1040

Gould

PROCEEDINGS OF THE

FLATHEAD RIVER BASIN BULL TROUT BIOLOGY AND POPULATION DYNAMICS MODELLING INFORMATION EXCHANGE

July 24, and 25, 1985

D.D. MACDONALD

Editor

Published by:
Fisheries Branch
B.C. Ministry of Environment
106 - 5th Avenue South
CRANBROOK, BRITISH COLUMBIA
V1C 2G2

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

DOLLY VARDEN CULTURE IN BRITISH COLUMBIA

Peter Brown
B.C. Ministry of Environment
Fisheries Branch
Kootenay Trout Hatchery
Wardner, B.C.
V0B 2J0

Abstract

Declining populations of Dolly Varden char (bull trout) have caused fisheries managers concern in British Columbia. One of the major efforts at restoring these populations has been seen in hatchery production of juveniles, even though knowledge of cultural techniques for this species has been extremely limited.

Various aspects of Dolly Varden culture at Kootenay Trout Hatchery are described, and include incubation, initial rearing, pond culture and transportation.

Introduction

Declining populations of Dolly Varden char (bull trout) have been a source of concern for fisheries managers in British Columbia. The declines have been caused by overharvesting, poaching and dam construction blocking access to spawning areas.

One of the conceived methods of restoring these populations was hatchery production of juveniles, even though knowledge of cultural techniques for this species was extremely limited. The information that was found was not encouraging. This was exemplified by a note from Bernie Kepshire (Alaska) to Hugh Sparrow (B.C.), that read, "These critters do not seem

to like life... They sure like the bottom as you said; maybe we should rename them 'cottid char' or 'sucker char'." And indeed they do perform differently in many aspects of their biology to other salmonids.

This talk will give you some information about what we have done and will conclude with what we feel are some acceptable methods of culturing Dollies. Remember, however, that each hatchery, and indeed different stocks of this species, may require slightly different techniques to achieve some measure of success.

Our initial attempts in 1977-78, 1978-79 and 1980-81 were relatively limited, with only indicative testing being done. Very little conclusive information was gained, though many avenues were explored.

In 1981-82, emphasis was placed on getting qualitative results. Experiments were carried out on the effect of water temperature during incubation, as well as the testing of four diets.

In 1982-83, we tested adult males to try to determine the causes for the loss of ripeness during holding, the use of substrates during incubation and their effects on growth for three months after initial feeding, as well as four diets.

In 1983-84, we felt relatively confident in the results of much of our work, and further experiments consisted only of tests to determine the effects various substrates on incubation and subsequent growth of fry.

It should be noted here that, to a great degree, the philosophy behind the testing was not necessarily to find the ultimate methods of raising these fish, but to find the best methods, within reason, to suit our existing hatchery structure (i.e. trying to fit the fish to the facility).

From our experimentation and experience we have found the following to be worthwhile methods for culturing Dolly Varden at the Kootenay Trout Hatchery:

Adult Capture

This has been done successfully by angling, dip-netting and electroshocking. The fish should be treated fairly gently, to avoid undue stresses. These techniques are similar to those other trout and char species.

Adult Holding

The fish should be held in conditions resembling natural spawning areas until just prior to ripening. In our operation, the fish were captured 2 to 3 weeks prior to initial spawning, and were held in a portion of a spawning channel. As we noted evidence of redd building taking place, the fish were then confined to a corner pool which had a concrete floor This discouraged further redd building activities.

Males present a problem in that, for some unknown reason, once captured and held, they lose their desire or ability to produce sperm. This often causes problems towards the end of the egg collections.

Egg Collections

We have used normal expression spawning techniques with good results. All adults are anesthetized prior to spawning using 2-Phenoxyethanol. The eggs are water hardened in an erythromycin phosphate solution as a precautionary measure against BKD. The eggs are transported back to the hatchery within 24 hours of fertilization. A 100 ppm Wescodyne treatment is given upon arrival at the hatchery.

Incubation

Water temperature appears to be a major factor in incubation success. Our best results have been with our ground water supply, normally 7° - 8°C, which is chilled to about 4°C. This temperature is maintained throughout incubation. Some minor

fluctuations, due mainly to mechanical failures, have not caused serious problems. The next best incubation water supply was a water source that simulated natural creek temperatures (i.e. declining in the fall, low over the winter period and increasing in late winter). We have had reasonable success with creek temperatures as low as 0°C for short periods.

