[1984 Unpublished]

Dr. B.,
Kurt Fausch has a set of the slides for this presentation.
The concept herein builds on the sub-Basin working model I built for the Kharuna River/Reservoir (E. central W. P. India 71-73) system, & what I used to call ... Static/Dynamic Beaver trout associations", but what are known as "Source/Sink" systems in current jargon, today. (India + Wyo. = Col. R. Basin (explained in my note)
BS

Bone Draw: RIPARIAN REHABILITATION FOR DEVELOPMENT OF A SEASONAL SPORT FISHERY

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Bureau of Land Management
P.O. Box 1869
Rock Springs, Wyoming 82902-1869

ABSTRACT

Riparian rehabilitation, stream habitat improvement, and experimental trout stocking have created suitable conditions for establishment of a seasonal ~~[illegible]~~ ADFLUVIAL trout run, in an otherwise unfavorable cold desert stream system.

INTRODUCTION

(P-1) Bone Draw is an ephemeral tributary of the Big Sandy River, located five miles southwest of Eden, Wyoming. (Figure 1.) Most of the runoff in this drainage originates as seasonal irrigation return flow from the Farson/Eden Reclamation Project. (P-2) Traversing cold desert sagebrush plains, along the western boundary

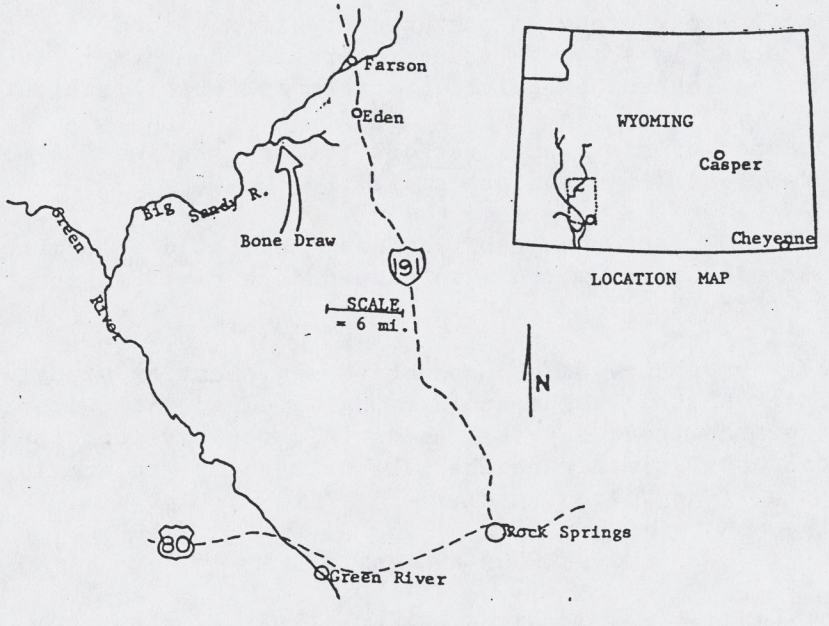


FIGURE 1. Location map of Bone Draw

[1] Presented to the American Fisheries Society/Wildlife Society Chapter Joint Meeting, February 8, 9, 10, 1983 Logan, Utah.

of Wyoming's Red Desert, neither Bone Draw nor the Big Sandy River would have been considered as typical trout streams. On Bone Draw however, the last three quarters of a mile are unique, as several alkaline spring seeps surface in this reach and generate a perennial flow of 0.5 to 1.0 cubic feet per second. (P-3) Generally wide, shallow and heavily silted, this lower reach and the Big Sandy River received intensive livestock trampling, due to season long grazing.

BACKGROUND

(P-4) While performing raptor inventories of the Big Sandy River, during the spring of 1976, survey crews reported the occurrence of "Kokanee salmon" (Oncorhynchus nerka) near the Bone Draw confluence. Familiar with the annual spring run of flannelmouth suckers (Catostomus latipinnis), Bureau biologists investigated, but could find no evidence of salmonids in either Bone Draw or the Big Sandy River. (P-5) In 1977, a few trial rock and log overpours were constructed in the lower reach of Bone Draw, with the thought that these mystery fish might, in the future, move into Bone Draw and utilize this developed pool habitat. (P-6) With wide fluctuations in runoff and unstable banks, these structures were washed out in short order and only non-game fish were observed the following spring. In 1978, Bureau managers approved initiation of a Bone Draw riparian and stream habitat recovery project, as an effort to promote cooperative public information and education programs for riparian habitat management.

Key aspects of this program included the following: (P-7)

1. Fencing of four riparian pastures (two forty acres and two twenty acres in size) in order to provide rest from livestock grazing and enhance vegetative streambank stabilization.

2. Performance of riparian livestock grazing studies in two pastures (one large and one small).

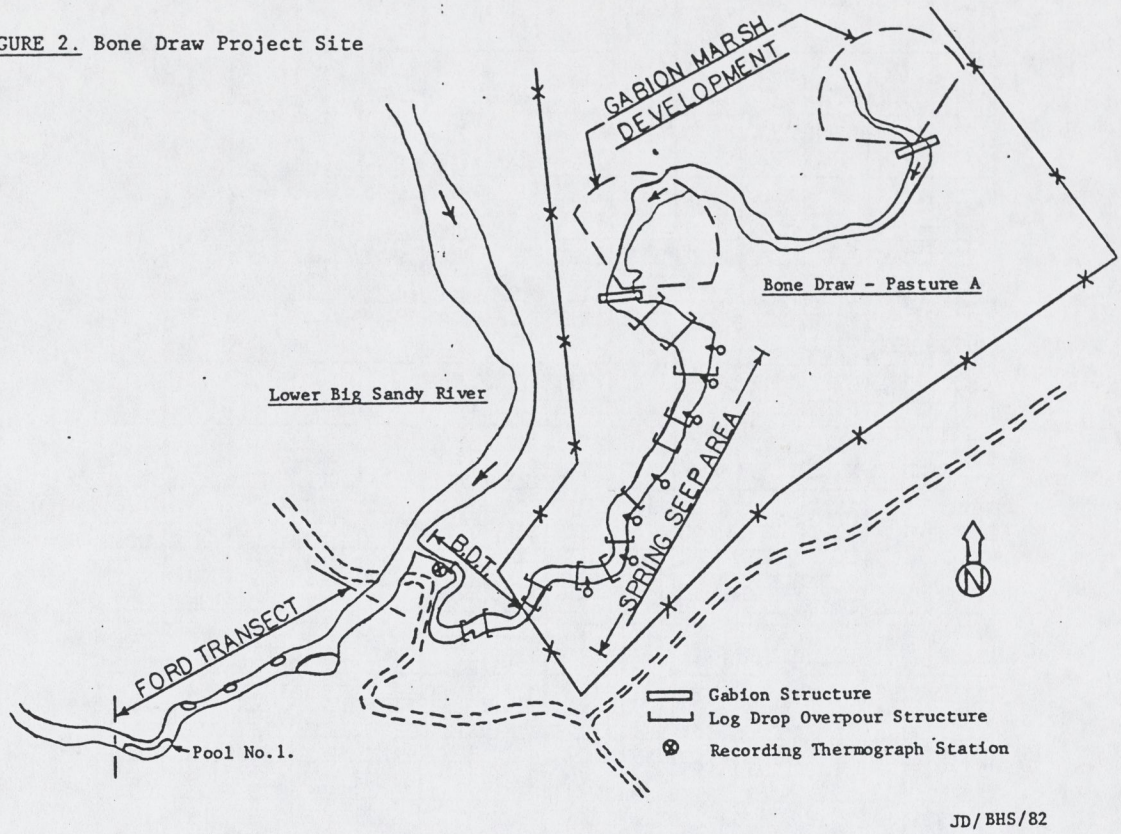
3. (P-8, 9, 10) Performance of instream habitat development in one large pasture, which also served as a riparian control unit. (Figure 2.)

4. (P-11) Performance of a cooperative egg planting study with the Izaak Walton League and Wyoming Game and Fish Department, to determine trout survival potentials for development of a salmonid run, similar to the Lake McConaughy project in Nebraska. (Van Velson, n.d.)

METHODS AND MATERIALS

(P-12) Initially, Izaak Walton members received 5,000 rainbow (Salmo gairdneri) sac fry (the eggs hatched just prior to planting) from the Wyoming Daniel fish hatchery. (P-13) Whitlock Vibert Boxes were then utilized (Whitlock, 1977) to perform an egg

FIGURE 2. Bone Draw Project Site



survival study within the improved reaches of Bone Draw. (P-14) After charging and tempering, river run gravel and (P-15) the Vibert boxes were placed in 0.5 cubic foot wire baskets, (P-16) in stream locations with optimum flows. These artificial redds were used due to poor bottom composition, consisting of two dimensional sandstone gravels and large amounts of fines, within Bone Draw. (P-17) Prior to swim up, algae growth, (P-18) low flows, (P-19) high flows, (P-20) and sedimentation, all took their toll. (P-21) Fortunately however, half of the Vibert boxes were successful. (P-22) Despite packing of exterior gravels by sand, approximately 50% survival was observed. (P-22) By the fall, five months later, these fish averaged four inches in length. (P-23) Subsequently, in 1979, swim up fry and in 1980, two inch fin clipped McConaughy fingerlings, were planted directly to the stream, in order to overcome sedimentation related mortality problems. (P-24) Planting of the McConoughy rainbow fingerlings in May of 1980, resulted in growth to an average length of seven inches, by November. (Figure 3.)

In addition, numerous unmarked rainbow and brown trout (Salmo trutta) began to appear in Bone Draw at this time as well. (Figure 4). (Smith & Dunder, 1981)

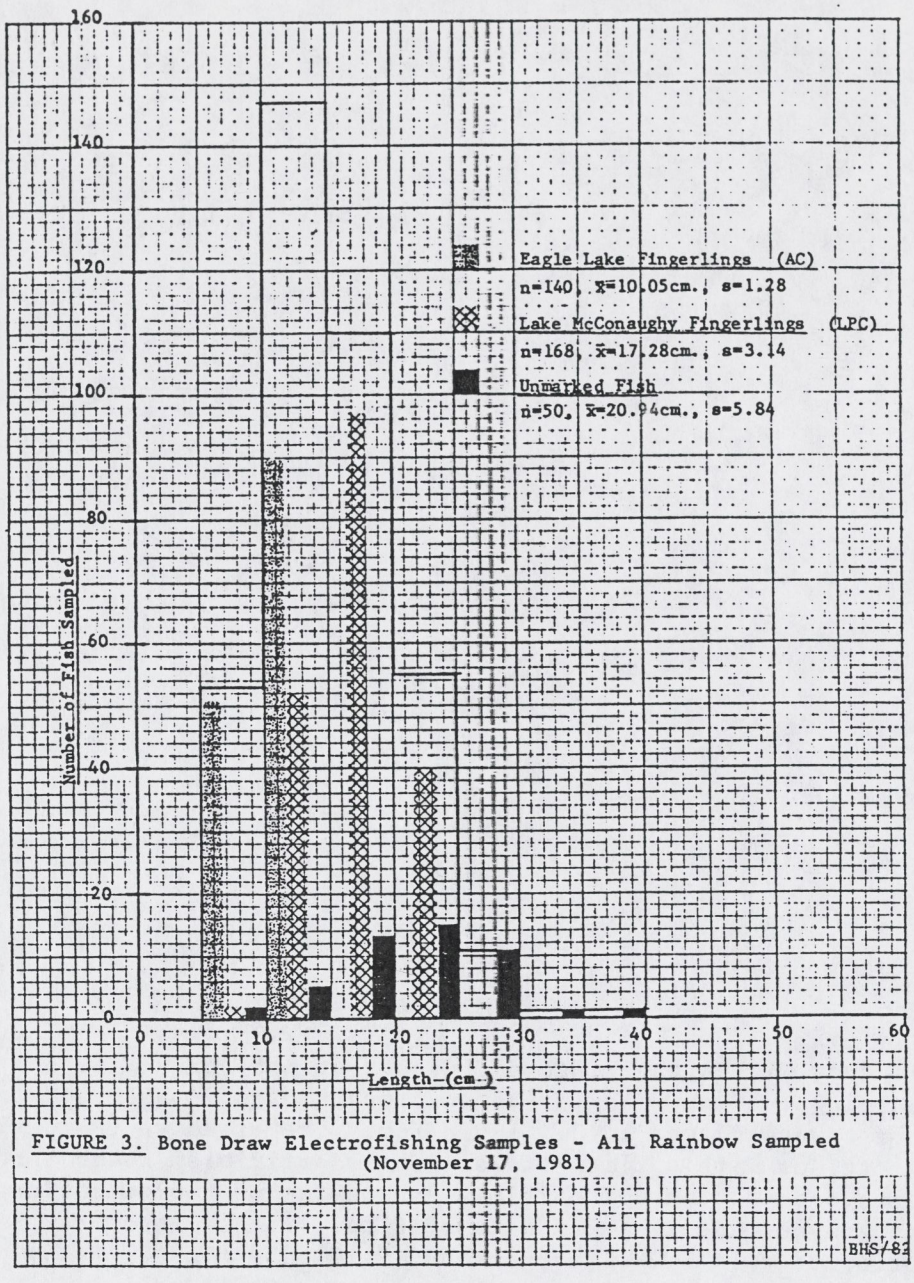


FIGURE 3. Bone Draw Electrofishing Samples - All Rainbow Sampled (November 17, 1981)

(P-25) Subseqently, in 1981, 1982 and 1983, an increasing amount of rainbow spawning activity was becoming noticeable within the improved reaches of Bone Draw. (P-26) Therefore, more river run gravel was added to the stream, in areas of observed spawning activity. (P-27) However, large amounts of fines still presented a major problem for successful natural reproduction. Additionally, the high conductivity of Bone Draw (1,000 to 2,500 micromhos) caused some question as to whether natural fertilization could be achieved.

(P-28) At this point, we were also working on development of "Lang's Pond Spawning Box". A device which, when filled with

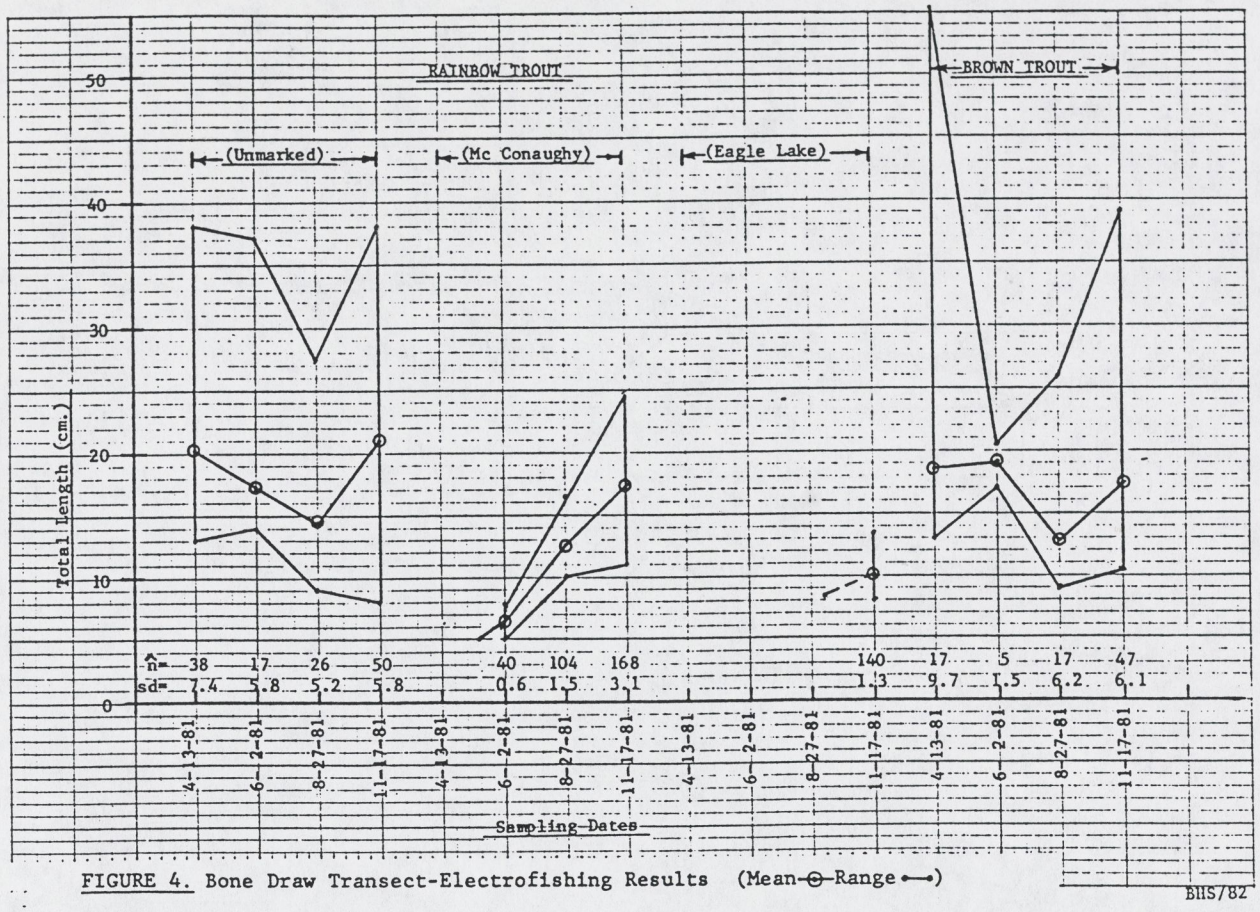


FIGURE 4. Bone Draw Transect-Electrofishing Results (Mean-⊖-Range •—•)

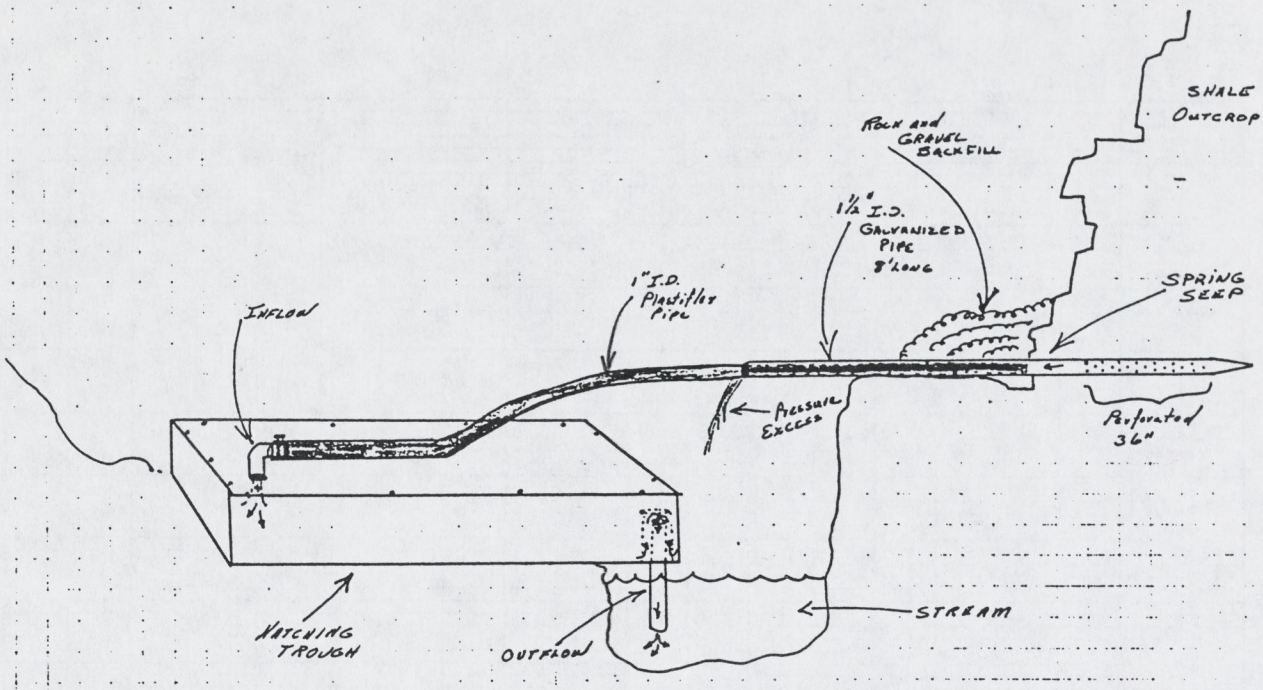
BHS/82

gravel, placed in a pond (P-29) and coupled to a developed spring, might enable natural salmonid reproduction in an otherwise unsuitable habitat. (P-30) This basic concept was then slightly modified (P-31) for development of our, "Bone Draw Hatching Box". (Illustration 1. and 2.)

This device was designed for fall placement (P-32) of Kokanee salmon or brown trout eggs and their subsequent winter hatching, (P-33) swim up and displacement directly into the stream, via a double drain pipe. (P-34) Primarily constructed of excess materials, for a total out of pocket cost of $12.50, this device has performed successfully to recorded winter temperatures of -28° F. During winter, when access to Bone Draw was limited to snowmobile travel, the "warmer" spring water feeding this device accelerated normal instream hatching and swim up time by approximately ninety days.

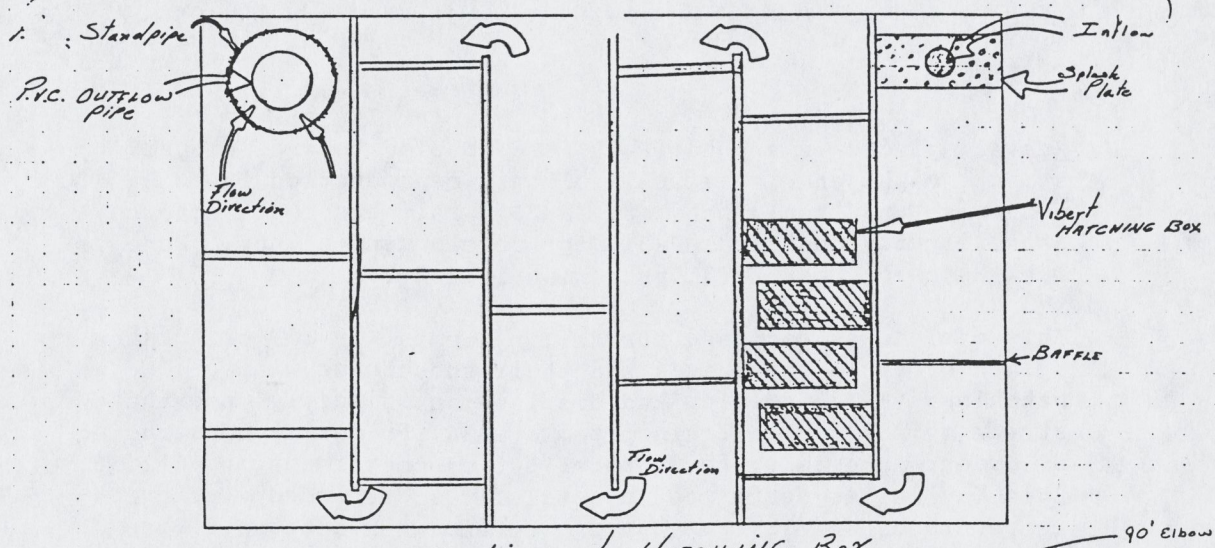
RESULTS

(P-35) Today, not only are flannelmouth suckers making their annual spring run up the Big Sandy River; they are also

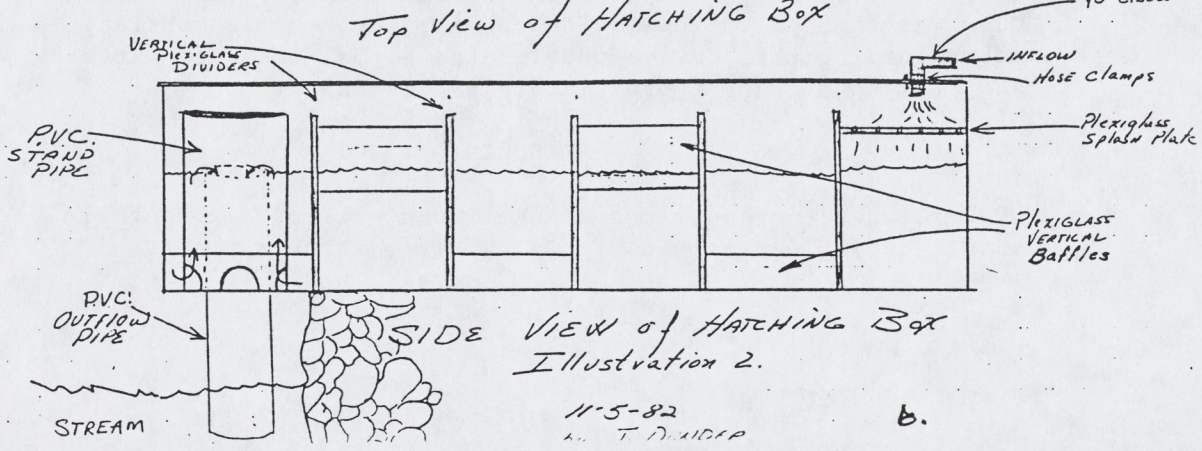


TROUT EGG HATCHING facility on BONE DRAW

11-5-1982
by J. DUNDER
Illustration 1.



Top View of HATCHING Box



SIDE VIEW of HATCHING Box
Illustration 2.

11-5-82
J. T. DUNDER

enjoying the company of increasing numbers of rainbow trout. (Figure 5.)

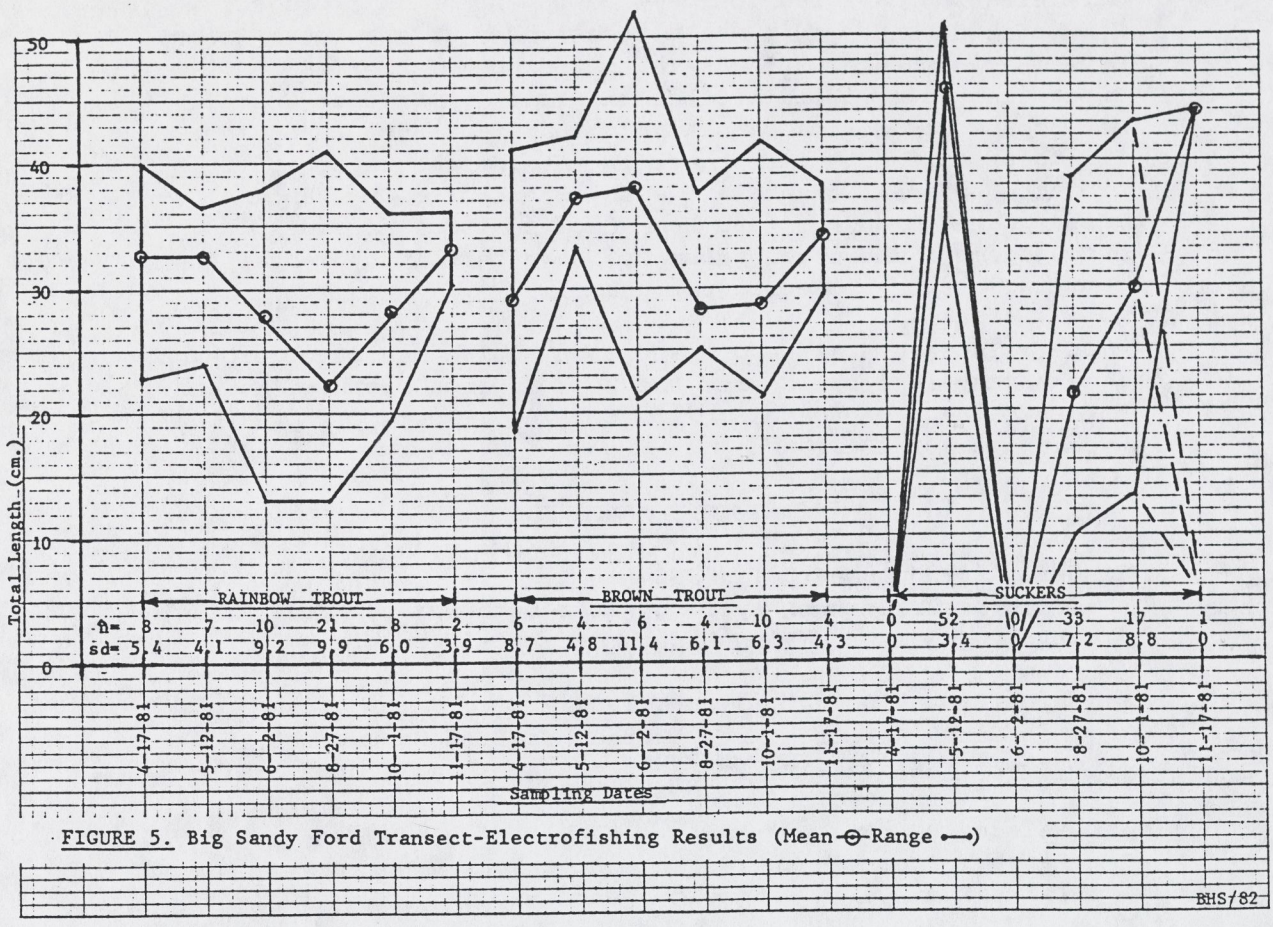


FIGURE 5. Big Sandy Ford Transect-Electrofishing Results (Mean-⊖-Range •—•)

Trout which have been recorded from one to four pounds, and reported up to six pounds. (P-36) In addition, brown trout are also making their appearance in Bone Draw, with young of the year being in evidence the past three summers.

DISCUSSION

(P-37) Today, Bone Draw is confirming our initial objective of "intensive management of a small area, for a maximum return". Besides providing the nucleus for a developing spring and fall salmonid run, up forty miles of the Big Sandy River, this little stream has developed quite a reputation of its own. Wyoming Game and Fish Department estimates in 1982 found a density of 2,046 trout per mile, with a standing crop of 313 pounds, per acre. (Conder, & Annear, 1982) Given our experiences with this "little muddy ditch, out in the desert", and the vast potentials for riparian and stream habitat improvement on other, "muddy ditches" throughout the west, there is no telling (P-38) what the future may hold in store.

ACKNOWLEDGEMENTS

The authors wish to express their thanks and appreciation to all of the Bureau managers and personnel whose total participation have led to the development of this project. Appreciation and credit are also extended to the Lower Green River Basin Chapter - Izaak Walton League of America, Sweetwater County Wildlife Association, Jim Bridger Council - Boy Scouts of America, and Wyoming Game and Fish Department, for their extensive assistance in the implementation of this project. Special thanks are also extended to Orv Landen, Dave Dufek, Jared Brandwein and Paul Cuplin, whose personal encouragement and ongoing support have been instrumental in carrying out the Bone Draw program.

(Note: This is a slide presentation, which may be obtained on a temporary loan basis from the Rock Springs District Manager, Bureau of Land Management, P.O. Box 1869, Rock Springs, Wyoming, 82902-1869.)

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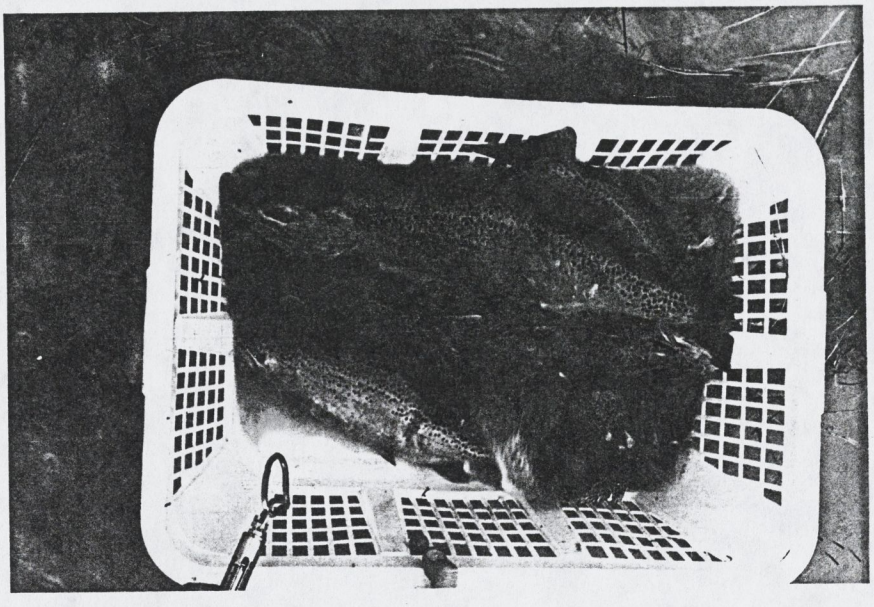
(Author's Note: The objective of on-site hatching boxes is to achieve the maximum survival possible, of a limited egg supply, by avoiding or minimizing natural in-stream mortality factors. Compared to typical natural in-stream egg hatching and survival rates of 10% to 50% in optimum situations, egg hatching boxes have achieved hatching rates of 95% on a consistent basis. In this design, behavioral conditioning of sac fry and swim up fry is achieved through the use of splash plates, flow baffles, large pieces of gravel placed on the bottom of the last two runs, and the amount of light penetration, which is controlled by the number and sizes of holes drilled in the plywood lid. Escape and automatic planting into the stream is achieved via a double concentric drain system which siphons fry off the bottom and drops them into the stream. Water depth and turnover times are controlled by adjusting the height of the inner/smaller drain pipe. For use in ponds, this box design is modified with a reverse filter backflushing system, which when filled with gravel and sunk to the pond bottom, simulates conditions similar to spring upwellings often found in corners of beaver ponds, which while limited in size, provide an excellent spawning site in an other-wise unfavorable or unsuitable environment.)

BONE DRAW

THEN (1978)



AND NOW. (1983)

TROUT UNLIMITED

FLAMING GORGE/LOWER GREEN RIVER CHAPTER

ROCK SPRINGS/GREEN RIVER, WYOMING

1250 WEST FOOTHILL BLVD.
ROCK SPRINGS, WYOMING 82901
(307) 382-4857 or 875-6350

March 3, 1998

Bruce Smith
Fisheries Biologist
Salmon National Forest
Box 729
Salmon, Idaho 83467

RE: A record of the "old refrigerator" streamside incubator for hatching trout and salmon eggs.

Dear Bruce,

Enclosed is a breakdown of all of our egg hatching using the "old refrigerator" type of streamside incubator since we started this particular project in 1987. We have hatched out over 7 million eggs in ten years including eight different species/strains of trout and one species of salmon using this method. Some of the lower hatching rates were from green eggs, e.g., Kokanee at 33%. We would encourage using eyed eggs from State or Federal hatchery systems. With eyed eggs, the hatching success can consistently be over 90 and 95%. We consider it a very simple and inexpensive yet reliable and effective technique for hatching trout and salmon eggs of any species. The principles would be the same, even for different species.

An old refrigerator streamside incubator unit costs about $50.00 each for parts only. We have made more portable units out of "Coleman" coolers as well. But of course, they are smaller. An old refrigerator type, depending on its size can hold from about 40,000 to 90,000 eggs per unit at each hatch. A cooler type holds about 10,000. In other words, a Whitlock-Vibert box holds about 1,000 eggs, and then it depends on how many W-V boxes can fit loosely into the refrigerator or cooler.

We have shared this technique with others who have used it successfully also. The Wyoming Game and Fish Department now supplies eggs to several TU cooperative efforts in Laramie, Jackson, Casper, ours at Bone Draw and maybe others. It will be used this spring in Pinedale with Colorado River Cutthroat trout eggs. The Shoshone-Bannock tribes out of Ft. Hall, Idaho have been very successful with this technique on many tributaries hatching steelhead and possibly Chinook salmon eggs. Don Duff, the USFS-TU National coordinator, has several sites and cooperators with whom he works hatching out Bonneville Cutthroat trout in Utah. A TU chapter in Texas hatches Brown and Rainbow trout eggs on the Guadalupe River. In the last couple of years we have shared this concept with a BLM office in Dillon Montana for use with West Slope Cutthroat and a Natural Resources Conservation office in Weaverville, California, although we do not know how they are doing. And just a few days ago, we were asked to come to Nevada in a few weeks to help set up two "old refrigerators" for use with Lahontan Cutthroat trout eggs. As you can see, this technique has widespread acceptance and application for a variety of trout and salmon species in a multitude of situations.

