F-C-7

F-C-7

STATE OF MONTANA
DEPARTMENT OF FISH AND GAME

SUMMARY OF RETURNS ON QUESTIONNAIRE CONCERNING NATIVE CUTTHROAT TROUT CULTURE IN THE WESTERN STATES

The response to our questionnaire concerning native cutthroat trout practices among the hatcheries propagating this species in the Western States was excellent. Completed questionnaires were received from forty-eight hatcheries in the states of Montana, Idaho, Washington, Oregon, California, Colorado, Wyoming and the Fish and Wildlife Service in Regions I and II. In summarizing the information received, no attempt will be made to evaluate the individual practices as reported by the various hatcheries as the peculiarities of a particular hatchery frequently dictate the procedures and practices that are used. Such factors as water, disease, availability of food supply, etc., are prime considerations in the operation of each individual hatchery. The majority of responses in the questionnaire were general in nature. The summary should enable the individual hatchery to compare their operation with the practices, problems, and solutions of the other reporting hatcheries; point out the peculiar problems faced by all hatcheries in propagating this species, and determine the areas in which the need for complete scientific investigation should be encouraged as reported by the group as a whole.

WATER SUPPLY

I. SOURCE OF WATER SUPPLY

1. Spring	19
2. Series of springs	14
3. Bog	2
4. Pond	1
5. Creek	7
6. Lake	2
7. Artesian well	3

II. NATURE OF WATER SUPPLY

1. Algæ infested -	Light 3, Med. 16
2. Moss	Med. 9
3. Gravel	22
4. Mud	16
5. Water cress	3

III. NATURAL FOOD AVAILABLE

1. Very light	19
2. Light	11
3. Medium	5
4. Heavy	0
5. None	17

IV. METHOD OF CONVEYANCE

1. Wood pipe	10
2. Steel or iron pipe	12
3. Ditch	1
4. Galvanized pipe	1
5. Cement	1
6. Tile	1

V. DISTANCE CONVEYED

1. Wood pipe	150' - 7000'
2. Steel	150' - 2400'
3. Ditch	2000'
4. Galvanized	2300'
5. Cement	6'
6. Tile	1000'

VI. Ph OF WATER

1. Not reported	21
2. Highest	8.4
3. Lowest	6.1
4. Mean	7.6

WATER SUPPLY

VII. OXYGEN CONTENT

1. Not reported	23
2. Highest	11.1
3. Lowest	4-6
4. Mean	8.6

VIII. WATER TEMPERATURE

1. Spring and summer	
(a) Highest reported	67
(b) Lowest reported	36
(c) Average reported	51
2. Fall and winter	
(a) Highest reported	58
(b) Lowest reported	32
(c) Average reported	47

EGG SUPPLY

I. STRAIN OF BROOD STOCK

1. Coastal	8
2. Yellowstone	16
3. Henry Lake	11
4. Blue Lake	3
5. Kings Lake	2
6. Unknown	3

II. SOURCE OF EGG SUPPLY

1. Wild brood stock	35
2. Domestic brood stock	5
3. Not reported	8

III. CONDITION OF BROOD STOCK

1. Good	26
2. Average	10
3. Not reported	12

IV. CONDITION OF THE EGGS

1. Good	28
2. Average	1
3. Soft	3
4. Fair	1
5. Not reported	15

PRODUCTION

I. TYPES OF REARING FACILITIES

1. Troughs	33
2. Inside tanks	16
3. Outside tanks	7
4. Earth ponds	15
5. Cement ponds	21
6. Earth raceway	2
7. Cement raceway	2