The use of substrates, placed immediately prior to hatching, results in the production of larger fry at ponding. It is not clear, however, if these substrate-produced fry maintain the size difference over the first three months of rearing, or if they are better fry with respect to ponding in our outdoor raceways.

Rearing

Nearly buttoned up alevins are placed in our indoor rearing troughs, (4.9 m x .44 m x .16 m water depth), with water flows of about 40 L/min. Temperatures during the trough rearing stage are in the 7° - 8°C range. We raise up to 35,000 fry per trough. This type of trough appears to be suitable for this species. We have heard some negative comments about circular containers.

Fry are started out on Silvercup salmon starter to which is added approximately 10%, by weight, raw, pureed beef liver. This liver is mixed into the Silvercup food and then the mixture is rescreened so that it can be fed through our automatic feeders. This diet is given for 4 to 6 weeks, then we switch to OMP. Although we are happy with this diet schedule, we feel confident in saying that they are not the only diets that will work. When planning diets for this species, it must be remembered that these fish are not generally surface feeders and therefore a food that will sink is a necessity. Palatability is also a major concern with respect to Dolly Varden diets as the fish demonstrate clear preferences for certain flavours and textures.

The fish reach about 0.5 g about three months after ponding and are then transferred to our outdoor rearing ponds. (14.5 m x 3.6 m x .83 m water depth). Water temperatures can vary from 7° - 11°C at this time. We continue to feed OMP, supplementing with unaltered Silvercup salmon diets. Our major problems, especially since we have overcome those encountered initially in incubation and early fry rearing, tend to come at this time. These take the form of myxobacterial outbreaks, which have caused losses of up to 20% of our fish in a week. The main cause has been a Flexibacter, similar to cold water disease, but gill disease has been involved as well. We have treated with oxytetracycline in the food and externally with Hyamine 3500 and have been able to eventually control the problems. These fish appear to be fairly susceptible to diseases and respond stubbornly to treatments. We try to avoid water temperatures in excess of 12°C for this species as the disease problems appear to become more acute.

The fish are reared for three to four months in these ponds prior to release in the fall as 3 g to 4 g fish. Overall, growth appears to be slower with this species compared to other wild species that we culture.

Transportation and Liberation

We have encountered problems on several occasions because of the nature of Dolly Varden to orient to the bottom. Since they generally utilize such a small portion of the water column, loading densities must be reduced significantly. Also, in the way our tank truck oxygen systems are set up, the fish can get underneath the oxygen lines. Even though the space is only 1-2 cm, it is enough room for them to lay on top of one another to cause suffocation. Ideas for new tanks which would prevent this from happening have been contemplated, but not yet built.

All of our stocking has been into streams which flow into large lake systems. The fish are scatter planted over as wide an area as possible. Dolly Varden apparently do not move very far from where they are released until it is time for them to migrate to the lake system, which is usually at least one year after stocking.

At this time we are out of Dolly Varden production at the Kootenay Trout Hatchery as it is being handled by a private contractor at another facility. Our Section is continuing to keep its hand in Dolly culture as one of our smaller hatcheries has a rearing project underway.

I would like to leave you with some targets for production which you can shoot for if you decide to get into rearing Dollies. Those figures noted as 'attained' have been, with the percentage figure indicating the survival of the entire year class of eggs or fish (about 350,000), and not just successful experimental lots.

1. Green egg to 'swim-up' fry - 93% survival (attained)
2. 'Swim-up' fry to 0.5 g* - 95% survival (attained)
3. 0.5 g to release (3-4 g) - 95% survival (not yet attained)

Although the possibilities for success with Dolly Varden looked bleak a few years ago, it has been demonstrated to be a culturable species provided we can accommodate its requirements.

*This is the stage at which we transfer the fish from the indoor troughs to the outdoor raceways.

