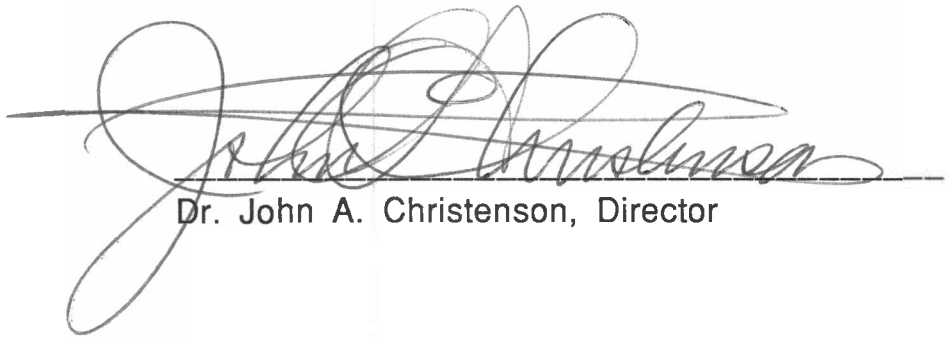
RAINBOW TROUT STRAIN EVALUATION FOR GEORGETOWN LAKE DURING THE SUMMER OF 1987

Submitted in Partial Fulfillment of the Requirements for Graduation with Honors to the Department of Biology at Carroll College, Helena, Montana

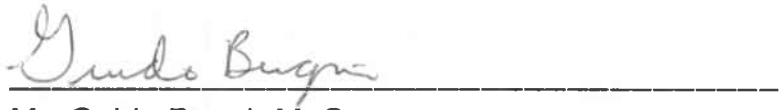
Michael Cain Casebeer

April 8, 1988

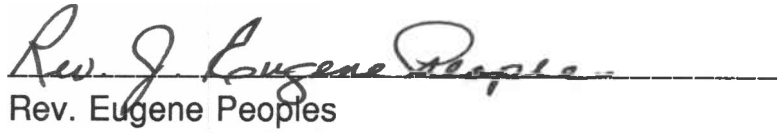
This thesis for honors recognition has been approved for the Department of Biology by:



Dr. John A. Christenson, Director



Mr. Guido Bugni M. S.



Rev. Eugene Peoples

April 8, 1988

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

I wish to thank my faculty advisor and readers, Dr. John Christenson, Mr. Guido Bugni, and Reverend Eugene Peoples for agreeing to review this thesis and for their advice and guidance. George Holton of the Montana Fish and Game deserves recognition for his assistance in finding and organizing this project. His help is greatly appreciated. Thanks also go to Jim Peterson, Fish Health Biologist, Montana Department of Fish, Wildlife and Parks for examination of bone marks for strain determination. Dr. Wayne Hadley of the Montana Department of Fish, Wildlife and Parks deserves a very special thanks for his integral involvement in this study. His assistance was greatly needed as he provided the needed information about the lake, the correct methods for sampling the data, the needed equipment, and a background and understanding in this field that is like no other. His active participation and support during this study really made it work. Thanks also go to the fishermen of Georgetown Lake for their interest in the study by allowing the timely examinations of their fish.

ABSTRACT

Two newy introduced strains of rainbow trout, Eagle Lake and Kamloops rainbow, were examined to determine their sizes and populations in the angler's creel. Arlee rainbow that were present in the lake before the introduction of the new strains were examined to determine how they were being affected by the new fish and managment change.

Eagle Lake rainbow decreased in average size from 13.8 in. to 12.6 in. and from 30% to 16% of the fisherman's catch compared to the winter of 1986-87.

Average length of Kamloops rainbow increased by 1.3 in. from the winter of 1986-87 to 12.5 in. The percent of the fisherman's catch of this strain increased from 1% to 10%.

Arlee rainbow increased in average length from 11.5 to 12.7 in. when compared to the winter of 1986-87, and from 71% to 74% of the angler's catch.

Kamloops rainbow increased in both average size and population in the angler's creel. Eagle Lake rainbow increased in average size but showed a decrease in number which could not be accounted for. Eagle Lake and Kamloops rainbow were predacious on the large population of redside shiners (Richardsonius balteatus) in the lake but not on juvenile Kokanee salmon. It appears that Eagle Lake and Kamloops rainbow are reaching the size and age required for the ingestion of these smaller fish, but are not fully piscivorous yet.

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

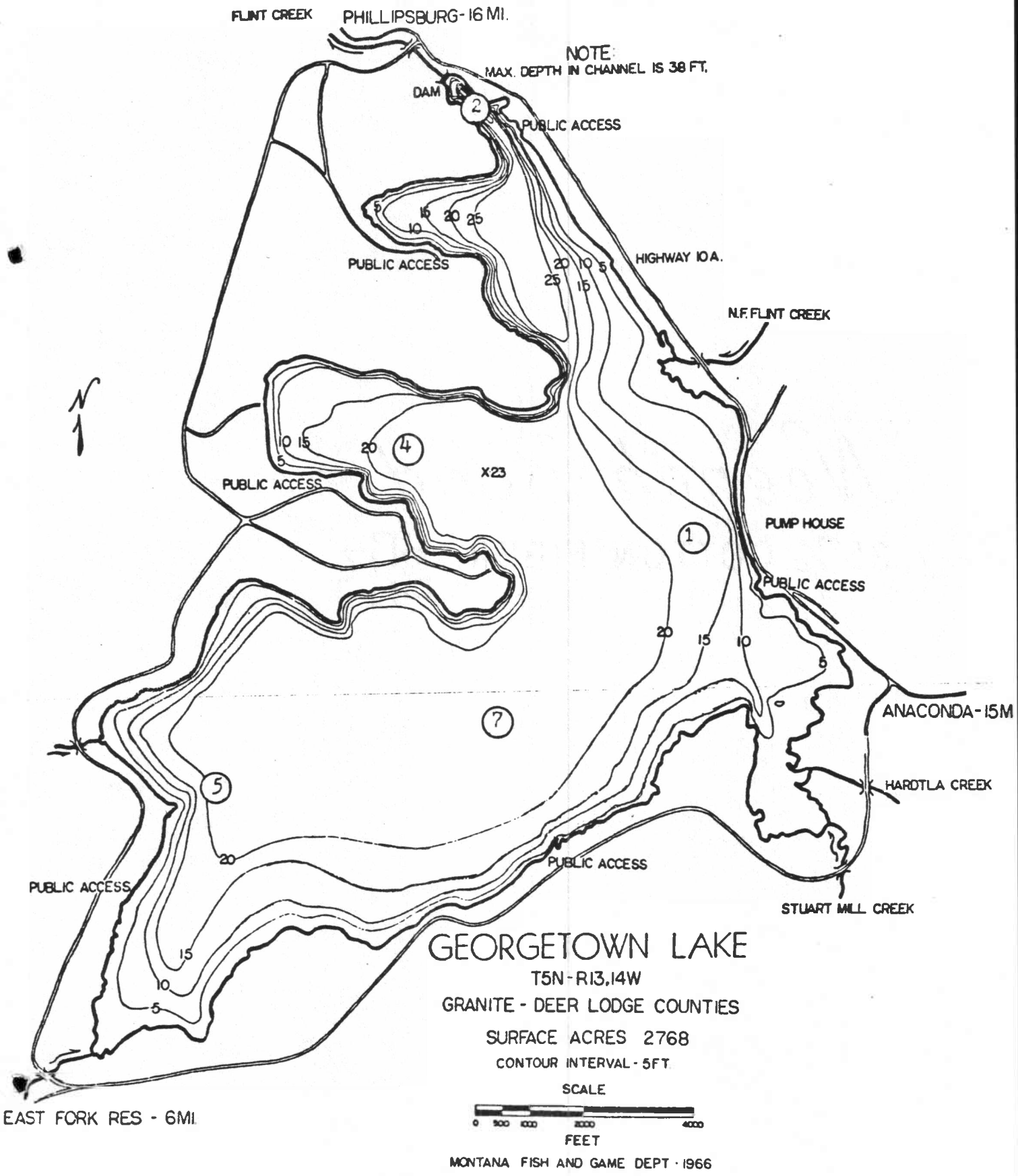
Angling pressure on Georgetown Lake is very great since it represents a major fishery of Southwestern Montana. Rainbow trout (Salmo gairdneri) represent the major fish type of the lake. The Arlee strain of Salmo gairdneri was the only fish being stocked in the lake prior to the summer of 1984 . Self sustaining numbers of brook trout (Salvelinus fontalis) make up an important part of the fishermen's catch (Hadley, pers. com.)