Enclosed also is a pie graph demonstrating how we maximize just one hatching box. Since we use spring water which has a constant water temperature of 44^{o} F, and since (through

WG & F hatchery division) various species of trout and salmon that we use spawn from early fall through late spring, we can hatch eggs all winter long out of one hatching box. While this is very useful for our situation, it may not be useful for a T & E species, where only one trout species may be desirable.

In any event, in whatever manner you can find application for the "old refrigerator" streamside incubator, we would encourage you to stress this point to others: This is a good way to kick start a trout or salmon population and buy about four year's worth of time to get watershed problems solved so that return spawners can run the river and spawn naturally and successfully as they were designed to do from the beginning. At no time should this method ever be used to replace proper watershed management. We should all be in the business of repairing the watershed, and not just hatching trout or salmon eggs.

We hope this has been of help to you. If you have further questions, please feel free to call.

Respectfully,

Fred L. Eales DVM
Chairman, Resource Management and Protection Committee

enclosures

TROUT UNLIMITED

RESOURCES COMMITTEE

FLAMING GORGE/LOWER GREEN RIVER CHAPTER

ROCK SPRINGS/GREEN RIVER, WYOMING

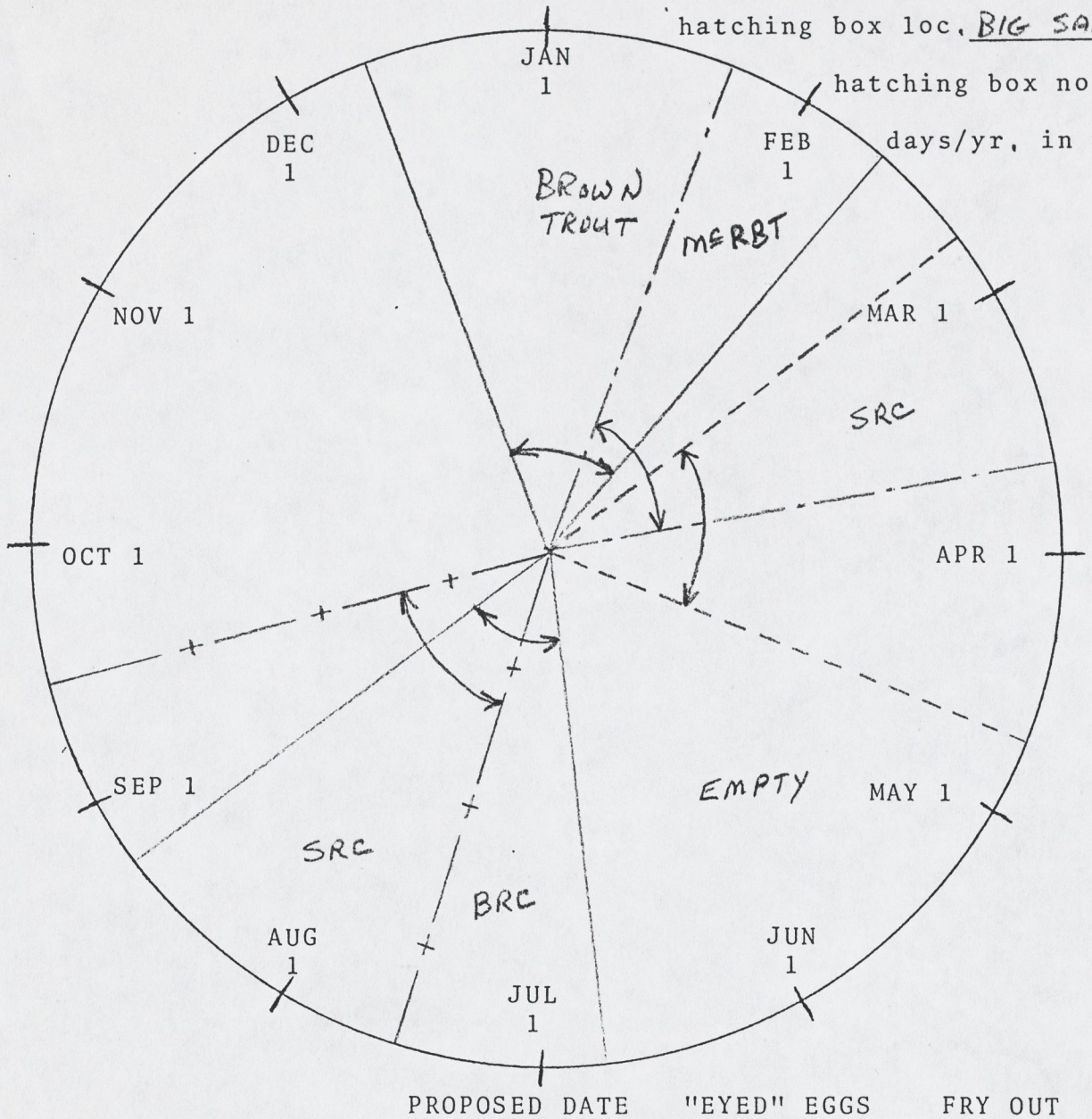
BIOLOGICAL TIMING PLAN

plan year(s) 1996-97

hatching box loc. BIG SANDY R.

hatching box no. 3

days/yr. in use 215



Spp. TROUT/SALMON	PROPOSED DATE "EYED" EGGS IN	"EYED" EGGS ACTUALLY IN	FRY OUT (≅60 DAYS)	NO. EGGS
1. BROWN TROUT		DEC. 10, 1996	FEB. 10	85,756
2. McCONAUGHY RAINBOW TROUT		JAN. 23, 1997	MAR. 23	100,660
3. SNAKE RIVER CUTTHROAT TROUT (AUBURN)		FEB. 22, 1997	APR. 22	66,402
4. BEAR RIVER CUTTHROAT TROUT		JUN. 26, 1997	AUG. 26	10,431
5. SNAKE RIVER CUTTHROAT TROUT (BAR BC)		JUL. 16, 1997	SEPT. 16	33,909
6.				

RESOURCES COMMITTEE

FLAMING GORGE/LOWER GREEN RIVER CHAPTER

ROCK SPRINGS/GREEN RIVER, WYOMING

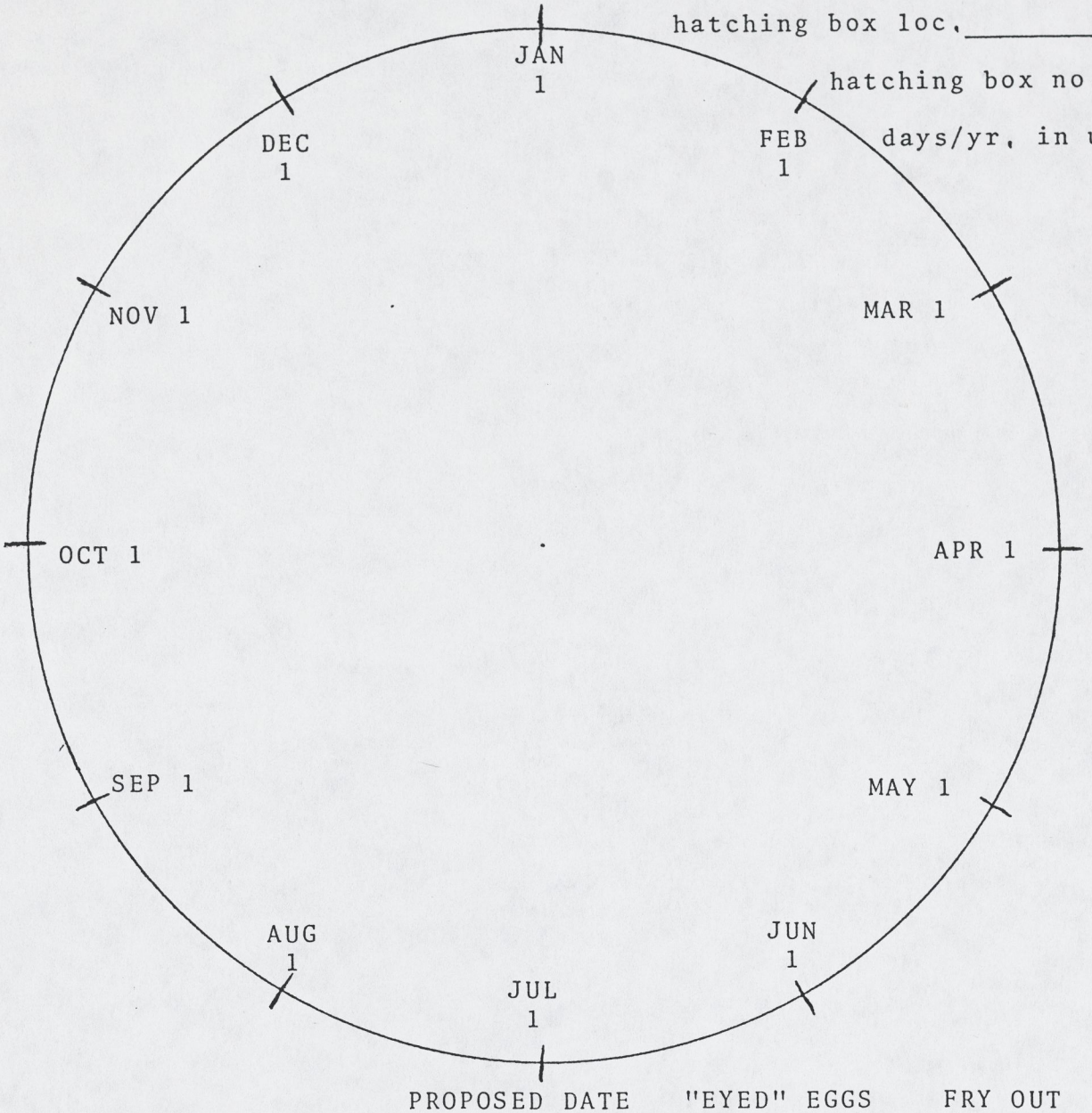
BIOLOGICAL TIMING PLAN

plan year(s)_____

hatching box loc._____

hatching box no._____

days/yr. in use____



Spp. TROUT/SALMON	PROPOSED DATE "EYED" EGGS IN	"EYED" EGGS ACTUALLY IN	FRY OUT (≅60 DAYS)	NO. EGGS
1.				
2.				
3.				
4.				
5.				
6.				

FLAMING GORGE/LOWER GREEN RIVER
TROUT UNLIMITED

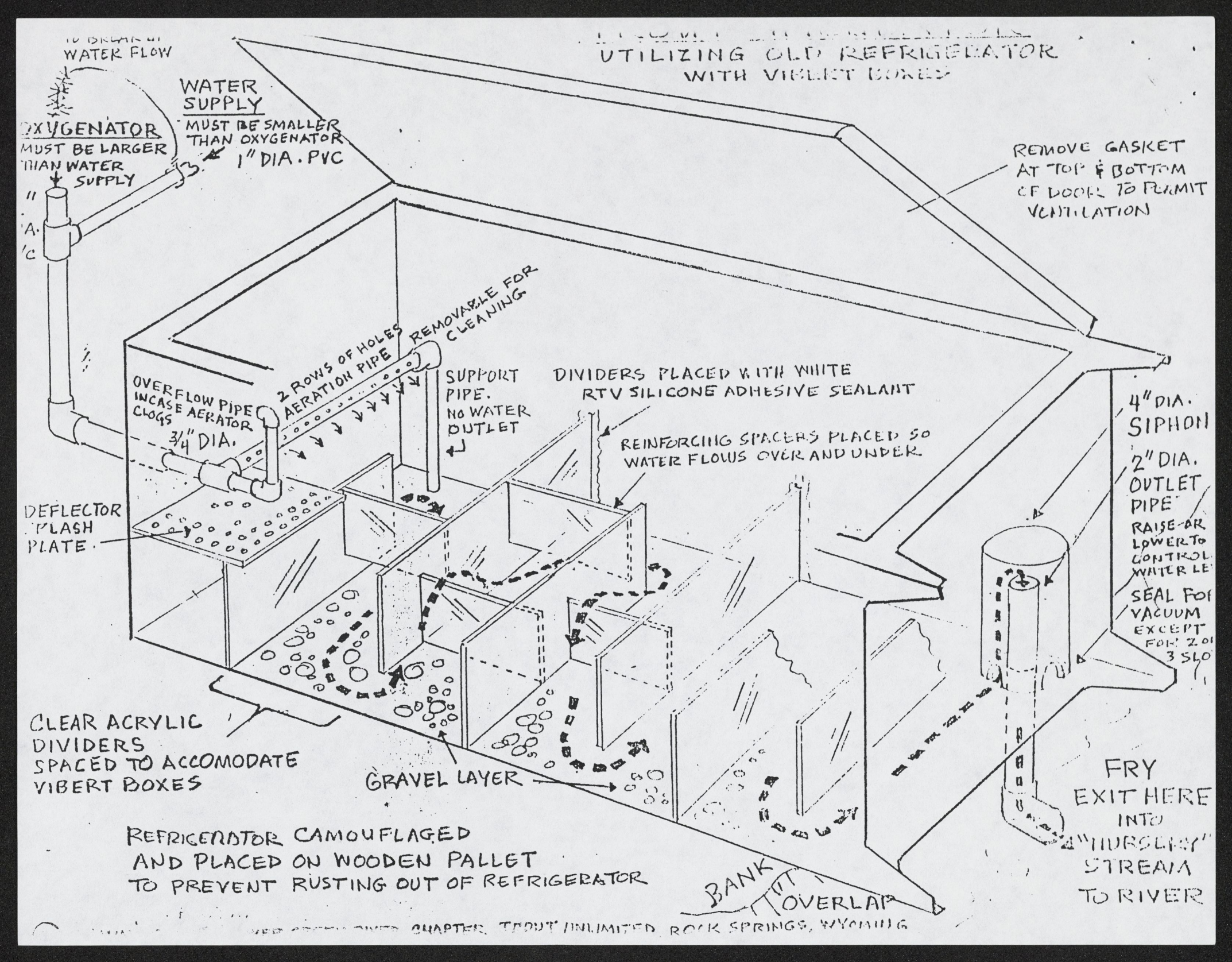
FISH EGG HATCHING SUMMARY

SPECIES	Eggs Received	Dead Eggs	Eggs Hatched	Hatch Success
1987/1988 Season				
Brown	9120	347	8773	96.20%
Kokanee	12000	8040	3960	33.00%
Snake River Cuts	31160	1371	29789	95.60%
Eagle Lake Rainbow	14168	2125	12043	85.00%
Kemmerer City Rainbow	9280	93	9187	99.00%
Bear River Cuts	51300	1158	50142	97.74%
Total 87/88 Season	**127028**	**13134**	**113894**	**89.66%**
1988/1989 Season				
Kokanee	42000	14679	27321	65.05%
Brown	50406	1512	48894	97.00%
Snake River Cuts	109000	3921	105079	96.40%
Kemmerer City Rainbow	166250	19976	146274	87.98%
Bear River Cuts	100476	3474	97002	96.54%
Eagle Lake Rainbow	108284	38169	70115	64.75%
Total 88/89 Season	**576416**	**81731**	**494685**	**85.82%**
1989/1990 Season				
Brown	67951	680	67271	99.00%
Kokanee	525250	79948	445302	84.78%
Snake River Cuts	74000	6960	67040	90.59%
Bear River Cuts	54455	1621	52834	97.02%
Eagle Lake Rainbow	34272	960	33312	97.20%
Snake River Cuts (BBC)	168083	69345	98738	58.74%
Total 89/90 Season	**924011**	**159514**	**764497**	**82.73%**
1990/1991 Season				
Fall Spawn Rainbow	69777	11371	58406	83.70%
Brown	20000	120	19880	99.40%
Kokanee	22000	3080	18920	86.00%
Snake River Cuts	10800	799	10001	92.60%
McConaughy Rainbow	65116	9767	55349	85.00%
Eagle Lake Rainbow	178521	9246	169275	94.82%
Bear River Cuts	53827	1916	51911	96.44%
Yellowstone Cuts	224141	46455	177686	79.27%
Total 90/91 Season	**644182**	**82754**	**561428**	**87.15%**
1991/1992 Season				
Fall Spawn Rainbow	293525	6392	287133	97.82%
Snake River Cuts	184008	6452	177556	96.49%

McConaughy Rainbow	273290	75095	197995	72.45%
Yellowstone Cuts	162885	61009	101878	62.54%
Total 91/92 Season	**913708**	**149148**	**764560**	**83.68%**
1992/1993 Season				
Snake River Cuts	291756	6075	285681	97.92%
McConaughy Rainbow	49200	2460	46740	95.00%
Yellowstone Cuts	211004	13770	197234	93.47%
Bear River Cuts	171772	42340	129432	75.35%
Total 92/93 Season	**723732**	**64645**	**659087**	**91.07%**
1993/1994 Season				
Brown	191050	51134	139916	73.24%
McConaughy Rainbow	56142	2030	54112	96.38%
Snake River Cuts	672854	62327	610527	90.74%
Snake River Cuts (BBC)	165795	2932	162863	98.23%
Eagle Lake Rainbow	48708	9741	38967	80.00%
Bear River Cuts	234642	4295	230347	98.17%
Total 93/94 Season	**1369191**	**132459**	**1236732**	**90.33%**
1994/1995 Season				
Brown	62511	875	61636	98.60%
Snake River Cuts	850268	126197	724071	85.16%
McConaughy Rainbow	50736	600	50136	98.82%
Total 94/95 Season	**963515**	**127672**	**835843**	**86.75%**
1995/1996 Season				
Brown	326153	6594	319559	97.98%
McConaughy Rainbow	50006	2528	47478	94.94%
Eagle Lake Rainbow	631681	24109	607572	96.18%
Snake River Cuts	108036	14525	93511	86.56%
Total 95/96 Season	**1115876**	**47756**	**1068120**	**95.72%**
1996/1997 Season				
Brown	140404	2352	138052	98.32%
McConaughy Rainbow	112164	4250	107914	96.21%
Snake River Cuts	186558	5968	180590	96.80%
Eagle Lake Rainbow	27200	1330	25870	95.11%
Bear River Cuts	10431	300	10131	97.12%
Snake River Cuts (BBC)	33909	630	33279	98.14%
Total 96/97 Season	**510666**	**14830**	**495836**	**97.10%**
1997/1998 Season (as of 1/26/98)				
Brown	12126	220	11906	98.19%
Fall Rainbow	137552	2693	134859	98.04%
McConaughy Rainbow	101707	2910	98797	97.14%

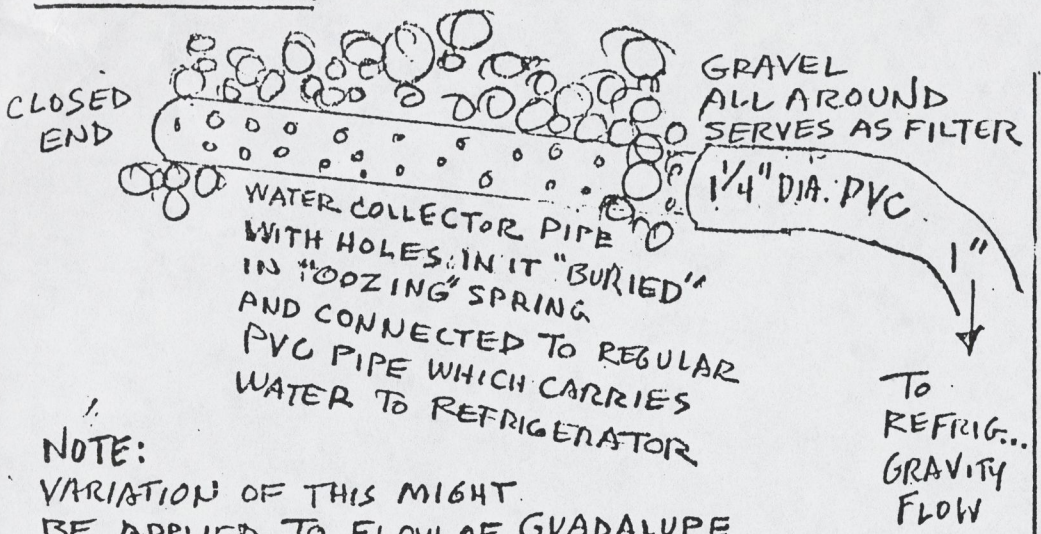
Total 97/98 Season	**251385**	**5823**	**245562**	**97.68%**
GRAND TOTAL	**8119710**	**879466**	**7240244**	**89.17%**

2/18/98 Snake River Cuts	44515	In boxes hatching
2/18/98 Eagle Lake Rainbow	19992	In boxes hatching


UTILIZING OLD REFRIGERATOR
WITH VIBERT BOXES
TO BREAK UP WATER FLOW
WATER SUPPLY
MUST BE SMALLER THAN OXYGENATOR
1" DIA. PVC
OXYGENATOR
MUST BE LARGER THAN WATER SUPPLY
REMOVE GASKET AT TOP & BOTTOM OF DOOR TO PERMIT VENTILATION
2 ROWS OF HOLES AERATION PIPE
REMOVABLE FOR CLEANING
SUPPORT PIPE. NO WATER OUTLET
OVERFLOW PIPE INCASE AERATOR CLOGS
3/4" DIA.
DIVIDERS PLACED WITH WHITE RTV SILICONE ADHESIVE SEALANT
REINFORCING SPACERS PLACED SO WATER FLOWS OVER AND UNDER
4" DIA. SIPHON
2" DIA. OUTLET PIPE
RAISE OR LOWER TO CONTROL WATER LE
SEAL FOR VACUUM EXCEPT FOR 2 OR 3 SLO
DEFLECTOR SPLASH PLATE
CLEAR ACRYLIC DIVIDERS SPACED TO ACCOMODATE VIBERT BOXES
GRAVEL LAYER
FRY EXIT HERE INTO "NURSERY" STREAM TO RIVER
REFRIGERATOR CAMOUFLAGED AND PLACED ON WOODEN PALLET TO PREVENT RUSTING OUT OF REFRIGERATOR
BANK
OVERLAP
CHAPTER, TROUT UNLIMITED, ROCK SPRINGS, WYOMING

TYPES OF WATER COLLECTION

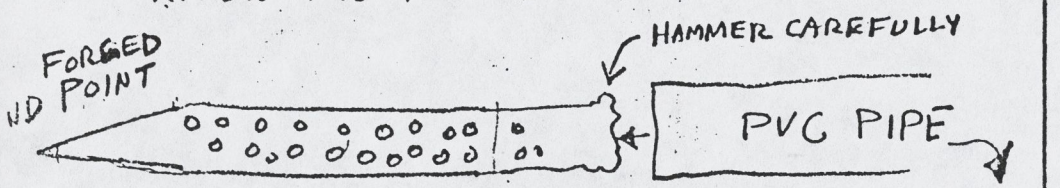
SPRING BOX



NOTE:
VARIATION OF THIS MIGHT BE APPLIED TO FLOW OF GUADALUPE FROM UPPER DAM AT KANZ LEASE

SAND ~~BOX~~ POINT

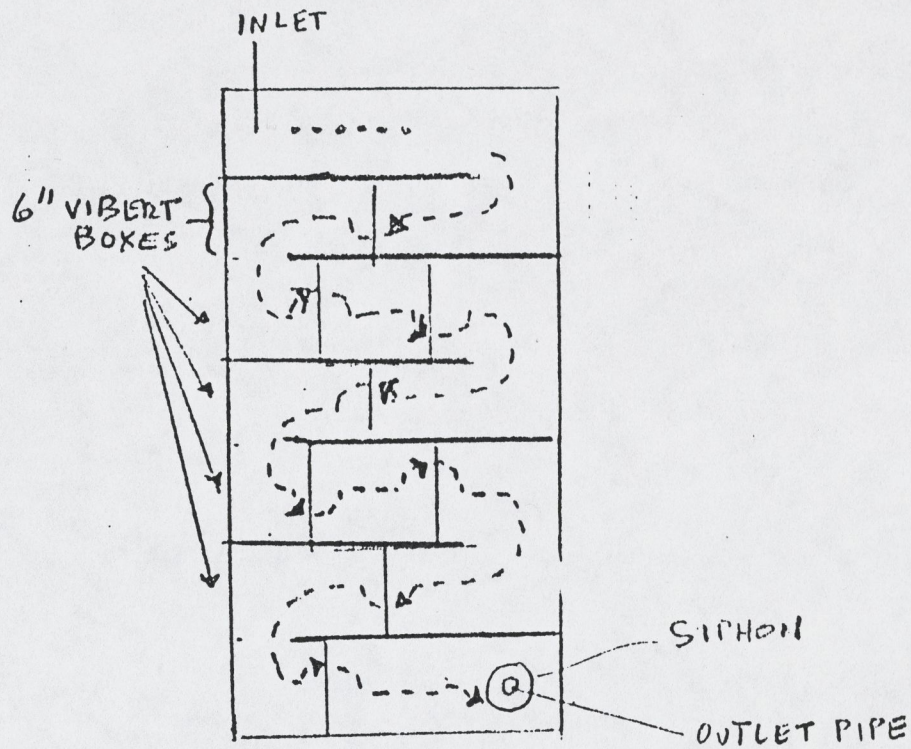
UTILIZING SAND POINT—A PERFORATED IRON PIPE WITH FORGED TIP DRIVEN INTO BURIED "OOZING" SPRING.



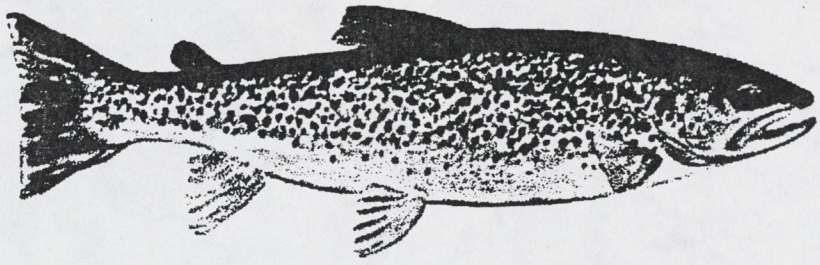
SLEDGE HAMMER INTO SPRING BUT DO SO CAREFULLY SO AS NOT TO DAMAGE DRIVING END TOO BADLY SO THAT PLASTIC PIPE CAN BE SLIPPED OVER

(SIZE AND NUMBER OF HOLES REQUIRED TO GET ADEQUATE FLOW OF WATER DETERMINES SIZE OF IRON PIPE)

TOP VIEW REFRIGERATOR



Summer



STREAMSIDE EGG INCUBATION

1997

Ed Galindo
Shoshone-Bannock Tribes

Ben Rinehart
Idaho National Engineering and Environmental Laboratory

TROUT RECOVERY DATA

SUMMER 97

Students Included In Project:
Michael Hanson
Chris Lenda
Breanne Anderson
Jessie Lovejoy

Report Written By:
Michael Hanson

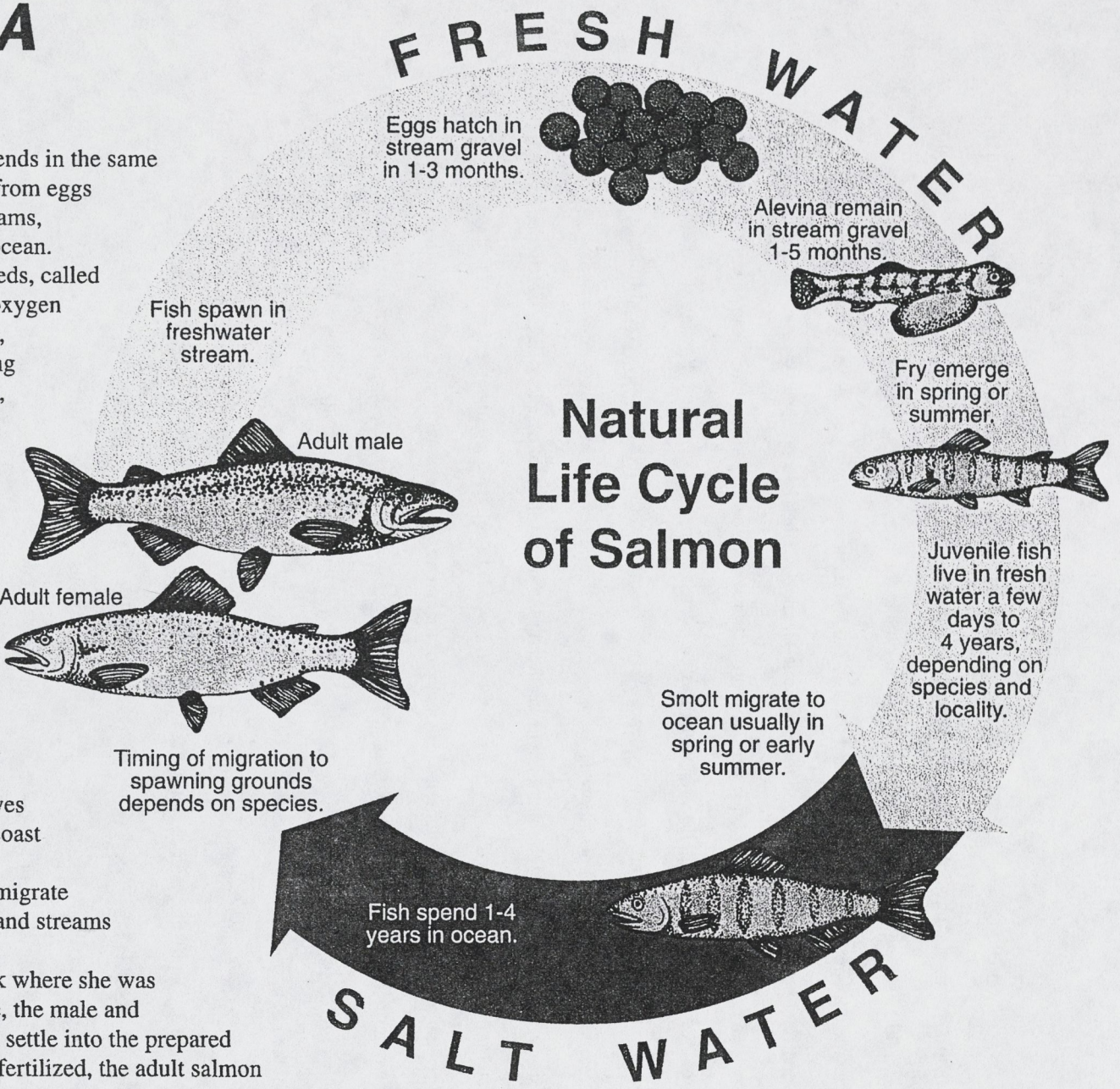
THE LIFE OF A SALMON

The life of wild salmon begins and ends in the same place—freshwater habitat. They hatch from eggs deposited, or spawned, in mountain streams, sometimes hundreds of miles from the ocean. The eggs incubate in gravel spawning beds, called redds, while clean, cold water delivers oxygen and washes away waste. After hatching, salmon rear in quiet pools, where shading vegetation moderates water temperature, provides streambank stability, and gives protection from predators.

Young salmon, or smolts, migrate from the rearing areas at about one year of age. They instinctively follow the creeks and rivers downstream during spring runoff and eventually reach the Pacific Ocean. As they travel, a physiological change occurs. This process, called smoltification, enables the young salmon to make the transition from fresh water to salt water.

Salmon spend most of their adult lives in the ocean, ranging along the Pacific coast from Monterey, California, north to the Aleutian Islands. After maturing, they migrate back home to spawn in the same rivers and streams where they were born.

The female, upon reaching the creek where she was hatched, digs a redd. Then, side by side, the male and female discharge sperm and eggs which settle into the prepared gravel. After the eggs are released and fertilized, the adult salmon die. The life cycle is complete.



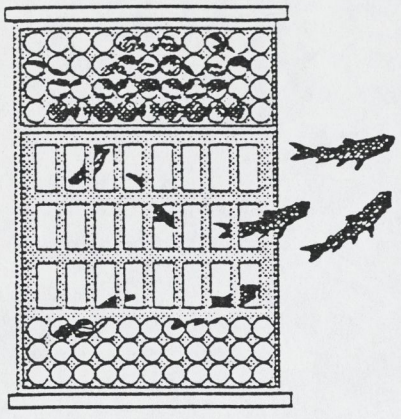
Something needs to be done to help save the dwindling numbers of trout and salmon returning to Idaho's steams to spawn. In 1995, Idaho Department of Fish and Game biologists predicted a run of 90,000 to 95,000 fish, which ranked in the lowest seven runs in the last 21 years. Many groups and individuals have become concerned with the salmon and trout counts, which are declining every year. In 1995, the U.S. Department of Energy helped fund the Shoshone-Bannock Tribes in a steelhead recovery project on Squaw Creek, a tributary to the Salmon River. This project proved to be very successful. A group of students at Shelley High School, in Shelley, Idaho, expressed interest in the project. The following summer a group of these students got involved with the Science Action Teams with the INEEL and received funding to experiment with hatching Rainbow Trout eggs using different streamside incubation methods.

The majority of the salmon and steelhead runs are made up of hatchery fish. Hatcheries rely on hatching large numbers at a hatch rate of between 75-85% to get just a small percentage of fish to return. Fish that are raised in fish hatcheries lose many of the natural instincts that it takes to survive in the wild. On the other hand, when wildlife biologists try to hatch eggs in artificial redds; they only achieve about a 50% hatch rate. The concept of streamside incubators tries to take the best of both worlds. The eggs would be hatched in a more natural, yet sheltered environment.

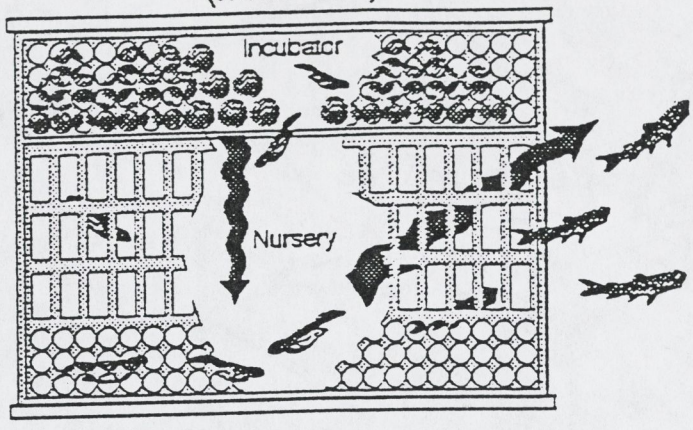
The group from the Shoshone-Bannock Tribes had converted old refrigerators into incubator boxes (page 2 & 3), and the Science Action Team students, using a similar design on a smaller scale. began changing regular picnic coolers into incubator boxes (page 7). Before testing even began, some of the advantages and disadvantages of each design were obvious. The larger refrigerators could hold as many as 50,000 eggs while the coolers could only hold 2,500 to 3,000 eggs. When it came to finding locations on the stream to set the incubators, the coolers had a clear advantage. The coolers were ideal for narrow streams with gentle slopes. Having everyone in the group grab a cooler proved to be a lot easier than trying to haul a massive refrigerator up a mountain.