II. ANNUAL PRODUCTION OF REPORTING HATCH

1. Fry	7,627,000
2. Fingerlings	3,378,000
3. Legal	210,000

DIET

SCHEDULE OF STARTING DIETS

No. Report.	1	26	2	1	1	1	1	1	1	1	1	
% Beef Liver	80	100	50	50	65	90	75	50	98	88	98	
% Fish Oil												
% Dist. Sol.												
% Salt												
% Salmon Vis.	10						10					
% Meat Meal	10										2	
% Red Gill			50									
% Pork Liver				50								
% Lungs					30							
% Cod Oil					3							
% Yeast					2		2		2	2		
% Meal						10				10		
% Aurofac							1					
% Spleen							12	50				
% Lean Meat												

SCHEDULE FOR ADVANCED FRY DIET

No. Reported	1	1	1	1	1	1	1	1	1	1	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Beef Liver	60	60	96		45	85	65	98	60	60	50	100	80	95	75	25	50	75	85	70	80	63	50	70	92	46
Salmon Viscera	20	30							15				10									25	25	15		
Meat Meal	20																									
Magnolia oil		10																								
Yeast			2				2		2	1												2		2		
Red Gill				100												50		25								
Pork Liver					45																					
Meals					10																20		5			
Distiller Sol.						10																				
Fish Oil						3																				
Salt			2			2																	2			2
Lungs							30			39	50															
Cod liver oil							3																			
Spleen									22				10		15								20	15		46
Aurofac								2	1																	
Cortland diet														5	10											
Lean meat																25	50									
Anchovies																			15							
Carp																				30						
Salmon eggs																									8	
Fish meal																										6

FINGERLING DIET

No. Reported	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1
Cod Liver oil																	
Fish oil																	
Lungs	85	15		45	30		20	30	80		35						
Meat Meal	15																
Salmon Viscera		30					20				20						
Tripe		15															
Pork liver		15				5											
Beef liver		5	75	20	60	80	20	30		90	40	25	100	50	25	70	60
Dry Meal																	
Yeast		2			2						5						
Salt		2															
Cortland No. 6			25	10								50					
Spleen				25		5	30					25					
Kelp meal					2												
Hagerman meal					6					10							
Meal		16				10	10										
Lean Meat								40						50	25		
Fish Meal									20								
Red Gill																30	
Sea Fish															25		
Salmon sawdust																	
Salmon eggs																	

FINGERLING DIET

No. Reported	1	1	1	1
Cod Liver Oil				
Fish Oil				
Lungs	15			
Meat Meal				
Salmon Viscera	35		17	33
Tripe				
Pork Liver				
Beef Liver		40		66
Dry Meal				
Yeast			5	
Salt	2		3	
Cortland No. 6		15	50	
Spleen	20	20		
Kelp Meal				
Hagerman Meal				
Meal	10			
Lean Meat			25	
Fish Meal				
Red Gill				
Sea Fish				
Salmon Sawdust	20			
Salmon Eggs		25		

DIET

I. FOLLOW A FEEDING CHART

1. Yes	18
2. No	26

II. TYPE OF FEEDING CHART FOLLOWED

1. Cortland	17
2. Idaho	1

III. NO. OF FEEDINGS PER DAY

1. Fry	
(a) 32 per day	1
(b) 10 per day	1
(c) 8 per day	5
(d) 7 per day	1
(e) 6 per day	6
(f) 5 per day	10
(g) 4 per day	9
(h) 3 per day	7
(i) 2 per day	6
2. Fingerling	
(a) 14 per day	1
(b) 5 per day	1
(c) 4 per day	6
(d) 3 per day	17
(e) 2 per day	11
(f) 1 per day	1
3. Legal	
(a) 3 per day	3
(b) 2 per day	9
(c) 1 per day	10