Long term decreases in rainbow size indicated by Montana Fish, Wildlife and Parks studies from 1966, brought a management change into effect in 1984 by Wayne Hadley, Fisheries Biologist, Montana Department of Fish, Wildlife and Parks. This new program was intended to increase the size of the rainbow trout and kokanee salmon in the lake. This managment change involved the introduction of two new strains of rainbow, a lengthened fishing season and a reduced fish harvest or limit.

Eagle Lake and Kamloops strains of rainbow trout were planted in the lake and were selected because of several characteristics that would beneficial. First these fish are piscivorous at larger sizes and could utilize the large forage base of redside shiners and kokanee salmon. This abundant food resource could allow Eagle Lake and Kamloops rainbow to reach very large sizes. Second Eagle Lake and Kamloops strains have longer life spans than the shorter lived Arlee and could reach older ages and larger sizes. Thirdly these two strains could reach larger sizes because they are reputedly less susceptable to angling mortality than the Arlee.

Eagle Lake and Kamloops rainbow would produce two fish populations in the lake, neither of which would be easy to catch. In this way large fish similar to those of the 40's and 50's could be produced. Arlee rainbow would continue to be a population of fish that maintained the high catch rates of the past years, while Eagle Lake and Kamloops rainbow would be a population of larger fish. The angler's creel might then contain several smaller Arlee rainbow and an occasional large Eagle Lake or Kamloops rainbow.

Because of the importance of this fishery, it was essential that management changes were introduced when fishermen and past Montana Fish, Wildlife and Parks studies from 1975 indicated a steady decrease in fish size, (Hadley, 1987). My study was designed to inform the Montana Department of Fish, Wildlife and Parks about the three rainbow strains. The information from this study will provide the fisheries management team of Georgetown Lake with the needed data to draw conclusions as to how these fish are affecting the fishery so that changes can be made if needed.


FLINT CREEK
PHILLIPSBURG - 16 MI.
NOTE:
MAX. DEPTH IN CHANNEL IS 38 FT.
DAM
2
PUBLIC ACCESS
5
10
15
20
25
PUBLIC ACCESS
HIGHWAY 10A.
N.F. FLINT CREEK
N
4
X23
PUBLIC ACCESS
PUMP HOUSE
1
PUBLIC ACCESS
ANACONDA - 15M
HARDTLA CREEK
7
5
PUBLIC ACCESS
PUBLIC ACCESS
STUART MILL CREEK
EAST FORK RES - 6MI.
GEORGETOWN LAKE
T5N - R13,14W
GRANITE - DEER LODGE COUNTIES
SURFACE ACRES 2768
CONTOUR INTERVAL - 5FT.
SCALE
0 500 1000 2000 4000
FEET
MONTANA FISH AND GAME DEPT · 1966

LITERATURE REVIEW

The introduction of a management change came in 1984 with Regulations Proposed for Improved Angling Quality in Georgetown Lake (Hadley, 1984). These regulations included changes in season length, creel limits and stocking. The status of the lake was described as being one that produced a large number of Arlee rainbow all of small size. Brook trout catches were indicated with occasional large fish, and also an enormous number of very small kokanee salmon. To increase the quality of the catch, the proposal indicated that it would be required to make changes that would increase the sizes of all fish species of the lake. The major problem would be the extremely high harvest rate of the rainbow being stocked in the lake. Because the harvest rate removes the trout before they can reach larger sizes the lake became overpopulated with the kokanee salmon. To improve the angling quality an increase in rainbow longevity and a decrease in kokanee salmon numbers must occur.

Here is the introduced management change:

1) Season Current:
3rd Saturday in May to October 3
3rd Saturday in December to February 28
Total = 280 days = 8 months open
Proposed:
Open 3rd Saturday in May
Close March 31
Total = 314 days = 10 months open

Rationale: An increase in the number of salmon being caught would be a result as well as an additional trout harvest to counter the reduction in the limit.

2) Creel Limits: Brook Trout
Current: 10 pounds not to exceed 20 fish.
Proposed: Combine with rainbow and reduce to 5 fish total.

Rainbow trout

Current: 10 pounds not to exceed 10 fish. Two fish may be taken regardless of weight limit.

Proposed: Combine with brook trout and reduce the total to 5 fish.

Kokanee salmon

Current: No daily or possession limit.

Proposed: Unchanged.

Rationale: By combining the brook trout and rainbow trout limits, and reducing the total limit on trout to a total of 5 fish a day, the harvest of both of these species should be reduced with an increase in trout size. Current limits for kokanee should reduce their size.

3) Stockin: Current: 250,000 Arlee rainbows per year.

Proposed: 250,000 rainbows made up of 1/3 Arlee,

Rationale: Continuation of Arlee rainbow should allow for the presence of a highly catchable fish to maintain catch rates of the past. Eagle Lake and the Kamloops rainbow will be more difficult to catch and would reach larger sizes. Both of these fish are predators of smaller fish and should help reduce kokanee salmon numbers.