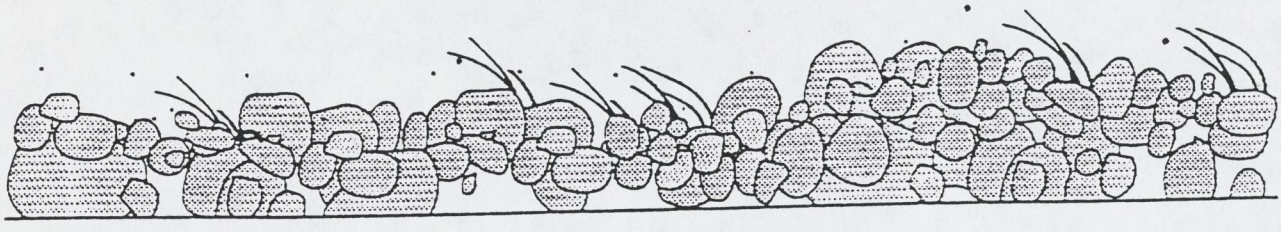
At the end of the summer of '96, it was obvious that cooler design needed some work. If the cooler was set in a stream that had very low amounts of sediment, it could have a hatch rate well into the high 90% range. But if it was set in a stream with even a moderate sediment problem, the sediment was

Whitlock Vibert Box
(side view)



Whitlock Vibert Box
(front view)





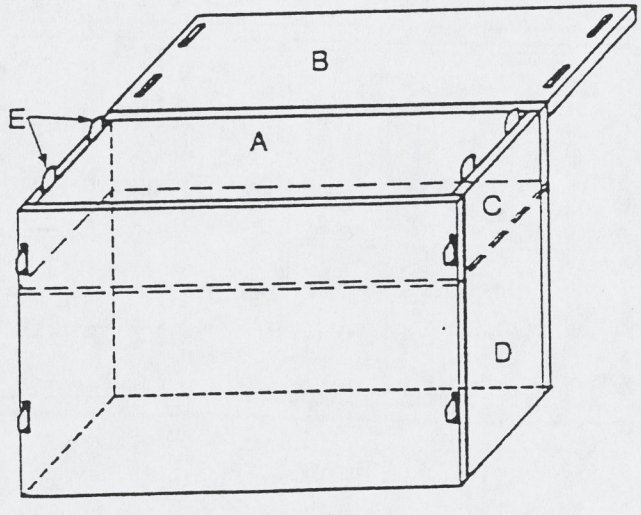
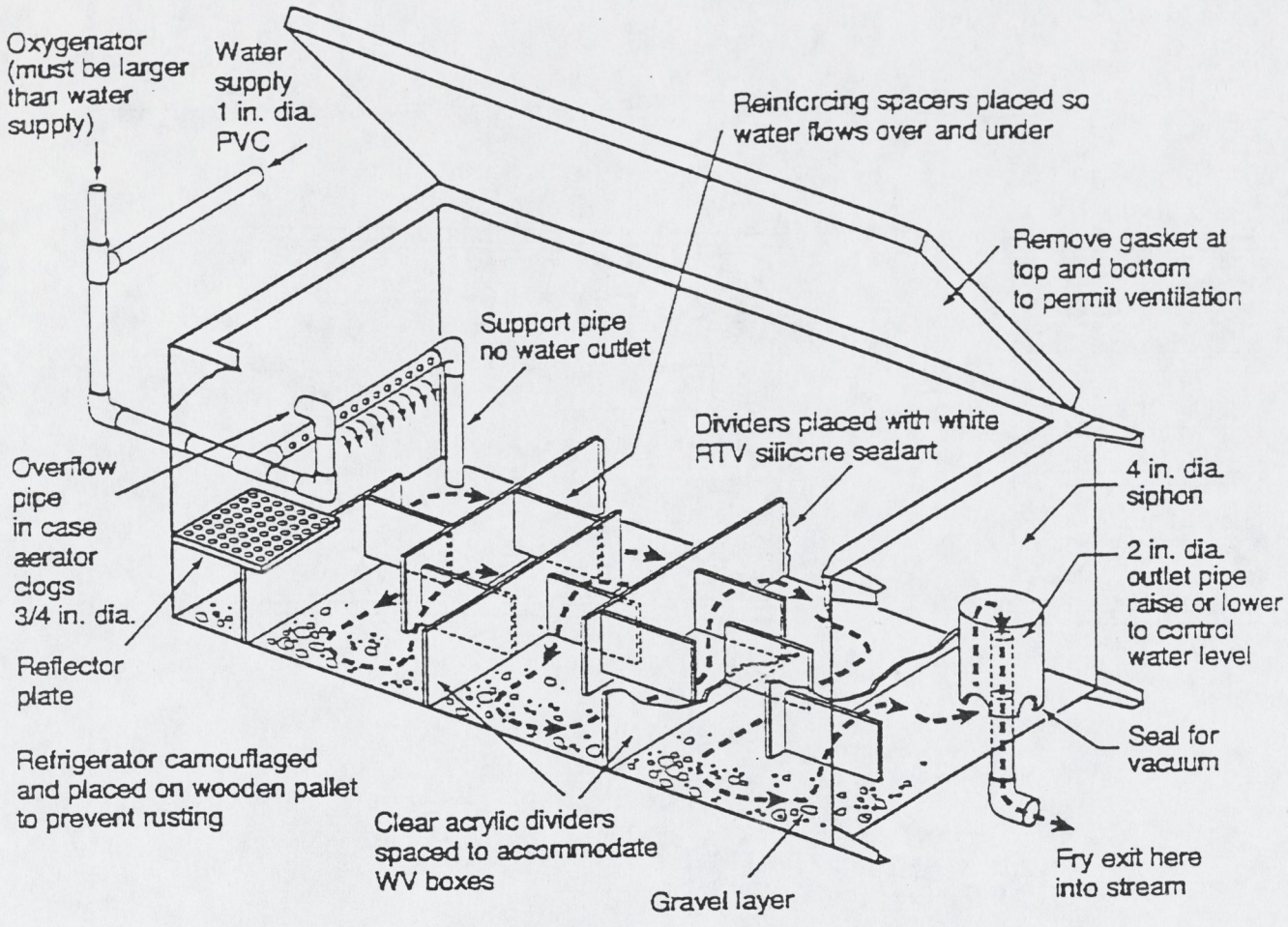


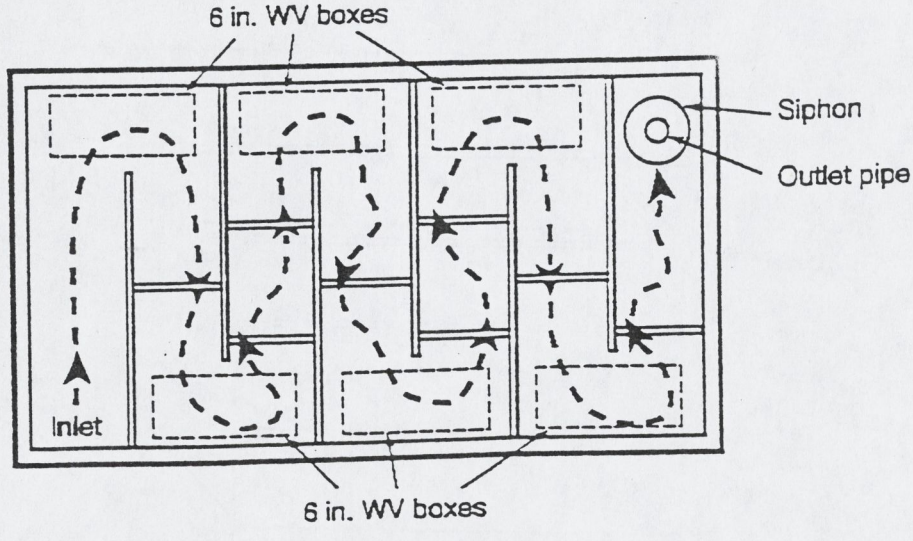
Diagram of WV Box

A. Top lid of incubator
B. top lid flap
C. Incubator compartment
D. Nursery compartment
E. Box tabs for assembly



Trout Hatchbox

Using old refrigerator with Whitlock Vibert boxes



Top View Refrigerator

trapped in the incubator, and the eggs were smothered. For an overall summer total, the Science Action Team students had about a 50% live hatch rate, but the group from the Shoshone-Bannock Tribes had about 80% live hatch rate. The Shoshone-Bannock project was a great success, but the Science Action Team students were sent back to the drawing board.

Over the course of the 1996/1997 school year, the Shelley students modified their boxes and conducted further research. In the spring of 1997 the students felt confident enough with their project that they approached the Idaho Department of Fish and Game in Pocatello and asked if they could try hatching Yellowstone Cutthroat, a native trout species whose numbers are getting dangerously low. To the surprise of the students, the Department agreed to let them use all of the Yellowstone Cutthroat eggs that would be gathered by the Grace Fish Hatchery. Not only did the Fish and Game give the students the eggs they asked for, but they also invited them to help with the artificial spawning process. Three students and their teacher were able to make the trip. The students picked up a lot of information, and it also provided the students an opportunity to meet and talk to the Fish and Game officers that they would be working with throughout the summer. It also turned out good for the Fish and Game's public relations because footage from the event was shown on the six o'clock news.

Two of the students were able to continue their education on streamside incubation by joining the Shoshone-Bannock for their opening camp in Stanley Basin. The students spent ten days observing and participating in monitoring and placing incubators in the stream. They also got to experience first-hand how much easier coolers are to haul up mountains than refrigerators. The Shelley students learned a lot of secrets that the Shoshone-Bannock Team had uncovered.

After the camping trip, the students began setting out their boxes in streams in the tributaries of the Blackfoot River and filling them with eggs. They continued doing this once a week, setting out about 16,000 eggs at a time until their egg supply was depleted. The students also constructed and tested five incubators that substituted the cooler with a five-gallon bucket. The incubators were monitored once a week until the water level dropped so low on one stream that one of the boxes dried up and killed 3,000 eggs. Another box that was set below a beaver dam became plugged with moss and lost nearly one-fourth of its eggs.

At the end of the summer, the students compiled their results. They had used approximately 88,000 eggs and had an overall live hatch rate of 90%. If the lost box is not included, the hatch rate was up over 94%.

Considering fish hatcheries have live hatch results of 75% to 85%, the project was considered a success by both the students and the Fish and Game officers involved. However, the students would like to continue experimenting with different incubator designs over the course of the school year, and also work more with habitat restoration. The goal for next summer is to achieve a hatch rate of 96%. It is high, but with any luck, it is obtainable.

Left to right
Jessie, Breanne, Chris, Mike

TROUT RECOVERY PROGRAM
RESULTS

West May Creek

Number of Eggs	35,400
Number of Non-Hatched	1,186
Live Hatch Rate	96.08%

Diamond Creek (beaver dams)

Number of Eggs	16,200
Number of Non-Hatched	1,444
Live Hatch Rate	91.09%

Timber Creek

Number of Eggs	37,800
Number of Non-Hatched	1,652
Live Hatch Rate	95.62%

(These results do not include one box whose eggs were totally lost.)

Number of Eggs	37,800
Number of Non-Hatched	5,252
Live Hatch Rate	86.11%

(These results do include one box whose eggs were totally lost.)

OVERALL

NUMBER OF EGGS	88,600
NUMBER OF NON-HATCHED	3,982
LIVE HATCH RATE	**95.51%**

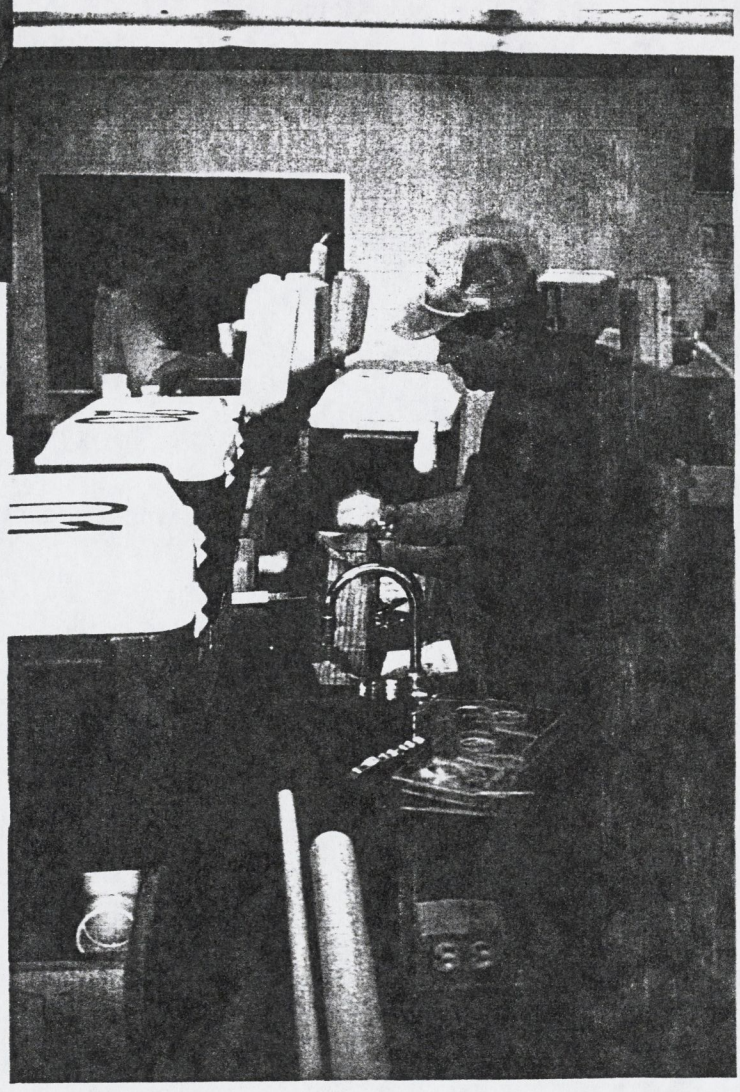
(These results do not include one box whose eggs were totally lost.)

NUMBER OF EGGS	88,600
NUMBER OF NON-HATCHED	7,582
LIVE HATCH RATE	**91.44%**

(These results do include one box whose eggs were totally lost.)

Students working with Fish & Game to spawn cutthroat

Constructing streamside incubator boxes.



PLACING EGGS IN THE W-V BOXES

STUDENTS & FISH AND GAME OFFICERS ON THE STREAM

Ed Galindo
Shoshone-Bannock Tribe
&
Ben Rinehart
Idaho National Engineering and Environmental Laboratory

Indian Summer III

Student Streamside Incubation Project
1997

Acknowledgments

The Indian Summer III project was sponsored and funded by the U.S. Department of Navy, Office for Naval Research (ONR). The Indian Summer research and development program was adminstered by the Idaho National Engineering and Environmental Laboratory (INEEL) Institute under Director, Francis Grant. The U.S. Department of Energy (DOE), through the INEEL Institute, funded the mentor and non-Tribal students and teachers. With the assistance provided by these agencies, our teachers are able to work with national laboratories and technology centers to enhance their leadership skills, increase their awareness of current science and technology, and tranfer this knowledge to their students.

As the third year of Indian Summer draws to a close, we would like to extend our appreciation to the people and organizations who helped make the project a reality for the students.

Ed Galindo—As a Native American science teacher at the Shoshone-Bannock Junior/Senior High School, Ed continues to provide his students with the resources, enthusiasm, and care that all young people need and deserve. Ed's commitment to his profession and to his students is rewarded each year when his students graduate and begin to work toward their goals.

Ben Rinehart—With DOE's Hydropower Program for 17 years, Ben is a science and engineering mentor through the INEEL. In support of the TRAC educational programs, Ben provides technical advice, resources, and yearly support to the Indian Summer projects.

Dirk Kempthorne—Senator Kempthorne made a substantial contribution to the project this year by sponsoring legislation to make Basin Creek a free area where no activities, such as mining, can take place. This allows the creek to return to a natural state that will enhance salmon and trout spawning areas and assist in their recovery.

U.S. Army—Thanks to Major Meckley, who is in charge of the JROTC program at the Shoshone-Bannock High School. SFC John Moeller and Major Meckley provided the camping gear, Army rations, and fun outdoor activities, like river rafting and camping. It was great!

J.R. Simplot—Gerald McNabb and his staff analyzed our samples for mercury, lead, and arsenic, among others. We appreciate their time and effort to help us determine what the samples contained.

U. S. Forest Service—Bruce Smith, a Forest Fisheries Biologist for the Salmon and Challis National Forests, provided information on the cycle of steelhead and salmon, the environments they thrive in, and hatching methods and devices. Thanks to the Leadore, North Fork, Challis, and Yankee Fork ranger districts.

Private landowners and site hosts—Fred Porter, Jim Bower and Mary Bullard, Jack Ellis Ranch, John Burns Ranch, Scott Turner Ranch, Bruce Mulkey Ranch, and Dave Richmond.

Idaho Fish and Game, Region 7—Mike Larkin, Fisheries Supervisor and Gary Bertellotti, Pahsimeroi Hatchery Manager.

Program Assistance—Sawtooth Hatchery; Idaho Model Watershed Project, Jude Trapani, Coordinator, and Scott Turner, North-end Hatching Coordinator; Flaming Gorge/Lower Green River Chapter, Wyoming Trout Unlimited.

Idaho Rivers Unlimited—This organization provides us with a voice in the public sector. They have been instrumental in spreading the word of our achievements with the steelhead eggs.

Shoshone-Bannock Tribe—Thanks to the Fisheries Department for their technical support and egg supply and Lavern Broncho for teaching the Tribe's viewpoint on science; Shoshone-Bannock School and our principal, Dr. Shortman, for supplying the buses and drivers; Shoshone-Bannock faculty for giving up their summer vacations; Tribal Elders and our parents for their words of encouragement and cultural views. A special thank you to John Moeller, Ben Bloom, and Linda Jay for putting up with us for 12 weeks during their summer vacation. In spirit and on the road, we cover many hundreds of miles. Thanks to everyone.

The Indian Summer Story

Here lives my story. It happened long ago that there was a man named Zimo who was a good planter. He cared well for his crops and he gave thanks to Ketci Niweskewe. But when the time came for him to do his planting, he became sick. The other people of his village planted their crops and harvested them and dried them for the winter, but Zimo remained sick all through that time. The other people of the village and their families had plenty of vegetables, but Zimo had none. The first cold winds of late autumn were blowing and he knew it would be hard to survive the winter without the food he always got from his fields.

So Zimo went to Gluskabe.

'Master,' Zimo said, 'I have been sick. The time came to plant and then the time to harvest and now I have no food for the winter. I have always been thankful, and I have worked hard in the past. Help me.'

'Go back to your field,' Gluskabe said. 'Plant your seeds.'

Zimo did as Gluskabe said. The people of Zimo's village thought he was crazy as he began to plant his corn and squash and beans. But as soon as he put the seeds in the earth, the weather changed and it became warm as summer. The seeds sprouted and grew tall overnight. By the time seven days had passed, Zimo had gathered a whole season's crop. Then winter came.

Since then, though the seeds no longer grow as quickly as Zimo's seeds did with the help of Gluskabe, there is always a time of warm weather just before the snows. That is the time the Penobscot people call 'A Person's Summer.' It is known to most as 'Indian Summer,' even though few seem to remember that it is a time given as a reminder to us all to be thankful for the gifts from Earth and the Creator.

Indian Summer III

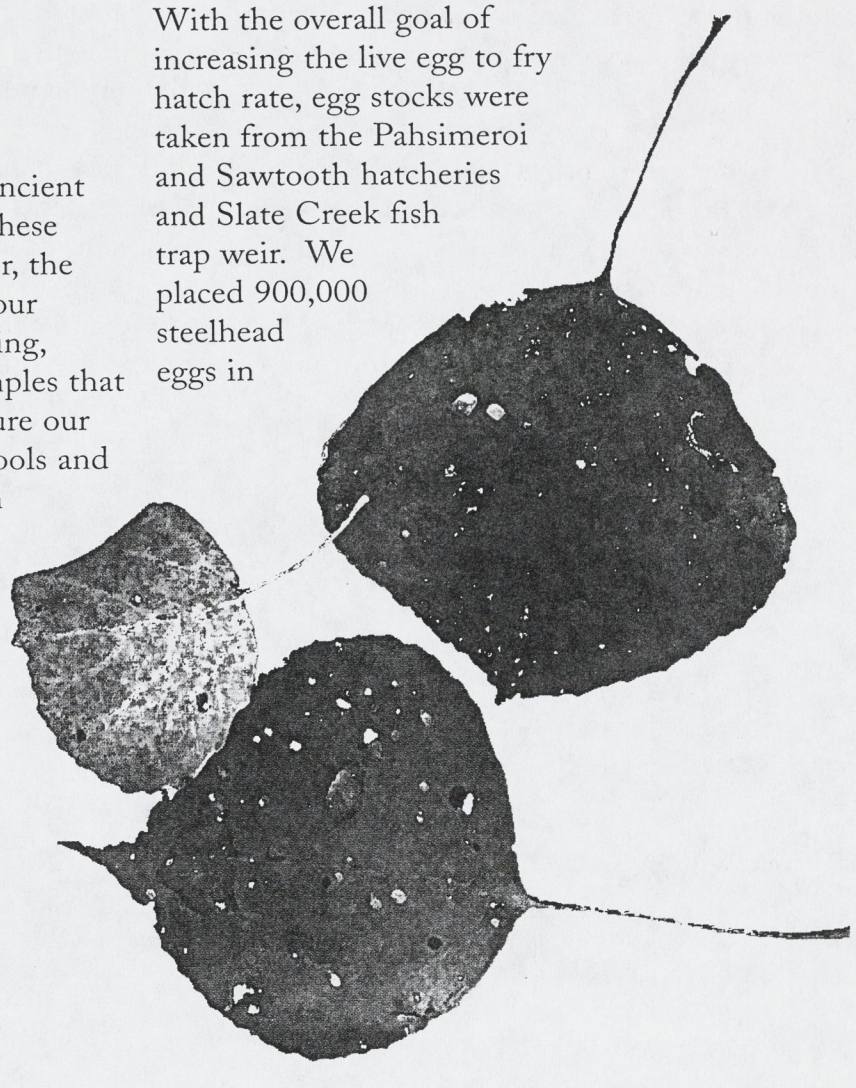
Renewing our Earth's Gifts

Legacy of the Salmon—'*Survival of the Salmon has always meant more than just food for the Indian People. Indians have long recognized that if they are to survive and if their children's children are to survive it will be because the Salmon Survives. It is their legacy.*'—Bill Frank, Jr.

The gifts in life are many as our ancient Native ancestors knew. Today, these gifts—the land, the air, the water, the inhabiting creatures—are the life line to our children's' future. It is through our teaching, understanding, encouragement, and examples that generations to come will renew and nurture our earth. We must provide them with the tools and help them along the way. We must teach them to see and listen beyond their own needs, and to maintain the balance between giving and receiving with the earth.

Each year the Indian Summer project results in renewal and growth for the fish and the students. This project offers all those involved the opportunity to learn and understand natural production and mortality factors associated with fish in early life stages. The 1997 project encompassed 20 stream and tributary sites of the Salmon and Challis National Forests, Sawtooth National Recreation Area, and private lands. It involved 24 students, 5 staff members, and support from the Idaho National Engineering and Environmental Laboratory.

With the overall goal of increasing the live egg to fry hatch rate, egg stocks were taken from the Pahsimeroi and Sawtooth hatcheries and Slate Creek fish trap weir. We placed 900,000 steelhead eggs in



streamside incubators. Again this year, the project focused on assessing stream health, enhancing conditions for egg incubation, and restoring stream habitat. We tried new experiments involving a solar-powered fish data logging device that monitors the outflow of fry from the streamside incubators. We also tested a device called an upweller to see how sediment settled and tested the live hatch rate. The Forest Service, who monitored the hatch project for the north-end sites, tested some new devices too: Jordan/Scotty boxes and a Washington State remote site incubator design. Because we tested new equipment, our total hatch rates were less this year, but we discovered many new concepts that hopefully will increase the hatch rate next year.

In a fisheries recovery project, called the Purcell Springs Stream Ecosystem Outdoor Classroom, the Shoshone-Bannock student team and the Leadore Ranger District of the Salmon and Challis National Forest built island frames. These islands were placed in the stream to provide better water flow and increase nursery habitat by 50%. Several islands were built and placed in the stream and filled with sediment excavated from the channel. Next summer, the teams will return to Purcell Springs and plant willows on the islands and on the banks of the stream, which will provide shade and cover in the stream for the fish. This is just one way that the Indian Summer team is working to rehabilitate waterways the fish will use in their journey.

Another new occurrence was inviting students from the Shelley, Hillcrest, Idaho Falls, and Leadore High Schools to participate. This was the first year that students from outside Fort Hall participated. Our student project provided young Tribal members the opportunity to help develop hands-on workable solutions for a problem affecting the future of Indian fishing culture and for students from different cultures to work side by side. It was a great opportunity for the students to show their strong attachment to the land and their spiritual attachment to the creatures inhabiting the land and seas.

An Indian Summer team placing island frames in the streams to provide better water flow for fish.

Positive Influences and Effects

What is the relationship between the fish project and students' achievements in the world? Both struggle for survival in a continually changing and often hostile, unfamiliar environment. Our goals as educators and mentors should be to assist young people in the transition from a protected environment to the outside world. Much like the fish protected in their incubators, we hope to provide students with an opportunity to grow and mature in a natural setting. The students, through programs like Indian Summer, are developing tools and skills to deal successfully with rapidly changing environments. From our Tribal heritage, we offer the students knowledge of experienced Elders, stories and traditions from the past, and encouragement for the future.

Bringing a cultural mix of students together allows young people to begin to understand one another by working toward a common goal. Our Indian Summer projects are a way to foster the growth of fish and offer a setting where students can open their perceptions to different cultures by listening and effectively communicating beyond all barriers. We can learn about the fish and the environment by doing it together. Did the students learn about fish? Did they learn more about themselves? Yes, I think so.

I would like to think that the project is making a difference for both the fish and students' lives. From these projects, I have seen students grow more confident and bond with each other. Two of the students completed the full 10 weeks of the program, and the fisheries department has shown interest in hiring our students because of their ability to build the incubators and record data. Some students are doing well and some are struggling. This is life. I wonder about the young fish. Are they happy? Are some struggling? The answer is probably yes to these questions.

Fish Issues
We Are Making Progress

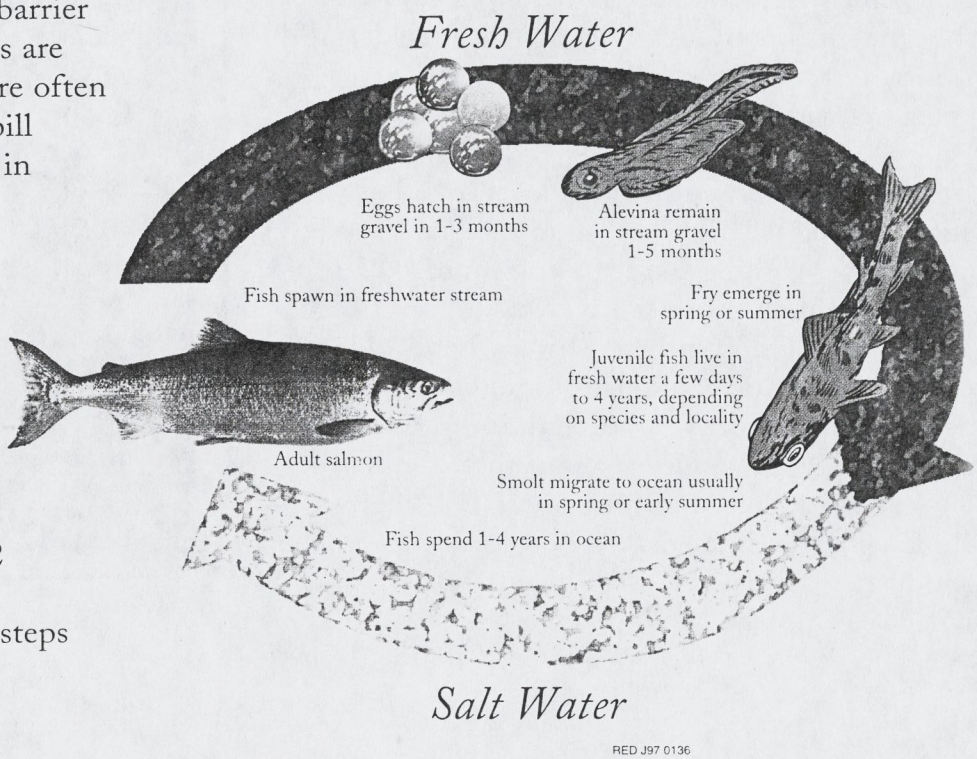
Reaching home streams to spawn is a difficult journey for salmon and trout. Dams, land use, and increasing pollution lessen the chances of the fish reaching their birthplaces to spawn. In the past 3 years, however, progress has been made to improve the climate for fish recovery. Measures have been taken to provide a balance for the young salmon and steelhead by improving river conditions for migration during the spring and by providing cool water when needed in the fall to improve steelhead and fall Chinook runs.

Dams

Hydropower projects block the fish's movement up and downstream. For fish trying to move upstream, a dam poses an impassable barrier unless fish ladders and mechanical lifts are provided. Fish moving downstream are often killed in the dam's turbines unless a spill flow or bypass is provided. Currently in the Columbia River Basin, 150 dams are in place.

Based on a study from the Natural Resources Conservation Service (NRCS), Sierra Club, and American Rivers, there are a number of alternatives that help the fish to make their journey up and down the rivers. In the past, fish would travel 2 to 3 weeks to reach the ocean; it now takes 2 months. Three cost-effective steps to aid the fish would be (a) spilling the fish past the dams, (b) drawdowns, and (c) adjusting flows. A combination of these steps will make our dams safe for the fish. By drawing down existing reservoirs, increasing river flows to a rate nearer the natural level, and allowing for spilling water, young fish will have a greater chance of survival.

Spilling water allows young fish to pass over a dam without going through the deadly turbine blades. Drawdowns release water from reservoirs allowing fish to be carried by the current instead of waiting in still pools, and flow increases the speed of the river making it easier for young fish to get to sea quickly.



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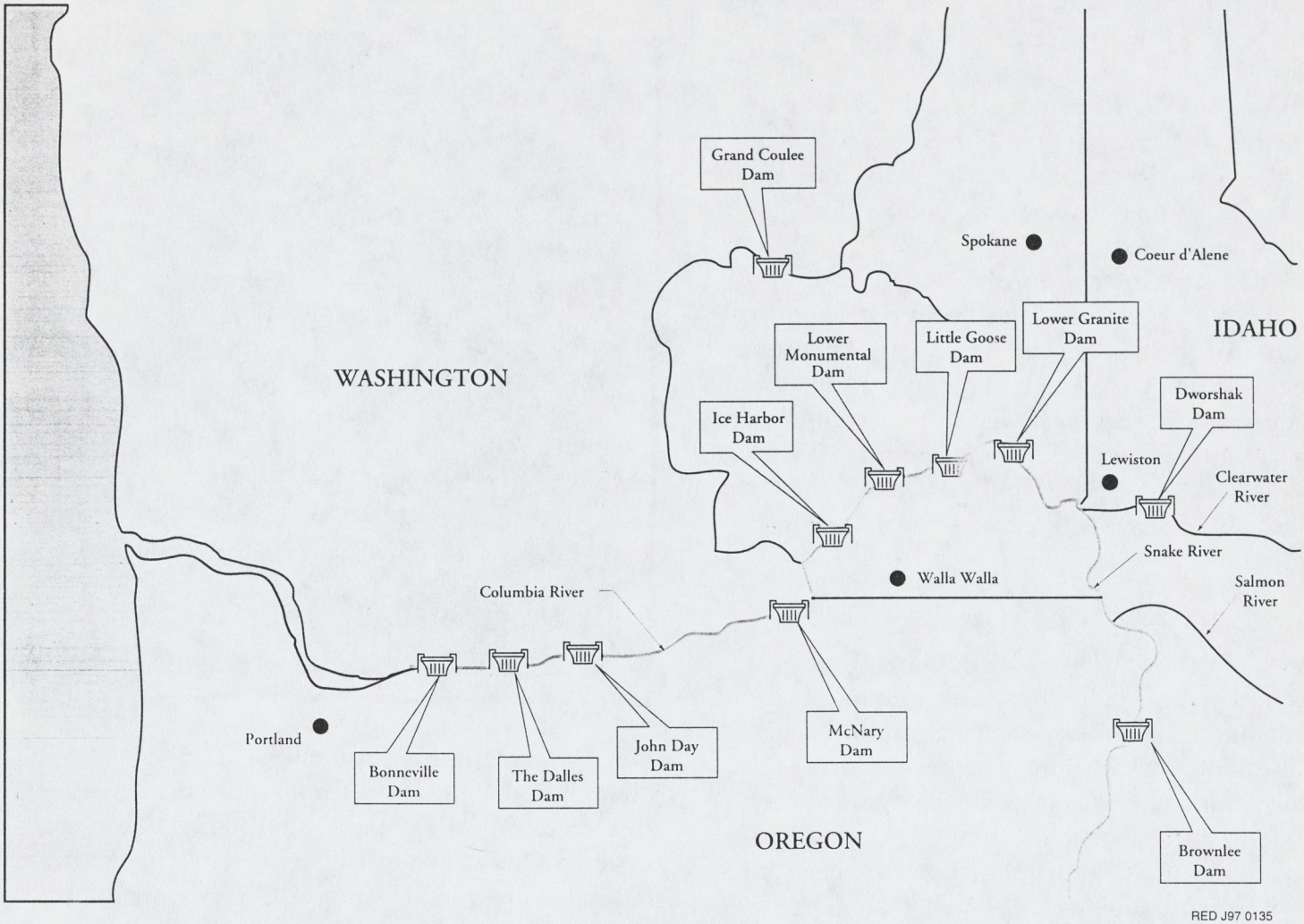


Fish traveling to home streams in Idaho encounter a number of dams. The dams highlighted are under consideration for removal.

The 1997 spring runoff was projected to be near the largest on record for the Snake River and in the top 10 of historical record for the Columbia River. Spilling the water over the dam's spillway can help young fish get past the dams, but too much water spilling over the dams increases levels of dissolved gas in the water, which causes severe problems in the young fish. With 1997's high flows, controlling the excess water will be crucial to fish operations. It will be interesting to see the results.

Recently in Idaho, consideration is being given to eliminating four Snake River dams: Lower Granite, Little Goose, Lower Monumental, and Ice Harbor. The John Day Dam in Oregon is also under consideration. A four-state council is weighing a proposal to remove the dams sometime early in the next century. The final decision is up to the National Marine Fisheries Service (NMFS), who is empowered to enforce the Endangered Species Act and is charged with developing a salmon recovery plan for the entire Northwest. This year the NMFS placed wild

Idaho steelhead on the threatened list under the Endangered Species Act.

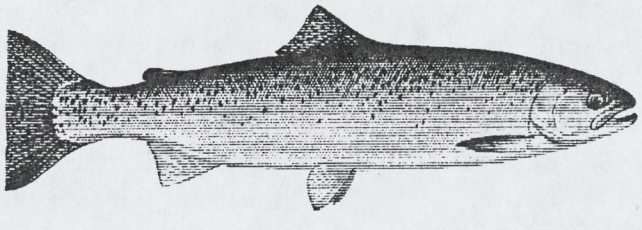
The Idaho Water Resource Board held three informational meetings in November to see if there was sufficient support to file for minimum stream flows on the lower Salmon and Jarbidge and Bruneau Rivers. Minimum flows help maintain flow instream for threatened and endangered salmon and steelhead during critical periods of their life cycle. It also prevents future excess diversion of water. The flow protects water quality and preserves the natural character of the river and riparian area. Three minimum streamflow water right applications were originally filed with the board by Idaho Rivers United in 1994.