IV. PROCEDURE USED TO FEED

1. Water mix	15
2. Spoon	23
3. Ricer	15
4. Hand	1
5. Fork	1
6. Sieve	3
7. Pressure gun	4
8. Sprinkling can	2
9. Bulb	1

DISEASE CONTROL

I. FREQUENCY OF TREATMENT

1. None	14
2. Weekly	5
3. Bi-Weekly	4
4. Monthly	1
5. As symptoms appear	19

II. TYPE OF TREATMENT USED ON EGGS

1. None	26
2. Malachite Green	15
3. Salt	1
4. Copper sulphate	1
5. Sulphamathiolate	11
6. Jenson Violet	1

III. TYPE OF TREATMENT ON FRY

1. Formalin	9
2. P.M.A.	4
3. Salt	5
4. Potassium perman.	1
5. Roccal	4
6. Salt and Sulpha	3
7. Copper sulphate	2
8. Malachite Green	1
9. No treatment	19

IV. TYPE OF TREATMENT ON FINGERLINGS

1. No treatment	16
2. Formalin	10
3. P.M.A.	7
4. Salt and Sulpha	3
5. Phenothiazin	1
6. Roccal	4
7. Sulmet	1
8. Acetic acid	1
9. Copper Sulphate	2
10. Malachite Green	1
11. Potassium permanganate	1
12. Carbarsone	2

DISEASE CONTROL

V. STAGE EXPERIENCING GREATEST LOSS

1. Fry	17
2. Advanced Fry	17
3. Fingerling	13

VI. DEGREE OF ANNUAL LOSS

	Light	V. Light	Med.	Heavy
1. Fry	13	5	15	7
2. Fingerlings	9	4	14	7
3. Yearlings	8	5	4	2

VII. OPINIONS ON PRIMARY CAUSES OF GREATEST LOSSES

1. Not determined	5	9. Ulcer disease	1
2. Dietary defficiency	9	10. Red throat	1
3. Gyrodactylasis	2	11. Blood disease	1
4. Water condition	3	12. Fungus	1
5. Inability to digest first feeding	4	13. Overfeeding	1
6. Overcrowding	7	14. Octomitus	1
7. Susceptability to disease	1	15. Poor eggs	4
8. Gill disease	5	16. Brain tumor	1
		17. External parasite	3

GENERAL

I. OVER-ALL SUCCESS WITH CUTTHROAT TROUT RATED AS

Very Poor	Poor	Fair	Good	Very Good	Excellent
4	3	19	11	4	4

II. PARTICULAR PHASE OF CULTURE CONTRIBUTING SUCCESS OR FAILURE

1. Insufficient information available	1
2. Dietary information lacking	17
3. Control of disease	9
4. Not determined	12
5. Water supply	1
6. Frequency of feedings	2
7. Frequent grading	2
8. Prevention of overcrowding	6
9. Amount of food intake	2
10. Cleanliness	2
11. Becoming acquainted with one station	1
12. Degeneration of body organ function	1

III. TYPES OF INVESTIGATION DESIRED

1. Diet	23	8. Reproduction in nature	1
2. Survival	4	9. New culture methods	1
3. Domestic strain selectively bred	3	10. New strain or source of eggs	2
4. Life cycle	2	11. Establishing brood stock in drainage to be planted	2
5. None	2	12. Water analysis	1
6. Disease control	2	13. Carrying capacity of hatchery for cutthroat species	1
7. Introduction into alkali water	1		

IV. MARKED DIFFERENCE BETWEEN RESIDENTIAL STREAM AND LAKE NATIVES

Yes 20 No 8

V. EXPERIENCED GREATEST SUCCESS WITH STREAM OR LAKE NATIVES

Stream 4 Lake 18

SUMMARY OF ABOVE SECTIONS

In any evaluation of the above observations brought out in the questionnaires received, it must be kept in mind that the answers were entirely subjective, based on firsthand experience and conclusions drawn through personal observation, without control factors present in a more formal scientific survey. In studying the above results, certain factors seem to become apparent. All hatcheries attempting to propagate the native cutthroat trout experience certain similar difficulties. It is suggested that the biologists from the various State and Federal Game Departments concerned with the problems involved could make a cooperative study of all the factors involved in rearing these fish. A coordinated effort, with each individual state department concentrating their efforts on a particular phase of the propagation, would unquestionably answer many of the present problems facing the hatcheries, and materially reduce the time and cost for all concerned so this fish could be produced in the quantities desired and warranted with a minimum of expense.

