnel through the Fremont Canyon Power Stock at the upstream end of the reservoir. The water level is lowered about 10 vertical feet during the non-irrigation season to prevent ice damage to the canal inlet and boat dock facilities.

Non-fishing recreational use including water-skiing, pleasure boating, swimming and jet skiing is heavy in the warm summer months. Fishing use is heavy, likely due to the proximity to Casper, easy access and well-developed recreational facilities.

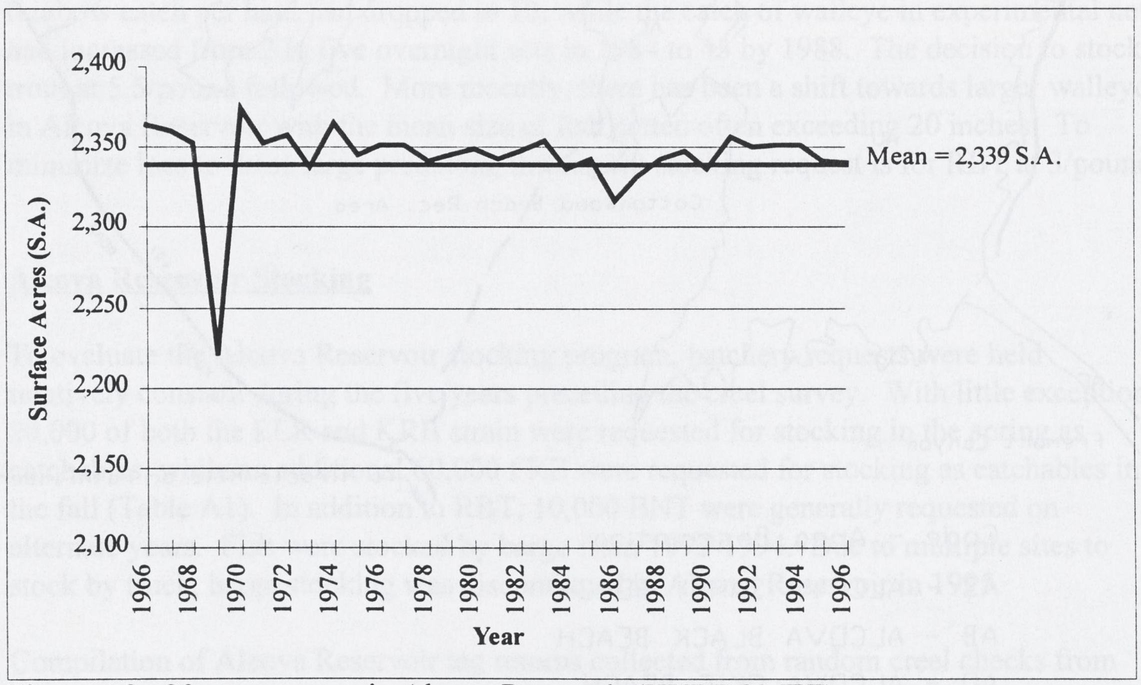
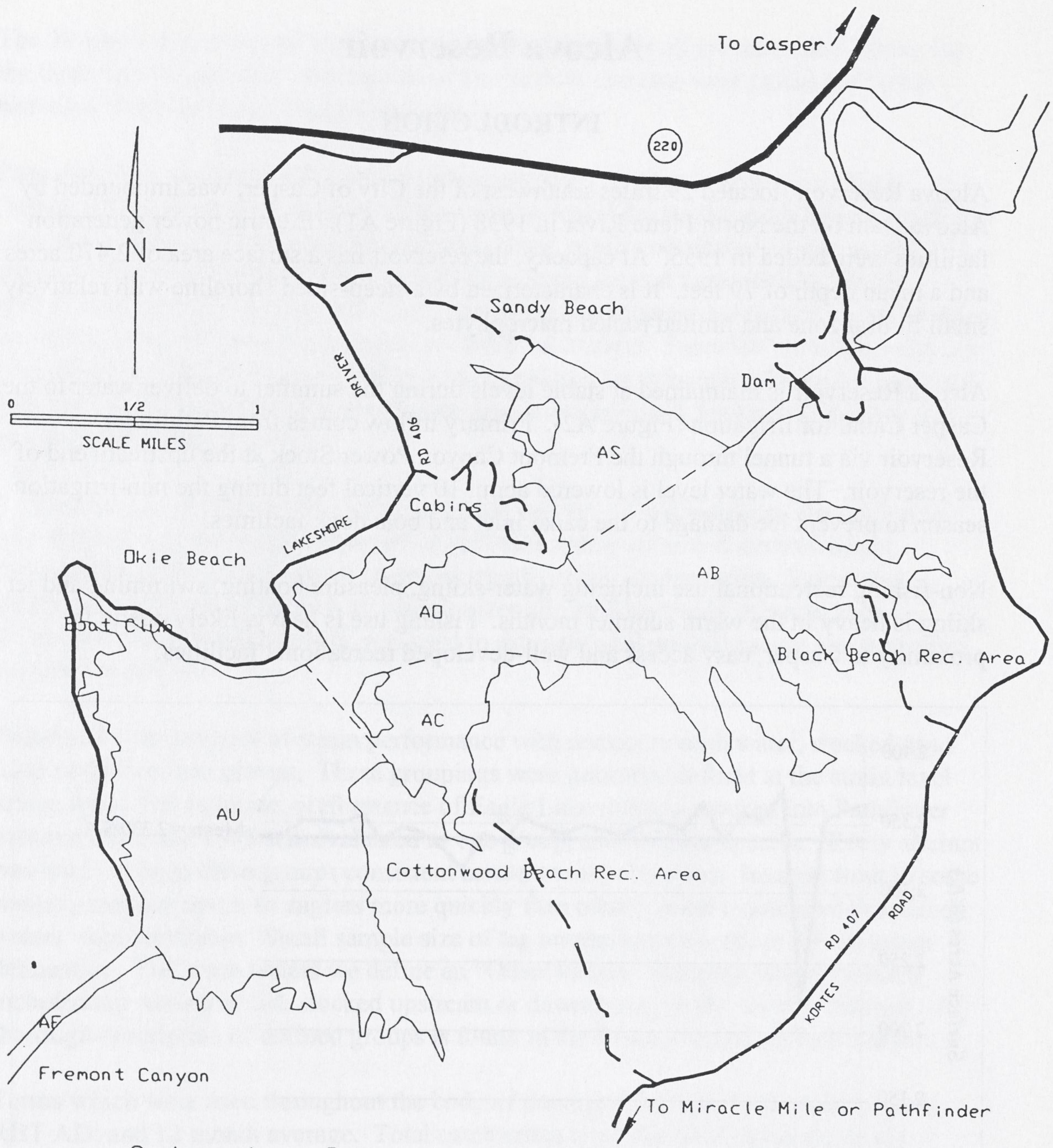


Figure A2. 30 year storage in Alcova Reservoir (HYDROMET).

History of Alcova Reservoir

Alcova Reservoir, because of its close proximity to Casper, has always been managed as a basic yield rainbow trout fishery. Creel surveys conducted every three years from the



Code - Area Description

AS - ALCOVA SANDY BEACH

AB - ALCOVA BLACK BEACH

AO - ALCOVA OKIE BEACH

AC - ALCOVA COTTONWOOD BEACH

AU - ALCOVA UPPER END

AF - ALCOVA FREMONT CANYON

Figure A1. Alcova Reservoir

late 1950s through the 1960s indicated that the number of trout caught increased rapidly from 13,600 in 1956 to an average of 103,000 between 1959 and 1968 (Peterson 1971). Increasing angler catch coincided with completion of Speas Rearing Station and subsequent 10 to 15 fold increase in densities of advanced fingerling trout stocked. Between 1974 and 1984, 800,000 advanced fingerling trout were scheduled for stocking annually. A 12-month creel survey conducted in 1984-5 estimated 31,850 anglers fished 103,109 hours and caught 73,107 trout (Peterson 1986).

During the 1970s and early 1980s, a 60 foot deep purse seine was used to monitor the rainbow trout population in Alcova Reservoir. During this period catches of rainbow trout of over 100 fish per haul at ten standardized sites were common (Wyoming Game and Fish Department, unpublished data). The invasion of walleye would forever change what had come to be called a “fast family fishery”. Reports of walleye (WAE) in Alcova Reservoir were rare until an extended and uncontrolled spill of Pathfinder in 1985. By 1985, fisheries biologists believed walleye had increased substantially. By 1985, the catch of rainbow trout in 10 standardized purse seine sites had dropped to 50 trout per haul. In 1987 the stocking program was altered from 500,000 subcatchable size trout (88/pound) to 450,000 (50/pound) and 50,000 at 5.5/pound. Purse seining in October 1987 indicated that the vast majority of trout captured (95%) were carry-over trout and catchable stocks outnumbered sub-catchable stocks 11.1 to 1 (n = 27). By 1988, the rainbow catch per haul had dropped to 10, while the catch of walleye in experimental nets had increased from 2 in five overnight sets in 1984 to 43 by 1988. The decision to stock trout at 5.5/pound followed. More recently, there has been a shift towards larger walleye in Alcova Reservoir with the mean size of fish netted often exceeding 20 inches. To minimize loss to these large predators, the current stocking request is for RBT at 3/pound.

Alcova Reservoir Stocking

To evaluate the Alcova Reservoir stocking program, hatchery requests were held relatively constant during the five years preceding the creel survey. With little exception, 20,000 of both the ELR and KRB strain were requested for stocking in the spring as catchables, while an additional 60,000 FRB were requested for stocking as catchables in the fall (Table A1). In addition to RBT, 10,000 BNT were generally requested on alternate years. Fish were stocked by barge from 1992-1994. Due to multiple sites to stock by truck, barge stocking was discontinued in Alcova Reservoir in 1995.

Compilation of Alcova Reservoir tag returns collected from random creel checks from 1992 through 1994 suggests that 90% of the rainbow harvested in the reservoir at any given time were stocked within the previous two years (WGFD, 1994 Progress Report). We limited our analysis of strain performance to 1994 and 1995 fish since we assumed

Table A1. Number of trout stocked into Alcova Reservoir prior to and during the 15 month programmed creel survey.

Species/ Strain	Stock Date	Pounds Stocked	Number/ Pound	Number Stocked	Tag Retention	Number Stocked w/ Tags
ELR	92/04/01[1]	5,716	3.6	20,600	91.7	18,900
	92/08/26[1]	2,735	2.9	7,900	83.5	6,600
	93/04/20[1]	7,239	2.9	21,000	95.9	20,100
	93/10/05[1]	3,825	2.5	9,600	69.8	6,700
	94/04/19[3]	8,087	2.3	18,600	97.3	18,100
	94/04/19[5]	1,436	13.5	19,400	92.8	18,000
	95/03/17[3]	5,110	3.1	15,800	99.2	15,700
	95/03/17[6]	4,070	5.0	20,400	97.0	19,700
	96/04/09[7]	2,870	3.4	9,800	93.5	9,100
Sub-Total		41,088		143,100	92.9	132,900
KRB	92/04/08[1]	4,755	4.2	20,000	96.6	19,300
	92/08/01&26[1]	4,820	3.9	18,800	96.5	18,100
	93/04/20[1]	4,875	3.1	15,100	94.8	14,300
	93/10/27[1]	1,610	2.2	3,500	76.4	2,700
	94/04/19[2]	5,601	2.4	13,400	97.0	13,000
	94/04/19[5]	1,975	10.5	20,700	94.0	19,500
	95/03/21[2]	6,480	3.0	19,400	99.6	19,300
	95/03/14[6]	3,924	4.8	18,800	94.9	17,900
	96/04/09[7]	6,474	3.8	24,300	98.5	24,000
Sub-Total		40,514		154,000	92.9	148,100
FRB	92/10/08[1]	14,280	3.2	45,700	98.5	45,000
	93/10/05[1]	12,399	2.8	34,700	92.2	32,000
	94/09/15[4]	16,674	3.4	56,900	98.5	56,000
	95/09/22[4]	12,170	3.9	47,800	96.4	46,100
Sub-Total		55,523		185,100	96.8	179,100
BNT	92/08/26	3,745	2.6	9,700	86.5	8,400
	93/04/20	2,905	3.0	8,700	90.2	7,900
	95/09/22	1,530	4.8	7,300	95.0	7,000
Sub-Total		8,180		25,700	90.7	23,300
Grand Total		145,300		507,900	95.2	483,400

[1]- 92&93 (All Strains)
[2]- 94&95 KRB Catchable
[3]- 94&95 ELR Catchable
[4]- 94&95 FRB Catchable
[5]- 94 Sub-Catchable
[6]- 95 Large Sub-Catchable
[7]- 96 (All Strains)

most of the fish stocked prior to 1994 were no longer in the reservoir. Thus, the evaluation of strain performance of catchable rainbow was made by comparing estimates of annual catch from the creel survey to the average pounds and numbers of catchable ELR, KRB, and FRB stocked in 1994 and 1995. Between 1994 and 1995, Alcova Reservoir was stocked with an average of 86,000 catchable-size rainbow trout, or 27,000 pounds per year. Assuming a 30-year mean surface area of 2,339 acres (Figure A2), 36.8 catchable rainbow trout (11.5 pounds) were stocked per acre per year. An average of 52,400 FRB (61% of the total), 17,200 ELR (20%) and 16,400 KRB (19%) were stocked annually. In addition to rainbow trout, 6,400 BNT per year (2.7 per acre) were also stocked.

During the spring of 1994 and 1995 different sizes of both ELR and KRB were stocked to evaluate size at stocking of large sub-catchable and sub-catchable trout (Table A2). The Results section of this report refers to the smaller ELR and KRB stocked in 1994 and 1995 as Sub-Catchables and Large Sub-Catchables, respectively. Discussion of performance of these groups will be covered in a future Size at Stocking report.

Table A2. Stocked fish making up the Size at Stocking Study in Alcova Reservoir.

Strain	Stocking Date	Number Stocked	Number per Pound	Pounds Stocked	Average Length (in.)
ELR	94/04/19[5]	19,400	13.5	1,436	5.5
KRB	94/04/19[5]	20,700	10.5	1,975	5.9
ELR	95/03/17[6]	20,400	5.0	4,070	7.3
KRB	95/03/14[6]	18,800	4.8	3,924	8.0

[5]- 94 Sub-Catchables

[6]- 95 Large Sub-Catchables

METHODS

Methods for Alcova are similar to the General Methods with the exception of boat pressure in the canyon section. The Fremont Canyon (Figure A1) section at the upper end of Alcova is characterized by steep-sided canyons rising up to 250 feet above the water surface. This topography makes for unpredictable wind currents in and above the canyon section. Due to the unpredictability of the winds, the creel plane could not fly low enough for the clerk to discriminate between fishing boats and recreational boats, therefore, all boats in the canyon section were counted. Average number of anglers per boat for Alcova was used to determine the number of boat anglers in the canyon section.

Biological (gill net and purse seine) data collected during the creel survey were used to establish length-weight relationships specific to Alcova Reservoir. The equations for rainbow trout strains and brown trout are:

FRB- weight = exp((2.273720389*length) - 6.01620596) ($R^2 = 0.77$).
KRB- weight = exp((2.827052527*length) - 7.496534189) ($R^2 = 0.94$).
ELR- weight = exp((2.899413731*length) - 7.69184468) ($R^2 = 0.90$).
BNT- weight = exp((3.040808747*length) - 7.885367759) ($R^2 = 0.75$).

These equations were applied to the respective strain group/species measured by a creel clerk. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and total pounds caught.

RESULTS

Angler Information

Creel clerks interviewed 3,565 anglers at Alcova Reservoir. Of these, 3,244 (91%) were Wyoming residents while 321 (9%) were nonresidents. Anglers were asked about terminal tackle they were using when contacted (Table A3). The majority of anglers used solely bait (69.9%) with lure anglers making up the next largest group (14.1%) followed closely by anglers using both bait and lures (13.7%).

Table A3. Terminal tackle employed by Alcova Reservoir anglers.

Terminal Tackle	All Anglers Number	%	Bank %	Boat %	Ice %
Bait	2,491	69.9	86.3	22.1	100.0
Lures	503	14.1	4.5	41.8	0.0
Bait and Lures	487	13.7	7.1	32.9	0.0
Bait and Flies	40	1.1	1.6	0.0	0.0
Bait, Flies and Lures	23	0.6	0.3	1.6	0.0
Flies	11	0.3	0.2	0.6	0.0
Flies and Lures	10	0.3	<0.1	1.0	0.0

Of the 82% of anglers who stated a species preference, 86.5% were targeting any trout species, 7.5% targeted trout and walleye and 6% were fishing for walleye.

The majority of anglers used only one pole (78%) rather than the allowable maximum of two (21%) (Table A4). The remaining 1% is made up of ice anglers during the special ice regulation season where anglers could use up to six poles. Bank and ice anglers harvested a higher proportion of their catch than boat anglers. Boat anglers harvested the most fish per angler followed by ice, then bank anglers.

Table A4. Angler characteristics on Alcova Reservoir (completed trips only).

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Bank	816	1 - 76% 2 - 24% Avg.=1.24	83%- Harv. 17%- Rel.	1.06
Boat	711	1 - 87% 2 - 13% Avg.=1.13	70%- Harv. 30%- Rel.	1.23
Ice	37	1 - 14% 2 - 23% 3 - 27% 4 - 11% 5 - 2% 6 - 23% Avg.=3.33	95%- Harv. 5%- Rel.	1.19

Over half of all anglers were able to catch at least one trout and only 4% were able to harvest their limit (Table A5). Rainbow trout made up the majority (97%) of the total trout catch. Anglers were far less successful catching walleye. Only 1% of all anglers were able to catch at least one walleye.

Table A5. Percentage of anglers who harvested/caught 0 fish, at least 1 fish, at least 2 fish, etc. in Alcova Reservoir (completed trips only) (TRT = all trout, ALL = all game fish).

		Number of Fish						
		0	≥1	≥2	≥3	≥4	≥5	≥6
TRT	Harvest	57%	43%	28%	19%	11%	7%	4%
	Catch	50%	50%	33%	23%	14%	10%	6%
WAE	Harvest	99%	1%	1%	1%	<1%	<1%	0%
	Catch	99%	1%	1%	1%	<1%	<1%	0%
ALL	Harvest	56%	44%	29%	19%	11%	7%	5%
	Catch	49%	51%	34%	23%	15%	10%	7%

Pressure

From April 1995 through June 1996, we estimated that 68,782 anglers (Table A6) fished 229,198 hours (Table A7). More anglers fished from the bank (65%) than by boat (35%). On an annual basis, we estimated 49,539 anglers fished 162,575 hours. This yields annual estimates of 21.2 anglers/acre and 69.5 hours/acre. Bank anglers (102,031 hours) fished significantly more ($p<0.01$) hours than boat anglers (60,544 hours).

Table A6. Alcova Reservoir- estimated number of anglers and anglers/acre.

	Bank	/acre	Boat	/acre	All	/acre
April	3,007	1.3	1,089	0.5	4,096	1.8
May	5,234	2.2	2,769	1.2	8,003	3.4
June	5,001	2.1	3,574	1.5	8,575	3.7
July	5,660	2.4	3,998	1.7	9,658	4.1
August	2,788	1.2	2,152	0.9	4,940	2.1
September	1,810	0.8	780	0.3	2,590	1.1
October	2,603	1.1	400	0.2	3,003	1.3
November	3,900	1.7	216	0.1	4,116	1.8
December	593	0.3	48	0.0	641	0.3
January	543	0.2	0	0.0	543	0.2
February	370	0.2	0	0.0	370	0.2
March	3,369	1.4	1,067	0.5	4,436	1.9
April	3,304	1.4	1,157	0.5	4,462	1.9
May	2,987	1.3	2,536	1.1	5,523	2.4
June	3,268	1.4	4,559	1.9	7,828	3.3
15 Month Total	44,437	19.0	24,345	10.4	68,782	29.4
Average 12 Months	33,036	14.1	16,503	7.1	49,539	21.2

Total fishing pressure (bank + boat) was generally high from May through August, then dropped slightly during September and October. Pressure increased in November, then decreased dramatically from December through February with the onset of the cold winter months (Table A7).

Table A7. Alcova Reservoir- estimated pressure (angler hours) for bank, boat and all anglers and hours/acre.

	Bank Hours	/acre	Boat Hours	/acre	All Anglers	/acre
April	6,283	2.7	4,894	2.1	11,178	4.8
May	18,968	8.1	11,094	4.7	30,061	12.9
June	16,529	7.1	12,973	5.5	29,502	12.6
July	17,393	7.4	11,510	4.9	28,902	12.4
August	8,233	3.5	7,291	3.1	15,524	6.6
September	6,438	2.8	3,643	1.6	10,082	4.3
October	9,559	4.1	1,566	0.7	11,126	4.8
November	11,408	4.9	717	0.3	12,124	5.2
December	1,591	0.7	225	0.1	1,816	0.8
January	2,167	0.9	0	0.0	2,167	0.9
February	1,811	0.8	0	0.0	1,811	0.8
March	7,275	3.1	5,126	2.2	12,401	5.3
April	10,143	4.3	4,529	1.9	14,672	6.3
May	9,340	4.0	10,656	4.6	19,997	8.5
June	11,049	4.7	16,787	7.2	27,836	11.9
15 Month Total	138,187	59.1	91,011	38.9	229,198	98.0
Average 12 Months	102,031	43.6	60,544	25.9	162,575	69.5

There was no statistical difference ($p = 0.11$) between total hours fished during the weekdays verses weekend days (Table A8).

Table A8. Pressure (hours fished) during weekdays (WD) and weekend days (WE) at Alcova Reservoir.

	Total WD	Total WE
15 Months	106,133	123,065
12 Month Average	75,411	87,165

An annual estimate of trip length for all anglers was 3.28 hours. Boat trips were longer (3.67 hrs) on average than bank trips (3.09 hrs).

Catch Rates

Catch rates peaked for both bank and boat anglers in October and November (Table A9). The lowest catch rates occurred in the winter months, December through February. Combining both bank and boat anglers yields a mean annual catch rate of 0.48 fish/hour.

Table A9. Catch rates (fish per hour, all species combined) for bank, boat and all anglers at Alcova Reservoir.

	Bank	Boat	All
April	0.47	0.59	0.53
May	0.53	0.77	0.62
June	0.34	0.56	0.44
July	0.32	0.46	0.37
August	0.30	0.42	0.35
September	0.25	0.37	0.29
October	0.86	3.04	1.23
November	1.20	0.72	1.20
December	0.44	0.00	0.39
January	0.29	0.00	0.29
February	0.15	0.00	0.15
March	0.27	0.42	0.34
April	0.06	0.14	0.08
May	0.15	0.31	0.23
June	0.13	0.48	0.34
15 Months	0.41	0.53	0.46
12 Month Average	0.44	0.54	0.48

Catch and Harvest

The estimated annual total catch was 77,853 fish (Table A10). Bank and boat anglers accounted for 58% and 42% of the total catch, respectively. Total estimated harvest was 55,209 (Table A11)

RBT AD

Stocked rainbow trout (RBT AD) made up over 92% of the total catch (Table A10). The mean size of RBT AD harvested from Alcova Reservoir was 13.0 inches (Figure A3A) with lengths ranging from 7.0 to 19.6 inches. The majority (71%) of the RBT AD caught were harvested (Table A11). Bank anglers harvested a higher proportion (77%) of RBT AD than boat anglers (62%). Annual catch rates for RBT AD were 0.44/hr and 30.8/acre.

BNT, WAE, SRC & RBT

Brown trout and walleye represented a small proportion of the total catch (2.9%) (Table A10). The mean size for harvested brown trout and walleye was 16.4 inches and 16.7 inches, respectively (Figure A3B). The largest walleye measured by a creel clerk was slightly larger (26 inches) than the largest brown trout (24 inches). Over 53% of the brown trout that were caught were released (Table A11). Walleye were rarely released with 92% of the catch harvested. All 83 of the SRC caught in Alcova were stocked upstream in Pathfinder Reservoir. No SRC are currently stocked in Alcova. Rainbow trout without an adipose clip (RBT) made up less than 5% of the total catch.

Table A10. Annual total catch by species at Alcova Reservoir.

Species	Bank Catch	%	Boat Catch	%	Total Catch	%
RBT AD	42,731	94.7	29,243	89.4	71,974	92.5
RBT	1,551	3.4	1,899	5.8	3,450	4.4
BNT AD	142	0.3	46	0.1	188	0.2
BNT	328	0.7	681	2.1	1,009	1.3
SRC AD	20	< 0.1	33	0.1	53	0.1
SRC	29	< 0.1	54	0.2	83	0.1
WAE	322	0.7	774	2.4	1,096	1.4
Total Catch	45,123	100.0	32,730	100.0	77,853	100.0

Table A11. Annual harvest, release, total catch and catch/acre by bank, boat and all anglers for Alcova Reservoir.

Species	Angler Type	Harvest	%	Released	%	Total Catch	Catch/Acre
RBT AD	Bank Anglers	33,060	77.4	9,671	22.6	42,731	18.3
	Boat Anglers	18,092	61.9	11,151	38.1	29,243	12.5
	All Anglers	51,152	71.1	20,822	28.9	71,974	30.8
RBT	Bank Anglers	1,177	75.9	374	24.1	1,551	0.7
	Boat Anglers	1,239	65.3	659	34.7	1,899	0.8
	All Anglers	2,416	70.0	1,034	30.0	3,450	1.5
BNT AD	Bank Anglers	141	99.3	1	0.7	142	0.1
	Boat Anglers	42	91.3	4	8.7	46	<0.1
	All Anglers	183	97.3	5	2.7	188	0.1
BNT	Bank Anglers	153	46.7	175	53.3	328	0.1
	Boat Anglers	226	33.2	455	66.8	681	0.3
	All Anglers	379	37.6	630	62.4	1,009	0.4
SRC AD	Bank Anglers	13	65.0	7	35.0	20	<0.1
	Boat Anglers	21	63.6	12	36.4	33	<0.1
	All Anglers	34	64.2	19	35.8	53	<0.1
SRC	Bank Anglers	13	44.8	16	55.2	29	<0.1
	Boat Anglers	26	48.2	29	53.7	54	<0.1
	All Anglers	39	46.9	45	54.1	83	<0.1
WAE	Bank Anglers	299	92.9	23	7.1	322	0.1
	Boat Anglers	709	91.6	65	8.4	774	0.3
	All Anglers	1,008	92.0	88	8.0	1,096	0.5
Annual Totals							
	Bank Anglers	34,856	77.2	10,267	22.8	45,123	19.3
	Boat Anglers	20,355	62.2	12,375	37.8	32,730	14.0
	All Anglers	55,211	70.9	22,643	29.1	77,853	33.3

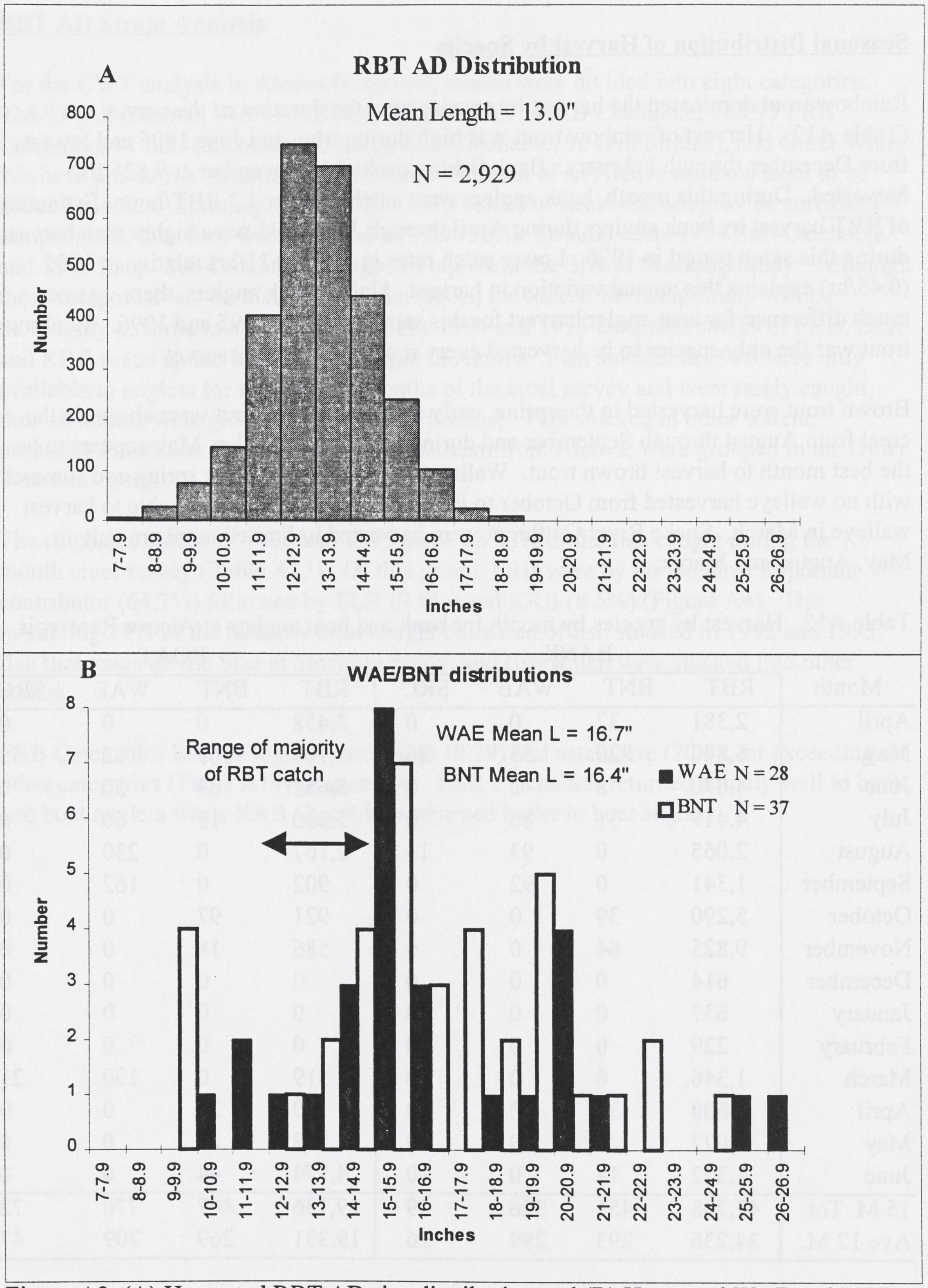


Figure A3. (A) Harvested RBT AD size distribution and (B) Harvested WAE and BNT size distribution at Alcova Reservoir.

Seasonal Distribution of Harvest by Species

Rainbow trout dominated the harvest by species over the duration of the survey (Table A12). Harvest of rainbow trout was high during May and June 1995 and lowest from December through February. Bank fishing peaked in November at 9,825 fish harvested. During this month, bank anglers were catching over 1.2 RBT/hour. Estimates of RBT harvest by bank anglers during April through June 1995 were higher than harvest during this same period in 1996. Lower catch rates in 1996 (0.11/hr) relative to 1995 (0.45/hr) explains this annual variation in harvest. Unlike bank anglers, there was not much difference for boat angler harvest for this same period in 1995 and 1996. Rainbow trout was the only species to be harvested every month of the creel survey.

Brown trout were harvested in the spring, early summer and fall, but were absent in the creel from August through September and during the winter months. May appears to be the best month to harvest brown trout. Walleye were harvested in the spring and summer with no walleye harvested from October to February. Boat anglers were able to harvest walleye in March. Snake River Cutthroat were harvested in limited numbers only in May, August and March.

Table A12. Harvest by species by month for bank and boat anglers at Alcova Reservoir.

	BANK				BOAT			
Month	RBT	BNT	WAE	SRC	RBT	BNT	WAE	SRC
April	2,381	32	0	0	2,458	0	0	0
May	6,840	229	53	26	5,184	163	102	51
June	4,670	8	2	0	5,662	23	20	0
July	4,419	31	86	0	3,830	15	66	0
August	2,065	0	93	13	2,167	0	230	0
September	1,341	0	92	0	902	0	162	0
October	5,290	39	0	0	921	97	0	0
November	9,825	64	0	0	586	18	0	0
December	614	0	0	0	0	0	0	0
January	637	0	0	0	0	0	0	0
February	229	0	0	0	0	0	0	0
March	1,346	0	0	0	519	0	190	21
April	608	34	0	0	180	24	0	0
May	1,072	0	0	0	2,552	23	0	0
June	1,372	14	0	0	4,774	44	0	0
15 M. Tot.	42,708	451	326	39	29,736	407	770	72
Ave 12 M.	34,236	293	299	26	19,331	269	709	47

RBT AD Strain Analysis

For the CWT analysis in Alcova Reservoir, strains were divided into eight categories: 92&93 (All Strains), 94&95 ELR Catchable, 94&95 KRB Catchable, 94&95 FRB Catchable, 94 Sub-Catchable, 95 Large Sub-Catchable, 96 (All Strains), and Other Water. We have previously determined the average lifespan of an Alcova rainbow trout to be about 7 months. Splitting the 1992 and 1993 stocks to strain did not provide sufficient sample sizes, thus they were grouped as 92&93 (All Strains). The 1994 Sub-Catchable and 1995 Large Sub-Catchable categories represent the Size at Stocking Study. Although these categories will be discussed in this report, the Size at Stocking Study will be thoroughly covered in a future report. The 1994 and 1995 catchable stocks of FRB, ELR and KRB made up the bulk of fish caught in Alcova. Fish stocked in 1996 were only available to anglers for the last few months of the creel survey and were rarely caught, thus all strains were grouped in 1996 (All Strains). Fish stocked in other waters, primarily Pathfinder Reservoir directly upstream from Alcova, were grouped in the Other Water category.

The catchable stocks of 1994 and 1995 made up 83% of the fish caught during the 15 month creel survey (Table A13). Of this group, FRB were by far the most important contributor (64.7%) followed by ELR (9.8%) and KRB (8.5%) (Figure A4). The remaining 17% of the rainbow trout caught consisted of fish stocked in 1992 and 1993, fish that made up the Size at Stocking Study, and fish which were stocked into other waters.

FRB Catchables had the highest catch/hour (0.29) and catch/acre (20.0), far exceeding all other categories (Table A14) (Figure A4). ELR Catchables returned equally well to bank and boat anglers while KRB Catchables returned better to boat anglers.

Table A13. Strain catch stratified by bank and boat by month, April 1995 - June 1996, Alcova Reservoir.

TOTAL CATCH

BANK FISHING MONTH

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92 & 93(All Strains)	194	1,553	418	267	115	50	321	343	0	35	18	0	74	28	31	3,446	2,297
94 & 95 ELR Catchable	349	1,087	378	384	115	33	518	1,029	52	82	0	332	25	84	46	4,513	3,528
94 & 95 KRB Catchable	271	738	279	267	115	182	321	429	26	35	18	111	25	0	31	2,846	2,174
94 & 95 FRB Catchable	2,054	5,629	4,124	4,068	1,738	893	5,256	9,858	443	446	146	884	371	814	965	37,689	30,711
94 Sub-Catchable	116	78	80	67	19	0	0	86	26	0	18	111	0	0	0	600	463
95 Large Sub-Catchable	116	39	179	167	191	165	469	686	130	12	18	111	74	112	31	2,500	2,224
96 (All Strains)	0	0	0	0	0	0	0	0	0	0	0	0	49	168	245	463	231
Other Water	155	155	100	83	57	33	321	86	26	23	9	221	0	56	15	1,341	1,100
TOTAL	3,255	9,277	5,558	5,302	2,350	1,356	7,206	12,516	703	634	229	1,768	618	1,263	1,363	53,397	42,730

BOAT FISHING MONTH

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92 & 93(All Strains)	138	693	696	631	70	92	539	185	0	0	0	0	0	0	204	3,249	2,383
94 & 95 ELR Catchable	275	693	774	777	386	123	863	155	0	0	0	183	308	64	306	4,904	3,695
94 & 95 KRB Catchable	458	751	928	680	596	154	431	62	0	0	0	183	51	64	917	5,275	3,690
94 & 95 FRB Catchable	1,834	4,908	4,178	2,428	1,298	399	1,725	464	0	0	0	914	51	1,404	5,092	24,695	15,962
94 Sub-Catchable	138	58	77	0	35	31	0	0	0	0	0	0	0	0	0	338	202
95 Large Sub-Catchable	46	231	309	388	246	31	431	31	0	0	0	274	103	96	611	2,797	2,099
96 (All Strains)	0	0	0	0	0	0	0	0	0	0	0	0	0	160	407	567	283
Other Water	0	115	155	194	35	31	324	0	0	0	0	91	0	32	204	1,181	928
TOTAL	2,888	7,449	7,117	5,099	2,666	860	4,313	897	0	0	0	1,646	513	1,818	7,739	43,006	29,243

ALL FISHERMEN MONTH

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92 & 93(All Strains)	331	2,246	1,115	898	185	142	860	528	0	35	18	0	74	28	234	6,694	4,680
94 & 95 ELR Catchable	624	1,780	1,152	1,160	501	156	1,381	1,183	52	82	0	514	332	148	351	9,417	7,224
94 & 95 KRB Catchable	730	1,488	1,207	947	711	335	752	490	26	35	18	293	76	64	947	8,121	5,865
94 & 95 FRB Catchable	3,888	10,536	8,301	6,497	3,036	1,292	6,981	10,322	443	446	146	1,798	422	2,218	6,057	62,384	46,673
94 Sub-Catchable	254	135	157	67	54	31	0	86	26	0	18	111	0	0	0	938	665
95 Large Sub-Catchable	162	270	489	555	437	196	900	717	130	12	18	385	177	208	642	5,297	4,323
96 (All Strains)	0	0	0	0	0	0	0	0	0	0	0	0	49	328	652	1,030	515
Other Water	155	271	254	278	92	64	644	86	26	23	9	312	0	88	219	2,522	2,028
TOTAL	6,144	16,726	12,675	10,401	5,016	2,216	11,519	13,412	703	634	229	3,414	1,131	3,081	9,102	96,404	71,974

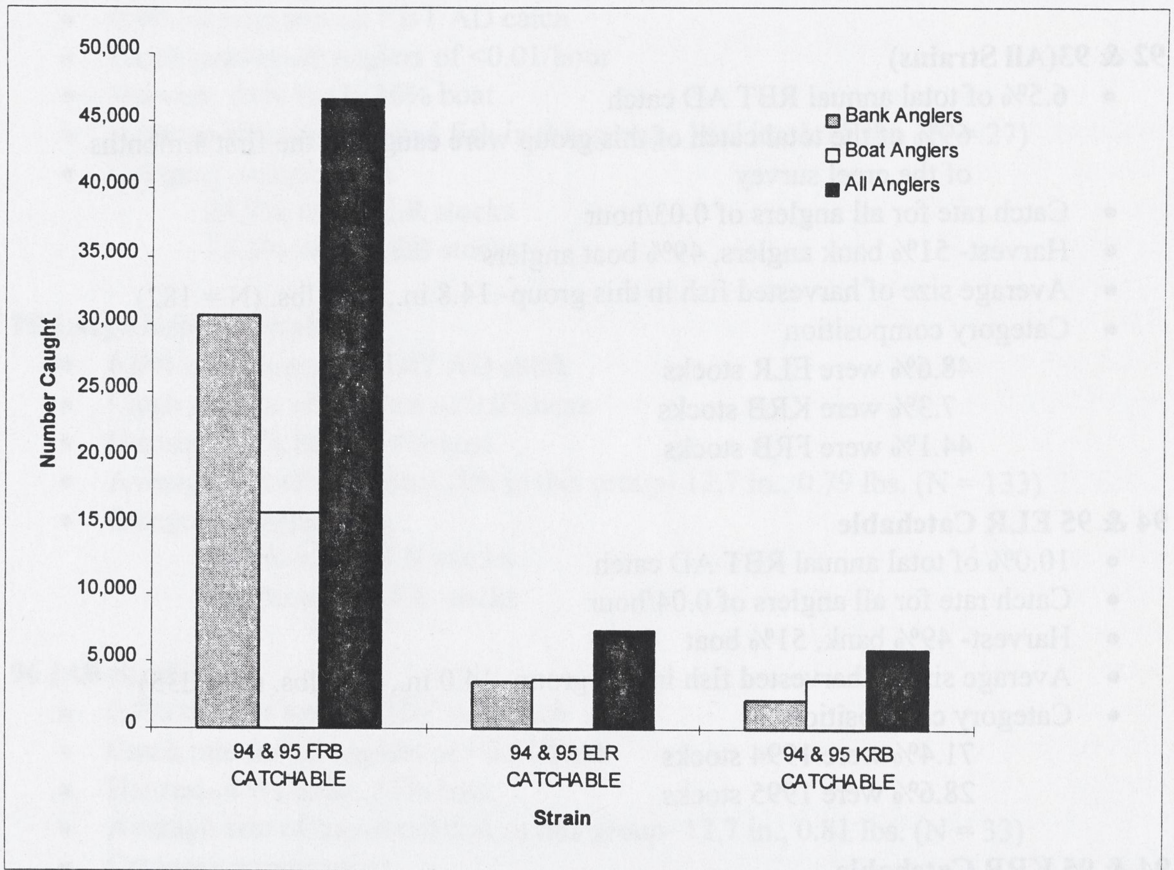


Figure A4. Annual catch of catchable-sized RBT AD, by strain at Alcova Reservoir.

Table A14. Strain catch rates per hour and per acre for bank, boat and all anglers (annually) at Alcova Reservoir.

	Catch/Hour			Catch/Acre		
	Bank	Boat	All	Bank	Boat	All
92 & 93(All Strains)	0.02	0.04	0.03	1.0	1.0	2.0
94 & 95 ELR Catchable	0.03	0.06	0.04	1.5	1.6	3.1
94 & 95 KRB Catchable	0.02	0.06	0.04	0.9	1.6	2.5
94 & 95 FRB Catchable	0.30	0.26	0.29	13.1	6.8	20.0
94 Sub-Catchable	0.00	0.00	0.00	0.2	0.1	0.3
95 Large Sub-Catchable	0.02	0.03	0.03	1.0	0.9	1.9
96 (All Strains)	0.00	0.00	0.00	0.1	0.1	0.2
Other Water	0.01	0.02	0.01	0.5	0.4	0.9
Total	0.42	0.48	0.44	18.3	12.5	30.8

Strain Summaries

92 & 93(All Strains)

- 6.5% of total annual RBT AD catch
  69% of the total catch of this group were caught in the first 4 months of the creel survey
- Catch rate for all anglers of 0.03/hour
- Harvest- 51% bank anglers, 49% boat anglers
- Average size of harvested fish in this group- 14.8 in., 1.17 lbs. (N = 182)
- Category composition
  48.6% were ELR stocks
  7.3% were KRB stocks
  44.1% were FRB stocks

94 & 95 ELR Catchable

- 10.0% of total annual RBT AD catch
- Catch rate for all anglers of 0.04/hour
- Harvest- 49% bank, 51% boat
- Average size of harvested fish in this group- 14.0 in., 0.99 lbs. (N = 235)
- Category composition
  71.4% were 1994 stocks
  28.6% were 1995 stocks

94 & 95 KRB Catchable

- 8.2% of total annual RBT AD catch
- Catch rate for all anglers of 0.04/hour
  Boat anglers catch rate 3 times greater than bank anglers
- Harvest- 36% bank, 64% boat
- Average size of harvested fish in this group- 13.4 in., 0.89 lbs. (N = 198)
- Category composition
  19.9% were 1994 stocks
  80.1% were 1995 stocks

94 & 95 FRB Catchable

- 64.9% of total annual RBT AD catch
- Catch rate for all anglers of 0.29/hour
  More than 6 times the catch rate of any other category
- Harvest- 60% bank, 40% boat
- Average size of harvested fish in this group- 12.6 in., 0.79 lbs. (N = 1,731)
- Category composition
  70.7% were 1994 stocks
  29.3% were 1995 stocks

94 Sub-Catchable

- 0.9% of total annual RBT AD catch
- Catch rate for all anglers of <0.01/hour
- Harvest- 64% bank, 36% boat
- Average size of harvested fish in this group- 14.7 in., 1.15 lbs. (N = 27)
- Category composition
  - 24.7% were ELR stocks
  - 75.3% were KRB stocks

95 Large Sub-Catchable

- 6.0% of total annual RBT AD catch
- Catch rate for all anglers of 0.03/hour
- Harvest- 46% bank, 54% boat
- Average size of harvested fish in this group- 12.7 in., 0.79 lbs. (N = 133)
- Category composition
  - 37.4% were ELR stocks
  - 62.6% were KRB stocks

96 (All Strains)

- 0.7% of total annual RBT AD catch
- Catch rate for all anglers of <0.01/hour
- Harvest- 45% bank, 55% boat
- Average size of harvested fish in this group- 12.7 in., 0.81 lbs. (N = 33)
- Category composition
  - 18.3% were ELR stocks
  - 81.7% were KRB stocks

Other Water

- 2.8% of total annual RBT AD catch
- Catch rate for all anglers of 0.01/hour
- Harvest- 53% bank, 47% boat
- Composition of tag origins
  - 71% Pathfinder Reservoir
  - 12% Seminoe Reservoir
  - 7% Miracle Mile
  - 1% 1-80 to Seminoe Reservoir
  - 8% Impossible (fish would have had to move upstream through a dam)

DISCUSSION

The majority of Alcova Reservoir anglers were residents (91%), fishing from the bank (67%) using solely bait (70%). Alcova Reservoir is a consumptive fishery with most anglers interested in harvesting fish. Catch and release is practiced, although to a limited extent. The majority of all RBT caught are harvested (71%). Boat anglers were more successful (0.54 fish/hr) than bank anglers (0.44 fish/hr). However, when catch rates are considered just for rainbow trout (RBT AD + RBT), boat anglers are only slightly more successful (0.48 trout/hr) than bank anglers (0.44 trout/hr). Rainbow trout (RBT AD + RBT) made up 97% of the total catch with brown trout, walleye and Snake River Cutthroat trout making up the remaining 3%. Brown trout and walleye provide the only opportunity to catch trophy-sized (≥ 20 inches) fish.

Criteria

For a strain to be considered successful, it must meet at least one of the four criteria defined in the General Introduction (50% caught or harvested by number or 1 pound caught or harvested for each pound stocked). The only strains that met any of the criteria were FRB and ELR Catchables (Table A15). FRB Catchables were the only strain that met all four criteria; in fact, this strain far exceeded all other strains (Figure A5). Nearly 90% of the FRB stocked were caught and 2.56 pounds were caught for every pound stocked.

Table A15. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch at Alcova Reservoir (* indicates criteria met).

HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94 & 95 ELR Catchable	17,200	6,599	4,820	4,772	0.28	0.72
94 & 95 KRB Catchable	16,400	6,041	4,086	3,637	0.25	0.60
94 & 95 FRB Catchable	52,400	14,422	33,916	26,794	0.65*	1.86*
BNT AD	6,425	2,045	183	210	0.03	0.10
Overall Sums and Avg.	92,425	29,107	43,005	35,412	0.47	1.22

TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94 & 95 ELR Catchable	17,200	6,599	7,224	7,152	0.42	1.08*
94 & 95 KRB Catchable	16,400	6,041	5,865	5,220	0.36	0.86
94 & 95 FRB Catchable	52,400	14,422	46,673	36,872	0.89*	2.56*
BNT AD	6,425	2,045	188	216	0.03	0.11
Overall Sums and Avg.	92,425	29,107	59,944	49,459	0.65	1.69

[1]- Number and pounds stocked represent an annual average over two years.

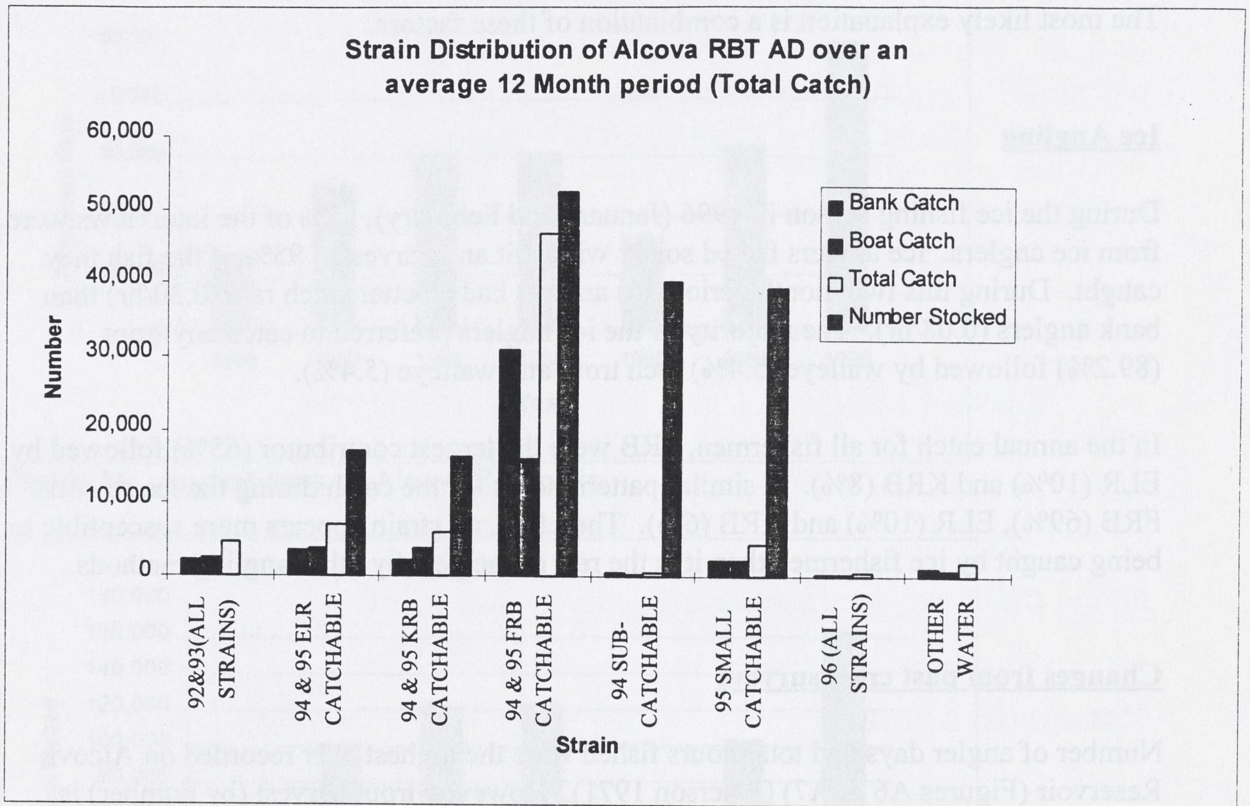


Figure A5. Total catch by strain of RBT AD at Alcova Reservoir (annually).

Catchable ELR did meet one criteria of at least 1.0 pound caught for each pound stocked. Although ELR were considered successful, their returns were far behind FRB.

KRB Catchables and BNT AD failed to meet any of the four criteria. KRB returned better to boat than bank anglers and returned quicker (the same year as stocked) than the other catchable stocks.

Migration from upstream waters was minimal as demonstrated by the Other Waters category (Table A13). This group made up only 2.8% of the annual RBT AD catch. As expected, the majority (71%) of these fish were stocked in Pathfinder Reservoir.

Non AD Clipped Trout

There is no known natural reproduction of salmonids in Alcova Reservoir. Currently, no significant tributaries that could support natural reproduction flow into Alcova Reservoir. The creel survey estimated that 96% of the RBT had an adipose clip, suggesting that 4% of the RBT were "wild". The presence of RBT without an adipose clip can arise from:

1) Fish not being adipose-clipped in the hatchery,
2) Hatchery fish stocked prior to 1992 (before fish were adipose-clipped),
3) Migration from upstream waters which support natural reproduction, or

4) Creel clerk data collection and entry errors.
The most likely explanation is a combination of these factors.

Ice Angling

During the ice fishing season in 1996 (January and February), 55% of the interviews were from ice anglers. Ice anglers fished solely with bait and harvested 95% of the fish they caught. During this two month period, ice anglers had a better catch rate (0.30/hr) than bank anglers (0.08/hr). The majority of the ice anglers preferred to catch any trout (89.2%) followed by walleye (5.4%) then trout and walleye (5.4%).