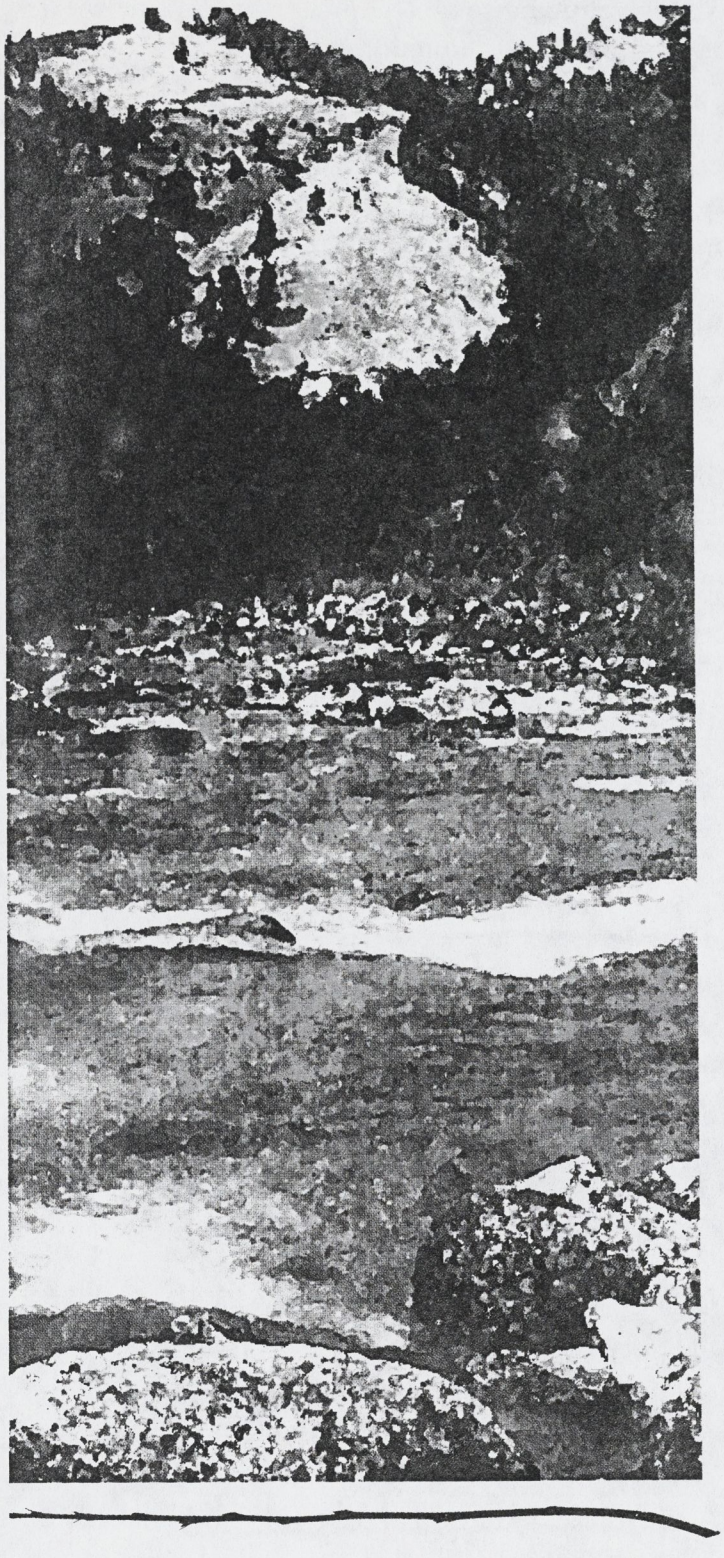
Land Use

Land cultivation, roads, overgrazing, forest removal and fires, lumber and mining operations contribute to the lack of natural ground cover that provides slow drainage into streams, maintaining even flows and temperature. In semiarid climates such as Idaho's, more water is diverted in the summer for irrigation, resulting in lower, often inadequate flows for fish.

The 1996 Farm Bill included a provision to help landowners establish conservation buffers, which include riparian areas along rivers, streams, and wetlands. The U.S. Department of Agriculture

(USDA) is committed to helping farmers and other landowners create 2 million miles of conservation buffers by the year 2002. The National Conservation Buffer Initiative was a multiyear effort led by the NRCS in cooperation with USDA agencies—Farm Service Agency, Cooperative Extension Service, and the U.S. Forest Service—state conservation agencies, conservation districts, agribusinesses, and agricultural and environmental organizations.





Pollution

Streams and lakes are often receptacles for domestic and industrial waste. Sewage, oil, mining, and pulp and paper mill byproducts are discharged into streams and lakes. The damage is smothered or destroyed bottom aquatic foods and reduced water oxygen supplies, increased acidity, and unhealthy fungal growth. Toxic wastes cause dangerous cumulative effects and radioactive wastes raise stream temperature above the aquatic organism tolerance.

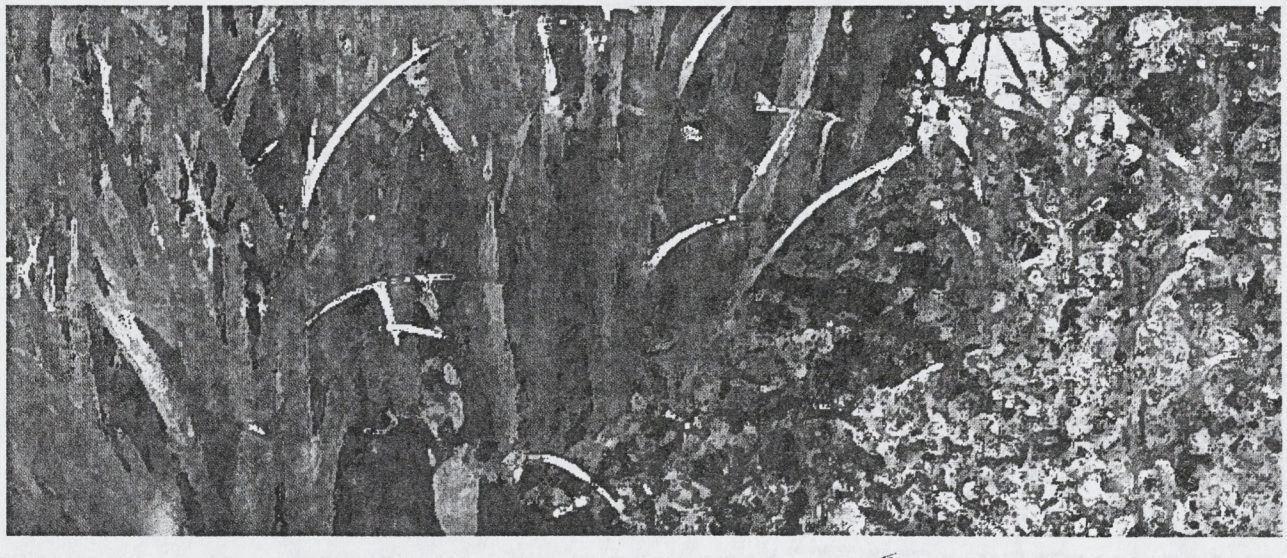
Can anything be done about this pollution? Yes, we can all work together to reduce and prevent this type of pollution, called nonpoint source pollution. This pollution results from a variety of human activities on the land, such farming, energy production, construction, and livestock operations. We all contribute to this pollution and may not even know it. Some of these activities are federal responsibilities, like ensuring federal lands are properly managed to reduce soil erosion. Some are state responsibilities, like developing legislation to govern mining and logging, and to protect groundwater. Some activities are handled locally by zoning or erosion control ordinances. Each individual can play a role by practicing conservation and by changing everyday habits, like practicing recycling.

The Environmental Protection Agency (EPA) is forming partnerships with stakeholder groups to encourage voluntary incentives on nonpoint source water pollution. The current partnerships include the National Association of Wheat Growers, National Pork Producers Council, National Cattlemen's Association, Southeastern Poultry & Egg Association, National Marine

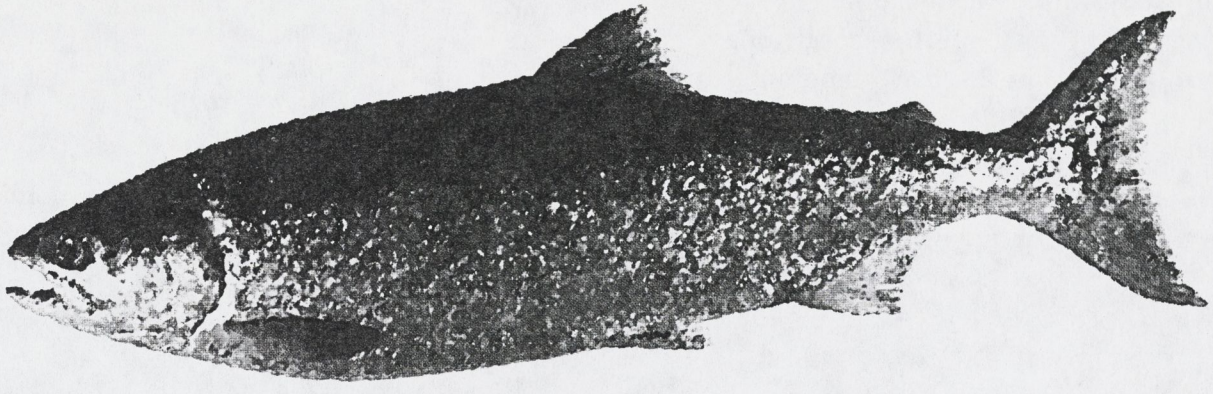
Manufacturer's Association, International Marina Institute, National Association of Homebuilders, and the National Golf Foundation. The EPA works with these associations to adopt management practices that reduce nonpoint pollution by their memberships. In the 33/50 Program, the EPA asked industry to voluntarily refocus corporate policies and help meet program goals in reducing toxic chemical releases (in 1995, for example, total reductions reached 55%).

The environmental benefits of recycling are becoming well known. Many businesses, governments, and households are collecting discards for recycling, and recovering more materials than ever before. Over one-fifth of the municipal solid waste generated in our country is currently recycled or composted (EPA; www.epa.gov/docs/WhatsNew.html.).

All other problems aside, hatch success and natural production must be increased to allow enough of the smart, strong fish to survive the journey downstream to the ocean and later the return to their spawning beds. Our objective is to increase the percentage of fish hatched with a naturalized upbringing, understand natural fisheries production and mortality factors, and test different devices to enhance this environment.



Indian Summer III
Projects for 1997



Science as Group Problem-Solving

A good way to show students the utility of science is to teach it as a problem-solving activity (Gilliland 1988). At the Shoshone-Bannock High School, we are using the environment as our classroom. Because Mother Earth is our home, what better place to teach the students! Starting with the environment, students can learn the scientific method of making a hypothesis and drawing conclusions from the evidence. This year we invited students from Shelley, Hillcrest, Idaho Falls, and Leadore High Schools to work with us on our group problem-solving experiments. As educators, we are building an environment that fosters learning and teaches respect, curiosity, problem-solving skills, information gathering skills, and recording techniques. Students learn that the scientific method is a naturally occurring event; it happens every day in their lives.

There is much evidence that the educational experience needs to be improved for all students. Low levels of achievement, teenage suicide, and adult unemployment indicate the need for better education (Gilliland 1988). There are many causes for lack of achievement. Poor self-concept and lack of motivation on the part of the student may be largely responsible.

A publication (1996) by the Idaho Committee on Indian Education listed several goals and recommendations for improving Native American education. These goals include (a) preparing Indian children for future educational experiences by providing early childhood education programs that are culturally, linguistically, and developmentally appropriate; (b) establishing a school environment that respects, maintains, and promotes Native American values, languages, and traditions; (c) encouraging Native American parents, Tribal officials, and community leaders to participate in the education of children; and (d) raising the self-esteem and cultural pride of Native American students.

Project Goals and Scope

We believe that student projects, such as Indian Summer, is a step toward increasing student motivation, participation, and self-esteem. Projects like these encourage students to think independently and to interact confidently in group situations. Much like the struggling salmon and steelhead, Native American students have many hurtles to cross and need a healthy, safe environment in which to grow and thrive. We firmly believe that the Indian Summer projects are reaching these objectives, not for just Native Americans, but for all students.

The Indian Summer team developed three goals to help increase the hatch rate of salmon and steelhead in Idaho waters:

1. Examine current fish populations and habitat conditions
2. Determine what factors may be affecting fish populations
3. Address the factors limiting fish populations.

The following objectives were formulated to help students reach the goals of the project:

1. Test the technology for successful hatching
2. Increase egg to fry survival
3. Determine optimum incubator densities and configuration
4. Minimize cost
5. Minimize process
6. Minimize handling of fish
7. Test new equipment and designs
8. Increase community education and involvement.

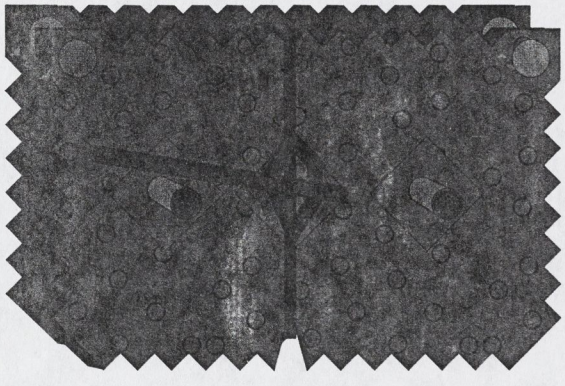
Since the streamside egg incubation project started in 1995, we have expanded from 4 to 20 sites. The 20 project sites are in the Salmon and Challis National Forests; Leadore, North Fork, Challis, Yankee Fork and Salmon/Cobalt districts; Sawtooth recreation area; and extend over 200 miles within the Salmon River Drainage and on private lands. The project was divided into two areas: the north-end sites (downstream from Challis) and the south-end sites (upstream from Challis). The Shoshone-Bannock team coordinated efforts for the south-end sites, and the Idaho Model Watershed Project, Forest Service, and Idaho Fish and Game coordinated efforts for the north-end sites.

Equipment Designs and Methods

Based on the success of the 1995 and 1996 projects, the students decided to use the same methods in 1997 for the south-end sites. They used a modified incubator box and Whitlock Vibert (WV) boxes to hatch steelhead eggs obtained from the Pahsimeroi and Sawtooth hatcheries, and Slate Creek fish trap weir.

For the south-end sites, two new devices were added: the solar-powered fish data logging device and an upweller. The fish data logging device was powered by the sun during the day and by battery at night. Its purpose is to show when the fish moved. The young fry moved between 11:00 p.m. and 5:00 a.m. This was important because it showed us that the fish were beginning to act like wild fish, even at the fry stage.

Jordan/Scotty box



RED J97 0140

The upweller incubator is designed using a 5-gallon bucket, perforated plate, and irrigation diversion screen materials. The objective of the upweller was to see if its use would help solve the sediment problem. It was successful. The sediment settled on the bottom of the bucket, and the clear water remained on top.

For the north-end sites, different types of Washington State remote site incubators, Canadian Jordan/Scotty boxes, and the homemade Crystalex bucket upweller, in addition to the refrigerator incubator with WV boxes were tested.

Because of a variety of natural conditions and the new devices tested, the south-end live hatch rate was 80% as compared to the 90 to 95% rate we saw last year. The north-end live hatch rate dropped to 62% this year from 70% last year. The drop in the north-end sites' success resulted from not only new device tests, but also from water flow losses.

Whitlock Vibert Box and Hatch Box

The original Vibert box was developed in France in 1950 by Richard Vibert. The students' WV box is an improved version of the original WV box. It is larger in size than the original, uses more current materials and design, which improved its function. The box can be used for trout, salmon, and char eggs in any water that supports the species. The WV box is constructed of polypropylene and measures 145 × 90 × 60 mm. The sides, top, and bottom are various sized and shaped rectangular slots for water circulation, desilting, retaining and releasing the eggs and fry, and prohibiting predators from entering the hatch box. The incubator portion of the WV box protects the eggs until they are hatched. After they are hatched, the fry remain protected from predators in the nursery until the yolk sac is absorbed. Then, the fry escape through the slots and feed in pools and riffles of the stream.

The top lid of the WV box has sixty 3.5 × 13 mm slots for water circulation and swimup fry escape passage. It also restricts predators and works as a desilting mechanism. The flap of the top lid opens into the incubator and has sixty-nine 2 × 2 mm vents also for circulation, ventilation, predator protection, and silt retention. The incubator compartment can hold one or two layers of approximately 250 salmon eggs or 500 trout eggs. Typically, hatch success in the WV boxes averages from 75 to 95%. Fry that successfully leave the WV box and enter the stream average from 20 to 50% of the original number of eggs.

For the streamside incubator, the students modified the interior of an old refrigerator. Acrylic dividers and rocks were placed in the bottom of a refrigerator so water flowing through it created currents similar to a small nursery the stream. Water from the stream was supplied using 1-inch diameter polyvinyl chloride (PVC) piping. The students also built an oxygenator

Whitlock Vibert box

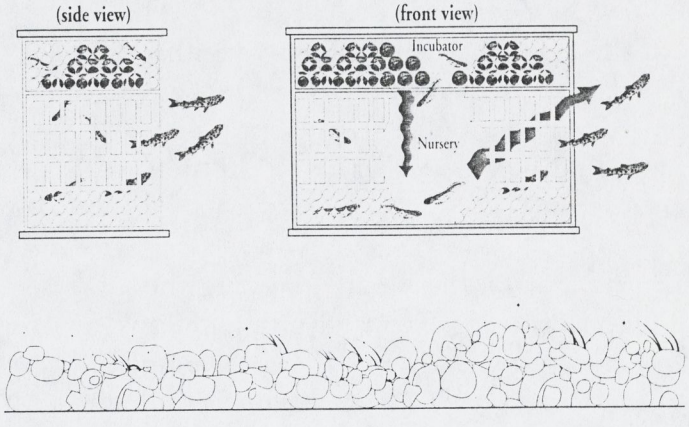
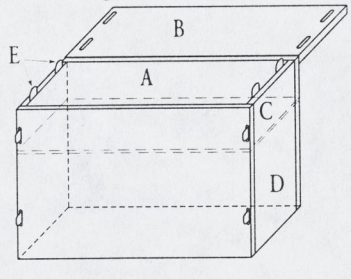


Diagram of WV box

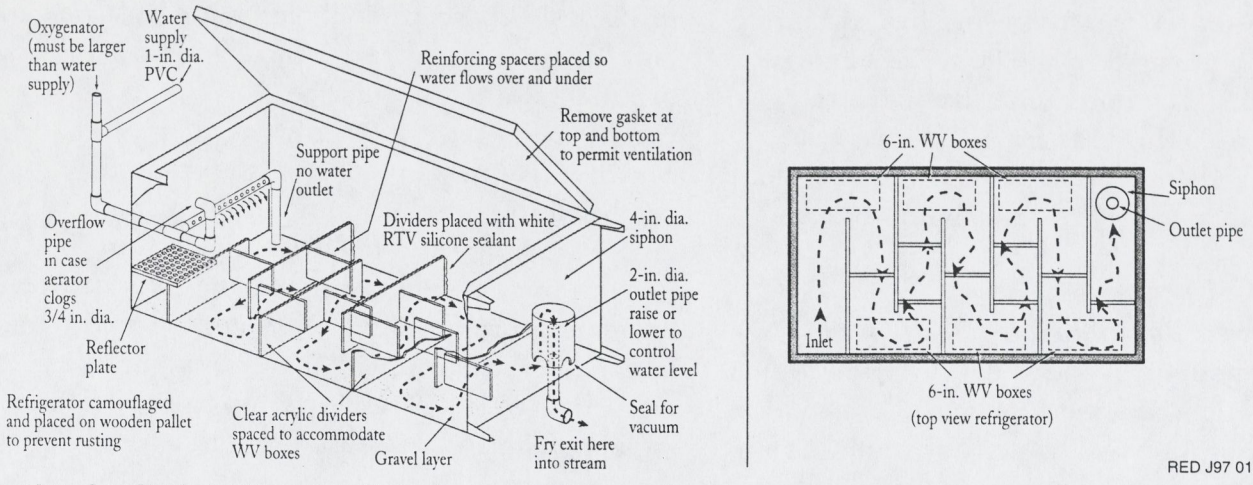


A. Top lid of incubator
B. Top lid flap
C. Incubator compartment
D. Nursery compartment
E. Tabs for assembly

(Whitlock Vibert Box Handbook)

RED J97 0143

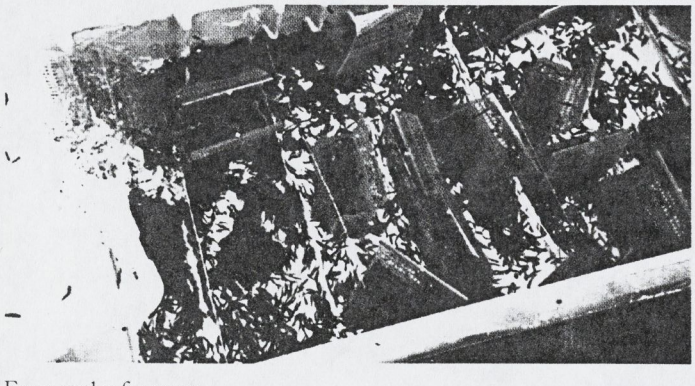
Trout streamside incubator



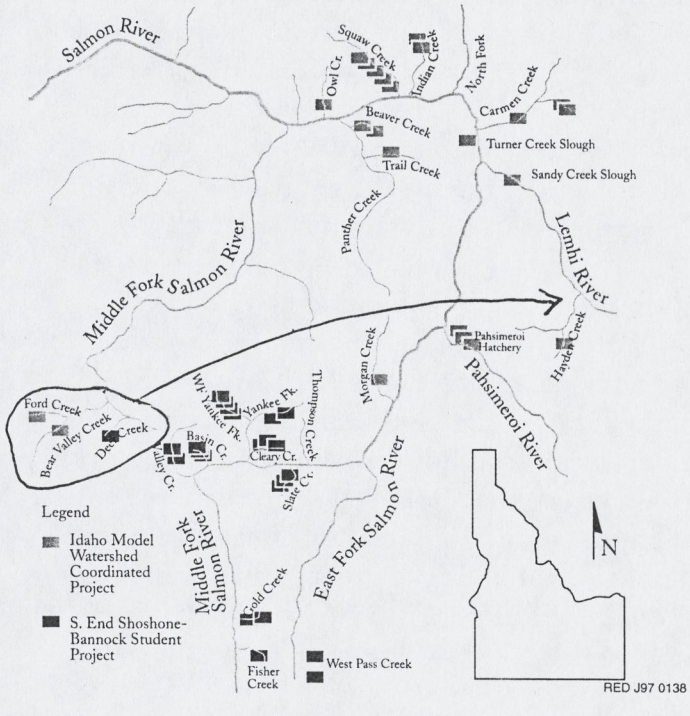
(Flaming Gorge/Lower Green River Chapter, Wyoming Trout Unlimited, Bone Draw Project)

and aerator with PVC pipe. A 2-inch diameter outlet pipe was used to control the water level and allow the fry to exit the incubator. The total cost of the converted incubator was $60.50. The incubator was camouflaged and placed at the side of the stream on a pallet to prevent it from rusting. The WV boxes fit along the sides within the incubator.

Unlike hatcheries, the incubator using the WV boxes allows the eggs to survive in an almost natural environment. Once the eggs are placed in the box, they are not handled again by humans. Much like natural spawning, eggs in the WV boxes are subject to random mortality, which allows the stronger, 'smart' fish to develop greater survival skills. The new fry, protected in the incubator, develop a more advanced yolk sac, producing stronger, mature fry, that after leaving the box, have a better chance of survival from natural losses.



Eggs at the fry stage.



Locations and numbers of incubator devices for the 1997 project.

Fish Data Logging Device

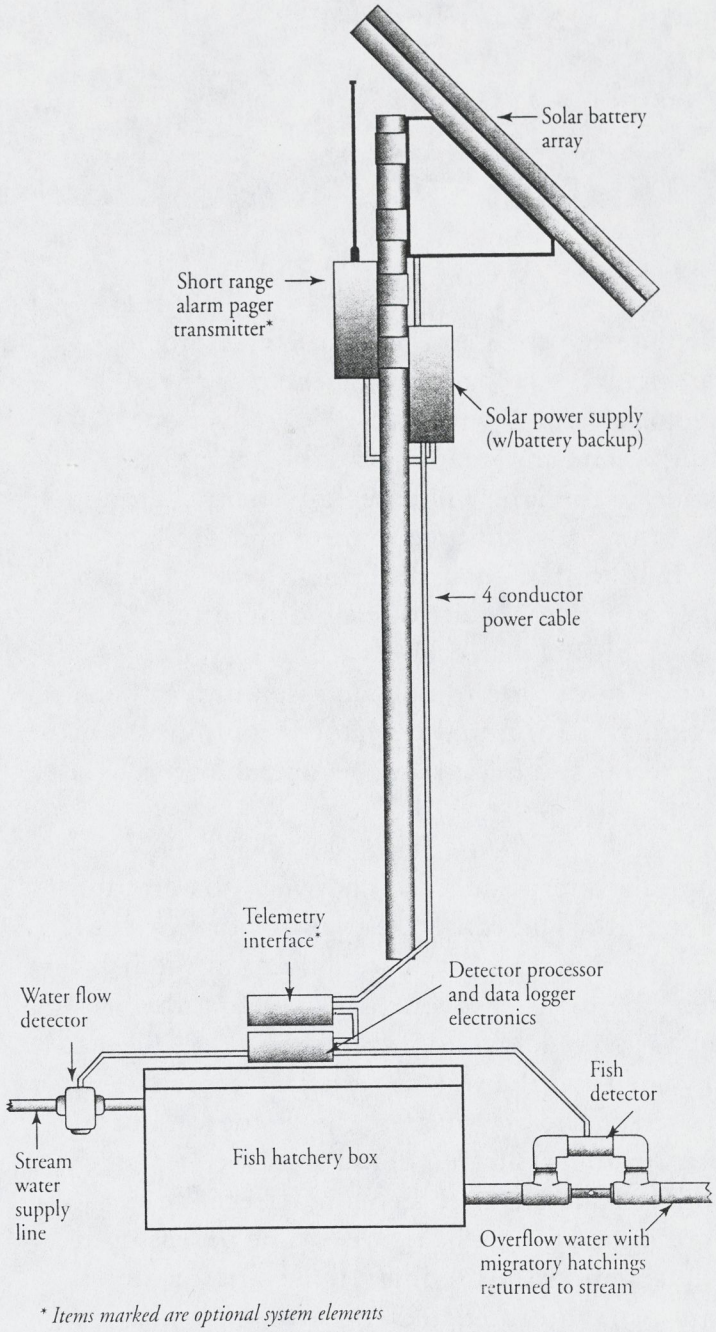
The fish detector device shown is a working model of a fish detector built and field tested by the Shoshone-Bannock Indian Summer III project team. This detector monitors the outflow from the streamside incubators. Any fish leaving the hatchery are detected and logged, allowing data to be collected on the migration habits of newly hatched fish.

A narrow channel houses an infrared emitter and detector to detect passing fish, and a bypass channel carries any hatchery outflow not able to pass through the detector channel. Fish are prevented from traveling through the bypass channel by a screen placed in the inlet and outlet of the device.

The detector is assembled with standard irrigation-type PVC fittings and pipe. The box mounted at the top right is the junction box in which wires from the emitter and detector are spliced to single shielded cable that runs to the logger apparatus. This particular unit is fitted with a calibration pot and jack to make setting up the monitor in differing light easier.

The fish screen, used to make fish exit via the detector channel, is made from a piece of nylon mesh. The material is cut to just the size needed to fully fit the inside circumference of the 'T' fitting. The seam where the two ends of the plastic meet are positioned at the bottom of the fitting, 180 degrees away from the bypass outlet. The largest feeder pipe going into the hatch box is 1 inch, so a 1.5-inch pipe is used for the T fittings and bypass section. Two-inch assemblies are also used because many of the discharge pipes in the newer hatch boxes are constructed of 2-inch PVC.

Fish data logging device



** Items marked are optional system elements*

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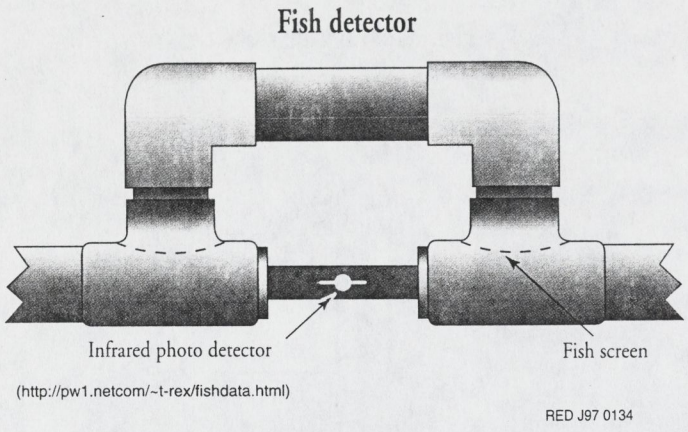
(http://pw1.netcom/~t-rex/fishdata.html)



The detector channel is constructed from 0.75-inch PVC pipe, fitted to the rest of the detector assembly with two PVC reduction fittings. The channel is painted black on the outside so no light will enter the channel around the sensors. An infrared emitter and detector are inserted into the channel through two small holes drilled exactly opposite of each other in the PVC pipe. Tightly twisted lead wires run to the junction box at the top of the assembly. When operating, the infrared detector is illuminated by the emitter and biased just beyond the switch-on point.

Anything interposing itself between the emitter and detector will cause the detector to switch off, signaling the presence of something in the fish gate. The majority of the fish traveling the detector channel will do so in the middle, because the velocity of the water is quickest there, as opposed to the area nearest the inside wall of the pipe. A single infrared detector pair covering the middle of the channel seems to detect the migration of fish satisfactorily. The unit is used to detect and measure migration patterns, not count fish, and the detector seems well suited to this use.

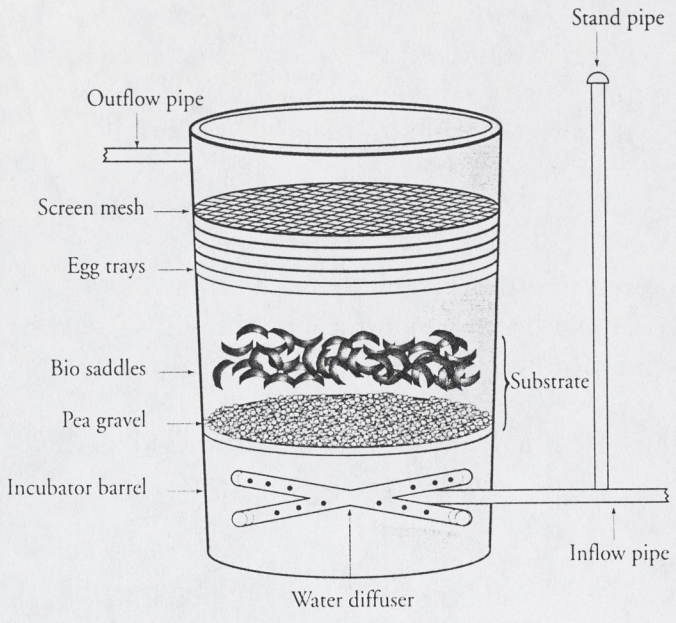
Using this fish data logging device, we found that the fish departed at about the same time of day (11:00 p.m. through 5:00 a.m.) at the first of the month (8/2/97 through 8/9/97). With the aid of the logging device, we saw that the fry left the hatch box at night, when it was cool. This was the best time for them to survive on their own.

Upweller Design

Upweller incubator devices were evaluated at the north and south-end sites. The upweller was designed using 5 to 10-gallon plastic buckets or 50-gallon barrels with lids. The buckets have inlet and outlet pipes to allow the water to run through. Inside the bucket, there is water diffuser, filter screens, substrate, and up to 5 egg trays. As the water flows through the bucket, the bottom filter screen keeps sediment and leaves from settling in the egg trays. The plastic egg trays hold the eggs until they hatch. Once the eggs hatch into fry, they drop through 1/4 × 1/2-inch slots in the trays to the artificial substrate layer, which are plastic fortune cookie-shaped

Students at Fisher Creek incubator.

Upweller device



(Washington State Remote Site Incubator)

pieces, in the middle of the bucket. The substrate keeps the fry above the sediment that has settled in the bottom of the bucket. At the bottom of the bucket, there is another filter screen with a 1/4-inch layer of pea gravel that keeps the bottom layer of sediment from the fry. The fry exit the bucket through the outlet pipe to enter the stream. Homemade versions of the concept were made using Crystalex buckets.

Assessing Fish Habitat and Stream Conditions

In accessible waters today, fish populations should be maintained by natural production alone. Everything possible should be done to enhance breeding, such as adequate protection during spawning, making spawning beds easy to reach, and ensuring healthy stream conditions. Following their natural instincts, salmon and trout inhabit streams and lakes because the food and water conditions are favorable. For this reason alone, every effort should be made to protect and maintain the balance of fish in Idaho waters.

Physical and chemical stream conditions are important in producing and distributing salmon and trout. Temperature, water clarity, flow, and oxygen contribute to healthy streams.

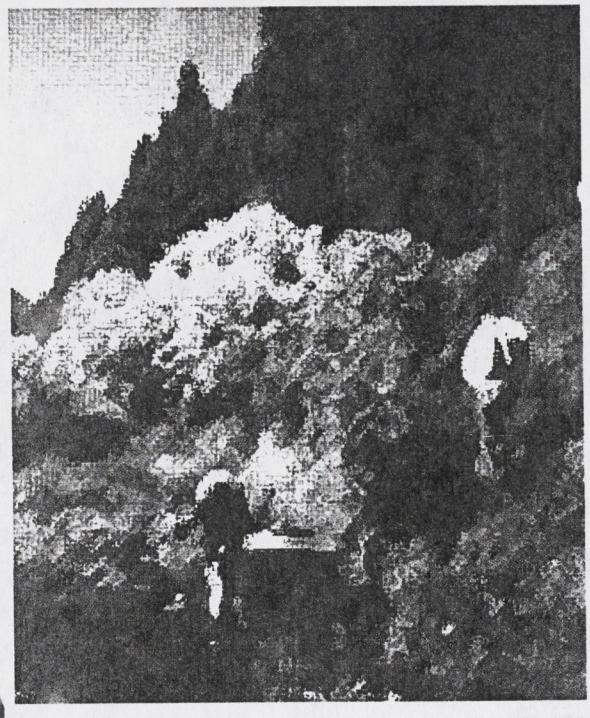
To learn to effectively manage and enhance fish populations, the students gathered basic physical and biological data. With the help of community mentors, they analyzed the data to determine population status and factors limiting fish production.

Table 1 shows the life history survival rate for three steelhead production strategies: hatchery, wild, and incubator. The difference between the hatchery and incubator in the number of adults produced is minimal; however, the difference in production cost is large—the hatchery is more expensive than the incubator.

Table 1. Expected life history survival for three production strategies. Starts with 40 steelhead (20 males, 20 females); progression from left to right.

Strategy	*Eggs*	*Survival rate (%)*	*Eyed eggs*	*Survival rate (%)*	*Fry*	*Survival rate (%)*	*Smolt*	*Survival rate (%)*	*Adults*
Hatchery	100,000	95	95,000	95	90,250	95	85,750	3/10	258
Wild	100,000	--	--	10	10,000	38	3,800	6/10	23
Incubator	100,000	95	95,000	95	90,250	38	34,300	6/10	206

Streamside Data Collected by Students



The students conducted five streamside tests: (1) temperature, (2) nitrate (NO_3), (3) dissolved oxygen (DO), (4) millimeter (mm) size of the eggs and fry, and (5) pH acid or base readings in the boxes and stream. The boxes were monitored daily for 10 days and then weekly for 60 days. A summary of the results follows.

Temperature

Temperature was measured to see if the hatch boxes would hold temperature consistently. We found that they did, with temperatures ranging from 3°C (Basin Creek) to 10°C (Fisher Creek). The temperatures remained consistent every day during the project time (62 days). We had extremes in outside temperatures from -2°C (upper West Fork) to 23.3°C (lower West Pass).

Spring temperatures remained the same. However, we had a wet summer, which resulted in high amounts of sediment and fast moving, muddy river water. Although some of the streams were high in sediment, all the fry had exited the hatch boxes before that time.

Nitrate

(NO_3) was measured to indicate (1) possible pollution in the streams and (2) pollution of fry in the hatch boxes. We wanted to know if the longer the fry spent in the boxes, would they make a greater concentration of their own pollution, and if those concentrations were toxic to the fry. We found that the majority of the boxes were at 0 mg/liter. A few of the boxes reached 1 mg/liter, but this was at the end of the study time.

Dissolved Oxygen

DO was monitored to make sure the eggs had enough oxygen to sustain life. The range was high as one would expect in a mountain stream. We were interested in knowing if levels of DO would drop in our incubators as time went on. They stayed the same. Ranges were from 8 mg/liter to 12 mg/liter (upper Cleary Creek to upper West Fork).