The answers to the questionnaire as tabulated above seem to warrant drawing the following conclusions:

1. In general, the available water supply does not seem to be a primary factor in the success or failure in the propagating of native cutthroat trout. The similarity of success in all types of water conditions as reported by the individual hatcheries, with certain extremes excluded, would tend to indicate that the species is adaptable to a variety of water conditions.

2. Hatcheries are using predominantly wild brood stock as a source for their egg supply, with the Yellowstone eggs being the most frequently used. The supply of eggs from Blue Lake is generally regarded as too soft by those receiving their eggs from this source. Hatcheries maintaining domestic brood stock experience similar difficulties with a high mortality after the third year.

3. The rearing facilities for this species are quite diverse. However, many of the reporting hatcherymen felt that dirt ponds were more successful than cement ponds. The general concensus of opinion seems to be that this species requires more room than other species of trout at all stages of rearing and overcrowding is frequently a primary cause of difficulties.

4. The majority of hatcheries restrict their production to fry and fingerling because of difficulties experienced in keeping them beyond this stage. The production of legal-size trout is comparatively small.

5. Diet is apparently of primary concern among all of the reporting hatcherymen. Dietary deficiencies seem to cause the greatest difficulty in propagating the species. A majority (70.3%) of those reporting their starting diets use 100% liver. Liver is the predominate ingredient in the remainder. The advanced fry diet is predominantly liver with a wide variety of other ingredients used as supplements. No two reporting hatcheries use the same fingerling diet, with the single exception of three using 100% liver. This would indicate a great deal of individual experimenting by hatcherymen in an attempt to find a successful feeding formula. In spite of the great diversity in diet, only one hatchery was able to report any outstanding success with a particular diet used. A detailed account of the operation is reported below.

6. The majority of hatcherymen are not using a feeding chart. Of those who follow a chart, the Cortland chart is used almost exclusively.

7. The number of feedings per day and the manner of feeding varies greatly among the individual hatcheries. However, the general concensus seems to indicate that native cutthroat trout should be fed more frequently than other species.

8. Disease control as reported by the individual hatcheries apparently follows the standard practices for all species of trout. This is an area that indicates a need for further study.

9. No attempt will be made to evaluate the section on losses, as the method employed in the questionnaire was too general to permit specific answers.

10. The majority of hatcheries experience only moderate success in propagating the native cutthroat trout in comparison with other species. The reported difficulties were experienced in the field of dietary control as the primary cause of low survival, with disease control being of considerable import.

11. As has been indicated, the majority of reporting hatcherymen feel the greatest need for further investigation for successful propagation of the native cutthroat lies in the field of diet. It is apparently the lack of adequate scientific knowledge in this area that creates the most problems and contributes to the general moderate success in rearing the species.

12. The majority of hatcherymen feel there is a marked difference between residential stream and residential lake natives, with the majority experiencing the greatest degree of success with the lake native.

13. Attached hereto are examples of statements submitted by hatcheries. These examples do not necessarily indicate successful practices, but portray the widespread techniques used in culturing this species.

Our starting diet is 100% beef liver. Unless thawed and washed, we avoid the use of charcoal dipped liver and prefer dyed liver (method used by Armour and Company of Spokane), in fact we prefer the liver received from Armour of Spokane to any other liver as a starting diet. While we have no proof, we believe that excessive amounts of charcoal in the liver tends to make the iodine unavailable to the fish resulting in a slight goiter condition. The straight beef liver is fed for a period of two to three weeks at which time we change to a diet of 10% distillers solubles, 3% A and D fish oil, 2% salt (mesh) and 85% beef liver. At about six weeks the diet is changed to 75% beef liver, 6% distillers solubles, 6% cottonseed meal, 6% wheat midds, 6% salmon meal and 1% salt. At about ten weeks the diet is changed to 50% beef or 50% beef and pork liver, 12% distillers solubles, 12% cottonseed meal, 12% wheat midds, 12% salmon meal and 2% salt (mesh) and continued as the final diet.