In the annual catch for all fishermen, FRB were the largest contributor (65%) followed by ELR (10%) and KRB (8%). A similar pattern holds for the catch during the ice season: FRB (69%), ELR (10%) and KRB (6%). Therefore, no strain appears more susceptible to being caught by ice fishermen than it is the rest of the year by other angling methods.

Changes from past creel surveys

Number of angler days and total hours fished were the highest ever recorded on Alcova Reservoir (Figures A6 & A7) (Peterson 1971). However, trout harvest (by number) is down (Figure A8) with walleye the likely cause. In 1984, five sinking gill nets caught 2 walleye (0.4/net). In 1996, 13 sinking gill nets captured 40 walleye (3.1/net); an increase in walleye catch of 775% from 1984 to 1996.

Catchable trout are now stocked to reduce losses to walleye predation. In 1984, 800,000 (88/pound) fingerling RBT were stocked (Peterson 1986). Alcova Reservoir now receives about 95,000 catchables (3-4/pound; ~30,000 pounds) annually, a decrease of 88% by number and an increase of 330% by weight from historic fingerling stocking.

The survey in 1984-5 was the last creel survey conducted before walleye became established and fingerlings were still stocked. It provides interesting comparisons to the 1995-6 creel.

- 1984-5 31,850 anglers
- 1995-6 49,539 anglers

- 1984-5 RBT 99% of harvest, WAE <0.5%
- 1995-6 RBT 96% of harvest, WAE 2%

- 1984-5 Pressure: 77% bank anglers, 23% boat anglers
- 1995-6 Pressure: 64% bank anglers, 36% boat anglers

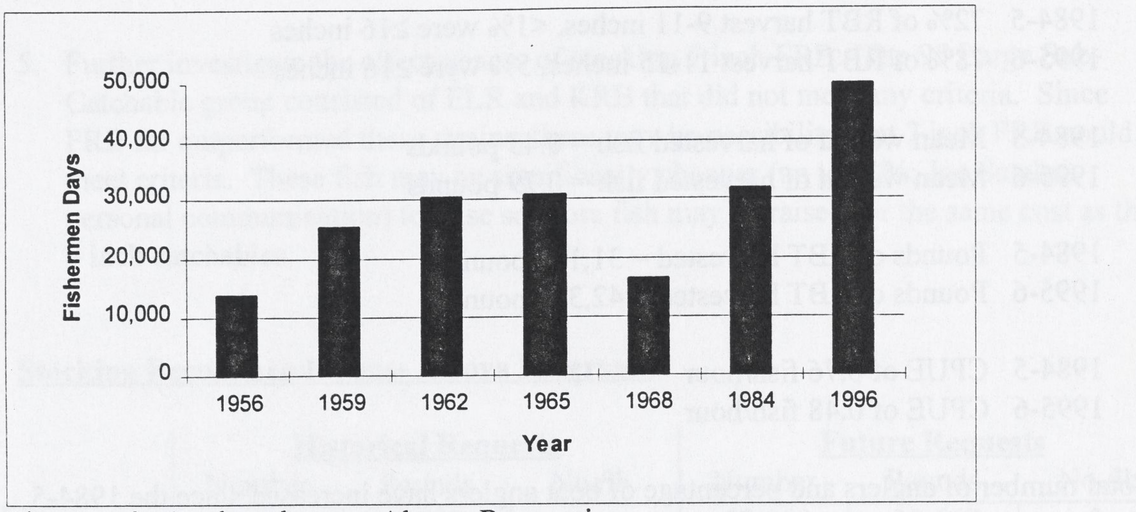


Figure A6. Anglers days on Alcova Reservoir.

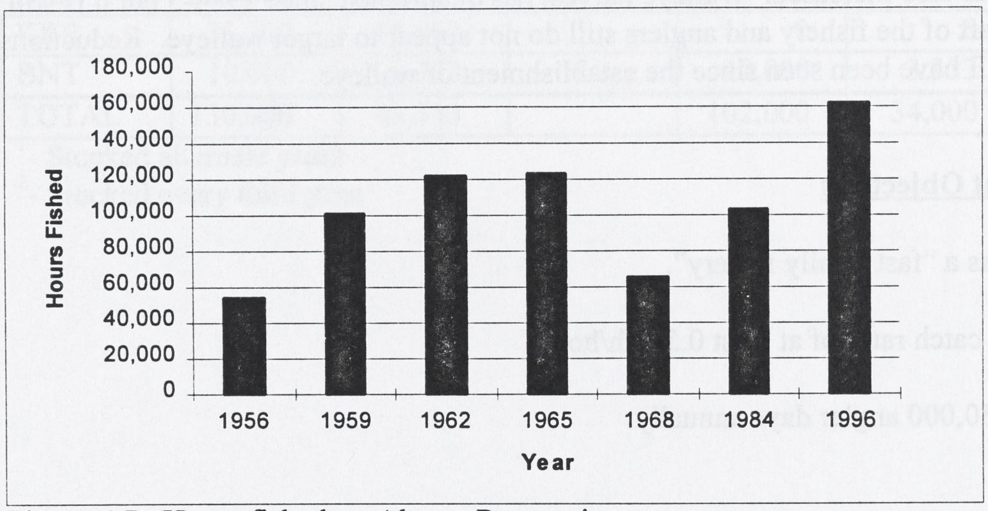


Figure A7. Hours fished on Alcova Reservoir.

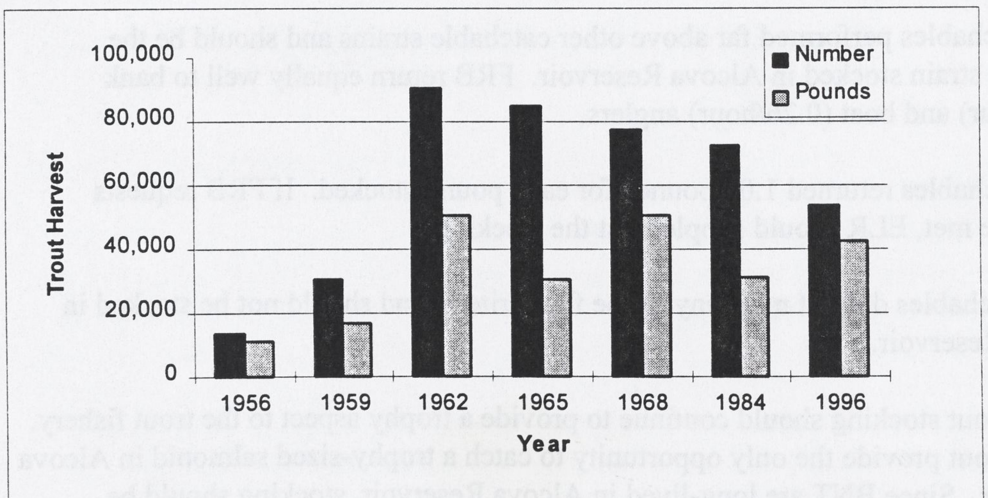


Figure A8. Trout harvest on Alcova Reservoir, number and pounds.

- 1984-5 72% of RBT harvest 9-11 inches, <1% were ≥16 inches
- 1995-6 78% of RBT harvest 11-15 inches, 5% were ≥16 inches

- 1984-5 Mean weight of harvested fish = 0.43 pounds
- 1995-6 Mean weight of harvested fish = 0.79 pounds

- 1984-5 Pounds of RBT harvested = 31,182 pounds
- 1995-6 Pounds of RBT harvested = 42,318 pounds

- 1984-5 CPUE of 0.76 fish/hour
- 1995-6 CPUE of 0.48 fish/hour

Total number of anglers and percentage of boat anglers have increased since the 1984-5 survey. Average size and weight of harvested fish as well as percentage of harvested fish ≥16 inches has also increased. Walleye harvest has quadrupled since 1984-5 but it is still not a large part of the fishery and anglers still do not appear to target walleye. Reductions in trout CPUE have been seen since the establishment of walleye.

Management Objectives

1. Manage as a "fast family fishery".

2. Maintain catch rates of at least 0.5 fish/hour.

3. Support 50,000 angler days annually.

Recommendations

1. FRB catchables performed far above other catchable strains and should be the principle strain stocked in Alcova Reservoir. FRB return equally well to bank (0.30/hour) and boat (0.26/hour) anglers.

2. ELR catchables returned 1.08 pounds for each pound stocked. If FRB requests cannot be met, ELR should supplement the stocking.

3. KRB catchables did not meet any of the four criteria and should not be stocked in Alcova Reservoir.

4. Brown trout stocking should continue to provide a trophy aspect to the trout fishery. Brown trout provide the only opportunity to catch a trophy-sized salmonid in Alcova Reservoir. Since BNT are long-lived in Alcova Reservoir, stocking should be reduced to every third year.

5. Further investigate the effectiveness of stocking 7 inch FRB. The 95 Large Sub-Catchable group consisted of ELR and KRB that did not meet any criteria. Since FRB far outperformed these strains, there may be possibility that 7 inch FRB could meet criteria. These fish may be significantly cheaper (up to 53%; Joe Satake, personal communication) to raise so more fish may be raised for the same cost as the 9 inch catchables.

Stocking Recommendations- Alcova Reservoir

	Historical Requests			Future Requests		
	Number	Pounds	No./lb.	Number	Pounds	No./lb.
FRB	60,000	20,000	3	92,000	30,667	3
ELR	25,000	8,333	3	0	0	-
KRB	35,000	11,667	3	0	0	-
BNT	10,000[1]	3,333	3	10,000[2]	3,333	3
TOTAL	130,000	43,333		102,000	34,000	

[1]- Stocked alternate years

[2]- Stocked every third year

Pathfinder Reservoir

INTRODUCTION

Pathfinder Reservoir, located approximately 40 miles southwest of the City of Casper, was completed in 1909 and receives its primary inflows from the North Platte (Miracle Mile) and Sweetwater Rivers (Figure P1). At full pool, surface area is 22,000 acres and mean depth is 46.3 feet. The 30-year mean surface area is 14,259 acres or 65% of maximum pool (Figure P2). Between 1990 and 1995, the reservoir surface area averaged 8,300 acres or only 38% of capacity. The mean surface area of Pathfinder Reservoir nearly doubled from 9,500 surface acres during the 1995 water year to 18,600 surface acres in 1996.

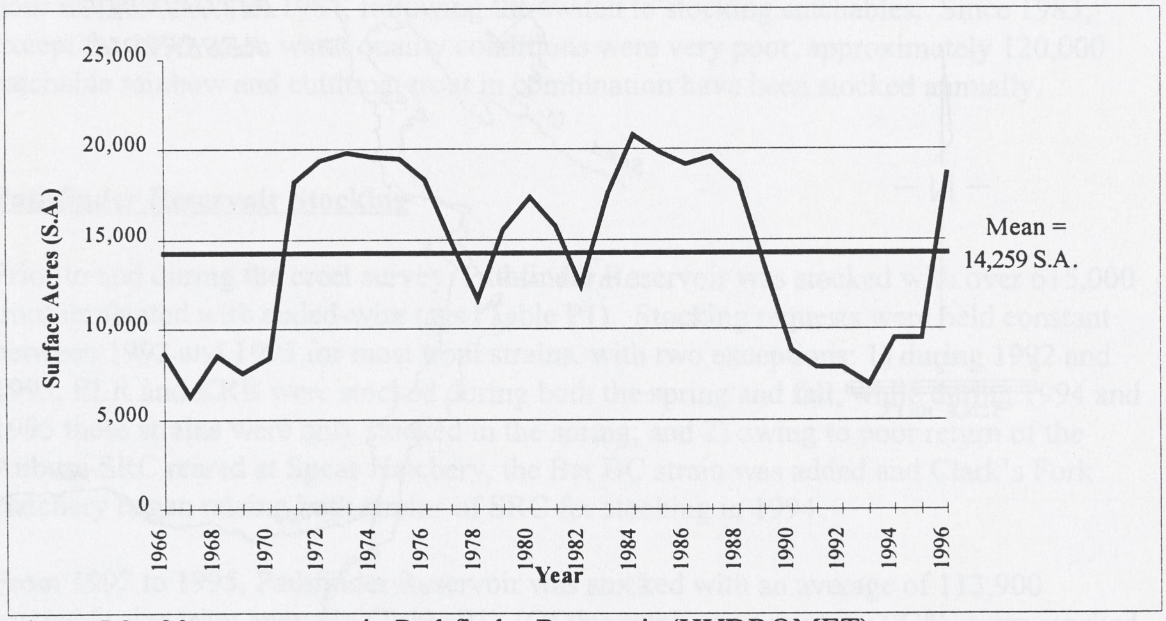
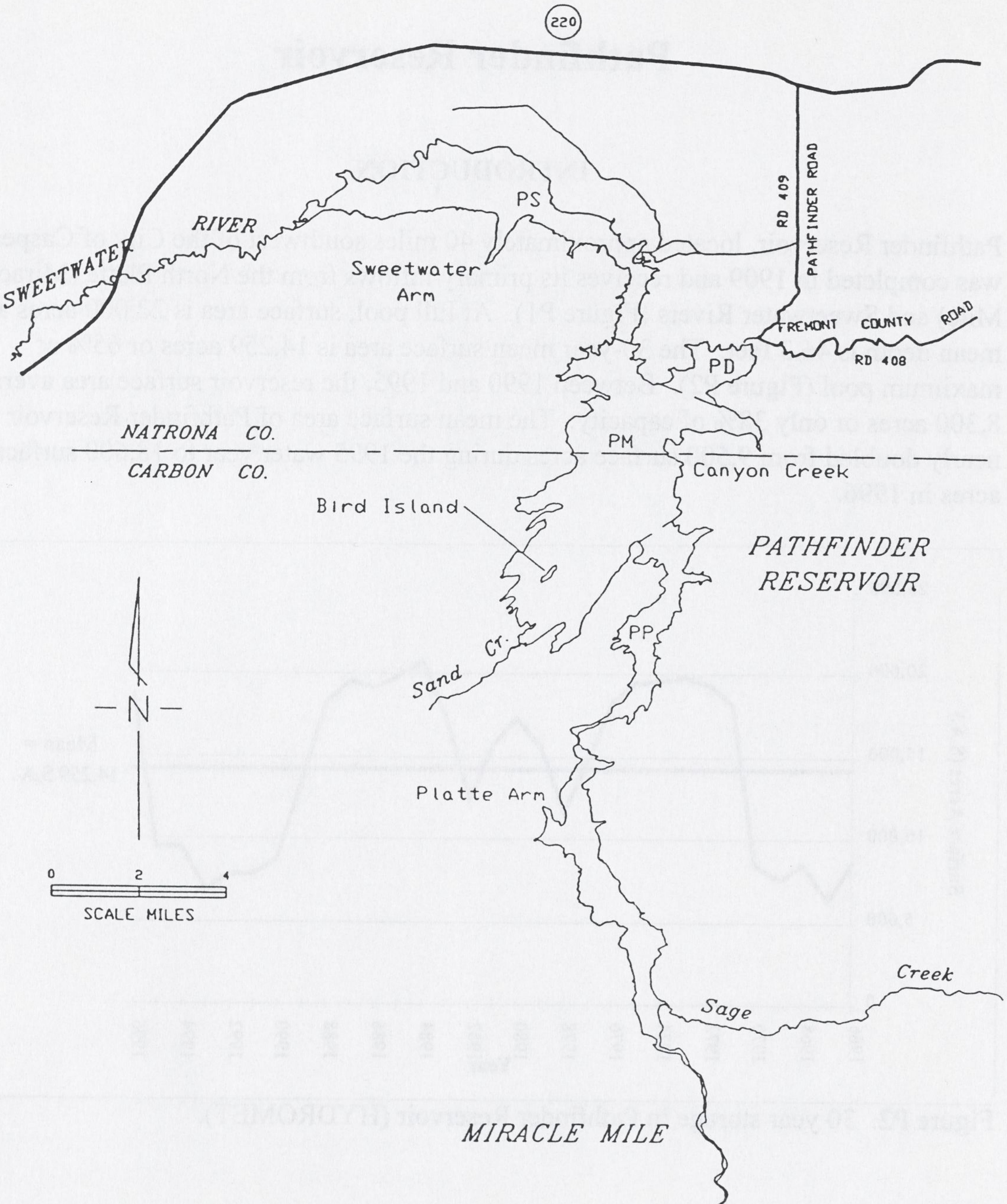


Figure P2. 30 year storage in Pathfinder Reservoir (HYDROMET).

History of Pathfinder Reservoir

Much of the early fisheries work on Pathfinder Reservoir was concentrated not on sport fish, but rather to evaluate the potential commercial harvest of nongame species. In 1955, it was estimated that commercial seiners harvested 300 tons of rough fish, mostly carp, from Pathfinder Reservoir (Peterson and Leik 1956). A mark-recapture study in 1974-75 estimated 1.4 million adult white suckers and 157,000 adult carp. Since both species were only easily vulnerable to harvest between April and June, catch rates the remainder of the year would probably be too low to sustain a profitable enterprise (Facciani and Baxter 1977).



Code - Area Description

PS - PATHFINDER SWEETWATER ARM
PD - PATHFINDER DAM AREA
PM - PATHFINDER MIDDLE AREA
PP - PATHFINDER PLATTE ARM

Figure P1. Pathfinder Reservoir

Walleye were first captured in Pathfinder Reservoir in 1974 following a prolonged spill of Seminoe Reservoir in 1973. Netting through the mid 1970s suggested that the initial pulse of walleye did not successfully reproduce. Large numbers of 13-14 inch walleye were found in Pathfinder Reservoir in 1976 and were again thought to have originated from Seminoe Reservoir, since this year-class had been absent as smaller fish in previous years. Like in the early 1970s, no evidence of reproduction of walleye in Pathfinder Reservoir was documented over the next several years of sampling. Between 1979 and 1981, Pathfinder Reservoir was stocked with 1 to 2 million fingerling cutthroat trout annually. During this interval, the 13-14 inch walleye that entered the fishery in 1976, continued to grow and by 1981, most of these walleye exceeded 20 inches in length (WGFD, 1981 Progress Report). Experimental gill net catch rates of cutthroat trout and rainbow trout also dropped quickly from 1979 to 1981. In 1982, stocking of sub-catchable cutthroat trout was adopted, and size was increased to 5.5 per pound by 1983. The 1984 fall experimental gill netting catch rate increased 4 times from 0.2 cutthroat per hour in 1983 to 0.8 in 1984, following the switch to stocking catchables. Since 1983, except for 1990 when water quality conditions were very poor, approximately 120,000 catchable rainbow and cutthroat trout in combination have been stocked annually.

Pathfinder Reservoir Stocking

Prior to and during the creel survey, Pathfinder Reservoir was stocked with over 615,000 trout implanted with coded-wire tags (Table P1). Stocking requests were held constant between 1992 and 1995 for most trout strains, with two exceptions: 1) during 1992 and 1993, ELR and KRB were stocked during both the spring and fall, while during 1994 and 1995 these strains were only stocked in the spring; and 2) owing to poor return of the Auburn SRC reared at Speas Hatchery, the Bar BC strain was added and Clark's Fork Hatchery began raising both strains of SRC for stocking in 1994.

From 1992 to 1995, Pathfinder Reservoir was stocked with an average of 113,900 catchable size trout annually (Table P1). Of this total, more rainbow (73%) were stocked than cutthroat (27%). ELR were the most commonly stocked strain (31,800 annually), followed by KRB (25,600), FRB (25,500), SRC Auburn (24,400) and SRC Bar BC (6,600). Using a 30 year mean surface area of 14,259 acres, Pathfinder Reservoir has been recently stocked with 5.8 catchable rainbow trout and 2.2 catchable cutthroat trout per acre per year. This stocking density equates to 2.3 pounds per acre annually.

Table P1. Number of trout stocked into Pathfinder Reservoir prior to and during the 15 month programmed creel survey.

Species/ Strain	Stock Date	Pounds Stocked	Number/ Pound	Number Stocked	Tag Retention	Number Stocked w/ Tags
ELR	92/04/21[1]	2,355	4.0	9,400	75.7	7,100
	92/08/19[1]	8,825	3.1	27,400	91.1	25,000
	93/04/12[1]	7,348	2.5	18,400	96.5	17,700
	93/09/22[1]	2,995	2.7	8,100	79.9	6,500
	94/04/18[1]	12,155	2.9	35,300	96.9	34,200
	94/04/18[4]	1,240	6.1	7,600	98.0	7,400
	94/06/03[5]	2,025	15.3	31,000	97.2	30,100
	95/04/20[1]	8,931	3.2	28,600	100.0	28,600
	95/04/20[4]	5,590	5.4	30,200	99.3	30,000
	96/05/15[6]	2,408	3.7	8,900	99.0	8,800
Sub-Total		53,872		204,900	95.4	195,400
KRB	92/04/21[2]	3,985	3.9	15,500	93.4	14,500
	92/08/19[2]	4,265	3.2	13,600	94.1	12,800
	93/04/07[2]	5,616	3.0	16,800	89.9	15,100
	93/09/22[2]	2,432	3.5	8,500	87.3	7,400
	94/04/18[2]	6,775	2.8	18,700	92.5	17,300
	94/04/18[4]	4,380	6.8	29,800	91.7	27,300
	95/04/20[2]	10,074	2.9	29,200	99.6	29,100
	95/04/20[4]	5,234	4.5	23,600	99.5	23,400
	96/05/16[6]	17,912	4.0	70,900	96.9	68,600
Sub-Total		60,673		226,600	95.1	215,500
FRB	92/09/28[3]	7,755	3.2	24,800	98.0	24,300
	93/09/22[3]	6,675	3.4	22,700	86.2	19,600
	94/09/14[3]	7,957	3.6	28,600	94.1	26,900
	95/09/18[3]	7,360	3.5	26,000	99.4	25,800
Sub-Total		29,747		102,000	94.6	96,600
SRC	92/09/28[7]	8,807	4.2	37,000	88.2	32,600
	93/10/26[7]	4,515	5.0	22,600	72.6	16,400
	94/06/02[7]	1,450	7.3	10,600	75.6	8,000
	94/09/14[7]	2,734	6.5	17,800	90.2	16,000
	95/09/18[7]	2,600	5.5	14,300	95.5	13,700
	95/09/18[7]	3,855	4.2	16,200	100.0	16,200
	95/09/18[7]	1,320	4.1	5,400	100.0	5,400
Sub-Total		25,281		123,900	87.4	108,300
Grand Total		169,573		657,500	93.7	615,800

[1]- 92-95 ELR Catchable
[2]- 92-95 KRB Catchable
[3]- 92-95 FRB Catchable
[4]- 94&95 Large Sub-Catchable
[5]- 94 Sub-Catchable
[6]- 96 All Strains
[7]- 92-95 SRC Catchable

In addition to catchable size stocks, during the spring of 1994 and 1995 both ELR and KRB were stocked as large sub-catchables (~ 7 inches) to identify if stocking trout at these sizes was more economical than the current catchable program. In addition to large sub-catchables, 31,000 ELR were stocked as sub-catchables (15.3/pound) in 1994. The numbers of ELR and KRB catchables and large sub-catchables stocked in 1994 and 1995 are found in Table P2. In the Results section of this report, ELR and KRB have been pooled and are referred to as Large Sub-Catchables, while the sub-catchable ELR are called Sub-Catchables. Discussion of performance of these groups will be covered in a future Size at Stocking report.

Table P2. Stocked fish making up the Size at Stocking Study at Pathfinder Reservoir.

Strain	Stocking Date	Number Stocked	Number/ Pound	Pounds Stocked	Average Length (in.)
ELR	94/04/18[4]	7,600	6.1	1,240	7.1
ELR	94/06/03[5]	31,000	15.3	2,025	5.5
KRB	94/04/18[4]	29,800	6.8	4,380	7.1
ELR	95/04/20[4]	30,200	5.4	5,590	7.6
KRB	95/04/20[4]	23,600	4.5	5,234	7.9

[4]- 94&95 Large Sub-Catchable
[5]- 94 Sub-Catchable

METHODS

General creel methods are outlined in General Methods. All methods outlined in the General Methods are applicable to Pathfinder Reservoir.

Biological (floating and sinking gill nets) data collected during the creel survey were used to establish length-weight relationships specific to Pathfinder Reservoir. The equations for rainbow trout strains and SRC are:

FRB- weight = exp((2.63575788*length) - 6.777882927) ($R^2 = 0.89$).
KRB- weight = exp((2.779591382*length) - 7.341992152) ($R^2 = 0.91$).
ELR- weight = exp((2.942704248*length) - 7.693531438) ($R^2 = 0.97$).
SRC- weight = exp((3.299795199*length) - 8.56836281) ($R^2 = 0.70$).

These equations were applied to the respective strain group/species measured by creel clerks. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and caught.

RESULTS

Angler Information

Creel clerks interviewed 3,469 anglers at Pathfinder Reservoir. Of these, 3,165 (91%) were Wyoming residents and only 304 (9%) were nonresidents. Anglers were asked what terminal tackle they were using when contacted (Table P3). The majority of anglers used solely bait (48.0%) followed by lures (28.9%) and a combination of bait and lures (21.8%).

Table P3. Terminal tackle employed by Pathfinder Reservoir anglers.

Terminal Tackle	All Anglers Number	%	Bank %	Boat %	Ice %
Bait	1,666	48.0%	85.9%	13.8%	100%
Lures	1,004	28.9%	4.1%	51.1%	0.0%
Bait and Lures	756	21.8%	8.2%	34.3%	0.0%
Bait and Flies	20	0.6%	1.2%	0.1%	0.0%
Bait, Flies and Lures	15	0.4%	0.5%	0.4%	0.0%
Flies and Lures	5	<0.1%	<0.1%	0.2%	0.0%
Flies	3	<0.1%	<0.1%	0.1%	0.0%

Of the 88% of anglers who stated a species preference, 62.2% were targeting any trout species, 20.5% targeted trout and walleye and 17.3% were fishing for walleye.

The majority of anglers used only one pole (71%) rather than the maximum two (26%) allowed (open-water) (Table P4). The remaining 3% were ice anglers during the special ice regulation season where anglers could use up to 6 poles. Bank and ice anglers harvested the highest proportion of their catch but boat anglers were able to harvest more fish per angler than bank or ice anglers.

Table P4. Angler characteristics at Pathfinder Reservoir (completed trips only).

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Bank	631	1 - 58% 2 - 42% Avg.=1.42	80%- Harv. 20%- Rel.	0.55
Boat	1,665	1 -85 % 2 -15 % Avg.=1.15	68%- Harv. 32%- Rel.	1.39
Ice	67	1 - 0% 2 - 6% 3 - 9% 4 - 10% 5 - 25% 6 - 49% Avg.=5.03	92%- Harv. 8%- Rel.	1.04

Nearly 50% of all anglers were able to catch at least one trout and 3% were able to harvest their limit (Table P5). Anglers were far less successful catching walleye. Only 7% of anglers caught at least one walleye and less than 1% harvested 6 walleye. When all game fish are combined, 8% of anglers caught at least 6 fish.

Table P5. Percentage of anglers who harvested/caught 0 fish, at least 1 fish, at least 2 fish, etc. at Pathfinder Reservoir (completed trips only) (TRT = all trout, ALL = all game fish).

		Number of Fish						
		0	≥1	≥2	≥3	≥4	≥5	≥6
TRT	Harvest	56%	44%	26%	16%	10%	5%	3%
	Catch	48%	52%	33%	22%	15%	10%	7%
WAE	Harvest	95%	5%	2%	1%	<1%	<1%	<1%
	Catch	93%	7%	3%	2%	1%	1%	<1%
ALL	Harvest	52%	48%	29%	18%	11%	6%	4%
	Catch	44%	56%	36%	24%	16%	11%	8%

Pressure

From April 1995 through June 1996, we estimated 51,895 anglers (Table P6) fished 223,318 hours (Table P7). More anglers fished from boats (53%) than from the bank (47%). On an annual basis, we estimated 37,216 anglers fished 159,023 hours. This yields annual estimates of 2.6 anglers/acre and 11.2 hours/acre.

Table P6. Pathfinder Reservoir- estimated number of anglers and anglers/acre.

	Bank	/acre	Boat	/acre	All	/acre
April	807	0.1	541	0.0	1,348	0.1
May	2,608	0.2	2,366	0.2	4,974	0.3
June	2,818	0.2	4,975	0.3	7,793	0.5
July	4,025	0.3	5,615	0.4	9,641	0.7
August	1,133	0.1	2,841	0.2	3,974	0.3
September	1,088	0.1	2,143	0.2	3,231	0.2
October	849	0.1	527	0.0	1,376	0.1
November	823	0.1	132	0.0	956	0.1
December	599	0.0	0	0.0	599	0.0
January	1,127	0.1	0	0.0	1,127	0.1
February	421	0.0	0	0.0	421	0.0
March	996	0.1	218	0.0	1,214	0.1
April	2,483	0.2	1,180	0.1	3,664	0.3
May	2,190	0.2	2,584	0.2	4,774	0.3
June	2,166	0.2	4,640	0.3	6,806	0.5
15 Month Total	24,134	1.7	27,761	1.9	51,895	3.6
Average 12 Months	17,598	1.2	19,618	1.4	37,216	2.6

Total fishing pressure (bank + boat) was highest from May through September, then dropped significantly in October through March. There was an increase in pressure in January, due to an increase in ice angling (Table P7). There was no significant difference ($p = 0.16$) between the total hours fished by bank and boat anglers.

Table P7. Pathfinder Reservoir- estimated pressure (angler hours and hours/acre) for bank, boat and all anglers.

	Bank Hours	/acre	Boat Hours	/acre	All Anglers	/acre
April	3,495	0.2	2,326	0.2	5,821	0.4
May	9,095	0.6	11,025	0.8	20,120	1.4
June	10,378	0.7	28,139	2.0	38,517	2.7
July	8,064	0.6	29,778	2.1	37,842	2.7
August	3,712	0.3	12,624	0.9	16,335	1.1
September	3,844	0.3	10,504	0.7	14,348	1.0
October	3,471	0.2	1,871	0.1	5,342	0.4
November	2,925	0.2	461	0.0	3,386	0.2
December	2,954	0.2	0	0.0	2,954	0.2
January	7,962	0.6	0	0.0	7,962	0.6
February	1,869	0.1	0	0.0	1,869	0.1
March	3,759	0.3	930	0.1	4,689	0.3
April	10,080	0.7	5,667	0.4	15,747	1.1
May	7,927	0.6	11,025	0.8	18,952	1.3
June	5,871	0.4	23,562	1.7	29,433	2.1
15 Month Total	85,405	6.0	137,913	9.7	223,318	15.7
Average 12 Months	61,982	4.3	97,040	6.8	159,023	11.2

Pressure was significantly greater ($p < 0.01$) on weekend days than weekdays (Table P8). This shows nearly two-thirds of the pressure occurred on one-third of the available days, indicating Pathfinder Reservoir is mainly a weekend fishery.

Table P8. Pressure (hours fished) during weekdays (WD) and weekend days (WE) at Pathfinder Reservoir.

	Total WD	Total WE
15 Months	75,036	148,282
12 Month Average	52,098	106,924

An annual estimate of trip length for all anglers was 4.27 hours. Boat trips were much longer (4.95 hours) than bank trips (3.52 hours).

Catch Rates

Combining bank and boat anglers yields a mean annual catch rate of 0.32 fish/hour (Table P9). Overall boat catch rates were more than double the bank catch rates. Catch rates were highest for boat anglers in the spring. Bank catch rates peaked in November and December.

Table P9. Catch rates (fish per hour, all species combined) for bank, boat and all anglers at Pathfinder Reservoir.

	Bank	Boat	All
April	0.25	0.62	0.37
May	0.37	0.99	0.68
June	0.19	0.55	0.45
July	0.12	0.35	0.30
August	0.09	0.27	0.24
September	0.05	0.33	0.23
October	0.13	0.43	0.23
November	0.22	0.45	0.26
December	0.63	0.00	0.63
January	0.07	0.00	0.07
February	0.14	0.00	0.14
March	0.17	2.88	0.46
April	0.18	0.16	0.18
May	0.09	0.19	0.15
June	0.03	0.43	0.35
15 Month	0.18	0.42	0.33
Average 12 Months	0.18	0.41	0.32

Catch and Harvest

The estimated annual total catch was 50,762 fish (Table P10). Boat and bank anglers accounted for 78% and 22% of the total catch, respectively. Total estimated annual harvest was 34,732 (Table P11).

RBT AD

Stocked rainbow trout (RBT AD) made up 76.5% of the bank, boat and total catch (Table P10). The mean size of harvested RBT AD from Pathfinder Reservoir was 15.8 inches with lengths ranging from 9.1 to 24.2 inches (Figure P3). The majority (67%) of the RBT AD caught were harvested (Table P11). Bank anglers harvested 82% of their RBT AD catch while boat anglers only harvested 62%. Combined bank and boat annual catch rates for RBT AD were 0.24/hr and 2.72/acre.

Table P10. Annual total catch by species at Pathfinder Reservoir.

Species	Bank Catch	%	Boat Catch	%	Total Catch	%
RBT AD	8,652	76.5	30,193	76.5	38,844	76.5
RBT	970	8.6	1,674	4.2	2,644	5.2
BNT	314	2.8	1,783	4.5	2,097	4.1
SRC AD	340	3.0	1,231	3.1	1,571	3.1
SRC	245	2.2	79	0.2	324	0.6
BKT	8	0.1	0	0.0	8	<0.1
WAE	780	6.9	4,495	11.4	5,274	10.4
Total Catch	11,309	22.3	39,455	77.7	50,762	100

WAE, RBT, BNT & SRC

Walleye make up the next largest component of the total catch (10%) followed by unmarked rainbow trout (RBT) (5%), BNT (4%) and stocked and unmarked SRC (SRC AD + SRC) (4%) (Table P10). Harvested WAE had a mean length of 14.7 inches with lengths ranging from 10.0 to 29.5 inches. Boat anglers were much more successful at catching all species except unmarked SRC, however, this may be a result of low sample sizes for SRC. Except for WAE, these species make up a minor component of the Pathfinder Reservoir fishery.

Table P11. Estimated annual harvest, release, total catch and catch/acre by bank, boat and all anglers for Pathfinder Reservoir.

Species	Angler Type	Kept	%	Released	%	Total Catch	Catch/Acre
RBT AD	Bank Anglers	7,091	82.0	1,561	18.0	8,652	0.61
	Boat Anglers	18,762	62.1	11,431	37.9	30,193	2.11
	All Anglers	25,853	66.6	12,991	33.4	38,844	2.72
RBT	Bank Anglers	730	75.3	240	24.7	970	0.07
	Boat Anglers	1,104	66.0	570	34.1	1,674	0.12
	All Anglers	1,833	69.3	811	30.7	2,644	0.19
BNT	Bank Anglers	258	82.2	56	17.8	314	0.02
	Boat Anglers	1,280	71.8	503	28.2	1,783	0.05
	All Anglers	1,537	73.3	560	26.7	2,097	0.15
SRC AD	Bank Anglers	268	78.8	72	21.2	340	0.02
	Boat Anglers	949	77.1	282	22.9	1,231	0.09
	All Anglers	1,217	77.5	354	22.5	1,571	0.11
SRC	Bank Anglers	181	73.88	64	26.1	245	0.02
	Boat Anglers	56	70.89	23	29.1	79	0.01
	All Anglers	238	73.46	86	26.5	324	0.02
BKT	Bank Anglers	8	100	0	0	8	<0.01
	Boat Anglers	0	0	0	0	0	<0.01
	All Anglers	8	100	0	0	8	<0.01
WAE	Bank Anglers	645	82.7	135	17.3	780	0.05
	Boat Anglers	3,401	75.7	1,094	24.3	4,495	0.32
	All Anglers	4,046	76.7	1,228	23.3	5,274	0.37
Annual Totals							
	Bank Anglers	9,181	81.2	2,128	18.8	11,309	0.79
	Boat Anglers	25,552	64.8	13,903	35.2	39,455	2.77
	All Anglers	34,732	68.4	16,030	31.6	50,762	3.56

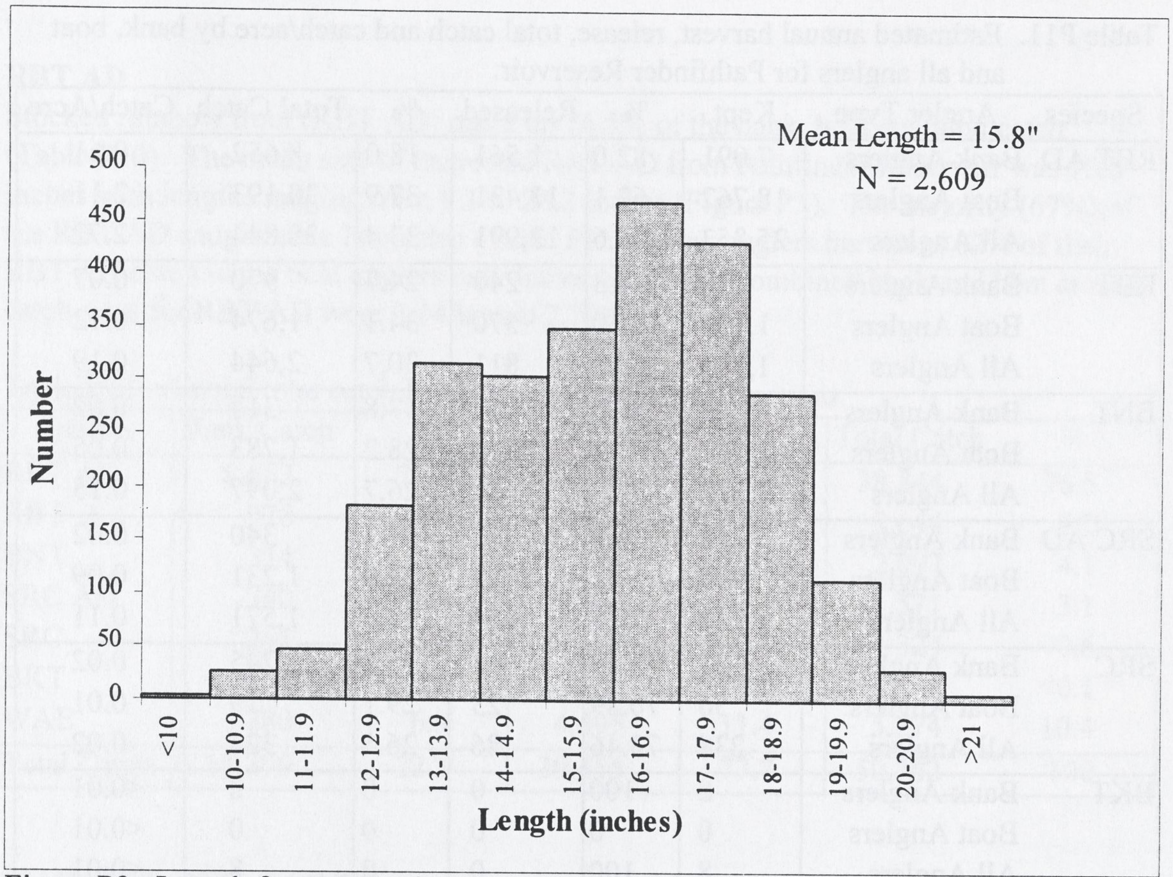


Figure P3. Length frequency of RBT AD harvested in Pathfinder Reservoir.

<u>Seasonal Distribution of Harvest by Species</u>

Rainbow trout dominated the harvest by species over the duration of the survey (Table P12). Harvest of rainbow trout increased during the spring and peaked in June. Harvest decreased through the summer and by October, few fish were harvested. A pulse of harvest occurred in December, likely due to favorable ice conditions. Bank harvest peaks in spring and again in December. Boat harvest is highest in early summer and lowest in the winter months. Rainbow trout was the only species harvested every month of the survey.

Walleye were harvested in the spring and summer, mainly by boat anglers. No WAE were harvested in the fall or through the ice. The majority of BNT are harvested in the spring and summer by boat anglers. Few BNT were harvested by bank anglers. SRC were harvested in similar patterns to BNT.

Table P12. Harvest by species by month for bank and boat anglers at Pathfinder Reservoir.

	BANK				BOAT			
Month	RBT	BNT	SRC	WAE	RBT	BNT	SRC	WAE
April	698	0	46	5	528	87	91	27
May	2,621	34	53	0	3,632	128	164	475
June	1,390	0	27	132	7,759	695	308	1,235
July	348	0	39	354	5,569	333	161	1,621
August	193	0	0	133	1,991	35	17	754
September	124	0	34	53	2,155	289	92	137
October	378	0	0	0	276	40	0	0
November	533	0	6	0	73	0	0	0
December	1,484	172	240	0	0	0	0	0
January	636	21	62	0	0	0	0	0
February	269	8	0	0	0	0	0	0
March	467	29	0	0	636	0	0	0
April	1,178	0	12	73	573	86	61	0
May	755	22	0	0	1,449	91	91	0
June	135	0	0	0	4,388	79	753	41
15 M. Tot.	11,209	285	518	750	29,030	1,863	1,739	4,290
Avg. 12 M.	7,820	258	450	645	19,865	1,280	1,005	3,401

Stocked Trout Strain Analysis

For the CWT analysis in Pathfinder Reservoir, strains were divided into 8 groups: 92-95 FRB Catchable, 92-95 ELR Catchable, 92-95 KRB Catchable, 92-95 SRC Catchable, 94-95 Large Sub-Catchable, 94 Sub-Catchable, 96 All Strains and Other Waters (Table P13). The 94-95 Large Sub-Catchable group consisted of ELR and KRB strains. The 94 Sub-Catchable group is one stock of ELR. Fish stocked in 1996 were only available to anglers for the last few months of the survey and were rarely harvested, thus all strains were grouped into 96 All Strains. Fish that were stocked in waters other than Pathfinder Reservoir were grouped in Other Waters.

92-95 FRB Catchables made up the largest percentage (34.8%) of the total stocked trout catch (Figure P4). This group also had the highest catch/hour (0.08) and catch/acre (0.95) (Table P14). 92-95 KRB Catchables made up the next largest component (26.7%) followed by 92-95 ELR Catchables (16.3%). Of the catchable stocks, 92-95 SRC Catchables had the lowest catch/hour (0.01) and made up the smallest component (5.3%) of the total stocked trout catch. The remaining 16.6% of the stocked trout catch consisted of Size of Stocking fish, 96 All Strains and Other Waters.

Table P13. Strain catch stratified by bank and boat by month, April 1995 - June 1996, at Pathfinder Reservoir.

TOTAL CATCH

BANK

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
	MONTH																
92-95 FRB Catchable	241	695	542	258	129	53	282	431	906	327	202	412	730	370	54	5,633	4,316
92-95 ELR Catchable	338	1299	293	72	14	18	35	43	219	73	0	32	216	78	36	2,765	1,635
92-95 KRB Catchable	96	494	366	14	14	18	88	108	219	97	67	32	0	39	18	1,671	1,164
92-95 SRC Catchable	0	146	44	29	0	0	0	22	187	49	0	0	0	19	0	496	391
94-95 Large Sub-Catchable	48	293	220	43	43	0	88	22	31	85	0	0	108	0	0	981	646
94 Sub-Catchable	24	55	15	14	0	0	0	22	94	36	0	0	27	0	0	287	226
96 All Strains	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Waters	24	110	59	0	0	35	0	0	31	0	0	0	27	175	18	480	273
TOTAL	772	3,093	1,538	429	201	124	494	646	1,686	667	269	476	1,108	682	126	12,311	8,652

BOAT

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
	MONTH																
92-95 FRB Catchable	195	1,811	2,779	2,499	578	762	273	0	0	0	0	1,188	169	607	2,228	13,086	9,192
92-95 ELR Catchable	346	1,944	1,617	1,344	289	389	109	36	0	0	0	216	56	133	529	7,008	4,695
92-95 KRB Catchable	86	2,450	4,327	2,499	1,191	931	55	85	0	0	0	216	188	398	1,142	13,567	9,271
92-95 SRC Catchable	173	320	478	189	18	68	0	18	0	0	0	0	19	209	1,559	3,050	1,671
94-95 Large Sub-Catchable	22	772	1,321	1,037	397	355	164	53	0	0	0	0	38	227	585	4,972	3,489
94 Sub-Catchable	22	373	433	141	72	85	55	2	0	0	0	0	38	0	167	1,387	871
96 All Strains	0	0	0	0	0	0	0	19	0	0	0	0	0	57	1,364	1,440	729
Other Waters	43	27	137	0	0	34	0	0	0	0	0	108	0	0	56	404	273
TOTAL	887	7,695	11,092	7,708	2,545	2,623	656	213	0	0	0	1,727	507	1,630	7,629	44,913	30,193

ALL

GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
	MONTH																
92-95 FRB Catchable	436	2,506	3,320	2,756	707	815	555	431	906	327	202	1,600	899	977	2,282	18,718	13,508
92-95 ELR Catchable	684	3,243	1,910	1,415	303	407	145	79	219	73	0	248	273	211	565	9,773	6,330
92-95 KRB Catchable	183	2,944	4,693	2,513	1,206	948	143	192	219	97	67	248	188	437	1,160	15,238	10,435
92-95 SRC Catchable	173	466	522	217	18	68	0	40	187	49	0	0	19	228	1,559	3,546	2,062
94-95 Large Sub-Catchable	70	1,065	1,541	1,080	440	355	252	75	31	85	0	0	146	227	585	5,952	4,135
94 Sub-Catchable	46	428	447	156	72	85	55	24	94	36	0	0	65	0	167	1,674	1,097
96 All Strains	0	0	0	0	0	0	0	19	0	0	0	0	0	57	1,364	1,440	729
Other Waters	67	136	195	0	0	69	0	0	31	0	0	108	27	175	74	884	546
TOTAL	1,658	10,788	12,629	8,137	2,746	2,747	1,150	860	1,686	667	269	2,203	1,615	2,313	7,755	57,224	38,844

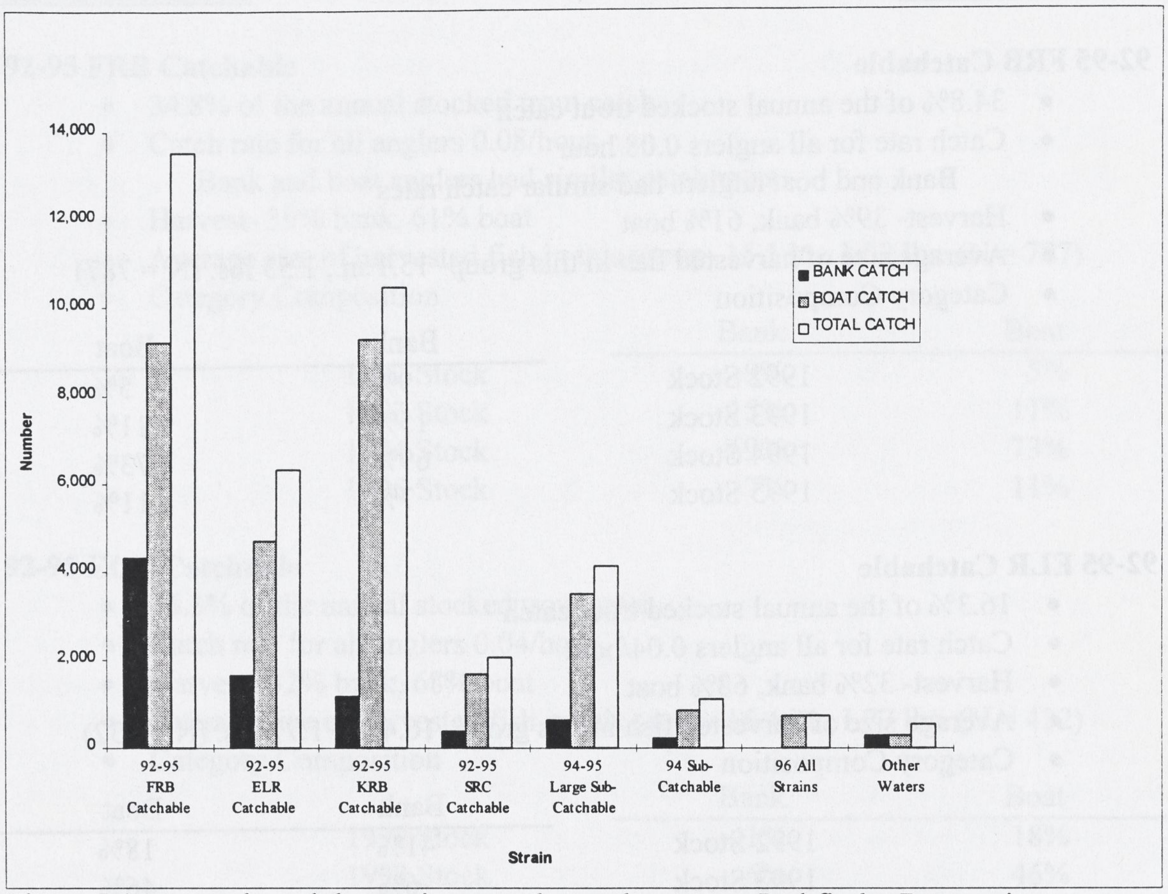


Figure P4. Annual catch by strain group by angler type at Pathfinder Reservoir.

Table P14. Strain catch rates per hour and per acre for bank, boat and all anglers at Pathfinder Reservoir (annually).