Millimeter Size

The size in mm was used to monitor growth of the fry. We were interested in knowing if their size continued to increase once the eggs were in the hatch boxes. Remember, we do not feed the fry once they are in the boxes. Ranges were from 0 mm (6/10/97) to 20–30 mm (8/10/97). We noted good growth during the project time (62 days).

Acid or Base of the Stream

The pH of the stream is important to the well being of fry. We were interested in knowing if the pH of the fry in the boxes would change as a result of their environment. We saw no change in stream versus the boxes. The range was 7.0 to 8.0 in all boxes.

Summary of Data

Table 2 summarizes the results of the streamside incubator project. The high school students gathered the data for the south-end sites. This area is located below the Galena Summit to the White Clouds area (East Fork of the Salmon River). The students had 560,435 eggs and the hatch rate was 89.37%. The north end consisted of the lower Salmon River country, mainly from the Middle Fork to Challis and was jointly carried out by private landowners, Idaho Model Watershed Project, Idaho Fish and Game, and the Salmon and Challis National Forest staff. The north-end sites had a 62% live hatch rate and the south-end sites had an 89.37% live hatch rate. The hatch rates for all areas in the study are shown in Table 2. The map on page 14 shows the hatch box locations.

1997 Indian Summer III Science Action Team.

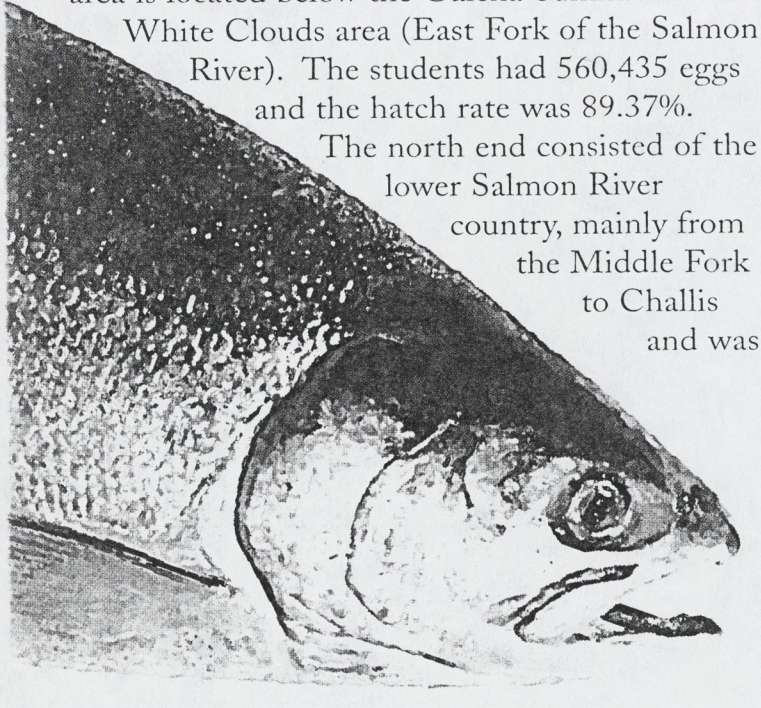


Table 2. Summary of results of the Salmon River streamside incubation project. (WV boxes and refrigerator incubators used except where noted).

Area	*Box No.*	*No. eggs*	*No. live fry*	*Hatch rate (%)*	*Comments*
North-end Sites					
Morgan Creek	1	50,000	49,000	98	Optimum conditions
Hayden Creek Drainage					
Ford Creek	1	25,000	23,750	95	Optimum conditions
Deer Creek	1	25,000	3,750	15	Loss of flow
Bear Valley Creek	1 JSB	8,000	7,760	97	Optimum conditions
Bear Valley Creek Spring	1 RSI	77,700	7,500	10	Loss of flow
Indian Creek					
Ranch	1	25,000	2,500	10	Loss of flow
Spring	1 box/1CBU	25,000	22,500	90	1 optimum conditions/1 loss of flow
Beaver Creek/Trail Creek	2	50,000 eggs planned		0	Not operated in 1997
Live hatch rate for north-end sites		440,000	254,000	62	
South-end Sites					
Sandy Creek Slough	1	23,000	20,700	90	Optimum conditions
Turner Slough	1 JSB	5,000	4,800	96	Optimum conditions
Carmen Creek	1	25,000	5,000	20	Sediment problem
after runoff		12,400	11,500	90	
Freeman Creek	1 and 2	25,000	24,250	97	Optimum conditions
Squaw Creek	1 and 2 CBUs 1, 5-gal RSI	56,000	53,200	95	Optimum conditions
Owl Creek	1 1, 5-gal RSI	50,000	30,000	60	Optimum conditions
Pahsimeroi Hatchery	1 box 1 CBU 1, 5-gal RSI	8,000	7,520	94	Optimum conditions
Gold Creek	1	20,300	19,869	97.8	
Gold Creek	2	20,200	19,824	98.13	
Valley Creek	1	25,000	24,648	98.59	
Valley Creek	2	25,000	24,583	98.3	
Basin Creek	1	34,000	26,269	77.26	
Basin Creek	2	36,400	34,364	94.4	
Basin Creek	3	30,000	24,041	80.1	
Cleary Creek	1	37,400	34,547	92.3	
Cleary Creek	2	30,000	28,409	94.6	
Cleary Creek	3	2,400	2,304	96	
Upweller		800	647	80.8	
Slate Creek	1	34,915	33,866	96.9	
Slate Creek	2 and 3	67,320	65,180	96.82	
Fisher Creek	1	35,000	17,406	49.73	
Lower West Pass Creek	1	25,000	24,153	96.6	
Upper West Pass Creek	2	25,000	23,809	95.2	
West Fork Yankee Fork	1	27,500	26,704	97.1	
West Fork Yankee Fork	2	30,000	21,300	71	
West Fork Yankee Fork	3	29,200	28,750	98.4	
West Fork Yankee Fork	4	25,000	20,200	80.8	
Live hatch rate for south-end sites		560,000	501,000	89.37	
Total		1,000,000	755,000	76	

Notes:

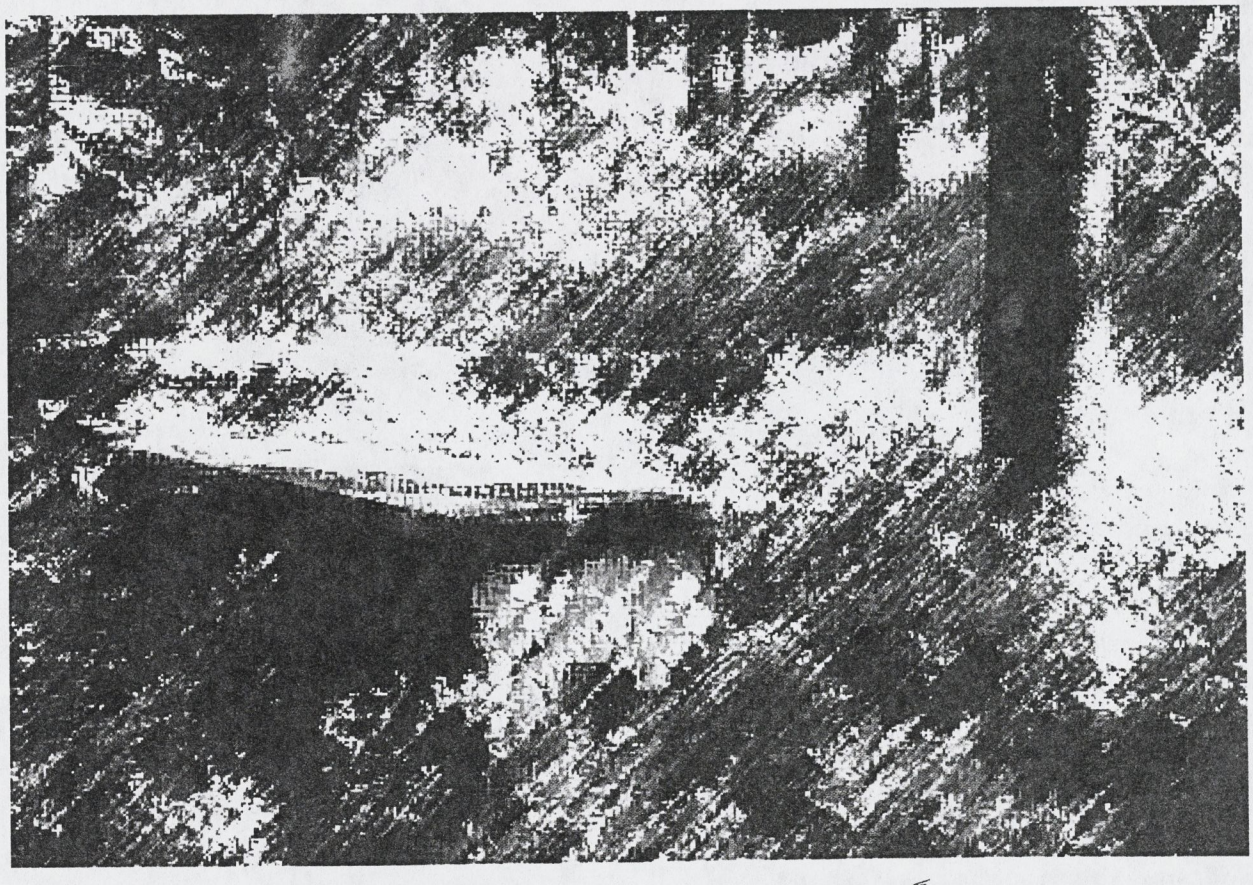
JSB= Canadian Jordan/Scotty Boxes

RSI= Washington State Remote Site Incubator

CBU= Crystalex Bucket Upweller

Salmon Egg Placement Project

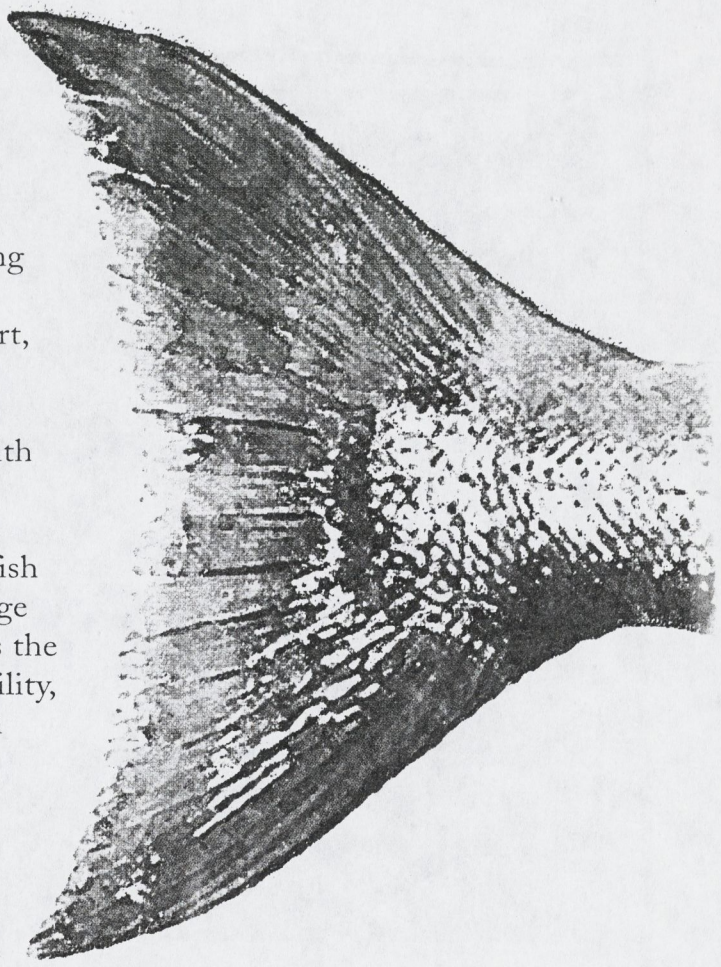
In the fall, we will be placing Chinook salmon eggs in Warm Lake, the headwaters of the South Fork of the Salmon River and its tributaries. The salmon fry will leave the hatch box in February 1998. We will then have data to compare the salmon and steelhead hatch rates. This is our first attempt at placing salmon eggs, and we hope that it is as fruitful as the steelhead project. This will also be the first time we have used the streamside incubators and WV boxes in the winter. The salmon placement project is managed completely by the Tribe. We will maintain and care for all these salmon eggs.



Evaluating the Indian Summer III Project

'As you can see, the traditional thinking of the American Indians is a major factor in the way they think about saving the salmon. Their desire to maintain a salmon population that is viable protects their immediate needs, and also the needs of the future, American Indian or not.'—Ted Strong, Columbia River Intertribal Fish Commission

At no other time in the century, have Native Americans been in a position to influence changes in education and fish recovery programs. Native American communities are bringing forward traditional natural law systems for the sake of future generations and all living things. By helping students to learn ecological wisdom through seeing and listening, we can pass down information through ritual, art, and practical example. Hands-on learning, seeing results from their efforts through experiential learning enhances their science and math skills and provides our children with valuable tools to meet the future.



It is a great honor to work with the youth of two tribes: fish and students. Change must come from within, and change takes time. Achievement for the fish and students means the same thing. Achievement is accomplishment through ability, effort, and courage. Achievement is creative contribution and giving. The Indian Summer students are achievers. They are working for the good of the fry and to help themselves. In return, they are giving back to society by surviving, making a good life, taking care of family, and being life-long learners. They are learning to give, and this is what is important.

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For More Information, Contact

Ed Galindo, Sho-Ban School, Box 709, Fort Hall, Idaho 83203, (208) 238-4200.

Ben Rinehart, Lockheed Martin Idaho Technologies Company, P.O. Box 1625, Idaho Falls, Idaho 83415-3830, (208) 526-1002.

Streamside Incubator Designs

Refrigerator Incubator Design, Flaming Gorge/Lower Green River Chapter, Wyoming Trout Unlimited, Bone Draw Project. Contact Dr. Fred Eales (307) 382-4857.

Washington State Remote Site Incubators (Upweller Design). Contact Jerry Manuel (360) 427-2161.

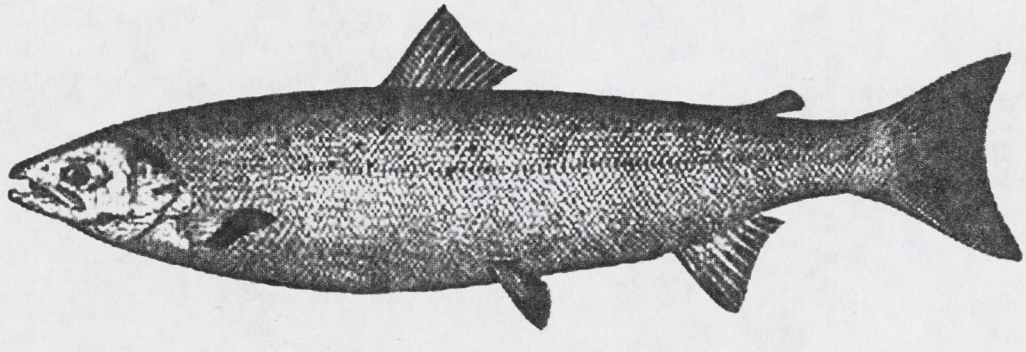
Jordan/Scotty Boxes, B.C. Canada. Contact Blaney Scott (250) 382-0141.

Whitlock Vibert Boxes, Federation of Fly Fishers. Contact Evelyn Taylor (406) 585-7592.

Summer of '97

To this day I can recall,
The best summer I've had of all,
The winding rugged roads,
And all the memories that it holds,
Is up to me to be told,
Blue mountains and green trees,
All around as far as the eye can see,
And then the hidden dusk comes crawling in,
The day is almost at the day's end,
Hamburgers and hotdogs on an open grill,
Soon our hunger is fulfilled,
Around the fire everyone gathers,
Laughing and talking seems like for hours,
Rain, lightning and thunder says it's time to rest,
Away in our tents we are nodding off,
The rain and the thunder's story is the last we hear,
We fall asleep but not for long,
Soon the birds awake and sing their morning song,
Then off in the distance I hear "First wake up call,"
And just then a new day filled with freedom starts for all.

—Autumn Pratt



The Indian Summer project is part of the Shoshone-Bannock Tribe program called *Dance of the Salmon*, which undertakes environmental studies and encourages tribal students to use their skills to build a better future.

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SHO-BAN NEWS

50¢

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Volume 22 Number 43 FRIDAY, SEPTEMBER 18, 1998 FORT HALL, IDAHO

Beaver Plantation Takes Place In Lincoln Creek

by Nellie Broncho
of the News

On ~~August~~ Sept. 7, the Tribal Environmental/Forestry Department released two young adult beaver at Wood Creek in the Little Indian area.

"This was one of the four creeks we surveyed this summer with Summer Youth participants," said LaVern Broncho, Sr., environmental technician. "The beaver were trapped off the reservation on property of a private landowner at Aberdeen, Idaho. He had a family of beaver which was becoming a nuisance building dams in his canals. He was going to shoot them, but he heard about our beaver program through the Soil Conservation Service in Aberdeen, and when environmental coordinator Jim Reed, and I paid him a visit he liked the idea of replanting them on the reservation."

"Tony Galloway, chairman of the Land Use Policy Commission, is pushing for recharging reservation ground water," continued Broncho. "Letting water percolate through springs again without letting it go off the reservation, using beaver to do that. When beaver dams are created, the water soaks into the acquifer and recharges itself. Using beaver, we are putting pieces of the puzzle back together on the reservation. Birds will come back and native plants. It is amazing what beaver can do. They are building ponds for us and keeping our water on the reservation."

Broncho noted that fall is a good time to start transplanting beaver. "They will stay and make a home. Their instincts tell them to get ready for winter. They make homes of whatever is available; sagebrush, willows, cattails, and even rocks. If they were transplanted during the spring or summer, they might migrate out of the system," he said.

"When we released them at Wood Creek, we held a cedar ceremony," said Broncho. "We will bring more beaver there as soon as we start trapping again. We will take photographs at Wood Creek and again next year to see how they have progressed. We will notice the grass and tress coming back and more water in the creek. Once the beaver start establishing ponds, we will start placing side stream incubators a year and reintroduce Yellowstone Cutthroat natives."

"The reservation is growing," he said, " and there is a need to restore beaver habitat for the future in the mountains. Stream banks will be reestablished because of beaver dams, which will draw in deer and elk and native birds."

Broncho emphasized that he wished to caution tribal hunters not to shoot any beaver, they may see, in the mountains because they are important to improving the environment in a natural way. Also, according to legend, beaver are "the little people."

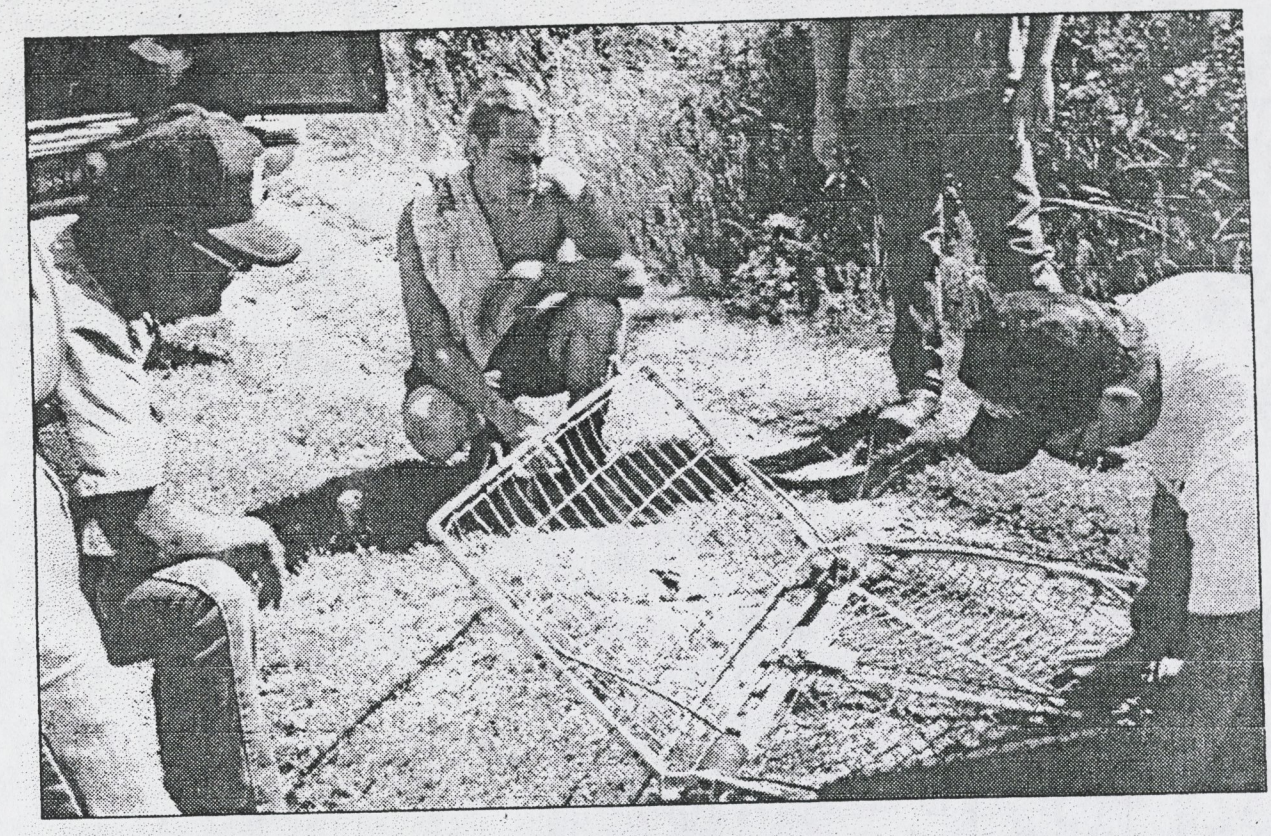
Indian legend tells of Beaver having a large, flat hairless tail because when he was challenged by Otter to build a slide, Beaver did so by sitting on his tail going downhill.

Lavern Broncho, Sr. environmental technician watching over trapped beaver

At the time when everything was a huge sea and there was no land, Beaver along with Muskrat and Otter played a part in the creation of the world. Legend says, Apa, who lived above the clouds, sent each of the animals in turn to find out what was under the water. After Beaver and Otter failed to find anything, Muskrat dived and came up with a ball of mud on his nose. Apa, took the mud and created the world from it. That is how the world came to be.

Dr. B., The Beaver Bell is (still) largely being carried by the general 'public' vs. agencies & institutions. Maybe that's the only way it will persist & grow... -B.

SHO-BAN NEWS - FT. HALL, IDAHO
Volume 22 Number 41 AUG 21, 1998 FRIDAY,



Bruce Smith demonstrates how best to operate the beaver traps he is loaning the Environmental/Forestries Department. l to r: Laverne ~~Shepard~~ Broncho, Jim Reed and Bruce Smith. (Sho-Ban News Photo).

Land Use Advised On Environmental Issues

Geri Hootchew of the News

Bruce Smith, Fisheries Biologist for the Salmon/Challis National Forest was in Fort Hall August 13-15, 1998 to view different areas of the reservation and advise the Land Use and Environmental Departments on a variety of environmental issues they are dealing with.

On Thursday, the 13th a trip was made to the Mount Putnam area where Tony Galloway, Land Use Commission Chairman, Curtis Farmer, Land Use Commissioner and the Environmental/Forestries Department showed Smith around the on-going Putnam Project. Smith stated that there are a lot of Land Management issues, from mine pollution as well as burns which could cause erosions, but there are many opportunities for improving the conditions in the area. He named as number one the need for a management plan to define objectives and goals. Environmental/Forestries has this plan in the completion stage. At the end of the tour Smith summarized by saying the Spring Creek area needs to be maintained, the Jeff Cabin Creek area needs to be improved and the Wood Creek area needs to be recovered through management of the beaver population. His feeling was that a good job is being done by those involved in the Putnam Project and loaned two beaver traps to save the Department from having to purchase any for the beaver relocation.

Smith was very helpful with the advise and suggestions he gave during his stay here. One comment he made in regards to the beaver was: "Anyone can kill something. How many can create something? If a person wants to show their skill they should get out and create something." Creating is certainly what the Putnam Project is doing and they continue to invite Tribal members to join them by identifying areas where nuisance beaver need to be relocated, not killed, so they can do the job nature intended them to do.

1998 News

1998 Volunteers - - Thank You!!!

Polly Wilson- aka - Momma
Dick Northrup
Stephanie Hagopian
Ray Fisher
Candy Cannon
Pam Graves
Bob Cleary
Ty Marks
David&Kelley Martin
Deshawn & Ron Mitchell
Jan Fredrickson
Michael Conn
Ken Haraldson

Special thanks to:

Jerry Bolinski, Mike Ernest, and the "Rangers" at Quincy Reservoir and Dr., Bryan Michener.

Aurora cares!

Stephanie Hagopian (center) came all the way from Massachusetts to learn how to live trap beaver. *See page 4.* On this day Jerry Bolinski *(* left) and Bill Belt (right) of Aurora Waste Water, were giving us a hand with beaver they'd asked **Wildlife 2000** to relocate. Stephanie said she wished officials in MA cared about beaver and were as cool as those in Aurora

WOW ! Wildlife 2000, with the help of wonderful volunteers, live trapped forty two beaver this year! *See trapping season highlights. Page's 4,5,6*

Home Sweet Home

Wildlife 2000 also wants to thank the "beaver smart" people who welcomed the beaver into their lives and onto their property.

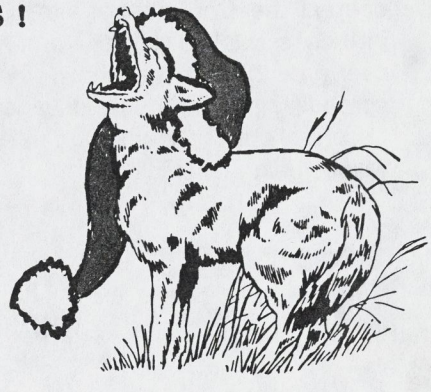
Vic Barnes, a recently retired biologist from the U.S. Department of the Interior who now lives on a ranch his great-grandfather homesteaded near Westcliff, wanted beaver because he not only realizes their benefit to the land, but because he simply enjoys watching them.

Jerry Rapp of Rapp Guides and Outfitters, wanted beaver relocated to his property near Mancos Colorado. He needed them to raise the water table, stop soil erosion and create habitat for wildlife. *See Page 5*

Dr., Bryan Michener wanted beaver relocated to property in Estes Park because, like **Wildlife 2000** president Sherri Tippie, Dr. Michener believes in the beaver and their vital role as a "Key Stone" species.

Wildlife 2000 also relocated beaver to property who's owners wish to remain anonymous

HAPPY HOLIDAYS !



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Spreading the Word

by Sherri Tippie

When Stephanie Hagopian, Living With Wildlife Program Coordinator for the Massachusetts Society of the Prevention of Cruelty to Animals (MSPCA), invited me to speak at a conference she was organizing, I was honored to accept. The conference, Solving Human-Beaver Conflicts, was held in Methuen, MA, and was co-sponsored by The Humane Society of the United States (HSUS).

a little background. . .

In MA beaver can't be relocated. If they're perceived a nuisance, the only option is to hire a trapper who kills them. However, the people of MA banned leg hold, snares and Conabear traps so only humane traps like Hancock traps, which **Wildlife 2000** uses, or Bailey traps, can be used to catch beaver. Many trappers are afraid of the Hancock and Bailey traps saying they're too big, they don't work, and they're so dangerous you have to wear a hard hat when you set them. Trappers who do use the humane traps are accused of not being humane when they kill the beaver. One of the reasons Stephanie and HSUS organized the conference is because a trapper, after catching a beaver in a Hancock trap drowned the beaver and the whole thing was shown on TV. Many people in MA were outraged and one of the big questions being argued was. . . is drowning a humane way to kill a beaver? Plus, instead of educating the public about beaver and offering options to dealing with beaver/human conflicts, the MA Dept. of Fisheries and Wildlife have adopted a hands off approach that some believe is a way to punish the people who voted to ban cruel kill traps.

who was there. . .

Stephanie invited a diverse group of people to the conference, from trappers to animal rights activists, to wildlife conservationists, and managers. She also amassed a variety of speakers who covered different aspects of humane beaver management options, and most importantly, discussed the beaver themselves.

speakers. . .

Dr. John Hadidian, Urban Wildlife Coordinator at HSUS opened the Conference with his interesting slides that include a satellite view of North America. The slides, taken over a period of time, show the lights of cities and towns spreading across the landscape, as our population grows uncontrollably, threatening to engulf the entire continent, wildlife being the victim's.

Bill Bridgeland of Maryland has been using humane methods to solve human/wildlife conflicts for 15 years. He demonstrated the correct way to wrap trees to protect them from beaver and showed some really innovative ways to catch beaver when he relocates them.

One of the things I covered in my presentation is how to use the Hancock traps properly. I also talked about how I first got involved with beaver, some of my experiences, and why I believe the goal should be to coexist with them.

Hope Ryden, who's written many wonderful books on wildlife, including Lily Pond, about a beaver family, interpreted an absolutely amazing video made by Dr. Donald Griffin of Harvard Univ., a renowned animal cognition expert, who used a video probe to capture what happens inside a beaver lodge. It was interesting to see how active the beaver were inside their lodge and how touching each other is a major part of their lives. It was also fun to see the various creatures who shared the beavers' space from time to time. We saw two muskrats nuzzling each other, and there was a little vole, a moth, and a mouse who freaked the beaver out by biting him on the tail when it was in his way. It was extremely funny!

Laura Simon, with the Fund for Animals, talked about how the public views beaver conflicts.

Sharon Brown of Beavers: Wetlands and Wildlife talked about some of her experiences with beaver. She had a captivating slide show and her husband, Joe Brown, BW&W president, told about some of his problems with the New York Highway Department.

Robert Deblinger, from the MA Dept. of Fisheries and Wildlife, explained how to get a trapping permit.

Killing certainly isn't an easy topic to talk about or for those of us who care about animals to listen to. I've gotten into some heated discussions with people who say dead is dead. Well, I agree but the way an animal gets dead, forgive my English, makes a Hell of a lot of difference. Euthanasia means an easy or painless death. Since, in MA, there's no alternative to killing beaver, how they are killed is of the utmost importance.

Dr. Patrice Klein, Director and Wildlife Veterinarian at the HSUS Wildlife Rehabilitation Training Center, did an extraordinary job in discussing a very difficult topic. If the trappers who listened to Dr. Klein can make the death of the beaver and other wildlife they catch easier and less painful, important progress was made.

what a trip. . .

Stephanie also planned a field trip where experts, Skip Hilliker and Skip Lisle, installed their beaver flow devices.

Skip Hilliker from Connecticut, uses PVC pipe, concrete reinforcing wire and stakes to install a simple but effective device that almost anyone can install if they are having problems with beaver plugging up a culvert. It doesn't take too long to install, about 20 minutes, and it is simple.

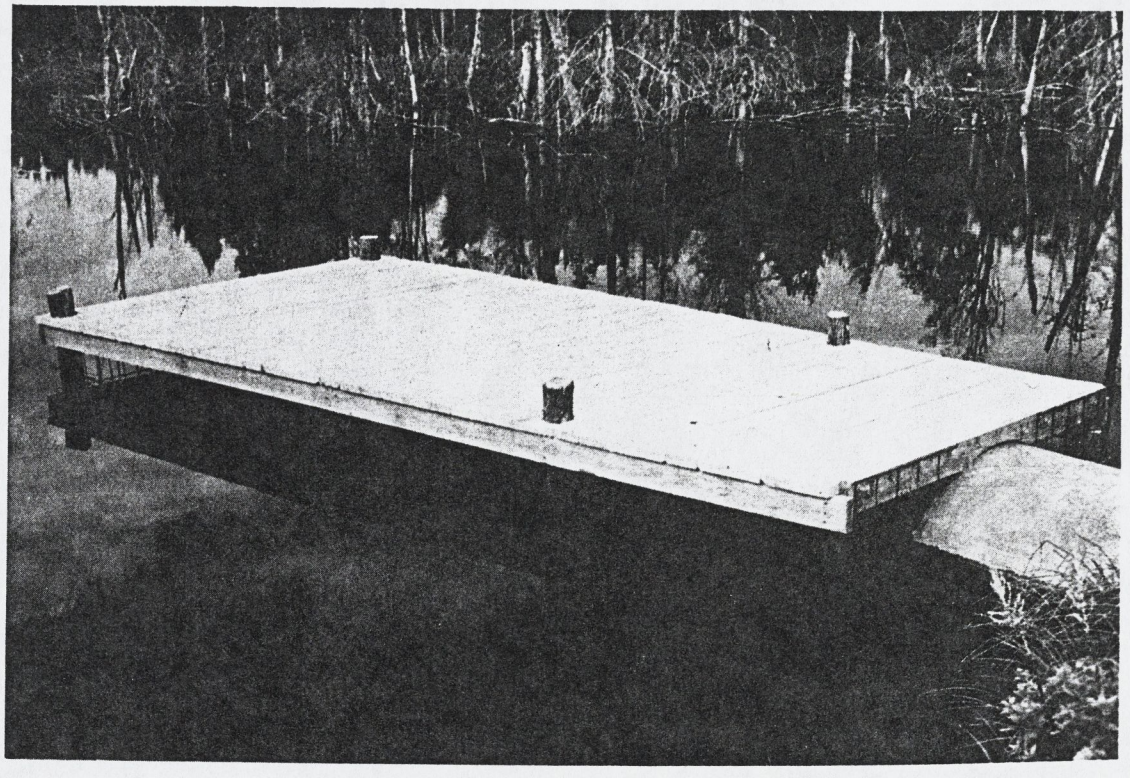
Skip Lisle was named one of "the ten most intriguing people in Maine" by Portland Magazine. He jokingly calls himself a "construction biologist." Lisle first did a slide presentation showing various designs of the **Beaver Deceivers** he's installs for the Penobscot Indian Nation in Maine. On the field trip, we watched as he actually installed one of his Deceivers. Lisle's device is more complicated than Hillikers', but what Lisle created could almost be considered a work of art. And it's both 'functional' and 'beautiful.' On some of the Deceivers, Lisle installs a deck like the one below, which prevents beaver from plugging up the culvert and can be used for observing wildlife or fishing.

A success. . .

My hat goes off to Stephanie Hagopian of the MSPCA and John Hadidian at HSUS! Their conference, Solving Human-Beaver Conflicts was a great success. It was educational, interesting and entertaining. Equally important, friends were made. You may think . . . Right, what about the trappers? (just kidding) I actually mean the trappers too ! Maybe it happened on the field trip when we were on the bus together. We all started talking and telling stories and laughing. I loved it because walls dissolved and a feeling of warmth and camaraderie developed. I believe most of the trappers who attended the conference want to do the right thing for the beaver. I believe they would relocate beaver if they could. But they can't, even though there are people in MA who want them.

1999 Colorado. . .

It was such a great conference and I was so happy to be a part of it that I turned to John Hadidian and said, "I wish we could do a conference like this in Colorado! He looked at me and said, "Let's do." I said, **"FAR OUT!"** On September 6th through the 9th, 1999, The Humane Society of the United States, **Wildlife 2000** and Rocky Mountain National Park will be putting on a conference at the Holiday Inn in Estes Park, about beaver and how to coexist with them and options for solving conflicts humanely. We will mail out information concerning the conference as we get closer to the date! Hope we see you there!!



This is one of Skip Lisle's more elaborate '**Beaver Deceivers**,' it not only prevents beaver from plugging up culverts, it's a great place to watch wildlife or to fish! Lisle will be at our beaver conference, September 1999, to demonstrate how he deceives the beaver.

Highlights - 1998

1998 was special! **Wildlife 2000** live trapped **forty two** beaver and relocated them to wonderful new homes where they will create vital habitats for both wildlife and human life, and two of our volunteers came from far away to help out!