It is possible that further nutritional studies may reduce the amount of liver required, however, until definitely established we feel that a minimum of 50% level of liver should be maintained. We encountered definite deficiencies in biotin and pantothentic acid at levels of 12½% to 25% liver. It is, therefore, very obvious that the biotin and pantothentic acid requirements of native or cutthroat trout is considerably higher than the rainbow, brown or brook trout.

We further believe that frequent feedings at start and continued so for a period of at least four or five weeks contributes greatly to the survival of the fish during the critical or fry stage and results in a minimum of pin-heads.

The following is a breakdown, during 1954, of losses at the various stages in percentage to original number: Eyed eggs 5.0%, Fry 1.0%, No. 1 4.0%, No. 2 1.0%, No. 3 8.0%, No. 4 1.0%, total mortality 20%. The dietary deficiency was encountered at the time the fish were No. 3 and approximately 74 fish per pound. Conversion for the lot was 4.3 which we consider high and was caused by the period of mortality at the time of the dietary deficiency. We point out that the deficiency was corrected by raising the liver portion of the diet and maintaining it at a 50% level. These fish were transferred to another station at an average of 35.9 fish per pound at an age of six months. Size groups as follows:

No. Fish	No. per lb.
3,139	28.8
9,169	29.2
3,419	30.8
4,205	43.8
4,733	49.3
4,259	50.1
4,584	57.3

Further observations and studies will be made during the current year on this species of trout.

We incubate and hatch only the eggs taken from fish which spawn for the first time at three years of age. About sixty percent spawn at two years of age. We only hold brood stock and spawn once. Losses very high from Copopods at second spawning.

Losses in eggs, from time taken to hatching, runs from five to twenty percent. We pick our eggs over the same day taken and the following days until the blastopore is closed. We do not pick out the dead ones unless some start to fungus. Remove dead eggs every two or three days as long as they show no signs of fungus. Losses in fry usually run from .02% to .05%. Losses in fingerlings are about 10%. Losses in yearlings are about .001 to .005%.

We place 5000 in baskets made of No. 16 mesh fly screen and hatch. Remove egg shells by syphon as they hatch. Hold the fry in the same baskets and when about one-fifth of them start to swim-up, we start feeding. Use 50% beef livers mixed with 50% pork melts. Grind, while frozen, through a 1/64" plate four times. Only enough ground to last three days, held at 33 degrees after grinding. Add water and mix to a batter which will float for feeding. We try and feed often enough to keep some food floating on the surface all of the time. When all of the fish swim-up, we thin the feed so that some of it will sink. Still keep some floating on surface. Continue this method of feeding for two weeks. Will clean baskets by scrubbing, using whisk broom, on outside and removing to a clean trough two or three times.

At two weeks of age, they are transferred to concrete tanks, 18' x 3' x 30" deep. Dipped in a 3% salt solution for one minute as moved. Place 5,000 to 10,000 to each tank. Fed 6 to 8 times per day by shaking, 49% beef liver mixed with a 49% pork livers and a 2% of salt, through a shaker made of 14 mesh fly screen. Treated once a week with 3% salt, one minute.

Transferred from tanks to outside ponds at six weeks of age or 400 to pound. Outside ponds are of concrete, 100' x 12' x 30" deep. Place 30,000 to 40,000 per pond. In the outside ponds they are treated as needed. Make regular microscopical examinations. For external protozoan parasites, we use formalin 1:5000 for one hour. If any fungus shows, we use PMA 1:200,000 for one hour..