The first observations of the performance of the new strains came in 1986 with a winter creel census (Hadley,1987). Winter data are present for both kokanee salmon for 20 or more years (Table 1).

Table 1. Average kokanee salmon lengths in winter angler creel, Georgetown Lake (Hadley, 1987).

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sample Number	34	55	no	20	149	717	302
Average Length	12.3	10.7	data	11.4	10.9	10.6	9.9
Year	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Sample Number	no	no	14	346	194	119	7
Average Length	data	data	11.5	10.8	9.2	7.9	8.2
Year	80-81	81-82	82-83	83-84	84-85	85-86	86-87
Sample Number	127	no	no	46	96	133	187
Average Length	8.2	data	data	7.8	8.2	9.1	8.6

Average kokanee length decreased from 85-86 to 86-87 for no known reason, but an overall increase in length has occurred since the introduction of the two new rainbow strains in summer 1984.

Rainbow data are available from winter creel censuses. Average lengths for Arlee rainbow are shown in Table 2, beginning 1966-67. Average length was 1.7 inches greater in 85-86 than in 84-85 and average length was 1.3 inches greater in 86-87 than in 85-86. Overall Arlee have shown a 3 inch increase in average length since the new fish were introduced and the regulations were changed.

Table 2. AverageArlee rainbow lengths in winter angler creel, Georgetown Lake (Hadley, 1987).

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sample Number	214	306	no	247	555	1407	888
Average Length	11.7	11.3	data	11.1	10.1	10.6	10.7
Year	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Sample Number	no	no	45	247	171	165	30
Average Length	data	data	10.4	10.6	10.0	9.9	11.2
Year	80-81	81-82	82-83	83-84	84-85	85-86	86-87
Sample Number	124	no	no	3	42	296	242
Average Length	9.7	data	data	9.7	9.8	11.5	12.8

Strain performances are indicated in Tables 3 and 4. These two tables represent the winter studies of 85-86 and 86-87 respectively. Table 4 indicates that Arlee rainbows increased by 1.0 inch in average length while Eagle Lake rainbow increased by 2.4 inches. The increase in length of Arlee was attributed to the decreased harvest due to the new limits. A reduced length for Kamloops could not be accounted for. The low harvest of Kamloops rainbow was presumed to be the result of their being much smaller at the time of planting, which was late in the growing season and near the winter harvest. Lower angling mortality of Kamloops may be a factor but probably not.

Arlee were a large fraction of the catch. Arlee represented 51% of the rainbows stocked and 71% of the catch in 1985-86, but

decreased to 70% of the catch in 1986-87 when it represented 47% of the fish stocked. Eagle Lake rainbow increased in percent of the catch from 1985-86 to 1986-67, but the percent stocked was approximately the same. The percent catch of Kamloops was still low which was again attributed to their late stocking, and short time for growth.

Table 3. Rainbow trout strain evaluation for winter 1985-86, Georgetown Lake (Hadley, 1987).

Strain	Stocking date - size	Stocking Number - %	Number Collected	% of Catch	Mean Length	Range
Arlee	6-84/85 5"	157273	53	210	71	11.6" 8.4"-15.7"
Eagle Lake	9-84 5"	100556	34	84	28	11.2" 6.0"-12.9"
Kamloops	8-84 3"	38115	13	2	1	11.4" 9.8"-12.9"
Total		295944	100	296	100	11.5" 6.0"-15.7"

Table 4. Rainbow trout strain evaluation for winter 1986-87, Georgetown Lake (Hadley,1987).

Strain	Stocking date - size	Stocking Number - %	Number Collected	% of Catch	Mean Length	Range
Arlee						
	6/84 6/85 5"	257000	47	169	70	12.6" 7.7"-16.8"
Eagle Lake						
	9/84 7/85 5"	184000	33	70	29	13.6" 8.3"-16.4"
Kamloops						
	8/84 8/85 3-4"	111000	20	3	1	11.1" 9.3"-14.8"
Total		552000	100	242	100	12.8" 7.7"-16.8"

MATERIALS AND METHODS

Data were collected in a systematic way and all the fish in the angler's creel were examined to represent the angler's harvest.

1) Weight

Each fish was first weighed whether it was previously cleaned or not. Weights were to the nearest 1/10 lb. with approximations to the nearest 1/100 lb.

2) Length

The length of each fish was determined with a fish measuring board. The board was a cradle 24 in. long with a wooden stop at the zero end. Lengths were recorded to the nearest 1/10 in. using a ruler located in the bottom of the cradle. When the length was measured the fish's anterior end (nose) was snugged up against the stop at the zero end and the tips of the tail were pinched together to form a point and the measurement was taken from that point.

3) Adipose Fin Clip

After the length was recorded, each fish was examined for the presence of an adipose fin which is the first fin posterior to the dorsal fin. The adipose fin contains no bone, and once clipped will not grow back. Because Kamloops rainbow were adipose fin clipped at the hatchery before being planted in the lake this clip was used for identification.

4) Cleaning

Once the fish had been identified as a Kamloops or not by the fin clip, it was then cleaned. If the fish had already been cleaned by the fisherman than this step was skipped. Cleaning was done carefully so as not to rupture the stomach. During the cleaning procedure the fish's gill membranes were removed as well as the tongue and pectoral fins. The stomach was then removed from the viscera by cutting 1/2 in. above the stomach at the esophagus, and 1/2 in. below at the small intestine. This was done to prevent the materials in the stomach from exiting either end and being lost. The stomachs were then placed in an individual plastic containers and labeled with the corresponding number on the data collection sheet

for that fish. From here the containers were then placed in a cooler on ice for later examination of stomach contents.

5) Second weighing

After cleaning and taking the stomach the fish was weighed again. This cleaned and uncleaned combination of weights was used to determine a percentage of material removed from each fish during the cleaning process for differences between strains.

6) Vertebral Sample

For each rainbow trout a vertebral sample was taken. This sample of the vertebrae was used in the identification of Eagle Lake rainbow. When these fish were raised in the hatchery they were fed food that contained the antibiotic oxytetracycline. This chemical was incorporated into the bones of the growing fish and shows up as a mark in the vertebrae of the adult fish which can be used for identification.

After each fish was cleaned two vertebrae were removed by cutting them out as a pair. The vertebrae removed were usualy the fourth and fifth cervical vertebrae. The vertebrae were removed from the ventral side of the cleaned fish where they were most accessible via the body cavity. The removed vertebrae were then placed in an envelope and the corresponding fish's number was written on it. The envelopes were placed in a plastic bag to keep them dry and then kept on ice in a cooler. When the day of collecting was over the envelopes were frozen for later examination of the vertebral marks. Freezing prevents the bones from drying out which makes the marks difficult to detect (Peterson, 1987).