Stephanie Hagopian (MSPCA), wanted to learn how to set the Hancock trap and live trap and experience relocating beaver. In MA you can't relocate beaver you can only kill them once they're caught. So Stephanie came to Colorado.

STEPHANIE GETS TO HOLD BEAVER KIT !

What an adventure. . .

While Stephanie was with us she learned how to set the Hancock trap and even take the safety off. She live trapped 6 beaver and helped relocate them as far away a Mancos, CO.

Pam Graves is from South Carolina. At home she has a beaver named Bucky that she and her husband Jimmy raised from a kit. But, if you truly love beaver they way Pam does, to make life complete, you need to live trap and relocated a few beaver too. Pam tells her story:

Trapping with Tippie
by Pam Graves

After several years of trying, I finally succeeded in making my way to Denver to help Tippie relocate some of our flat tailed friends. The first day I arrived Tippie had a huge female beaver waiting, so we relocated her where the other members of her family had gone, to property near Estes Park.

Pam, gives Momma a last pat good bye

My first trapping experience came the next day. We drove almost an hour to get to the site and when I looked at the creek the poor beaver were living in, I couldn't wait to get them out of there. The water was dirty and littered with tires, shoes and other things that don't belong in a creek! I knew the 30 lb traps were going to require some physical effort and I wouldn't admit it to Tippie, but, I thought the first thing snapped up in that trap was going to be me! She was busy setting the other four traps and politely didn't call attention to the ridiculous sight I must have made. Then she said, "grab a trap, rebar, nut-driver and the sledge hammer and lets put them in place." "Right" I thought, I'll get that stuff, put the rebar between my teeth and jump right into that creek!" However, Tippie already had her share of the equipment and was heading down the bank.

I could hardly sleep that night for worrying. Had I secured the traps and tightened the nuts well enough to keep the trap from falling into the water and drowning our precious beaver?!

The next day as we approached the water we could see small waves being generated from inside the traps. I got excited and jumped into the water for a closer look, and there, in the first trap, was a very perturbed little masked face looking back at me. It was a raccoon! As Tippie released the little fellow I rushed to the other traps, and was met with the sight we hoped for. . . TWO young kits slapping their little tails.

We took the kits home and returned late that afternoon to set more traps for their parents. Checking them the next day, I felt we had more luck than leprechauns, because mom and dad were there in the traps just waiting for us! Oh yes, that raccoon was there too! As I released him, trying to stay away from his sharp teeth, I could have sworn by his sparkling eyes that he was laughing at me.

It was my last day and Tippie, to no avail, had been on the phone several hours trying to locate one of the land owners who said they wanted beaver. I was afraid I wasn't going to be part of relocating the beaver I had helped live trap. Then just when I thought all hope was lost, she surprised me by announcing, "Lets go!"

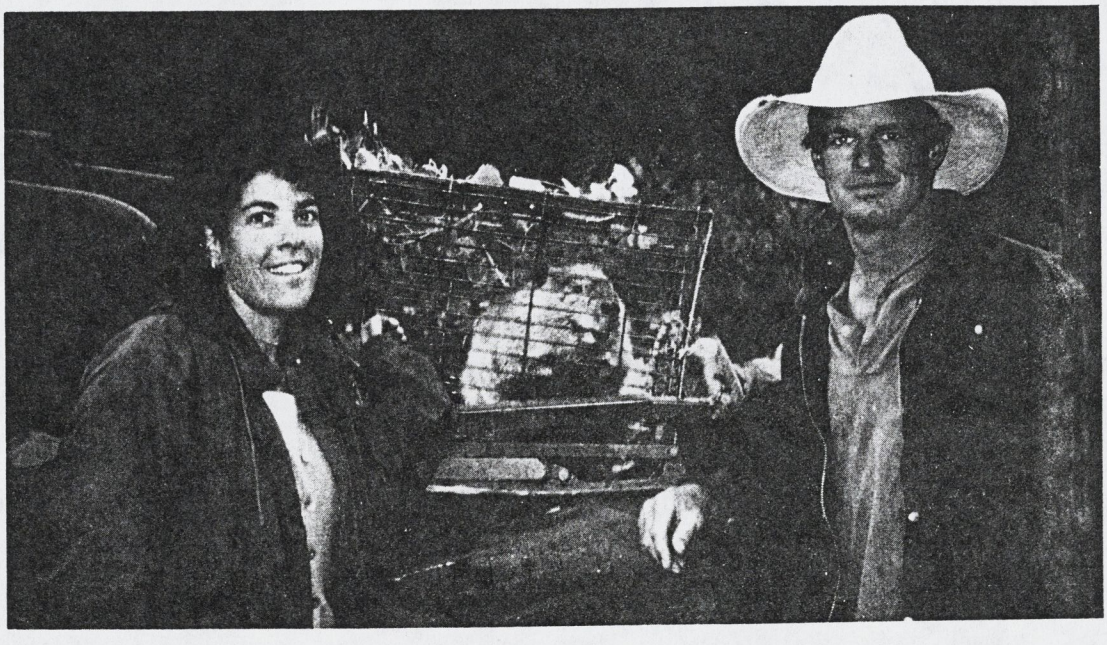
The landowner, Tippie and I, found the perfect spot for the beaver, high in the mountains and beautiful. We carried the beaver family into the woods and released them into a gently flowing stream. We could hear their gentle mewing sounds as they took protection under an eroded stream bank. What a wonderful experience!

Riding home on the plane, I pondered the dedication of a lady who, for fourteen years, has been the catalyst for saving so many members of this "keystone" species. And I salute the people at Denver Water and Aurora Waste Water. Far too often, the only method for dealing with nuisance animals is to kill them. I can't find the words to express my respect for the city of Aurora and Denver Waterwho are courageous and compassionate and have the vision to explore humane alternatives.

Both Denver Water and the City of Aurora deserves our appreciation and thanks!

Deshawn Mitchell snuggles beaver beaver kit.

Deshawn lives far away but talked his dad, Ronnie, into bringing him over so he could volunteer for **Wildlife 2000**. Deshawn said he's always liked beaver, but never dreamed he would be this close to one !



Stephanie Hagopian, MSPCA, helped relocate Talula, to the property of Jerry Rapp, a Guide and Outfitter near Mancos. Talula's one of many beaver who now call his beautiful place home

Wildlife 2000 especially wants to thank those agencies and companies for choosing the humane approach when it comes to taking care of their beaver. All of us who care about wildlife owe them a great big **Thank You!!**

Denver Water, Aurora Waste Water, Spring Hills Golf Coarse, Center Hills Golf Coarse, the Denver Country Club, Lakewood Country Club and James Nursery.

Below, the beaver Tippie is holding, will have a better life thanks to the compassion of those people above!

Photo by Gordon Illg

On November 8th or 11th you can see Tippie on Wild Rescues, on the cable channel, Animal Planet!

Ty Marks, pulls a huge beaver from the lake at Center Hills Golf Coarse in Aurora. Ty's 11 years old and sets traps and catches beaver like a pro!

If you are looking for a wilderness adventure with people who understand and know wildlife, and you want to have the time of your life. . .
I promise!! Call:

Strange reunion

In early June, Rick Spowart a District Wildlife Manager from Estes Park, brought a beaver to **Wildlife 2000.** We thought the beaver had a broken leg. I called our board member, Candy Cannon, and we took the emaciated beaver to Dr. Cox at Deer Creek Animal Hospital. The x-ray showed the reason the beaver couldn't walk was sever arthritis in his spine. You could also see a strange looking object in the beaver's abdomen. One of the vet tech's thought it looked like a sprinkler head. It took me a minute, but I finally realized what I was looking at: a radio transmitter!

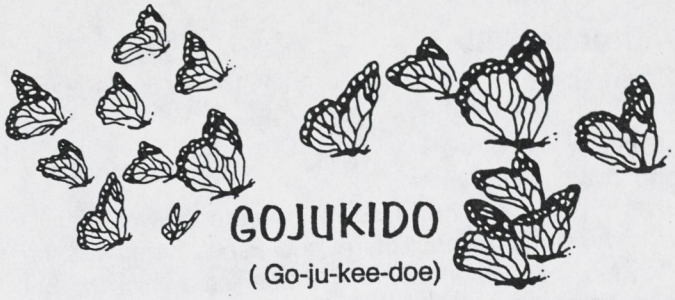
Dr. Cox, gave me Prednisone for the beaver, and told me to give him half a tablet twice a day. Now giving a beaver a pill is quit a feat but Candy and I developed a method; I would push the pill into the corner of the beaver's mouth and at that exact moment, Candy would stick an apple in front of his face. The beaver would bite into the apple not realizing he'd gotten a pill too! We also got the beaver a swimming pool so he could exercise his stiff and sore back but actually he could hardly swim.

I called around to no avail, trying to find out who was doing studies on beaver and using telemetry . It looked like the transmitter would remain a mystery. So we were just hoping, with the medication and physical therapy the condition of the beaver would improve and he could be relocated.

However, after eleven days he died. Candy and I had cared and fretted over him and we were really broken up. But at the same time I was extremely curious about that transmitter. So, with Candy there for moral support, I removed the transmitter and was shocked! In 1990 I assisted Dr. David Robinson when he put the transmitter, ID # 151.990 into this beaver! The beaver had been part of the contraception study **Wildlife 2000** and the CDOW were involved in, in 1989/1990.

How the beaver got to Estes Park is a puzzle. From Denver to Estes is a long way but by water implausible. And DWM Rick Spowart hadn't given anyone permission to relocate beaver from Denver. Someone most likely , live trapped and dumped the beaver because they didn't want to go through the proper processes it takes to relocate. What's new?

We did take comfort in knowing the beaver was well fed and made comfortable in his last days.



(Go-ju-kee-doe)

The twelve postures of Gojukido, a Japanese for of Karate, are presented by Larry Kishiyama in the stunning, 27 minute video tape. HEI WA (Peaceful Universe), scored by the internationally revered composer KITARO

Comments about this awarde-winning video:

•"Through these postures I experience a sense of quiet and peace that is rare in life today. I have a new positive attitude."
Sherri Tippie President and Executive Director, **Wildlife 2000**

•"The postures reflect the movements in nature. These movements have brought peace and joy to my soul."
Susan de Castro McCann, Journalist, Lyons, CO

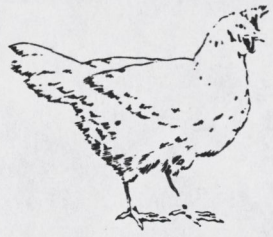
Visit Larry's Web Page for more information
http://www.earthnet.net/harmony

You can order this inspiring video by sending a check or money order for $23.00 (US) plus $3.95 shipping and handling ($9.95 international)

To: Larry Kishiyama
P.O. Box 20092
Cheyenne, WY 82003-7002

My Chicken Story

by Sherri Tippie



For over a week I'd been seeing this dirty little white chicken running around loose in the yard of a church. I knew she didn't belong there because there was no shelter, food or water. OK, she was just a chicken, but for some reason the thought her running loose and unprotected, exposed to traffic, not to mention dogs and kids who would harm her, really weighed on my mind.

One day, my friend, Andrea Nelson and I, were driving past the church and there she was running around, that dirty little chicken, I told Andrea, "Let's catch her!" It took some fast maneuvering on our parts, and we must have looked rather funny, two grown women chasing a chicken, but we finally caught her and took her back to my house. She was the skinniest chicken I have ever seen and the end of her beak had been cut off so she must have come from a egg battery. That's where "egg laying" chickens are crammed into tiny little spaces and their beaks are cut off because the conditions are so stressful they mutilate each other.

She had also lost most of her feathers and seeing her up close, she was a pathetic sight. Looking into her eyes you even got the feeling she was self- conscious about the way she looked. Maybe that's why I decided to call her Rosalie. I've always thought the name Roselie sounded pretty and feminine, so maybe a pretty name would make her feel better about herself.

We prepared a cage for her, got her fresh water and the right kind of food, and she seemed to enjoy her new accommodations.

We have a huge back yard and thought she would enjoy wondering around it. We have cats and a dog, Larry, but they're used to all kinds of animals and wouldn't hurt her. Rosalie seemed to know this, and feeling safe, she started wondering around the garden. She also hung out by the cages the beaver were in; watching them like she was wondering what they were.

It was warm, so we left the patio doors open. Rosalie, feeling welcome, came into the house one afternoon, jumped up by the fire place, and made herself comfortable. It was so funny, almost like she wanted to be near us. But I was completely shocked when one evening instead of carrying her to her cage I said, "common Rosy, lets go to bed" and she followed me! It was strange, funny and wonderful all at the same time. When I walked faster she would hold out her wings and walk faster too. I laughed so hard I cried.

City ordinances wouldn't let us keep Rosalie, but she's in a wonderful place with people who will love and care for her just the way my little chicken deserves. I took Rosalie to one of the most beautiful places I have ever seen, with some of the kindest people I have ever met, "Best Friends Animal Sanctuary" in Kanab UT. That's right, I drove a chicken all the way to Kanab. But that little chicken really touched my heart. So you may laugh and that's OK because you ever met my Rosalie.

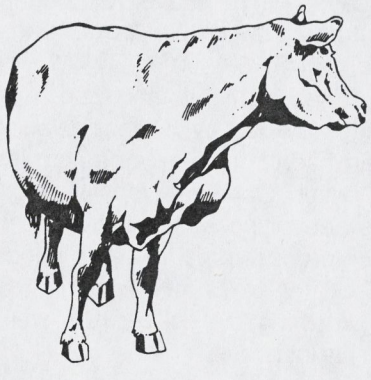
A Rancher to Support

Jan and Will Holder's "Anchor" ranch sits near the Blue Mountain Range near Arizona's eastern border. It is just 11 miles from the release site of 11 Mexican gray wolves. Unlike the majority ranchers - who systematically slaughtered wolves into near extinction a century ago - the Holders practice "holistic resource ranching or eco-ranching" and choose to coexist with all predators.

This is a far cry from the way Will Holder's paternal grandfather, Eugene Cleveland did things. Cleveland is believed to have trapped and killed the last Mexican gray wolf in Arizona which caused them to became extinct in the United States.

Today the Holder's manage 300 head of cattle on 10,000 acres of both land they own and lease, for the health of the grass, plants and wildlife that share the land. They spend lots of time on horse back with their herd. They also study the behavior of predator's and use non-lethal techniques like bunching cattle, using guard dogs and frequently changing ranges, which is good for the range too, instead of shooting or trapping wolves, mountain lions, bears or coyotes.

Not to say they wouldn't kill a predator. If their non-lethal techniques fail over a prolonged period of time and it's documented, and if the predator is rabid or "deviant" they would kill it. But their eco-ranching is working well because they haven't lost any livestock to a predator since they started practicing this method. This is in contrast to their neighbors who, according to Holder, have had plenty.



The Holders also raise their cows without using steroid's, hormones, pesticides or irradiation, on open grasslands rather than in feed-lots so it's considered organic, humanely raised, "predator friendly" beef.

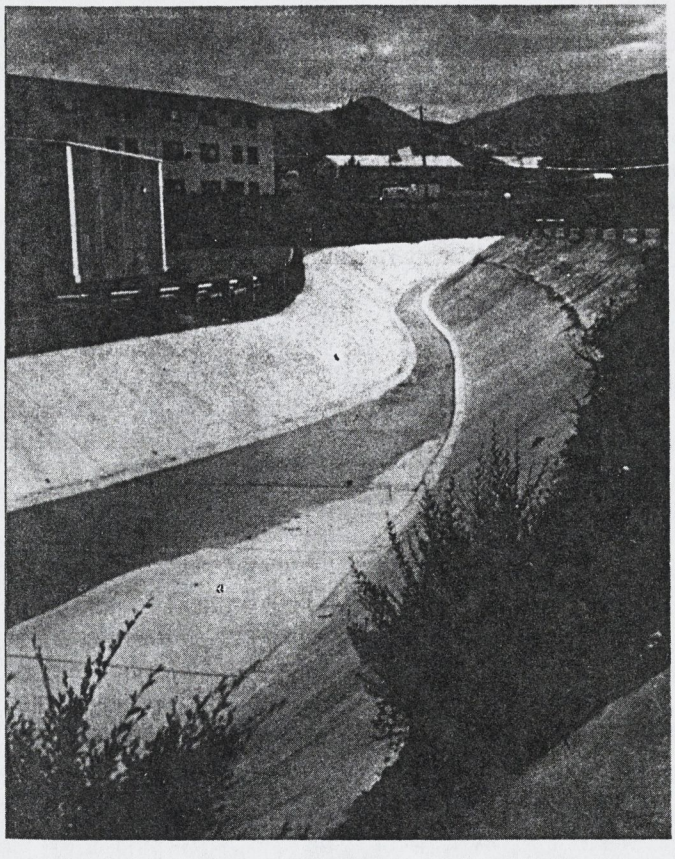
Wildlife 2000 believes if we choose to eat meat, we should support the ranchers who are good to their animal and respect the earth and it's wildlife. The Holders certainly fall into this category .

Their product labeled, Ervin's Natural Beef, can only be bought in Tucson. But ask you grocer next time you go to the store if they have a product like this and if they don't ask them to provide it.

Tippie's two cents. . .

What we call something truly does affect the way we perceive and treat it.

I believe the reason people feel free to throw everything imaginable into our creeks and rivers is because we call them drainages. The term 'drainage' creates a picture in your mind of something being taken away, draining off, or disappearing. You know, like down the drain. To refer to a little meandering creek or a magnificent river as a 'drainage' when it provides life-giving water for all life, is totally disrespectful and it minimizes what creeks and rivers do. I mean, when you think about it, in their natural state, without man's heavy hand, they actually have a life of their own! They grow, they die down, they nourish, they are a home for many wildlife species, they provide for all sorts of recreation, and for many of us they are a source of spiritual reflection. They deserve our respect and even our awe. When I started live trapping beaver, the Platte River looked like a a place where tires go to die. And there were grocery carts, mattresses, hot water heaters, tons of disposable diapers. . . everything! One time I yelled at a woman who was throwing the sacks from her just eaten lunch into the river . " **HEY!!** What are you doing? We drink that stuff! You pinhead!" Maybe it's because we call our water ways 'drainage's' that people find it so easy to throw their refuse into them. . . My point: The wonderful revival hymn *Shall We Gather at The River* would really lose it's impact if instead it were, *Shall We Gather at The Drainage*. . .



One of the more extreme examples of how ignorance and greed are killing of our creeks.

The people who help our wildlife, need your help.

In every issue of our newsletter **Wildlife 2000** introduces you to one of Colorado's wildlife rehabilitators. This time it's Kris Wagner, a new wildlife rehabilitator in the Larkspur area. Even though her facility is still small, many injured or orphaned animals have been treated there this year. A coyote, foxes, prairie dogs, fawns, several raccoons, a night heron, and over a 100 song birds have come through the facility since March of this year. Kris finds helping animals very full filling however the financial burden has been great. In caring for various birds, 80,000 meal worms were consumed. If you have any questions or care to send a donation, you can contact Kris at:

Kris Wagner
802 Tenderfoot Drive
Larkspur CO 80118
(303) 681-9216

Good News for Prairie Dogs in South Dakota

When a dozen or so black footed ferrets, who were being reintroduced, moved into a prairie dog colony located on the 70,000-acre Conata Basin in South Dakota's Buffalo Gap National Grasslands, the U.S. Forest Service decided they'd better close the area down to prairie dog shooters. Since the ferrets take up residence in prairie dog burrows and use the little dogs as their main source of food, there's always the chance one of the shooters would mistake a ferret for a prairie dog.

In addition to ferrets, hawks, eagles and other predators use the prairie dogs as food. In fact, prairie dogs are a "keystone" species that keep whole prairie ecosystems healthy. So, even though this in the only protected area on any national grassland, it's a step in the right direction. **Wildlife 2000** has a great idea! You know how our government has a "Just Say No" campaign to drugs. They also need a "Just Say **NO!**" campaign to those who enjoy to killing our wildlife for the fun of it.

Good News for Coyotes

In Delta, British Columbia, residents complained to their environmental conservation officer about coyotes going after their pets. They were told the following: We will not remove the coyotes as it is not effective because other coyotes quickly occupy the area. Coyotes are hard to trap and poison in this instance is illegal. . .Citizens just need to learn to live with coyotes.

Closer to home. . .

Our Colorado Division of Wildlife told the residents of Greenwood and Cherry Hills Villages almost exactly the same thing concerning Coyotes!! That's one of the reasons I love our CDOW!!

Wildlife 2000's

Western Slope Representative:
Carol Buchanan

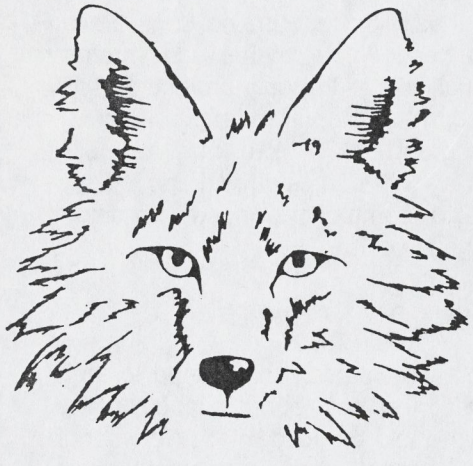
One of the issues we're dealing with is educating what we call "urban refugees" who purchase a little piece of rural heaven "to be closer to nature" then think they can pick and choose which wild creatures can exist in their space. They also don't want to accept the fact that living in rural areas requires you to live responsibly. So you don't create a conflict with wildlife. Tippie has been doing pretty well educating people about beaver and how to coexist with them . And we want to broaden that to include other species as well. Sometimes it comes down to a matter of financial resources.

Urban refugees aren't the only ones having a negative impact on wildlife. Since Governor Romer appointed Tom Kourlis Colorado State Agriculture Commissioner, Kourlis has spent a lot of his time and energy wresting management of Colorado's wildlife (mostly predators) out of the hands of the Colorado Division of Wildlife.

In another one of his power play's, Kourlis this summer proposed a rule change that would allow landowners to keep "for their pleasure or for black market profit" the carcass's of bear and mountain lion that are killed on their property for causing damage of some kind. This only encourages the illegal killing of bear and mountain lion.

Kudos for Woolgrowers. . .

In a surprising turn of events, at the public meeting in Rifle concerning this issue, the Colorado Woolgrowers sided with the wildlife activist and spoke against the rule change.

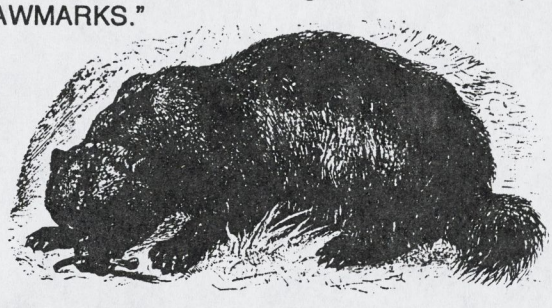


This was a step in the right direction for Woolgrowers who have always prescribed to the old adage, "the only good predator is a dead predator. And, if you look at Kourlis's record, he sure believes it. That's why we have to get predators and fur-bearers put back to where they belong, in the jurisdiction of our CDOW!

Recently, I attended a wonderful conference at the Biosphere near Tucson AZ., that was sponsored by the Wildlife Damage Review. It centered around USDA-APHIS Animal Damage Control issues. This Spring legislation was introduced in Congress to cut by 10 billion dollars (the amount taxpayers pay to kill coyotes, lion, bear, beaver, bobcat, etc.) from the 60 billion dollar budget of ADC. This legislation came close to passing in the House and the plan is to make sure it passes in 1999. WDR is also kicking off a campaign to collect a million signatures to again ban Compound 1080. and Sodium Cyanide Crystals (M-44) across the U.S. Even though we severely restricted the use of those poisons in Colorado with our 1996 ballot initiative, it is a growing problem in many other states and they need our help. Let me know if you would like information on this issue.

Carol Buchanan
P.O. Box 517
Norwood, CO 81423
(970) 327-4737

Due in large part to the successful 1996 ban on traps, snares and prisons in Colorado, the CDOW is going forward with plans to reintroduce both the lynx and wolverine. I'm cautiously optimistic about this reintroduction because lets face it, the habitat they called home is a whole lot different today than it was when these critter's last graced out state. For those of you who would like to keep updated of this tenuous issue, ask the CDOW to put you on their mailing list for their publication "CLAWMARKS."

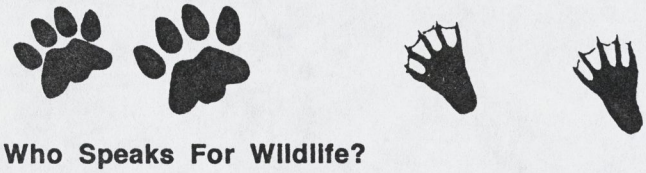


Wolverine reintroduction will be put on hold, for this year at least. The CDOW has decided to put all their effort and money into the reintroducing lynx pending further approval by the Colorado Wildlife Commission. The problem, according to John Siedel, who represents biologist from the CDOW, Rocky Mountain National Park, U.S. Forest Service Bureau of Land Management and the U.S. Fish and Wildlife Service on the working group know as CLAWS (Colorado Lynx And Wolverine Strategy) said they just don't have the man power to pursue the project.

THE WAY THINGS OUGHT TO BE!

FINDERS KEEPERS!!

What did this 52-year-old Greeley man, who was archery hunting in the Buffalo Peaks Wilderness Area, expect would happen when he left the elk he had killed alone in the forest?! It seem's the elk was too big for him to pack out alone. . .**duh**! So he went back to Buena Vista, about 15 miles away, and returned the next day planning to transport the dead elk back to civilization. However, when he arrived at the carcass, a substantial portion of the hind quarters had been consumed. Not thinking the animal who had eaten the elk was still in the vicinity he started preparing it. But just as he was getting ready to hang it in a tree, the bear who had been taking a little nap after her belly was full of elk got understandable mad! After all, it had been left alone and unintended in the forest. It was her elk now and she was going to defend her bounty, as anyone who knows anything about bears, knows they will do. So not surprising, she chased the Greeley man up a tree! And she aggressively kept him there until District Wildlife Officer Randy Hancock, who had volunteered to help man pack the elk out, arrived.
The bear was being very persistent with no intention of leaving the elk. So Hancock, went back to his truck, retrieved his gun, returned and shot the bear killing her. The only good news is she had no cubs.
Wildlife 2000 believes the bear should have been tranquilized not killed! She was only protecting the food she had found. Was this man who was killing our wildlife, so naive that he thought he could leave a dead elk in the wilderness and it wouldn't be claimed buy the first predator that got a whiff of it?!



Who Speaks For Wildlife?

Wildlife 2000 receives hundreds of calls and answers questions about wildlife and wildlife related conflicts from people not just in Colorado but all over the United States.

Wildlife 2000 works with private land owners and city agencies to resolve wildlife conflicts in non-lethal ways.

Wildlife 2000 goes to schools and talks about the importance of learning about and coexisting with the wildlife we share our state with.

Wildlife 2000 enables people to work hands on with wildlife. And by helping to live trap and relocate beaver , they can be a part of helping to improve and maintain Colorado's public and private lands.

There are higher laws in the wilderness than mans' laws. He lost his claim to the elk when he abandoned it, even if he was going to return the following day. Finders Keepers. Perhaps those are things that should be included in CDOW "Hunter Safety" class. For one thing don't hunt alone! It's not safe for the person doing the hunting and, if you kill a large animal, you can't pack it out if your by yourself. But, if you do kill an animal and leave it then return to find a bear has claimed it. You loose! **TOO BAD**!

But that's the way things ought to be. . .

WRONG SPECIES

You know the CDOW has a one strike law for bear. That's where a bear can get in trouble once, like eating out of a garbage can, etc. , and the next time the CDOW kills them. Well, **Wildlife 2000** supports a law like that . . . except for people. That's right! Anyone living in the mountains who attracts bear or any other predator because they've left out their garbage, or are just basically not living responsible in areas where there is wildlife. . . these people get one strike. They can screw up once causing a conflict with wildlife and that's it! The second time they have to relocate back to the city!

But that's the way things ought to be. . .

Wildlife 2000 believes that everyone who lives in Colorado should be educated about the creatures we share our state with so we can protect and preserve what makes Colorado a wonderful place to live.

With so many people moving to Colorado **Wildlife 2000** has a bigger job ahead of us than ever before. So please remember **Wildlife 2000** this Holiday Season! The only way we can continue helping wildlife is through your contributions!

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Ecology, 79(3), 1998, pp. 928–942

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INFLUENCE OF BEAVERS ON STREAM FISH ASSEMBLAGES: EFFECTS OF POND AGE AND WATERSHED POSITION

JOEL W. SNODGRASS AND GARY K. MEFFE

University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29802 USA

Abstract. We used a spatial survey of fish assemblage structure in streams and beaver ponds to: (1) determine the effects of beavers on fish assemblage structure at the reach and drainage basin scales, and (2) assess the influences of pond age, watershed position, and pond environment on fish assemblage structure within beaver ponds. Stream impoundment by beavers affected species richness at the reach scale, but this effect was highly dependent on pond age and drainage area above the pond. In headwater streams, species richness per pond increased to a high in ponds 9–17 yr old and then decreased to a low in ponds >17 yr old. Farther downstream, species richness showed little change with pond age. Assemblage structure varied significantly among unimpounded, impounded, and previously impounded stream reaches, and variation in assemblage structure among ponds was related to pond age and physical habitat. In large ponds there was a shift from lotic to lentic species, and as ponds aged, small-bodied minnows were replaced by larger predators. Because there was high species turnover among impounded and previously impounded reaches, beavers affected patterns of species richness at the drainage basin scale; we collected more species in first- and second-order streams (32 and 38, respectively) than in third-order streams (26). Taken together these results indicate: (1) that beavers have a positive effect on fish species richness in low-order, blackwater streams, but maintenance of this effect requires preservation of both spatial and temporal dynamics of beaver pond creation and abandonment, and (2) the positive relationship between stream fish species richness and drainage area described for many streams may be a recent phenomenon resulting from the extirpation of beavers from much of their historical range.

Key words: *anoxic conditions; beaver ponds;* Castor canadensis; *fish assemblages; fish predation; landscape position; patch dynamics; pond age; species richness.*

INTRODUCTION

Beaver (*Castor canadensis*) impoundment of low-order streams in North America greatly modifies ecosystem processes and influences biota. Beavers alter nutrient and carbon cycles (Francis et al. 1985, Naiman et al. 1991, Yavitt et al. 1992), nutrient availability (Wilde et al. 1950, Johnston and Naiman 1990, Pinay and Naiman 1991), nutrient and material standing stocks and their transport (McDowell and Naiman 1986, Naiman et al. 1986, Smith et al. 1991), decomposition dynamics (Hodkinson 1975), and water characteristics (Gard 1961, Smith et al. 1991). These changes result in increased standing stocks and production of invertebrate assemblages, as well as shifts in invertebrate assemblage structure (Hanson and Campbell 1963, McDowell and Naiman 1986, Smith et al. 1991, Clifford et al. 1993) and major changes in aquatic plant communities (Johnston and Naiman 1990, Feldmann 1995).

Relatively little is known of the effects of beavers on stream fish assemblages in North America. The expansion of a beaver population in a California stream increased trout production (Gard 1961). In Ontario beaver ponds, harsh winter conditions influenced life history characteristics, demographics, and feeding behavior of pumpkinseed sunfish (*Lepomis gibbosus*) populations (Fox and Keast 1990, 1991), and fishes were predominantly of small body size and partitioned resources among species (Keast and Fox 1990). Schlosser (1995) presented evidence suggesting ponds support "source" populations that provide a supply of immigrants to "sink" populations in adjacent streams, and that the supply of immigrants is controlled by the influence of discharge on boundary characteristics between ponds and streams. Hanson and Campbell (1963) present the only information that compares fish assemblage structure among beaver ponds. In comparing three beaver ponds to other pool habitats in a Missouri stream, they found increased standing stocks and richness of fish in the ponds compared to adjacent natural pool habitats. No studies have described the temporal dynamics of stream fish assemblages as they are affected by beavers, or investigated the influences of pond watershed position, age, and physical habitat on fish assemblage structure within ponds. In addition, most studies of beaver pond ecology have been conducted in northern latitudes (>35° N) although the historic range of beavers included most of North America (Hill 1982).

Manuscript received 6 September 1996; revised 23 April 1997; accepted 24 April 1997.

In this study, we describe the influence of beaver impoundment of Southeastern blackwater streams on fish assemblage structure. Our goals are to: (1) compare fish assemblage structure among unimpounded, impounded, and previously impounded stream reaches; and (2) to investigate correlations among species richness and fish assemblage structure, and pond watershed position, pond age, and physical environment. We ask three specific questions: (1) how does impoundment of low-order streams influence stream fish species richness and assemblage structure at the reach scale (two to three pool–run sequences, Frissel et al. 1986) and at the drainage basin scale (e.g., across a third-order drainage basin); (2) are influences related to beaver pond watershed position and age; and (3) is beaver pond physical habitat related to pond watershed position and age? Because of the large temporal and spatial scales involved (ponds may persist for >100 yr and are found on first- through fourth-order streams) we take a natural experiment approach (sensu Diamand 1986) and compare ponds ranging from 1 to >17 yr old on first- through third-order streams.

Methods

The study system

Beaver ponds and streams were sampled at the Savannah River Site (SRS) on the Upper Coastal Plain of South Carolina (USA). Large portions of this 780-km^2 site have been undisturbed since the SRS was established in the early 1950s by the U.S. Department of Energy. The beaver population on the SRS has recovered from a low of two stream-dwelling colonies in 1950 to ~37 stream-dwelling colonies in 1992 (Snodgrass 1996). At the SRS, beaver ponds are limited to first- through third-order streams. Local geomorphology is characterized by streams with broad, flat floodplains flanked by uplands with moderate topographic relief. This results in broad, shallow ponds with depths >1 m restricted mainly to areas of the old stream channel.

Streams of the SRS are low gradient (usually <2 m/km), with shifting sand bottoms. In streams that have not been impounded by beavers, wood (both dead and living) provides the main structure; waters are usually acidic to neutral (pH 5–7), near 80% saturated with dissolved oxygen, and range in annual temperature between 8° and 24°C (Newman 1986). In impounded or previously impounded streams, aquatic plants become quite dense (Feldmann 1995) and contribute substantially to fish habitat structure. Water temperatures in impounded reaches may fluctuate between 1° and 30°C annually, and during summer months daily dissolved oxygen levels may range between zero and super saturation (>100%; J. W. Snodgrass, *unpublished data*).

Fish collections and physical habitat measures

Thirty-one beaver ponds were identified on 1992 color infrared aerial photographs and sampled for fishes in April and May 1994. During this period, 11 unimpounded stream reaches also were sampled; nine had never been impounded and two were previously impounded. Four additional previously impounded stream sites were sampled during April 1995 to yield sample sizes of 31 and 15 for ponds and streams, respectively.

We sampled ponds with seines and backpack electroshockers. All mesohabitats (e.g., emergent marsh, open water) that were accessible with the electro-shocker (<1 m depth) were sampled until 20–30 min of effort yielded no new species. This was followed by sampling with seines. In ponds with open areas, we used a short, straight seine (2 m deep × 3.3 m long, 0.32-cm mesh) and a longer bag seine (1.3 m deep × 10 m long, 0.16-cm mesh). In two of the ponds, obstructions prevented the use of the longer seine. The number of species collected from these ponds was relatively high, so it is unlikely that the lack of use of the large seine affected estimates of species richness and assemblage structure. Again, we sampled all mesohabitats until 20–30 min of effort yielded no new species.

We sampled streams by blocking the upper and lower ends of 30–50 m reaches with straight seines and removing fishes with three consecutive passes of a backpack electro-shocker. The exact sample length was determined by the location of areas where stream physiography allowed effective block-netting. We chose reach lengths of 30–50 m because they contained two to three pool–run sequences, the main mesohabitat elements in these streams (Meffe and Sheldon 1988). In addition, the average length of stream affected by beaver dams at the SRS is ~40 m (Snodgrass 1996), and preliminary investigations indicated that slopes of species accumulation curves level off dramatically after 30–50 m of stream are sampled. Preliminary investigations also indicated that this method was effective at removing most of the fish >20 mm standard length (SL) from the stream; 90% of the individuals collected in six electro-shocker passes were removed in the first three passes, and we collected many small fish (20–30 mm SL).