	Catch/Hour			Catch/Acre		
	Bank	Boat	Total	Bank	Boat	All
92-95 FRB Catchable	0.07	0.09	0.08	0.30	0.64	0.95
92-95 ELR Catchable	0.03	0.05	0.04	0.11	0.33	0.44
92-95 KRB Catchable	0.02	0.10	0.07	0.08	0.65	0.73
92-95 SRC Catchable	0.01	0.02	0.01	0.03	0.12	0.14
94-95 Large Sub-Catchable	0.01	0.04	0.03	0.05	0.24	0.29
94 Sub-Catchable	0.00	0.01	0.01	0.02	0.06	0.08
96 All Strains	0.00	0.01	0.00	0.00	0.05	0.05
Other Waters	0.00	0.00	0.00	0.02	0.02	0.04
Total	0.14	0.31	0.24	0.61	2.12	2.72

Strain Summaries

92-95 FRB Catchable

- 34.8% of the annual stocked trout catch
- Catch rate for all anglers 0.08/hour
  Bank and boat anglers had similar catch rates
- Harvest- 39% bank, 61% boat
- Average size of harvested fish in this group- 15.1 in., 1.53 lbs. (N = 787)
- Category Composition

	Bank	Boat
1992 Stock	9%	5%
1993 Stock	15%	11%
1994 Stock	69%	73%
1995 Stock	7%	11%

92-95 ELR Catchable

- 16.3% of the annual stocked trout catch
- Catch rate for all anglers 0.04/hour
- Harvest- 32% bank, 68% boat
- Average size of harvested fish in this group- 16.4 in., 1.77 lbs. (N = 432)
- Category Composition

	Bank	Boat
1992 Stock	41%	18%
1993 Stock	6%	46%
1994 Stock	45%	18%
1995 Stock	7%	18%

92-95 KRB Catchable

- 26.9% of the annual stocked trout catch
- Catch rate for all anglers 0.05/hour
  Boat anglers had 5 times greater catch rate than bank anglers
- Harvest- 14% bank, 86% boat
- Average size of harvested fish in this group- 16.2 in., 1.56 lbs. (N = 671)
- Category Composition

	Bank	Boat
1992 Stock	33%	8%
1993 Stock	16%	17%
1994 Stock	14%	30%
1995 Stock	37%	45%

92-95 SRC Catchable

- 5.3% of the annual stocked trout catch
- Catch rate for all anglers 0.01/hour
- Harvest- 24% bank, 76% boat

Strain Summaries

92-95 FRB Catchable

- 34.8% of the annual stocked trout catch
- Catch rate for all anglers 0.08/hour
  Bank and boat anglers had similar catch rates
- Harvest- 39% bank, 61% boat
- Average size of harvested fish in this group- 15.1 in., 1.53 lbs. (N = 787)
- Category Composition

	Bank	Boat
1992 Stock	9%	5%
1993 Stock	15%	11%
1994 Stock	69%	73%
1995 Stock	7%	11%

92-95 ELR Catchable

- 16.3% of the annual stocked trout catch
- Catch rate for all anglers 0.04/hour
- Harvest- 32% bank, 68% boat
- Average size of harvested fish in this group- 16.4 in., 1.77 lbs. (N = 432)
- Category Composition

	Bank	Boat
1992 Stock	41%	18%
1993 Stock	6%	46%
1994 Stock	45%	18%
1995 Stock	7%	18%

92-95 KRB Catchable

- 26.9% of the annual stocked trout catch
- Catch rate for all anglers 0.05/hour
  Boat anglers had 5 times greater catch rate than bank anglers
- Harvest- 14% bank, 86% boat
- Average size of harvested fish in this group- 16.2 in., 1.56 lbs. (N = 671)
- Category Composition

	Bank	Boat
1992 Stock	33%	8%
1993 Stock	16%	17%
1994 Stock	14%	30%
1995 Stock	37%	45%

92-95 SRC Catchable

- 5.3% of the annual stocked trout catch
- Catch rate for all anglers 0.01/hour
- Harvest- 24% bank, 76% boat

- Average size of harvested fish -(Auburn) 14.9 in., 1.53 lbs. (N = 124)
  (Bar BC) 14.3 in., 1.40 lbs. (N = 23)
- Category Composition

	Bank	Boat
1992 Stock	34%	9%
1993 Stock	18%	24%
1994 Stock	14%	18%
1995 Stock	34%	49%

94-95 Large Sub-Catchable

- 10.6% of the annual stocked trout catch
- Catch rate for all anglers 0.03/hour
- Harvest- 19% bank, 81% boat
- Average size of harvested fish in this group- 16.0 in., 1.68 lbs. (N = 271)
- Category Composition

	Bank	Boat
94 ELR	12%	12%
94 KRB	64%	38%
95 ELR	0%	3%
95 KRB	24%	47%

94 Sub-Catchable

- 2.8% of the annual stocked trout catch
- Catch rate for all anglers 0.01/hour
- Harvest- 25% bank, 75% boat
- Average size of harvested fish in this group- 15.1 in., 1.40 lbs. (N = 73)

96 All Strains

- 1.9% of the annual stocked trout catch
- Catch rate for all anglers <0.01/hour
- Harvest- 0% bank, 100% boat
- Average size of harvested fish in this group- 12.2 in., 0.80 lbs. (N = 52)

Other Waters

- 1.4% of the annual stocked trout catch
- Catch rate for all anglers <0.01/hour
- Harvest- 63% bank, 37% boat
- Composition of tag origins (N = 37)
  - 54%- Impossible (fish had to move upstream through a dam)
  - 35%- Miracle Mile
  - 8%- Seminoe Reservoir
  - 3%- I-80 to Seminoe Reservoir

DISCUSSION

The majority of Pathfinder Reservoir anglers were residents (91%) fishing mostly with bait (48%) followed by lures (29%) and a combination of bait and lures (22%). Bank and boat anglers were estimated in nearly equal numbers (47% bank, 53% boat). Pathfinder Reservoir is a consumptive fishery, with a harvest rate of nearly 70% of the total catch. Boat anglers were much more successful (0.41 fish/hour) than bank anglers (0.18 fish/hour) and fished nearly 30% longer per trip. Rainbow trout (RBT AD + RBT) made up 81.7% of the total catch followed by walleye at 10.4%. BNT, all SRC (SRC AD + SRC) and BKT made up the remaining 7.9% of the total catch. Catch rate for all anglers and all species was 0.32/hour.

Criteria

Pathfinder Reservoir

For a strain to be considered successful, it must meet at least one of the four criteria defined in the General Introduction (50% caught or harvested by number or 1 pound caught or harvested for each pound stocked). For fish harvested/caught in Pathfinder Reservoir, all catchable rainbow trout strains met at least one criteria (Table P15). FRB returned best, nearly 2 pounds were harvested and nearly 3 pounds were caught for each pound stocked. FRB met 3 of 4 criteria, only 50% by number harvested (36%) was not met. KRB met two criteria; pounds harvested and pounds caught. ELR met one criteria; pounds caught. Of the catchable stocks, only SRC did not meet any criteria.

Table P15. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch (* indicates criteria met) (For fish caught in Pathfinder Reservoir).

PATHFINDER HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
92-95 FRB Catchable	25,525	7,437	9,147	13,995	0.36	1.88*
92-95 ELR Catchable	31,800	10,652	4,188	7,413	0.13	0.70
92-95 KRB Catchable	25,575	8,287	6,940	10,826	0.27	1.31*
92-95 SRC Catchable	30,975	6,320	1,306	2,795	0.04	0.44
Overall Sums and Avg.	113,875	32,696	21,581	35,029	0.19	1.07

PATHFINDER TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
92-95 FRB Catchable	25,525	7,437	13,508	20,667	0.53*	2.78*
92-95 ELR Catchable	31,800	10,652	6,330	11,204	0.20	1.05*
92-95 KRB Catchable	25,575	8,287	10,435	16,279	0.41	1.96*
92-95 SRC Catchable	30,975	6,320	2,062	4,413	0.07	0.70
Overall Sums and Avg.	113,875	32,696	32,335	52,563	0.28	1.61

[1]- Numbers and pounds stocked represent an annual average over four years (1992-1995).

Pathfinder Reservoir + Miracle Mile

Pathfinder Reservoir stocked trout accounted for over half (55%) of the stocked trout catch in the Miracle Mile (see Miracle Mile chapter). When fish stocked in Pathfinder Reservoir and harvested/caught in the Miracle Mile are added to the criteria analysis, the three rainbow strains meet 3 of 4 criteria (Table P16). SRC still did not meet any criteria.

Table P16. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch (* indicates criteria met) (For fish caught in Pathfinder and the Miracle Mile).

PATH + MM HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
PATH FRB 92-95	25,525	7,437	10,134	15,831	0.40	2.13*
PATH ELR 92-95	31,800	10,652	5,588	10,427	0.18	0.98*
PATH KRB 92-95	25,575	8,287	7,291	11,447	0.29	1.38*
PATH SRC 92-95	30,975	6,320	1,347	2,869	0.04	0.45
Overall Sums and Avg.	113,875	32,696	24,360	40,574	0.21	1.24

PATH + MM TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
92-95 FRB Catchable	25,525	7,437	19,973	32,692	0.78*	4.40*
92-95 ELR Catchable	31,800	10,652	14,987	29,817	0.47*	2.80*
92-95 KRB Catchable	25,575	8,287	12,643	20,209	0.49*	2.44*
92-95 SRC Catchable	30,975	6,320	2,217	4,692	0.07	0.74
Overall Sums and Avg.	113,875	32,696	49,820	87,410	0.44	2.67

[1]- Numbers and pounds stocked represent an annual average over four years (1992-1995).

ELR were the most common Pathfinder Reservoir stocked strain caught in the Miracle Mile (49%) (Figure P5). FRB were the next largest contributor (37%) followed by KRB (13%) and SRC (1%).

The strain composition of the Pathfinder Reservoir stocked fish in the Miracle Mile indicates ELR have a propensity to move from lentic to lotic environments. In fact, more ELR stocked in Pathfinder Reservoir were caught in the Miracle Mile than in Pathfinder Reservoir (Figure P6). Interestingly, FRB, which are thought to be mainly a lentic strain, showed up in significant numbers in the Miracle Mile. KRB and SRC appear to be mainly lentic strains.

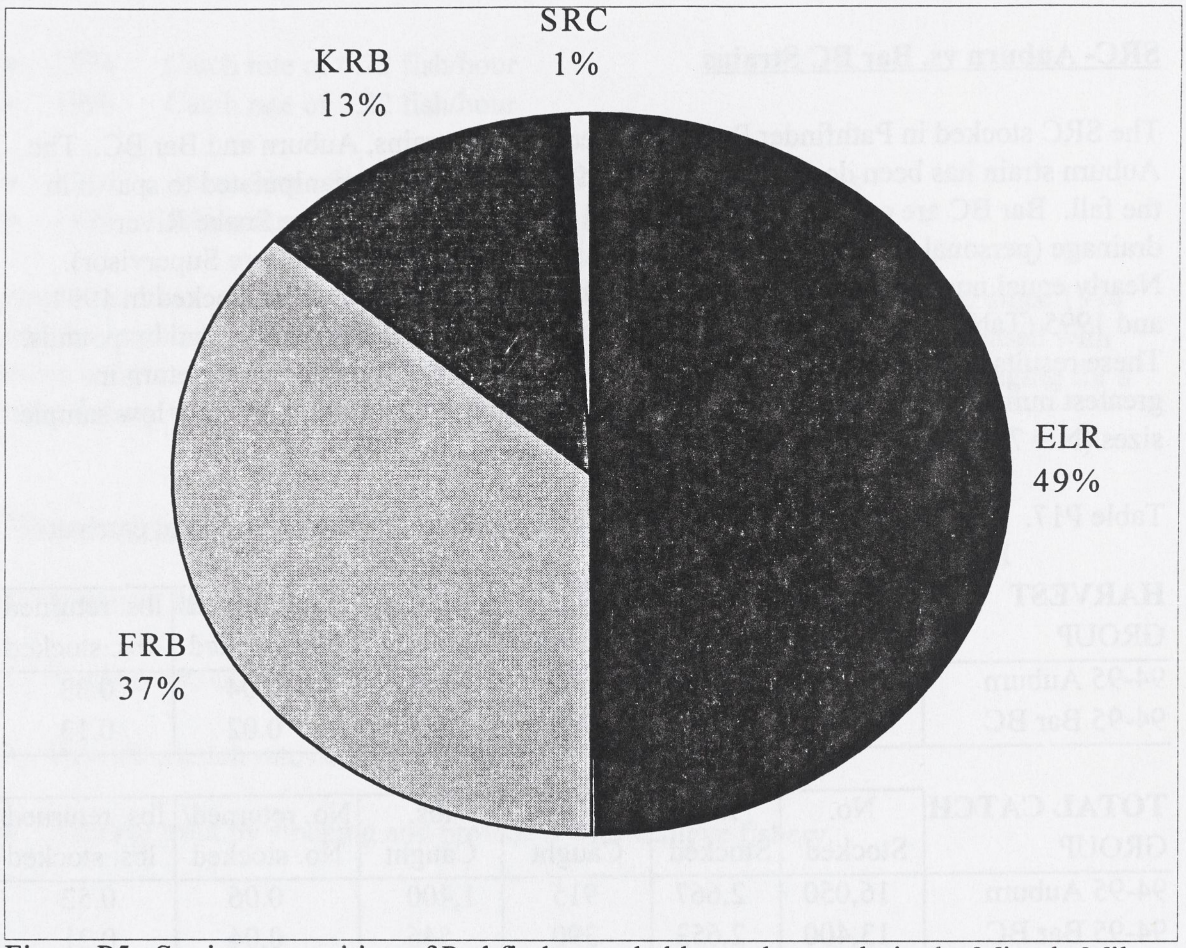


Figure P5. Strain composition of Pathfinder catchable stocks caught in the Miracle Mile.

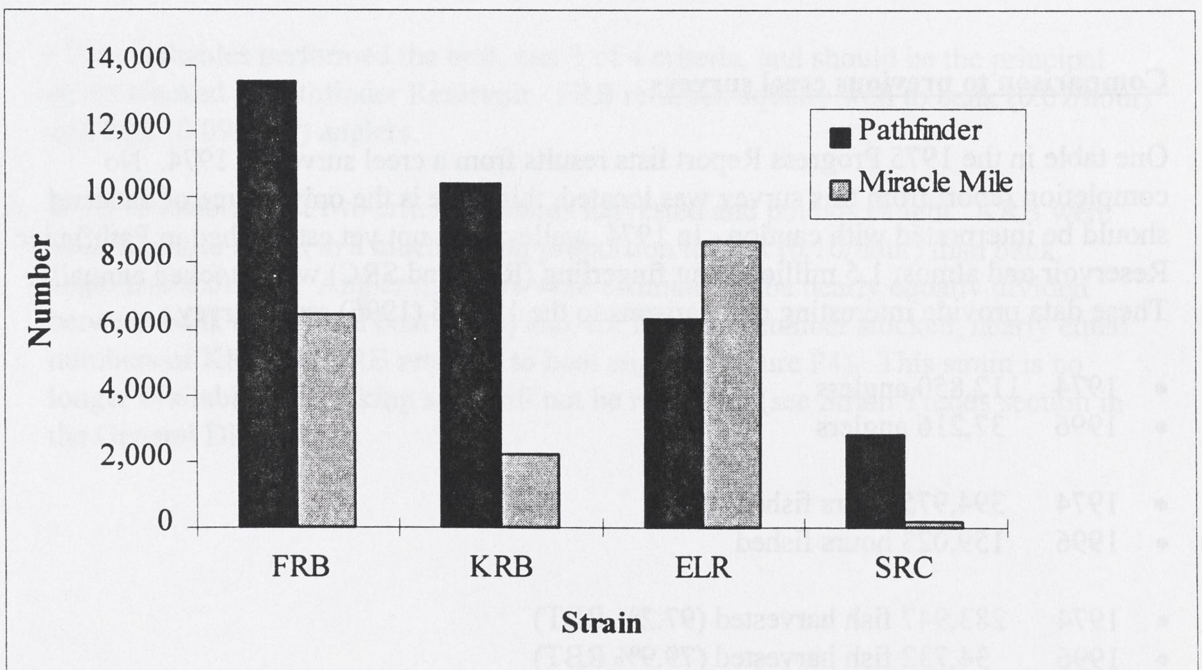


Figure P6. Catch location of Pathfinder Reservoir stocked catchable fish.

SRC- Auburn vs. Bar BC Strains

The SRC stocked in Pathfinder Reservoir were of two strains, Auburn and Bar BC. The Auburn strain has been domesticated since 1953 and has been manipulated to spawn in the fall. Bar BC are one generation removed from wild stocks in the Snake River drainage (personal communication, Steve Sharon, Assistant Fish Culture Supervisor). Nearly equal numbers and pounds of Auburn and Bar BC strains were stocked in 1994 and 1995 (Table P17). Auburn performed better than Bar BC by number and by pounds. These results should be interpreted with caution since SRC were shown to return in greatest numbers up to three years following stocking. In addition, relatively low sample sizes (N = 70) may influence results.

Table P17. Criteria for stocked SRC (average 12 months) for harvest and total catch at Pathfinder Reservoir.

HARVEST GROUP	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94-95 Auburn	16,050	2,667	567	868	0.04	0.33
94-95 Bar BC	13,400	2,653	246	345	0.02	0.13

TOTAL CATCH GROUP	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94-95 Auburn	16,050	2,667	915	1,400	0.06	0.52
94-95 Bar BC	13,400	2,653	390	546	0.04	0.21

[1]- Number and pounds stocked represent an annual average over two years (1994-1995).

Comparison to previous creel surveys

One table in the 1975 Progress Report lists results from a creel survey in 1974. No completion report from this survey was located, this table is the only source of data and should be interpreted with caution. In 1974, walleye had not yet established in Pathfinder Reservoir and almost 1.5 million trout fingerling (RBT and SRC) were stocked annually. These data provide interesting comparisons to the 1995-6 (1996) creel survey.

- 1974 112,850 anglers
- 1996 37,216 anglers

- 1974 394,975 hours fished
- 1996 159,023 hours fished

- 1974 283,947 fish harvested (97.2% RBT)
- 1996 34,732 fish harvested (79.9% RBT)

- 1974 Catch rate of 0.72 fish/hour
- 1996 Catch rate of 0.32 fish/hour

- 1974 Mean size of harvested fish- 13.4 inches, 0.81 pounds
- 1996 Mean size of harvested fish- 15.8 inches, 1.62 pounds

Angler numbers, hours fished, fish harvested and catch rates have decreased since 1974 and the establishment of walleye. Only mean size of harvested fish has increased with mean weight nearly doubling. This comparison shows the challenges of managing for a trout fishery with the presence of walleye.

Management Objectives

1. Preserve the opportunity for anglers to catch large trout (>20 inches).

2. Support 40,000 angler days annually.

3. Provide a catch rate of 0.4 fish/hour.

4. Manage trout by stocking and provide a wild walleye fishery.

Recommendations

1. FRB catchables performed the best, met 3 of 4 criteria, and should be the principal strain stocked in Pathfinder Reservoir. FRB returned equally well to bank (0.07/hour) and boat (0.09/hour) anglers.

2. KRB catchables met two criteria; pounds harvested and pounds caught. KRB were also shown to return in a much higher proportion to boat (0.10/hour) than bank anglers (0.02/hour). Angler numbers were estimated to be nearly equally divided between bank (47%) and boat (53%) and, for the same number stocked, nearly equal numbers of KRB and FRB returned to boat anglers (Figure P4). This strain is no longer available for stocking so it will not be requested (see Strain Trends section in the General Discussion).

3. ELR catchables met criteria for at least 1 pound caught for each pound stocked. This strain returned in lower numbers and pounds in Pathfinder Reservoir than FRB or KRB. It is recognized that ELR stocked as catchables in Pathfinder Reservoir make up a significant percentage of the stocked trout catch in the Miracle Mile, however, the same number of FRB stocked will return many more fish to the creel (Figure P6). In addition, FRB migrated to the Miracle Mile in large numbers (Figure P5).

4. SRC did not meet any criteria and should no longer be stocked in Pathfinder Reservoir.

5. Investigate the effectiveness of stocking 7 inch FRB. These fish would be cheaper to raise, therefore, more fish could be raised for the same cost within space constraints of the hatchery system. A group of 7 and 9 inch FRB will be tagged in 1997 and 1998 to ascertain the success of 7 inch versus 9 inch FRB. Results from this evaluation will be available in 2001.

Stocking Recommendations- Pathfinder Reservoir

	Historical Requests			**Future Requests**[1]		
	Number	Pounds	No./lb.	Number	Pounds	No./lb.
FRB	30,000	10,000	3	120,000	40,000	3
ELR	40,000	13,333	3	0	0	-
KRB	30,000	10,000	3	0	0	-
SRC	35,000	11,667	3	0	0	-
TOTAL	135,000	45,000		120,000	40,000	

[1]- These requests may be changed based on the results of the performance of 7 inch fish in Pathfinder Reservoir.

Seminoe Reservoir

INTRODUCTION

Seminoe Reservoir, formed by a 206 foot-high dam completed in 1939, is the most upstream impoundment on the North Platte River (Figure S1). The unregulated North Platte and Medicine Bow Rivers are the main tributaries to the reservoir. Several small tributaries contribute small amounts of water during runoff periods. The maximum surface area of the reservoir is 20,300 acres with a mean depth at full pool of 50.2 feet. Large water level fluctuations are common with a mean annual fluctuation of 31.8 feet (Marwitz 1994). Seminoe Reservoir fills rapidly during spring runoff, usually reaches its maximum storage in July, then is drawn down gradually to minimum storage levels in April. Over the past 30 years the mean surface area of the reservoir has varied from a low of 7,500 acres in 1967 to 19,400 acres in 1974 (Figure S2). From 1990 to 1995, the mean surface area of Seminoe Reservoir averaged 53% of capacity, 13% below the 30 year mean of 66%. A combination of heavy snow pack during the winter of 1994-95 and above average rainfall during the spring of 1995 increased the reservoir surface area across the 1996 water year to 16,623 acres or 82% of capacity.

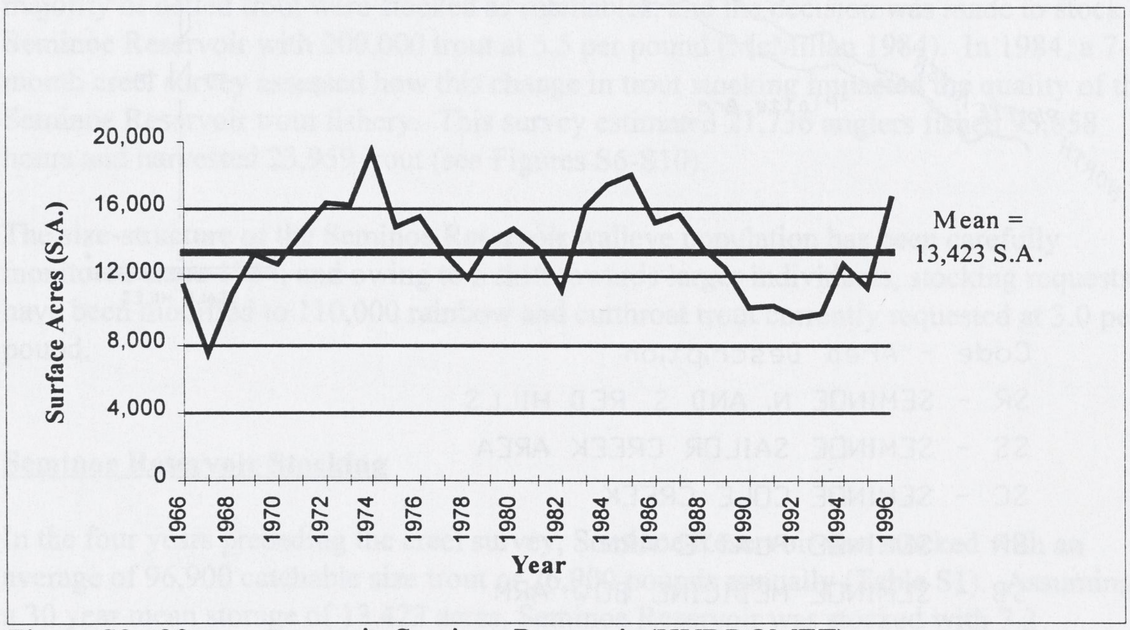
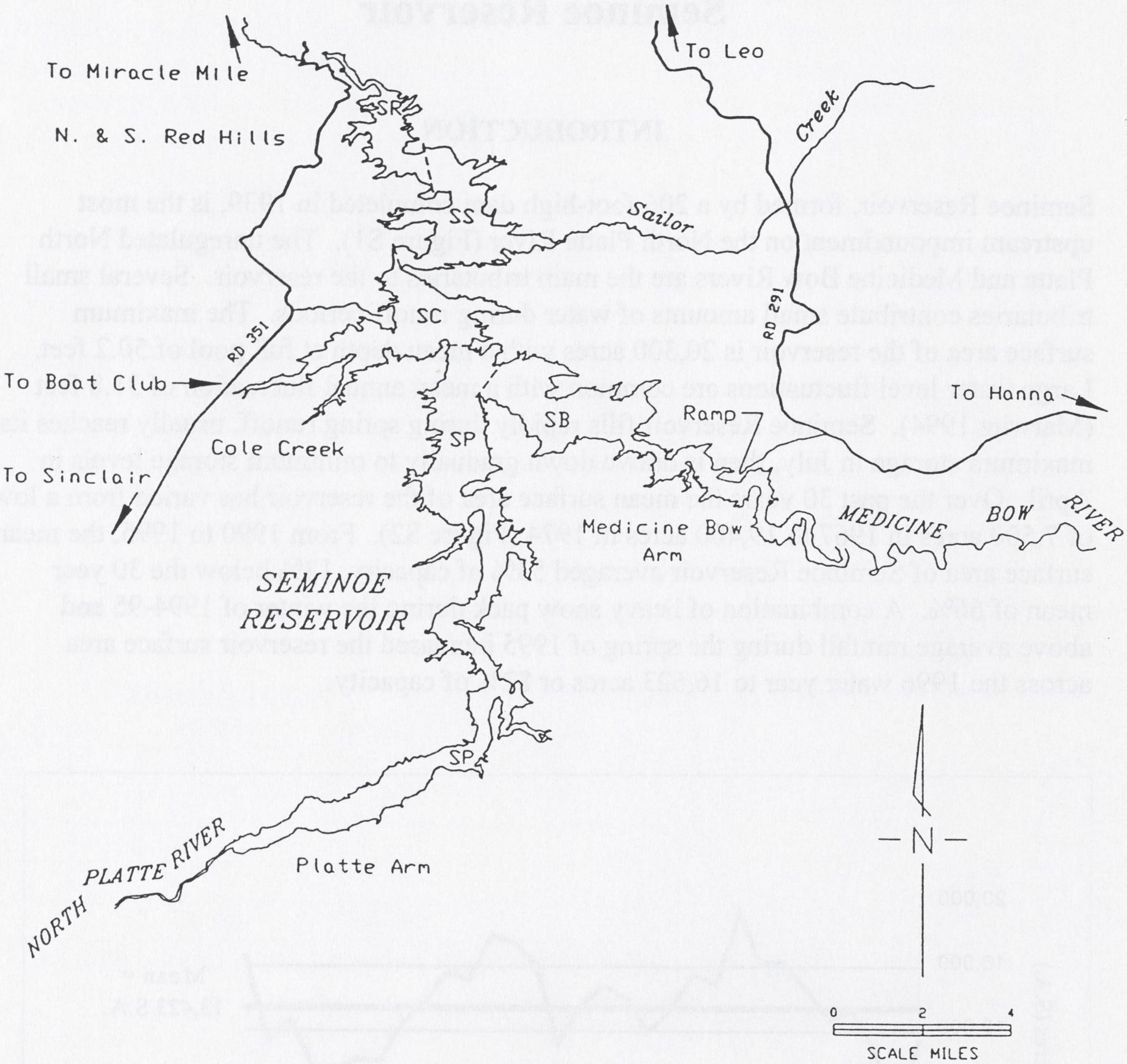


Figure S2. 30 year storage in Seminoe Reservoir (HYDROMET).



Code - Area Description

SR - SEMINOE N. AND S. RED HILLS

SS - SEMINOE SAILOR CREEK AREA

SC - SEMINOE COLE CREEK

SP - SEMINOE PLATTE ARM

SB - SEMINOE MEDICINE BOW ARM

Figure S1. Seminoe Reservoir

History of Seminoe Reservoir

Trout management in the North Platte drainage would forever be changed with the first documented catch of walleye in Seminoe Reservoir in 1961. After that time, numbers increased rapidly and by 1968, exploratory gill netting confirmed a well established walleye population in the Red Hills, Saylor Creek, and Coal Creek Bay portions of the reservoir. Through the 1960s and 1970s, the Wyoming Game and Fish Department continued to stock fingerling trout into Seminoe Reservoir, but fisheries biologists began to question what impacts walleye were having on stocked trout. An extensive study was initiated in 1974 to examine the success of trout stocked into Seminoe Reservoir. Through the next five years, the vast majority of the 500,000 to 800,000 rainbow trout fingerlings stocked annually were marked with fluorescent dye to later identify their size and date of stocking. In 1978, the Game and Fish Department completed a 7-month creel survey of Seminoe Reservoir that estimated 11,287 anglers fished 34,654 hours, but harvested only 1,753 trout (Peterson 1984). The results of this survey are significant because, prior to 1978, Seminoe Reservoir had been stocked exclusively with rainbow trout fingerlings. Loss of trout to walleye predation was identified as the major cause for the decline of the trout fishery. From 1979-1982, Game and Fish biologists continued to dye mark trout, but began requesting fish for stocking at larger sizes including sub-catchable and catchable size trout. Gill netting through this interval suggested the vast majority of netted trout were stocked as catchables, and the decision was made to stock Seminoe Reservoir with 200,000 trout at 5.5 per pound (McMillan 1984). In 1984, a 7-month creel survey assessed how this change in trout stocking impacted the quality of the Seminoe Reservoir trout fishery. This survey estimated 21,736 anglers fished 93,058 hours and harvested 23,959 trout (see Figures S6-S10).

The size-structure of the Seminoe Reservoir walleye population has been carefully monitored since 1984, and owing to a shift towards larger individuals, stocking requests have been modified to 110,000 rainbow and cutthroat trout currently requested at 3.0 per pound.

Seminoe Reservoir Stocking

In the four years preceding the creel survey, Seminoe Reservoir was stocked with an average of 96,900 catchable size trout or 26,900 pounds annually (Table S1). Assuming a 30 year mean storage of 13,423 acres, Seminoe Reservoir was stocked with 7.2 catchable trout or 2.0 pounds of trout per acre per year. Unlike Alcova and Pathfinder reservoirs where a significant proportion of stocked trout have been stocked in the spring over the past two years, 89% of the trout stocked into Seminoe Reservoir were released in the fall.

Rainbow strains accounted for 82% of the trout stocked, with SRC strains the remaining 18%. Between 1992 and 1995, 31,600 ELR (33% of the total), 31,400 KRB (32%), and

16,100 FRB (17%) were stocked annually. Between 1992 and 1994, an average of 23,900 SRC (18%) were stocked annually. The Auburn strain accounted for 79% of the total SRC stocked, with the Bar BC strain making up the balance (21%). SRC were not stocked in 1995.

During fall 1994, rainbow strains were marked with coded-wire tags to later identify if they were stocked by truck or barge (Table S2). This study was undertaken to understand the best method for stocking catchable trout to maximize angler return. Information on method of stocking, movement and annual survival rates of stocked trout will be discussed in future reports.

Table S2. Method of stocking fish- Seminoe Reservoir.

Strain	Stocking Date	Method of Stocking	Pounds Stocked	Number/ Pound	Number Stocked
ELR	94/09/12	TRUCK	2,572	3.9	10,000
	94/09/12	BARGE	5,040	4.1	21,400
KRB	94/09/12	TRUCK	5,450	3.5	19,000
	94/09/12	BARGE	6,494	3.6	23,700

Table S1. Number of trout stocked into Seminoe Reservoir prior to and during the 15 month programmed creel survey.

Species/ Strain	Stock Date	Pounds Stocked	Number/ Pound	Number Stocked	Tag Retention	Number Stocked w/ Tags
ELR	92/04/28[1]	6,390	3.1	19,800	88.7	17,600
	92/09/02[1]	3,875	2.5	9,700	81.5	7,900
	93/04/22[1]	6,666	3.0	20,000	87.4	17,500
	93/09/21[1]	3,580	2.4	8,600	87.1	7,500
	94/09/12[1]	7,612	4.1	31,400	93.3	29,300
	95/04/24[1]	2,720	3.0	8,200	98.5	8,000
	95/09/20[1]	8,130	3.5	28,500	99.3	28,300
	96/05/17[5]	1,750	3.4	6,000	91.0	5,400
Sub-Total		40,723		132,200	91.9	121,500
KRB	92/04/28[2]	4,160	3.8	15,800	94.9	15,000
	92/09/02[2]	1,815	3.9	7,100	88.0	6,200
	93/04/23[2]	5,135	2.7	13,900	94.5	13,100
	94/09/12[2]	11,944	3.6	42,700	92.0	39,300
	95/09/20[2]	12,643	3.6	45,900	97.6	44,800
	96/05/17[5]	1,440	5.1	7,300	97.0	7,100
Sub-Total		37,137		132,700	94.6	125,500
FRB	92/10/06[3]	3,145	2.8	8,800	92.0	8,100
	93/09/21[3]	5,990	3.0	18,000	86.2	15,300
	94/09/12[3]	3,750	2.6	9,800	91.3	8,900
	95/09/20[3]	7,470	3.7	27,900	98.2	27,400
Sub-Total		20,355		64,500	92.6	59,700
SRC01	92/10/06[4]	7,214	4.6	33,200	95.2	31,600
	93/10/25[4]	2,460	6.8	16,700	74.5	12,500
	94/09/12[4]	770	9.0	6,900	91.7	6,400
SRC09	94/06/07[4]	2,180	6.8	14,800	80.6	11,900
Sub-Total		12,624		71,600	87.2	62,400
Grand Total		110,839		401,000	92.0	369,100

[1]- ELR Catchable 92-95
[2]- KRB Catchable 92-95
[3]- FRB Catchable 92-95
[4]- SRC Catchable 92-94
[5]- 96 All Strains

METHODS

All methods outlined in the General Methods are applicable to Seminoe Reservoir.

Biological (floating and sinking gill nets) data collected during the creel survey were used to establish length-weight relationships specific to Seminoe Reservoir. The equations for rainbow trout strains and SRC are:

FRB- weight = exp((3.021128742*length) - 7.87722281) ($R^2 = 0.97$).
KRB- weight = exp((2.789868584*length) - 7.360421682) ($R^2 = 0.96$).
ELR- weight = exp((2.865672877*length) - 7.516251442) ($R^2 = 0.96$).
SRC- weight = exp((2.992116997*length) - 7.82143691) ($R^2 = 0.96$).

These equations were applied to the respective strain group/species measured by a creel clerk. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and caught.

RESULTS

Angler Information

Creel clerks interviewed 1,550 anglers at Seminoe Reservoir. Of these, 1,018 (66%) were Wyoming residents and 532 (34%) were nonresidents. Anglers were asked what terminal tackle they used when contacted (Table S3). The majority of anglers used solely bait (41.4%) followed by lures (31.4%) and a combination of bait and lures (24.3%). Bank and ice anglers used mainly bait while lures were most used by boat anglers.

Table S3. Terminal tackle employed by Seminoe Reservoir anglers.

Terminal Tackle	All Anglers Number	All Anglers %	Bank %	Boat %	Ice %
Bait	641	41.4%	70.8%	19.4%	60.5%
Lures	486	31.3%	11.1%	46.9%	7.9%
Bait and Lures	377	24.3%	15.5%	30.4%	31.6%
Flies and Lures	17	1.1%	1.0%	1.2%	0%
Bait and Flies	11	0.7%	1.3%	0.3%	0%
Bait, Flies and Lures	9	0.6%	0.3%	0.8%	0%
Flies	9	0.6%	0%	1.0%	0%

Of the 95% of anglers who stated a species preference, 49.6% were targeting any trout species, 31.0% targeted trout and walleye and 19.4% were fishing for walleye.

The majority of anglers used only one pole (71%) rather than the maximum two (27%) allowed (open-water) (Table S4). The remaining 2% were ice anglers during the special ice regulation season where ice anglers could use up to 6 poles. Bank anglers harvested the highest proportion of their catch but boat anglers were able to harvest more fish/angler than bank or ice anglers.

Table S4. Angler characteristics at Seminoe Reservoir (completed trips only).

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Bank	304	1 - 61% 2 - 39% Avg.=1.40	88%- Harv. 12%- Rel.	1.48
Boat	594	1 - 81% 2 - 19% Avg.=1.19	71%- Harv. 29%- Rel.	2.08
Ice	25	1 - 28% 2 - 24% 3 - 16% 4 - 12% 5 - 8% 6 - 12% Avg.=2.84	68%- Harv. 34%- Rel.	0.76

Nearly two-thirds of all anglers caught at least one trout and 4% harvested their limit (Table S5). Eleven percent of anglers caught at least one walleye. Only 1% of anglers harvested 6 or more walleye. When all game fish are combined, 11% of anglers caught at least 6 fish.

Table S5. Percentage of anglers who harvested/caught 0 fish, at least 1 fish, at least 2 fish, etc. at Seminoe Reservoir (completed trips only) (TRT = all trout, ALL = all game fish).

		Number of Fish						
		0	≥1	≥2	≥3	≥4	≥5	≥6
TRT	Harvest	41%	59%	40%	25%	16%	8%	4%
	Catch	34%	66%	48%	32%	24%	14%	9%
WAE	Harvest	89%	11%	8%	5%	3%	2%	1%
	Catch	89%	11%	8%	5%	3%	2%	1%
ALL	Harvest	33%	67%	47%	30%	20%	11%	6%
	Catch	26%	74%	55%	39%	28%	18%	11%

Pressure

From April 1995 through June 1996, we estimated 44,759 anglers (Table S6) fished 179,371 hours (Table S7). More anglers fished from a boat (59%) than from the bank (41%). On an annual basis, we estimated 33,246 anglers fished 136,079 hours. This yields annual estimates of 2.5 anglers/acre and 10.1 hours/acre.

Table S6. Seminoe Reservoir- estimated number of anglers and anglers/acre.

	Bank	/acre	Boat	/acre	All	/acre
April	1,259	0.1	401	0.0	1,661	0.1
May	1,565	0.1	2,692	0.2	4,256	0.3
June	3,349	0.2	4,232	0.3	7,581	0.6
July	2,463	0.2	9,290	0.7	11,753	0.9
August	838	0.1	2,658	0.2	3,496	0.3
September	865	0.1	2,508	0.2	3,373	0.3
October	519	0.0	182	0.0	701	0.1
November	311	0.0	0	0.0	311	0.0
December	91	0.0	0	0.0	91	0.0
January	562	0.0	0	0.0	562	0.0
February	445	0.0	0	0.0	445	0.0
March	887	0.1	114	0.0	1,001	0.1
April	1,233	0.1	123	0.0	1,356	0.1
May	1,825	0.1	1,261	0.1	3,086	0.2
June	2,073	0.2	3,013	0.2	5,086	0.4
15 Month Total	18,283	1.4	26,475	2.0	44,759	3.3
Average 12 Months	12,631	0.9	20,614	1.5	33,246	2.5

Total fishing pressure (bank + boat) was highest from May through September, then dropped in October through March. There was no significant difference ($p = 0.12$) between the total hours fished by bank and boat anglers.

Table S7. Seminoe Reservoir- estimated pressure (angler hours and hours/acre) for bank, boat and all anglers.

	Bank Hours	/acre	Boat Hours	/acre	All Anglers	/acre
April	2,402	0.2	2,140	0.2	4,541	0.3
May	4,959	0.4	11,814	0.9	16,773	1.2
June	6,981	0.5	18,751	1.4	25,732	1.9
July	7,798	0.6	43,527	3.2	51,325	3.8
August	2,769	0.2	14,077	1.0	16,846	1.3
September	2,375	0.2	9,837	0.7	12,212	0.9
October	2,434	0.2	787	0.1	3,220	0.2
November	1,163	0.1	0	0.0	1,163	0.1
December	353	0.0	0	0.0	353	0.0
January	1,843	0.1	0	0.0	1,843	0.1
February	2,258	0.2	0	0.0	2,258	0.2
March	3,072	0.2	495	0.0	3,567	0.3
April	5,032	0.4	451	0.0	5,482	0.4
May	6,136	0.5	5,396	0.4	11,532	0.9
June	7,473	0.6	15,053	1.1	22,526	1.7
15 Month Total	57,045	4.2	122,326	9.1	179,371	13.4
Average 12 Months	40,555	3.0	95,524	7.1	136,079	10.1

Pressure was significantly greater (p = 0.02) on weekend days than weekdays (Table S8), indicating Seminoe Reservoir is mainly a weekend fishery.

Table S8. Pressure (hours fished) during weekdays (WD) and weekend days (WE) at Seminoe Reservoir.

	Total WD	Total WE
15 Months	65,381	113,991
12 Month Average	47,850	88,229

An annual estimate of trip length for all anglers was 4.09 hours. Boat trips were much longer (4.63 hours) than bank trips (3.21 hours).

Catch Rates

Combining both bank and boat anglers yields a mean annual catch rate of 0.64 fish/hour (Table S9). Catch rates were highest for boat anglers in the spring. Bank catch rates peaked in June and October.

Table S9. Catch rates (fish per hour, all species combined) for bank, boat and all anglers at Seminoe Reservoir.

	Bank	Boat	All
April	0.64	0.84	0.74
May	0.60	1.01	0.87
June	1.45	0.89	1.03
July	0.63	0.75	0.71
August	0.85	0.81	0.85
September	0.43	0.41	0.42
October	1.05	0.66	0.91
November	0.19	0.00	0.19
December	0.71	0.00	0.71
January	0.23	0.00	0.23
February	0.21	0.00	0.21
March	0.23	0.00	0.20
April	0.24	0.30	0.26
May	0.43	0.75	0.58
June	0.24	0.72	0.56
15 Month	0.60	0.70	0.67
Average 12 Months	0.58	0.66	0.64

Catch and Harvest

The estimated annual total catch was 87,067 fish (Table S10). Boat and bank anglers accounted for 73% and 27% of the total catch, respectively. Total estimated annual harvest was 69,215 (Table S11).

RBT AD

Stocked rainbow trout (RBT AD) made up over 65% of the total catch (Table S10). The mean size of harvested RBT AD from Seminoe Reservoir was 15.1 inches with lengths ranging from 8.8 to 21.8 inches (Figure S3). The majority (73%) of the RBT AD caught were harvested (Table S11). Although boat anglers harvested more RBT AD than bank anglers, bank anglers were more harvest-oriented. Bank anglers harvested 83% while boat anglers harvested 68% of their RBT AD catch. Annual catch rates for RBT AD were 0.42/hr and 4.3/acre.

Table S10. Annual total catch by species at Seminoe Reservoir.

Species	Bank Catch	%	Boat Catch	%	Total Catch	%
RBT AD	17,676	74.7	39,434	62.2	57,110	65.6
RBT	1,666	7.0	2,707	4.3	4,373	5.0
BNT AD	39	0.2	0	0.0	39	0.0
BNT	204	0.9	162	0.3	365	0.4
SRC AD	957	4.0	885	1.4	1,842	2.1
SRC	286	1.2	123	0.2	409	0.5
LAT	21	0.1	83	0.1	104	0.1
WAE	2,814	11.9	20,011	31.6	22,825	26.2
Total Catch	23,663	27.2	63,405	72.8	87,067	100.0

WAE, RBT, BNT, SRC & LAT

Walleye make up the second largest component of the total catch (26%) followed by wild rainbow trout (RBT) (5%), stocked SRC (SRC AD) (2%) and BNT (0.4%) (Table S10). The mean size of harvested WAE was 14.7 inches with lengths ranging from 10.0 to 24.9 inches (Figure S4). The overwhelming majority (97%) of the WAE caught were harvested (Table S11). Annual catch rates for WAE were 0.17/hour and 1.7/acre. Boat anglers were much more successful at catching all species except unmarked SRC and BNT. This may be a function of small sample sizes for these species. Lake trout (LAT) were caught in small numbers by boat and bank anglers. These fish represent a stock of 12,000 9.5 inch (4.6/pound) fish in 1990. No further stocking of LAT has occurred since 1990 and none are anticipated. With the exception of WAE, these species make up a minor component of the Seminoe Reservoir fishery.

Table S11. Estimated annual harvest, release, total catch and catch/acre by bank, boat and all anglers for Seminoe Reservoir.

Species	Angler Type	Kept	%	Released	%	Total Catch	Catch/Acre
RBT AD	Bank Anglers	14,638	82.8	3,038	17.2	17,676	1.3
	Boat Anglers	26,943	68.3	12,491	31.7	39,434	2.9
	All Anglers	41,581	72.8	15,529	27.2	57,110	4.3
RBT	Bank Anglers	1,274	76.5	393	23.6	1,666	0.1
	Boat Anglers	1,531	56.6	1,176	43.4	2,707	0.2
	All Anglers	2,804	64.1	1,569	35.9	4,373	0.3
BNT AD	Bank Anglers	36	92.3	3	7.7	39	0.0
	Boat Anglers	0	0.0	0	0.0	0	0.0
	All Anglers	36	92.3	3	7.7	39	0.0
BNT	Bank Anglers	194	95.1	10	4.9	204	0.0
	Boat Anglers	115	71.4	46	28.6	161	0.0
	All Anglers	309	84.7	56	15.3	365	0.0
SRC AD	Bank Anglers	939	98.1	18	1.9	957	0.1
	Boat Anglers	826	93.3	59	6.7	885	0.1
	All Anglers	1,765	95.8	77	4.2	1,842	0.1
SRC	Bank Anglers	281	98.3	5	1.7	286	0.0
	Boat Anglers	107	87.0	16	13.0	123	0.0
	All Anglers	388	94.9	21	5.1	409	0.0
LAT	Bank Anglers	21	100.0	0	0.0	21	0.0
	Boat Anglers	83	0.0	0	0.0	83	0.0
	All Anglers	104	100.0	0	0.0	104	0.0
WAE	Bank Anglers	2,800	99.5	14	0.5	2,814	0.2
	Boat Anglers	19,428	97.1	583	2.9	20,011	1.5
	All Anglers	22,228	97.4	597	2.6	22,825	1.7
Annual Totals							
	Bank Anglers	20,183	85.3	3,481	14.7	23,663	1.8
	Boat Anglers	49,033	77.3	14,371	22.7	63,404	4.7
	All Anglers	69,215	79.5	17,852	20.5	87,067	6.5

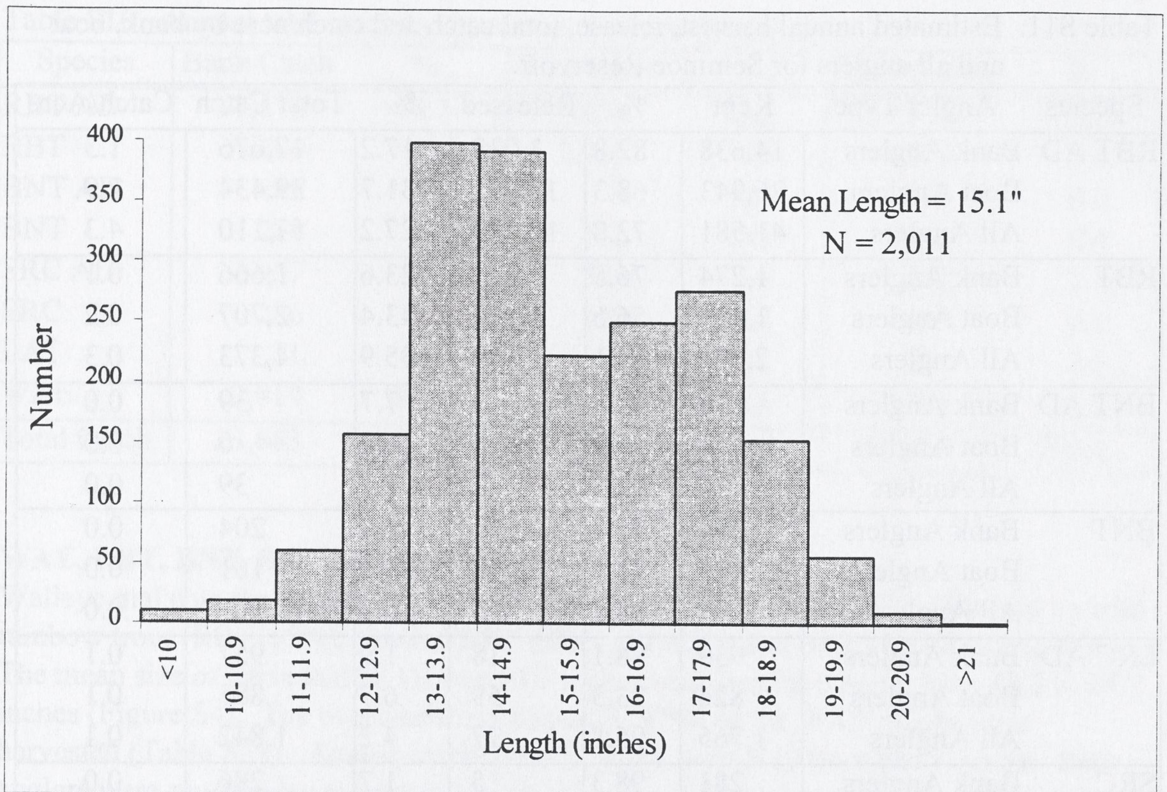


Figure S4. Length frequency of RBT AD harvested in Seminoe Reservoir.

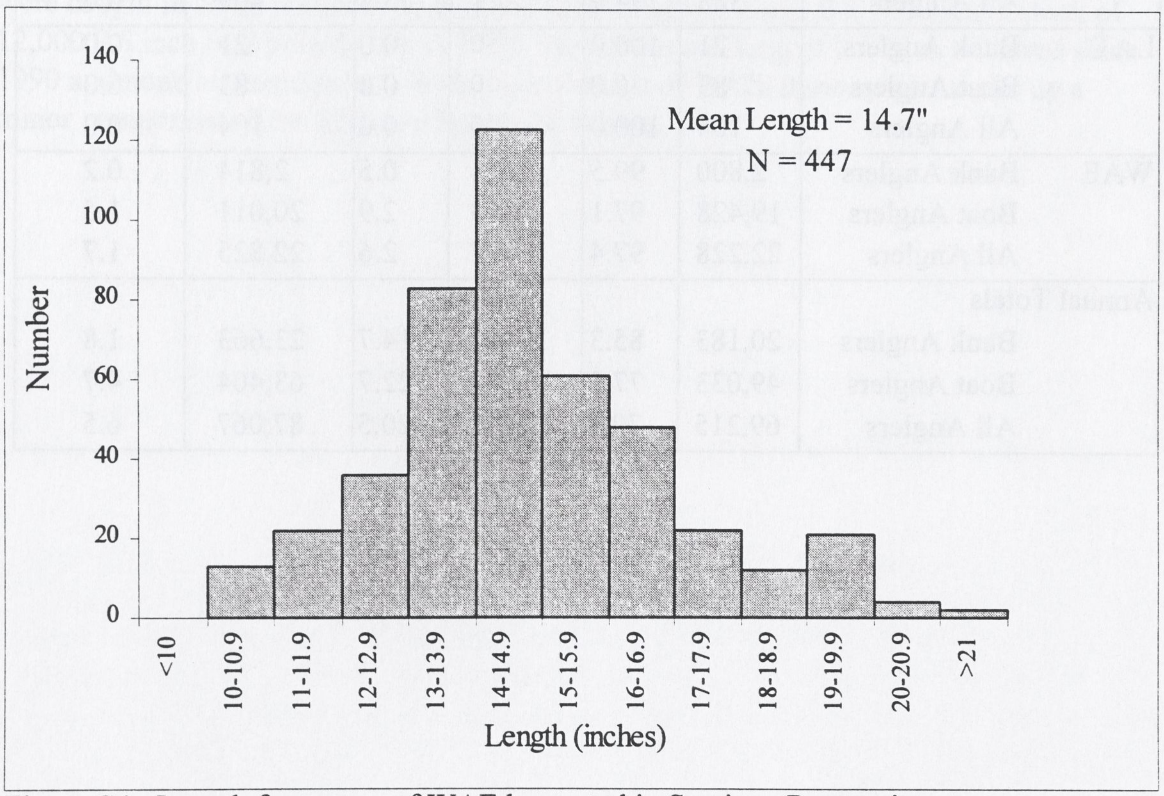


Figure S4. Length frequency of WAE harvested in Seminoe Reservoir.

Seasonal Distribution of Harvest by Species

Rainbow trout were the largest component (64%) of the harvest by species over the duration of the survey (Table S12). Harvest peaked in June and steadily decreased until the next spring. Rainbow trout was the only species harvested every month of the survey.

Walleye were harvested throughout the summer, mainly by boat anglers. July was the peak month for WAE harvest. No WAE were harvested in the fall or through the ice. The majority of SRC and BNT are harvested in the spring and summer. SRC were harvested every month except March, however, numbers of SRC harvested were far below RBT or WAE. Lake trout were harvested in small numbers in the spring and summer.

Table S12. Harvest by species by month for bank and boat anglers at Seminoe Reservoir.

	BANK					BOAT				
Month	RBT	BNT	SRC	LAT	WAE	RBT	BNT	SRC	LAT	WAE
April	1,240	0	199	31	0	875	0	89	3	0
May	2,012	108	487	10	0	5,335	99	507	58	0
June	7,864	80	710	0	1,159	12,877	46	563	32	369
July	3,258	46	51	0	1,426	9,973	21	287	0	13,722
August	1,749	34	34	0	622	3,604	0	0	37	5,115
September	584	40	94	0	98	2,094	21	51	0	369
October	1,005	0	124	0	67	103	0	0	0	21
November	234	0	59	0	0	0	0	0	0	0
December	206	0	51	0	0	0	0	0	0	0
January	123	0	12	0	0	0	0	0	0	0
February	386	0	15	0	0	0	0	0	0	0
March	423	11	0	0	0	0	0	0	0	0
April	1,109	9	22	0	0	118	0	0	0	0
May	2,129	0	76	0	0	2,600	0	32	0	0
June	1,534	0	65	0	15	3,594	0	0	0	32
15 M. Tot.	23,855	329	1,999	41	3,387	41,173	188	1,528	129	19,628
Avg. 12 M.	15,912	230	1,220	21	2,800	28,473	115	933	83	19,428

Stocked Trout Strain Analysis

For the CWT analysis in Seminoe Reservoir, strains were divided into 6 groups: 92-95 FRB Catchable, 92-95 ELR Catchable, 92-95 KRB Catchable, 92-94 SRC Catchable, 96 All Strains and Other Waters (Table S13). Fish stocked in 1996 were only available to anglers for the last few months of the survey and were rarely harvested, thus all strains were grouped into 96 All Strains. Fish that were stocked in waters other than Seminoe Reservoir were grouped in Other Waters.