Vertebrae were examined by Jim Peterson, Fish Health Biologist, Montana Department of Fish, Wildlife and Parks as follows:

> "The best bone samples appear to be those with two complete vertebrae. I make my cut and clean out tissue between the vertebrae, and this gives a much better look at the mark. It is much easier than cleaning tissue away from a single bone. It also gives me two bones to look at which is especially helpful if marks are poor or questionable." (Peterson, 1987).

Vertebrae were not taken from Brook trout examined since it was easy to identify them by external markings (Brown, 1971).

7) Stomach Dissections

Each stomach taken from fish that were not previously cleaned was examined for content. Small fish were looked for to indicate the piscivorous nature of the three strains. Small fish looked for included redside shiners and kokanee salmon. Because of the importance of the identification of the small fish in this study it was important to inquire with each fisherman about the bait they were using. If a fisherman indicated that he or she was using bait fish when asked, it was noted for the fish examined from his or her creel. The possibility may be there that fish in the stomachs of these trout strains were introduced artificially as bait.

RESULTS

The results from the data are indicated in Table 5 along with stocking information.

Table 5. Rainbow trout strain evaluation for the summer of 1987, Georgetown Lake.

Strain	Stocking date - size	Stocking Number - %	Number Collected	% of Catch	Mean Length	Range
Arlee 6/84/85/86	5"	257000	47 136	73.9	12.9"	6.5"-16.8"
Eagle Lake 9/84/85/86	5"	184000	33 29	15.8	12.6"	9.2"-16.8"
Kamloops 8/84/85/86	3"-4"	111000	20 19	10.3	12.5"	10.4"-14.7"
Total		552000	100 184	100	12.7"	6.5"-16.8"

Stomach examinations indicated that there was ingestion of smaller fishes for all three strains. Six Arlee trout had small fish in their stomachs, and were identified to be the redside shiners (Needham and Needham, 1962). Eagle Lake rainbow showed a lesser ingestion with only three having redside shiners in their stomachs. Two Kamloops had redside shiners in their stomaches (Fig. 6.). No fish remains were found in stomachs of rainbow smaller than 11.0 in. To compare fish ingestion any fish under 11.0 in. was removed from the analysis as well as any fish that was cleaned. Arlee in sample dropped to 95 fish, Eagle Lake to 16 fish, and Kamloops to 11 fish. For fish in the 11.0 in. and above range percentages with fish remains in stomachs were: Arlee 6.3%, Eagle Lake 18.8%, and Kamloops 18.2%. It appears that Eagle Lake and Kamloops rainbow ingest prey fish more frequently than Arlee rainbow, but the small sample sizes should be taken into account (Fig. 6.).

The analysis of viscera to body weight of cleaned to uncleaned fish indicated that Eagle Lake trout lost approximately 17.6% of their body weight, Kamloops trout lost 15.8% of their body weight and Arlee trout lost 18.3% of their body weight. This percentage body weight lost for each strain of trout appears to show no major differences (Hadley, pers. com.), which could be due to taxonomic similarities of these strains . Length frequency histograms (Figs. 2, 3, 4 and 5) indicate the numbers of fish present at each length in the sample.

Length to weight relationships for each strain were graphed (Fig. 7, 8 and 9). The data indicated that Eagle Lake and Kamloops rainbow had similar length to weight relationships while Arlee rainbow needed longer lengths to reach the same weights as the other two.

Fig. 2. Length frequencies of Arlee, Eagle Lake and Kamloops strains of rainbow trout, Georgetown Lake (summer 1987). Total number of fish sampled = 184.

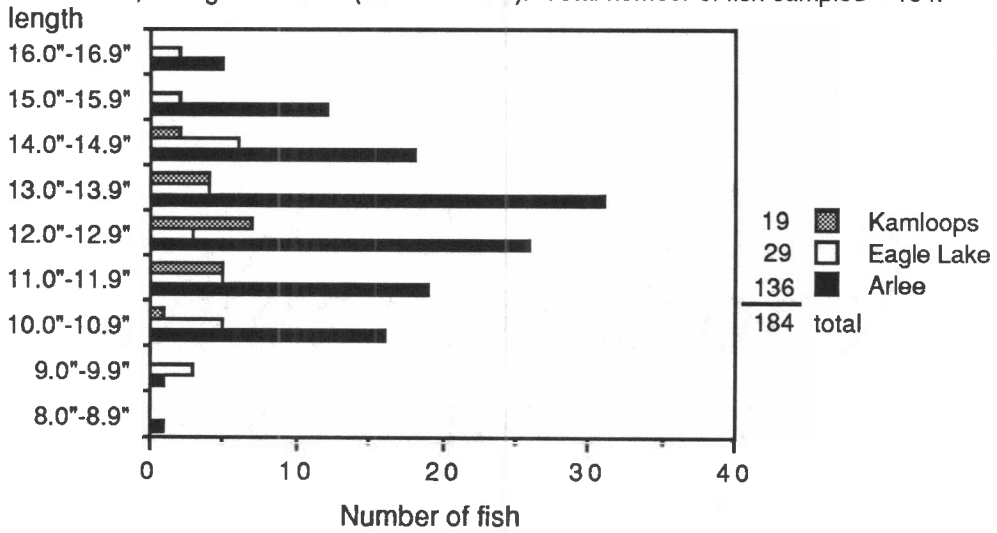


Fig. 3. Length frequency of Arlee rainbow trout, Georgetown Lake (summer 1987). Total number of fish sampled = 136.

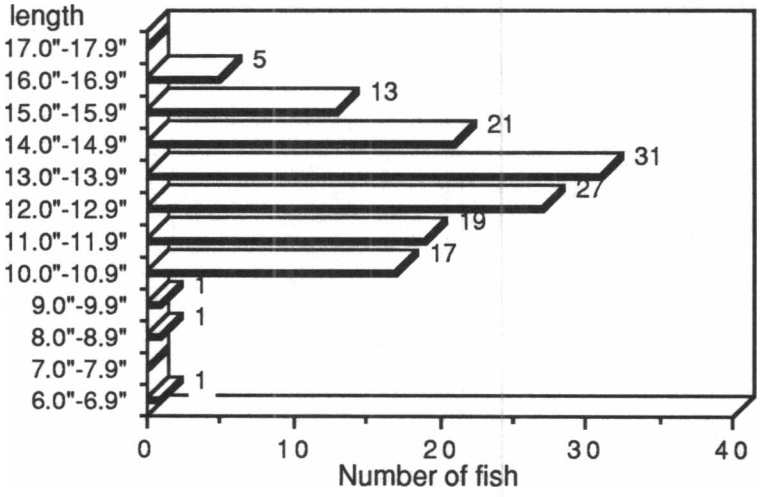


Fig. 4. Length frequency of Eagle Lake rainbow trout, Georgetown Lake (summer 1987). Total number of fish sampled = 29.

