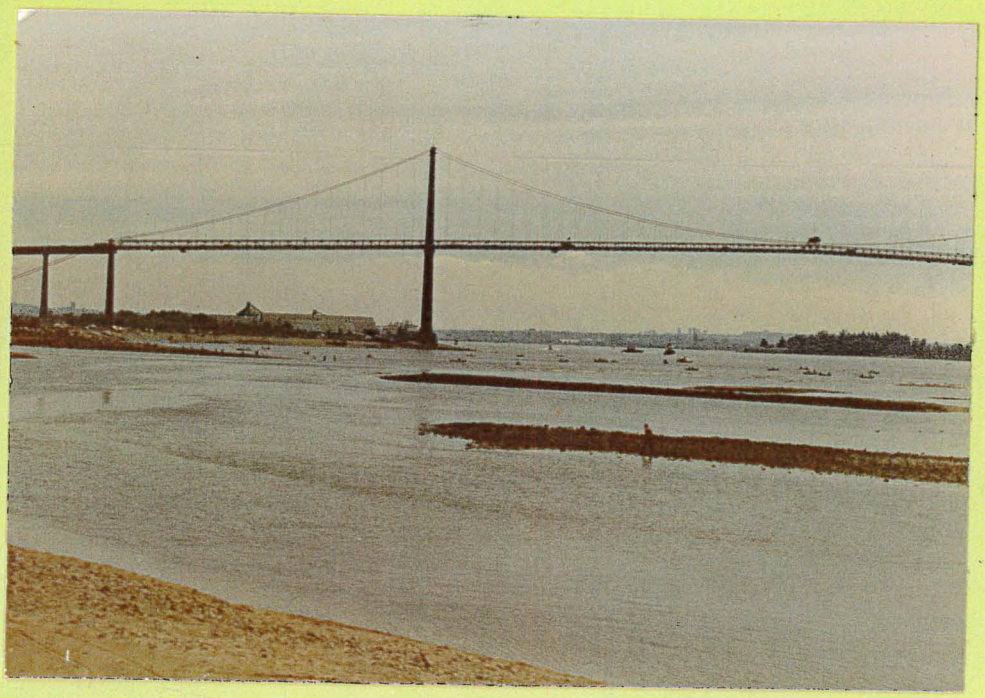
THE SALMONID CULTURE MANAGERS CONFERENCE 1982



A REPORT ON THE PROCEEDINGS OF THE SALMONID CULTURE MANAGERS CONFERENCE

The Empress Hotel - Victoria, British Columbia

Janaury 19 to 21, 1982.

Eldon Stone - Chairman

TABLE OF CONTENTS
(In order of presentation)

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OPENING REMARKS

I would like to welcome you all to this conference and to thank you for bringing your various topics here to share. It was a particularly busy fall for me and I gather it was the same for the rest of the Facilities. Peter Larkin was our invited guest speaker for this year but was forced to cancel on short notice. Unfortunately there was not enough time to supply an alternate. I do hope that some time in the future Peter Larkin will attend, perhaps next year.

In the last 6 years since this conference was initiated it would appear that some of our original objectives have been ahcieved. The technology being applied at the various facilities is becoming more and more consistent. On the whole I think the exchange of information and ideas is much better than it was prior to our forming this group. We do have considerably more people involved in salmon hatcheries than we did six years ago and it is apparent that the interest and enthusiasm of the people coming along is a reflection of the efforts of BCIT, Malaspina College and the Salmonid Enhancement Training Program. I think it also reflects a change in the attitudes of Senior hatchery staff. This change in attitudes has been partly a result of us getting together on this common ground and thrashing out some of our day to day problems.

I do apologize for not having an agenda but judging by the information that I do have there should be a fair generation of information in the topics we are about to discuss. I hope everybody gets something out of it.

Eldon Stone

Puntledge Hatchery

Loading of Chum Keepers

When the keepers were constructed for Puntledge, the design was for 4 million Chum, planted at 15,000 eggs per square meter over an area of 310 meters squared for a total of 4,650,000 eggs.

When the biological program came out it called for 6,000,000 Chum fry to be released; at the time an optimum loading rate for Puntledge was in order. For the 1979 and 1980 broods, a loading rate of 13,000 eggs per square meter was used, with a success rate of approximately 94% survival from egg-take to release of 1.0 to 1.2 gram fry.

In 1980, the first experiment took place in three 10 meter sections and a loading rate of 19,000 eggs per square meter was used; this gave a total of 1,111,500 eggs, an increase of 234,000 eggs over the standard loading rate of 15,000 eggs per square meter, the result was a high percentage of suffocation at the upstream end of each section.

Loading at 13,000 eggs per square meter, the capacity of the Chum building is 4,000,000 eggs. For the 1981 brood the following procedure took place:

	Building Capacity
1 section planted at 13,000/sq m	4,030,000
1 section planted at 15,000/sq m	4,650,000
1 section planted at 16,000/sq m	4,960,000
1 section planted at 17,000/sq m	5,270,000

The result of this procedure is not known at this time, but it is hoped it will give us a standard loading rate for the future.

The flows in the keepers were started at 275 liters per minute and are to be increased as the alevins develope.

The gravel size was 2.5 cm to 3.81 cm and placed one layer deep, this gives a void of 40% for the alevins to incubate.

Water depth was set at 14.5 cm at the bottom of each 10 meter section.

In 1981, an experiment of reducing the number of screens was tried. In the design, 10 screens were to be used with one layer of eggs on each screens. This took a long time to load and to count the dead. To speed up the operation, all but four screens were removed. The distribution took longer but obtained the same results.