KRB Catchables made up the largest percentage (59.8%) of the total stocked trout catch (Figure S5). This group also had the highest catch/hour (0.21) and catch/acre (2.39) (Table S14). ELR Catchables made up the next largest component (19.0%) followed by FRB Catchables (15.5%). Of the catchable stocks, SRC Catchables had the lowest catch/hour (0.01) and made up the smallest component (3.7%) of the total stocked trout catch. The remaining 2.0% of the stocked trout catch consisted of 96 All Strains and fish from Other Waters.

Table S13. Strain catch stratified by bank and boat by month, April 1995 - June 1996, at Seminoe Reservoir.

TOTAL CATCH

BANK

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92-95 FRB Catchable	490	276	1855	839	471	108	444	0	82	88	232	501	267	569	492	6,715	4,740
92-95 ELR Catchable	294	804	2120	581	314	189	761	59	41	175	174	0	289	813	523	7,138	4,716
92-95 KRB Catchable	392	502	3446	1613	1100	162	476	0	0	29	58	188	600	976	277	9,818	6,722
92-94 SRC Catchable	343	176	398	0	0	54	127	0	82	29	29	0	22	61	62	1,383	852
96 All Strains	0	0	0	0	0	0	0	0	0	0	0	0	0	20	31	51	26
Other Waters	147	201	398	129	0	0	63	0	0	0	29	0	0	20	31	1,018	620
TOTAL	1,666	1,959	8,216	3,161	1,886	514	1,872	59	206	322	523	689	1,178	2,460	1,415	26,123	17,676

BOAT

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92-95 FRB Catchable	176	856	1,636	1,407	228	387	19	0	0	0	0	0	9	217	1,213	6,148	4,095
92-95 ELR Catchable	528	1,826	1,782	1,583	762	562	19	0	0	0	0	0	57	650	1,586	9,354	6,140
92-95 KRB Catchable	925	5,820	11,745	7,975	3,884	1,511	0	0	0	0	0	0	76	2,816	6,716	41,467	27,418
92-94 SRC Catchable	88	571	255	352	152	211	0	0	0	0	0	0	0	93	93	1,814	1,265
96 All Strains	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	93	47
Other Waters	0	114	0	0	76	35	37	0	0	0	0	0	0	155	373	791	470
TOTAL	1,717	9,186	15,417	11,317	5,103	2,706	75	0	0	0	0	0	142	3,929	10,074	59,667	39,434

ALL

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
92-95 FRB Catchable	666	1,132	3,492	2,246	700	495	463	0	82	88	232	501	276	786	1,705	12,863	8,835
92-95 ELR Catchable	822	2,630	3,902	2,164	1,076	751	780	59	41	175	174	0	346	1,463	2,109	16,492	10,856
92-95 KRB Catchable	1,317	6,322	15,190	9,588	4,984	1,673	476	0	0	29	58	188	676	3,791	6,993	51,285	34,141
92-94 SRC Catchable	431	746	652	352	152	265	127	0	82	29	29	0	22	154	155	3,197	2,117
96 All Strains	0	0	0	0	0	0	0	0	0	0	0	0	0	20	124	144	72
Other Waters	147	315	398	129	76	35	101	0	0	0	29	0	0	175	404	1,809	1,089
TOTAL	3,383	11,145	23,634	14,478	6,988	3,219	1,947	59	206	322	523	689	1,320	6,389	11,489	85,790	57,110

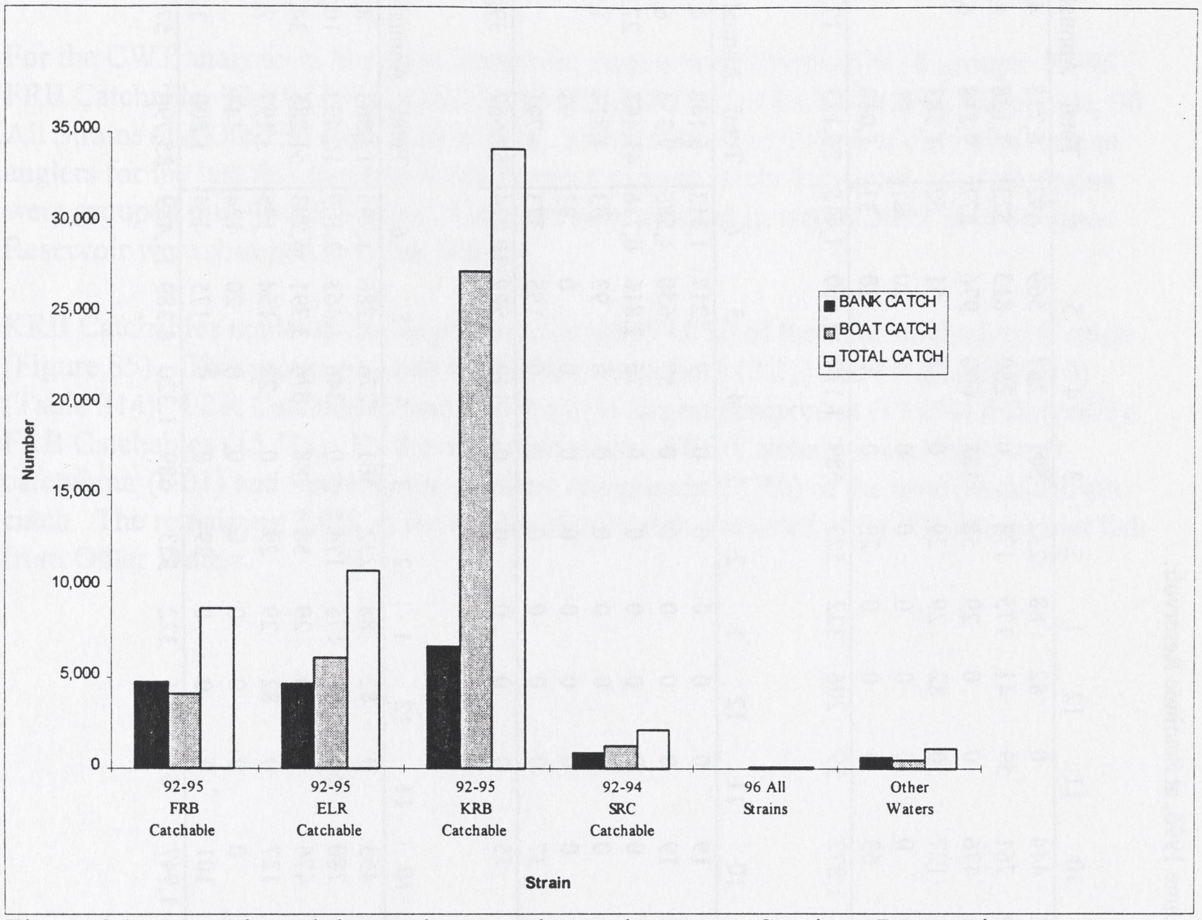


Figure S5. Annual catch by strain group by angler type at Seminoe Reservoir.

Table S14. Strain catch rates per hour and per acre for bank, boat and all anglers at Seminoe Reservoir (annually).

	Catch/Hour			Catch/Acre		
	Bank	Boat	Total	Bank	Boat	All
92-95 FRB Catchable	0.08	0.04	0.06	0.33	0.29	0.62
92-95 ELR Catchable	0.08	0.06	0.07	0.33	0.43	0.76
92-95 KRB Catchable	0.11	0.28	0.21	0.47	1.92	2.39
92-94 SRC Catchable	0.01	0.01	0.01	0.06	0.09	0.15
96 All Strains	0.00	0.00	0.00	0.00	0.00	0.01
Other Waters	0.01	0.00	0.01	0.04	0.03	0.08
Total	0.29	0.41	0.36	1.24	2.77	4.01

Strain Summaries

92-95 FRB Catchable

- 15.5% of the annual stocked trout catch
- Catch rate for all anglers 0.06/hour
- Harvest- 58% bank, 42% boat
- Average size of harvested fish in this group- 15.4 in., 1.54 lbs. (N = 263)
- Category Composition

	Bank	Boat
1992 Stock	10%	4%
1993 Stock	41%	23%
1994 Stock	43%	61%
1995 Stock	6%	12%

92-95 ELR Catchable

- 19.0% of the annual stocked trout catch
- Catch rate for all anglers 0.07/hour
- Harvest- 48% bank, 52% boat
- Average size of harvested fish in this group- 15.9 in., 1.57 lbs. (N = 368)
- Category Composition

	Bank	Boat
1992 Stock	24%	19%
1993 Stock	27%	22%
1994 Stock	39%	46%
1995 Stock	10%	13%

92-95 KRB Catchable

- 59.8% of the annual stocked trout catch
- Catch rate for all anglers 0.21/hour
  Boat anglers had 2.5 times greater catch rate than bank anglers
- Harvest- 24% bank, 76% boat
- Average size of harvested fish in this group- 14.7 in., 1.20 lbs. (N = 1,013)
- 1994 stock made up 81.3% of the catch of this strain
- Category Composition

	Bank	Boat
1992 Stock	8%	4%
1993 Stock	7%	4%
1994 Stock	77%	82%
1995 Stock	8%	10%

92-94 SRC Catchable

- 3.7% of the annual stocked trout catch
- Catch rate for all anglers 0.01/hour
- Harvest- 44% bank, 56% boat
- Average size of harvested fish -(Auburn) 17.0 in., 1.98 lbs. (N = 62)
  (Bar BC) 14.6 in., 1.23 lbs. (N = 8)
- Category Composition

	Bank	Boat
1992 Stock	59%	47%
1993 Stock	25%	31%
1994 Stock	16%	22%

96 All Strains

- 0.1% of the annual stocked trout catch
- Catch rate for all anglers <0.01/hour
- Harvest- 59% bank, 41% boat
- Average size of harvested fish in this group- 12.1 in., 0.75 lbs. (N = 3)
- All tag returns were KRB for this group

Other Waters

- 1.9% of the annual stocked trout catch
- Catch rate for all anglers 0.01/hour
- Harvest- 67% bank, 33% boat
- Composition of tag origins (N = 36)
  89%- Impossible (fish would have had to move upstream through a dam)
  11%- I-80 to Seminoe

DISCUSSION

The majority of Seminoe Reservoir anglers were residents (66%) fishing mostly with bait (41%) followed by lures (31%) and a combination of bait and lures (24%). Seminoe Reservoir is a consumptive fishery, with a harvest rate of nearly 80% of the total catch. Boat anglers far outnumbered bank anglers (62% boat, 38% bank). Boat anglers were more successful (0.66 fish/hour) than bank anglers (0.58 fish/hour) and fished nearly 30% longer per trip. Rainbow trout (RBT AD + RBT) made up 70.6% of the total catch followed by walleye at 26.2%. All BNT (BNT AD + BNT), all SRC (SRC AD + SRC) and LAT made up the remaining 3.2% of the total catch. Catch rate for all anglers and all species was an impressive 0.64/hour.

Criteria

For a strain to be considered successful, it must meet at least one of the four criteria defined in the General Introduction (50% caught or harvested by number or 1 pound caught or harvested for each pound stocked). All catchable strains met at least one criteria (Table S15). The most impressive performer was KRB with a harvest rate of 0.79 by number and 3.33 pounds for each fish and pound stocked. FRB returned next best followed by ELR and SRC. Although more ELR were harvested and caught than FRB, FRB were stocked in lower densities thus performed better. SRC only met one criteria and returned far poorer than all RBT strains.

Table S15. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch at Seminoe Reservoir (* indicates criteria met).

HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
92-95 FRB Catchable	16,125	5,089	6,642	10,229	0.41	2.01*
92-95 ELR Catchable	31,550	9,743	7,859	12,339	0.25	1.27*
92-95 KRB Catchable	31,350	8,924	24,732	29,678	0.79*	3.33*
92-94 SRC Catchable	17,900	3,156	1,547	2,924	0.09	0.93
Overall Sums and Avg.	96,925	26,912	40,780	55,170	0.42	2.05

TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
92-95 FRB Catchable	16,125	5,089	8,835	13,606	0.55*	2.67*
92-95 ELR Catchable	31,550	9,743	10,856	17,044	0.34	1.75*
92-95 KRB Catchable	31,350	8,924	34,141	40,969	1.09*	4.59*
92-94 SRC Catchable	17,900	3,156	2,117	4,001	0.12	1.26*
Overall Sums and Avg.	96,925	26,912	55,949	75,620	0.57	2.81

[1]- Numbers and pounds stocked represent an annual average over four years (1992-1995).

SRC- Auburn vs. Bar BC Strains

The SRC stocked in Seminoe Reservoir were of two strains, Auburn and Bar BC. The Auburn strain has been domesticated since 1953 and has been manipulated to spawn in the fall. Bar BC are one generation removed from wild stocks in the Snake River drainage (personal communication, Steve Sharon, Assistant Fish Culture Supervisor). Over twice as many numbers and pounds of Bar BC than Auburn were stocked in 1994 (Table S16). Despite this stocking differential in favor of Bar BC, Auburn returned as well or better by number and pounds. These results should be interpreted with caution since SRC were shown to take up to three years to return in significant numbers following stocking. These results are also based on very few (N = 12) tag returns which may influence the results.

Table S16. Criteria for stocked SRC (average 12 months) for harvest and total catch at Seminoe Reservoir.

HARVEST GROUP	No. Stocked	lbs. Stocked	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94 Auburn	6,900	770	50	99	0.01	0.13
94 Bar BC	14,800	2,180	236	290	0.02	0.13

TOTAL CATCH GROUP	No. Stocked	lbs. Stocked	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
94 Auburn	6,900	770	86	170	0.01	0.22
94 Bar BC	14,800	2,180	327	402	0.02	0.18

Comparison to previous creel surveys

Number of angler days and total hours fished in 1995-6 were the highest ever recorded on Seminoe Reservoir (Figures S6 & S7) (Peterson 1986). Trout and walleye harvest were also the highest ever recorded (Figures S8 & S9).

The increase in trout harvest in 1984 coincides with the management decision to stock catchable trout. Walleye harvest should continue to be high in the near future. A large proportion of the 1995-6 walleye harvest was fish 13-15 inches. These fish should return at larger sizes in the near future.

Walleye harvest exceeded trout harvest until 1984 (Figure S10), demonstrating the effectiveness of stocking catchable-sized trout in the presence of walleye. From 1978 to 1996, trout harvest has increased 26.8 times even while walleye harvest has increased 3.1 times.

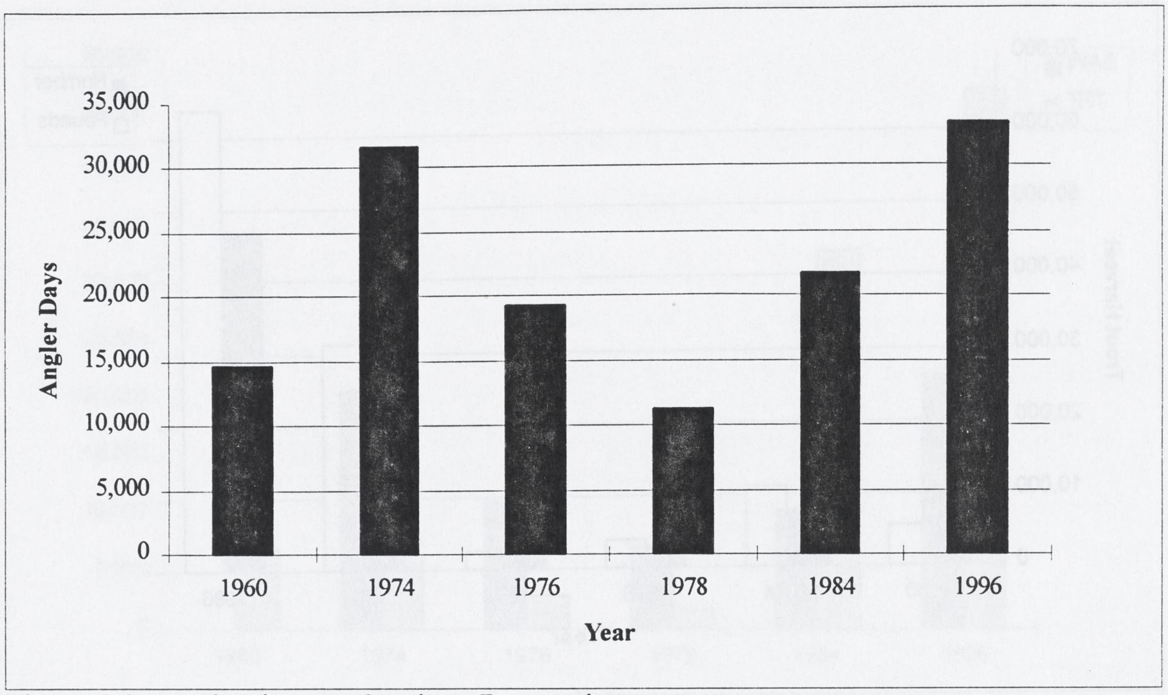


Figure S6. Angler days on Seminoe Reservoir.

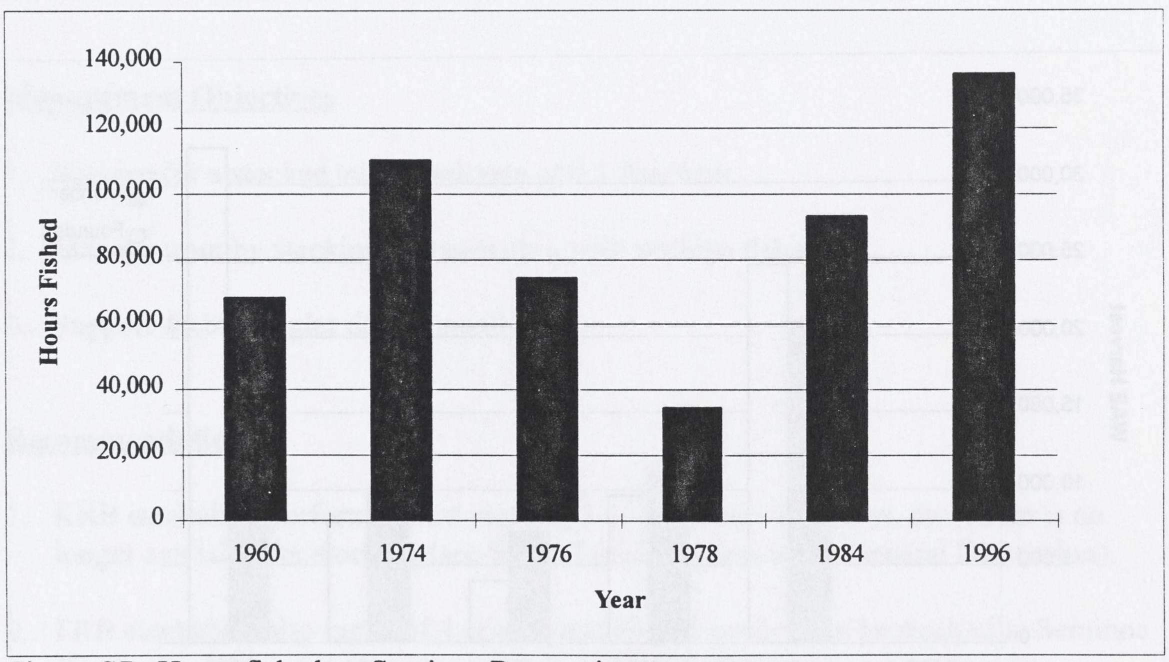


Figure S7. Hours fished on Seminoe Reservoir.

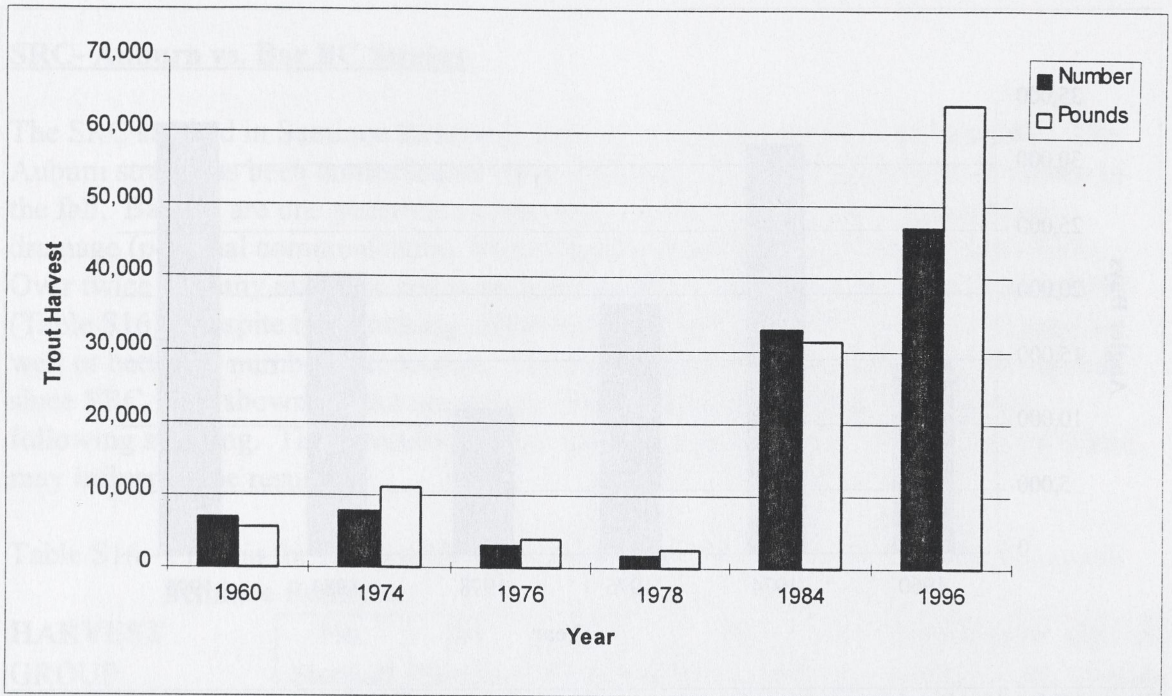


Figure S8. Trout harvest on Seminoe Reservoir.

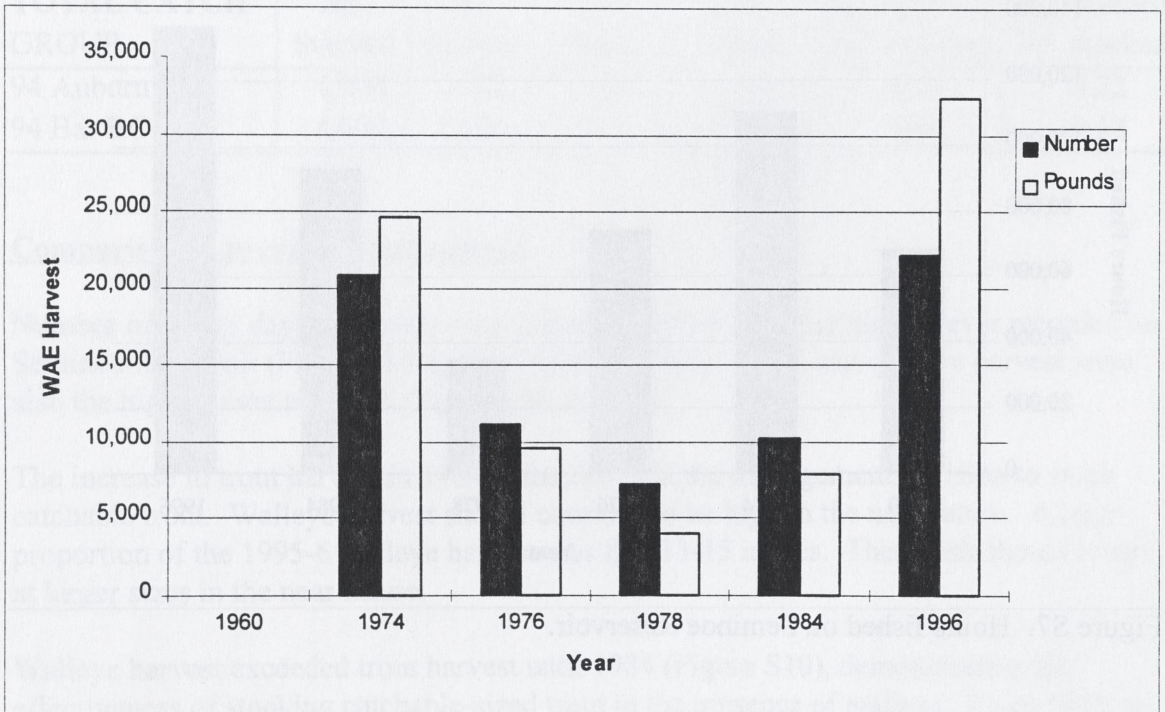


Figure S9. Walleye harvest on Seminoe Reservoir.

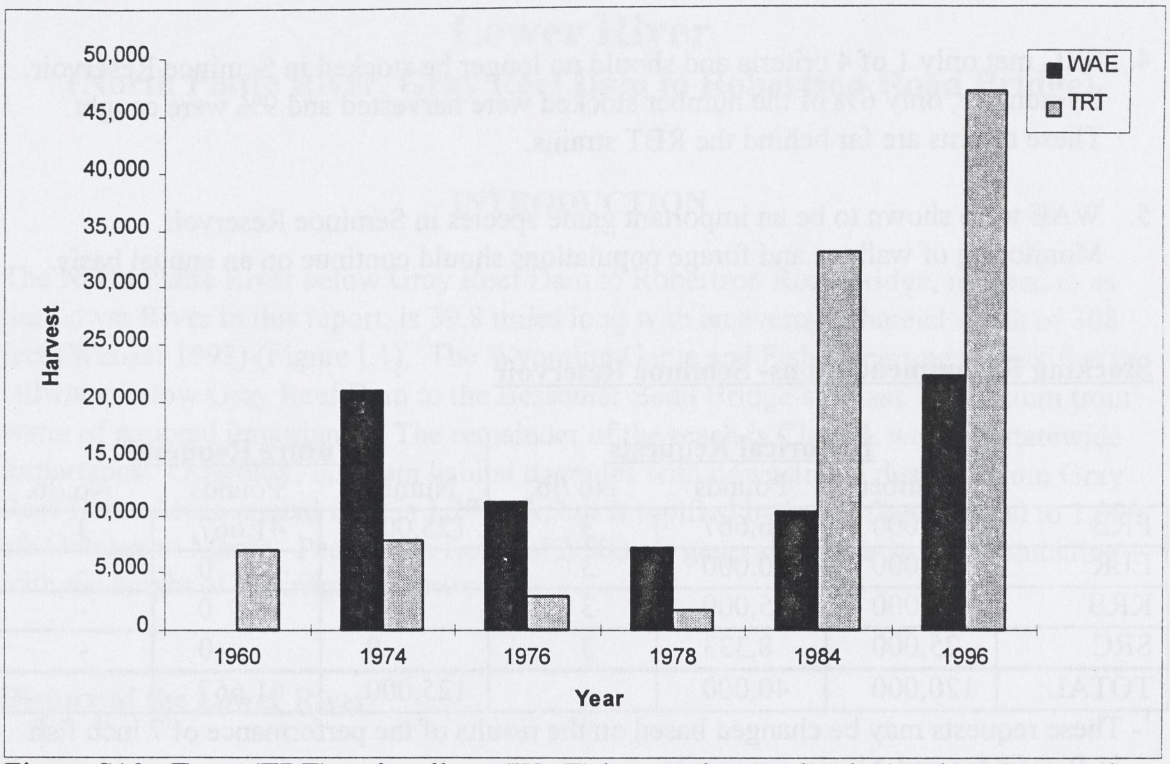


Figure S10. Trout (TRT) and walleye (WAE) harvest by number in Seminoe Reservoir.

Management Objectives

1. Manage for a stocked trout catch rate of 0.5 fish/hour.

2. Manage trout by stocking and provide a wild walleye fishery.

3. Support 40,000 angler days annually.

Recommendations

1. KRB catchables performed best meeting 3 of 4 criteria. However, this strain is no longer available for stocking (see Strain Trends section in the General Discussion).

2. FRB catchables also met 3 of 4 criteria and should continue to be stocked in Seminoe Reservoir. FRB returned better to bank anglers (0.08/hour) than boat anglers (0.04/hour).

3. ELR catchables met 2 of 4 criteria and could be considered for stocking in Seminoe Reservoir. ELR should only be stocked if the desired number of FRB are not available or future information shows ELR provides something (e.g. larger size, longer lived, etc.) that FRB do not.

4. SRC met only 1 of 4 criteria and should no longer be stocked in Seminoe Reservoir. By number, only 6% of the number stocked were harvested and 9% were caught. These returns are far behind the RBT strains.

5. WAE were shown to be an important game species in Seminoe Reservoir. Monitoring of walleye and forage populations should continue on an annual basis.

Stocking Recommendations- Seminoe Reservoir

	Historical Requests			**Future Requests**[1]		
	Number	Pounds	No./lb.	Number	Pounds	No./lb.
FRB	20,000	6,667	3	125,000	41,667	3
ELR	30,000	10,000	3	0	0	-
KRB	45,000	15,000	3	0	0	-
SRC	25,000	8,333	3	0	0	-
TOTAL	120,000	40,000		125,000	41,667	

[1]- These requests may be changed based on the results of the performance of 7 inch fish in Pathfinder and Alcova reservoirs.

Lower River
(North Platte River, Gray Reef Dam to Robertson Road Bridge)

INTRODUCTION

The North Platte River below Gray Reef Dam to Robertson Road bridge, referred to as the Lower River in this report, is 39.8 miles long with an average channel width of 308 feet (Wenzel 1993) (Figure L1). The Wyoming Game and Fish Department classifies the tailwater below Gray Reef Dam to the Bessemer Bend Bridge as Class 1, premium trout water of national importance. The remainder of the reach is Class 2, water of statewide importance. Generally, instream habitat degrades with downstream distance from Gray Reef Dam. Mean annual flow is 1,270 cfs, but is typified by lower flows of 500 to 1,000 cfs October to March. Peak mean flows of 2,500 cfs generally occur in July coinciding with the height of the irrigation season.

History of the Lower River

In 1973, a 9 month survey from Gray Reef Dam to Bessemmer Narrows estimated 7,721 anglers fished 22,820 hours and harvested 6,896 rainbow and 440 brown trout (Peterson and McMillan 1973).

On March 31, 1987 a Continental Pipeline Company (subsidiary of Conoco Inc.) gasoline pipeline ruptured in a tributary draw to Bolton Creek, spilling 91,225 gallons of gasoline. An estimated 97,300 rainbow and brown trout greater than 6 inches were killed by this spill. An estimated 95% of the trout from the mouth of Bolton Creek to Speas Rearing Station, a distance of 16.9 miles, were thought to have been killed. Along the 11 mile stretch from Speas to the Robertson Road Bridge, the trout mortality rate was estimated at 54% (Wichers 1992). Interestingly, sampling of fish and aquatic insect populations in 1988 suggested that although the gasoline spill was disastrous the effects were not long lasting. Estimated trout numbers greater than 6 inches in the affected Bessemer Bend electrofishing station were actually greater in 1988 relative to 1987 pre-spill estimates (Wichers 1992). Moreover, both the number of aquatic invertebrates per square foot and indices of species richness (aquatic health) were both higher than baseline data collected in 1978 (Conder 1989). These data suggest a general improvement in aquatic habitat following successive high water years from 1983-86, when the river channel was essentially scoured.

Since the mid 1980s two and three pass electrofishing population estimates have been made on two river sections to follow trends in the rainbow trout fishery. Since 1987, the numbers of rainbow trout of acceptable size to anglers have declined dramatically (Table L1).

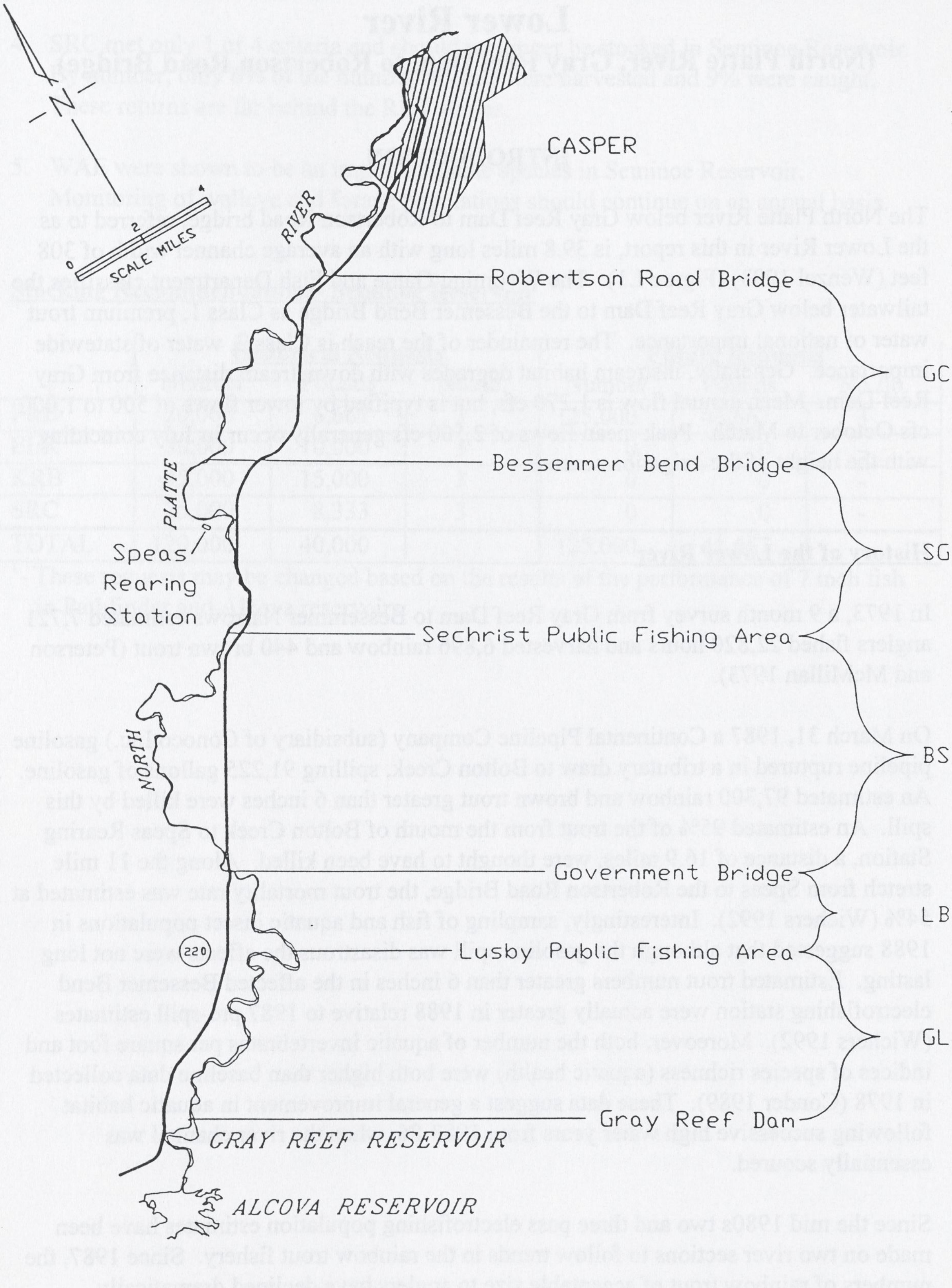


Figure L1. Lower River

Table L1. Estimates of rainbow trout (>6 inches) in the Lower River.

	Gray Reef Station			Bessemer Bend Station		
Year	No./Mile	No./Acre	lbs./Acre	No./Mile	No./Acre	lbs./Acre
1987	14,463	495.3	271.3	2,247	84.8	45.7
1988	5,966	204.3	210.5	2,842	107.2	52.6
1991	1,251	42.8	128.5	526	19.8	18.3
1995	850	29.1	29.1	1,480	55.8	15.7
1996	558	19.1	42.7	805	30.4	8.5

Two factors have been cited for this dramatic decline in this once premiere rainbow trout fishery; predation by piscivorous birds and habitat degradation. There is a large double-crested cormorant colony on two islands at Soda Lake, north of Casper, and cormorants have also nested on Bird Island on Pathfinder Reservoir. The Lower River is hunted extensively by both cormorants and white pelicans. White pelicans have also been observed nesting at Bird Island.

Growing public concern over the impacts of piscivorous birds on trout stocks prompted biologists to conduct analyses of cormorant food habits prior to and after trout stocking in 1988 and 1989. Prior to stocking, small trout accounted for 1% of the chick diet in both 1988 and 1989, with the dominant prey being fathead minnows, longnose dace, and crayfish. Shortly after stocking in 1988, adults fed chicks predominantly fathead minnows and darters, but in 1989 stocked rainbow trout fingerlings constituted the largest portion of the chicks diet (38%) (Wichers 1990).

A more extensive study of cormorant and white pelican impacts of trout stocks was undertaken in 1993 and 1994 by a graduate student from the University of Wyoming (Derby 1995). By monthly counts of adults and chicks and simultaneous collection of food habit data, estimates of the fish consumption of both bird species were calculated. Interestingly, white pelicans consumed mostly suckers and minnows even after trout stocking thus their overall impact to the trout population, at least in 1994, was felt to be minimal. Conversely, it was estimated that cormorants consumed 100,000 trout, or up to 50% of what was stocked, between the months of March and October. Derby also documented that the cormorant population peak caloric demand coincided with the time the river was typically stocked with advanced fingerling trout.

Habitat degradation is the primary factor cited for the decline in the Lower River fishery. Examination of historic aerial photographs of the Lower River indicates that river channel width decreased an average of 43.3 feet from 1947 to 1989, while the length of the main channel decreased 2.68 miles. A 40% reduction in the magnitude of peak flows following dam construction resulted in a 18% decline of active channel surface area in 50 years (Wenzel 1993). Suspected impacts of fine sediments on the quality and quantity of trout spawning habitat led to two studies designed to assess benefits of short duration high water releases on the Lower River, known as flushing flows (Wenzel 1993 & Leonard 1995).

Leonard (1995) concluded flows of 4,000 cubic feet per second (cfs) increased bedload and suspended sediment transport, initiated scour, and successfully improved spawning substrate suitability. An annual fifteen-hour flushing flow of this magnitude prior to spawning was recommended. Coordination with the Bureau of Reclamation has afforded flushing opportunities that holds promise towards improving the quality of spawning habitat. Efforts to make contacts with receptive landowners that graze cattle and/or sheep to improve land use practices in the drainage are ongoing, and also hold promise (Travis Cundy, Aquatic Habitat Biologist, personal communication).

Lower River Stocking

Attempts were made to hold stocking requests for the Lower River constant in the years preceding the creel survey. Problems procuring sufficient numbers of eggs led to some annual variation in the numbers of each strain actually stocked.

In the four years preceding the creel survey, 195,300 trout (5,022 pounds) were annually stocked into the Lower River (Table L2). Assuming the Lower River is 39.8 miles long and has a surface area of 1,094 acres (8 miles, 233.7 acres above Lusby Public Fishing Area (Above); 31.8 miles, 859.8 acres below Lusby (Below), approximately 5,750 trout were stocked per river mile and 210 trout were stocked per acre per year.

Of the 781,200 trout stocked since 1992, approximately 88% were rainbow and 12% were cutthroat trout. ELR, which were typically stocked in early July at 40 per pound, accounted for 39% of the total number stocked and 37% of the total pounds stocked. RRB were also stocked in early July but at a slightly larger size (22.4 per pound). This strain accounted for 17% of the total number stocked, but because of their large size at stocking, accounted for 29% of the total pounds stocked. In 1992 and 1993, KRB were stocked in July at about 200 per pound. In 1994 and 1995, KRB were held through the summer at Speas and stocked at 30 per pound in early September. This strain accounted for 33% of the total number stocked, but only 15% of the total pounds.

With minor exception, groups of trout destined for stocking into the Lower River were combined into the same raceway and allowed to thoroughly mix prior to stocking. Attempts were made to distribute fish evenly throughout the entire length of the Lower River by either stocking by truck at several public fishing areas; or by spreading the fish throughout the section by jet boat.

Table L2. Number of trout stocked into the Lower River prior to and during the 15 month programmed creel survey.

Species/ Strain	Stock Date	Pounds Stocked	Number/ Pound	Number Stocked	Tag Retention	Number Stocked w/ Tags
ELR	92/07/08	2,078	46.4	96,400	73.0	70,400
	93/07/02	2,116	46.9	99,300	75.5	75,500
	94/06/27	1,939	28.7	54,800	97.8	54,100
	95/06/26	1,292	40.0	51,700	92.8	48,000
Sub-Total		7,425		302,000	82.1	248,000
KRB	92/07/08	466	209.0	97,400	88.0	85,700
	93/07/01	501	191.0	95,900	86.4	86,000
	94/09/06	899	21.0	18,900	97.9	18,500
	95/09/06	1,100	42.0	46,600	90.7	42,300
Sub-Total		2,976		258,800	89.8	232,500
RRB	92/07/08	816	20.0	16,300	70.5	11,500
	93/07/02	2,554	10.7	27,300	83.0	22,700
	95/06/26	2,426	35.5	86,100	97.0	82,200
Sub-Total		5,796		129,700	89.8	116,400
SRC	92/07/08	2,152	23.9	51,400	93.8	48,200
	94/06/27	1,738	22.6	39,300	99.6	38,900
Sub-Total		3,890		90,700	96.0	87,100
Grand Total		20,087		781,200	87.6	684,000

METHODS

All methods outlined in the General Methods are applicable to the Lower River.

Results for the Lower River are split at the Lusby Public Fishing Area (PFA). Above will refer to the river from Gray Reef Dam through Lusby PFA. Below will refer to the river from Lusby PFA to Robertson Road Bridge.

Biological (electrofishing) data collected during the creel survey were used to establish length-weight relationships specific to the Lower River. The equations for ELR and all trout (TRT) strains combined are:

ELR- weight = exp((3.028197013*length) - 7.956398087) ($R^2 = 0.99$).

TRT- weight = exp((2.994606579*length) - 7.867015056) ($R^2 = 0.99$).

These equations were applied to the respective strain group/species measured by a creel clerk. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and caught.

RESULTS

Angler Information

Creel clerks interviewed a total of 1,091 anglers at the Lower River. Of these, 855 (78%) were residents and 236 (22%) were nonresidents. Anglers were asked what terminal tackle they were using when contacted (Table L3). The majority of anglers used bait (37.9%), followed by flies (29.1%) then lures (13.0%). There were differences in terminal tackle use Above and Below. More anglers used solely flies Above (33.8%) than Below (12.4%) while bait fishing was more prevalent Below (55.8%) than Above (33.2%).

Table L3. Terminal tackle employed by Lower River anglers.

	Above		Below		All	
Terminal Tackle	Number	%	Number	%	Number	%
Bait	280	33.2	139	55.8	414	37.9
Flies	285	33.8	31	12.5	318	29.2
Lures	117	13.9	24	9.6	142	13.0
Bait and Lures	51	6.0	25	10.1	76	7.0
Flies and Lures	55	6.5	14	5.6	69	6.3
Bait and Flies	38	4.5	10	4.0	48	4.4
Bait, Flies and Lures	18	2.1	6	2.4	24	2.2

Of the 92% of anglers that stated a preference, 99.8% were targeting any trout and 0.2% were targeting trout and walleye. These percentages were similar for anglers Above and Below.

Nearly all anglers used only one pole (Table L4). Anglers Above were more release-oriented than anglers Below. More fish per angler were harvested Below (0.32) than Above (0.18).

Table L4. Angler characteristics Above and Below (completed trips only) in the Lower River.

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Above	473	1 - 95% 2 - 5% Avg.=1.05	20%- Harvested 80%- Released	0.18
Below	108	1 - 88% 2 - 12% Avg.=1.12	31%- Harvested 69%- Released	0.32

At least 30% of all anglers caught at least one trout Above and Below (Table L5). More anglers Below harvested 2 trout (10%) than Above (2%), however, these low harvest rates and differences between percentages caught and harvested indicate extensive catch and release. Over 3% of anglers Above and Below were able to catch at least 6 trout.

Table L5. Percentage of anglers who harvested/caught 0 trout, at least 1 trout, at least 2 trout, etc. in the Lower River (completed trips only).

		Number of Trout						
		0	≥1	≥2	≥3	≥4	≥5	≥6
Above	Harvest	84%	16%	2%				
	Catch	63%	37%	18%	12%	7%	5%	3%
Below	Harvest	78%	22%	10%	2%	1%		
	Catch	69%	31%	18%	11%	7%	5%	5%

Pressure

From April 1995 through June 1996, we estimated 15,395 anglers fished Above and 8,669 anglers fished Below (Table L6). The average annual estimate was 10,805 and 6,187 anglers Above and Below, respectively. This yields an annual estimate of 46.2 anglers/acre Above and 7.2 anglers/acre Below. The majority of the anglers Above (81.1%) and Below (94.1%) were fishing from the bank. Numbers of anglers were highest in July and lowest in January. There were significantly more ($p<0.01$) anglers Above than Below.

Table L6. Lower River- estimated numbers of anglers.

	Above	/acre	Below	/acre	All	/acre
April	2,274	9.7	1,411	1.6	3,686	3.4
May	1,003	4.3	811	0.9	1,814	1.7
June	1,813	7.8	854	1.0	2,667	2.4
July	1,103	4.7	1,813	2.1	2,916	2.7
August	1,394	6.0	276	0.3	1,670	1.5
September	642	2.7	416	0.5	1,058	1.0
October	330	1.4	259	0.3	588	0.5
November	513	2.2	178	0.2	690	0.6
December	327	1.4	154	0.2	481	0.4
January	251	1.1	15	0.0	266	0.2
February	446	1.9	182	0.2	628	0.6
March	1,210	5.2	414	0.5	1,624	1.5
April	1,791	7.7	1,056	1.2	2,847	2.6
May	753	3.2	577	0.7	1,330	1.2
June	1,545	6.6	254	0.3	1,798	1.6
15 Month Total	15,395	65.9	8,669	10.1	24,063	22.0
Average 12 Months	10,805	46.2	6,187	7.2	16,993	15.5

The annual estimate for hours fished was 26,759 Above and 12,536 Below (Table L7). The Above section receives more hours and far more hours/acre (114.5) than Below (14.6). The entire Lower River supports an estimated 39,294 angling hours or 35.9 angling hours/acre, annually. Anglers Above fished significantly more ($p<0.01$) hours than anglers Below.

Table L7. Lower River- estimated pressure (angler hours) Above, Below and total hours.

Month	Above	/acre	Below	/acre	Total Hours	/acre
April	7,073	30.3	4,706	5.5	11,779	10.8
May	3,241	13.9	1,729	2.0	4,970	4.5
June	4,694	20.1	1,657	1.9	6,350	5.8
July	2,548	10.9	1,382	1.6	3,930	3.6
August	1,545	6.6	842	1.0	2,387	2.2
September	1,609	6.9	891	1.0	2,500	2.3
October	1,194	5.1	550	0.6	1,744	1.6
November	1,338	5.7	468	0.5	1,806	1.7
December	884	3.8	423	0.5	1,307	1.2
January	594	2.5	42	0.0	636	0.6
February	1,488	6.4	501	0.6	1,990	1.8
March	2,973	12.7	1,165	1.4	4,138	3.8
April	4,765	20.4	2,200	2.6	6,965	6.4
May	2,807	12.0	1,060	1.2	3,867	3.5
June	2,589	11.1	1,193	1.4	3,782	3.5
15 Months	39,343	168.3	18,808	21.9	58,151	53.2
12 Month Average	26,759	114.5	12,536	14.6	39,294	35.9

There was significantly more ($p<0.01$) pressure on weekend days (WE) than weekdays (WD) on the Lower River (Table L8). Weekend days received more pressure than weekdays Above and Below.

Table L8. Pressure (annual hours fished) during weekdays (WD) and weekend days in the Lower River (WE).

	WD	WE
Above	11,184	15,575
Below	4,546	7,989
All	15,730	23,564

An annual estimate of trip length for all anglers was 2.31 hours. Trip length Above (2.48 hrs) was longer than trip length Below (2.03 hrs).

Catch Rates

Combining both Above and Below yields an annual catch rate of 0.35 fish/hour (Table L9). Anglers Above had a higher catch rate (0.40) than anglers Below (0.29), but this difference was not significant ($p = 0.10$). Catch rates peaked in October (1.52) and were lowest in August (0.03).

Table L9. Catch rates (fish per hour, all species combined) for Above, Below and All anglers in the Lower River.

	Above	Below	All
April	0.41	0.44	0.42
May	0.22	0.11	0.17
June	0.63	0.18	0.40
July	0.81	0.10	0.46
August	0.02	0.03	0.03
September	0.30	0.88	0.59
October	0.70	2.33	1.52
November	0.55	0.41	0.48
December	0.63	0.00	0.32
January	1.02	0.00	0.51
February	0.29	0.17	0.23
March	0.27	0.03	0.15
April	0.36	0.20	0.28
May	0.14	0.05	0.09
June	0.15	0.10	0.12
15 Month Total	0.38	0.27	0.33
Average 12 Months	0.40	0.29	0.35

Catch and Harvest

The estimated annual total catch was 14,396 (Table L10). Anglers Above caught 10,780 (75% of the total) while anglers Below caught 3,616 (25% of the total). An estimated 13,623 rainbow trout were caught, of which 8,677 (64%) were wild rainbow trout (RBT) and 4,946 (36%) were stocked rainbow (RBT AD). Snake River Cutthroat, brown trout and walleye made up the remaining 5.4% of the total catch.

Table L10. Annual total catch by species in the Lower River.

Species	Above	%	Below	%	Total Catch	%
RBT	5,814	53.9	2,863	79.2	8,677	60.3
RBT AD	4,353	40.4	593	16.4	4,946	34.4
SRC AD	239	2.2	71	2.0	310	2.2
SRC	166	1.5	0	0.0	166	1.2
BNT	157	1.5	89	2.5	246	1.7
WAE	51	0.5	0	0.0	51	0.4
Total Catch	10,780	74.9	3,616	25.1	14,396	100.0

Above, total estimated harvest was 1,893 or only 17.6% of the total catch (Table L11). Catch and release is practiced with a release rate of 82.4% of the total catch. SRC (wild and stocked) had the highest harvest rates and no BNT or WAE were harvested. Bank anglers caught 89% of the total catch with boat anglers making up the remaining 11%.

Table L11. Annual harvest, release, total catch and catch/acre Above, for the Lower River.

Species	Area	Harvested	%	Released	%	Total Catch	Catch/Acre
RBT	Bank Anglers	815	15.2	4,547	84.8	5,362	22.9
	Boat Anglers	168	37.2	284	62.8	452	1.9
	All Anglers	983	16.9	4,831	83.1	5,814	24.9
RBT AD	Bank Anglers	746	19.8	3,013	80.1	3,760	16.1
	Boat Anglers	67	11.3	526	88.7	593	2.5
	All Anglers	813	18.7	3,540	81.3	4,353	18.6
SRC AD	Bank Anglers	26	17.6	122	82.4	148	0.6
	Boat Anglers	38	41.8	53	58.2	91	0.4
	All Anglers	64	26.8	175	73.2	239	1.0
SRC	Bank Anglers	14	11.5	108	88.5	122	0.5
	Boat Anglers	19	43.2	25	56.8	44	0.2
	All Anglers	33	19.9	133	80.1	166	0.7
BNT	Bank Anglers	0	0.0	140	100.0	140	0.6
	Boat Anglers	0	0.0	17	100.0	17	0.1
	All Anglers	0	0.0	157	100.0	157	0.7
WAE	Bank Anglers	0	0.0	51	100.0	51	0.2
	Boat Anglers	0	0.0	0	0.0	0	0.0
	All Anglers	0	0.0	51	100.0	51	0.2
Annual Totals							
	Bank Anglers	1,601	16.7	7,981	83.3	9,583	41.0
	Boat Anglers	292	24.4	905	75.6	1,197	5.1
	All Anglers	1,893	17.6	8,887	82.4	10,780	46.1

Below, total estimated harvest was 614 or only 17.0% of the total catch (Table L12). Catch and release is practiced with a release rate of 83.0% of the total catch. SRC AD had the highest harvest rate and wild RBT had the highest release rate. Bank anglers caught 93% of the total catch with boat anglers making up the remaining 7%.