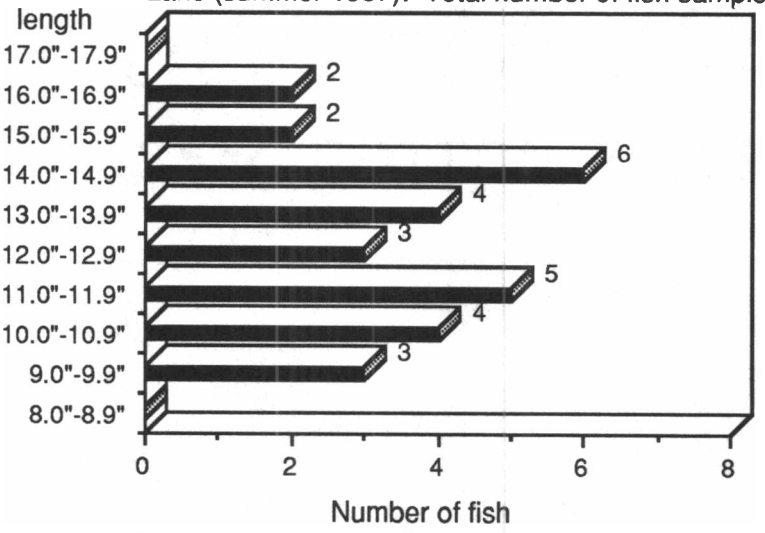


Fig. 5. Length frequency of Kamloops rainbow trout, Georgetown Lake (summer 1987). Total number of fish sampled = 19.

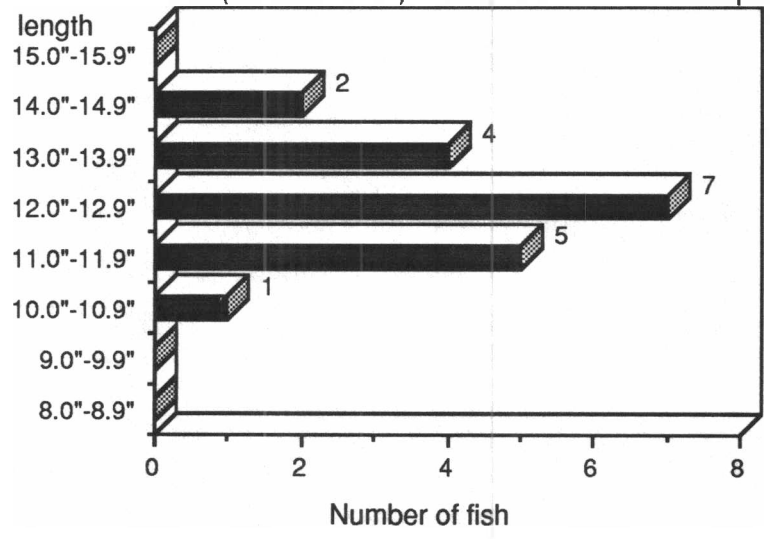


Fig. 6. Strains of rainbow trout identified as being piscivorous, and their corresponding length frequency, Georgetown Lake (summer 1987).

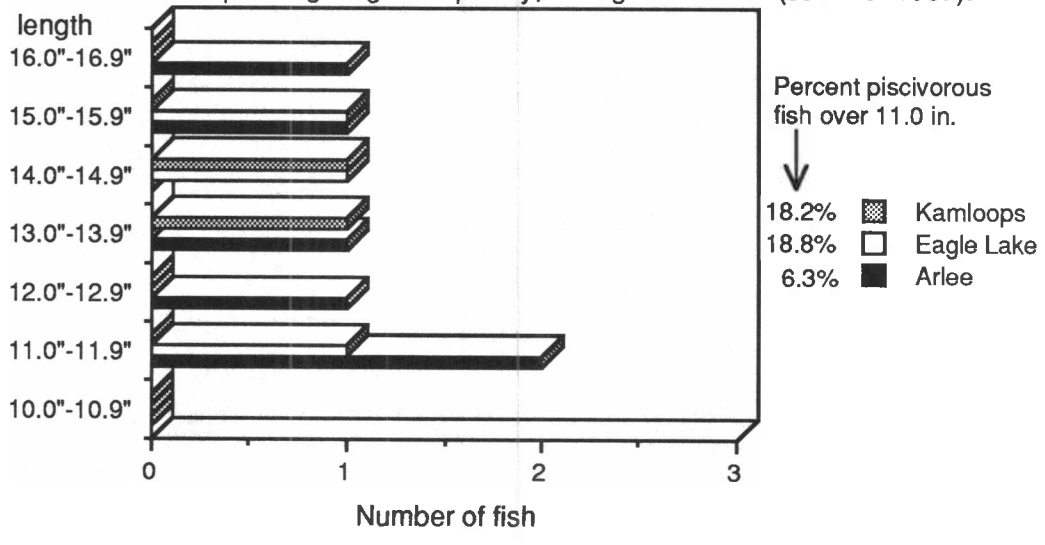


Fig. 7. Length to weight ratio of Arlee rainbow, Georgetown Lake (summer 1987). 112 data points.

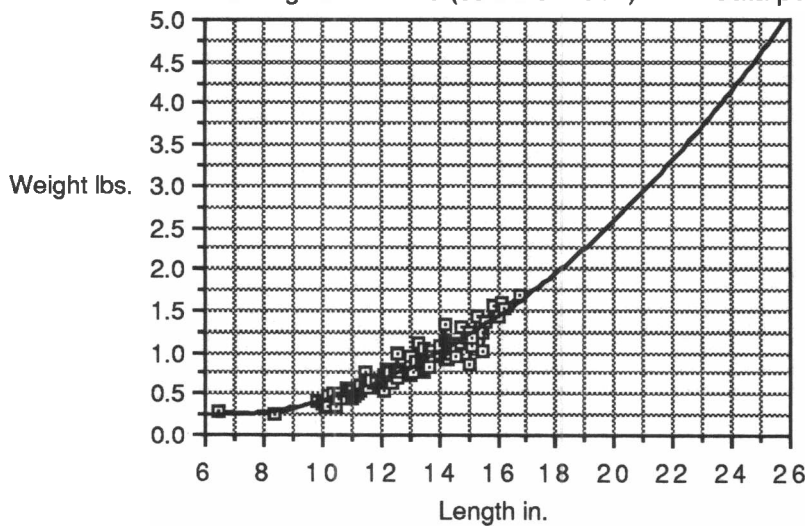


Fig. 8 Length to weight ratio of Eagle Lake rainbow, Georgetown Lake (summer 1987). 22 data points.