To sample physical habitat at each site we used a point transect method. At equally spaced points along each transect, substrate type, water column structure, depth, and current were recorded. For beaver ponds, 4–5 transects were spaced equally along the length of the pond, beginning 5 m above the dam. We recorded data at 5-m intervals in large ponds (>50 m wide) and 2-m intervals in smaller ponds. In streams, we spaced transects at 5-m intervals beginning at the downstream block net and recorded data at 0.25-m intervals. We recognized four substrate types (gravel, sand, silt, and detritus), and five water column structure types: aquatic vegetation, coarse wood (>5 cm diameter), fine wood (<5 cm diameter), coarse roots (>5 cm diameter), and fine roots (<5 cm diameter). Current was measured using a Marsh-McBirney current meter at 0.6 times depth at each point, and dissolved oxygen (DO) and

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— * Canal
Experts

beaver — Humboldt

high grasslands

intermittent
stream

- 50 or 60+ yrs
pesticides

40 yrs
- 1959
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Date: October 6, 1998

Subject: Field Report and Photographs of Coanda Effect Prototype Screens for Streamside Incubation and Remote, Small-Scale, Stream Diversion Fish Protection

To: Glenn Seaberg, Idaho Model Watershed Project Coordinator

This report outlines results of 1998 Model Watershed Project trials for both a Streamside Incubation Sediment Filter Box (Prototype 1.) and development of a low profile, small-scale, stream diversion fish protection screen (Prototype 2.) which may be suitable for remote locations throughout the upper Salmon River sub-basin. These prototypes have been developed with assistance from the Bonneville Power Administration's Fish Passage Project and Forest Service Southwest Idaho Ecogroup. Cooperation and assistance were also received from Jim Strong and Bob Weir, of Fluids Engineering Company; Jim Buell, of Buell and Associates; Dan Axness and Dale Gooby of the NRCS; and local screen shop personnel of the Idaho Fish and Game Department. We have attempted to apply large-scale Coanda screen technology to the small-scale requirements of streamside incubation, as well as many small "pick and shovel" type diversions, found on inaccessible spawning or nursery streams in our area.

The enclosed photographs and narratives illustrate these devices in operation and the results of their trials this summer.

Discussion:

1. Steelhead Streamside Incubation - 0.1 mm Coanda Screen Filter Box - Prototype 1.

Coanda screen bar spacing and surface area are primary factors for consideration, in designing customized filter boxes for use with streamside incubation. Bar spacings of 0.2 or 0.3 mm, while increasing flow output, also allow for larger sediment sizes (negative) and greater amounts of instream organic matter and plankton (positive), to pass through the filter. Therefore, during initial egg incubation stages, the finest screen spacings (0.1 - 0.2 mm) could be employed to minimize sediment problems. Prior to the point of final yolk sac absorption or "buttoning up," the filter screen could then be replaced with a slightly larger size (0.2 - 0.3 mm) to allow for initiation of natural fry feeding within the incubator, for one or two weeks, prior to migrating to their adjacent nursery stream.

D.R.
Some other simple, low cost solutions we're trying to develop to help solve problems at a larger scale.

The results of sediment filter box flow and performance tests, for three different test screen spacings, were as follows:

1 Ft. x 1 Ft. x 1 Ft. Streamside Incubator Sediment Filter Box

1. 0.1 mm 1′ x 1′ Screen

Volume	Time	Flow	Performance
1 gal.	12 sec.	5 gpm	Full-screen flow
5 gal.	60 sec.	5 gpm	

2. 0.2 mm 1′ x 1′ Screen

1 gal.	10 sec.	6 gpm	1/2-screen flow
5 gal.	50 sec.	6 gpm	

3. 0.3 mm 1′ x 1′ Screen

1 gal.	10 sec.	6 gpm	1/3-screen flow
5 gal.	50 sec.	6 gpm	

With 1 1/2-inch inlet and 1 1/4-inch outlet sump pump flex pipes, it appeared the filter box's 1 inch inlet and outlet ports were "balanced," when the 0.1 mm screen was used. However, when the 0.2 and 0.3-inch filter screens were utilized, their capture capabilities exceeded both filter box flow delivery and flow removal capabilities, as both screens were dewatered within only 6 and 4 inches, respectively. These results would indicate that in these size ranges, a smaller screen surface area (e.g., 1/2 and 1/4 sq. ft.) would still be sufficient to generate a ≥5 gpm flow. Larger pipelines and filter box port holes could enhance performance as well. (See photographs 1. through 7.)

2. Small-Scale Fish Protection with Coanda Type Screens - Prototype 2.

Given our pilot study performance objectives, to design a simple 1 cfs, 2-square foot collector, which cost less than $300, the predicted performance of our test screen was to capture at least 0.35 cfs per square foot, when set at a 35 degree angle. The use of a round pipe manifold allowed for spillway rotation, to enable evaluations of various angle settings. We utilized two test screen collectors, with bar spacings of 1.0 and 1.5 mm, both set at 5 degree bar angles. Low stream flows, low channel gradients, large bottom material, creating a tight "fit" or anchoring of the collector to the stream bottom, and backflow out the lower screen, all limited flow delivery in these tests, to levels below catchment capabilities of these collectors.

Given that the National Marine Fisheries Service criteria for profile bar screens (when used as "static" or filter screens) is a minimum 1.75 mm bar spacing, the prototype test sizes of 1.0 mm and 1.5 mm were well below the NMFS standard for salmon/steelhead sized fry, as well as any larger-sized fish. Therefore, it would appear that these sizes of screens would also afford an added margin of safety, especially for the smaller fry of resident species such as bull, rainbow, or cutthroat trout. In addition, when compared to larger, channel-wide stream diversions, which tend to "fish" most of the horizontal and vertical stream channel, the prototype spillway width

of 2 feet, within the 40-foot wide Bear Valley Creek channel, amounted to only a 5 percent risk of contact for fish moving downstream. In contrast to NMFS' maximum approach velocity requirements for static screens (0.4 fps) in order to preclude fish entrapment or entrainment and to facilitate escape, in this application, streamflow and velocity function to expedite the passage of fish across the spillway screen.

Given the small size of this design, its 30 - 45 degree operational angle (necessary to enable a water shearing effect), and continuous sweeping of the screen surface, it would appear that even in longer lengths (i.e., 10 - 30 percent channel-width, risk of contact) there would be no measurable affect to salmonids of even the smallest size categories, which may pass over this type of screen. (See photographs 8. through 13.)

Recommendations:

1. Streamside Incubation Filter Box - Prototype 1.

Given the initial performance of this filter box in 1998, evaluated under high mineral (sand/silica) sediment loads at the Carmen Creek incubation site, it is recommended that it be evaluated next year in an area with both high mineral and organic sediment loads, such as those found in the Bear Valley Creek Watershed, Indian Creek, or Boulder Creek. In addition, given the high cost of manufacturing finely spaced screens, it is recommended that alternatives be investigated, for Coanda screens which could be more affordable.

2. Fish Protection with Small-Scale Coanda Effect Screens - Prototype 2.

Given the initial performance of these small prototype fish screens in 1998, it is recommended that further evaluations be carried out in 1999, utilizing designs which would alleviate problems experienced with Prototype 2. Specifically, by going to smaller 10-inch and 8-inch plastic pipe or box collectors, with narrower (e.g., 6-inch) but longer (e.g., 4 feet+) spillways, it should be possible to minimize problems associated with trying to elevate streams with low gradients over a screen set at a 30 - 45 degree angle and keep from losing water out the bottom of the screen. This would allow us to stay within proximity of a 1 cfs flow objective, while maintaining our cost objective of $300 or less per collector. In addition, smaller sizes of plastic pipe would be more readily available from local sources, rather than having to travel to Hamilton, Montana, (200 miles round trip), which is the closest source of 12-inch plastic pipe and fittings. The latter of which (elbows, reducers, etc.) can also cost half as much as the collector device itself....!

If you or the Advisory Committee have any questions, additional ideas, or know of volunteers who would like to cooperate in evaluations next year, please let me know this fall, in order to facilitate preliminary site reviews, planning, and coordination. My telephone number is 756-5109.

Bruce H. Smith

BRUCE H. SMITH
Forest Fisheries Biologist

Enclosures

Denver Water Bd.- Maintenance Supervisor

cc: (w/enclosures)
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Gordon Haugen, Columbia Basin Fish & Wildlife Coordinator
B. Smith

Eco:B.Smith:bhs:jm:10/6/98

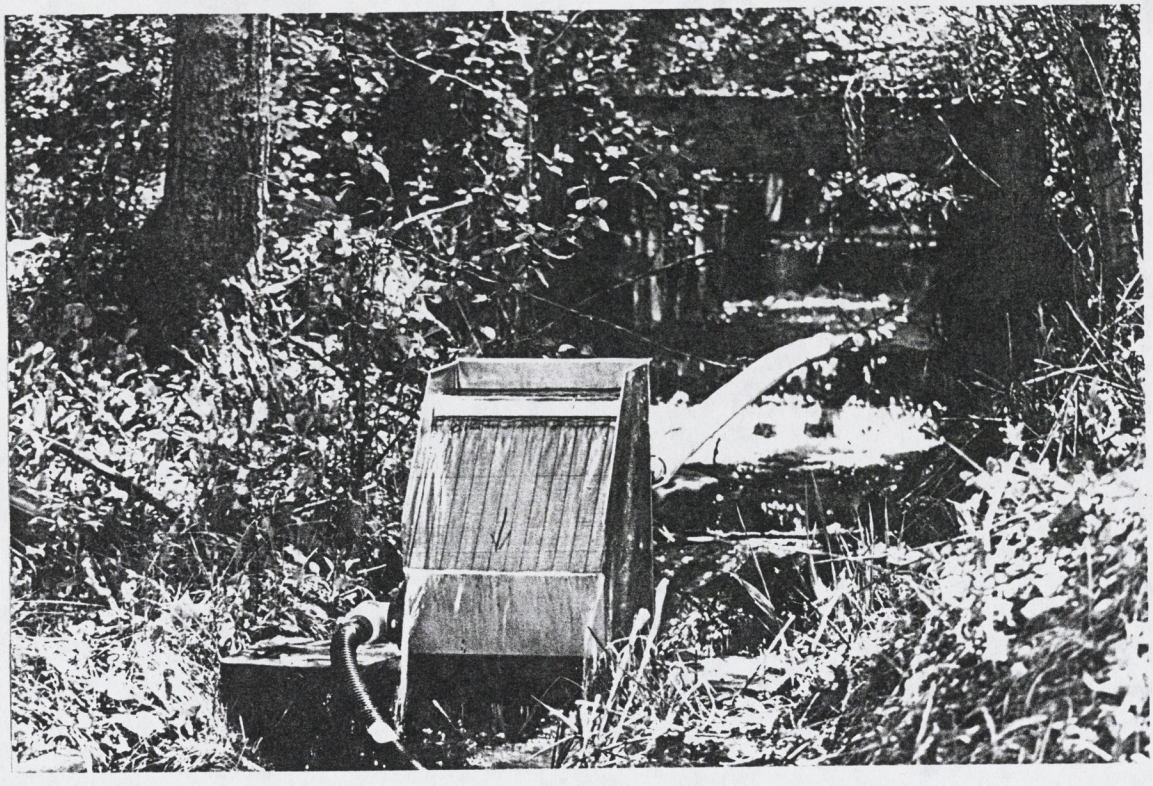

PHOTO 1. Steelhead Streamside Incubation - 0.1 mm Coanda Screen Filter Box - Prototype 1.

Upstream view of filter box being fed from an irrigation diversion at the Burns' residence on Carmen Creek.

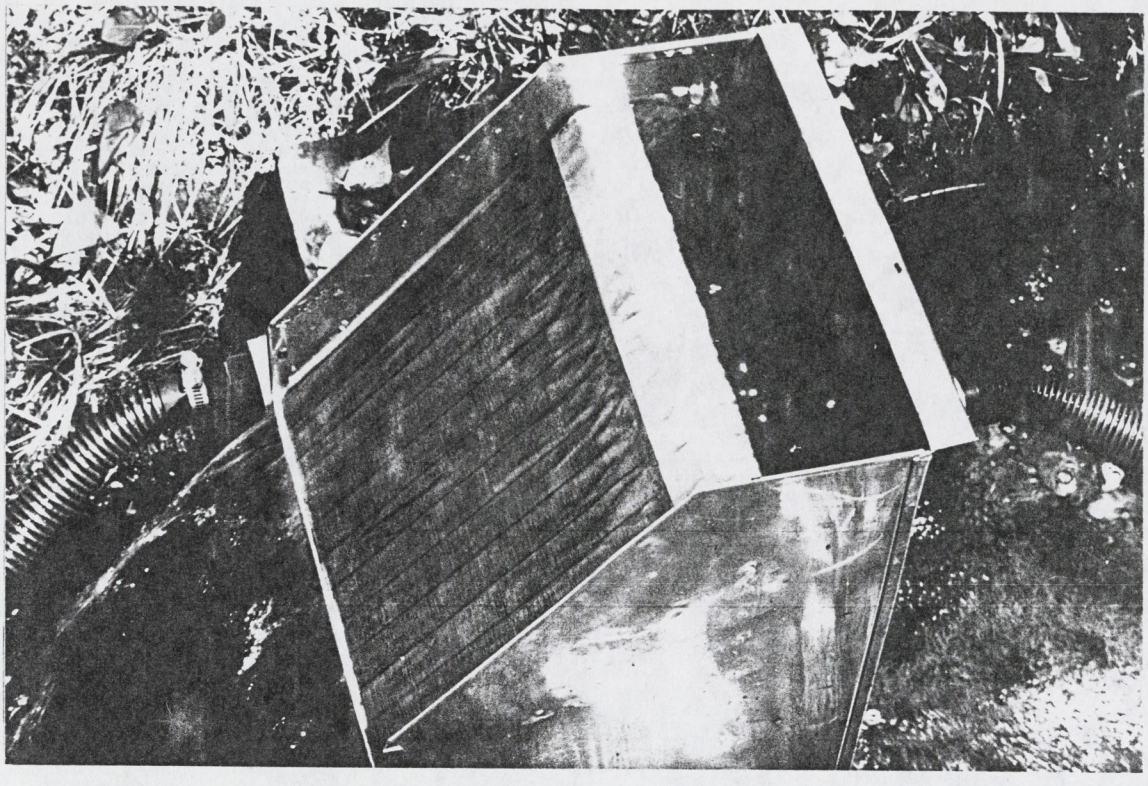

PHOTO 2. Steelhead Streamside Incubation - 0.1 mm Coanda Screen Filter Box.

Top view noting inlet line, upwelling chamber, level streaming across screen, minimal flow separation at top, and outlet line to incubators.

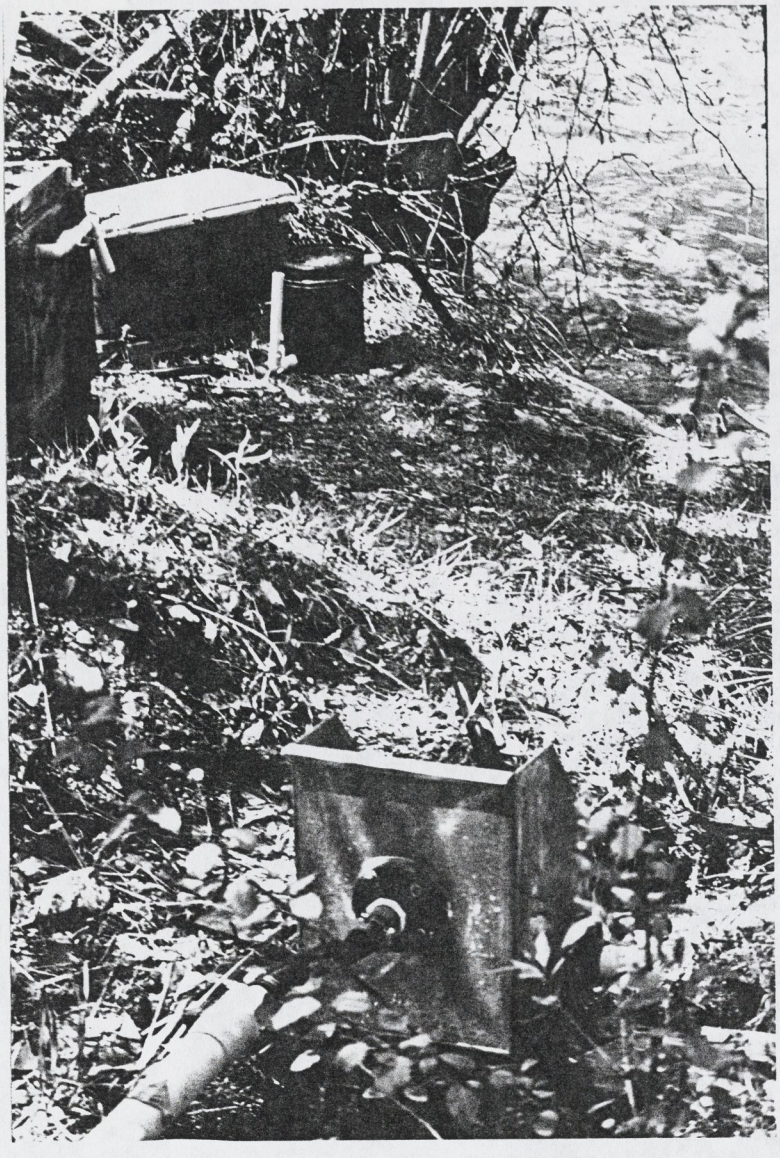

PHOTO 3. Steelhead Streamside Incubation - 0.1 mm Coanda Screen Filter Box.

Site overview, noting various types of streamside incubators (refrigerator, ice chest and upwelling bucket), the filter box, and adjacent Carmen Creek. Extensive sediment removal was achieved, with only the finest sediments passing through the collector system. Flow was approximately 5 gpm, which could be improved with slightly larger screen spacings of 0.2 - 0.3 mm.

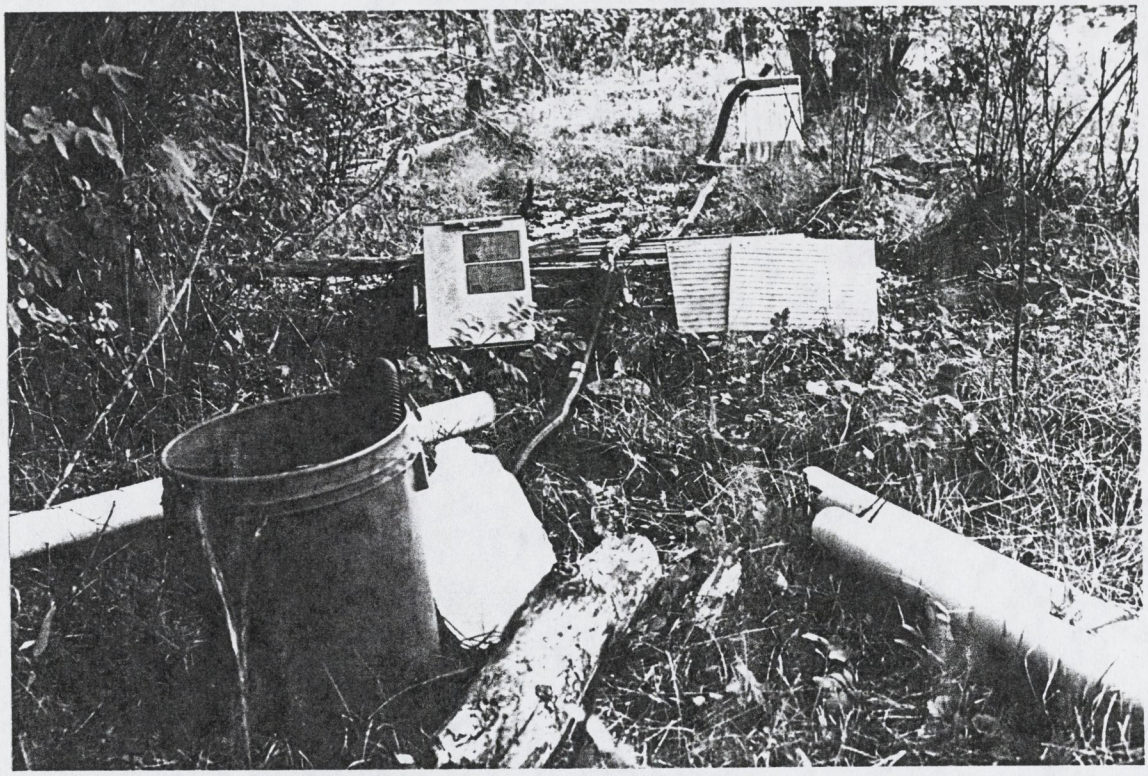

Photo 4. Streamside Incubation Coanda Screen Filter Box.

Flow measurement set-up using the existing incubator delivery system on Ford Creek.

Photo 5. Streamside Incubation Filter Box.

Close-up of 0.1 mm test screen noting full length streaming (and self-cleaning), level spill and degree of flow separation at top of screen.

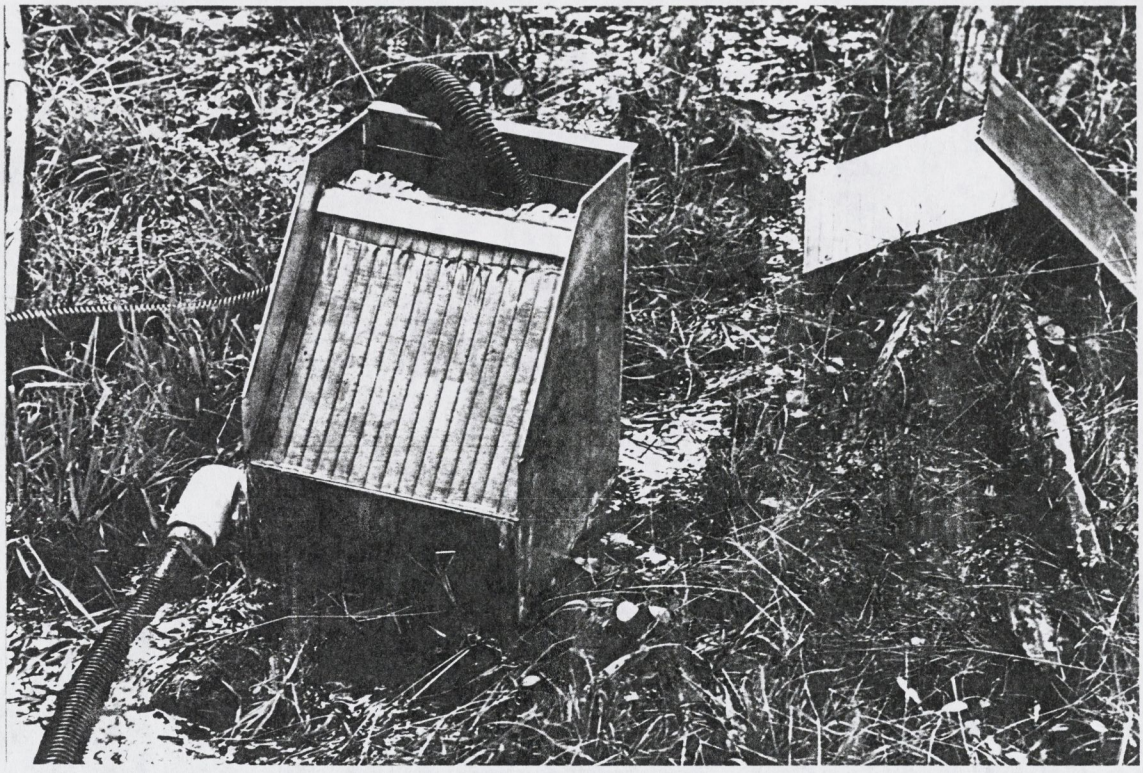

Photo 6. Streamside Incubation Coanda Screen Filter Box.

Close-up of 0.2 mm test screen noting total water capture with only a 1/2 length flow acress the screen face. Flushing of debris is lost, indicating the need for a greater flow delivery or smaller screen surface area.

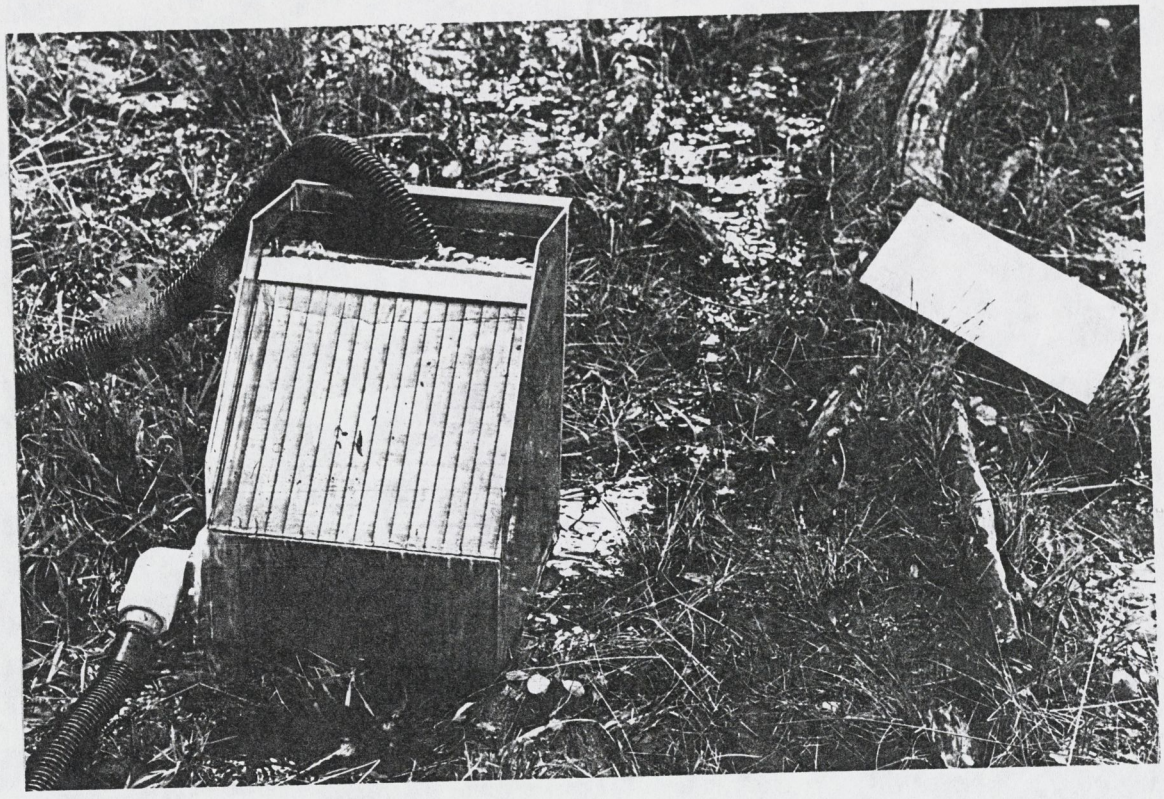

Photo 7. Streamside Incubation Coanda Screen Filter Box.

Close-up of 0.3 mm screen noting total water capture with only a 1/3 length flow across the screen face. Debris flushing is lost, indicating the need for a greater flow delivery or a smaller screen surface area.

PHOTO 8. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

Bear Valley Creek test site, with 12" diameter intake manifold, using a 1′ x 2′, 1.0 mm Coanda Screen, coupled to a 10" delivery pipe.

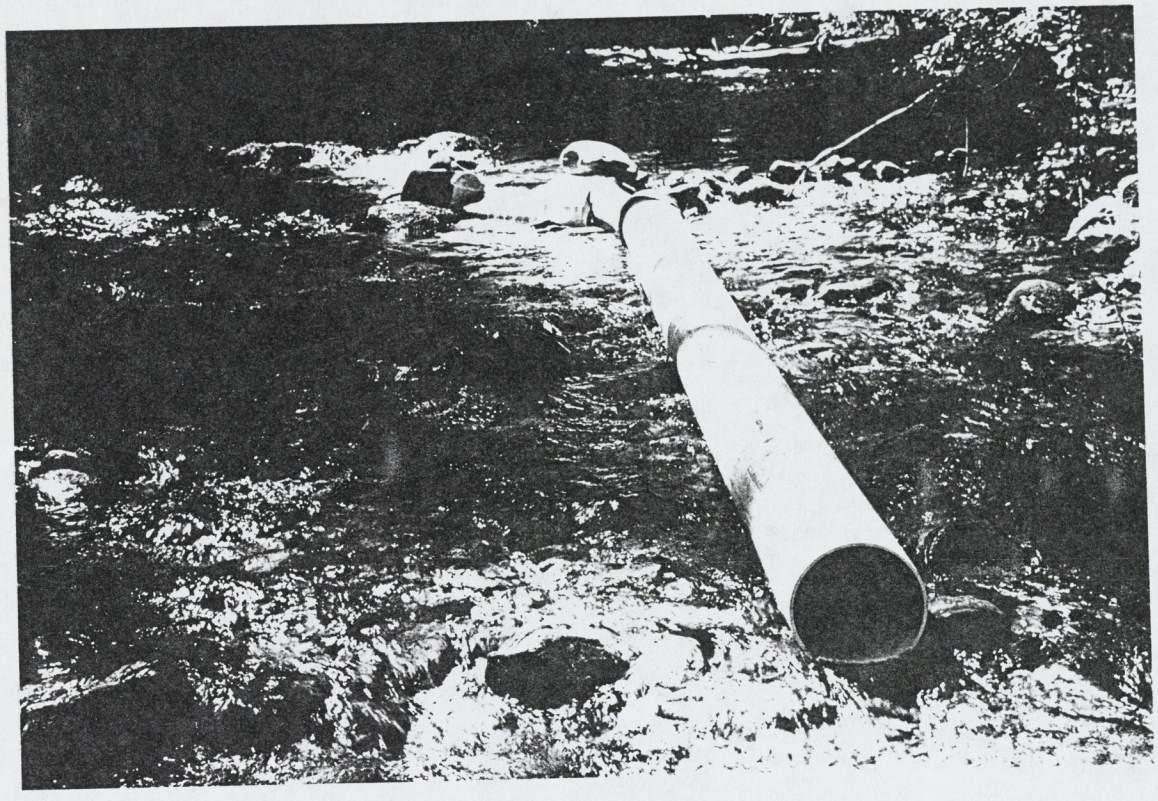

PHOTO 9. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

Close-up of 10" delivery line outlet, noting a water delivery of about 2" depth. Very low gradient limited the degree to which captured flows could be moved into and through the delivery line.

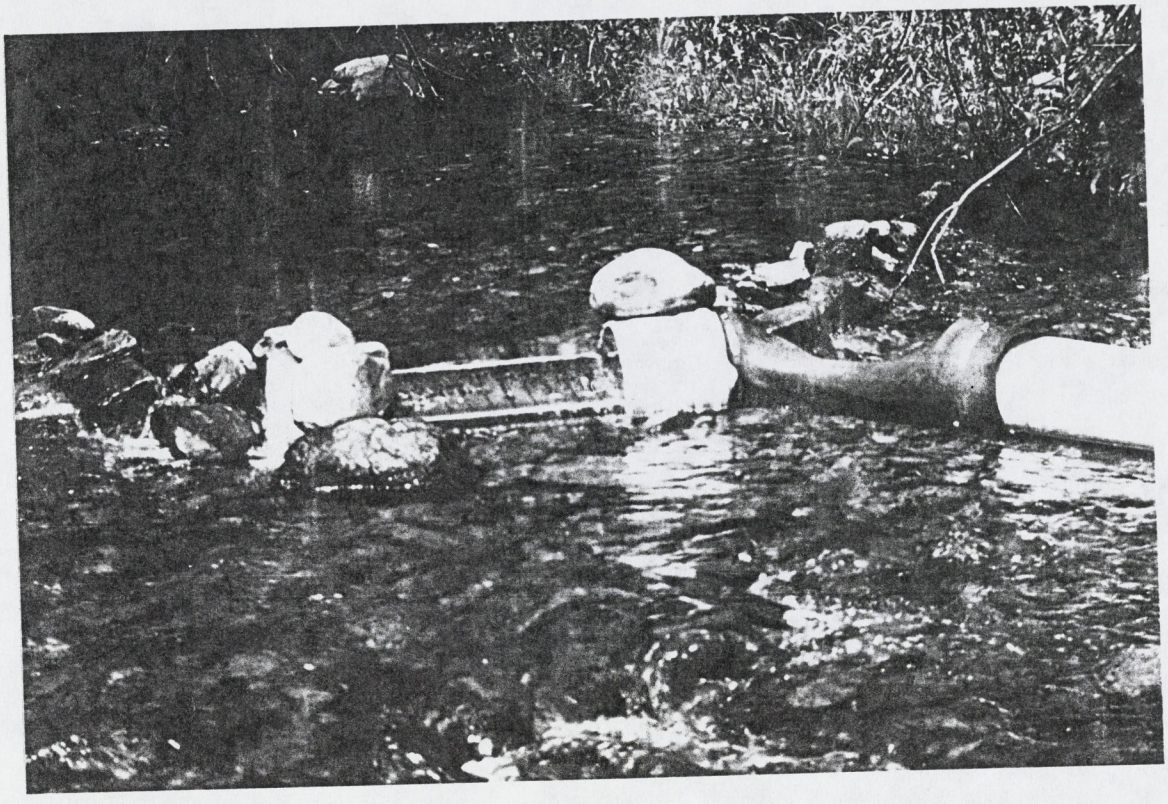

PHOTO 10. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

Close-up of 12" diameter intake manifold and a 1′ x 2′, 1.0 mm Coanda Screen, noting use of a tractor inner tube for a flex coupling, the amount of rock work required to raise stream depth to a height sufficient to overtop the intake spillway, and the use of irrigation dam fabric to reduce flow losses under or around the intake.

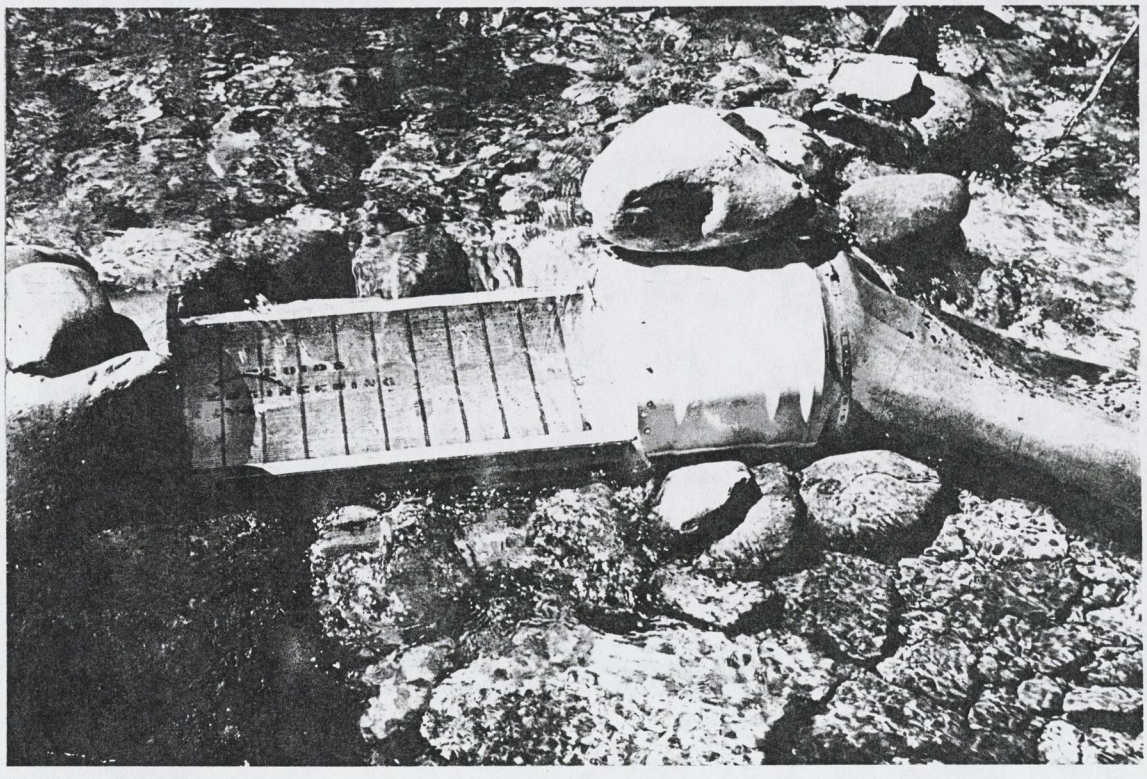

PHOTO 11. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

Close-up of 12" diameter intake manifold, noting connection of flex coupling with a band clamp, plus the total capture of spillway flows within 50% of the 12" screen width. However, some loss of flow was occurring in the lower half of the screen, as water backs up within the intake, prior to flowing down the delivery line.