Table L12. Annual harvest, release, total catch and catch/acre Below, for the Lower River.

Species	Area	Harvested	%	Released	%	Total Catch	Catch/Acre
RBT	Bank Anglers	331	12.3	2,358	87.7	2,689	3.1
	Boat Anglers	92	52.9	82	47.1	174	0.2
	All Anglers	423	14.8	2,440	85.2	2,863	3.3
RBT AD	Bank Anglers	76	14.7	441	85.3	517	0.6
	Boat Anglers	49	64.5	27	35.5	76	0.1
	All Anglers	125	21.1	468	78.9	593	0.7
SRC AD	Bank Anglers	23	36.5	40	63.5	63	0.1
	Boat Anglers	8	100.0	0	0.0	8	0.0
	All Anglers	31	43.7	40	56.3	71	0.1
SRC	Bank Anglers	0	0.0	0	0.0	0	0.0
	Boat Anglers	0	0.0	0	0.0	0	0.0
	All Anglers	0	0.0	0	0.0	0	0.0
BNT	Bank Anglers	30	35.7	54	64.3	84	0.1
	Boat Anglers	5	100.0	0	0.0	5	0.0
	All Anglers	35	39.3	54	60.7	89	0.1
WAE	Bank Anglers	0	0.0	0	0.0	0	0.0
	Boat Anglers	0	0.0	0	0.0	0	0.0
	All Anglers	0	0.0	0	0.0	0	0.0
Annual Totals							
	Bank Anglers	460	13.7	2,893	86.3	3,353	3.9
	Boat Anglers	154	58.6	109	41.4	263	0.3
	All Anglers	614	17.0	3,002	83.0	3,616	4.2

Seasonal Catch by Species

By species, rainbow trout make up 94% of the catch Above and 96% of the catch Below (Table L13). RBT catch was highest in the spring and summer and lowest in winter months. RBT were caught every month of the survey Above and 13 of 15 months Below.

BNT and SRC were more frequently caught Above than Below. Few WAE were caught Above and no WAE were caught Below.

Table L13. Catch by species by month for anglers Above and Below in the Lower River.

Month	ABOVE RBT	ABOVE BNT	ABOVE SRC	ABOVE WAE	BELOW RBT	BELOW BNT	BELOW SRC	BELOW WAE
April	2,599	203	35	0	1,654	125	28	0
May	643	0	0	0	133	0	0	0
June	2,431	118	112	0	259	0	0	0
July	1,545	41	23	0	133	8	0	0
August	30	0	0	0	26	0	0	0
September	547	0	0	0	1,066	0	0	0
October	1,004	8	0	0	565	0	0	0
November	687	41	0	0	161	0	54	0
December	538	0	0	0	0	0	0	0
January	611	0	51	51	0	0	0	0
February	398	0	0	0	112	0	0	0
March	746	144	0	0	21	0	0	0
April	1,731	17	0	0	511	0	0	0
May	359	0	0	0	22	0	43	0
June	360	0	19	0	165	0	0	0
15 Mon. Tot.	14,228	574	240	51	4,828	134	125	0
Ave 12 Mon.	10,167	404	157	51	3,456	71	89	0

Stocked Trout Strain Analysis

RBT and SRC are stocked in the Lower River. Both species (and associated strains) are stocked as either fingerlings or advanced fingerlings, no catchables are stocked.

For stocked trout analysis, fish caught in the Lower River were grouped into four categories: Gray Reef ELR, Gray Reef KRB, Gray Reef River Run Rainbow (RRB), and Gray Reef SRC. Fish originally stocked in upstream waters were grouped into the Other category (Table L14).

Gray Reef ELR had the highest catch/hour (0.10), exceeding all other categories combined (Table L15).

Table L14. Strain catch stratified by Above and Below by month, April 1995 - June 1996, in the Lower River.

TOTAL CATCH

ABOVE	MONTH															
GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
Gray Reef ELR	698	195	770	460	25	0	0	549	426	553	270	22	300	60	70	4,398	3,351
Gray Reef KRB	0	0	0	52	0	0	221	0	0	0	0	2	0	4	24	303	290
Gray Reef RRB	301	0	0	45	0	0	0	7	0	0	0	3	300	2	46	704	380
Gray Reef SRC	98	0	62	32	0	0	8	37	0	0	0	74	17	0	0	328	239
Other	0	0	0	53	0	54	221	0	0	0	0	2	0	4	0	334	332
TOTAL	1,097	195	832	642	25	54	450	593	425	553	270	103	617	70	140	6,067	4,592

BELOW	MONTH																
GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
Gray Reef ELR	349	20	0	48	0	164	0	25	0	0	0	21	77	17	53	774	516
Gray Reef KRB	0	5	0	0	0	41	0	6	0	0	0	0	19	4	0	75	61
Gray Reef RRB	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	8
Gray Reef SRC	125	0	0	0	9	0	0	0	0	0	0	0	0	0	0	134	71
Other	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	8
TOTAL	506	25	0	48	9	205	0	31	0	0	0	21	96	21	53	1,015	664

ALL ANGLERS	MONTH																
GROUP	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	Total	Annual Avg.
Gray Reef ELR	1,047	215	770	508	25	164	0	574	426	553	270	43	377	77	123	5,172	3,867
Gray Reef KRB	0	5	0	52	0	41	221	6	0	0	0	2	19	8	24	378	351
Gray Reef RRB	317	0	0	45	0	0	0	7	0	0	0	3	300	2	46	720	388
Gray Reef SRC	223	0	62	32	9	0	8	37	0	0	0	74	17	0	0	462	310
Other	16	0	0	53	0	54	221	0	0	0	0	2	0	4	0	350	340
TOTAL	1,603	220	832	690	34	259	450	624	426	553	270	124	713	91	193	7,082	5,256

Table L15. Strain catch rates per hour and per acre for Above, Below and All anglers in the Lower River (annually).

	Catch Rate/Hour			Catch/Acre		
	Above	Below	Total	Above	Below	All
Gray Reef ELR	0.13	0.04	0.10	14.34	0.60	3.53
Gray Reef KRB	0.01	<0.01	0.01	1.24	0.07	0.32
Gray Reef RRB	0.01	<0.01	0.01	1.63	0.01	0.35
Gray Reef SRC	0.01	<0.01	0.01	1.02	0.08	0.28
Other	0.01	<0.01	0.01	1.42	0.01	0.31
Total	0.17	0.05	0.13	19.65	0.77	4.80

Strain Summaries

Gray Reef ELR

- 73.6% of total annual stocked trout catch
- Catch rate of 0.10/hr
- Average size of harvested fish- 15.8 in., 1.65 lbs. (N = 25)

Gray Reef KRB

- 6.7% of total annual stocked trout catch
- Catch rate of 0.01/hr
- Average size of harvested fish- 13.7 in., 1.18 lbs. (N = 3)

Gray Reef RRB

- 7.4% of total stocked trout catch
- Catch rate of 0.01/hr
- Average size of harvested fish- 20.3 in., 3.24 lbs. (N = 3)

Gray Reef SRC

- 5.9% of total stocked trout catch
- Catch rate of 0.01/hr
- Average size of harvested fish- 13.6 in., 0.97 lbs. (N = 7)

Other

- 6.4% of total stocked trout catch
- Catch rate of 0.01/hr
- Average size of harvested fish- 13.2 in., 1.38 lbs. (N = 3)
- Composition of tag origins (N = 4)
  - 75% Pathfinder Reservoir
  - 25% Alcova Reservoir

DISCUSSION

The majority of Lower River anglers were residents (78%) fishing mostly with bait (38%) followed by flies (29%) and lures (13%). The Lower River is a catch and release fishery, with a harvest rate of only 17.4% of the total catch. Bank anglers outnumbered boat anglers (86% bank, 14% boat). Bank anglers were more successful (0.41 fish/hour) than boat anglers (0.19 fish/hour). Rainbow trout (RBT AD + RBT) made up 95% of the total catch followed by SRC AD + SRC at 3%. BNT and WAE made up the remaining 2% of the total catch. Stocked trout made up 36.5% of the total catch. Although the area Above only encompassed 20% of the river miles of the Lower River, anglers Above accounted for 75% of the total catch. Catch rate for all anglers and all species was 0.35/hour.

Constraints on data interpretation

Low sample size (N = 38 tag returns) may influence data interpretation for different strain groups and suggest caution. In addition, river flows were exceptionally turbid and high during the creel survey, possibly discouraging anglers from fishing the Lower River. Sample sizes were large enough to allow estimates of angler pressure and catch, however, data should be interpreted with caution.

Criteria

For a strain to be considered successful, it must meet at least one of the four criteria defined in the General Introduction (50% caught or harvested by number or 1 pound caught or harvested for each pound stocked). Only Gray Reef ELR met any of the four criteria (Table L16). Gray Reef ELR returned at 3.44 pounds caught for each pound stocked. KRB returned next best followed by RRB and SRC.

Table L16. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch in the Lower River (* indicates criteria met).

HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
GRAY REEF ELR	75,500	1,856	814	1,343	0.01	0.72
GRAY REEF KRB	64,700	744	23	27	<0.01	<0.01
GRAY REEF RRB	32,425	1,449	58	188	<0.01	0.13
GRAY REEF SRC	22,675	973	95	92	<0.01	0.09
Overall Sums and Avg.	195,300	5,022	990	1,650	<0.01	0.33

TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
GRAY REEF ELR	75,500	1,856	3,867	6,381	0.05	3.44*
GRAY REEF KRB	64,700	744	351	414	0.01	0.56
GRAY REEF RRB	32,425	1,449	388	1,257	0.01	0.88
GRAY REEF SRC	22,675	973	310	301	0.01	0.31
Overall Sums and Avg.	195,300	5,022	4,916	8,353	0.03	1.66

[1]- Numbers and pounds stocked represent an annual average.

Pressure by section

The Lower River was split into five sections to help determine areas of highest use. The area from Gray Reef Dam to Lusby PFA had the highest number of anglers and angler hours, exceeding all other areas combined (Table L17). The section from Lusby PFA to Government Bridge received the second lowest pressure, likely due to lack of access and it is the shortest section. With the exception of Lusby PFA to Government Bridge, pressure decreases as the river approaches Casper and habitat declines.

Table L17. Pressure by section in the Lower River.

Area	Number	Number /Acre	Hours	Hours /Acre
Gray Reef Dam to Lusby PFA	10,805	41.1	26,759	101.8
Lusby PFA to Government Bridge	1,065	7.3	2,831	19.4
Government Bridge to Sechrist PFA	3,858	12.6	6,858	22.4
Sechrist PFA to Bessemmer Bend Bridge	1,461	10.0	2,846	19.5
Bessemmer Bend Bridge to Robertson Rd. Bridge	390	1.6	1,124	4.5

Contribution of wild trout to the fishery

Wild trout (RBT, BNT and SRC) accounted for 63% of the total catch, 57% Above and 82% Below. Of the wild catch, RBT is the largest contributor (95%) followed by BNT (3%) and SRC (2%). The average size of wild RBT is 17.5 inches compared to 16.0 inches for stocked trout. Due to their large size, a portion of these wild fish may have been hatchery fish stocked before 1992.

Wild RBT had the highest catch rate (0.22/hour) for the Lower River. Despite limited natural recruitment, wild trout comprised nearly 2/3 of the rainbow trout catch.

Comparison to past creel surveys

The most recent creel survey prior to the this one was in 1973. The 1973 survey covered 9 months (March - November) and a shorter section of river (Gray Reef Dam to Bessemer Narrows). However, little pressure was documented in 1995-6 below Bessemer Narrows and from December through February, therefore, data from the 1973 survey are comparable to the current survey. In 1971 and 1972, 37,500 RBT were stocked annually. Currently, 183,400 RBT and 45,350 SRC are annually stocked in the Lower River, over 6 times the stocking rate of 1973.

Angler tackle use has changed since 1973. Far fewer anglers used solely bait or a combination of bait and lures in 1996 than in 1973 (Table L18). Many more anglers used flies or lures in 1996 than in 1973.

Table L18. Terminal tackle comparison in the Lower River.

	1973	1996
Terminal Tackle	%	%
Bait	69%	38%
Flies	12%	29%
Lures	5%	13%
Bait and Lures	14%	7%

Creel limits have been reduced to 2 fish, one over 20 inches above Goose Egg Bridge. This regulation change along with a change in tackle use coincides with a reduction in harvest. In 1973, a harvest of 7,350 gamefish (94% RBT, 6% BNT, cutthroat and grayling) was estimated. In 1996, a harvest of 2,507 gamefish (93% RBT, 7% BNT, SRC and WAE) was estimated. Catch rates have remained fairly stable; 0.32/hour in 1973 and 0.35/hour in 1996.

Since 1973, pressure has increased on the Lower River. Number of anglers and angler hours have nearly doubled (Table L19).

Table L19. Pressure comparison between 1973 and 1995-6 in the Lower River.

	1973	1995-6
Number of anglers	7,721	16,993
Angler hours	22,820	39,294

Management Objectives

1. Maintain the Class 1 status of the Lower River from Gray Reef Dam to Goose Egg Bridge.

2. Manage for a catch rate of 0.5 fish/hour.

3. Obtain additional public access to the Lower River.

4. Minimum standing crop objectives should be met (Table L20). As recently as 1991, the Gray Reef and Bessemer Bend stations had standing crops of 210 lbs./acre and 53 lbs./acre, respectively. These estimates show the standing crop objectives in Table L20 are obtainable.

Table L20. Standing crop objectives for the Lower River.

	Total No. >6 in./mile	Total No. >16 in./mile	Total lbs./mile	Total lbs./acre
Gray Reef Station	5,000	1,000	3,000	103
Bessemmer Bend Station	2,000	750	1,000	37

4. Continue efforts, through cooperation with the Bureau of Reclamation, to reduce fine sediments with semi-annual flushing flows.

5. Reduce sediment loading from the Bates Hole basin.

Recommendations

1. Continue to stock ELR in the Lower River for 5 years (until 2002) while monitoring standing crop objectives (Table L20). ELR will be fin clipped to evaluate their contribution to the fishery.

2. Discontinue stocking of KRB and SRC in the Lower River

3. Evaluate new river strains of rainbow trout when they become available.

4. With continued decline of trout populations from Gray Reef Dam to Lusby PFA combined with an estimated exploitation rate of 43%, a more stringent regulation is recommended on this section (Above). A Trophy regulation (one fish over 20 inches, artificial flies and lures only) has been proposed and approved for the 1998-9 regulation cycle.

Stocking Recommendations- Lower River

	Historical Requests			**Future Requests**[1]		
	Number	Pounds	No./lb.	Number	Pounds	No./lb.
ELR	75,000	1,875	40	100,000	2,500	40
SRC	50,000	1,250	40	0	0	-
KRB	75,000	1,875	40	0	0	-
RRB	45,000	1,125	40	0	0	-
TOTAL	245,000	6,125		100,000	2,500	

[1] - Fish stocking will be evaluated in 2002 (see Recommendation #1)

Miracle Mile

INTRODUCTION

The section of the North Platte River from Kortes Dam to the headwaters of Pathfinder Reservoir, known as the Miracle Mile (Figure M1), is classified as a Class 1 trout stream by the Wyoming Game and Fish Department. This river section varies in length from 6 to 12 miles depending on water elevations in Pathfinder Reservoir (Eiserman 1962). The Miracle Mile is characterized by areas of deep, swift water interspersed with numerous islands and associated side channels and gravel bars. The amount of water released from Kortes Dam is generally 500 cfs at night, but during the day flows are often raised rapidly to 2,250 cfs in a matter of hours to provide hydroelectric power (Zafft and Vogt 1992). Roads parallel both sides of the river channel providing excellent public access.

History of Miracle Mile

The first 12-month creel survey of the Miracle Mile, completed in 1961, estimated anglers fished 69,600 hours in 13,200 days and harvested 5,400 brown trout and 10,900 rainbow trout (Eiserman 1962). The Miracle Mile was subject to huge daily variation in flows throughout the 1950s and early 1960s that often led to de-watering of the river bed during days of non-generation of hydroelectric power at Kortes Powerplant. De-watering led to trout losses, brought about by the combination of high water temperatures and low flows. A cooperative research project initiated in 1963 by the Wyoming Game and Fish Commission, U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service had as its primary goal the establishment of an operating plan for Kortes Dam that would prevent further fish kills and maintain the aquatic habitat and trout population. Using data from the 1961 creel survey, it was calculated that Miracle Mile anglers harvested 200 pounds of trout per surface acre, when the river was subject to a mean flow of 34 cfs. By estimating the surface area of the Miracle Mile as a function of flow, and assuming 1) the estimate of pounds of fish harvested per surface area in 1961 would be maintained at higher flows, and 2) 1961 anglers were expending $15.00 per pound of trout harvested, researchers estimated the value of the tailwater fishery to the economy of Wyoming at $500,000 at 500 cfs. Based on the value of the Miracle Mile, an Act of Congress in 1971 established a minimum flow of 500 cfs.

Results of later creel surveys indicated the Miracle Mile fishery prospered as a result of the minimum flow. An 8-month creel survey conducted in 1973 estimated 21,700 anglers fished 111,300 hours with a total catch of 37,211 rainbow and 8,634 brown trout (Peterson and McMillan 1976). A 12-month creel survey conducted in 1982, estimated 16,386 anglers fished 51,058 hours and caught 7,104 rainbow trout and 4,395 brown trout (Peterson 1984). Despite the estimated reduction in total catch from 1973 to 1982, biologists concluded through analysis of trends in catch rates and population size-structure, that no restrictive changes in fishing regulations should be instituted. During

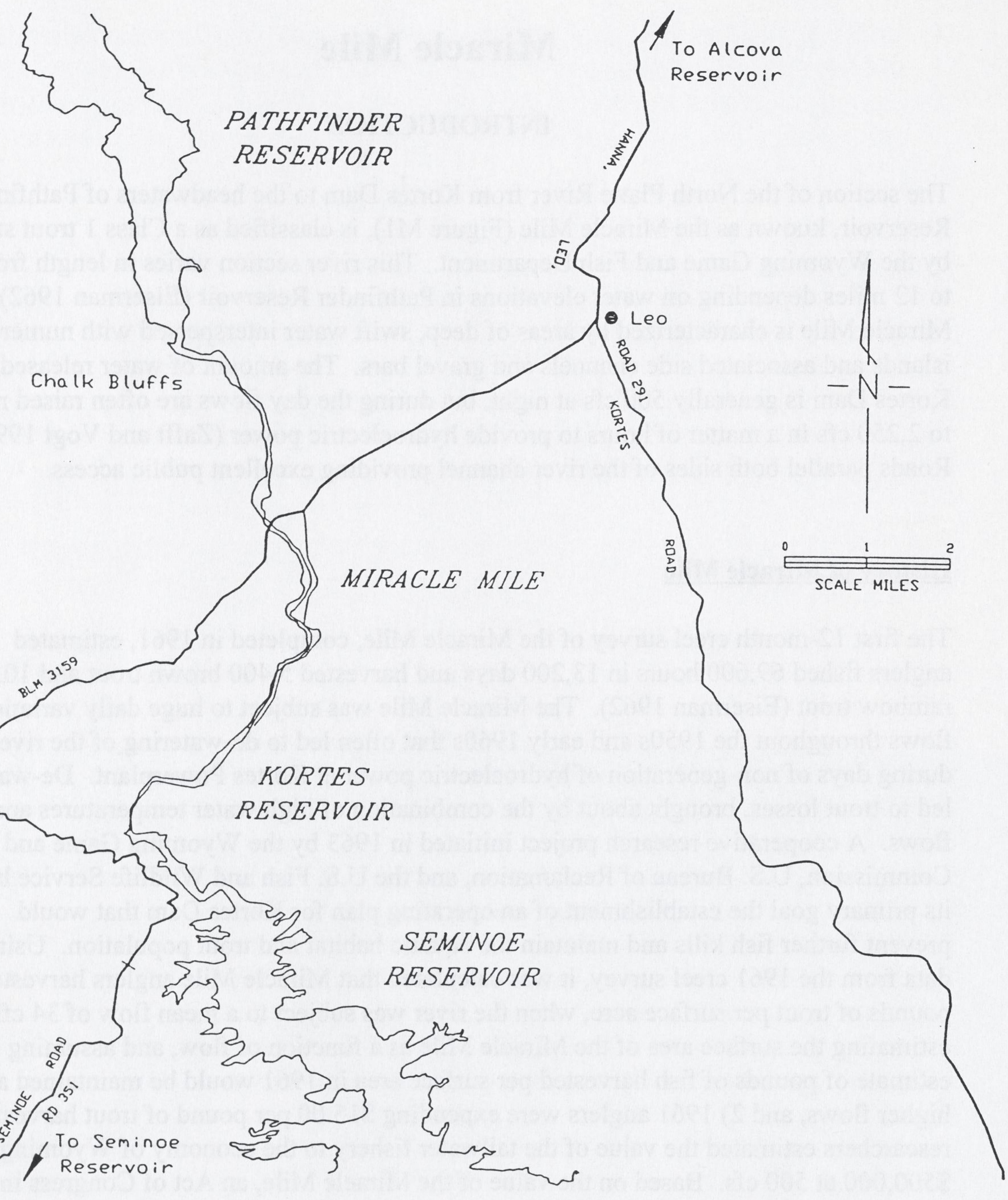


Figure M1. Miracle Mile

the late 1980s, in response to the Bureau of Reclamation contemplating draining Pathfinder to do repair work on the hydro-electric stock, a one fish brown trout limit was imposed in 1990 to protect this valuable fishery.

Recently, electrofishing population estimates have been used to monitor the rainbow and brown trout fisheries of the Miracle Mile. Three such estimates were completed during June 1993 and 1995 and July 1996 (Table M1).

Table M1. Population estimates for the Miracle Mile.

Species	Year	Number/ Mile	Number/ Acre	Pounds/ Mile	Pounds/ Acre	Average Length (in.)
Brown Trout	1993	1,400	51.3	2,800	102.6	14.8
	1995	3,700	135.6	2,900	106.3	9.3
	1996	3,409	125.0	2,247	82.4	10.8
Rainbow Trout	1993	192	7.0	419	15.4	14.4
	1995	793	29.1	1,407	51.6	15.1
	1996	947	34.7	1,003	36.8	12.7

The brown trout population was believed to be increasing in response to the 1990 one fish limit, and recent stable fall and winter flows coinciding with spawning and egg incubation. The alarmingly low numbers of rainbow trout estimated in 1993 was attributed to wide daily fluctuations in flows during rainbow trout spawning and incubation, the decline of rainbow trout in Pathfinder Reservoir and to the restrictive brown trout regulation which may have concentrated harvest on rainbow trout. To maintain numbers of large trout, but not preclude bait fishing, the limit was revised in 1995 to 2 trout in possession, only one fish may exceed 20 inches (Personal communication, Al Conder, Casper Region Fish Supervisor).

Miracle Mile Stocking

There has been little variation in rainbow trout stocking requests since the 1960s with between 100,000 to 150,000 fingerlings stocked annually. Brown trout are self-sustaining and thus have not been stocked since 1950 (Eiserman 1962).

Unlike reservoir catchable stocks, the Miracle Mile is stocked with fingerlings (3-4 inches) (Table M2). During this survey, two strains have been stocked: Eagle Lake Rainbow (ELR) and River Run Rainbow (RRB). The ELR stocked in 1993 (ELR 93) were part of the Covered Raceway Experiment. A portion of this group was raised in covered raceways at the hatchery; the rest were in conventional uncovered raceways. ELR were requested for the Miracle Mile in 1994 but were not stocked due to a statewide shortage of this strain in 1994. RRB stocked as fingerlings in 1995 were not large enough to be widely vulnerable to anglers during the creel survey and thus will not be separately analyzed. Assuming the Miracle Mile is 6.1 miles long and has a surface area of 166.4 acres, an average of 15,960 trout per mile and 9.9 pounds per acre were stocked annually from 1992-3.

Table M2. Number of trout stocked into the Miracle Mile prior to and during the 15 month programmed creel survey.

Species/Strain	Stock Date	Pounds Stocked	Number per pound	Number Stocked
ELR	92/06/24[1]	1,368	67.0	91,700
uncovered	93/07/06[2]	700	70.0	49,000
covered	93/07/06[2]	1,220	44.3	54,000
Sub-Total		3,288		194,700
RRB	95/07/12[3]	330	46.0	15,200
Grand Total		3,618		209,900

[1]- 92 ELR
[2]- 93 ELR
[3]- Other

METHODS

Methods for the Miracle Mile are similar to the General Methods with the exception of the canyon section. The discharge from Kortes Reservoir is in a steep-sided canyon. The aerial clerk was unable to count anglers in this canyon section, only vehicles. Anglers per vehicle was recorded by ground clerks. The average number of anglers per vehicle was used to estimate the number of anglers in the canyon section.

The results for the Miracle Mile are split between above and below the bridge. The river above the bridge is characterized by numerous riffles and fast water velocities. Below the bridge, pools are more numerous and water velocities are slower. This split was made to aide in the decision process for future regulations. For the remainder of this report, the areas above and below the bridge will be referred to as Above and Below, respectively.

Unlike reservoir chapters, boat and bank anglers will not be analyzed separately due to low sample sizes for boat anglers. Boat and bank tag returns were combined for the strain analysis.

For acre estimation, a mean width of 225 feet was used Above and Below (Tom Annear, Instream Flow Supervisor, personal communication). The Above section was 3.1 miles long while the Below section was only slightly shorter at 3.0 miles. These parameters yield estimates of 84.6 acres Above and 81.8 Below.

Biological (electrofishing) data collected during the creel survey (June 1995, N = 182) were used to establish a length-weight relationship specific to rainbow trout in the Miracle Mile. The equation used for fish stocked in the Miracle Mile was:

$$\text{weight} = \exp((2.885520181*\text{length}) - 7.354144657)\ (R^2 = 0.85)$$

The equations by strain used for trout stocked in Pathfinder and caught in the Miracle Mile were:

ELR- $\text{weight} = \exp((2.942704248*\text{length}) - 7.693531438)\ (R^2 = 0.97)$

FRB- $\text{weight} = \exp((2.63575788*\text{length}) - 6.777882927)\ (R^2 = 0.89)$

KRB- $\text{weight} = \exp((2.779591382*\text{length}) - 7.341992152)\ (R^2 = 0.91)$

SRC- $\text{weight} = \exp((3.299795199*\text{length}) - 8.56836281)\ (R^2 = 0.70)$

These equations were applied to the respective strain group/species measured by a creel clerk. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and caught.

RESULTS

Angler Information

Creel clerks interviewed a total of 3,464 anglers, 2,189 Above and 1,275 Below, at the Miracle Mile. Of these, 907 (26%) were residents and 2,557 (74%) were nonresidents. Anglers were asked what terminal tackle they were using when contacted (Table M3). The majority of anglers used flies (47.1%), followed by bait (19.4%) then lures (8.4%). There were differences in terminal tackle use Above and Below. More anglers used solely flies Above (51.2%) than Below (40.0%) while bait fishing was more prevalent Below (27.3%) than Above (14.8%).

Table M3. Terminal tackle employed by Miracle Mile anglers

Terminal Tackle	Above Number	Above %	Below Number	Below %	All Number	All %
Flies	1,080	51.2	490	40.0	1,570	47.1
Bait	313	14.8	335	27.3	648	19.4
Lures	196	9.3	83	6.8	279	8.4
Flies and Lures	168	8.0	87	7.1	255	7.6
Bait and Flies	125	5.9	87	7.1	212	6.4
Bait and Lures	124	5.9	80	6.5	204	6.1
Bait, Flies and Lures	104	4.9	64	5.2	168	5.0

Of the 93% of anglers who stated a preference, 90% were targeting any trout, 9.2 % targeted a specific trout species, 0.5% targeted walleye and 0.3% were targeting trout and walleye. These percentages were similar for anglers Above and Below.

Nearly all anglers used only one pole (Table M4). Anglers Above were more release-oriented than anglers Below. More fish per angler were harvested Below (0.53) than Above (0.31).

Table M4. Angler characteristics Above and Below (completed trips only) in the Miracle Mile.

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Above	951	1 - 100% 2 - 0% Avg.=1.00	10%- Harvested 90%- Released	0.31
Below	470	1 - 98% 2 - 2% Avg.=1.02	24%- Harvested 76%- Released	0.53

Nearly half of all anglers caught at least one RBT and 10% caught 6 or more (Table M5). BNT were not as frequently caught as RBT. Only 4% of anglers caught at least 6 BNT. A very impressive 17% of all anglers caught 6 or more game fish. Nearly 75% of all anglers did not harvest any game fish and only 9% harvested two or more fish.

Table M5. Percentage of anglers who harvested/caught 0 fish, at least 1 fish, at least 2 fish, etc. in the Miracle Mile (completed trips only) (ALL = all game fish).

		Number of Fish						
		0	≥1	≥2	≥3	≥4	≥5	≥6
RBT	Harvest	78%	22%	6%				
	Catch	52%	48%	31%	23%	17%	14%	10%
BNT	Harvest	92%	8%	1%				
	Catch	71%	29%	18%	12%	9%	7%	4%
ALL	Harvest	72%	28%	9%				
	Catch	42%	58%	41%	31%	26%	22%	17%

Pressure

From April 1995 through June 1996, we estimated 20,123 anglers fished Above and 17,999 anglers fished Below (Table M6). The average annual estimate was 14,975 and 13,978 anglers Above and Below, respectively. This yields an annual estimate of 177.0 anglers/acre Above and 170.9 anglers/acre Below. Nearly all of the anglers Above (99.8%) and Below (95.9%) were fishing from the bank. Numbers of anglers were highest in July and lowest in January. There was no statistical difference ($p = 0.21$) between the number of anglers Above and Below.

Table M6. Miracle Mile- estimated numbers of anglers.

	Above	/acre	Below	/acre	All	/acre
April	1,301	15.4	1,432	17.5	2,733	16.4
May	2,017	23.8	1,537	18.8	3,554	21.4
June	2,022	23.9	1,301	15.9	3,323	20.0
July	2,929	34.6	1,977	24.2	4,906	29.5
August	1,342	15.9	1,918	23.4	3,260	19.6
September	1,346	15.9	1,079	13.2	2,425	14.6
October	1,433	16.9	1,378	16.8	2,811	16.9
November	501	5.9	554	6.8	1,055	6.3
December	166	2.0	261	3.2	427	2.6
January	65	0.8	243	3.0	308	1.9
February	619	7.3	944	11.5	1,563	9.4
March	1,426	16.9	1,604	19.6	3,030	18.2
April	1,549	18.3	1,183	14.5	2,732	16.4
May	1,943	23.0	1,578	19.3	3,521	21.2
June	1,465	17.3	1,010	12.3	2,474	14.9
15 Month Total	20,123	237.9	17,999	220.0	38,122	229.1
Average 12 Months	14,975	177.0	13,978	170.9	28,953	174.0

The annual estimate for hours fished was 59,432 Above and 54,439 Below (Table M7). The entire Miracle Mile supports an estimated 113,871 angling hours or 684 angling hours/acre, annually. There was no statistical difference between total hours fished Above and Below ($p = 0.11$).

Table M7. Miracle Mile- estimated pressure (angler hours) Above, Below and All Anglers.

Month	Above	/acre	Below	/acre	All Anglers	/acre
April	5,593	66.1	7,158	87.5	12,750	76.6
May	8,736	103.3	6,877	84.1	15,613	93.8
June	7,900	93.4	5,691	69.6	13,591	81.7
July	8,364	98.9	7,187	87.9	15,551	93.5
August	5,145	60.8	5,993	73.3	11,138	66.9
September	5,875	69.4	4,234	51.8	10,109	60.8
October	6,079	71.9	4,681	57.2	10,759	64.7
November	2,162	25.6	2,230	27.3	4,393	26.4
December	914	10.8	1,154	14.1	2,068	12.4
January	187	2.2	916	11.2	1,103	6.6
February	3,074	36.3	3,985	48.7	7,059	42.4
March	6,015	71.1	6,861	83.9	12,876	77.4
April	7,346	86.8	5,487	67.1	12,833	77.1
May	7,286	86.1	5,591	68.4	12,877	77.4
June	6,375	75.3	3,591	43.9	9,966	59.9
15 Months	81,050	958.0	71,637	875.8	152,686	917.6
12 Month Average	59,432	702.5	54,439	665.5	113,871	684.3

Although weekend days received more pressure, there was no statistical difference between the total hours fished during weekdays versus weekend days ($p = 0.10$) (Table M8).

Table M8. Pressure (hours fished) during weekdays (WD) and weekend days (WE) in the Miracle Mile.

	WD	WE
15 Month Total	70,245	82,442
12 Month Average	52,218	61,653

An annual estimate of trip length for all anglers was 3.94 hours. Trip length Above (3.98 hrs) was longer than trip length Below (3.89 hrs).

Catch Rates

Combining both Above and Below yields an annual catch rate of 0.62 fish/hour (Table M9). Anglers Above had a higher catch rate (0.67) than anglers Below (0.56), but this difference was not significant ($p = 0.10$). Catch rates peaked in December (1.47) and were lowest in April 1996 (0.30). During the summer months (July-September), catch rates were higher Below than Above. Generally, catch rates were highest Above for the rest of the survey. Anglers Above caught 469 fish/acre while anglers Below caught 372 fish/acre.

Table M9. Catch rates (fish per hour, all species combined) for Above, Below and all anglers in the Miracle Mile.

	Above	Below	All
April	0.84	0.60	0.72
May	0.86	0.81	0.84
June	0.59	0.46	0.52
July	0.51	0.61	0.56
August	0.43	0.88	0.66
September	0.89	1.03	0.96
October	0.91	0.36	0.63
November	0.46	0.51	0.48
December	1.79	1.14	1.47
January	0.43	0.53	0.48
February	0.72	0.51	0.62
March	0.66	0.44	0.55
April	0.30	0.30	0.30
May	0.54	0.33	0.44
June	0.79	0.22	0.51
15 Month Total	0.66	0.53	0.60
Average 12 Months	0.67	0.56	0.62

Catch and Harvest

The estimated annual total catch was 70,138 (Table M10). Anglers Above caught 39,675 (57% of the total) while anglers Below caught 30,462 (43% of the total). An estimated 45,303 rainbow trout were caught, of which 35,012 (77%) were RBT AD and 10,291 (23%) were wild rainbow (RBT). Brown trout were the second most commonly caught species (24,519). Two-thirds of the total BNT catch was Above. Rainbow and brown trout make up the bulk (99.6%) of the catch in the Miracle Mile (Table M10).

Table M10. Annual total catch by species in the Miracle Mile.

Species	Above	%	Below	%	Total Catch	%
RBT AD	16,314	41.1	18,698	61.4	35,012	49.9
RBT	6,741	17.0	3,550	11.7	10,291	14.7
BNT	16,518	41.6	8,001	26.3	24,519	35.0
SRC AD	0	0.0	185	0.6	185	0.3
SRC	86	0.2	0	0.0	86	0.1
BKT	11	0.0	0	0.0	11	0.0
WAE	5	0.0	29	0.1	34	0.0
Total Catch	39,675	100	30,462	100	70,138	100

Total estimated harvest was 8,065 or only 11.5% of the total catch (Table M11). Above, 92.5% of all fish caught were released. Below, the release rate drops to 83% of all caught fish. Brown trout are released at the highest rate Above and Below while stocked rainbows (RBT AD) are harvested at the highest percentage (excluding SRC, WAE and BKT due to low sample sizes), although only 14% of the RBT AD caught are harvested.

Table M11. Annual harvest, release, total catch and catch/acre Above, Below and All anglers for the Miracle Mile.

Species	Area	Harvested	%	Released	%	Total Catch	Catch/Acre
RBT AD	Above	1,384	8.5	14,929	91.5	16,313	192.8
	Below	3,481	18.6	15,217	81.4	18,698	228.6
	All Anglers	4,865	13.9	30,146	86.1	35,011	210.4
RBT	Above	580	8.6	6,161	91.4	6,741	79.7
	Below	643	18.1	2,908	81.9	3,551	43.4
	All Anglers	1,223	11.9	9,069	88.1	10,292	61.9
BNT	Above	995	6.0	15,523	94.0	16,518	195.2
	Below	914	11.4	7,087	88.6	8,001	97.8
	All Anglers	1,909	7.8	22,610	92.2	24,519	147.3
SRC AD	Above	0	0.0	0	0.0	0	0.0
	Below	16	8.6	169	91.4	185	2.3
	All Anglers	16	8.6	169	91.4	185	1.1
SRC	Above	18	20.9	68	79.1	86	1.0
	Below	0	0.0	0	0.0	0	0.0
	All Anglers	18	20.9	68	79.1	86	0.5
BKT	Above	0	0.0	11	100.0	11	0.1
	Below	0	0.0	0	0.0	0	0.0
	All Anglers	0	0.0	11	100.0	11	0.1
WAE	Above	5	100.0	0	0.0	5	0.1
	Below	29	100.0	0	0.0	29	0.4
	All Anglers	34	100.0	0	0.0	34	0.2
Annual Totals							
	Above	2,982	7.5	36,692	92.5	39,674	238.4
	Below	5,083	16.7	25,381	83.3	30,464	183.1
	All Anglers	8,065	11.5	62,073	88.5	70,138	421.5

Seasonal Catch by Species

By species, rainbow trout make up 58% of the catch Above and 73% of the Below catch (Table M12). RBT catch was highest in the spring and summer and lowest in January. RBT were caught every month of the survey Above and Below.

BNT make up nearly 42% the catch Above and 26% of the Below catch (Table M12). Like RBT, BNT were caught every month Above and Below.

SRC were sporadically caught Above and Below throughout the survey. WAE were rarely caught in the Miracle Mile, with an annual catch of only 34.

Table M12. Catch by species by month for anglers Above and Below in the Miracle Mile.

	ABOVE				BELOW			
Month	RBT	BNT	SRC	WAE	RBT	BNT	SRC	WAE
April	3,442	1,413	13	0	3,046	845	56	0
May	5,201	2,258	38	0	3,931	1,059	19	0
June	3,084	1,437	0	0	1,842	470	20	0
July	2,237	2,011	20	0	2,966	1,378	0	0
August	1,389	777	0	0	3,625	797	10	0
September	2,921	2,082	29	5	3,590	571	7	12
October	2,944	2,199	6	0	1,040	582	8	0
November	772	219	0	0	707	449	0	0
December	410	1,410	0	0	315	1,010	0	0
January	47	112	0	0	159	325	0	0
February	1,156	1,055	0	0	1,603	428	0	0
March	2,235	1,546	0	0	2,076	886	79	0
April	876	1,311	5	0	1,282	198	0	33
May	2,734	1,285	0	0	1,589	427	64	0
June	2,548	2,510	6	0	644	146	3	0
15 Mon. Tot.	31,998	21,624	117	5	28,415	9,574	266	45
Ave 12 Mon.	23,055	16,518	86	5	22,248	8,001	185	29

Stocked Trout Strain Analysis

Rainbow trout are the only trout species stocked into the Miracle Mile. Rainbow and Snake River Cutthroat are stocked as catchables into Pathfinder Reservoir. All BNT are wild; no brown trout are stocked into either the Miracle Mile or Pathfinder Reservoir.

For stocked trout strain analysis, fish caught in the Miracle Mile were grouped into seven categories. Two groups of fish were stocked as fingerlings into the Miracle Mile, ELR 92 and ELR 93. Pathfinder Reservoir fish were grouped into PATH 92-95 ELR, PATH 92-95 KRB, PATH 92-95 FRB and PATH SRC 92-95. Other refers to fished stocked into waters other than the Miracle Mile and Pathfinder Reservoir, Miracle Mile RRB (stocked in 1995 of which only one tag was recovered) and sub-catchable fish stocked into Pathfinder Reservoir.

ELR 93 (ELR stocked as fingerlings in 1993) had the highest catch/hour (0.13) and catch/acre (86.3) for the whole Miracle Mile (Table M13). ELR 93 were also the largest contributor to total catch followed by Pathfinder Reservoir catchable stocks (Figure M2) (Table M14).

Table M13. Strain catch rates per hour and per acre for Above, Below and All anglers in the Miracle Mile (annually).

	Catch Rate/Hour			Catch/Acre		
	Above	Below	Total	Above	Below	All
ELR 92	0.00	0.00	0.00	2.8	0.0	1.4
ELR 93	0.18	0.07	0.13	124.3	46.9	86.3
PATH ELR 92-95	0.05	0.10	0.08	38.1	66.5	52.1
PATH KRB 92-95	0.01	0.03	0.02	6.3	20.5	13.3
PATH FRB 92-95	0.02	0.10	0.06	14.0	64.4	38.7
PATH SRC 92-95	0.00	0.00	0.00	0.6	1.3	0.9
OTHER	0.01	0.04	0.03	6.8	28.9	17.7
Total	0.27	0.34	0.31	192.8	228.6	210.4

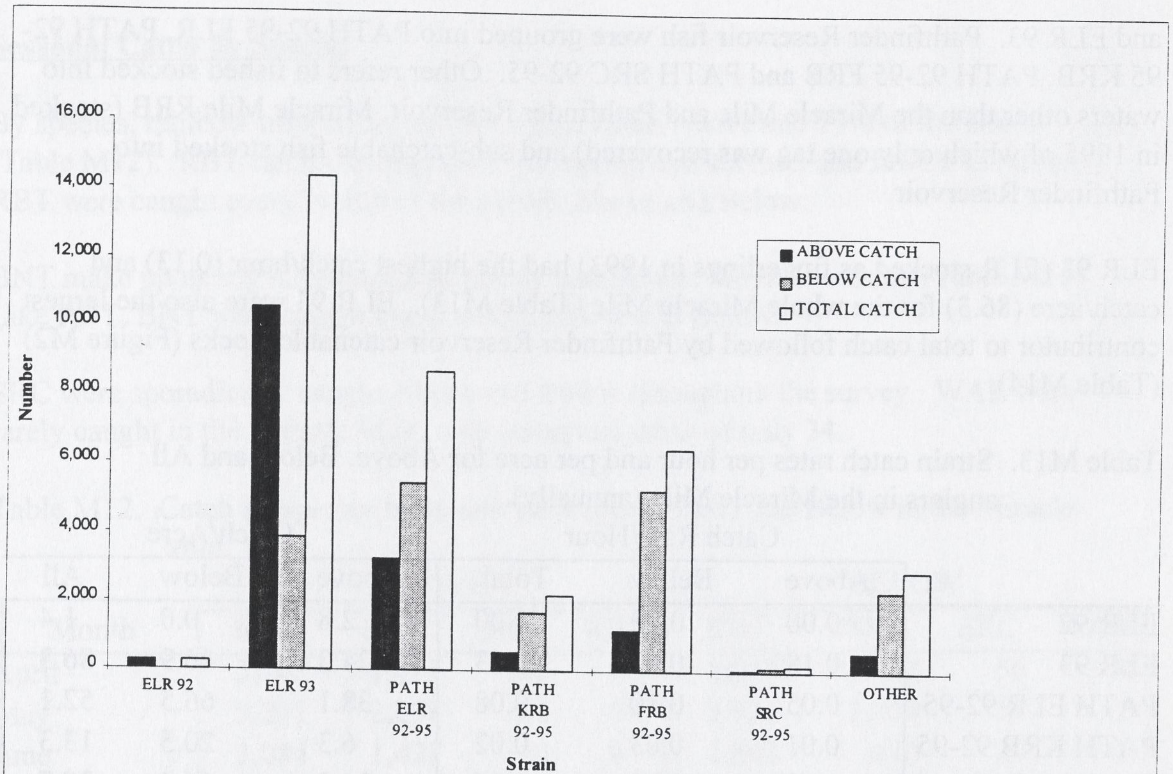


Figure M2. Annual catch by strain group in the Miracle Mile.

Above, ELR 93 performed best with a catch rate more than 3 times any other strain group. Miracle Mile stocks accounted for 68% of the Above stocked trout catch with Pathfinder stocks making up the remaining 32% (Figure M3).

Below, Pathfinder stocked groups were the most important contributor (Figure M3). PATH ELR and FRB had the highest catch rates at 0.10/ hour each (Table M13). Pathfinder stocks accounted for 77% of the Below stocked trout catch with Miracle Mile stocks making up the remaining 23%.

Overall, Pathfinder stocks account for 55% of the total stocked trout catch in the Miracle Mile (Figure M3). A total of 8,667 ELR, 6,447 FRB and 2,209 KRB originally stocked in Pathfinder Reservoir were caught annually in the Miracle Mile.

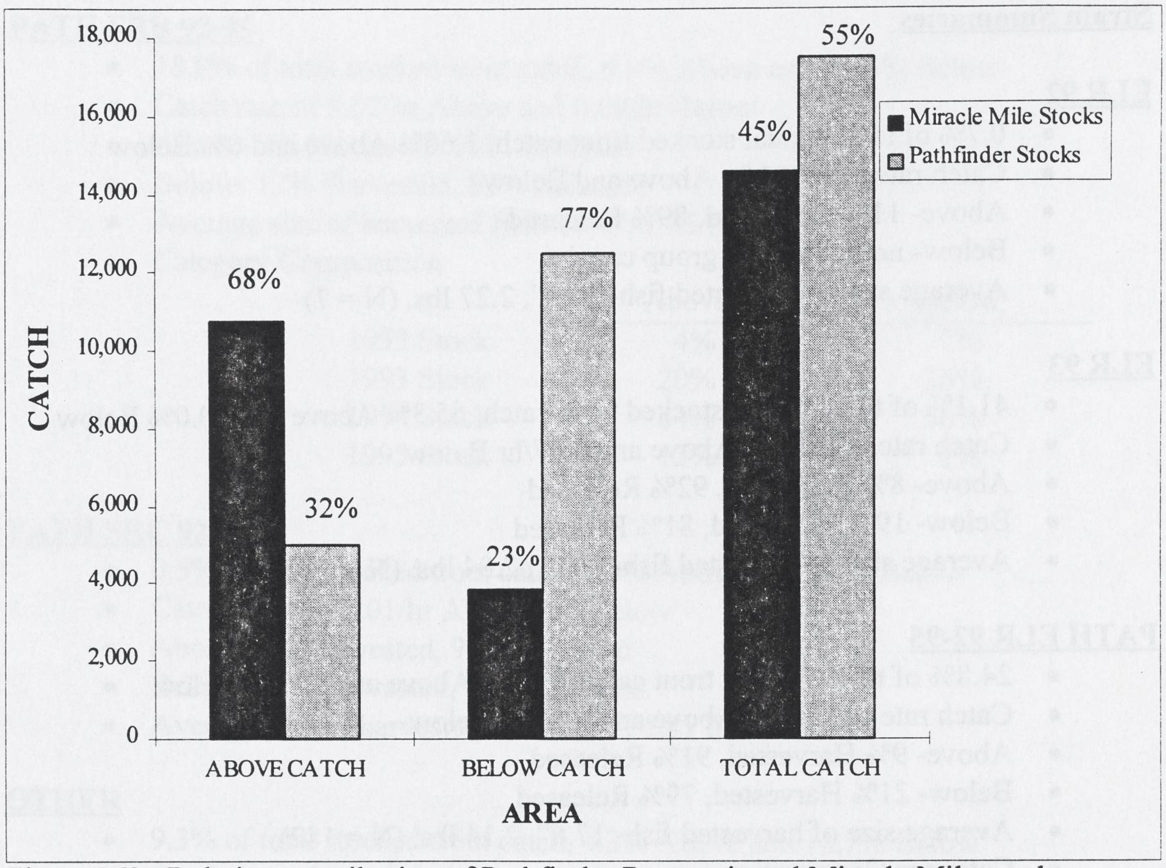


Figure M3. Relative contribution of Pathfinder Reservoir and Miracle Mile stocks to Miracle Mile catch by area.

Strain Summaries

ELR 92

- 0.7% of total annual stocked trout catch, 1.60% Above and 0% Below
- Catch rate of <0.01/hr Above and Below
- Above- 11% Harvested, 89% Released
- Below- no fish of this group caught
- Average size of harvested fish- 16.8", 2.27 lbs. (N = 7)

ELR 93

- 41.1% of total annual stocked trout catch, 65.3% Above and 20.0% Below
- Catch rate of 0.18/hr Above and 0.07/hr Below
- Above- 8% Harvested, 92% Released
- Below- 19% Harvested, 81% Released
- Average size of harvested fish- 16.2", 2.04 lbs. (N = 186)

PATH ELR 92-95

- 24.8% of total stocked trout catch, 19.8% Above and 29.2% Below
- Catch rate of 0.05/hr Above and 0.10/hr Below
- Above- 9% Harvested, 91% Released
- Below- 21% Harvested, 79% Released
- Average size of harvested fish- 17.6", 2.14 lbs. (N = 182)
- Category Composition

	Above	Below
1992 Stock	60%	48%
1993 Stock	9%	16%
1994 Stock	21%	33%
1995 Stock	10%	3%

PATH KRB 92-95

- 5.6% of total stocked trout catch, 1.9% Above and 8.9% Below
- Catch rate of 0.01/hr Above and 0.03/hr Below
- Above- 10% Harvested, 90% Released
- Below- 19% Harvested, 81% Released
- Average size of harvested fish- 17.1", 1.78 lbs. (N = 34)
- Category Composition

	Above	Below
1992 Stock	0%	19%
1993 Stock	12%	23%
1994 Stock	0%	34%
1995 Stock	88%	24%

PATH FRB 92-95

- 18.0% of total stocked trout catch, 6.9% Above and 27.6% Below
- Catch rate of 0.02/hr Above and 0.09/hr Below
- Above- 9% Harvested, 91% Released
- Below- 17% Harvested, 83% Released
- Average size of harvested fish- 16.4", 1.85 lbs. (N = 92)
- Category Composition

	Above	Below
1992 Stock	4%	7%
1993 Stock	20%	36%
1994 Stock	64%	56%
1995 Stock	12%	1%

PATH SRC 92-95

- 0.5% of total stocked trout catch, 0.3% Above and 0.6% Below
- Catch rate of <0.01/hr Above and Below
- Above- 9% Harvested, 91% Released
- Below- 33% Harvested, 67% Released
- Average size of harvested fish- 16.1", 1.81 lbs. (N = 2)

OTHER

- 9.3% of total stocked trout catch, 4.3% Above and 13.7% Below
- Catch rate of 0.01/hr Above and 0.05/hr Below
- Above- 11% Harvested, 89% Released
- Below- 17% Harvested, 83% Released
- Average size of harvested fish- 16.3", 1.81 lbs. (N = 37)
- Composition of Tag Origins

  47% PATH 95 Large Sub-Catchables
  26% PATH 94 Sub-Catchables
  3% RRB (stocked in the Miracle Mile in 1995)
  3% Seminoe Reservoir
  21% Impossible (stocked downstream of Pathfinder Dam)

Table M14. Strain catch stratified by Above and Below by month, April 1995 - June 1996, in the Miracle Mile.