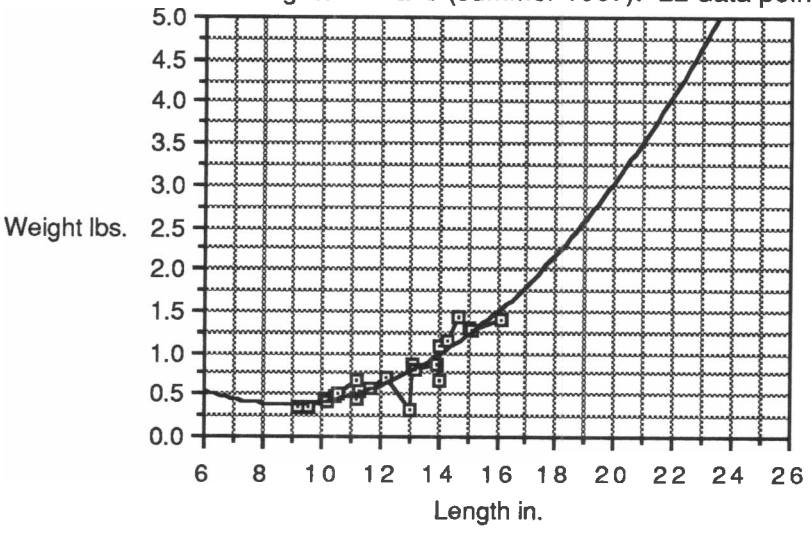
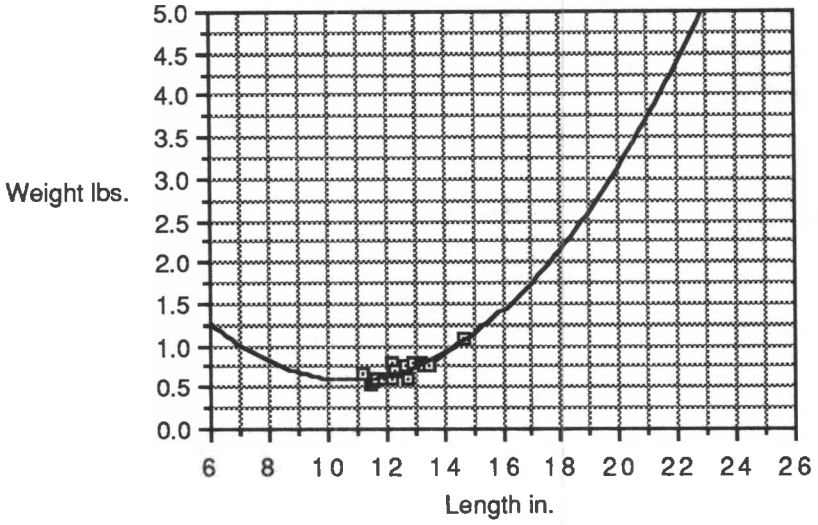


Fig. 9. Length to weight ratio of Kamloops rainbow, Georgetown Lake (summer 1987). 15 data points.



DISCUSSION AND CONCLUSIONS

The results from this study suggest the possible consequences of the new managment program.

Arlee trout data (Fig. 3.) showed that average length increased from 12.6 in. to 12.9 in. and the percentage in the angler's catch increased from 70% to 74%, when compared to the winter of 1986-87. Arlee still represent a large number of fish in the angler's creel which is most likely due to new regulations imposed on the lake. A longer fishing season combined with a reduced limit seem to be having an effect. The Arlee are living longer and getting larger. A winter study of 1984-85 (Hadley, 1987) showed Arlee rainbow had an average size of 9.8 in., so Arlee size has increased dramatically over the past four years. This increase in size seems to be due to the new fishing season and limits. Some Arlee stomachs showed ingestion of redside shiners (Fig. 6.). Very few Arlee ate small fish so they are probably not reducing kokanee salmon populations, or are too small in size to do so. The data indicated that Eagle Lake and Kamloops rainbow ate small fish more frequently than Arlee but the small samlpe sizes need to be taken into consideration.

Eagle Lake rainbow (Fig. 4.) decreased in average size in this study when compared to the winter of 1986-87 (Hadley, 1987), which indicated that the fish were 13.6 in. in average length. A decrease to 12.6 in. in average length, as well as a decrease in percentage in the angler's catch from 29% to 16% was found in my study. This decrease could not be accounted for, but may be due to differing catch rates between summer and winter (Hadley, pers. com.).

Stomachs of three Eagle Lake rainbow showed they had fed on small fish. Two large fish of 14 in. and 15 in. fed on small fish identified as redside shiners. The fact that these two large fish were feeding on these small fish may indicate that a switch to a piscivorous diet is occurring.

The study indicated that Kamloops rainbow (Fig. 5.) were growing in size and number. The average length increased from 11.1 in.

during the winter study of 1986-87 (Hadley, 1987), to 12.5 in. The percentage of the fishermen's catch increased greatly from 1% to 10%. The increase in size of Kamloops rainbow seems to lag that of Eagle Lake rainbow, which could be due to their late summer introductions into the lake, as well as their smaller planting size. The large increase in percentage of the angler's catch could be due to Kamloops increasing in number in the lake, but could also be due to differing catch rates between summer and the winter (Hadley, pers. com.). The presence of redside shiners in the stomachs of two Kamloops of 13.2 in. and 14.7 in. suggests a piscivorous nature at larger sizes, similar to Eagle Lake rainbow.

Kokanee salmon have become somewhat larger (Hadley, pers. com.) but for no apparent reason. The two new strains of fish are not yet predacious on the kokanee salmon, but could be in the future. The extended season could be reducing the kokanee salmon numbers but because this has been in effect for seven years it is most likely not due to this. The salmon population might be reduced if the two new strains start feeding on smaller kokanee but this isn't apparently happening yet.

The changes in limits and season length are most likely the cause for the increase in size of Arlee rainbow. If these fish can stay in the lake longer they could increase in size. The new limits may be protecting the rainbow and allowing them to become larger before they are removed from the lake. Kamloops rainbow are increasing in size and population and may be making a switch to a piscivorous diet (Fig. 6.). Several large fish of both Kamloops and Eagle Lake strains may suggest that larger fish (Fig. 2.) are entering the population.

One factor that should be considered about this is the influence of the angler on the results. Because the collection of data required such a great deal of time for each fish it was almost impossible to collect data from boat fishermen. For this reason all collections were made from shore fishermen which without boats may catch fewer fish as well as smaller fish which they indicated when asked. These results may better indicate the shore fisherman's catch.