ELECTROPHORETIC VARIATION WITHIN AND BETWEEN POPULATIONS OF BULL TROUT IN THE UPPER COLUMBIA RIVER DRAINAGE

R.F. Leary
Department of Zoology
University of Montana
Missoula, Montana
59812

Abstract

The total amount of genetic variation in a species consists of both genetic differences between individuals within populations and genetic differences between populations. Electrophoretic analysis of the products of 43 protein loci in samples from five populations of bull trout (Salvelinus confluentis) in the upper Columbia River drainage indicates that these populations contain relatively low amounts of genetic variation; average expected heterozygosity ranges from 0.0 to 3.6 percent (mean = 2.3) and the proportion of polymorphic loci ranges from 0.00 to 0.11 (mean = 0.08). A substantial percentage (26.4) of the total amount of genetic variation detected is due to genetic differences between populations. Preservation of the genetic resource represented by the bull trout, therefore, will require the continued existence of many populations.

Electrophoretic data indicate that the bull trout, arctic char (S. alpinus), brook trout (S. fontinalis), and lake trout (S. namaycush) are all genetically very distinct. The bull trout and arctic char are the two most similar taxa. The amount of genetic divergence between the brook trout and the lake trout and between these fishes and the bull trout and arctic char is about twice as great as the amount of genetic divergence between the bull trout and arctic char.

No paper submitted.

MANAGEMENT PLAN FOR BULL TROUT IN ALBERTA

Leon Carl
Alberta Department of Energy and Natural Resources
Fisheries Branch
9945 - 108 Street
Edmonton, Alberta
T5K 2C5

Abstract

Bull trout populations have been severely reduced in many watersheds of the Eastern Slopes area of Alberta. The report Status of the Fish and Wildlife Resources in Alberta (1984) has indicated general problems with bull trout production. This report focuses in detail on the bull trout management problems of angling vulnerability, unproductive and limited habitat, and habitat alteration. Bull trout are taken only by sport fishing and species management is difficult since many anglers group it with other species as "trout". Listed below are management objectives and recommendations which will be implemented to improve bull trout populations in Alberta.

A. Mangement Objectives

1. Protect bull trout from extinction and maintain bull trout populations by natural reproduction and maintenance of habitat.
2. Rehabilitate populations of bull trout which have declined below full production.
3. Increase information on the biological and habitat requirements of the bull trout.
4. Develop an information/education program to help anglers to identify bull trout and to understand their unique characteristics for better compliance with fishing regulations.

B. Management Recommendations

1. Develop fishery regulations to protect bull trout stocks during spawning and rearing and regulate fishing in line with the production surplus.
2. Develop and implement a field enforcement program to encourage anglers to comply with the fishing regulations.
3. Develop an inventory on bull trout to identify distribution, spawning and rearing habitat, population structure and migration routes.
4. Develop a program to increase information on the biological characteristics of the bull trout, its habitat requirements, and techniques of culturing.
5. Develop a rehabilitation program based on an assessment of the status of current populations.
6. Monitor the sport fishery to assess the utilization and demand for bull trout.
7. Develop management strategies for individual stocks of bull trout.
8. Implement a public relations program to help anglers identify bull trout and to explain management strategies.

1. Introduction

1.1 Classification

The bull trout (Salvelinus confluentis), a salmonid fish known as a char, is native to the river systems of western Alberta. Other char species in Alberta include lake trout (S. namaycush) and brook trout (S. fontinalis). Until recently the bull trout was grouped in the same species as the Dolly Varden (S. malma) however, separating the two was proposed recently. At present the American Fisheries Society recognizes the two fish as distinct species. Generally, the bull trout is the inland form and the one found in Alberta, while the Dolly Varden is the seagoing species.

1.2 Distribution and Numbers

Bull trout are distributed in most Eastern Slopes river systems and in many of these systems are the only native char species. A review of comparisons with early records indicates the present range of the bull trout has decreased compared with its former range. Early records show bull trout were present in many foothills streams and in prairie and parkland areas before settlers arrived. No quantitative information on early distribution is available. The report Status of the Fish and Wildlife Resource in Alberta (1984) indicates that bull trout production has been reduced and should be increased through management and enhancement measures.

Mangement requirements inferred from the present distribution may be distorted because most populations today are restricted to the western foothills and inaccessible cold water mountain areas. Although bull trout appear to prefer colder water they may inhabit these areas because of habitat deterioration and over-fishing in more accessible waters, rather than out of a biological necessity. Given the long life span and large size which bull trout can reach, past numbers were probably greater and the total weight of fish was probably comparable to other trout species. At present the species is not endangered, but it is becoming severely reduced in numbers in many watersheds.