Fish are graded for first time when they will grade out 30 and 60 fish per pound. We always use a 3% salt solution as we grade (one minute dip). We grade again in the fall. This time, we dip using 3% salt mixed with 1:500 acetic acid for one minute. This dip cleans our fish of all protozoan parasites. Usually keeps them free of protozoa all winter.

We start adding meals (Cortland #6 less fish meal) to our diet when our fish go 400 to the pound. Reaching 50% meals, 25% fish products (salmon viscera and eggs) frozen, 20% red meats, 2% salt and 3% brewers yeast. Sometimes we increase the salt to 5% to get proper consistency. Also increase the brewers yeast if forced to feed red meats which are low in biotin. This diet produces fish going from 3 to 10 to the pound at one year of age.

The cutthroat program at this installation is a minor part of the over-all production. Eggs are usually recieved during the first two weeks of May and fingerlings planted out by the middle of September. This four and one-half month period comes at a time of year when hatchery facilities are available. Due to the ideal water conditions, temperatures 55-56 degrees, it is possible to raise these fingerlings to approximately 15 per oz. before conditions become crowded due to our fall spawning rainbow brood stock program. These fish are utilized in some areas as a supplemental carry-over planting in combination with the catchable program. In other areas, they are utilized as the entire stocking program. We have found that there is essentially no difference in the survival rate of cutthroat, brown or rainbow at this installation and the methods used to rear all varities are approximately the same. In our opinion, it is essential to prevent disease rather than try to cure it. Constant vigilance is necessary at all times due to the warmwater temperatures.

Immediately upon the raising of a few fish from the bottom of the troughs, feeding is started with a minute quantity of finely ground beef fluke liver. After fish have all risen and have been feeding for approximately two weeks, a prophylaxis treatment of formalin is given, 1 to 4,000 parts for approximately 30 minutes. During this time, fish are fed 8 to 10 times daily. As soon as fish have attained a size of approximately 100 per oz., 15% frozen sea fish is added to the diet (anchovies, mackerel, etc.). This diet is continued until the fish attain a size of approximately 60 per oz., when another 15% of frozen fish is added to the diet making the diet consist of 70% beef fluke liver and 30% frozen sea fish. The feedings are gradually cut down during this period to four a day. Fish are fed what they will eat at all times. Special care is necessary to see that the water does not become milked up too heavily from feeding the liver.

We have experienced better than average success with the cutthroat program at this hatchery, planting approximately 85% fingerlings from green eggs received. We feel that the three main reasons responsible for this are a good diet and proper feeding, constant vigilance and prophylactic measures as necessary and the avoidance of overcrowding as much as possible.

During the year of 1954, we have made greater advancement than any previous year in raising cutthroat trout. Whenever we are in doubt, specimen are sent to the Department laboratory. They give us a prompt report, and we try to make the proper corrections.

As soon as the cutthroat goes on feed, they are fed four times daily for approximately two weeks and the number of feedings reduced to three times daily and after about one month at water temperature 49 degrees, they are fed only twice daily. Feeding level is kept about half as much as with brook or rainbow. We find that cutthroat develop fatty infiltration of the liver much quicker than other trout on the same diet. From all indications, our problem is to develop a diet which is low in Cholesterol, as beef liver and spleen, which are some of the highest according to our reports. The last lot of cutthroat is approximately four inches in length and we have corrected this situation at least for the time being. If the plan is to raise them to legal size, our healthiest fish have been raised in earthen ponds. After the fish have been fed beef liver about one month, Cortland No. 6 meal is gradually mixed in the diet and by the time they are two inches in length, the diet should be 60% meat and 40% meal. At 3-4 inches, the diet is composed of 50% meat and 50% meal. When large enough to take pellets, they are fed pellets five days a week and meat two days.

We feel that our problem in the past has been over-feeding, but it will take a great deal of experimenting in the future to solve our problems, thereby, we will be able to propagate the cutthroat as easily as other trout.