One last consideration would be that of bait fish. Because it is legal to use bait fish while fishing, small fish could be introduced

into the stomachs of the trout. Bait fish are required to have heads removed so that lakes are not cross populated with different species of fish. Live bait with the heads on can be very productive for a fisherman. For this reason it was important to inquire with each fisherman about the bait they were using. The piscivorous nature of these strains could have been falsely indicated due to the possibility of live bait with the heads on. Several incidences of anglers using bait fish were noted and they may have been using live bait fish. These fish were not included in the analysis of piscivorous rainbow.

LITERATURE CITED

Brown, C. D. D. Fishes of Montana. Big Sky Books, Bozeman, Montana (1971).

Hadley, W. 1984. Tentative Regulations Proposed for Improved Angling Quality in Georgetown Lake, Montana Department of Fish, Wildlife and Parks Fisheries Division 1984 (unpublished).

Hadley, W. 1987. Western Montana Fisheries Investigation, Georgetown Lake Managment Survey, No. F-12-R-31, Job No. 11-b., July 1, 1986 to June 30, 1987 (1987).

Needham R. and Needham R. A Guide to the Study of Fresh-Water Biology. Holden-Day Inc., San Francisco (1962).

Peterson, J. 1987. Montana Department of Fish, Wildlife and Parks, Fish Biologist, letter to author.

Appendix.

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
1	6/9/87	14.0	0.66	0.50	Eagle Lake
2	6/9/87	13.6	0.40		Brook
3	6/9/87	13.0	0.33	0.28	Eagle Lake
4	6/25/87	10.5	0.43		Brook
5	6/25/87	15.3	1.25	1.01	Arlee
6	6/25/87	10.9	0.54	0.41	Arlee
7	6/25/87	11.5	0.77	0.62	Arlee
8	6/25/87	16.1	1.39	1.19	Eagle Lake
9	6/25/87	9.9		0.40	Eagle Lake
10	6/25/87	10.2		0.39	Arlee
11	6/25/87	11.4		0.48	Arlee
12	6/25/87	10.4		0.38	Kamloops
13	6/25/87	14.6		0.97	Arlee
14	6/25/87	13.5	0.82	0.71	Arlee
15	6/29/87	11.0	0.51	0.45	Arlee
16	6/29/87	12.1	0.54	0.43	Arlee
17	6/29/87	15.6	1.36	1.12	Arlee
18	6/29/87	14.3	1.13	0.93	Arlee
19	6/29/87	14.4	1.10	0.95	Arlee
20	6/29/87	10.6	0.52	0.45	Eagle Lake
21	6/29/87	10.7	0.60		Brook
22	6/29/87	13.5	1.04	0.92	Arlee
23	6/29/87	12.0		0.54	Arlee
24	7/5/87	14.9		0.92	Arlee
25	7/5/87	12.2		0.56	Arlee
26	7/5/87	12.3		0.60	Arlee
27	7/5/87	11.5	0.57	0.48	Arlee
28	7/5/87	11.2	0.52	0.45	Arlee
29	7/9/87	13.2		0.57	Arlee
30	7/9/87	14.0	1.08	0.77	Eagle Lake
31	7/9/87	10.5		0.32	Eagle Lake
32	7/9/87	13.6	1.15		Brook
33	7/9/87	15.7		1.16	Arlee
34	7/9/87	14.2		0.83	Arlee
35	7/9/87	13.0		0.70	Arlee
36	7/9/87	14.1		1.16	Brook

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
37	7/9/87	13.8	1.02	0.89	Arlee
38	7/9/87	11.3	0.54	0.47	Arlee
39	7/9/87	12.6		1.02	Brook
40	7/9/87	15.1	1.26	0.99	Eagle Lake
41	7/9/87	13.4		0.70	Arlee
42	7/9/87	14.7		0.88	Kamloops
43	7/9/87	13.2		0.67	Arlee
44	7/9/87	12.1	0.72	0.64	Arlee
45	7/9/87	15.0	1.31	1.07	Eagle Lake
46	7/9/87	12.1	0.71	0.58	Arlee
47	7/9/87	10.5	0.49	0.40	Eagle Lake
48	7/9/87	14.2	1.35	1.11	Arlee
49	7/9/87	12.6	0.98	0.88	Arlee
50	7/9/87	15.5		1.05	Arlee
51	7/9/87	13.5		0.76	Arlee
52	8/14/87	14.7	1.43	1.09	Eagle Lake
53	7/15/87	11.0	0.54	0.47	Arlee
54	7/15/87	6.5	0.30	0.28	Arlee
55	7/15/87	10.8	0.58	0.45	Arlee
56	7/15/87	12.3	0.73	0.62	Arlee
57	7/15/87	14.4	0.98	0.84	Arlee
58	7/15/87	10.3		0.41	Brook
59	7/15/87	10.0	0.39	0.32	Arlee
60	7/15/87	10.8	0.47	0.40	Arlee
61	7/15/87	10.2	0.34	0.29	Arlee
62	7/15/87	12.2	0.60	0.50	Kamloops
63	7/15/87	12.7	0.80	0.64	Arlee
64	7/15/87	11.7	0.66	0.51	Arlee
65	7/15/87	15.0	1.24	0.99	Arlee
66	7/15/87	12.8	0.60	0.51	Kamloops
67	7/15/87	12.3	0.81	0.65	Arlee
68	7/15/87	12.2	0.81	0.67	Arlee
69	7/15/87	9.2	0.36	0.29	Eagle Lake
70	7/15/87	13.1	0.87	0.74	Eagle Lake
71	7/16/87	12.7	0.75	0.62	Kamloops
72	7/15/87	10.9	0.57	0.45	Arlee
73	7/15/87	10.1	0.44	0.37	Eagle Lake
74	7/15/87	12.0	0.67	0.55	Arlee
75	7/15/87	13.3	1.11	0.80	Arlee
76	7/15/87	13.7	0.99	0.76	Arlee