TOTAL CATCH

ABOVE BRIDGE

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
ELR 92	88	0	0	0	35	111	0	0	0	0	0	0	26	60	0	321	233
ELR 93	1,495	2,832	1,739	862	729	1,391	1,416	681	0	0	403	1,775	26	423	0	13,774	10,516
PATH ELR 92-95	879	885	386	398	69	278	0	0	0	33	403	0	185	1,573	179	5,269	3,225
PATH KRB 92-95	0	0	0	66	0	0	0	0	378	0	0	0	53	60	60	617	530
PATH FRB 92-95	0	531	0	0	104	223	472	0	0	0	0	0	53	181	0	1,564	1,181
PATH SRC 92-95	0	0	97	0	0	0	0	0	0	0	0	0	0	0	0	97	48
OTHER	0	354	97	133	104	0	0	0	0	0	0	0	53	121	60	921	579
TOTAL	2,462	4,602	2,319	1,459	1,042	2,003	1,888	681	378	33	806	1,775	397	2,419	298	22,563	16,314

BELOW BRIDGE

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
ELR 92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ELR 93	1,271	750	576	616	783	521	205	112	43	31	0	211	0	21	12	5,151	3,837
PATH ELR 92-95	794	2,357	288	847	783	521	154	262	102	31	0	317	671	683	58	7,867	5,442
PATH KRB 92-95	0	107	0	154	587	417	205	56	22	0	0	106	67	62	29	1,811	1,679
PATH FRB 92-95	635	107	192	616	979	1,146	256	165	64	0	778	528	268	124	139	5,999	5,266
PATH SRC 92-95	0	0	0	77	0	0	0	7	3	0	0	0	0	41	0	128	108
OTHER	0	0	0	462	392	417	0	58	23	0	389	528	134	62	0	2,465	2,367
TOTAL	2,700	3,321	1,057	2,771	3,525	3,021	820	661	257	61	1,168	1,691	1,141	993	237	23,422	18,698

MIRACLE MILE

GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
ELR 92	88	0	0	0	35	111	0	0	0	0	0	0	26	60	0	321	233
ELR 93	2,765	3,582	2,316	1,478	1,512	1,911	1,621	793	43	31	403	1,987	26	444	12	18,925	14,353
PATH ELR 92-95	1,673	3,242	675	1,244	853	799	154	262	102	64	403	317	856	2,255	237	13,136	8,667
PATH KRB 92-95	0	107	0	220	587	417	205	56	399	0	0	106	120	123	89	2,428	2,209
PATH FRB 92-95	635	638	192	616	1,083	1,368	728	165	64	0	778	528	321	306	139	7,563	6,447
PATH SRC 92-95	0	0	97	77	0	0	0	7	3	0	0	0	0	41	0	225	156
OTHER	0	354	97	594	496	417	0	58	23	0	389	528	187	183	60	3,386	2,946
TOTAL	5,162	7,923	3,376	4,230	4,566	5,023	2,708	1,342	635	95	1,974	3,466	1,538	3,412	535	45,985	35,012

DISCUSSION

The majority of Miracle Mile anglers were nonresidents (74%) fishing with flies (47%). Catch and release was extensively practiced with 89% of fish caught subsequently released. By species, RBT were 64.6% of the total catch followed by BNT (35%). SRC, BKT and WAE made up the remaining 0.4% of the total catch.

There are differences in angler characteristics and catch Above and Below. Although flies were the most common tackle Above and Below, a greater percentage of anglers used solely flies Above (51%) than Below (40%). Bait fishing was much more prevalent Below (27%) than Above (15%). This difference in tackle use coincides with harvest percentages. Generally, Miracle Mile bait fishermen are more likely to harvest fish than fly anglers. Only 7.5% of the fish caught Above were harvested. Of these harvested fish, 66% were RBT and 34% were BNT. Below, 16.7% of the fish caught were harvested, of which 82% were RBT and 18% were BNT. Catch rates Above and Below were 0.67/hr and 0.56/hr, respectively.

<u>Criteria</u>

For a strain to be considered successful, it must meet at least one of the criteria defined in the General Introduction (50% harvested or caught by number or 1 pound harvested or caught for each pound stocked). For fish that were stocked in the Miracle Mile, ELR 92 and ELR 93, only ELR 93 meet any of the criteria (Table M15).

Less than 1% of the total stocked trout catch was ELR 92 compared to ELR 93 which made up 41.0%. ELR 93 met two criteria: pounds harvested and pounds caught. The extent of catch and release is exemplified by the difference between pounds harvested and pounds caught. For ELR 93, 1.70 pounds are harvested and 15.25 pounds are caught for each pound stocked. This is almost a 9 times difference between catch and harvest. If the 92 and 93 ELR stock are treated as a group, the group meets the same two criteria that ELR 93 met. In other waters, grouping such as this were done to simplify the results and look at trends by strain and not by year stocked.

Table M15. Criteria for stocked RBT (average 12 months) for harvest and total catch in the Miracle Mile (* indicates criteria met).

HARVEST	# Stocked	lbs. Stocked	# Harvested	lbs. Harvested	# returned/ # stocked	lbs. returned/ lbs. stocked
ELR 92	91,700	1,368	26	59	<0.01	0.04
ELR 93	103,000	1,920	1,597	3,258	0.02	1.70*

TOTAL CATCH	# Stocked	lbs. Stocked	# Caught	lbs. Caught	# returned/ # stocked	lbs. returned/ lbs. stocked
ELR 92	91,700	1,368	233	530	<0.01	0.39
ELR 93	103,000	1,920	14,353	29,279	0.14	15.25*

ELR 92 stock failed to meet any criteria, only 7 of 548 (1.3%) tag returns were from this group. Possible explanations for this difference include (but are not limited to): this group of fish was caught out before the survey, post-stocking environmental conditions were adverse to survival or this group was treated differently than the ELR 93 group in the hatchery system. These explanations and others will be explored in a future strain report.

ELR 93 stocks were part of a covered raceway experiment. Roughly half of this stock was kept in covered raceways at Speas Hatchery while the other half was kept in conventional uncovered raceways. There was no significant difference ($p = 0.15$) in returns between covered and uncovered fish. However, the covered fish returned in greater numbers than uncovered fish Above (63% of the 93 ELR catch) and Below (50.2%). Hatchery personnel like the covered raceways and plan to continue their use due to the benefits covering provides (Joe Satake, Speas Rearing Station Superintendent, personnel communication). Covering raceways reduces algal growth and avian predation, keeps fish out of direct sunlight and may reduce fish stress by providing a hiding place.

Fish originally stocked as catchables in Pathfinder Reservoir accounted for over half (55%) of the stocked trout catch in the Miracle Mile. When these fish are included in the analysis, ELR and FRB Catchables meet the criteria of 1 pound caught for each pound stocked (Table M16) just in the Miracle Mile. This information will be used in the Pathfinder Reservoir chapter to determine the success of these stocks.

Table M16. Criteria for stocked trout (average 12 months) for harvest and total catch in the Miracle Mile (* indicates criteria met).

HARVEST GROUP	# Stocked[1]	lbs. Stocked[1]	# Harvested	lbs. Harvested	# returned/ # stocked	lbs. returned/ lbs. stocked
ELR 92	91,700	1,368	26	59	<0.01	0.04
ELR 93	103,000	1,920	1,597	3,258	0.02	1.70*
PATH ELR 92-95	31,800	10,652	1,402	3,014	0.04	0.28
PATH KRB 92-95	25,575	8,287	351	621	0.01	0.07
PATH FRB 92-95	25,525	7,437	981	1,815	0.04	0.24
PATH SRC 92-95	30,975	6,320	40	72	<0.01	0.01

TOTAL CATCH GROUP	# Stocked[1]	lbs. Stocked[1]	# Caught	lbs. Caught	# returned/ # stocked	lbs. returned/ lbs. stocked
ELR 92	91,700	1,368	233	530	0.00	0.39
ELR 93	103,000	1,920	14,353	29,279	0.14	15.25*
PATH ELR 92-95	31,800	10,652	8,667	18,635	0.27	1.75*
PATH KRB 92-95	25,575	8,287	2,209	3,910	0.08	0.47
PATH FRB 92-95	25,525	7,437	6,447	11,928	0.25	1.60*
PATH SRC 92-95	30,975	6,320	156	281	0.01	0.04

[1]- Number and pounds stocked represent an annual average over four years for the Pathfinder Reservoir stocks only, Miracle Mile stocks are one year totals.

Upstream migration from Pathfinder Reservoir was shown to be significant (Figure M3). Catch rates of RBT in the Miracle Mile would likely decrease if the Pathfinder Reservoir stocks were discontinued or significantly reduced. Downstream migration from Kortes and Seminoe Reservoirs was almost non-existent (1 tag of 548) indicating fish did not pass through both Seminoe and Kortes powerplants in large numbers.

<u>Contribution of BNT to the fishery</u>

As stated earlier, all BNT in the Miracle Mile are wild. BNT were 42% of the catch Above, 26% Below and 35% of the overall catch (Figure M4). The overall catch rate for BNT was 0.22/hour.

Data from the 1996 population estimate (WGFD, 1996 Progress Report) indicate that 78% of the trout population is BNT (Figure M5). RBT (RBT AD + RBT) make up only 22% of the trout population, however, they provide 65% of the total trout catch (Figure M5). This difference illustrates that BNT are either not targeted by a large number of anglers or, more likely, are more difficult to catch than RBT.

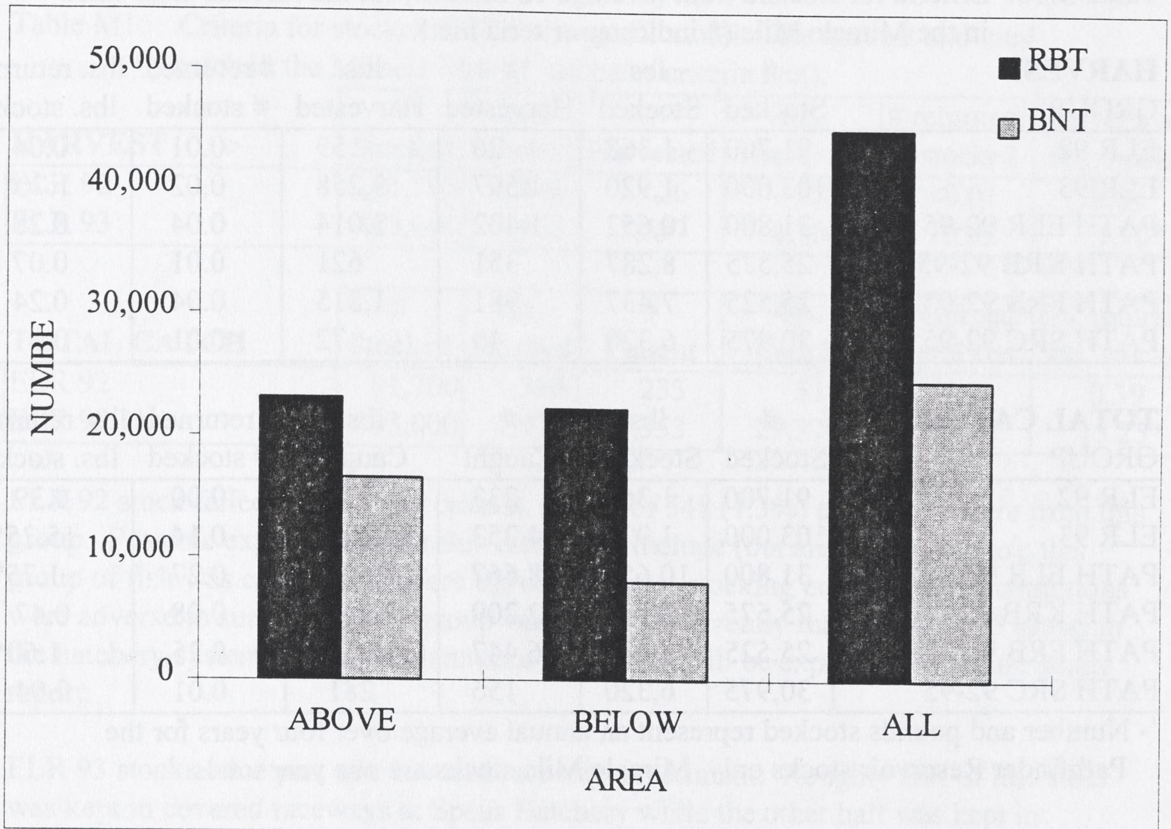


Figure M4. Proportions of RBT and BNT in the total catch in the Miracle Mile.

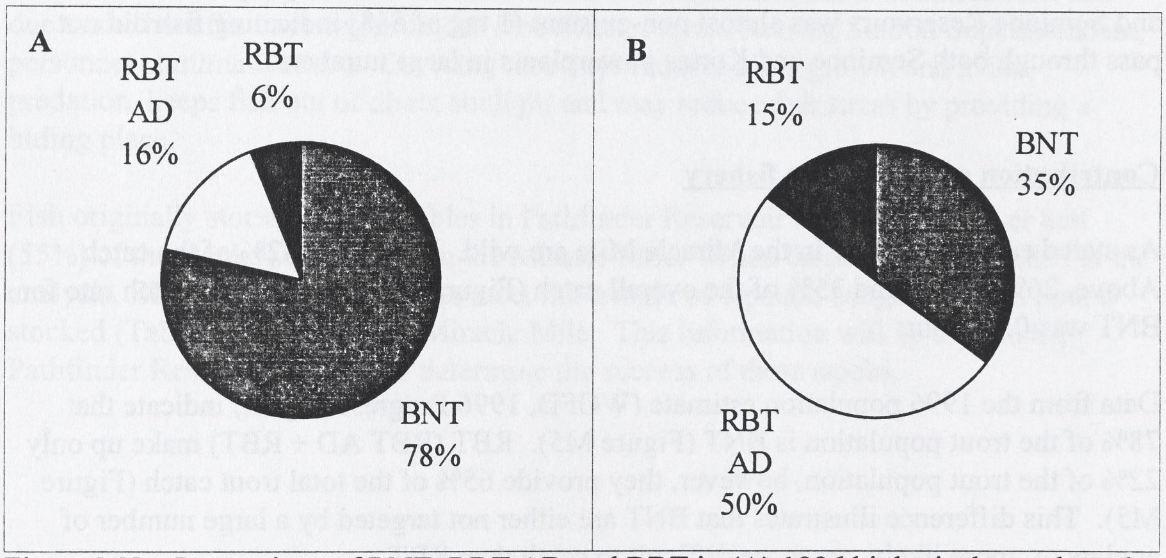


Figure M5. Proportions of BNT, RBT AD and RBT in (**A**) 1996 biological sample and (**B**) angler catch in the Miracle Mile.

Miracle Mile RBT appear more vulnerable to both flies and bait than BNT (Table M17). Although BNT appear most vulnerable to lures, only 8.4% of Miracle Mile anglers use solely lures (Table M3).

Table M17. Species composition of catch by terminal tackle in the Miracle Mile.

Terminal Tackle	Sample Size	Rainbow Trout	Brown Trout
Flies	1,635	61%	39%
Bait	666	79%	21%
Lures	292	44%	56%

Contribution of species/strain to the fishery

BNT make up the largest single component of catch followed by RBT stocked in Pathfinder Reservoir, RBT stocked in the Miracle Mile, wild RBT and Other fish (Figure M6). All the RBT stocked in Pathfinder Reservoir were stocked at catchable size. Of these catchable stocks, ELR make up the largest percentage (50%) followed by FRB (37%) and KRB (13%). The vast majority (98.4%) of the RBT caught in the Miracle Mile that were stocked as fingerlings were ELR 93. Other refers to fish stocked in waters other than the Miracle Mile or Pathfinder Reservoir, SRC stocked in Pathfinder Reservoir and Size at Stocking fish from Pathfinder Reservoir made up 4% of the total catch. Overall, stocked trout make up 50% of the total catch in the Miracle Mile. These stocked trout were either stocked in the Miracle Mile as fingerlings, Pathfinder Reservoir as catchables or Other fish of various sizes.

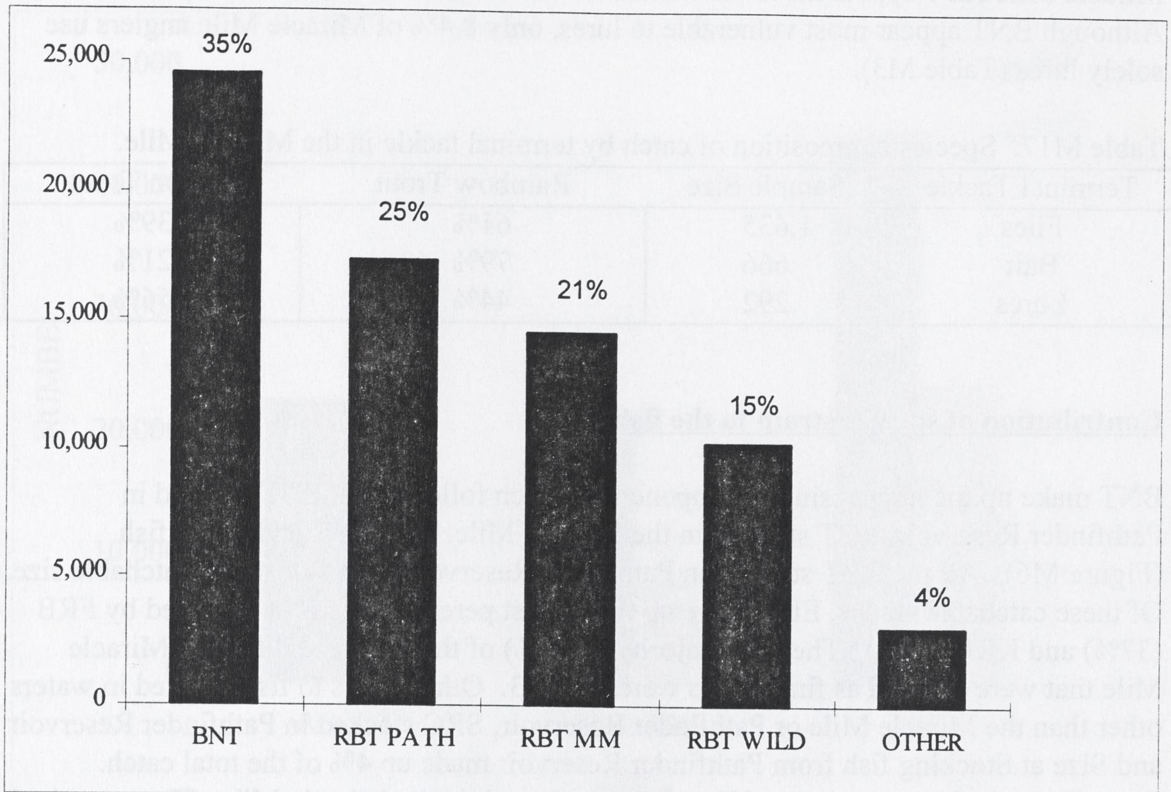


Figure M6. Annual total catch in the Miracle Mile.

Above and Below

BNT made up the largest single component of the fishery Above (42%) followed by RBT stocked in the Miracle Mile (27%), wild RBT (17%) then RBT stocked in Pathfinder Reservoir (12%) (Figure M7). Of these catchable stocks, ELR made up the largest percentage (65%) followed by FRB (24%) and KRB (11%). The catchable stocks from Pathfinder Reservoir do not appear to travel significant distances upstream as indicated by the difference between RBT PATH Above and Below.

RBT stocked in Pathfinder Reservoir as catchables make up the largest portion (41%) of the Below catch (Figure M8). Of these catchable stocks, ELR made up the largest percentage (44%) followed by FRB (43%) and KRB (13%). Wild RBT are caught Below in nearly as large numbers as RBT stocked in the Miracle Mile.

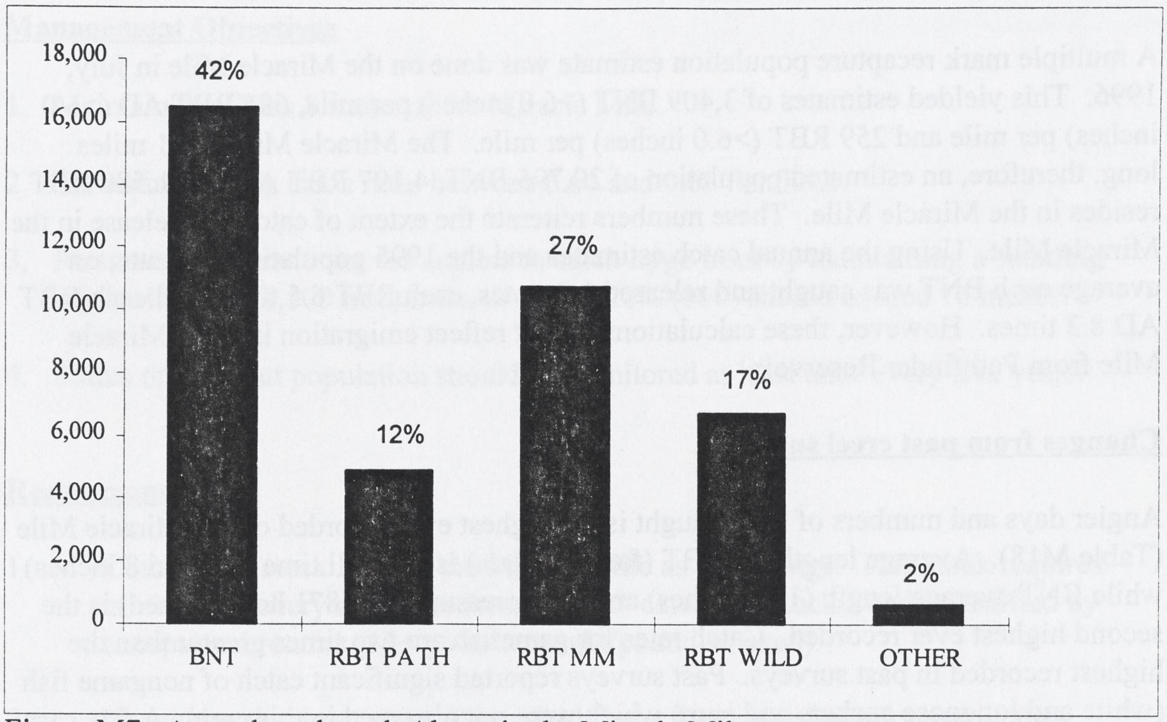


Figure M7. Annual total catch Above in the Miracle Mile.

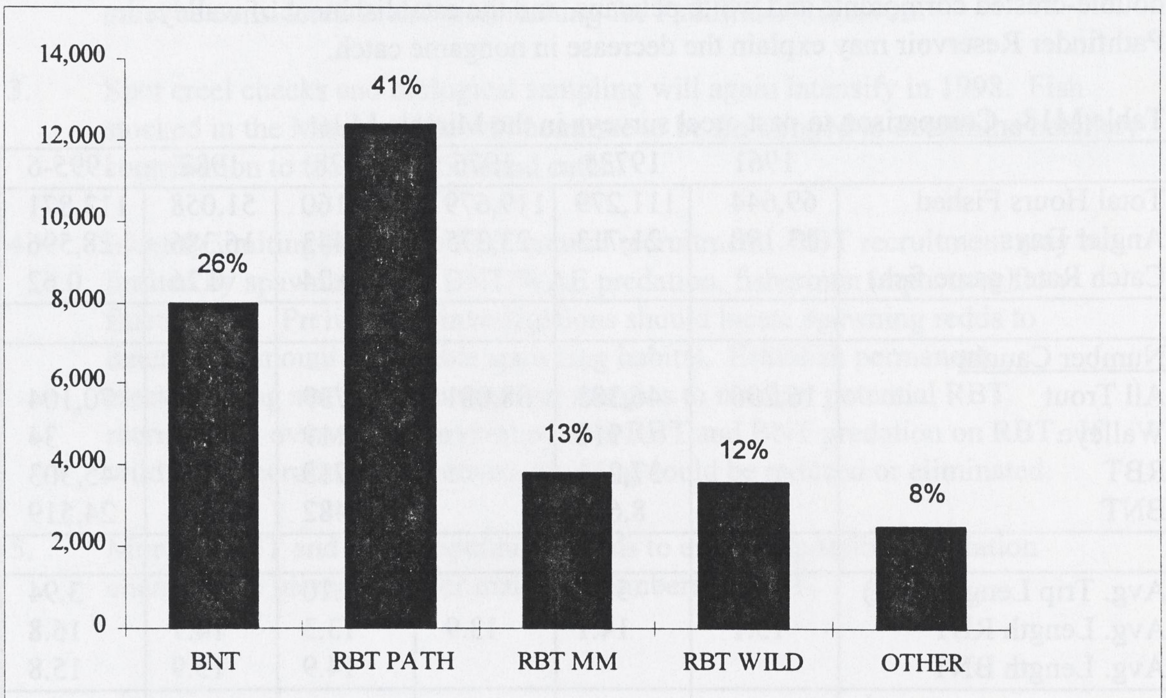


Figure M8. Annual total catch Below in the Miracle Mile.

Comparison to Biological Sample

A multiple mark recapture population estimate was done on the Miracle Mile in July, 1996. This yielded estimates of 3,409 BNT (>6.0 inches) per mile, 688 RBT AD (>6.0 inches) per mile and 259 RBT (>6.0 inches) per mile. The Miracle Mile is 6.1 miles long, therefore, an estimated population of 20,795 BNT, 4,197 RBT AD and 1,580 RBT resides in the Miracle Mile. These numbers reiterate the extent of catch and release in the Miracle Mile. Using the annual catch estimates and the 1996 population estimate, on average each BNT was caught and released 1.2 times, each RBT 6.5 times and each RBT AD 8.3 times. However, these calculations do not reflect emigration into the Miracle Mile from Pathfinder Reservoir.

Changes from past creel surveys

Angler days and numbers of trout caught is the highest ever recorded on the Miracle Mile (Table M18). Average length for RBT (for creel data) is at an all time high (16.8 inches) while BNT average length (15.8 inches) and total pressure (113,871 hours fished) is the second highest ever recorded. Catch rates for gamefish are two times greater than the highest recorded in past surveys. Past surveys reported significant catch of nongame fish (white and longnose suckers and carp) which were not observed in this creel. A few carp were the only nongame fish creeled in 1995-6. The expansion of piscivorous birds, double-crested cormorants and white pelicans, and the establishment of walleye in Pathfinder Reservoir may explain the decrease in nongame catch.

Table M18. Comparison to past creel surveys in the Miracle Mile.

	1961	1973*	1976	1978	1982	1995-6
Total Hours Fished	69,644	111,279	119,679	59,160	51,058	113,871
Angler Days	13,190	21,713	23,375	14,443	16,386	28,596
Catch Rate (game fish)				0.24	0.26	0.62
Number Caught						
All Trout	16,296	46,383	38,081	9,739	13,187	70,104
Walleye		918		119	171	34
RBT		37,211		7,715	7,104	45,303
BNT		8,634		1,482	4,395	24,519
Avg. Trip Length (hrs.)		5.12		4.10	3.12	3.94
Avg. Length RBT	15.1	14.1	13.9	13.3	14.7	16.8
Avg. Length BNT				14.9	15.9	15.8
Residency						
Wyoming		20%		17%	36%	26%
Other States		80%		83%	64%	74%

* 8 month creel survey

Management Objectives

1. Maintain the Class 1 status of the Miracle Mile.

2. Maintain existing catch rates between 0.60 and 0.65 fish/hour.

3. Preserve the opportunity for anglers to catch large trout by maintaining a standing stock of at least 1,500 trout/mile, of which 20% (300) should exceed 16 inches.

4. Status of the trout population should be monitored at least once every five years.

Recommendations

1. Continue to stock ELR in the Miracle Mile as fingerlings. This stock requires minimal hatchery resources (compared to catchable stocks) and is justified by exceptional returns (15+ pounds caught/pound stocked).

2. Recognize that trout stocked into Pathfinder Reservoir but returning in the Miracle Mile are integral to the management strategy for the Miracle Mile and must be considered in decision making for Pathfinder Reservoir.

3. Spot creel checks and biological sampling will again intensify in 1998. Fish stocked in the Miracle Mile will continue to be fin-clipped to determine hatchery contribution to the population and catch.

4. Identify limiting factors to RBT natural recruitment. RBT recruitment may be limited by spawning area, BNT/WAE predation, fishermen impacts or flow fluctuations. Preliminary investigations should locate spawning redds to determine amount of suitable spawning habitat. Establish permanent electrofishing station(s) on the river margins to monitor potential RBT recruitment, overwinter survival of wild RBT and BNT predation on RBT. If wild RBT recruitment improves, stocking could be reduced or eliminated.

5. Monitor BNT and RBT population trends to evaluate possible regulation change(s) to increase and/or maintain numbers of RBT.

Stocking Recommendations- Miracle Mile

	Historical Requests			Future Requests		
	Number	Pounds	No./lb.	Number[2]	Pounds[2]	No./lb.
RBT[1]	100,000	2,500	40	50,000-100,000	1,250-2,500	40

[1] - These were either ELR or RRB, depending on current information.

[2] - Will be ELR until a RRB can be evaluated. Currently, a study to determine the optimum stocking rate is ongoing at the Miracle Mile. The result will either be to continue stocking 100,000 or reduce to 50,000. Results from this evaluation will be available in 2002.

Upper River
(I-80 to Seminoe Reservoir)

INTRODUCTION

The North Platte River from Interstate 80 (I-80) to Seminoe Reservoir, referred to in this report as the Upper River, is the only unregulated portion of the river in the Casper Region (Figure U1). As a result, flows are dependent on natural precipitation levels and subject to wide fluctuations. Bank access is poor, with only three public bank access areas over 25 river miles. The entire reach is floatable with the exception of a flow measurement weir where portaging is required.

History of the Upper River

A programmed creel survey has never been conducted on this river stretch. In 1987, a multiple-pass population estimate was completed near the current Dugway electrofishing station. RBT was the most common species in the population followed by SRC and BNT (Yundt and Annear 1987) (Table U1). In August 1996, a three-pass population estimate was completed at the Dugway electrofishing station (Table U1). BNT was the most commonly captured species followed by RBT and SRC. The BNT sample was dominated by unmarked (wild) fish (93%). The majority of RBT (62%) and SRC (99%) sampled were stocked fish, indicating limited natural reproduction.

Table U1. Population estimates, mean length, weight and condition factor (C) for trout >6 inches at the Dugway electrofishing station, 1987 and 1996.

Year	Species	Number/ Mile	Number/ Acre	Pounds/ Mile	Pounds/ Acre	Mean L (in.)	Mean Wt. (lbs.)
1987	RBT	609	1.0	198	0.3	9.8	0.37
	BNT	50	0.1	33	0.1	12.3	0.75
	SRC	226	0.4	95	0.2	10.4	0.45
1996	RBT	148	0.2	146	0.2	13.5	1.03
	BNT	165	0.3	93	0.2	11.0	0.71
	SRC	51	0.1	26	<0.1	10.6	0.51

In 1989 and 1990, roughly 10,000 Bear River cutthroat trout were stocked annually. Very few Bear River cutthroat trout were recovered during subsequent sampling and as a result were no longer stocked. Snake River cutthroat trout replaced Bear River cutthroat in the stocking program in this reach in 1991.

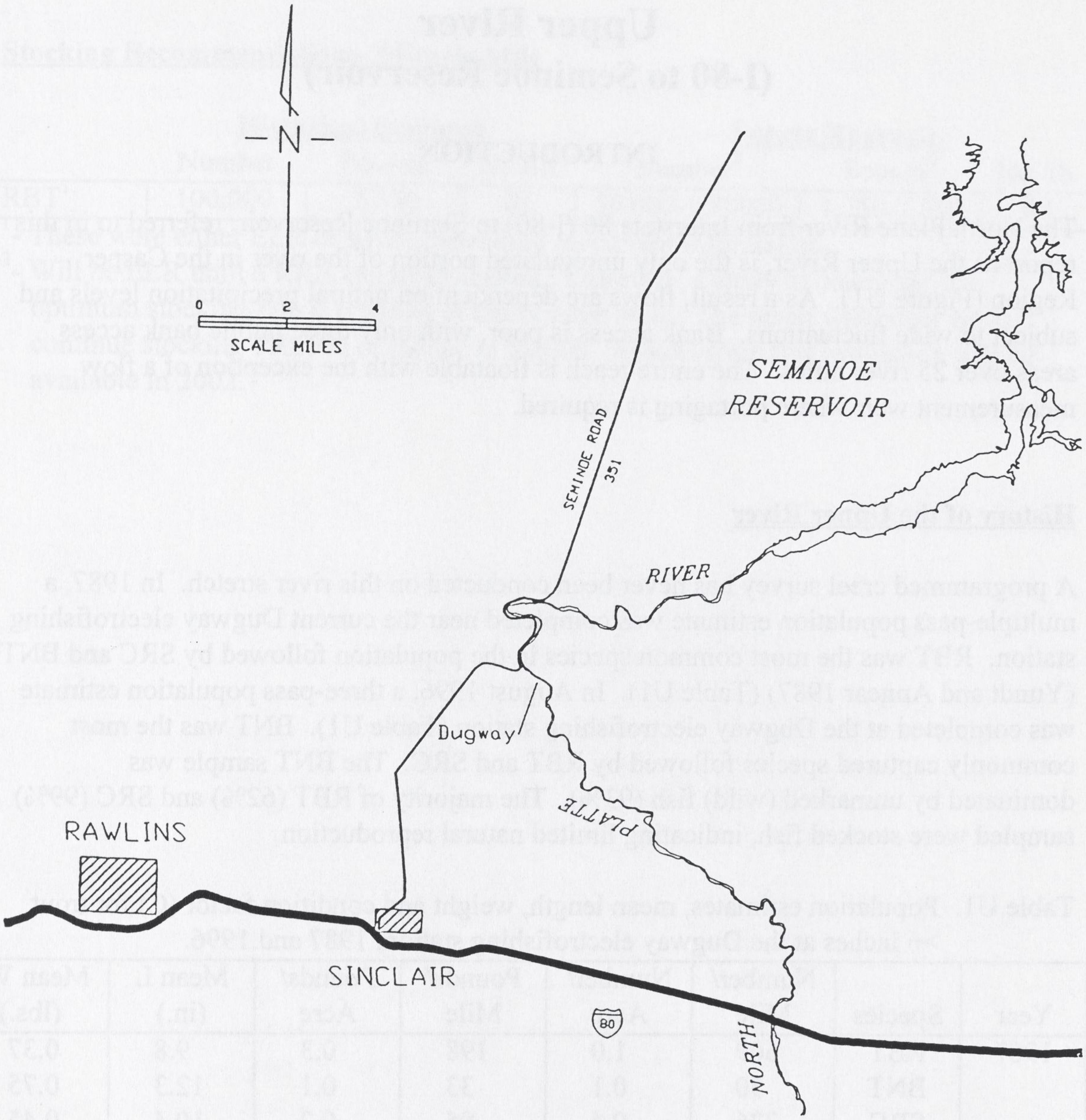


Figure U1. North Platte River, I-80 to Seminoe Reservoir (Upper River)

Upper River Stocking

Upper River stocking requests were generally held constant in the years preceding the creel survey (Table U2). Between 1992 and 1995 the Upper River was stocked annually with 13,575 ELR, 15,750 SRC and 9,650 BNT.

Between 1992 and 1995, an average of 39,000 advanced fingerling and sub-catchable trout, or 2,800 pounds, was stocked annually. Assuming the Upper River is 25 miles long and has a surface area of 621 acres, this stocked number equals 1,560 fish per river mile or approximately 62.8 fish per acre per year.

Table U2. Number of trout stocked into the Upper River prior to and during the 15 month programmed creel survey.

Species/ Strain	Stock Date	Pounds Stocked	Number/ Pound	Number Stocked	Tag Retention	Number Stocked w/ Tags
ELR	92/05/28	1,610	8.5	13,700	98.0	13,400
	93/07/15	450	44.0	19,800	71.1	14,100
	94/06/14	263	39.0	10,300	98.8	10,100
	95/07/10	2,100	5.0	10,500	100	10,500
Sub-Total		4,423		54,300	88.6	48,100
BNT	92/05/20	1,480	5.6	8,300	85.4	7,100
	93/07/15	1,450	6.0	8,700	89.9	7,800
	94/06/14	253	46.0	11,600	95.0	11,100
	95/07/10	520	20.0	10,400	97.5	10,100
Sub-Total		3,703		38,600	93.5	36,100
SRC	92/06/10	487	40.0	19,500	95.0	18,500
	93/07/15	320	25.0	8,000	80.5	6,400
	94/06/14	583	23.3	13,600	97.7	13,400
	95/07/10	1,680	13.0	21,900	93.5	21,000
Sub-Total		3,070		63,000	94.1	59,300
Grand Total		11,196		155,900	92.0	143,500

The Laramie Region manages the North Platte upstream of Interstate 80 to the Colorado border as a wild fishery. No fish have been stocked in this portion of the river since 1989-91 when approximately 12,000 advanced fingerling BNT were stocked annually.

METHODS

General creel methods are outlined in General Methods. All methods outlined in the General Methods are applicable to the Upper River.

Biological (electrofishing) data collected during the creel survey were used to establish length-weight relationships specific to the Lower River. The equations for ELR, SRC and BNT are:

ELR- weight = exp((3.30477766*length) - 8.762314714) ($R^2 = 0.99$).
SRC- weight = exp((3.086798505*length) - 8.095110112) ($R^2 = 0.60$).
BNT- weight = exp((2.171439334*length) - 5.995645347) ($R^2 = 0.52$).

These equations were applied to the respective strain group/species measured by a creel clerk. The average weight by strain was multiplied by the annual estimates of harvest and catch to estimate total pounds harvested and caught.

RESULTS

Angler Information

Creel clerks interviewed a total of 64 anglers on the Upper River. Of these, 55 (86%) were residents and 9 (14%) were nonresidents. Anglers were asked what terminal tackle they were using when contacted (Table U3). The majority of anglers used bait (60.9%), followed by flies (15.6%) then lures (12.5%).

Table U3. Terminal tackle employed by Upper River anglers.

	Bank		Boat		All	
Terminal Tackle	Number	%	Number	%	Number	%
Bait	39	63.9	0	0	39	60.9
Flies	8	13.1	2	66.7	10	15.6
Lures	7	11.5	1	33.3	8	12.5
Bait and Lures	6	9.9	0	0	6	9.4
Flies and Lures	1	1.6	0	0	1	1.6
Bait and Flies	0	0	0	0	0	0
Bait, Flies and Lures	0	0	0	0	0	0

Of the 91% of anglers who stated a preference, 75% were targeting any trout and 25% were targeting specifically RBT. No anglers contacted targeted walleye.

Nearly all anglers used only one pole (Table U4). Boat anglers were more release-oriented than bank anglers. More fish per angler were harvested by bank anglers (0.97) than boat anglers (0.67).

Table U4. Angler characteristics on the Upper River (completed trips only).

Angler Type	Number of Interviews	No. of Poles (%)	Harvest and Release	Fish Harvested per Angler
Bank	39	1 - 95% 2 - 5% Avg.=1.05	70%- Harvested 30%- Released	0.97
Boat	3	1 - 100% 2 - 0% Avg.=1.00	25%- Harvested 75%- Released	0.67

Nearly half of all anglers caught at least one RBT and 5% caught 6 or more (Table U5). Anglers rarely harvested more than 3 fish and no angler contacted harvested a limit of 6 trout. When all game fish are combined, over half of all anglers caught at least one fish and over 7% caught 6 or more.

Table U5. Percentage of anglers who harvested/caught 0 fish, at least 1 fish, at least 2 fish, etc. in the Upper River (completed trips only) (ALL = all game fish).

		Number of Fish						
		0	≥1	≥2	≥3	≥4	≥5	≥6
RBT	Harvest	67%	33%	14%	7%	0%	0%	0%
	Catch	57%	43%	19%	12%	5%	5%	5%
ALL	Harvest	55%	45%	26%	14%	7%	2%	0%
	Catch	45%	55%	31%	19%	12%	7%	7%

Pressure

From April 1995 through June 1996, we estimated 3,832 anglers (Table U6) fished 10,176 hours (Table U7). The average annual estimate was 3,223 anglers and 8,273 hours. This yields an annual estimate of 5.2 anglers/acre. There were significantly ($p = 0.01$) more bank anglers than boat anglers.

Table U6. Upper River- estimated numbers of anglers.

	Bank	/acre	Boat	/acre	All	/acre
April	400	0.6	16	0.0	416	0.7
May	256	0.4	7	0.0	263	0.4
June	48	0.1	3	0.0	51	0.1
July	218	0.4	114	0.2	332	0.5
August	625	1.0	64	0.1	689	1.1
September	355	0.6	43	0.1	399	0.6
October	269	0.4	11	0.0	280	0.5
November	176	0.3	0	0.0	176	0.3
December	0	0.0	0	0.0	0	0.0
January	0	0.0	0	0.0	0	0.0
February	0	0.0	0	0.0	0	0.0
March	738	1.2	0	0.0	738	1.2
April	103	0.2	10	0.0	113	0.2
May	96	0.2	0	0.0	96	0.2
June	78	0.1	202	0.3	280	0.5
15 Month Total	3,361	5.4	471	0.8	3,832	6.2
Average 12 Months	2,871	4.6	352	0.6	3,223	5.2

Annual estimates for hours fished were 5,847 (bank) and 2,426 (boat) (Table U7). The Upper River supports an estimated 8,273 angling hours or 13.3 angling hours/acre, annually. Bank anglers fished significantly ($p < 0.01$) more hours than boat anglers.

Table U7. Upper River- estimated pressure (angler hours) Bank, Boat and total hours.

Month	Bank	/acre	Boat	/acre	Total Hours	/acre
April	1,043	1.7	140	0.2	1,183	1.9
May	634	1.0	65	0.1	700	1.1
June	133	0.2	31	0.1	165	0.3
July	709	1.1	1,029	1.7	1,738	2.8
August	1,115	1.8	580	0.9	1,694	2.7
September	891	1.4	391	0.6	1,281	2.1
October	646	1.0	96	0.2	743	1.2
November	176	0.3	0	0.0	176	0.3
December	0	0.0	0	0.0	0	0.0
January	0	0.0	0	0.0	0	0.0
February	0	0.0	0	0.0	0	0.0
March	738	1.2	0	0.0	738	1.2
April	504	0.8	20	0.0	523	0.8
May	450	0.7	0	0.0	450	0.7
June	381	0.6	404	0.7	785	1.3
15 Months	7,419	11.9	2,756	4.4	10,176	16.4
12 Month Average	5,847	9.4	2,426	3.9	8,273	13.3

Although weekdays received more pressure, there was no statistical difference between the total hours fished during weekdays versus weekend days ($p = 0.58$) (Table U8).

Table U8. Pressure (hours fished) during weekdays (WD) and weekend days (WE) in the Upper River.

	WD	WE
15 Month Total	5,468	4,707
12 Month Average	4,503	3,769

An annual estimate of trip length for all anglers was 2.57 hours. Trip length for boat anglers was longer (6.89 hrs) than trip length for bank anglers (2.04 hrs). This difference may be due to boating access locations that are separated by several river miles.

Catch Rates

Combining both bank and boat anglers yields an annual catch rate of 0.22 fish/hour (Table U9). Bank anglers had a higher catch rate (0.30) than boat anglers (0.02). Bank catch rates peaked in May (1.63) and were lowest in the winter months. The only successful boat anglers were contacted in October.

Table U9. Catch rates (fish per hour, all species combined) for Bank, Boat and All anglers in the Upper River.

	Bank	Boat	All
April	0.18	0.00	0.14
May	1.63	0.00	1.56
June	0.00	0.00	0.00
July	0.31	0.00	0.09
August	0.50	0.00	0.32
September	0.28	0.00	0.19
October	0.53	0.44	0.51
November	0.00	0.00	0.00
December	0.00	0.00	0.00
January	0.00	0.00	0.00
February	0.00	0.00	0.00
March	0.00	0.00	0.00
April	0.00	0.00	0.00
May	0.03	0.00	0.03
June	0.00	0.00	0.00
15 Month Total	0.30	0.02	0.23
Average 12 Months	0.30	0.02	0.22

Catch and Harvest

The estimated annual total catch was 1,784 fish (Table U10). Bank anglers caught 1,726 fish (97% of the total) while boat anglers caught 58 fish (3%). An estimated 1,427 rainbow trout were caught, of which 1,376 (96%) were RBT AD and 51 (4%) were wild rainbow (RBT). SRC AD were the second most commonly caught species (296) followed by BNT AD (61). Stocked trout made up 97% of the total catch.

Table U10. Annual total catch by species in the Upper River.

Species	Bank	%	Boat	%	Total Catch	%
RBT AD	1,376	79.7	0	0.0	1,376	77.1
RBT	0	0.0	51	87.9	51	2.9
BNT AD	61	3.5	0	0.0	61	3.4
SRC AD	289	16.7	7	12.1	296	16.6
Total Catch	1,726	96.7	58	3.3	1,784	100

Total estimated harvest was 1,406 or 79% of the total catch (Table U11). Bank anglers were much more harvest-oriented (80.6%) than boat anglers (24.1%). Brown trout were harvested at the highest rate.

Table U11. Annual harvest, release, total catch and catch/acre Bank, Boat and All anglers for the Upper River.

Species	Area	Harvested	%	Released	%	Total Catch	Catch/Acre
RBT AD	Bank	1,143	83.1	233	16.9	1,376	2.2
	Boat	0	0.0	0	0.0	0	0.0
	All Anglers	1,143	83.1	233	16.9	1,376	2.2
RBT	Bank	0	0.0	0	0.0	0	0.0
	Boat	7	13.7	44	86.3	51	0.1
	All Anglers	7	13.7	44	86.3	51	0.1
SRC AD	Bank	188	65.1	101	34.9	289	0.5
	Boat	7	100.0	0	0.0	7	0.0
	All Anglers	195	65.9	101	34.1	296	0.5
BNT AD	Bank	61	100.0	0	0.0	61	0.1
	Boat	0	0.0	0	0.0	0	0.0
	All Anglers	61	100.0	0	0.0	61	0.1
Annual Totals							
	Bank	1,392	80.6	334	19.4	1,726	2.8
	Boat	14	24.1	44	75.9	58	0.1
	All Anglers	1,406	78.8	378	21.2	1,784	2.9

Seasonal Catch by Species

By species, rainbow trout make up 77% of the total catch (Table U12). RBT catch was highest in the spring and summer and lowest in the winter months. RBT were caught 7 of the 15 months of the survey. SRC were the second most commonly caught species. Brown trout were only caught in the fall.

Table U12. Catch by species by month for bank and boat anglers in the Upper River.

Month	BANK RBT	BANK SRC	BANK BNT	BOAT RBT	BOAT SRC	BOAT BNT
April	123	22	0	0	0	0
May	684	199	0	0	0	0
June	0	0	0	0	0	0
July	211	0	0	0	0	0
August	350	0	0	0	0	0
September	261	28	28	0	0	0
October	149	149	33	51	7	0
November	0	0	0	0	0	0
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	4	4	0	0	0	0
June	0	0	0	0	0	0
15 Mon. Tot.	1,781	402	61	51	7	0
Avg. 12 Mon.	1,376	289	61	51	7	0

Stocked Trout Strain Analysis

RBT, SRC and BNT are stocked into the Upper River. Rainbows stocked as catchables into Seminoe Reservoir were harvested in the Upper River. Natural reproduction appears to be limited in the Upper River.

For stocked trout strain analysis, fish caught in the Upper River were grouped into six categories. Fish stocked in the Upper River are split into three categories: I-80 ELR, I-80 SRC and I-80 BNT. Seminoe Reservoir stocked fish were grouped into SEM ELR 92-95, SEM FRB 92-95 and SEM KRB 92-95. No fish from waters other than the Upper River or Seminoe Reservoir were harvested in the Upper River.

SEM FRB had the highest catch/hour (0.11) followed by I-80 ELR (0.08), I-80 SRC (0.05) and SEM ELR (0.05) (Table U13).

Table U13. Strain catch rates per hour and per acre for Bank, Boat and All anglers in the Upper River (annually).

	Catch Rate/Hour			Catch/Acre		
	Bank	Boat	Total	Bank	Boat	All
I-80 ELR	0.08	0.00	0.05	0.72	0.00	0.72
I-80 SRC	0.05	<0.01	0.04	0.47	0.01	0.48
I-80 BNT	0.01	0.00	0.01	0.10	0.00	0.10
SEM ELR 92-95	0.05	0.00	0.03	0.45	0.00	0.45
SEM FRB 92-95	0.11	0.00	0.08	1.01	0.00	1.01
SEM KRB 92-95	<0.01	0.00	<0.01	0.04	0.00	0.04
Total	0.30	<0.01	0.21	2.78	0.01	2.79

Strain Summaries

I-80 ELR

- 25.8% of total annual stocked trout catch
- Catch rate of 0.05/hr
- Average size of harvested fish- 10.2 in., 0.36 lbs. (N = 15)
- 81% of the catch of this group were 1995 stocks

I-80 SRC

- 17.1% of total annual stocked trout catch
- Catch rate of 0.04/hr
- Average size of harvested fish- 9.6 in., 0.34 lbs. (N = 6)
- 83% of the catch of this group were 1995 stocks

I-80 BNT

- 3.5% of total stocked trout catch
- Catch rate of 0.01/hr
- Average size of harvested fish- 9.8 in., 0.37 lbs. (N = 2)
- 50% were of the catch of this group 1995 stocks

SEM ELR 92-95

- 16.0% of total stocked trout catch
- Catch rate of 0.03/hr
- Average size of harvested fish- 16.1 in., 1.56 lbs. (N = 3)

SEM FRB 92-95

- 36.1% of total stocked trout catch
- Catch rate of 0.08/hr
- Average size of harvested fish- 16.6 in., 1.89 lbs. (N = 4)

SEM KRB 92-95

- 1.5% of total stocked trout catch
- Catch rate of <0.01/hr
- Average size of harvested fish- 15.5 in., 1.33 lbs. (N = 1)

Overall, more Seminoe Reservoir stocked fish (930; 54%) were estimated caught than fish stocked in the Upper River (804; 46%) (Table U14). In addition, Seminoe Reservoir stocked fish were far larger (averaged 16.3 inches) than Upper River stocked fish (averaged 10.0 inches).

Table U14. Strain catch stratified by Bank and Boat by month, April 1995 - June 1996, in the Upper River.

TOTAL CATCH

BANK GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
I-80 ELR	123	0	0	0	0	235	148	0	0	0	0	0	0	4	0	510	447
I-80 SRC	22	199	0	0	0	28	149	0	0	0	0	0	0	4	0	402	289
I-80 BNT	0	0	0	0	0	28	33	0	0	0	0	0	0	0	0	61	61
SEM ELR 92-95	0	342	0	105	0	0	0	0	0	0	0	0	0	0	0	447	277
SEM FRB 92-95	0	343	0	105	350	0	0	0	0	0	0	0	0	0	0	798	627
SEM KRB 92-95	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	26	26
TOTAL	145	884	0	210	350	317	330	0	0	0	0	0	0	8	0	2,244	1,727

BOAT GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
I-80 ELR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I-80 SRC	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	7	7
I-80 BNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEM ELR 92-95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEM FRB 92-95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SEM KRB 92-95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	7	7

UPPER RIVER GROUP	MONTH 4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL	Annual Avg.
I-80 ELR	123	0	0	0	0	235	148	0	0	0	0	0	0	4	0	510	447
I-80 SRC	22	199	0	0	0	28	156	0	0	0	0	0	0	4	0	409	296
I-80 BNT	0	0	0	0	0	28	33	0	0	0	0	0	0	0	0	61	61
SEM ELR 92-95	0	342	0	105	0	0	0	0	0	0	0	0	0	0	0	447	277
SEM FRB 92-95	0	343	0	105	350	0	0	0	0	0	0	0	0	0	0	798	627
SEM KRB 92-95	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	26	26
TOTAL	145	884	0	210	350	317	337	0	0	0	0	0	0	8	0	2,251	1,734

DISCUSSION

The majority of Upper River anglers were residents (86%) fishing mostly with bait (61%) followed by flies (16%) and lures (13%). The Upper River is a consumptive fishery, with a harvest rate of nearly 80% of the total catch. Bank anglers far outnumbered boat anglers (89% bank, 11% boat). Bank anglers were more successful (0.30 fish/hour) than boat anglers (0.02 fish/hour). Rainbow trout (RBT AD + RBT) made up 80% of the total catch followed by SRC AD at 16.6%. BNT AD made up the remaining 3.4% of the total catch. Stocked trout made up 97% of the total catch. Catch rate for all anglers and all species was 0.22/hour.