Most bull trout populations south of the Bow River and those north of the Bow River, where there is vehicular access, are over-fished. Populations in remote streams north of the Bow River and in the larger, northern rivers, although depressed in numbers, appear to be more abundant than in southern rivers. Pinto Lake has the only large lake-dwelling population known outside the National Parks. Some lakes (A La Peche, Mystery, Bushy, Grande Cache and Abraham) have small, stable populations. Bull trout are occasionally caught by anglers in several other

lakes where there are very small populations present. Small, naturally reproducing populations of bull trout are currently protected from habitat loss and fishing in the North Ghost, Siffleur and Whitegoat Wilderness Areas where natural resource use and fishing are not permitted.

2. Biology of Bull Trout

2.1 Diet

Bull trout are the only stream dwelling char in Alberta that can grow to a large size (up to 8 kg). Incomplete biological information is available on bull trout in Alberta or elsewhere and only a rough sketch of their habitat, biological requirements and productivity is known. Adults apparently inhabit streams, large rivers and lakes where they feed mainly on mountain whitefish (Prosopium williamsoni) or minnows, if available. Where whitefish are rare or absent juveniles and adult populations feed on stream insects.

2.2 Spawning

Adults enter spawning streams in late July or August and spawn in September in small headwater streams which usually have a large spring or ground water input. First spawning appears to occur at five to six years of age. The female digs a nest or redd and after depositing her eggs covers it with gravel. The large size of the bull trout means the female will bury her eggs deeper and in larger gravel in midstream compared to smaller trout which can not move large gravel. This increases the chance of survival for the eggs in fast-flowing streams where spring flooding may scour out small gravel on the river bottom or where low flows in winter may leave redds, dug along the stream margin, stranded. The number of eggs each female produces is low or similar to other char of comparable size. Optimum egg incubation temperature

appears to be 4°C, which is cooler than for other char or trout in Alberta. In some locations juveniles inhabit their natal stream for up to five years before moving downstream to larger rivers and lakes. Bull trout nursery streams appear to be rare; only a few have been identified. Other types of spawning habitat may be used by bull trout, however these areas have not been identified to date.

2.3 Growth of Bull Trout

The bull trout is a long-lived fish (10-20 years) which grows slowly as a juvenile because of the cold water temperature and low productivity of the nursery streams. Growth rates recorded in the Sheep and Elbow Rivers varied from 75 mm per year for young of the year to 35 mm per year for fish aged five. Growth improves after the bull trout begins feeding on fish and is generally greater than for cohabiting rainbow trout.

2.4 Production of Bull Trout

The bull trout is easily over-fished because it lives in low productivity areas where food is scarce and the fish will readily take most fishing lures. Full production levels are difficult to estimate since bull trout are easily over-fished even before an area is opened to vehicular access. Most populations are not at maximum production. In Elk Creek, Alberta a 1970 survey indicated there were 83 bull trout per kilometre of stream, while in 1980 a survey indicated there were only 13 bull trout per kilometre of stream.

The bull trout is the char best adapted to cold, unproductive, fast flowing streams. Its loss would not be compensated by the stocking of other trout or char which are not adapted as well to the cold, unstable habitat. Other species could not maintain the same numbers or weight as bull trout and anglers would lose the opportunity to catch fish in these kinds of habitat. A net loss

to the fishery would occur if the bull trout is not managed in line with its production capabilities.

Three biological constraints limit bull trout production.

1. Low habitat production capability
2. a) Late maturity
   b) Low egg production
3. Angling vulnerability, particularly during spawning

3. Bull Trout Habitat

The bull trout has unique stream habitat requirements. These include unstable, cold and unproductive Eastern Slope streams. Such streams are vulnerable to habitat degradation, erosion, occasional flooding and low winter flows. Adults generally spawn in small streams fed by ground water. Ground water streams are rare in Alberta and make population rehabilitation efforts difficult because spawning habitat may be another limiting factor in achieving high production. The advantages to the bull trout of this type of spawning stream include warmer winter water temperatures, stable winter flows, low sediment loads and lack of winter anchor ice compared to other small streams in the Eastern Slopes. Juvenile bull trout inhabit these streams for the same reasons.