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
77	7/15/87	12.2	0.69	0.57	Arlee
78	7/15/87	9.8	0.40	0.36	Arlee
79	7/15/87	12.2	0.77	0.63	Arlee
80	7/15/87	11.0	0.54	0.44	Arlee
81	7/15/87	11.2	0.66	0.52	Kamloops
82	7/15/87	13.6	0.87	0.77	Arlee
83	7/15/87	10.6	0.50	0.42	Arlee
84	7/15/87	13.0	0.91	0.75	Arlee
85	7/15/87	12.2	0.79	0.64	Kamloops
86	7/15/87	13.2	0.81	0.67	Kamloops
87	7/15/87	15.3	1.42	1.15	Arlee
88	7/15/87	13.7	1.19	1.01	Brook
89	7/15/87	10.5	0.36	0.31	Arlee
90	7/15/87	11.6	0.58	0.50	Kamloops
91	7/15/87	12.2	0.70	0.60	Arlee
92	7/15/87	12.5	0.74	0.61	Arlee
93	7/15/87	10.2	0.47	0.39	Arlee
94	7/15/87	11.6	0.68	0.57	Arlee
95	7/15/87	13.2		0.74	Arlee
96	7/15/87	12.0		0.58	Kamloops
97	7/22/87	16.2	1.54	1.29	Arlee
98	7/22/87	12.3	0.67	0.54	Arlee
99	7/22/87	10.1	0.35	0.31	Arlee
100	7/22/87	11.1	0.49	0.35	Arlee
101	7/22/87	11.4	0.60	0.49	Brook
102	7/22/87	11.0	0.54	0.41	Arlee
103	7/22/87	9.3	0.31	0.27	Brook
104	7/22/87	13.5	0.75	0.65	Kamloops
105	7/22/87	13.0	0.95	0.70	Arlee
106	7/22/87	12.9	0.77	0.62	Arlee
107	7/22/87	11.2	0.68	0.54	Eagle Lake
108	7/22/87	14.3	1.14	0.95	Eagle Lake
109	7/22/87	10.8	0.51	0.41	Brook
110	7/22/87	14.2		0.96	Arlee
111	7/22/87	12.9		0.75	Eagle Lake
112	7/22/87	14.4	1.04	0.89	Arlee
113	7/22/87	16.8		1.06	Eagle Lake
114	7/22/87	14.0		0.85	Arlee
115	7/22/87	13.2		0.75	Arlee
116	7/22/87	14.0		0.81	Arlee

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
117	7/22/87	10.9		0.43	Arlee
118	7/22/87	13.6	0.82	0.67	Arlee
119	7/22/87	13.4	0.86	0.68	Arlee
120	7/22/87	10.6	0.45	0.35	Arlee
121	7/22/87	8.4	0.24	0.19	Arlee
122	7/22/87	12.4	0.65	0.52	Arlee
123	7/22/87	12.0	0.58	0.46	Arlee
124	7/22/87	13.2	0.81	0.63	Eagle Lake
125	7/22/87	12.2	0.71	0.58	Arlee
126	7/23/87	14.7	1.07	0.89	Kamloops
127	7/23/87	13.2	0.88	0.75	Arlee
128	7/23/87	9.8	0.40	0.31	Brook
129	7/23/87	11.8	0.64	0.51	Arlee
130	7/23/87	10.9	0.53	0.40	Arlee
131	7/23/87	14.0		0.99	Eagle Lake
132	7/23/87	14.6		1.19	Eagle Lake
133	7/23/87	10.8	0.52	0.42	Arlee
134	7/23/87	12.2	0.77	0.63	Arlee
135	7/23/87	14.6	0.94	0.76	Arlee
136	7/23/87	12.7	0.75	0.59	Arlee
137	7/23/87	11.2	0.50	0.41	Arlee
138	7/23/87	14.8	1.13	0.92	Arlee
139	7/23/87	14.6	1.07	0.85	Arlee
140	7/23/87	14.0	1.00	0.89	Arlee
141	7/23/87	13.6	0.91	0.73	Arlee
142	7/23/87	15.1	1.09	0.91	Arlee
143	7/23/87	13.7	1.01	0.82	Arlee
144	7/23/87	11.7	0.60	0.53	Kamloops
145	7/23/87	12.3	0.69	0.61	Kamloops
146	7/23/87	13.3	0.77	0.65	Kamloops
147	7/23/87	12.2	0.65	0.53	Arlee
148	7/23/87	13.0	0.76	0.65	Arlee
149	8/1/87	12.6	0.70	0.58	Arlee
150	8/2/87	11.6		0.46	Eagle Lake
151	8/2/87	13.2		0.76	Kamloops
152	8/2/87	13.3		0.63	Arlee
153	8/2/87	11.9	0.60	0.51	Kamloops
154	8/2/87	9.3	0.30	0.26	Brook
155	8/2/87	13.8	0.97	0.85	Arlee
156	8/2/87	11.3	0.57	0.46	Arlee

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
157	8/2/87	13.5	0.83	0.66	Arlee
158	8/2/87	10.2	0.40	0.35	Eagle Lake
159	8/2/87	13.9	0.87	0.77	Eagle Lake
160	8/2/87	11.3	0.59	0.49	Arlee
161	8/2/87	13.5	0.77	0.67	Arlee
162	8/2/87	12.3	0.75	0.62	Arlee
163	8/2/87	16.0	1.43	1.13	Arlee
164	8/2/87	16.1		1.06	Arlee
165	8/2/87	15.8		0.96	Arlee
166	8/2/87	15.5	1.03	0.87	Arlee
167	8/2/87	14.0	1.08	0.89	Arlee
168	8/2/87	12.9	0.80	0.66	Arlee
169	8/2/87	10.8	0.44	0.38	Arlee
170	8/2/87	9.6	0.34	0.28	Eagle Lake
171	8/2/87	15.0	1.13	0.89	Arlee
172	8/2/87	13.7	0.83	0.67	Arlee
173	8/2/87	11.3	0.54	0.40	Eagle Lake
174	8/2/87	11.2	0.46	0.37	Eagle Lake
175	8/2/87	11.7	0.57	0.47	Eagle Lake
176	8/9/87	12.2	0.69	0.59	Eagle Lake
177	8/9/87	13.5	0.79	0.64	Arlee
178	8/9/87	13.0	0.74	0.65	Arlee
179	8/9/87	14.8	1.29	1.08	Arlee
180	8/9/87	16.8	1.69	1.27	Arlee
181	8/9/87	16.1	1.60	1.21	Arlee
182	8/9/87	14.3	0.91	0.71	Arlee
183	8/9/87	15.0	0.85	0.68	Arlee
184	8/9/87	14.2	0.93	0.81	Arlee
185	8/9/87	13.0	0.77	0.66	Arlee
186	8/12/87	15.1	1.19	0.99	Arlee
187	8/12/87	10.4	0.52	0.41	Arlee
188	8/12/87	11.3		0.46	Brook
189	8/12/87	12.9	0.80		Kamloops
190	8/12/87	11.5	0.53		Kamloops
191	8/12/87	14.2	1.16	0.92	Arlee
192	8/12/87	13.0	0.82	0.64	Arlee
193	8/12/87	11.8	0.63	0.50	Arlee
194	8/12/87	13.1	0.78	0.62	Arlee
195	8/12/87	15.9	1.56	1.23	Arlee
196	8/12/87	14.5	1.08	0.91	Arlee

Fish number:	Date of exam:	Length in inches:	Weight in lbs uncleaned:	Weight cleaned:	Strain:
197	8/12/87	11.6	0.57	0.47	Arlee
198	8/12/87	11.0	0.44	0.36	Arlee
199	8/12/87	9.6	0.39	0.32	Brook
200	8/12/87	10.0	0.43	0.38	Brook