All of the larger fish (>14 inches) caught were fish originally stocked in Seminoe Reservoir. Upper River stocked fish do not appear to survive in large numbers to a large size.

Criteria

For a strain to be considered successful, it must meet at least one of the four criteria defined in the General Introduction (50% caught or harvested by number or 1 pound caught or harvested for each pound stocked). No strain/species met any criteria (Table U15). I-80 ELR returned best of the Upper River stocked fish followed by I-80 SRC and I-80 BNT.

Table U15. Criteria for stocked rainbow trout (average 12 months) for harvest and total catch in the Upper River (* indicates criteria met).

HARVEST	No. Stocked[1]	lbs. Stocked[1]	No. Harvested	lbs. Harvested	No. returned/ No. stocked	lbs. returned/ lbs. stocked
I-80 ELR	13,575	1,106	221	80	0.02	0.07
I-80 SRC	15,750	768	195	66	0.01	0.09
I-80 BNT	9,750	926	61	23	0.01	0.02

TOTAL CATCH	No. Stocked[1]	lbs. Stocked[1]	No. Caught	lbs. Caught	No. returned/ No. stocked	lbs. returned/ lbs. stocked
I-80 ELR	13,575	1,106	447	161	0.03	0.15
I-80 SRC	15,750	768	296	101	0.02	0.13
I-80 BNT	9,750	926	61	23	0.01	0.02

[1]- Numbers and pounds stocked represent an annual average over four years (1992-1995).

Constraints on data interpretation

Several factors are unique to the Upper River that influence data interpretation and suggest caution. The main factor is low sample size. In addition, river flows were exceptionally high during the creel survey, possibly discouraging anglers from fishing the Upper River. County Road 351, from the Town of Sinclair to Seminoe Reservoir, was under construction for most of the creel survey. Anglers could expect over one hour delays in the construction zone and may have avoided traveling this main access to the Upper River. Sample sizes were large enough to allow estimates of angler pressure and catch, however, without the high flows and road construction, the Upper River would have received more pressure.

Management Objective

1. Manage as a wild fishery.

Recommendations

1. Discontinue stocking of all trout species in the Upper River.

2. Manage the Upper River as a wild fishery.

Stocking Recommendations- Upper River

	Historical Requests			Future Requests		
	Number	Pounds	No./lb.	Number	Pounds	No./lb.
BNT	10,000	500	20	0	0	-
ELR	17,500	875	20	0	0	-
SRC	17,500	875	20	0	0	-
TOTAL	45,000	2,250		0	0	

GENERAL DISCUSSION

The Upper North Platte System (UNPS) creel survey represents the largest fisheries use survey ever conducted by the Wyoming Game and Fish Department. In the four years preceding the creel survey over 2.7 million trout were stocked with coded-wire tags to later identify strain, size, location of stocking, and date of release. From the programmed creel survey, annual estimates of angler numbers, hours fished, and catch and harvest of gamefish were derived for Seminoe, Pathfinder, and Alcova reservoirs. These same parameters were estimated for the flowing water sections of the North Platte River from Interstate 80 to Seminoe Reservoir (Upper River), the Miracle Mile, and Gray Reef Dam to the City of Casper (Lower River). Creel clerks conducted 13,328 angler interviews. During these interviews, 10,338 gamefish were measured of which 8,716 were stocked trout.

In this report, creel survey information and coded-wire tag returns were synthesized to evaluate the success of the trout stocking program. Recommendations were made to improve angling opportunity and optimize use of hatchery fish. Trout will continue to be stocked in the reservoirs and further evaluations of the river stocking programs are ongoing. A majority (60%) of UNPS reservoir anglers stated they were fishing solely for trout and 13% were fishing for a combination of trout and walleye. Only 13% were fishing solely for walleye and 14% of anglers stated they had no species preference. Similar results in favor of trout angling have been documented by an angler questionnaire (WGFD, 1991 Progress Report) and at Fish Allocation Meetings.

This General Discussion includes: 1) a comparison of angler use and gamefish catch across the UNPS reservoirs and river sections; 2) contribution of stocked trout to each fishery; 3) trends documented in the performance of various rainbow strains; 4) an analysis of the relative returns of trout stocked in the UNPS reservoirs in spring versus fall; 5) an overview of the proposed stocking changes which resulted from this work with emphasis on possible Fish Culture Section benefits; 6) the model used to determine numbers of stocked trout required to meet catch rate management goals; 7) an alternative trout stocking evaluation criteria is introduced and finally, 8) a discussion of the progress on each of the objectives of the North Platte Comprehensive Fisheries Study.

Comparisons between waters

Since the creel survey was completed on all waters at the same time, direct comparison between waters is possible. Reservoirs were compared to reservoirs and rivers to rivers.

Reservoirs

Alcova Reservoir is the smallest of the three main reservoirs in the system and receives nearly 10 times more pressure (anglers and hours) per acre than the other reservoirs (Table D1). This is likely due to its proximity to the City of Casper and facilities available at the reservoir. Stocked rainbow trout harvested in Alcova Reservoir are the smallest in the system. Fish over 2 years old were rare in Alcova Reservoir, indicating they are quickly harvested.

Pathfinder Reservoir had the largest average size of stocked rainbow trout harvested in the reservoirs. Catch rates and numbers of fish harvested were the lowest of the three reservoirs. Fish up to 3 years old comprised a large proportion of the total catch.

Seminoe Reservoir had the fewest anglers and hours fished but the highest catch rates and numbers of fish caught and harvested. Average size of RBT AD was not as large as Pathfinder Reservoir but was larger than Alcova Reservoir.

The largest average walleye were harvested in Alcova Reservoir. Walleye were slightly smaller in both Pathfinder and Seminoe reservoirs. Only in Seminoe Reservoir did walleye make up a significant proportion of the total catch.

Table D1. Comparisons between reservoirs (annual estimates).

	Alcova	Pathfinder	Seminoe
Number of anglers	49,539	37,216	33,246
Hours fished	162,575	159,023	136,079
Fish caught	77,853	50,762	87,067
Stocked Trout	72,215 (93%)	40,415 (80%)	58,991 (68%)
Wild Trout	4,542 (6%)	5,073 (10%)	5,251 (6%)
Walleye	1,096 (1%)	5,274 (10%)	22,825 (26%)
Fish harvested	55,211	34,732	69,215
Stocked Trout	51,369 (93%)	27,070 (78%)	43,382 (63%)
Wild Trout	2,834 (5%)	3,616 (10%)	3,605 (5%)
Walleye	1,008 (2%)	4,046 (12%)	22,228 (32%)
Catch/hour (all fish)	0.48	0.32	0.64
Stocked Trout	0.44	0.25	0.43
Wild Trout	0.02	0.03	0.04
Walleye	0.01	0.03	0.17
Avg. Size (inches)[1]			
RBT AD	13.0	15.8	15.1
WAE	16.7	14.7	14.7
Anglers/Acre	21.2	2.6	2.5
Hours/Acre	69.5	11.2	10.1
Catch/Acre	33.3	3.6	6.5
Species sought			
TRT[2]	86.5%	62.2%	49.6%
TAW[2]	7.5%	20.5%	31.0%
WAE[2]	6.0%	17.3%	19.4%

[1]- Average size is for harvested fish

[2]- TRT = any trout, TAW = trout and walleye, and WAE = walleye.

River Sections

The Miracle Mile is clearly the most important river section in terms of pressure and catch (Table D2). Four times more fish were caught in the Miracle Mile than the Lower and Upper River sections combined. The average size of RBT AD harvested was 16.8 inches, the largest in the whole UNPS. Miracle Mile anglers practiced extensive catch and release, with 89% of the fish caught subsequently released.

By acre, the Lower River receives <10% the pressure of the Miracle Mile. Like the Miracle Mile, Lower River anglers practiced catch and release, with 83% of the fish caught released. Harvested fish were large, with an average length of 16.0 inches for RBT AD.

Only 3,223 anglers fished the Upper River annually, which is far less angling pressure than on the Miracle Mile and the Lower River. In addition to low pressure, the size at which stocked rainbow trout are harvested is the smallest (11.6 inches) of the UNPS.

Table D2. Comparison between river sections (annual estimates).

	Lower River	Miracle Mile	Upper River
Number of anglers	16,993	28,953	3,223
Hours fished	39,294	113,871	8,273
Fish caught	14,396	70,138	1,784
Stocked Trout	5,256 (37%)	35,197 (50%)	1,733 (97%)
Wild Trout	9,089 (63%)	34,907 (50%)	51 (3%)
Walleye	0 (0%)	34 (<1%)	0 (0%)
Fish harvested	2,507	8,065	1,406
Stocked Trout	1,033 (41%)	4,881 (61%)	1,399 (99%)
Wild Trout	1,474 (59%)	3,150 (39%)	7 (1%)
Walleye	0 (0%)	34 (<1%)	0 (0%)
Catch/hour	0.35	0.62	0.22
Stocked Trout	0.13	0.31	0.21
Wild Trout	0.22	0.31	0.01
Avg. Size (inches)[1]			
RBT AD	16.0	16.8	11.6
Anglers/Acre	15.5	174.0	5.2
Hours/Acre	35.9	686.0	13.3
Catch/Acre	46.1	421.5	2.9

[1]- Average size is for harvested fish

Contribution of stocked trout

The percentage of the total catch supported by stocked trout varied by water (Figure D1). Of the reservoirs, the Alcova catch was most dependent on stocked trout (93%). Stocked trout in Pathfinder and Seminoe reservoirs also makes up a large proportion of the total catch. The total stocked trout catch in the reservoirs is 172,219 trout of the 215,682 (80%) gamefish annually caught.

Generally, stocked trout are not as important to the river fisheries as they are to the reservoir fisheries. Both the Miracle Mile and Lower River have substantial wild trout fisheries. Even with a wild fishery, 50% of the total catch in the Miracle Mile and 37% in the Lower River was provided by hatchery trout. Stocked trout made up 97% of the total catch in the Upper River. The majority of the stocked trout caught in the Upper River and the Miracle Mile were originally stocked in downstream reservoirs.

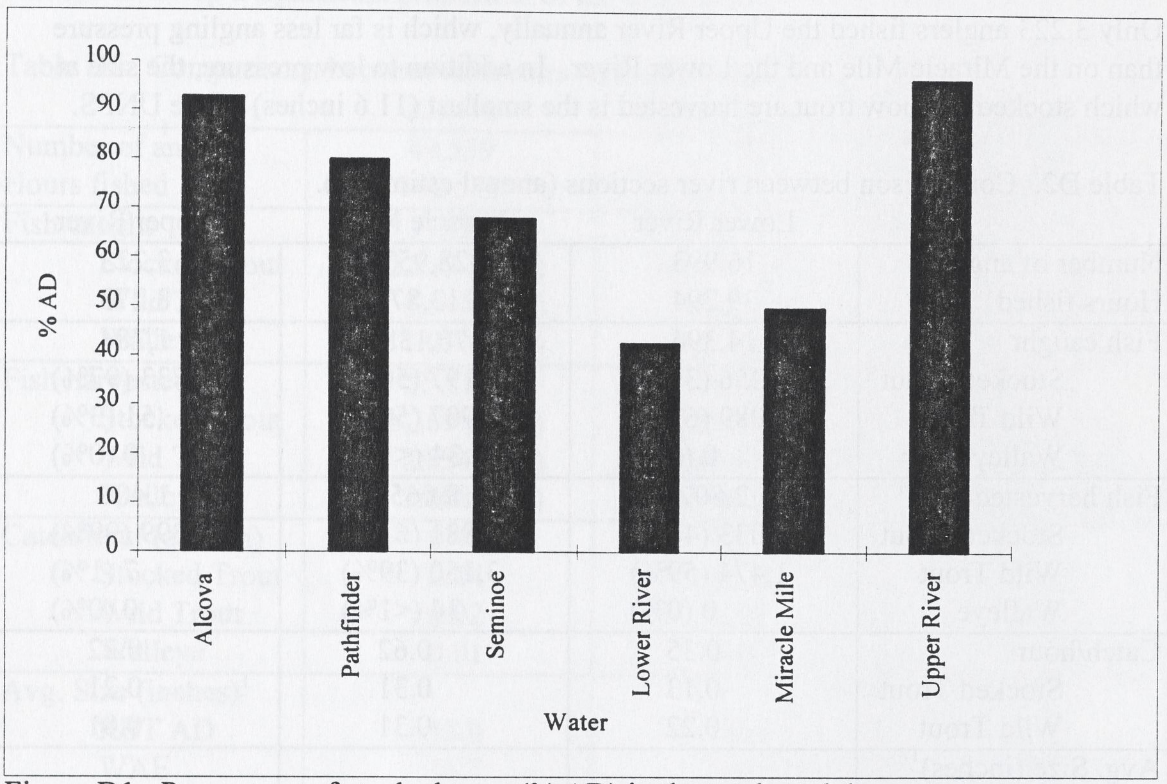


Figure D1. Percentage of stocked trout (% AD) in the total catch by water.

Strain Trends

FRB

FRB was the best performing strain. Generally, FRB returned best in reservoirs. This strain readily moved out of reservoirs into river sections. FRB consistently returned well to both bank and boat anglers, indicating this strain utilizes all available habitat. Largest returns were observed 1-3 years following stocking. FRB returned at the smallest size of the three strains.

ELR

ELR was the best strain for river environments, performing best in all river sections. In fact, more ELR stocked in Pathfinder Reservoir were caught in the Miracle Mile than in the reservoir. Largest returns were seen 2-4 years following stocking as catchables. In reservoirs, ELR were found to be available to both bank and boat anglers.

KRB

KRB performed well in reservoirs where the majority of pressure was from boat anglers. Bank anglers had very low KRB catch rates, indicating a pelagic nature. KRB performed very poorly in river sections. When given the chance to enter a river system (e.g., Miracle Mile from Pathfinder Reservoir), very few KRB moved into the river. KRB returned quickest of the three strains, usually 1-2 years following stocking as catchables. Interestingly, although KRB returned fastest, this strain typically returned at a large average size. This may indicate that KRB have a growth advantage over other strains.

During the summer of 1997, the KRB brood stock was eliminated due to problems with genetic variability and obtaining sufficient numbers of eggs. KRB were shown to be a mainly pelagic strain most utilized by boat anglers. The fast growth and aggressive nature of this strain also made them desirable. In the near future, a new pelagic strain should be sought for use in large bodies of water with the majority of the pressure from boat anglers.

<u>Fall vs Spring Stocking</u>

Preceding the creel survey, catchable fish were stocked during both the spring and fall. Regardless of strain, fish stocked in the fall returned (pound returned for pound stocked) better than the spring-stocked fish in all reservoirs (Figure D2). In Alcova Reservoir, fall stocked fish returned 2.03 times better than spring stocked fish, 1.53 times better in Pathfinder Reservoir and 2.71 times better in Seminoe Reservoir.

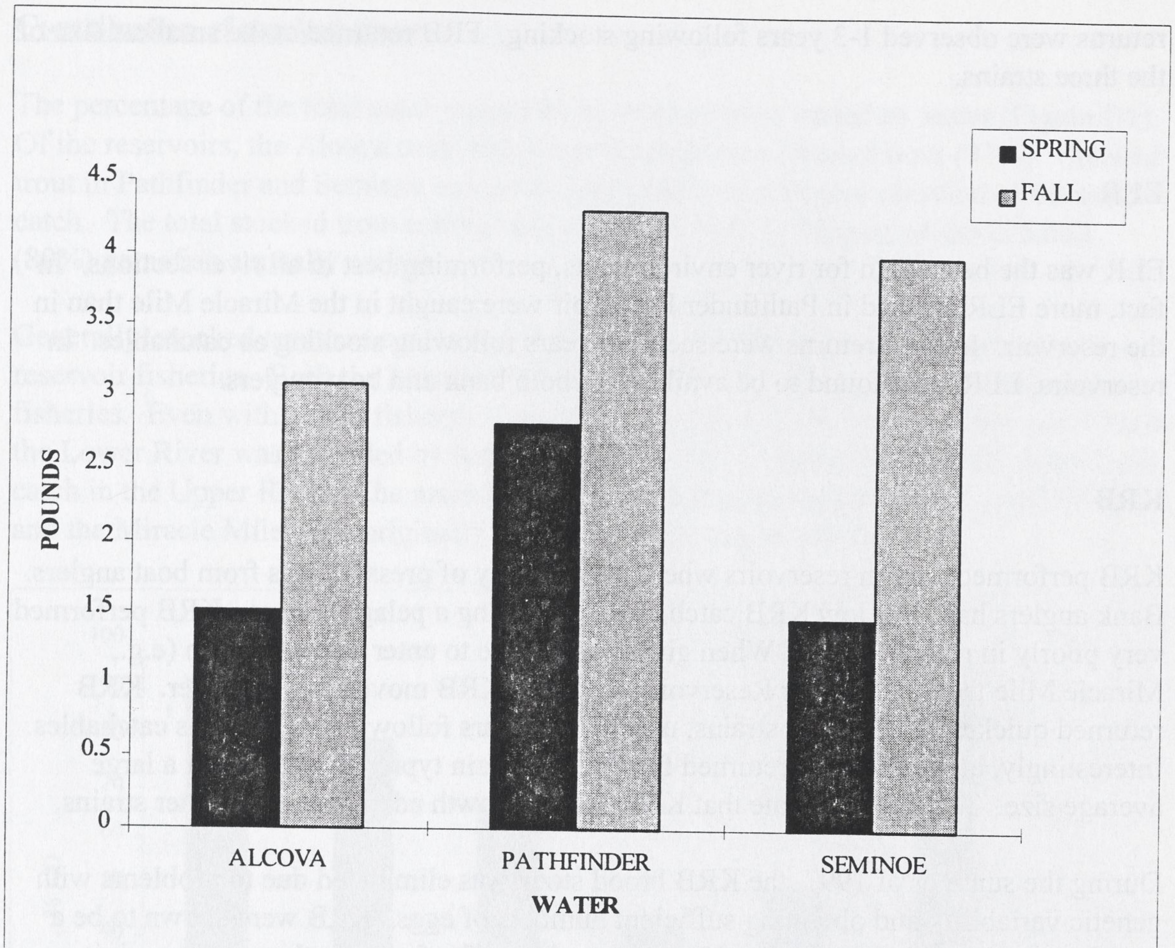


Figure D2. Pound returned for pound stocked for RBT AD, fall versus spring.

Changes to the Trout Stocking Program: Fish Culture Section Considerations

The creel survey and associated coded-wire tag analysis were used to generate a set of management recommendations for each of the six fisheries of UNPS that appear at the end of each chapter. The majority of these recommendations are in the form of modifications to the trout stocking program. Changes to the stocking program fall into three categories: 1) changing the season which trout are stocked to maximize angler return, 2) targeting the most successful strains for stocking by water, and 3) eliminating stocks that have been shown to be less successful. Because stocking requests are made nearly two and one-half years prior to stocking, the majority of changes to the stocking program resulting from the creel results will be incorporated by 1999. Since these requests had to be formulated prior to completion of this creel survey report, some minor discrepancies exist between what was requested for stocking in 1999 and what is recommended for stocking in this report. Recommendations will continue to evolve as more data become available. The purpose of this section is to discuss what changes to the stocking program were incorporated into the 1999 Trout Stocking Requests and how these changes might benefit the Wyoming Game and Fish Department- Fish Culture Section.

Reservoir Stocking

Fall versus Spring Stocking

Creel results overwhelmingly suggest that fall-stocked RBT return better to reservoir anglers than spring-stocked RBT (Figure D2). Accordingly, instead of stocking about 50% of the catchable trout in the spring and the rest in the fall, the 1999 trout stocking requests calls for all reservoirs to be stocked exclusively in the fall. Benefits to the Fish Culture System include:

- The most notable benefit will be a reduction in overall pounds requested from the entire Fish Culture System in the spring by moving to catchable fall stocks. Statewide requests for fish to be stocked in the spring has created a bottleneck resulting in shortages due to space limits in the hatchery system. Shifting requests to the fall should reduce this bottleneck.

- Requesting more fish for stocking in the fall will allow Clark's Fork Fish Hatchery to make better use of available water for fish rearing. In recent years, Clark's Fork has typically highest production demand in the spring when water availability is generally low (7 to 9 cfs is typically available for fish production in spring). When water availability is high (15 to 18 cfs of water is typically available in the fall), rearing space has historically been underutilized owing to few fall stocking requests (Lee McDonald, Superintendent, personal communication).

Strains

Changes in the composition of strains requested for stocking in the fall should also benefit the Fish Culture Section. The majority of all reservoir catchable stocks will be FRB, with far fewer ELR and SRC scheduled in the future. Requesting more FRB for stocking should be beneficial to the Fish Culture Section because:

- This strain is maintained as a broodstock at Boulder Rearing Station; it is the general consensus of those in the Fish Culture Section that eggs of this strain are more easily obtained than ELR or KRB.

- FRB are easier to rear than ELR or KRB.

- FRB can be reared to catchable size in one year, while ELR and KRB, since they spawn in the spring, must be held for upwards of 16 months to be available for stocking as catchables in the fall. Requesting ELR and KRB as fall catchables typically entails multiple transfers to and from colder water stations.

<u>Smaller Fish</u>

The returns of small catchable (7 - 8.2 inches) and large sub-catchable (5 - 7 inches) trout stocked during spring into Alcova and Pathfinder reservoirs were generally poor relative to catchable-size fish (>8.3 inches). However, fall-stocked catchables returned better than catchable-size spring stocks. There is potential that fisheries managers can improve angling opportunity by capitalizing on this phenomenon; with the possibility that smaller trout stocked during fall will return in sufficient numbers relative to catchables to facilitate requesting larger numbers but similar or less pounds of smaller fish for fall stocking. In 1997 and 1998, 30,000 FRB at both 7 per pound (7 inches) and 3 per pound (9 inches) are scheduled to be coded-wire tagged and stocked into Pathfinder Reservoir in the fall of both years. Evaluation will take place through collection of tags from spot creel survey work and netting.

Flowing Water Stocking

Analysis of stocked trout performance in the UNPS three flowing water sections suggests that continued stocking of the Miracle Mile and the Lower River is justified, while no stocking is recommended for the Upper River. It is noteworthy that the stocking of 100,000 advanced fingerling ELR in the Miracle Mile resulted in the highest estimated value of pounds caught by anglers versus pounds stocked for the entire system (15.25). ELR return rates in the Lower River also exceeded returns of KRB, RRB, and SRC. Given the recent decline in the rainbow stock of the Lower River, ELR will continue to be stocked annually for another 5 years then the need for continued stocking will be evaluated. Owing to poor return, requests for KRB and SRC have been eliminated from the flowing water stocking program.

Although analysis of tag returns from the Lower River in the early years of the CWT study suggested McDonald Lake RRB were more successful than any other strain, this trend was not observed throughout the creel survey. The performance of McDonald Lake RRB in the UNPS is moot, because this brood source will no longer be used after 1999. An "interim" stock of Jakey's Fork rainbow held at Tillet Rearing Station may produce eggs as early as 1999. The development of a Firehole River rainbow brood stock is also ongoing and should be available for stocking by 2002. It will be important to compare the success of these new strains of rainbow relative to ELR through coded-wire tags or mutilation clips once they become available for stocking.

Stocking Model

A model was designed to generate numbers of stocked fish (by strain) needed to meet the catch rate management goal by water. This creel survey represents the most complete data set we have ever had in Wyoming, however, we had to make several untestable assumptions while developing this model. Assumptions included angler hours (pressure), strain performance and predation on stocked trout will all remain constant. Perhaps the largest assumption we made is that the data fits a linear model, linearity was assumed in all calculations. Components of the model include annual angler hours, percent return (total catch) by strain by water, desired catch rate and catch required to meet that catch rate. The desired catch rate was multiplied by the annual angler hours to obtain the number of stocked trout that need to be caught by water. This number was then divided by the percent return of the best performing strain to generate the future requests. The desired catch rates are listed under Management Objectives near the end of each chapter's Discussion section.

Reservoirs

The future reservoir requests were based on only the best performing strain by water (Table D3). For example, FRB performed the best (% return) in all reservoirs so all the future requests are calculated using FRB.

Table D3. Model used to predict numbers of trout required to stock in reservoirs.

	Creel Estimates					
Water	Annual Hours	Strain	% Return (Total Catch)	Desired Catch Rate	Catch Required	Future Request
Alcova Reservoir	162,575	FRB	0.89	0.50	81,288	91,334
		ELR	0.42			
		KRB	0.36			
		BNT	0.03			10,000
Pathfinder Reservoir	159,023	FRB	0.53	0.40	63,609	120,017
		ELR	0.20			
		KRB	0.41			
		SRC	0.07			
Seminoe Reservoir	136,079	FRB	0.55	0.50	68,040	123,708
		ELR	0.34			
		KRB	1.09			
		SRC	0.12			

River Sections

The returns in the river sections were much more variable than the reservoirs. As with the reservoirs, only the most successful strain was used to calculate future requests (Table D4). Stocked trout did not meet any criteria in the Upper River Stocking and were not included in this model.

The river model is more complex than the reservoir model because of the wild trout and trout stocked in other waters components. The steps for this model are:

1. Multiply annual hours by desired catch rate to get the total number of trout that need to be caught to reach catch rate goals.
2. Subtract the estimated catch of wild trout and, in the case of the Miracle Mile, the estimated catch of Pathfinder stocks. This will yield the number of stocked trout that need to be caught.
3. This number is then divided by the % return to get the future request.

Table D4. Model used to predict numbers of trout required to stock in the Lower River (LR) and Miracle Mile (MM).

	Creel Estimates					Stocked		
Water	Annual Hours	Strain	% Return (Total Catch)	Wild TRT Catch	Pathfinder TRT Catch	Desired Catch Rate	TRT Catch Required	1999 Request
LR	39,294	ELR	0.05	9,090	N/A	0.50	10,557	211,140
MM	113,871	ELR	0.14	34,900	30,000	0.62	5,700	40,714

Overall for all waters, pounds requested to be stocked in the future will remain nearly the same or decrease (Table D5). The most noticeable change in the reservoir stocking requests is the most successful strain by water is requested (see Discussion sections of each chapter) and all reservoirs will be stocked in the fall. Until more information on strain performance is available, the total number of trout requested for stocking in the UNPS flowing water sections will be reduced from 390,000 to 150,000 trout annually or about 7,125 fewer total pounds. The Lower River request will be less than the model suggests because we believe that the habitat is improving and natural reproduction is increasing. Future requests will continue to evolve as more data are analyzed and collected. We plan to evaluate the changes through biological and spot creel information in the coming years.

Alternative Evaluation Criteria

Through the course of this report, our evaluation criteria centered on either the number of fish returning per number stocked or pounds returned by pounds stocked. We suggest that number caught divided by pounds stocked may quantify stocking success. Pounds drive the capacity of the hatchery system and anglers catch numbers of fish. When all the strain/water combinations stocked in the UNPS are calculated, almost all the strains/water combinations recommended for continued stocking ranked higher than ones that will no longer be stocked (Table D6). The only exception was BNT in Alcova that ranked low but was recommended for continued stocking because it provides a trophy aspect to the fishery. We offer that 1.5 trout caught per pound stocked could serve as an additional criteria for evaluating stocking programs.

Table D5. Summary table for historical and future stocking request totals for the UNPS.

WATER	Historical Requests: Number	Pounds	No./lb.	Future Requests: Number	Pounds	No./lb.
ALCOVA						
FRB	60,000	20,000	3	92,000	30,667	3
ELR	25,000	8,333	3	0	0	-
KRB	35,000	11,667	3	0	0	-
BNT	10,000[1]	3,333	3	10,000[2]	3,333	3
TOTAL	130,000	43,333		102,000	34,000	
PATHFINDER						
FRB	30,000	10,000	3	120,000	40,000	3
ELR	40,000	13,333	3	0	0	-
KRB	30,000	10,000	3	0	0	-
SRC	35,000	11,667	3	0	0	-
TOTAL	135,000	45,000		120,000	40,000	
SEMINOE						
FRB	20,000	6,667	3	125,000	41,667	3
ELR	30,000	10,000	3	0	0	-
KRB	45,000	15,000	3	0	0	-
SRC	25,000	8,333	3	0	0	-
TOTAL	120,000	40,000		125,000	41,667	
LOWER RIVER						
ELR	75,000	1,875	40	100,000	2,500	40
SRC	50,000	1,250	40	0	0	-
KRB	75,000	1,875	40	0	0	-
RRB	45,000	1,125	40	0	0	-
TOTAL	245,000	6,125		100,000	2,500	
MIRACLE MILE						
RBT	100,000	2,500	40	50K-100K	1.3K-2.5K	40
UPPER RIVER						
BNT	10,000	500	20	0	0	-
ELR	17,500	875	20	0	0	-
SRC	17,500	875	20	0	0	-
TOTAL	45,000	2,250		0	0	

[1]- Every other year.
[2]- Every third year.

Table D6. Number caught/pound stocked (NC/PS) by strain by water.

Water	Strain	Number Caught	Pounds Stocked	Number/ Pound	NC/PS[1]	Recommended Continued Stocking?	Criteria Met *			
							NH/NS[2]	PH/PS[3]	NC/NS[4]	PC/PS[5]
Miracle Mile	ELR	14,353	1,920	53.7	7.48	YES	0.02	1.70*	0.14	15.25*
Seminoe Reservoir	KRB	34,141	8,924	3.5	3.83	YES	0.79*	3.33*	1.09*	4.59*
Alcova Reservoir	FRB	46,673	14,422	3.6	3.24	YES	0.65*	1.86*	0.89*	2.56*
Pathfinder Reservoir	FRB	19,796	7,437	3.4	2.66	YES	0.40	2.12*	0.78*	4.34*
Seminoe Reservoir	FRB	8,853	5,089	3.2	1.74	YES	0.41	2.01*	0.55*	2.67*
Lower River	ELR	3,171	1,856	40.7	1.71	YES	0.01	0.72	0.05	3.44*
Pathfinder Reservoir	KRB	12,406	8,287	3.1	1.50	YES	0.28	1.38*	0.49*	2.39*
Pathfinder Reservoir	ELR	15,014	10,652	3.0	1.41	CONDITIONAL[6]	0.18	0.98*	0.47*	2.80*
Seminoe Reservoir	ELR	10,856	9,743	3.2	1.11	CONDITIONAL[6]	0.25	1.27*	0.34	1.75*
Alcova Reservoir	ELR	7,224	6,599	2.6	1.09	CONDITIONAL[6]	0.28	0.72	0.42	1.08*
Alcova Reservoir	KRB	5,865	6,041	2.7	0.97	NO	0.25	0.60	0.36	0.86
Lower River	SRC	836	973	23.3	0.86	NO	<0.01	0.09	0.01	0.31
Seminoe Reservoir	SRC	2,117	3,156	5.7	0.67	NO	0.09	0.93	0.12	1.26*
Lower River	KRB	334	744	87.0	0.45	NO	<0.01	<0.01	0.01	0.56
Upper River	ELR	447	1,106	12.3	0.40	NO	0.02	0.07	0.03	0.15
Upper River	SRC	296	768	20.5	0.39	NO	0.01	0.09	0.02	0.13
Pathfinder Reservoir	SRC	2,227	6,320	4.9	0.35	NO	0.04	0.45	0.07	0.75
Lower River	RRB	274	1,449	22.4	0.19	NO	<0.01	0.13	0.01	0.88
Alcova Reservoir	BNT	188	2,045	3.2	0.09	YES[7]	0.03	0.10	0.03	0.11
Upper River	BNT	61	926	10.5	0.07	NO	0.01	0.02	0.01	0.02

[1]- Number Caught/Pounds Stocked
[2]- Number Harvested/Number Stocked
[3]- Pounds Harvested/Pounds Stocked
[4]- Number Caught/Number Stocked
[5]- Pounds Caught/Pounds Stocked
[6]- Conditional indicates stocking is recommended only if desired numbers of other strains is impossible.
[7]- This stocking will continue to provide the trophy aspect to the Alcova trout fishery

Objectives of the North Platte Comprehensive Fisheries Study

In this section, objectives of the North Platte River Comprehensive Study outlined in the General Introduction are discussed. Results are presented for each objective that this report covered. If the objective was not covered in this report, a completion date for a report is given.

Objectives

1) Determine contribution of wild trout to each fishery.

- What proportion of the creel do wild fish constitute by fishery and by year?

Determination of the importance of naturally reproducing stocks of RBT, BNT, and SRC relative to hatchery trout to each fishery was quantified. In reservoirs, wild trout constitute a small proportion (<10%) of the total catch (Table D7). In the river sections, except for the Upper River, wild trout make up at least 49% of the total catch. Wild RBT are the largest component of the catch in the Lower River. Wild BNT make up a large percentage of the total catch only in the Miracle Mile.

Table D7. Percentage of total catch of wild trout by fishery.

	RBT	SRC	BNT	TOTAL
Alcova	4.4%	0.1%	1.3%	5.8%
Pathfinder	5.2%	0.6%	4.1%	9.9%
Seminoe	5.0%	0.5%	0.4%	5.9%
Lower River	60.3%	1.2%	1.7%	63.0%
Miracle Mile	14.7%	0.1%	35.0%	49.8%
Upper River	2.9%	0.0%	0.0%	2.9%

- What proportion of the fish captured in biological sampling by fishery and by year are wild?

The percentage of wild trout in the biological sample is similar to the percentage of wild fish in the catch (Tables D7 & D8). The reservoirs have small populations (<14%) of wild trout. Wild trout make up a much larger component of the flowing water fisheries. This topic will be further explored in the Strain Report scheduled for completion by 1999.

Table D8. Percentage of wild trout by fishery in the biological sample, March 1995 through June 1996.

	RBT	SRC	BNT	TOTAL
Alcova	0.3%	<0.1%	1.4%	1.7%
Pathfinder	1.0%	0.3%	9.1%	10.4%
Seminoe	7.7%	0.8%	4.8%	13.3%
Lower River	38.8%	<0.1%	5.2%	44.0%
Miracle Mile	3.0%	0.0%	81.6%	84.6%
Upper River	19.3%	0.0%	14.9%	34.2%

2) Evaluate species and strain contributions to each fishery.

- Which species and strains have the highest survival rates by fishery?

This question will be covered in a Survival Report that is scheduled for completion by Winter 2001.

- Which species and strains have the highest return to the creel by fishery?

This information is presented in the Discussion sections of all six chapters.

3) Refine trout stocking programs for best utilization of fish.

- What changes in stocking programs can be made to maximize creel return of hatchery fish?

We have identified fall as the most opportune time to stock reservoirs with established walleye populations. Moving towards fall stocks will increase rainbow trout numbers surviving walleye predation and have fish culture benefits previously mentioned.

We documented that catchable-size rainbow trout when stocked in spring return in greater numbers than trout stocked in the spring at smaller sizes. The potential to raise greater numbers of smaller trout in the hatchery for stocking in the spring does not compensate for their lower survival relative to catchables once stocked. Reservoir size-at-stocking studies indicate that rainbow trout vulnerability to walleye predation is size-dependent and that subtle differences in the sizes of rainbow trout stocked into waters with walleye can lead to pronounced differences in the numbers of rainbow trout that survive walleye predation and recruit to the fishery. The presence of established walleye populations, regardless of size-structure, dictates that rainbow trout should be released at catchable-size during spring to maximize angling opportunity. Since fall stocking was determined to provide the best returns, there is great need to evaluate smaller fish relative to catchables when stocked in the fall. These studies will be conducted on Pathfinder Reservoir with FRB during 1997 and 1998 and results will be available by 2002.

- Which species and strains should be targeted for a fishery to maximize returns?

Knowledge of strain performance by water can be used to maximize angling opportunity with limited hatchery fish. Poor performing strains have been identified and eliminated. Strains that returned best to anglers will be stocked in greater numbers. When preferred strains are not available, information allowing the next most appropriate strain to target for stocking is now available. Generally, FRB had the best returns in reservoirs and ELR returned best in river sections. This information is presented in the Discussion sections of each chapter.

4) **Determine contribution of drift and upstream migration to fisheries.**

- What proportion of the fish that return to the creel in a fishery were stocked either downstream or upstream of that fishery?

An understanding of how modifying a stocking program on one water might influence upstream and downstream fisheries has been determined. From 1992 through 1996, a period with no reservoir spill events, downstream movement of hatchery trout through dams was found to be insignificant to each fishery. Upstream migration, however, was found to be very important to the Miracle Mile and possibly the Upper River. Trout stocked in Pathfinder and Seminoe reservoirs greatly contributed to the total catch in the Miracle Mile and Upper River, respectively. Table D9 summarizes the movement of stocked trout through the UNPS. Impossible refers to stocked trout that would have had to migrate upstream through at least one dam. These fish either resulted from data collection and entry errors or jumped raceways at the hatchery. Overall, the Impossible group makes up a very small percentage of the total catch. Given that spill events are infrequent, fisheries managers can safely assume that contribution of reservoir stocks to downstream fisheries are of little consequence to the management of downstream waters.

Table D9. Percentage of all tagged trout recovered in each water that were stocked in each water. For example, of all the stocked trout recovered in the Upper River, 25% were stocked in Seminoe Reservoir and 75% were stocked in the Upper River.

	Fishery Where Tags Were Recovered					
Fishery Stocked	LR	ALC	PATH	MM	SEM	UR
Lower River (LR)	92.7%	X	X	X	X	X
Alcova (ALC)	2.4%	97.2%	X	X	X	X
Pathfinder (PATH)	4.9%	2.2%	98.4%	62.4%	X	X
Miracle Mile (MM)	0.0%	0.1%	0.5%	36.0%	X	X
Seminoe (SEM)	0.0%	0.3%	0.2%	0.2%	98.0%	25.0%
Upper River (UR)	0.0%	<0.1%	<0.1%	0.0%	<0.1%	75.0%
Impossible (IMP)	X	0.2%	0.8%	1.4%	2.0%	0.0%

- What effect do changes in stocking programs of a fishery have on fisheries downstream or upstream?

For the reservoirs, changes in the stocking programs in other waters have little direct effects on catch. For example, data shows there is very little movement of stocked trout from Pathfinder Reservoir to Alcova Reservoir. Therefore, changes in the Pathfinder Reservoir stocking program have little direct effect on the Alcova Reservoir fishery. If one or more of the reservoirs has an uncontrolled spill, fish from the upstream water will likely impact the catch of downstream waters.

The Miracle Mile and Upper River fisheries are greatly influenced by the stocking program in Pathfinder and Seminoe reservoirs, respectively. The Lower River is not impacted since there is no downstream reservoir that supports trout. Certain strains (ELR and FRB) showed a higher propensity to move upstream into flowing waters than other strains (KRB and SRC).

5) **Evaluate size-at-stocking and survival/contribution to each fishery.**

- Given production constraints, would stocking fewer large fish or small fish maximize creel returns?

This objective will be covered in a Size at Stocking Report that is scheduled for completion by April 1998. In addition, results from an ongoing study at Pathfinder Reservoir will be available by 2002.

6) **Culture experimentation.**

- What measures can we take to produce fish more likely to survive in the wild?

In the Miracle Mile, fish that were held in covered raceways performed better, although the difference was not statistically significant. The advantages of covering raceways is presented in the Discussion section of the Miracle Mile chapter.

7) **Evaluate fish distribution methods.**

- Does dispersing hatchery fish in a receiving water result in higher survival and creel return rates? Is one fish distribution method more successful than others?

During the fall of 1994, catchable rainbow trout strains were stocked either by truck or barge in Seminoe Reservoir (Table D10). The rationale for stocking with the barge was to scatter fish over a wide area instead of stocking all the fish from one of two boat ramps (truck stocks).

Initial results indicate the barge does not appear to increase returns for ELR (Table D10). KRB stocked with the barge returned better than the truck-stocked KRB, however, more data are needed to determine the effectiveness of the barge. In 1995, these strains as well as FRB were stocked with the barge and truck. Results from 1995 fish will be presented and discussed in a future report scheduled for completion by January 1999.

Table D10. Returns of fish stocked by truck and by barge.

	TRUCK			BARGE		
	Number Stocked	Number Returned	Percent Returned	Number Stocked	Number Returned	Percent Returned
ELR	10,000	1,534	15%	21,400	3,149	15%
KRB	23,700	14,092	60%	19,000	13,688	72%

8) **Supplementary information we hope to obtain from this research.**

- What role do anglers play in determining the numbers and size-structure of fish populations by fishery on the North Platte?

This question will be covered in a Survival Report that is scheduled for completion by Winter 2001.

- How do the configuration and operation of the respective dams in the study area influence drift?

All dams appear to prevent significant downstream drift during years when the dams do not spill.

- At what level would the North Platte fisheries have to be stocked, to achieve Fish Division goals for angler success?

We have modified stocking in an effort to maximize limited hatchery fish while maintaining or improving the catch rate to reach a goal ranging from 0.4 or 0.6 fish/hour (depending on water).

In conclusion, this project has been invaluable in promoting a better understanding of fisheries management issues to the UNPS angling public. Study results can be conveyed to the public for years to come. Better information to facilitate communication between fisheries managers, culture personnel, anglers, and Game and Fish Commissioners over proposed fishery management changes is now available.

Future Reports

This creel report is the first major write-up of the North Platte Comprehensive Fisheries Study. More reports which describe conclusions pertinent to our initial study objectives will follow:

1) A Comparative Report on Strain Performance.
This report may include but is not limited to: 1) An analysis of growth rates of strains across fisheries, 2) A comparison of strain composition of fish caught by biological sampling to strain composition derived concurrently during the creel survey, 3) An analysis of strain catch by regions within a fishery, and 4) An analysis of strain life expectancy in each fishery. Work on this report will begin the fall of 1997 and should be finalized by April, 1999.

2) A Comparative Report on Stocking Various Trout Sizes and Strains in Reservoirs.
This report will be written for submission to North American Journal of Fisheries Management by April 1998. It will include an analysis of stocking trout at various sizes in walleye reservoirs. A description of walleye/trout feeding experiments conducted at Colorado State University in 1994 will be included.

3) Stocking Trout by Barge versus Truck in Seminoe Reservoir: Analyses of Post-Stocking Dispersal and Angler Benefits.
This will be a Game and Fish Administrative Report that will be completed by January 1999. It will include a description of strain dispersal rates stocked by barge and truck and an analysis of angler returns across stocking method and reservoir location.

4) Estimates of Annual Survival Rates of Strains Stocked into Alcova, Pathfinder, and Seminoe Reservoirs: Correlation to Water Levels, Zooplankton Biomass, Walleye Size-Structure and Hatchery Survival Prior to Stocking.
The return of coded-wire tags across time for each strain/water combination can be used to estimate annual survival rates through tag recovery data. Differences in first year survival to subsequent survival can also be assessed. Multi-factor ANOVA can be used to assess the relative importance of water levels, zooplankton biomass, walleye size structure, and hatchery survival to differences in estimates of first-year trout survival rates. Data necessary to generate unbiased estimates of trout survival will become available by the year 1999, which dictates report completion will not occur until the winter of 2001.

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Appendix 1

Kortes Reservoir

Table AP1. Estimated angler numbers at Kortes Reservoir.

	Bank	/acre	Boat	/acre	All	/acre
April	0	0.0	0	0.0	0	0.0
May	0	0.0	21	0.2	21	0.2
June	0	0.0	27	0.3	27	0.3
July	0	0.0	22	0.3	22	0.3
August	0	0.0	27	0.3	27	0.3
September	6	0.1	53	0.6	58	0.7
October	0	0.0	7	0.1	7	0.1
November	0	0.0	0	0.0	0	0.0
December	0	0.0	0	0.0	0	0.0
January	0	0.0	0	0.0	0	0.0
February	0	0.0	0	0.0	0	0.0
March	0	0.0	0	0.0	0	0.0
April	0	0.0	14	0.2	14	0.2
May	0	0.0	12	0.1	12	0.1
June	20	0.2	46	0.6	66	0.8
15 Month Total	26	0.3	228	2.8	254	3.1
Average 12 Months	16	0.2	168	2.0	184	2.2

Table AP2. Estimated pressure at Kortes Reservoir.

	Bank Hours	/acre	Boat Hours	/acre	All Hours	/acre
April	0	0.0	0	0.0	0	0.0
May	0	0.0	131	1.6	131	1.6
June	0	0.0	128	1.5	128	1.5
July	0	0.0	100	1.2	100	1.2
August	0	0.0	198	2.4	198	2.4
September	31	0.4	207	2.5	238	2.9
October	0	0.0	40	0.5	40	0.5
November	0	0.0	0	0.0	0	0.0
December	0	0.0	0	0.0	0	0.0
January	0	0.0	0	0.0	0	0.0
February	0	0.0	0	0.0	0	0.0
March	0	0.0	0	0.0	0	0.0
April	0	0.0	80	1.0	80	1.0
May	0	0.0	48	0.6	48	0.6
June	84	1.0	271	3.3	355	4.3
15 Month Total	115	1.4	1,202	14.5	1,318	15.9
Average 12 Months	73	0.9	874	10.5	947	11.4

Below Alcova Reservoir, including Gray Reef Reservoir

Table AP3. Estimated angler numbers below Alcova Reservoir.

	Bank	/acre	Boat	/acre	All	/acre
April	126	0.6	0	0.0	126	0.6
May	228	1.0	52	0.2	280	1.2
June	192	0.9	0	0.0	192	0.9
July	49	0.2	18	0.1	67	0.3
August	58	0.3	72	0.3	130	0.6
September	68	0.3	7	0.0	75	0.3
October	17	0.1	0	0.0	17	0.1
November	24	0.1	0	0.0	24	0.1
December	74	0.3	0	0.0	74	0.3
January	0	0.0	0	0.0	0	0.0
February	235	1.0	0	0.0	235	1.0
March	154	0.7	0	0.0	154	0.7
April	115	0.5	0	0.0	115	0.5
May	251	1.1	0	0.0	251	1.1
June	150	0.7	64	0.3	214	0.9
15 Month Total	1,741	7.7	214	0.9	1,954	8.7
Average 12 Months	1,209	5.4	156	0.7	1,365	6.1

Table AP4. Estimated pressure below Alcova Reservoir.

	Bank Hours	/acre	Boat Hours	/acre	All Hours	/acre
April	331	1.5	0	0.0	331	1.5
May	816	3.6	209	0.9	1,025	4.6
June	618	2.7	0	0.0	618	2.7
July	124	0.6	47	0.2	171	0.8
August	96	0.4	252	1.1	348	1.5
September	156	0.7	34	0.2	190	0.8
October	83	0.4	0	0.0	83	0.4
November	66	0.3	0	0.0	66	0.3
December	189	0.8	0	0.0	189	0.8
January	0	0.0	0	0.0	0	0.0
February	1,181	5.3	0	0.0	1,181	5.3
March	363	1.6	0	0.0	363	1.6
April	358	1.6	0	0.0	358	1.6
May	561	2.5	0	0.0	561	2.5
June	511	2.3	169	0.8	680	3.0
15 Month Total	5,452	24.2	712	3.2	6,164	27.4
Average 12 Months	3,855	17.1	523	2.3	4,377	19.5

131: BT 78% RB 22%
sp. composition
3:1
Miracle Mile

Angler catch
BT 1:2 RB
35% 65%

catchability
i.e. BT < RB 6:1
1 : 6

But-	RB	BT
flies	61	39
bait	79	21
lures	44	56

C x R/yr. BT 1.2
wild RB 6.5
hatch RB 8.2

c 37 700 h/a angling use

74% nonresident
47% fly

c 78,000 catch
8,170 harvest

40/16. $\bar{x}$ 21b.
$\bar{x}$ BT 16"
RB 17"

p. 90
pipeline
spill

IN REPLY REFER TO

1541 (432)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

District Office
P.O. Box 1869
Rock Springs, Wyoming 82901

FEB 15 1978

Dr. Bob Behnke
3429 E. Prospect St.
Fort Collins, Colorado 80521

Dear Dr. Behnke:

As per your request, enclosed is a copy of our district stream survey completion report.

Sincerely yours,

Neil F. Morck,
District Manager

Enclosure

COMPLETION REPORT
Rock Springs District Stream Survey
1975 - 1977

For most practical purposes, the Rock Springs District stream survey has been completed, compiled and analyzed as noted in the attached District and Resource Area summary sheets (Appendices 1, 2, 3, 4). The compilation and analysis presented herein have been designed to provide survey data in a format specifically suited to the present URA manual requirements. In varying degrees, it also fulfills information requirements for the Annual Wildlife Report, Management Framework Plans, Habitat Management Plans, environmental analyses, Annual Work Plan, project planning, and other key District documents. This format is consistent at all levels of analysis (District, Resource Area, drainage or individual stream), and is a third-generation update and improvement of the "Stream Habitat Inventory Techniques - System Analysis" noted in my memo of January 6, 1977 (6610-432).

This entire effort (not counting typing time) required approximately 20 man-months for inventory and 15 man-months for compilation and analysis, resulting in an average total cost (at an average $1,300 per man-month) of approximately $40 per mile of stream surveyed. Individual items of primary significance have been noted from the District Summary Sheet as follows:

A. Although there were 23 major drainages initially identified to be inventoried on NRL, 31 have presently been identified or delineated as a result of the inventory. Initially, 166 streams were identified to be surveyed; 172 (+4%) were in fact inventoried and a total of 316 (+90%) were identified to exist on public lands within the district. The Green River Resource Area has the most significant amount of stream habitat in the District (715 miles) and the Kemmerer Resource Area has the largest number of streams (150).

B. Initially 300 stream miles were identified on record in 1974; 710 (+137%) were identified in 1975 for inventory and 770 (+157%) miles were actually inventoried on public lands. As a result of the survey, a total of 1,675 miles (+460%) of stream habitat have been identified on public lands within the District. Our survey target was 710 miles, but 1,125 miles (+59%) of stream habitat were actually inventoried as a result of broken land status. The implications of this District mileage change could be quite significant, insofar that, to date, public stream miles in many drainages have been thought to be insignificant (10 - 15%). However, public lands may actually be the first or second most significant ownership status in many drainages throughout the District below the USFS boundary. Associated with this is the realization that multiple use activities within this District and their relationships to stream habitat stability and quality are considerably more significant (+460%) than was previously assumed.

C. Within the parameters of the Channel Stability Rating Procedure, no streams on public lands attained an "Excellent" rating. In order to attain this level of stability, bedrock or large amounts of boulder-size rock are required. Most stream bottoms on public lands, even though they may contain rock materials, are essentially depositional in nature and dependent upon bank vegetation for their channel stability. Therefore, the highest rating attained in the District was that of "Good". Based on the NRL stream miles surveyed, public lands within the entire District average a low-fair stream channel stability with 9% average improvement potential, to a high-fair overall condition. Since 10-20% improvement potential delineates a "key area" for management improvement efforts, it can be concluded that the entire Rock Springs District is, on the average, almost a key area for improvement of stream channel stability.

The Green River and Kemmerer Resource Areas are key areas for improvement of channel stability. While the Pinedale Area presently averages a high fair condition, a fair degree (8%) of improvement potential also exists there. While these figures are area-wide averages, there are individual streams or site-specific reaches within each resource area which exceed 20% improvement potential and are, therefore, "critical areas" for improvement efforts. These areas and their significance within each individual drainage should be considered as high-level priorities in the establishment of District or Resource Area programs.

D. In relation to game fisheries habitat, it appears that a major limiting factor district-wide is the low availability of spawning habitat. This is primarily due to stream sedimentation, which in turn relates back to channel stability. Only 20% of the stream miles surveyed had good to fair spawning habitat. The remaining 80% falls in a poor, virtually none, or not significant category. Protection and improvement of spawning habitat throughout the District should therefore be one of our major program emphases. On a mileage basis, the Green River Resource Area stands out as having the most spawning habitat (72 miles) in a good to fair condition. The Kemmerer Resource Area, however, has the most habitat in this category as a percentage (35%) of its total stream mileage.