Adult habitat includes most Eastern Slope streams and rivers, and a few lakes. Adult bull trout require large deep pools in these streams and rivers to ensure good winter survival. Mountain whitefish are often present in these pools and provide an abundant prey for the bull trout.

4. Fishery for Bull Trout

Bull trout are currently taken only by sport fishing and supply approximately 7% of the provincial trout catch. The demand on the

fish resources is increasing steadily as reflected by the annual increase in the angling license sales. Concomitant with this increasing demand for recreational fishing, bull trout populations have decreased, some at a rapid rate. The bull trout is very popular with some anglers because in some rivers it reaches a large size and provides a quality fishing experience few other species can provide. Anglers enjoy keeping this fish for the amount of good quality meat it provides. Bull trout species management is difficult since a large number of anglers who take bull trout tend to group it together with other species as "trout" and do not differentiate bull trout from other trout species in terms of bag limits.

5. Issues and Concerns

5.1 Over-fishing

The bull trout is highly vulnerable to angling and is over-fished in many areas. In the early fall, large adults spawn in small tributaries and are easily caught with hook and line. In some areas, anglers have over-harvested bull trout populations long before road access became available. Easy access to much of the existing habitat and heavy fishing pressure severely constrains the opportunity to rehabilitate this species.

5.2 Spawning and Rearing Habitat Maintenance

Because of a lack of information, bull trout habitat is not well understood and is very difficult to identify, particularly where populations have been severely reduced and a major spawning run does not exist to indicate preferred spawning areas.

The small size of bull trout spawning and juvenile nursery streams makes them extremely sensitive to water extraction and siltation caused by mining, logging, seismic activity, and road and culvert construction.

The small size, unique nature and the apparent limited number of spawning and nursery streams requires that they be maintained in as productive a condition as possible.

5.3 Hatchery Rearing

Bull trout eggs incubate at cooler temperatures than other trout, making common incubation in hatcheries with other species difficult and requiring special equipment and procedures.

After bull trout begin to feed they remain on the bottom of the rearing tank. This makes feeding and disease control (gill infections) more difficult than with other trout and char. Expertise in hatchery methods is slight and is still being developed, principally in British Columbia. Sufficient eggs may be difficult to obtain because most accessible stocks in Alberta are depressed and cannot be used as an egg supply.

6. Data Gaps

There is a serious shortcoming in knowledge of population structure, production capability, biology, spawning and rearing habitat and ecology.

Angler catches and demand for this species is unknown.

7. Bull Trout Management

7.1 Present Management Program

Bag limit regulations for bull trout have been reduced so that only two may be taken in a day and two kept in possession. Known spawning and juvenile rearing streams are permanently closed to fishing. Those closed include all tributaries of the Clearwater River upstream of Peppers Creek, the headwaters of the Blackstone

River, Rundell Creek, Eunice Creek, an unnamed stream tributary to the Brazeau River, and Pinto Creek, tributary to North Burnt Timber Creek.

8. Management Objectives

1. Protect bull trout from extinction and maintain bull trout populations by natural reproduction and maintenance of habitat.
2. Rehabilitate populations of bull trout which have declined below full production.
3. Increase information on the biological and habitat requirements of the bull trout.
4. Develop information/education program to help anglers to identify bull trout and to understand their unique characteristics, for better compliance with fishing regulations.

9. Management Recommendations

1. Develop fishery regulations to protect bull trout stocks during spawning and rearing and regulate fishing in line with the production surplus.
2. Develop and implement a field enforcement program to encourage anglers to comply with the fishing regulations.
3. Develop an inventory on bull trout to identify distribution, spawning and rearing habitat, population structure and migration routes.
4. Develop a program to increase information on the biological characteristics of the bull trout, its habitat requirements, and techniques of culturing.
5. Develop a rehabilitation program based on an assessment of the status of current populations.

6. Monitor the sport fishery to assess the utilization and demand for bull trout.
7. Develop management strategies for individual stocks of bull trout.
8. Implement a public relations program to help anglers identify bull trout and to explain management strategies.