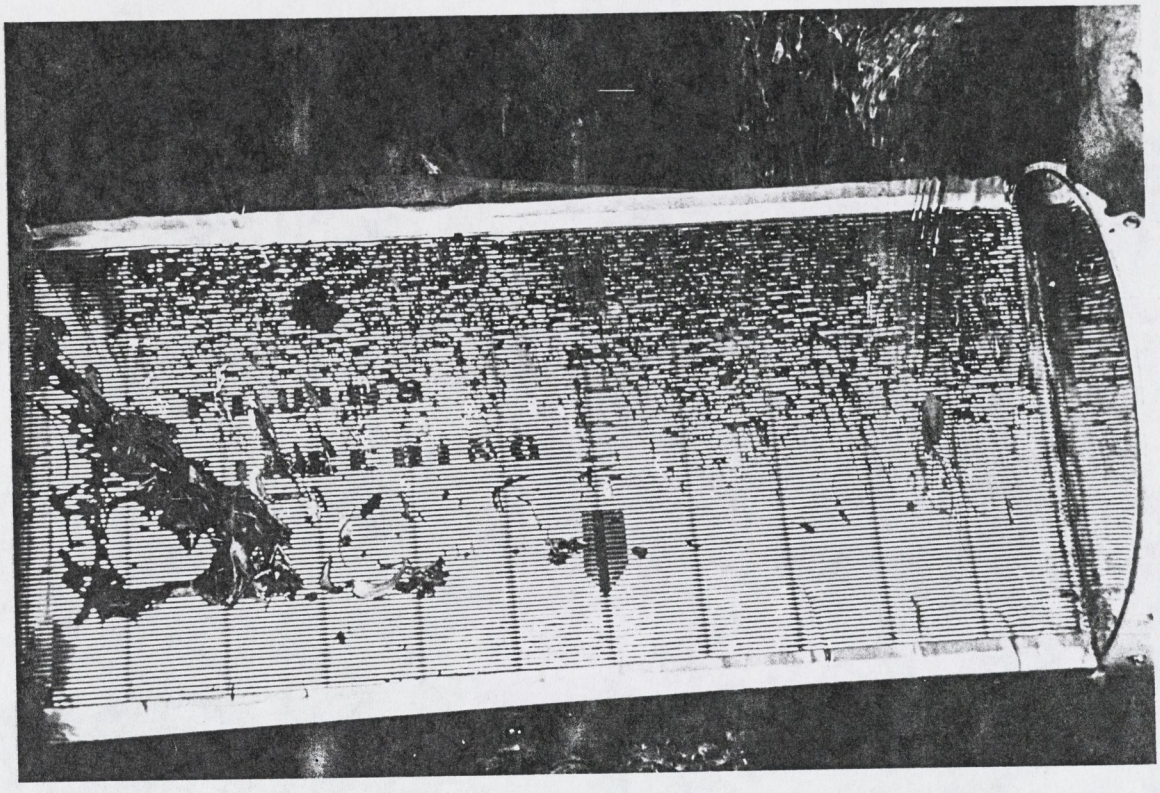

PHOTO 12. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

A close-up view of the Coanda Screen intake manifold after one week's operation, noting accumulated organic matter in the upper half of the screen, in the area of total flow capture. The dewatered mid-section of screen, along with organic accumulations, could lead to stranding or entrapment of fry; juvenile fish 2" or larger could probably manage to escape by flopping past or through this 3" wide area. Some water is still being lost "out" of the manifold, within the lower 25% of spillway. The ideal situation would be to retain all flow captured and still generate a surplus, which would maintain a continuous sweeping of the screen surface, to wash both organic matter and small fish down the stream. There was no screen plugging however, and most organic debris was easily removed with a sweep of the hand. Screen angle at this setting was approximately 30° from horizontal.

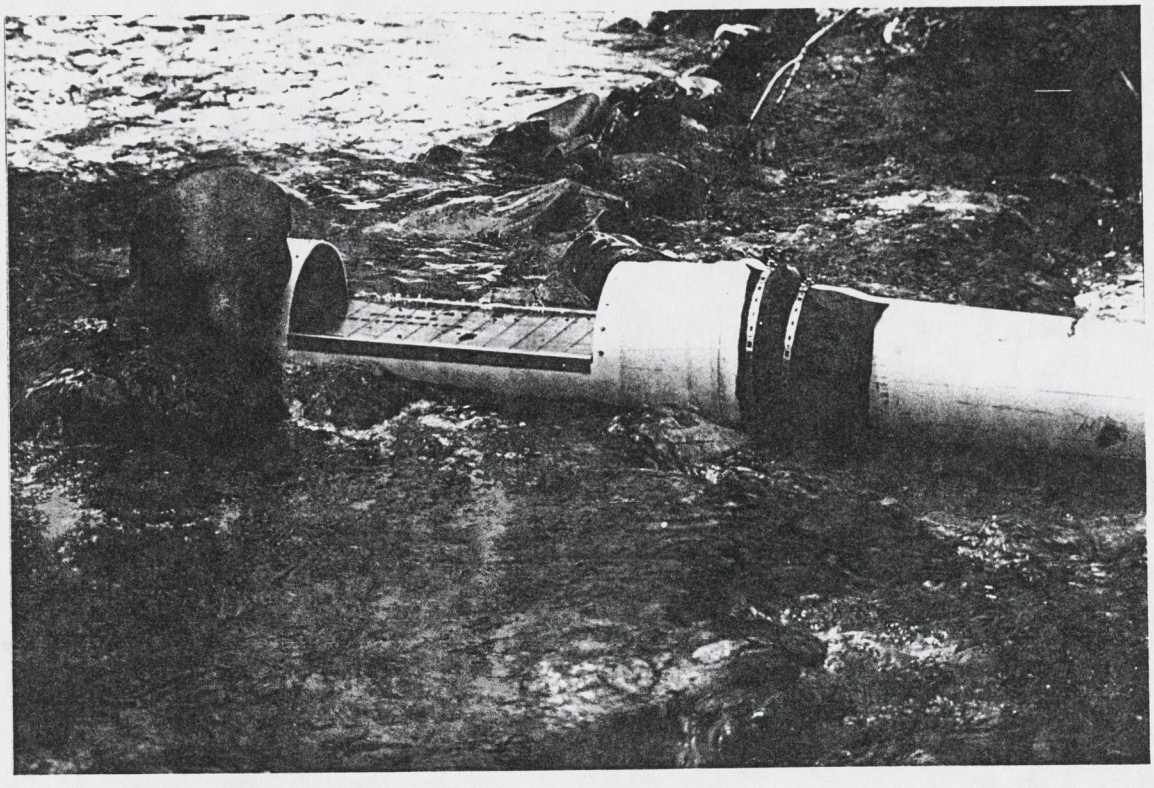

PHOTO 13. Small Scale Fish Protection with Coanda Type Screens - Prototype 2.

An alternate 12" Coanda Screen set-up was also tried, using a flexible, inner tube connection with a direct alignment. However, difficulty was encountered getting sufficient flow over the spillway, when set at the desired 30-40° angle, due to streamflow losses under and around the intake. Therefore, a10° spill angle was tried, which captured all flow within the first few inches of screen surface. In this application, while losing benefits of sweeping flows and the Coanda Effect, if operated (basically as a "static" screen) during periods of higher stream flows, it appeared there would be no loss of flow from the collector with all organic matter and fish easily washed downstream.

Glenn Seaberg, Idaho Model Watershed Project Coordinator

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Bob Russell, Salmon-Challis NF, Ecosystem Staff Officer
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B. Smith

Eco:B.Smith:bhs:jm:10/6/98

Dale Cooley
Jude Trojani
Wayne Hubert
Jerry Mansel
Fred Eales
Al Espinosa

Salmon article) or timelines (eg. a 200 year history of local fisheries decline; w/ emphasis on the loss of a "productive basis" at ecosystem levels + some imaginings for a Col. Basin-wide economic accounting system for fisheries losses, or gains.

ie. Consumer debits to offset (subsidize) & provide producer credits.

well, better run.

Best Regards

Bruce

castorbs@dmi.net
OR
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11/2
98

Hello Dr. Behnke,

Just a brief note to say how much I enjoy your articles in TROUT and to thank you for your melding of management principles and science into a packaged content for the general public. Kind of like a mini-class in each one ... ! GREAT!

Ref. "A Tale of Two Rivers" & your doubts as to whether the principles you outline are attainable, rest assured there are some folks trying along those lines! I believe it can be done, though agencies, institutions & politics are often quite a .... (?) (FILL IN BLANK).

The enclosed examples illustrate a collection of efforts ~~& principles~~ being carried out, which in total, relate ~~the~~ the principles you mention. (Good grief ... W/O my cheaters one contact is near, the other far, so I see double, but half out of focus. ∴, end up writing as much by feel as sight! ... Sorry)

All are attempts to get to management, vs. endless studies.

I'll write more when I get time some evening, as I've been trying to put together many similar ideas (eg. Yours ~~Hanbo~~

United States Department of Agriculture | Forest Service | Salmon-Challis National Forest | Headquarters Bldg RR 2 Box 600 Salmon, ID 83467

File Code: 2600

Date: October 21, 1998

D.N.B,
We invented this gadget 1988-1990 but it wasn't high tech, so never seemed to go anywhere. Recent bull trout/cutthroat concerns may help it to catch on, for a temporary solution, in some areas.
B.

Robert Steed
Water Quality Science Officer
Division of Environmental Quality
1445 North Orchard
Boise, ID 83706-2239

Dear Bob:

During my presentation to the Boise Watershed Advisory Group-Technical Committee, on September 10, 1998, I promised to send additional information on fish passage restoration for culverted road crossings. I recently sent you copies of cover pages from a number of fish passage sources, including blueprints for the Cow Creek culvert, various reports, manuals, books, and some training course handbooks. In addition, I am enclosing pictures of the Salmon Corrigated Metal Pipe (CMP) Downrigger, which was installed on Trinity Creek with Tim Burton and Don Corely on September 11, 1998, as well as a copy of our 1996 field report, evaluating tributary fish passage problems along approximately 200 miles of the Salmon River Road. Given discussions during the Technical Committee meeting, I thought your group may also be interested in the enclosed copies of some early1900 photographic postcards, showing Arrowrock Reservoir during construction and initial filling, as well as fish traps at Castle Rock on the Columbia River.

I hope you and the Technical Committee find this information helpful. If you have any questions or would like to tour some fish passage restoration projects in our area, please let me know.

Sincerely,

Bruce H. Smith

BRUCE H. SMITH
Forest Fisheries Biologist

Enclosures:
1. Photos of Salmon CMP Downrigger Installation on Trinity Creek and the U.S Hwy 93 Cow Creek Culvert
2. Field Report -Tributary Stream Crossings of the Salmon River Road - 1996
3. Ca. 1910-1920 Photos of Arrowrock Reservoir at Time of Construction

cc: (w/enclosures)
B. Russell, S-C NF
D. Ebert, Boise NF
T. Burton, Boise NF
D. Duffield, R4
G. Haugen, R6/CRB-FW
B. Smith

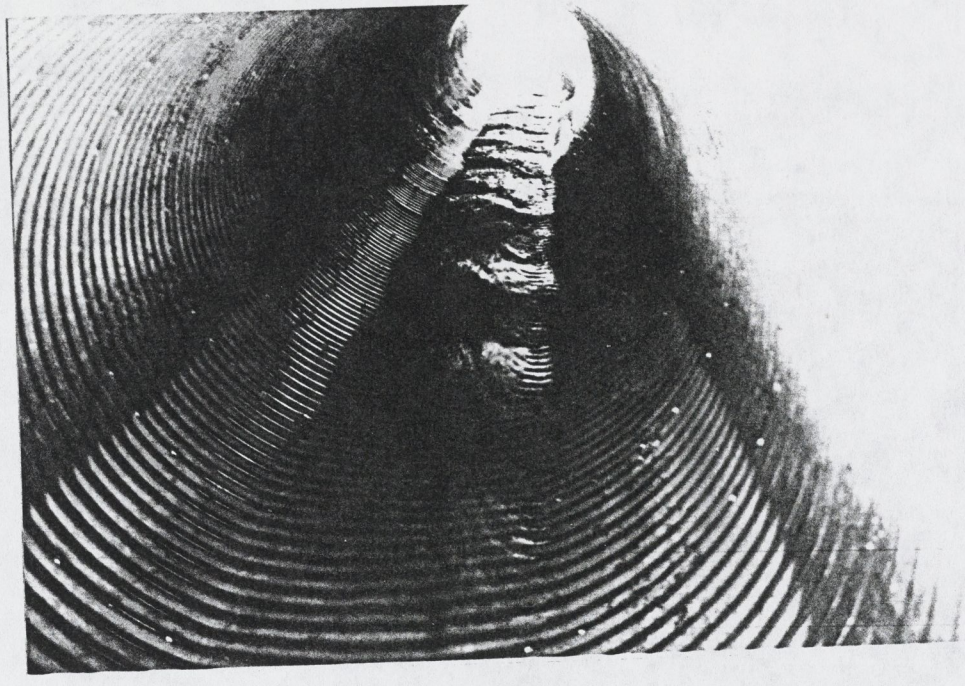

Photo 1. Trinity Creek Culvert - Original Condition at Base Flows

A slow shutter speed (1/15 sec.) captures rolling wave forms within the culvert, noting how frequency increases and amplitude decreases, as the stream gains velocity. Unfortunately, our (1970) flow meter was nonfunctional, so we couldn't measure instantaneous velocity at specific points within the culvert. However, general pre-installation measurements indicated the following. (Also note high flow rust line, indicating a half-full pipe at maximum flows.)

Culvert Length = 77 feet
Culvert Diameter = 5.0 feet

Water Width	Inlet = 2.5 ft.	Middle = 2.5 ft.	Outlet = 2.3 ft.
Water Depth	Inlet = 0.4 ft.	Middle = 0.5 ft.	Outlet = 0.3 ft.

Average Velocity	Inlet-to-Outlet = 4.3 ft/sec. (float method)
Average Turnover Time	Inlet-to-Outlet =18-30 sec.

Photo 2. Trinity Creek Culvert - Plunge Pool

Culvert outlet conditions were favorable for fish entry at all flow levels. This large and deep plunge pool provided good conditions for both jumping and swimming entries, for all sizes of fish, over an annual range of flows. A general rule of thumb is that the take-off pool should be a minimum of 1.5 times in depth, of the height of the jump required. Preferably, the best conditions exist when fish don't have to jump at all, but can achieve passage via a swimming entry or exit.

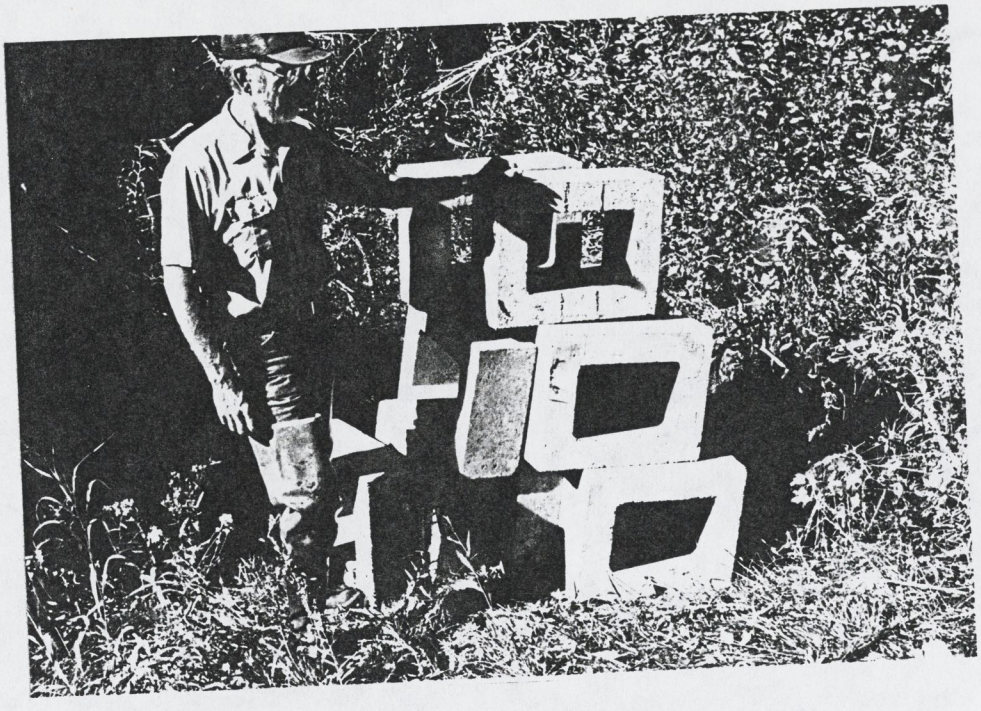

Photo 3. Trinity Creek Culvert - A "Salmon CMP Downrigger" Fish Ladder Kit

In culverts 4 feet or larger in diameter, "rectangular" concrete chimney blocks are used due to their additional weight and the flexibility of having two dimensions to work with, in placing pairs of these blocks (i.e., side-by-side in width, or side-by-side in length).

Materials required for converting this culvert into a fish ladder included:

1 - Belay Line Cable 87-90 ft. long, w/ cable hook on inlet end	($.50/ft.+ $1.50 = $46.50)
6 - Pairs of Concrete Chimney Blocks	($4.50/ea. x 12 = 54.00)
5 - Concrete Block Tether Cables, 8-10 ft. long	($.50/ft x 50ft. = 25.00)
15 - Cable Clamps	($.50 ea. x 15 = 7.50)
30 - Cable Clamp Lock Washers	($.06 ea. x 30 = 2.00)

Total Cost = $135.00

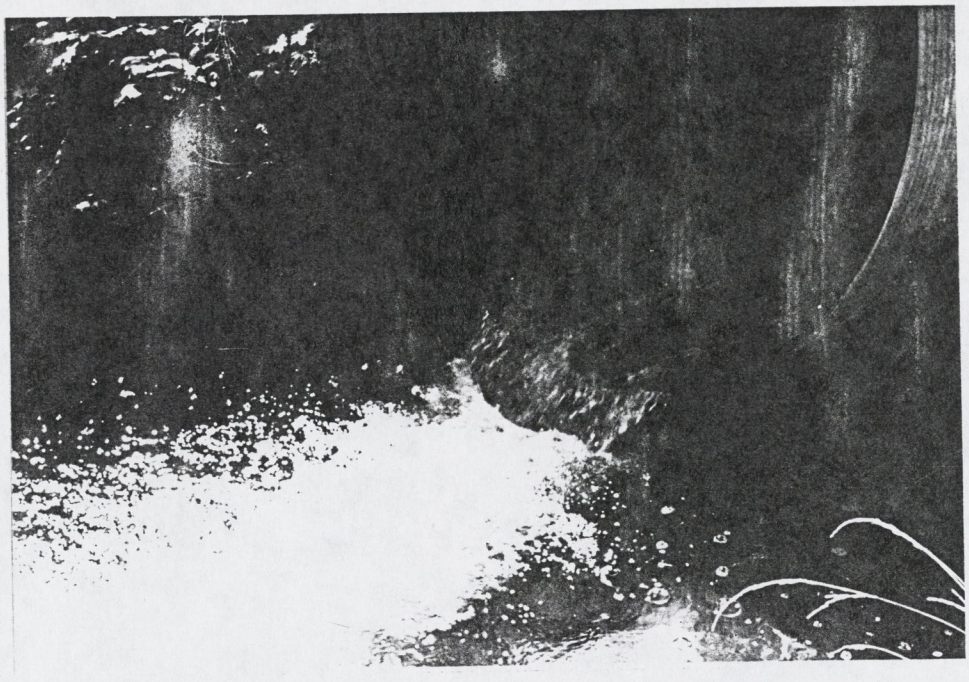

Photo 4. Trinity Creek Culvert - Initial Placement of Concrete Blocks

The first pair of concrete blocks are placed at one, to one and one-half block lengths inside the downstream lip of the culvert. At low flows, this creates a landing or staging area, with increased turbulence and reduced velocities, which enable fish to gain initial entry and a holding position, behind and in front of the first velocity break, or pair of concrete blocks. Multiple passage routes, which are dynamic with changing flow conditions throughout the year, are available under the blocks, around the sides of the blocks, within the blocks, and over the blocks. At higher flows, water spilling over the blocks also creates a standing wave in the outlet of the culvert, forming a landing area from which fish can "belly flop" into the structure, or use a burst of speed to gain entry.

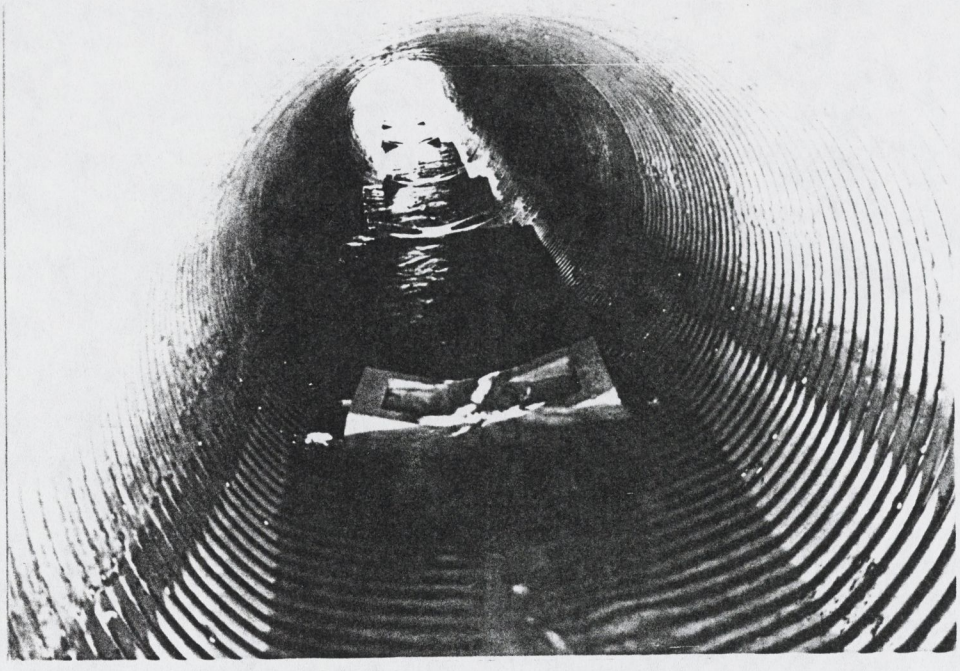

Photo 5. Trinity Creek Culvert - Inside View, Following Downrigger Installation

After installation of the first pair of blocks, subsequent blocks are installed at the pool apex, which is created by the initial and each successive pair of blocks. Care must be taken to ensure that the tether cable is threaded over, under, and over both blocks, to create the downrigger effect during high flows. In this manner, the greater the force on the blocks, the more vector forces cause them to plane downward, against the bottom of the culvert. Both ends of the tether line are double clamped to the belay line, approximately 6 to 8 feet above the blocks. Running the tether line under the belay line, which runs between the blocks, would also be beneficial, helping to ensure that the tether is threaded through the blocks properly and decreasing the potential for lifting of the leading edge. (If tethers are threaded backwards, i.e., from bottom to top, the blocks will plane upwards during high flows.) Cable clamps and block spacings can be adjusted, as monitoring evaluates downrigger performance during various flow levels throughout the year.

Unique features of "dynamic flow" passage (as opposed to "design flow" passage through a pool and [notched] weir system) using the "M" spillway configuration, can be noted in areas of both side spillways, both center spillways (top and bottom), both "holding cells" within and immediately in front of the blocks, and a lateral "elevator effect" which is created by reverse flow eddies along both sides of the culvert, which actually pump fish "up" the culvert! Salmon-Challis Forest efforts to restore or enhance fish passage on 300-400 miles of fragmented streams, from 1988-1991, utilizing the Salmon CMP Downrigger, have averaged between $5 and $50 per mile for materials, with an equivalent cost for labor. It usually takes two people 2-3 hours to perform a downrigger installation.

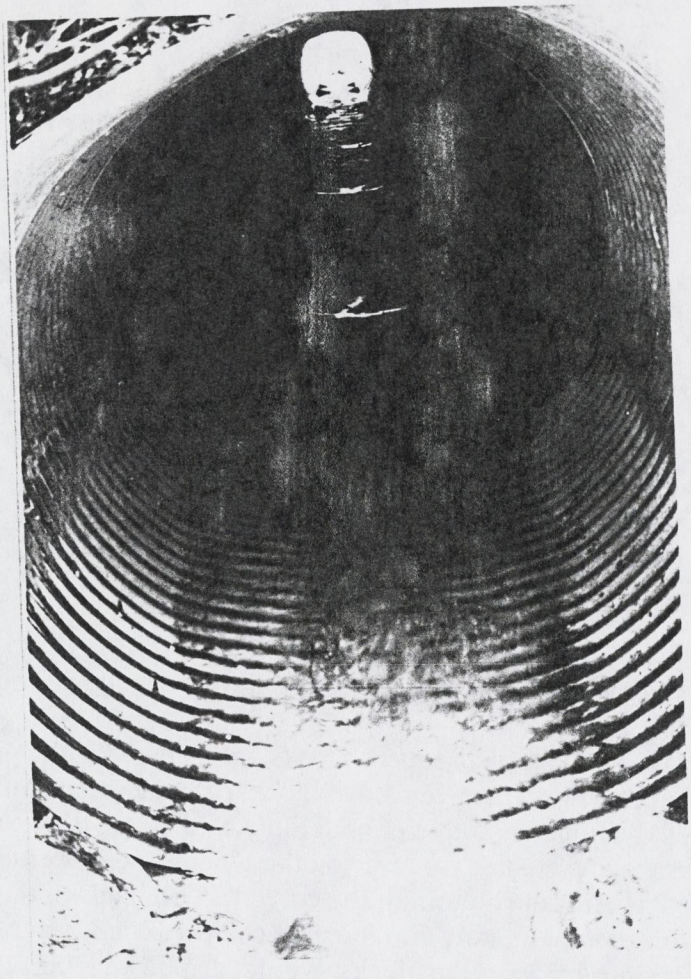

Photo 6. Trinity Creek Culvert - Full Length Inside View, Following Downrigger Installation

This full-length interior view illustrates how the naturally occurring baseflow wave-form is modified by a Salmon CMP Downrigger, creating features which enhance fish passage, while affecting only a minimal cross-sectional area of the culvert. Since most culverts are "inlet controlled" (i.e., size is everything), a side view of flow depths at even full capacity flows (e g., inlet inundation) would indicate that after the first couple feet, excess capacity exists throughout the rest of the length of the culvert. As depth increases and flows become more laminar, the concrete blocks' influence decreases proportionately, due to their low profile. However, even under peak runoff conditions, velocity breaks and baseflow water profiles are maintained within the blocks' 6 to 8-inch deep zone of influence. Besides creating an "elevator effect" right to the

Photo 6. continued.

mouth of the culvert (note the inverted "V's" of streamflow), the last set of blocks should be positioned close enough to the culvert mouth to enhance escape conditions as well. Ideally, large rocks or similar velocity breaks should also exist within the first 10 to 20 feet above a culvert, to enable fish to move through accelerating streamflows (created by a culvert) at all runoff levels throughout the year. A cable hook, anchoring the belay line, is attached in the center of the bottom leading edge of the culvert. (If not in the center, vectors creating the downrigger effect can also lead to lateral block movement, as a result of side-planing forces at maximum flows.)

Depending on water chemistry, bedload size and volume, a Salmon CMP Downrigger can last 5-10 years--until the cable rusts out, or the blocks wear out. They are most easily installed in culverts over 4 feet in diameter. However, in smaller culverts, a single block located just inside the outlet, has been found to be effective in improving fish passage conditions within the lower half of a culvert. In applications with multiple single block placements in smaller culverts (e.g., less than 5 feet in diameter) square concrete blocks are used and their tether cables are anchored through the corner of the block, forming a diamond placement pattern. This will also create dynamic passage flow pathways and holding areas, similar to double block placements in larger culverts. Trash collection by the cables has typically not been a problem, as most material is broken up and blown out at higher flows. As with any project however, periodic monitoring should be conducted in order to evaluate performance under varied flow conditions.

The entire unit is fully adjustable, should changes in spacing or additional blocks be desired. In the case of Trinity Creek, six pair of large blocks were required to create a continuous pattern of pools throughout the 77-foot long culvert. Steeper culverts require more blocks and have smaller step-type pools. Lower gradient culverts on the other hand, may only require one or two pair of blocks and have longer glide-type pools. Bedload accumulations behind the blocks may vary, depending on culvert slope. Typically, steeper culverts with step pools tend to have a better self cleaning effect, moving bedload through the culvert during high runoff. Culverts with lower gradients, while also passing bedload under high runoff conditions, will tend to have slightly more accumulation of gravel above the blocks. In both cases however, due to their low profiles, these types of structures have significantly less bedload accumulation than notched pool-and-weir type configurations, in which intended fish holding areas (pools) are often filled with bedload, instead of water. A light cable safety release can also be attached to the belay cable anchor hook, and threaded along the outside of the culvert to a point above high waterline. Should anything go wrong due to trash or debris accumulations during high water, one can easily attach a winch cable to this lighter line, pull it slightly forward to disengage the hook, then cut the light cable, which allows the entire downrigger to be flushed out of the culvert. (However, this situation has never arisen, so we have not evaluated the release of a downrigger under high flow conditions.)

Fluorescent dye was used to trace the various flow patterns, holding water and fish passage areas, created by the downrigger. Dye retention within cells inside and immediately upstream of the blocks was quite pronounced, as was the upstream migration of dye within zones experiencing the "elevator effect." Flow velocities were 34 percent to 44 percent of values

Photo 6. continued.

found prior to installation. While the leading edge of the dye plume took 40-50 seconds to reach the culvert outlet, the trailing edge took 2-3 minutes, indicating a significantly increased extension of time, for streamflows holding within and passing through the culvert.

In comparison to flow measurements taken prior to installation, noted in Photo 1., measurements taken following installation found the following conditions:

Culvert Length = 77 feet
Culvert Diameter = 5.0 feet

Water Width	Inlet = 3.0 ft.	Middle = 4.0 ft.	Outlet = 3.7 ft.
Water Depth	Inlet = 0.5 ft.	Middle = 0.9 ft.	Outlet = 0.9 ft.

Average Velocity Inlet-to-Outlet =1.5 to 1.9 ft/sec. (fluorescent dye method)
(leading edge of plume)

Average Turnover Time Inlet-to-Outlet = 2-3 min. (trailing edge of plume)

Average Velocity in Fish Holding Cells = Too low to measure

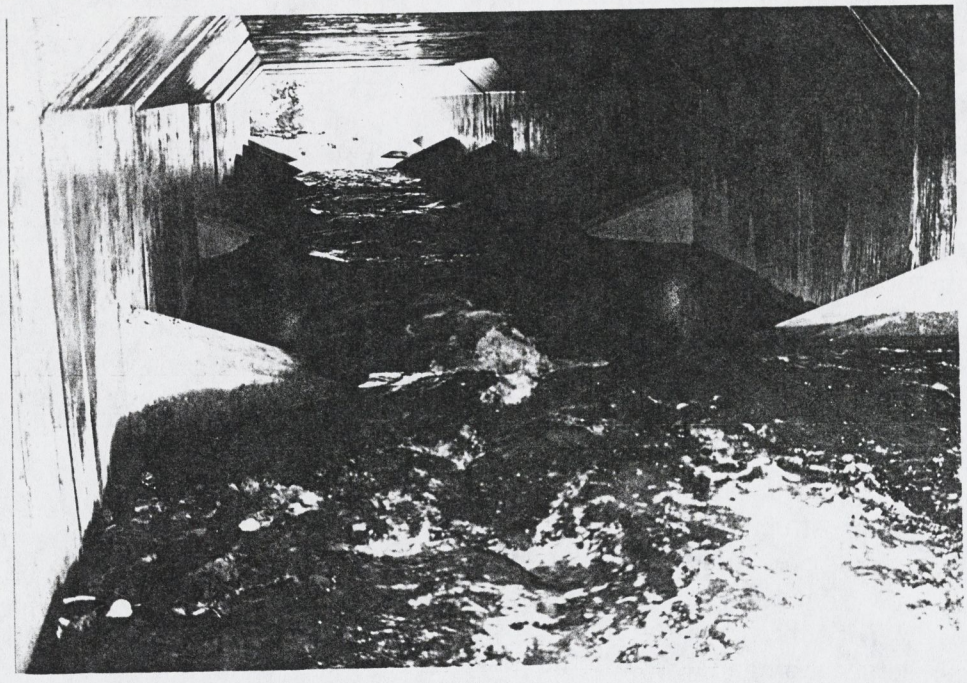

Photo 7. U.S. Highway 93 - Cow Creek Culvert

In 1992, Stream Ecosystem Baseline Surveys found both juvenile steelhead and Chinook salmon seeking thermal refuge from the Salmon River, within the lower reaches of Cow Creek, during late August and September. However, snorkeling surveys only found these fish in the first 50 yards of stream, below the Highway 93 concrete box culvert crossing. Since some reports indicated a temperature LD 50 for Chinook salmon juveniles of 74° Fahrenheit, a temperature often found in the Salmon River during late summer low flow periods, it appeared that in areas where thermal refuge in tributary streams was blocked due to fragmentation, these fish had

Photo 7. continued.

little chance of survival. Therefore, coordination with Idaho Highway Department personnel out of the Rigby and Salmon Offices, several years in advance of their planned reconstruction of this stretch of highway, developed a design for replacing the existing box culvert with a new, baffled, modular, concrete culvert which would facilitate fish passage. In contrast to a typical notched, pool and weir configuration, designed to provide optimal performance for a specific (design) flow and depth, the baffles developed for Cow Creek utilized both a full width sloping notch and a downstream sloping weir, in order to achieve "dynamic passage" conditions for all sizes of fish, at all levels of flow.

In contrast to pool and weir baffles, which often experience bedload filling of intended "fish holding" areas (pools), the intent of this design was to allow a filling of approximately 1 foot of natural streambed material, while moving excess bedload on through the culvert, via the downstream angled baffles, the centerline thalweg and (self-cleaning) reverse eddy flows on both sides of the thalweg. With approximately a 30° downstream angle and a 60° drop, unlike typical right angle notched weir designs, these weirs extend the full width of the culvert, creating proportional spill and performance at all stages of flow. In addition, this design is intended to maximize swimming (vs. jumping) passage, for all species and size groups of fish.

Fish passage was also enhanced by having both the inlet and outlet elevations in line with the natural stream gradient, as well as the inclusion of several large rocks in approach areas, to facilitate entry and escape. In this manner, the former concrete outlet splash apron, or an initially-planned (new) gabion apron, was eliminated.

One month following construction, observations found that during April, large numbers of hatchery-reared steelhead pre-smolts, recently planted in the Salmon River, were attempting to enter and ascend most tributaries. However, only in a few cases were they observed to be able to pass stream crossings of either Highway 93 or State Highway 75. In the Cow Creek culvert, these fish were observed moving into and holding, within pools inside the culvert.