Resident habitat, like spawning habitat, is presently limited by existing channel conditions. Only 32% of the stream miles inventoried rated good to high fair, with low fair, poor, virtually none or none making up the remaining 68%. It should be noted, however, that a significant amount (38%) of this latter category is in a "low fair" condition which, with improvement in riparian vegetal cover, could conceivably increase the amount of good and high fair resident habitat to as much as 50%.

E. Insofar that there was no previous stream survey information from which to determine habitat trend, the Apparent Stream Habitat Trend Rating was developed to satisfy the "habitat trend" requirement of the URA. The rating system was developed on the basis of an inverse relationship between channel stability rating factors and stream habitat quality trends. (See Appendix 5). As an example, stream habitat would tend to decline more slowly, or very little at all, in a stream with a poor (115+) channel stability rating. Once stream habitat becomes this poor, it can't get much worse as bank erosion, sedimentation, mass wasting, and lack of vegetative stabilization are major detriments to the quality of habitat within the stream. On the other hand, a stream with a presently good or high fair rating has a much higher potential for a downward trend if any impact initiating factors are presently occurring. Downward trend initiating factors include beaver ponds which are washing out, extensive stream bank cutting, mass wasting, low bank protection from vegetation, poor channel stability and the degree of bank trampling being experienced. As can be noted from the District Summary Table, the NRL stream miles rated with a good, fair or poor channel stability have 42%, 15% and 96% stable habitat and 58%, 85% and 4% declining habitat, respectively. In using this type of a rating system, it is important to note the degree of stable habitat existing in a "poor" condition. As an example, while the district-wide average habitat trend is 37% stable, over half of this (135 miles) is stable due to poor channel stability and low habitat quality. I estimate that a natural situation would approximate one-third declining and two-thirds stable, rather than the two-thirds declining and one-third stable, noted in the survey. I am fairly confident that at least a 40:60 (declining/stable) ratio can be attained through multiple use management and programs (especially the grazing program) that are designed to protect and enhance the condition of riparian habitat.

Surprisingly, there is little difference between resource areas in the category of habitat trend. The Green River Resource Area, however, has the most significant amount of habitat presently in a declining trend.

F. The ratings for riparian habitat on NRL streams have also been developed in response to URA information requirements. This evaluation simply identifies the extent of riparian habitat based on riparian zone width and plant density, vigor, composition and diversity (Item 4. on a channel stability rating form). This rating is relative to the extent of riparian habitat on streams within the district and as such, is not a riparian "quality" rating. Note the attached Techniques of Analysis Memorandum, Appendix 5.

District-wide, riparian habitat appears to be quite limited with the majority in a fair to poor condition. While the Green River Area has the most habitat in a good/fair condition (66%-235 miles), the Pinedale Resource Area has the best average acres per mile, due to the extensive beaver activity noted in that area. The extent of riparian habitat along streams on NRL is often directly associated with the degree of beaver activity present. Therefore, any efforts to improve riparian habitat should consider the requirements and relationships of beaver activity. Reestablishment of suitable riparian habitat to support beaver should be a key element in future watershed and channel stabilization for the maintenance or improvement of fisheries habitat.

G. On-stream beaver ponds were noted to be a major element contributing to the quality and stability of stream fisheries habitat within the District. Generally speaking, there appeared to be a low frequency (1.3 per mile) of small (0.03 acre) ponds which in most cases (84%), were extensively silted and provided fair to marginal fisheries habitat. While the District average indicated an almost 50/50 split between active and inactive ponds, there were specific areas (Pinedale) or drainages where beaver ponds were extensively inactive or not even present.

A standard reference for beaver ecology information has been the PhD thesis by Mayo Call on the Pole Mountain area of Eastern Wyoming. This study indicated that beaver populations were/are cyclical on approximately a 30-year basis and are primarily dependent on the utilization and regrowth of aspen, their primary food and material source. Observations associated with the stream survey, however, have indicated that beaver ecology in this part of the state, especially on NRL within the scope of multiple use, may be significantly different than that observed on Pole Mountain. Personal aspen aging studies along numerous streams throughout the District have shown that trees 0.75 inches in diameter are predominately 6 to 7 years old and four feet tall. Aspen 1.50 inches in diameter were observed to be predominately 12 to 14 years old and six feet tall. If aspen growth rates are linear, this would indicate that the cyclical timeframe observed on Pole Mountain is longer, by ten to fifteen years, on public lands within the District. An independent aspen browse utilization transect, run on Muddy Creek by a summer aide in the Pinedale area, found 75% of the young aspen available to cattle and an average diameter, height, age, hedging and percent leader utilization of 0.76 inches, 4.5 feet, 7 years, 73% moderately to severely hedged, and 22 to 45% utilization, respectively.

These observations indicate that in addition to the physical damage occurring on stream bottoms within the District, beaver complexes are possibly being extended to as much as a 50-year turnaround time, or may not be coming back at all, due to intensive grazing utilization of stream bottoms. The type of beaver habitat ecology and succession which appears to be occurring is generally as follows:

1. Aspen become established along a narrow, actively-eroding stream bottom.

2. Beaver move in and create a series of large (4 to 10 feet high) dams utilizing large construction materials provided by the aspen.

3. Elevated water tables and on stream water storage begin to stabilize the drainage as peak flows are moderated and an extensive riparian zone begins to develop. Willow begin establishing themselves at this time.

4. In time, the ponds silt in and begin to form marsh meadows. Reconstruction of large dams becomes necessary but, due to grazing pressures, is not possible as sufficient regrowth of aspen has not occurred within this period of time.

5. Beaver then maintain the old large dams and attempt construction of new small dams (1 to 3 feet high) with willow.

6. These small willow dams have a short life expectancy (2 to 3 years) and tend to wash out more frequently due to the smaller construction materials utilized. At this point, willow utilization by beaver begins to increase quite markedly.

7. Subsequent willow regrowth is retarded as the new shoots are grazed off or hedged.

8. In time, even willow growth is insufficient to maintain the beaver complex and within 2 to 4 years, the beaver abandon the stream bottom or reach.

9. At this point, the ponds begin washing out; on-stream water storage and riparian water tables are lost; and riparian habitat declines as the channel begins downcutting and actively erodiong throughout its entire length.

10. With the decline in stream bottom habitat quality, all values (fisheries, wildlife, grazing, recreation, etc.) decline and productivity of the stream bottom remains low until aspen reestablish themselves and the cycle begins once again.

The importance of beaver and beaver habitat on District streams cannot be stressed enough. On stream water storage is critical to the yearlong survival of resident fish populations. This requirement was dramatically illustrated in this year's drought, during which I would estimate from field examinations that 50% of NRL stream mileage went dry at some point in time and lost its associated fish populations. In the Bear River and Colorado River cutthroat habitat areas, this figure probably was closer to 75%. The only areas where these fish were observed to have survived were in good active beaver pond complexes or in those reaches of streams which had supplemental artesian flows.

Conclusions and Recommendations

The Stream Survey Effort

1. From the experience gained during this inventory, I do not recommend attempting to conduct a stream survey of an entire District at one time. The length of time and number of people required to conduct, compile and analyze this inventory resulted in the misplacement or loss of some information, inconsistency in some techniques, duplication of effort, etc.. Insofar that this entire effort has involved extensive development or modification of methodologies, such problems probably should have been expected.

2. I recommend that future inventory efforts be conducted on a small enough scale (drainage basis) to allow for inventory, compilation and analysis by the same person(s) performing the inventory. This will provide a completed and useable product at the earliest possible date.

3. The present survey completed a Level 2 inventory at an average rate of 3 to 5 miles per man-day and an average total cost of $40 per mile. Future surveys could anticipate the same rate of completion, but costs would probably be closer to $55 to $60 per mile.

4. Level 1 surveys (based on the Huff Creek Exclosure) required approximately 20 man-days per mile at an approximate cost of $2,000 per mile. Future costs would probably be around $2,500 to $3,000 per mile.

5. Future survey efforts should anticipate time allocations as follows.

1.	Training	20%
2.	Stream Inventory	50%
3.	Compilation and Analysis	30%

6. I strongly recommend that the individual responsible for conducting future inventories be allowed to interview and choose his own summer or temporary aides. Throughout this effort, most of the aides hired had no real appreciation for their job and in some cases, were even misinformed regarding their duties and responsibilities. In many instances (80%) the personnel recruited did not have a background in aquatics and had personal career interests ranging from terestrial wildlife to environmental science and even primate behavior! This form of staff recruitment results in low job interest or satisfaction for the

summer aides, as well as a difficult working relationship and lower quality product for the Bureau.

In future efforts, I will recommend abandonment of the entire inventory if this delegation of responsibility cannot be achieved.

Program Relationships

1. Aquatic and riparian habitat has repeatedly been identified as the most critical, productive and intensively used habitat with the most multiple-use conflicts on public lands. These habitat areas, therefore, require intensive management efforts. At present, however, no real aquatic program exists within the district and the resource area biologists, while charged with management of both terrestrial and aquatic habitat, are increasingly unable to give both types of habitat the attention they require.

   I therefore recommend, as a minimum, the attainment of three WAE aquatic habitat biologists to assist the resource area biologists in the development of an intensive aquatic habitat management program. At the maximum, I would recommend the establishment of a counterpart permanent position for aquatic habitat biologists in each resource area. Almost 500% more habitat has been identified to exist on public lands than was known at the time the area biologist positions were established. Considering the number and miles of streams on public lands, present and potential condition, existing problems, etc., I would recommend placement by priority in the Kemmerer, Green River and Pinedale Resource Areas, respectively. The Kemmerer area is the only area with both species of the rare (Wyoming list) and sensitive cutthroat trout (Colorado River and Bear River) in Wyoming. This further illustrates the need to develop a dynamic aquatic habitat program in that area on a priority basis.

2. All vegetation management specialists within the District (Range Conservationists, Wildlife Biologists, and Foresters) have production quotas (AUMs, board feet) to meet for multiple-use consumption. Therefore, I recommend the establishment of a district level Plant Ecologist position with special emphasis on riparian plant communities and watershed stabilization. Of all the plant communities we are actively managing today, the most important plant community on public lands is presently receiving little or no management at all. The riparian plant community is the major element affecting stream habitat quality and watershed stability within the district. While terrestrial multiple-use programs may vary in their extent or location, aquatic multiple uses are totally confined to their medium and are, therefore, in a position with little capacity for adjusting to reductions in habitat quality or quantity.

3. The most widespread impact to stream habitat identified during the inventory was that of livestock grazing. While grazing use by wildlife is also a factor related to streamside condition, when placed in perspective, use by livestock is much more intensive, extensive and the primary limiting factor on many streams within the District. Once bank erosion is initiated through direct physical trampling or removal/reduction of protective vegetative cover, the stream itself will continue to aggravate the problem. The solution to livestock grazing conflicts is, in my opinion, the reestablishment and maintenance of active on-stream beaver complexes. Livestock grazing will never be compatible with stream habitat due to the physical damage and trampling impacts incurred. On stream beaver complexes however, can mitigate these impacts by reducing their effects on stream habitat. Grazing systems incorporating sufficient rest for stream habitat improvement and maintenance will be essential elements to attaining this improved condition. I recommend that initially, at least two year's rest be added to that rest required within the grazing system itself. In those cases where stream habitat is seriously degraded (such as in the Thomas Fork Drainage) a major rehabilitation effort including protection, replanting and possibly physical structures may be required to attain a satisfactory condition which could then be maintained through a suitable grazing system.

   Expanding oil and gas exploration and development activities are the second most significant uses impacting stream habitat within the District. Accelerated erosion and subsequent stream sedimentation are the primary agents impacting stream habitat as a result of road development and surface disturbance associated with the mineral industry. It is my estimation however, that within five years recreational activities will equal those impacts associated with mineral programs, and within ten years, possible approach the significance of those impacts associated with livestock grazing. For these reasons, future priorities need to be placed on limiting surface disturbance across or along stream habitat. In addition, the maximum standards and stipulations for surface protection and rehabilitation should be placed upon these activities.

4. In order to improve stream habitat to its estimated potential condition and arrest declining trends, an active and effective aquatic habitat management program will be required. Future habitat plans need to be more limited in scope (to a stream or single drainage) and site specific in associated details for stream improvement. We also need to recognize the fact that in some areas, continued "multiple use" will eventually lead to "no use" for aquatic habitat values. While we may not be able to maintain or improve all stream habitat districtwide, there is a definite opportunity to offset this lost production through intensive management of selected areas or reaches for maximum production. An unlimited

opportunity also exists for the development and improvement of upland aquatic habitat (wetlands) as secondary benefits from both the mineral and livestock grazing programs. As a recreational resource, these intensive management or habitat development areas would provide significant benefits for the ever-increasing numbers of people moving into the District as a result of energy development.

With the presently increasing public awareness and concern for environmental problems within the District, intensive considerations for and uses of aquatic resources will eventually be necessary. With few exceptions, the solutions for stream habitat problems will be in the improvement and maintenance of the integrity of riparian habitat.

Acknowledgements

Special note should be made of the combined and coordinated efforts of State, District and Resource Area personnel who have participated in this project. This inventory could not have been completed without their combined participation and support. Of particular note, has been the dedication of summer and temporary aides. The quality of this product is entirely a result of their efforts and enthusiasm.

Thanks and appreciation are especially due the Division of Administration staff members for their support in the typing of all the survey information over the past two years.

Bruce H. Smith 1-3-78
District Fisheries Biologist

Appendix 1.

Rock Springs District - Stream Habitat Inventory

1975 - 1977

A. Number of Major Drainages in the District: 31
Number of Streams Identified on NRL: 316
Number of Streams Surveyed on NRL: 172

B. Mileage Summary

	NRL	%	State	%	Private	%	Total
Miles in the District:	1,675						
Miles Inventoried:	781		94		268		1,143
Miles Stability Rated:	630						miles

C.

Channel Stability Rating	Average CSR Present	Average % Improvement Possible	Estimated Condition Attainable
Weighted Average Channel Stability of the 630 Miles Rated on NRL:	100 (Low Fair)	9%	91 (High Fair)

D. Spawning Habitat (NRL Miles Only)

	Miles	%
Good	60	8%
Fair	98	13%
Poor	142	18%
V. None	386	50%
Total	686 mi.	

Resident Habitat (NRL Miles Only)

	Miles	%
Good	83	11%
H. Fair	165	21%
L. Fair	296	38%
Poor	92	12%
V. None	49	6%
Total	685	

No Fisheries Significance = 95 - 12%

E. Apparent Stream Habitat Trend

Present CSR	Good	%	Fair	%	Poor	%	Total	%
Miles Stable	35	42%	63	15%	135	96%	234	37%
Miles Declining	47	58%	345	85%	6	4%	398	63%
Total	83		408		141		631	

F. Riparian Habitat on NRL Streams (607 mi. Rated)

Total Acres Riparian Habitat	Acres Riparian Habitat/Miles	Condition (Miles) Good	%	Fair	%	Poor	%	V None	%
3611	6.0	98	16%	280	46%	192	32%	39	6%

G. Beaver Ponds

Total No of Ponds	Average #/Mile	Average Size(ft2)	Avg Size (Acre)	No. Active	No. Inactive	No. Silted	#Not Silted
1509	1.3	1408	0.03	722	732	1273	164

#Fresh Water	#Stagnant	#Fish Blocks	Ave Max Depth
1302	135	723	2.0 feet

1975 - 1977

Rock Springs District - Stream Habitat Inventory

Stream Miles by Land Status (Includes Only Streams on NRL)

Streams Inventoried	NRL (Miles)	State (Miles)	Private (Miles)	Total (Miles)
Green River Area	426	80	231	737
Pinedale Area	175	4	20	199
Kemmerer Area	180	10	17	207
District Total	781	94	268	1143

Uninventoried Stream Miles	NRL
Green River Area	287
Pinedale Area	262
Kemmerer Area	340
District Total	889

Resource Area	Total NRL Miles	Total NRL Streams	# of NRL Streams Inventoried
Green River Area	715	90	55
Pinedale Area	440	76	48
Kemmerer Area	520	150	69
District Total	1675	316	172

Rock Springs District - Stream Habitat Inventory

1975 - 1977

STREAM HABITAT STATUS (NRL MILES ONLY)

Resource Area	SPAWNING HABITAT (MILES) GOOD %	GOOD MILES	FAIR %	FAIR MILES	POOR %	POOR MILES	V. NONE %	V. NONE MILES	RESIDENT HABITAT (MILES) GOOD %	GOOD MILES	H. FAIR %	H. FAIR MILES	L. FAIR %	L. FAIR MILES	POOR %	POOR MILES	V. NONE %	V. NONE MILES	NO FISHERIES SIGNIFICANCE %	NO FISHERIES SIGNIFICANCE MILES
Green River	7%	30	10%	42	18%	78	58%	249	6%	23	17%	73	52%	222	10%	44	8%	36	7%	28
Pinedale	10%	17	15%	26	19%	33	41%	73	22%	39	22%	39	22%	38	14%	24	5%	9	15%	26
Kemmerer	7%	13	17%	30	17%	31	36%	64	12%	21	30%	53	20%	36	13%	24	2%	4	23%	41
DISTRICT TOTAL	8%	60	13%	98	18%	142	50%	386	11%	83	21%	165	38%	296	12%	92	6%	49	12%	95

*** % Not including miles with "No Fisheries Significance"**

Rock Springs District - Stream Habitat Inventory

1975 - 1977

CHANNEL STABILITY AND APPARENT STREAM HABITAT TREND

RESOURCE AREA	RATED MILES	WEIGHTED AVERAGE CHANNEL STABILITY		WEIGHTED AVERAGE	APPARENT STREAM HABITAT TREND			
		PRESENT	POTENTIAL	% IMP	MILES STABLE	% STABLE	MILES DECLINING	% DECLINING
Green River Area	377	102 (Low Fair)	94 (High Fair)	9%	142	37%	236	63%
Pinedale Area	133	92 (High Fair)	85 (High Fair)	8%	46	34%	87	66%
Kemmerer Area	121	101 (Low Fair)	91 (High Fair)	10%	46	38%	75	62%
DISTRICT TOTAL	631	100 (Low Fair)	91 (High Fair)	9%	234	37%	398	63%

*** Weighted Average**

Rock Springs District - Stream Habitat Inventory

1975 - 1977

RIPARIAN HABITAT ON NRL STREAMS

RESOURCE AREA	RATED MILES NRL	ACRES RIPARIAN HABITAT	AVERAGE ACRES RIPARIAN HABITAT/MILE	GOOD MILES	GOOD %	FAIR MILES	FAIR %	POOR MILES	POOR %	V. NONE MILES	V. NONE %
Green River	360	2033	6	45	13%	190	53%	112	31%	13	3%
Pinedale	128	1070	8	19	15%	56	44%	44	35%	9	6%
Kemmerer	119	508	4	34	29%	34	29%	36	30%	15	13%
DISTRICT TOTAL	607	3611	6	98	16%	280	46%	192	32%	37	6%

* Average

Rock Springs District - Stream Habitat Inventory

1975 - 1977

BEAVER PONDS

RESOURCE AREA	MILES INVEN	# PONDS	#/MILE	AVG SIZE (ft^2)	AVG SIZE ACRES	# ACTIVE	# INACTIVE	# SILTED	# NOT SILTED	# FRESH WATER	# STAGNANT	# FISH BLOCKS	AVG MAX DEPTH
Green River	737	302	0.4	1534	0.04	166	125	210	81	241	50	151	1.8'
Pinedale	199	499	3	1653	0.04	175	324	454	44	463	35	225	2.1'
Kemmerer	206	708	3	1182	0.03	381	283	609	39	598	50	347	1.9'
DISTRICT TOTAL	1142	1509	1.3	*1408	*0.03	722	732	1273	164	1302	135	723	1.9'

* **Weighted Average**

APPENDIX 2.

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

A. Number of Streams Identified on NRL: 90
Number of Streams Surveyed on NRL: 55

B.

Mileage Summary	NRL	%	State	%	Private	%	Total
Miles in the Area:	714						
Miles Inventoried:	426		80		231		737
Miles Stability Rated:	378						

C.

Channel Stability Rating	Average CSR Present	Average % Improvement Possible	Estimated Condition Attainable
Weighted Average Channel Stability of the 378 Miles Rated on NRL:	102 (Low Fair)	9%	94 (High Fair)

D. Spawning Habitat (NRL Miles Only)

	Miles	%
Good	30	7%
Fair	42	10%
Poor	78	18%
V. None	249	58%
Total	399	

Resident Habitat (NRL Miles Only)

	Miles	%
Good	23	6%
H. Fair	73	17%
L. Fair	222	52%
Poor	44	10%
V. None	36	8%
Total	399	

No Fisheries Significance = 28 7%

E. Apparent Stream Habitat Trend

Present CSR	Good	%	Fair	%	Poor	%	Total	%
Miles Stable	10		36		94		142	37%
Miles Declining	27		208				235	63%
Total	37		244		94		378	

F. Riparian Habitat on NRL Streams (360 mi. Rated)

Acres Riparian Habitat	Acres Riparian Habitat/Miles	Condition (Miles) Good	%	Fair	%	Poor	%	V None	%
2033	5.6	45	13	190	53	112	31	13	3

G. Beaver Ponds

Total No of Ponds	Average #/Mile	Average Size(ft2)	Avg Size (Acre)	No. Active	No. Inactive	No. Silted	#Not Silted
302	0.4	1534	0.04	166	125	210	81

#Fresh Water	#Stagnant	#Fish Blocks	Ave Max Depth
241	50	151	1.8 feet

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

Stream Miles by Land Status (Includes Only Streams on NRL)

Drainage Miles Inventoried	NRL	State	Private	Total
	Miles			
Big Sandy	*47.40	23.60	39.10	110.00
Little Sandy	*49.05	8.70	41.70	99.50
Sweetwater	55.30	2.60	6.6	64.50
Bitter Creek	50.60	1.40	61.40	113.40
Little Bitter Creek	20.30	3.50	18.0	41.80
Salt Wells Creek	66.30	5.50	24.60	96.40
East Flaming Gorge	35.30	3.60	14.30	53.20
Red Creek	35.90	3.00	3.40	42.30
Vermillion Creek	51.00	6.20	0.80	58.00
Henry's Fork	7.0	.3	0.0	7.3
Lower Green	* 8.4	21.6	21.0	51.0
Total	426.50	80.00	230.90	737.30

Drainage Miles Uninventoried	mi. NRL	# NRL Total Streams	NRL Streams No. Surveyed
Big Sandy	48.30	8	4
Little Sandy	58.00	8	3
Sweetwater	5.60	20	18
Bitter Creek	0.3	2	2
Little Bitter Creek	0.00	1	1
Salt Wells	26.50	8	7
East Flaming Gorge	10.30	5	4
Red Creek	12.60	11	8
Vermillion Creek	5.20	5	5
Henry's Fork	61.60	9	2
Lower Green	58.90	13	1
Total	287.3	90	55
Total NRL Miles	714		

* Includes Bureau of Reclamation Land Stream Miles

Big Sandy	25.9
Little Sandy	13.9
Lower Green	8.4
Total	48.20

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

STREAM HABITAT STATUS (NRL MILES ONLY)

	SPAWNING HABITAT (MILES)								RESIDENT HABITAT (MILES)											
	GOOD		FAIR		POOR		V. NONE		GOOD		H. FAIR		L. FAIR		POOR		V. NONE		NO FISHERIES SIGNIFICANCE	
DRAINAGE	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES
Big Sandy	4%	1.8	4%	2.10	48%	22.80	44%	20.70	22%	10.30	21%	9.90	56%	26.60	1%	0.60				
Little Sandy			4%	1.90	38%	18.90	58%	28.40	3%	1.70	37%	18.00	47%	22.80			13%	6.70		
Sweetwater	20%	10.70	20%	10.90	25%	14.00	25%	14.00	15%	8.00	31%	17.20	36%	19.90	7%	3.90	1%	0.60	10%	5.70
Bitter Creek			2%	0.90	1%	0.80	97%	48.90			2%	1.10	65%	33.00	23%	11.40	10%	5.10		
Little Bitter Creek							100%	20.30			4%	0.8	78%	15.8	7%	1.4	11%	2.3		
Salt Wells Creek	4%	3.00	11%	7.10	8%	5.10	71%	46.80			14%	9.30	72%	47.90	2%	1.30	6%	3.50	6%	4.30
East Flaming Gorge					6%	2.20	52%	18.40	1%	0.20			39%	14.00			18%	6.40	42%	14.70
Red Creek	26%	9.40	30%	10.60	33%	12.00	4%	1.40	3%	0.90			10%	3.50	58%	21.00	22%	8.00	7%	2.50
Vermillion Creek	6%	3.10	14%	7.00	3%	1.70	76%	38.60	3%	1.30	15%	7.85	73%	37.10	2%	1.00	6%	3.10	1%	0.60
Henry's Fork	26%	1.8	17%	1.2	13%	0.9	44%	3.1	16%	1.1	13%	0.9	21%	1.5	50%	3.5				
Lower Green							100%	8.4			100%	8.40								
Total	7%	29.8	10%	41.60	18%	78.4	58%	249.00	6%	23.50	17%	73.40	52%	222.10	10%	44.10	8%	35.7	7%	27.8

* % Not including miles with "No Fisheries Significance"

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

CHANNEL STABILITY AND APPARENT STREAM HABITAT TREND

DRAINAGE	RATED MILES	WEIGHTED AVERAGE CHANNEL STABILITY PRESENT	WEIGHTED AVERAGE CHANNEL STABILITY POTENTIAL	WEIGHTED AVERAGE % IMP	APPARENT STREAM HABITAT TREND: MILES STABLE	% STABLE	MILES DECLINING	% DECLINING
Big Sandy	43.20	100.3	94.2	6.1	10.20	24%	33.00	76%
Little Sandy	46.70	109.4	93.0	15.0	10.30	34%	36.40	66%
Sweetwater	47.10	94.3	88.2	6.5	13.50	29%	33.60	71%
Bitter Creek	48.00	105.9	99.4	6.1	33.20	69%	14.80	31%
Little Bitter Creek	19.90	103.4	95.2	7.9	11.0	55%	8.90	45%
Salt Wells Creek	59.80	114.3	102.6	10.8	38.10	64%	21.70	36%
East Flaming Gorge	20.60	103.4	95.3	7.8	6.50	32%	14.10	68%
Red Creek	26.10	103.7	93.6	9.7	10.90	40%	15.20	60%
Vermillion Creek	50.20	88.7	84.1	5.2	7.90	16%	42.30	84%
Henry's Fork	7.0	102.4	88.9	13.2			7.0	100%
Lower Green	8.4	85.1	78.3	8.0			8.4	100%
Total	376.90	102.3 (Low Fair)	93.6 (High Fair)	8.5%	141.6	37%	235.30	63%

* Weighted Average

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

RIPARIAN HABITAT ON NRL STREAMS

DRAINAGE	RATED MILES NRL	ACRES RIPARIAN HABITAT	AVERAGE ACRES RIPARIAN HABITAT/MILE	GOOD MILES	GOOD %	FAIR MILES	FAIR %	POOR MILES	POOR %	V. NONE MILES	V. NONE %
Big Sandy	43.20	440.7	10.2	10.8	24%	28.50	67%	3.9	9%		
Little Sandy	46.70	184.9	4.0	1.40	3%	31.90	68%	13.40	29%		
Sweetwater	47.10	323.4	6.9	15.90	34%	23.70	50%	6.50	14%	1.00	2%
Bitter Creek	48.00	222.8	4.6	4.90	10%	31.50	66%	10.90	23%	0.70	1%
Little Bitter Creek	13.30	35.80	2.7	1.7	13%	9.2	69%	2.4	18%		
Salt Wells Creek	59.80	263.50	4.4	6.40	11%	27.90	47%	21.60	36%	3.90	6%
East Flaming Gorge	20.60	46.50	2.30	0.0	0%	8.80	43%	8.40	41%	3.40	16%
Red Creek	27.10	233.7	8.6	1.60	6%	5.50	20%	20.00	74%		
Vermillion Creek	38.60	116.1	3.0	0.0	0.0	15.10	39%	19.50	51%	4.00	10%
Henry's Fork	7.0	112.2	16.0	0.4	6%	3.6	51%	3.0	43%		
Lower Green	8.40	53.0	6.3	2.3	27%	3.9	46%	2.2	27%		
Total	359.70	2032.6	5.6	45.4	13%	189.50	53%	111.8	31%	13.0	3%

* Average

Green River Resource Area - Stream Habitat Inventory

1975 - 1977

BEAVER PONDS

DRAINAGE	MILES INVEN	# PONDS	#/MILE	AVG SIZE (ft^2)	AVG SIZE ACRES	# ACTIVE	# INACTIVE	# SILTED	# NOT SILTED	# FRESH WATER	# STAGNANT	# FISH BLOCKS	AV. MAX DEPTH
Big Sandy	110.00	5	0.05	289	0.01	5		5		5	0	3	2.1'
Little Sandy	99.50												
Sweetwater	64.50	288	4.5	1516	0.04	152	125	196	81	227	50	143	1.81'
Bitter Creek	113.40												
Little Bitter Creek	41.80												
Salt Wells Creek	96.40												
East Flaming Gorge	53.20												
Red Creek	42.30												
Vermillion Creek	58.00												
Henry's Fork	7.30	9	1.2	2772	0.06	9	0	9	0	9	0	5	2.9'
Lower Green	51.00												
Total	737.30	302	0.4	1534*	0.04*	166	125	210	81	241	50	151	1.8'

* Weighted Average

Appendix 3.
Pinedale Resource Area - Stream Habitat Inventory

1975 - 1977

A. Number of Streams Identified on NRL: 76
Number of Streams Surveyed on NRL: 48

B. Mileage Summary

Mileage Summary	NRL	%	State	%	Private	%	Total
Miles in the Area:	437						
Miles Inventoried:	175		4		20		179
Miles Stability Rated:	135						

C.

Channel Stability Rating	Average CSR Present	Average % Improvement Possible	Estimated Condition Attainable
Weighted Average Channel Stability of the 133 Miles Rated on NRL:	92 (High Fair)	8%	85 (High Fair)

D. Spawning Habitat (NRL Miles Only)

	Miles	%
Good	17	10%
Fair	26	15%
Poor	33	19%
V. None	73	41%
Total	149	

Resident Habitat (NRL Miles Only)

	Miles	%
Good	39	22%
H. Fair	39	22%
L. Fair	38	22%
Poor	24	14%
V. None	9	5%
Total	149	

No Fisheries Significance = 26 15%

E. Apparent Stream Habitat Trend

Present CSR	Good	%	Fair	%	Poor	%	Total	%
Miles Stable	18		10		18		46	34%
Miles Declining	14		73		0		87	66%
Total	32		83		18		133	

F. Riparian Habitat on NRL Streams (128 mi. Rated)

Acres Riparian Habitat	Acres Riparian Habitat/Miles	Condition (Miles) Good	%	Fair	%	Poor	%	V None	%
1070	8.3	19	15%	56	44%	44	35%	9	6%

G. Beaver Ponds

Total No of Ponds	Average #/Mile	Average Size(ft2)	Avg Size (Acre)	No. Active	No. Inactive	No. Silted	#Not Silted
499	2.5	1653	0.04	175	324	454	44

#Fresh Water	#Stagnant	#Fish Blocks	Ave Max Depth
463	35	225	2.1 ft.

Pinedale Resource Area - Stream Habitat Inventory

1975-1977

Stream Miles by Land Status (Includes Only Streams on NRL)

Drainage Miles Inventoried	NRL (Miles)	State (Miles)	Private (Miles)	Total (Miles)
1. New Fork	16		2	18
2. Upper Green	22	2	11	35
3. Cottonwood	11		1	12
4. Muddy (North)	21		1	22
5. North Piney	13		1	14
6. Middle Piney	2			2
7. South Piney	32		1	33
8. Dry Piney	28		1	29
9. La Barge	25	1	2	28
10. Fontenelle	7		1	8
	175	4	20	199

Drainage Miles Uninventoried	mi. NRL	# NRL Total Streams	NRL Streams No. Surveyed
1. New Fork	23	10	8
2. Upper Green	24	2	2
3. Horse Creek	31	4	0
4. Cottonwood	19	7	7
5. Muddy (North)	54	4	2
6. North Piney	10	3	3
7. Middle Piney	2	2	1
8. South Piney	7	8	7
9. Dry Piney	23	9	8
10. Birch Creek	21	4	0
11. La Barge	13	13	7
12. Muddy (South)	31	6	0
13. Fontenelle	3	4	3
	262	76	48

Total NRL Miles 437

Pinedale Resource Area - Stream Habitat Inventory

1975 - 1977

STREAM HABITAT STATUS (NRL MILES ONLY)

	SPAWNING HABITAT (MILES)								RESIDENT HABITAT (MILES)											
	GOOD		FAIR		POOR		V. NONE		GOOD		H. FAIR		L. FAIR		POOR		V. NONE		NO FISHERIES SIGNIFICANCE	
DRAINAGE	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES
New Fork	3%	0.5	2%	0.3	43%	6.8	49%	7.7	31%	4.9	14%	2.2	35%	5.5	9%	1.4	8%	1.3	3%	0.5
Upper Green					42%	9.2	58%	12.7	43%	9.5	57%	12.5								
Cottonwood	16%	1.7	36%	3.8	19%	2.0	29%	3.1	16%	1.8	44%	4.7	32%	3.4	8%	0.8				
Muddy (North)			20%	4.2	2%	0.4	78%	16.3	35%	7.4	19%	3.9	44%	9.3	2%	0.5				
North Piney							52%	6.5	32%	4.0			8%	1.0	12%	1.5			48%	6.0
Middle Piney	100%	1.6													100%	1.6				
South Piney	27%	8.8	44%	14.1	11%	3.7	12%	3.8	30%	9.6	12%	4.0	26%	8.3	14%	4.4	12%	4.0	6%	2.0
Dry Piney	3%	0.8	7%	2.0			41%	11.7			11%	3.0	12%	3.5	26%	7.2	2%	0.7	49%	13.6
La Barge	14%	3.6	3%	0.9	38%	9.3	29%	7.2	7%	1.9	20%	5.0	25%	6.2	18%	4.5	14%	3.4	16%	3.9
Fontenelle			13%	0.9	27%	1.9	59%	4.2			49%	3.5	17%	1.2	33%	2.3			1%	0.1
Resource Area Total	10%	16.8	15%	26.0	19%	33.3	41%	73.1	22%	39.0	22%	38.6	22%	38.2	14%	24.2	5%	9.3	15%	26.1

*** % Not including miles with "No Fisheries Significance"**

Pinedale Resource Area - Stream Habitat Inventory

1975 - 1977

CHANNEL STABILITY AND APPARENT STREAM HABITAT TREND

Drainage	RATED MILES	WEIGHTED AVERAGE CHANNEL STABILITY		WEIGHTED AVERAGE	APPARENT STREAM HABITAT TREND			
		PRESENT	POTENTIAL	% IMP	MILES STABLE	% STABLE	MILES DECLINING	% DECLINING
New Fork	12.7	60.8	60.4	0.7%	11.40	90%	1.30	10%
Upper Green	21.9	81.8	77.5	5.2%	8.70	39%	13.25	61%
Fontenelle Creek	4.8	105.2	90.7	13.8%	2.80	58%	2.00	42%
LaBarge Creek	21.2	84.7	77.6	7.9%	2.20	10%	19.00	90%
Muddy Creek	19.6	112.2	98.4	12.3%	7.40	38%	12.20	62%
Cottonwood Creek	7.7	108.8	98.4	9.6%	1.40	18%	6.40	82%
Middle Piney	1.0	104	99	4	0.0	0	1.00	100%
South Piney	25.9	91.5	81.6	10.8%	2.40	9%	23.50	91%
North Piney	5.0	97.6	85.1	12.8%	0.0	0	5.00	100%
Dry Piney	13.3	107.7	99.1	7.4%	9.70	73%	3.70	27%
Resource Area Total	133.0	92.4 (High Fair)	84.6 (High Fair)	*8.4%	45.80	34%	87.20	66%

* Weighted Average

Pinedale Resource Area - Stream Habitat Inventory

1975 - 1977

RIPARIAN HABITAT ON NRL STREAMS

DRAINAGE	RATED MILES NRL	ACRES RIPARIAN HABITAT	AVERAGE ACRES RIPARIAN HABITAT/MILE	GOOD MILES	GOOD %	FAIR MILES	FAIR %	POOR MILES	POOR %	V. NONE MILES	V. NONE %
New Fork	12.20	59.8	4.9	4.80	39%	3.50	29%	0.50	4%	3.35	28%
Upper Green	21.30	208.2	9.8	6.90	32%	5.45	26%	8.95	42%		
Fontenelle Creek	4.80	21.2	4.4	1.80	37%	1.20	26%	1.80	37%		
LaBarge Creek	21.20	156.1	7.4	2.20	1.0%	6.25	30%	12.75	60%		
Muddy Creek	19.60	77.6	4.0	0.30	1%	6.10	31%	9.00	46%	4.25	22%
Cottonwood Creek	5.60	53.9	9.7			3.95	71%	1.60	29%		
Middle Piney	1.00									1.00	100%
South Piney	24.60	195.5	7.9			20.40	83%	4.20	17%		
North Piney	5.00	157.7	31.5			5.00	100%				
Dry Piney	13.30	140.2	10.5	3.20	24%	4.50	34%	5.60	42%	0.0	0
Total	128.40	1070.2	8.3	19.05	15%	56.35	44%	44.40	35%	8.60	6%

* Average

Pinedale Resource Area - Stream Habitat Inventory

1975 - 1977

BEAVER PONDS

DRAINAGE	MILES INVEN	# PONDS	#/MILE	AVG SIZE (ft^2)	AVG SIZE ACRES	# ACTIVE	# INACTIVE	# SILTED	# NOT SILTED	# FRESH WATER	# STAGNANT	# FISH BLOCKS	AVG MAX DEPTH
New Fork	17.40	43	2.5	1827	0.04	21	22	26	17	38	5	13	2.2'
Upper Green	34.90	5	0.1	6000	0.14	3	2	4	1	5	0	0	3.4'
Fontinelle Creek	8.10	26	3.2	1758	0.04	21	5	23	3	15	11	11	2.1
LaBarge Creek	28.20	101	3.6	1729	0.04	42	59	92	9	95	6	53	2.4
Muddy Creek	22.2	24	1.1	1081	0.02	1	23	24	0	24	0	6	2.2
Cottonwood Creek	12.00	27	2.3	2548	0.06	7	20	27	0	27	0	10	2.1
Middle Piney	1.60												
South Piney	32.80	163	5.0	1231	0.03	60	102	159	3	161	1	68	2.0
North Piney	13.10												
Dry Piney	28.80	110	3.8	1825	0.04	19	91	99	11	98	12	64	1.9
Total	199.00	499	2.5	*1653	0.04	175	324	454	44	463	35	225	*2.1

* **Weighted Average**

Appendix 4.

Kemmerer Resource Area - Stream Habitat Inventory

1975 - 1977

A. Number of Streams Identified on NRL: 150
Number of Streams Surveyed on NRL: 69

B. Mileage Summary

Mileage Summary	NRL	%	State	%	Private	%	Total
Miles in the Area:	482						
Miles Inventoried:	166		6		15		187
Miles Stability Rated:	124						

C.

Channel Stability Rating	Average CSR Present	Average % Improvement Possible	Estimated Condition Attainable
Weighted Average Channel Stability of the 124 Miles Rated on NRL:	101 (Low Fair)	10%	91 (High Fair)

D. Spawning Habitat (NRL Miles Only)

	Miles	%
Good	14	11%
Fair	32	24%
Poor	31	23%
V. None	50	38%
Total	126	

Resident Habitat (NRL Miles Only)

	Miles	%
Good	11	8%
H. Fair	52	38%
L. Fair	39	29%
Poor	23	17%
V. None	4	4%
Total	128	

No Fisheries Significance = 6 4%

E. Apparent Stream Habitat Trend

Present CSR	Good	%	Fair	%	Poor	%	Total	%
Miles Stable	3	23%	10	16%	25	100%	38	36%
Miles Declining	10	77%	57	84%			67	64%
Total	13		67		25		105	

F. Riparian Habitat on NRL Streams (360 mi. Rated)

Acres Riparian Habitat	Acres Riparian Habitat/Miles	Condition (Miles) Good	%	Fair	%	Poor	%	V None	%
560	4.6	20	16	41	33	43	35	19	16

G. Beaver Ponds

Total No of Ponds	Average #/Mile	Average Size(ft2)	Avg Size (Acre)	No. Active	No. Inactive	No. Silted	#Not Silted
709	3.8	903	0.02	381	271	609	43

#Fresh Water	#Stagnant	#Fish Blocks	Ave Max Depth
603	49	347	1.9'

Kemmerer Resource Area
Stream Habitat Inventory
1975 - 1977

Stream Miles by Land Status (Includes Only Streams on NRL)

Drainage Miles Inventoried	NRL	State	Private	Total
	Miles Inventoried			
Smiths Fork	33.25	1.70	1.65	36.60
Thomas Fork	33.30	2.85	1.80	37.95
Hams Fork	48.25		3.35	51.60
Blacks Fork	10.85		1.50	12.35
Bear River	31.50	4.20	2.50	38.20
Slate Creek	22.30	0.90	5.70	28.90
Total	180	10	17	206

Drainage Miles Uninventoried	NRL	NRL Total Streams	NRL Strea No. Surveyed
Smiths Fork	18.55	28	17
Thomas Fork	8.80	12	8
Hams Fork	20.20	33	26
Blacks Fork	96.25	24	8
Bear River	155.90	43	8
Slate Creek	38.80	5	2
Star Valley	1.50	5	0
Total	340	150	69

Total NRL Miles 520

DRAINAGE TOTALS

	NRL	State	Private	Total
Smiths Fork	51.80	20.20	52.50	124.50
Thomas Fork	42.10	8.00	10.35	60.45
Hams Fork	68.45	23.00	148.20	239.65
Blacks Fork	107.10	28.55	289.60	425.25
Bear River	187.40	55.60	334.70	577.70
Total	456.85	135.35	835.35	1427.55

Kemmerer Resource Area - Stream Habitat Inventory

1975 - 1977

STREAM HABITAT STATUS (NRL MILES ONLY)

	SPAWNING HABITAT (MILES)								RESIDENT HABITAT (MILES)											
	GOOD		FAIR		POOR		V. NONE		GOOD		H. FAIR		L. FAIR		POOR		V. NONE		NO FISHERIES SIGNIFICANCE	
DRAINAGE	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES	%	MILES
Smiths Fork	4%	1.25	21%	7.10	22%	7.40	28%	9.25	13%	4.20	5%	1.85	23%	7.60	27%	9.05	7%	2.30	25%	8.25
Thomas Fork	8%	2.60	15%	4.80	34%	11.35	35%	11.75	18%	6.10	39%	12.80	24%	8.00	9%	3.10	2%	0.50	8%	2.80
Hams Fork	14%	7.00	14%	6.60	20%	9.55	26%	12.65	3%	1.65	44%	21.00	14%	6.55	10%	5.00	3%	1.60	26%	12.45
Blacks Fork			3%	0.30	7%	0.80	77%	8.40	21%	2.35	43%	4.65	8%	0.90	14%	1.50	1%	0.10	13%	1.35
Bear River	4%	1.40	25%	7.70	7%	2.25	32%	10.20	19%	6.00	16%	5.20	27%	8.55	6%	1.80			32%	9.95
Slate Creek	4%	1.00	15%	3.3			55%	12.20	4%	1.00	33%	7.30	19%	4.30	18%	3.90			26%	6.00
Total	7%	13	17%	30	17%	31	36%	64	12%	21	30%	53	20%	36	13%	24	2%	4	23%	41

* % Not including miles with "No Fisheries Significance"

Kemmerer Resource Area - Stream Habitat Inventory

1975 - 1977

CHANNEL STABILITY AND APPARENT STREAM HABITAT TREND

		WEIGHTED AVERAGE CHANNEL STABILITY			APPARENT STREAM HABITAT TREND			
DRAINAGE	RATED MILES	PRESENT	POTENTIAL	AVERAGE % IMP	MILES STABLE	% STABLE	MILES DECLINING	% DECLINING
Smiths Fork	23.90	98.4	89.5	9.0%	7.40	31%	16.50	69%
Thomas Fork	23.80	104.7	87.7	16.2%	6.50	27%	17.30	73%
Hams Fork	34.05	102.0	94.2	7.6%	14.00	41%	20.05	59%
Blacks Fork	8.45	89.8	83.8	6.6%	1.40	17%	7.05	83%
Bear River	15.45	107.2	96.1	10.4%	9.20	60%	6.25	40%
Slate Creek	15.00	95.2	92.0	3.4%	7.70	52%	7.30	48%
Area Total	121	*101 (Low Fair)	*91 (High Fair)	10%	46	38%	75	62%

* Weighted Average

Kemmerer Resource Area - Stream Habitat Inventory

1975 - 1977

RIPARIAN HABITAT ON NRL STREAMS

DRAINAGE	RATED MILES NRL	ACRES RIPARIAN HABITAT	AVERAGE ACRES RIPARIAN HABITAT/MILE	GOOD MILES	GOOD %	FAIR MILES	FAIR %	POOR MILES	POOR %	V. NONE MILES	V. NONE %
Smiths Fork	23.90	124.2	5.2	8.15	34%	7.35	31%	5.90	25%	2.50	10%
Thomas Fork	23.80	74.8	3.1	2.50	11%	3.20	13%	15.35	64%	2.75	12%
Hams Fork	34.05	144.7	4.2	11.60	34%	12.10	36%	8.10	23%	2.25	7%
Blacks Fork	8.45	91.4	10.8	5.90	70%	1.95	23%	0.60	7%		
Bear River	15.45	35.2	2.3	0.90	6%	5.30	34%	4.30	28%	4.95	32%
Slate Creek	13.3	37.2	2.8	5.30	40%	4.25	32%	1.25	9%	2.45	19%
Area Total	119	508	4.3	34	29%	34	29%	36	30%	15	13%

* **Average**

Kemmerer Resource Area - Stream Habitat Inventory

1975- 1977

BEAVER PONDS

DRAINAGE	MILES INVEN	# PONDS	AVERAGE #/MILE	AVG. SIZE (ft^2)	AVG. SIZE ACRES	# ACTIVE	# INACTIVE	# SILTED	# NOT SILTED	# FRESH WATER	# STAGNANT	# FISH BLOCKS	AVG. MAX DEPTH (ft.)
Smiths Fork	36.60	143	3.9	821	0.02	52	91	115	28	132	11	98	1.5
Thomas Fork	37.95	60	1.6	971	0.02	47	13	54	6	53	7	29	2.7
Hams Fork **	51.60	363	7.0	1442	0.03	206	154	355	5	330	30	187	2.1
Blacks Fork	12.35	83	6.7	822	0.02	59	24	83		81	2	31	2.2
Bear River	38.20	2	0.05	1515	0.03	1	1	2		2		2	3.0
Slate Creek	28.80	57	2.0	No Data Available		--	----	----	----	-----	----	----	------
Area Total	206	708	3.4	*1182	*0.03	381	283	609	39	598	50	347	*1.9

* **Weighted Average**

** No Data for Three Ponds

Memo On Techniques of Analysis

The procedures and criterion by which several conclusions were reached in the following Aquatic Unit Resource Analysis are explained below:

1. On the drainage summary table, note that "inventoried streams" may not have been inventoried for their entire length. Generally, small isolated sections were not inventoried, as effective management of these areas would be impractical. Consult the fisheries habitat overlay to determine what miles of stream have been inventoried.

2. More miles were field inventoried than were rated for channel stability. Consult the fisheries habitat and channel stability overlays to determine the areas of stream that have been surveyed.

3. To determine an overall drainage rating for channel stability. Riparian Habitat Quality, and average beaver pond size, a weighted average was used. This technique involves multiplication of each stream's average condition on the habitat measure (channel stability, etc.) by number of miles (for Channel Stability and Riparian Habitat) or ponds (for average pond size) used to calculate the stream's average. These products are then summed for all streams in the drainage and divided by the total number of miles in the drainage which have been rated for riparian habitat or channel stability, or the total number of beaver ponds. This figure, the weighted average gives the best estimate of the average condition within the drainage because each reach of stream influences the magnitude of this rating, proportional to the percentage of the total drainage habitat which is contained on the stream.

4. Several points need to be clarified with regard to the Riparian Habitat Table. First, is the fact that the NRL miles listed are only the stability rated miles for each stream. This is because riparian habitat was only inventoried when a channel stability form was filled out (see also Memo #2). Second, Riparian Habitat condition was determined by the following criteria. From each channel stability form the numerical rating for "Bank Protection From Vegetation" was added to a number determined by the width of the riparian zone. If the total riparian zone width (both banks) was less than 10 feet, a rating of 4 points was given. A riparian zone width of 10-19 feet rated 3 points, 20-39 feet rated 2 points, and greater than 40 feet in width rated 1 point. The sum of this width-based rating and the channel stability rating for bank protection determines the overall rating for the reach of stream covered by the particular stability form within the following point spread.

Total Points	Riparian Habitat Condition
5-7	Good
8-10	Fair
11-13	Poor
14-16	Virtually None

To determine the percentage condition for the entire stream, all of the channel stability forms are rated for Riparian Habitat in this manner and the miles of stream in each condition category are summed. The percentage of the stream's total surveyed NRL miles in a particular riparian habitat condition (good, fair, poor or virtually none) is the result tabulated.

It should be noted that this method of rating takes into account the plant density, vigor, species composition and diversity (all built into the "Bank Protection from vegetation" rating on the channel stability form) and riparian zone width in determining the habitat condition.

5. Habitat trend, the projected stable or declining status of habitat quality with regard to aquatic species, has been determined in the following manner. The determination of trend is keyed to the stream's channel stability rating. The reason for this is that the channel stability gives an indication of the degree to which the erosion of a particular area is accelerated beyond the slow, gradual process considered natural from a habitat management standpoint. Thus, almost without exception, if the channel stability rating of a particular reach of stream increases (gets worse), we can expect a corresponding decrease in the quality of aquatic habitat. Based largely on this line of reasoning, the following three categories for determining habitat trend have been formulated:

    A. Channel Stability $\geq$ 115: Habitat Stable

    B. Channel Stability 77-114: Habitat Stable, unless:

        1. bank protection from vegetation $\geq$ 9 (as rated on channel stability form)

        2. ungulate damage $\geq$ 20% (also consider ungulate stability, if known)

        3. recently washed-out beaver ponds are present

4. cutting _ 12 (from channel stability form)

5. mass wasting _ 9

C. Channel Stability _ 76: Habitat Stable, unless:

1. bank protection from vegetation _ 7

2. ungulates damage _ 10%

3. recently washed-out beaver ponds present

4. cutting _ 9

5. mass wasting _ 7

NOTE: The stream narratives should be consulted for further information in making a final determination of habitat trend.

The logic behind this system of determination runs as follows:

First, streams with a channel stability rating greater than 114 are already eroding at an accelerated rate. Conditions on these streams generally are so poor that they would be unlikely to get much worse. On this basis such stream reaches are classified as stable. But note that this categorization holds true only for the generalized stream. It is possible, though not likely, for a stream to be in poor condition with regard to most of its physical features, yet to still provide some fair or good aquatic habitat such as spawning sites. In these few cases the habitat quality would not be stable, but would decline, as the accelerated erosion quickly made its impact. Cases such as these emphasize the importance of not relying too strictly on the fixed criterion listed in the preceding table, but of looking at all the information available, particularly the stream narrative.

Category B considers streams which are in fair condition at present. These streams are considered unstable if any of five key factors are present. These factors were chosen as trend indicators because they act as key initiators in determining the future of the stream. That is, if one of these key factors is in poor condition, it tends to set in the rating of other factors and the stream in general. For example, if a stream is in fair condition, but has a lot of mass wasting, the mass wasting will lead to cutting, deposition and the stream's overall channel stability and habitat quality will decline.

The same line of reasoning holds true for Category C, streams with channel stability ratings of less than 77. The only difference is that here, the quality of the key factors needn't be as significant to initiate a general decline. This is because such streams are essentially free of problems at present and thus are more sensitive to any disturbance which would occur.