In the 1981 brood, the screens were placed in each section in the following manner:

Starting at the downstream end with the first screen .3 meters up from the divider screen, all other screens had a 1.3 meter space between the screens and 1.8 meters to the top divider screen. A loading rate of 13,000 eggs per square meter required 2.4 layers of eggs per screen. The eggs were planted one week prior to hatching.

To date, these procedures look promising with excellent hatching and very good distribution.

H.S Genoe

INCHES CREEK HATCHERY

KEEPER CHANNELS

There are 4 lines of keeper channels at the hatchery which accomodate 2.0 million Blaney Creek chum and 2.0 million Inches Creek chum. Each keeper line is approximately 34 metres long. Suggested loading densities are 15,000 eggs per square metre at a flow of 455 LPM (100 GPM). At this flow there are two water exchanges per hour when the water is at a depth of 0.2 metres (7"). The channels were loaded with eggs at the suggested loading density and it was assumed that upon hatching the alevins would distribute themselves uniformly throughout the gravel.

To date we have loaded approximately 2.1 million Blaney Creek chum eggs into the keepers. All flows were set at 455 LPM and the water level was initially 28 cm (11"). The gravel in the keepers is one layer deep.

We used several different methods of loading the keepers. Wooden framed (6.5' x 3') baskets with 1/4" vexar screen bottoms were constructed. Some of the baskets were inverted and used as trays. The baskets and trays were placed on aluminum angle which sits approximately 2" above the gravel. Eggs were loaded in at greater than 3 egg layers deep. When hatching commenced we observed suffocation of alevins. To alleviate this problem the water level was dropped to 18 cm (7") to enhance gas exchange. In certain areas the vexar had kinked and the eggs had rolled into the resulting dips. Suffocation occurred especially in these areas. Since the baskets and trays were distributed uniformly throughout the channel, the alevins were also well distributed upon going through the vexar.

Advantages of the basket/tray system are that the baskets/trays are easily installed and removed. The major problem was the kinking of the vexar which caused suffocation of eggs.

The basket method was modified and the baskets were placed directly on the gravel rather than on the aluminum angle. The eggs were loaded in about 3 egg layers deep. Survivals were not as good as we had hoped and mortalities were as high as 7%. The basket method was most successful (less than 2% mortality), when placed on the gravel and loaded at a depth

of one egg layer.

Another method which utilized the aluminum angle pieces was quite successful. Holes were drilled through the aluminum angle at 8 inch centres and nylon fishing line was then weaved from hole to hole across the channel. Pieces of vexar screening (6' x 76"), were placed on the fishing line and weighted down. The eggs were loaded onto the vexar at a depth of one egg layer. The water level was also dropped here from 28 cm to 18 cm. Survivals were good but we still had the problem with the vexar kinking and this caused some mortality. The alevins were distributed uniformly upon hatching. As alevin stage of development increased, the alevins crowded toward the inlet end of the channel. They swam actively thus using much of their yolk sacs. They appeared to be much smaller than last years gravel incubator fry at swim up. Although survivals using this method were good, loading the eggs was inconvenient and removal for dead voluming was extremely awkward.

The last method used were termed the Bulky Loader. Its design was based on past success we have had with upwelling gravel incubators. The bulky loader is 6.5' long and 3.5' wide and sits 1/2" above the cement keeper channel floor. (It is also 1/4" vexar bottomed). The gravel was removed from underneath the bulky loader. We felt that the lack of gravel directly underneath the loader would cause the alevins to swim away from underneath the bulky loader and into the gravel, upstream. The eggs were loaded in at a depth of 2.5 inches. The water level was eventually dropped to a depth of 4". One of the bulky loaders was placed just in front of the downstream screen and the other was placed about half way up the channel.

Survival to hatching was excellent. The problem was that once the alevins hatched and dropped through the screen they did not move from underneath the bulky loader. They piled up beneath the bulky loader and mortality occurred due to suffocation. Eventually we had to distribute the alevins by hand throughout the keeper and mortalities exceeded 10%. In this case the alevins did not move just after hatching and dropping through the vexar. They only began to distribute at a later stage of development, 3 - 4 days after hatching.

It is interesting to note that several of the alevins from the extreme downstream bulky loader got through the 1/8" perforated aluminum, sealed screen, without injury.

If the bulky loader method could be made to work, it would be possible to load all the eggs into only one or two loactions in the channel. This would be quite time saving. Depending on your particular water supply and set up, this planting system could do away with the atkins cells.

Brenda Donas
Glen Dixon

NITINAT HATCHERY

KEEPER CHANNELS

Since there are still a lot of questions regarding the construction and operation of keeper ponds, I would like to describe Nitinat's keepers because of some unique aspects which appear to be advantages to alevin incubation. The major problem with keepers is smothering, due to over crowding in the upper end usually within 2 or 3 meters. The variables which influence this phenomenal crowding are as follows:

1 Density of alevins

2 Water depth and velocity

3 Gravel size and density

We seem to have over come problems of smothering by:

1 Loading to a maximum of 16,600/m^2

2 Controlling our flow @ 500 LPM or above and not exceeding a depth of 7.6 cm @ upper end, resulting in a high velocity.

3 Reducing gravel density to approximately 15% voids (bare concrete) throughout. Alevins tend to use voids - bare spots (no rocks) - up to 15 cm in diameter safely.

4 Gravel size in the range of 19 mm to 25 mm seems good. The alevins avoid areas of heavy silt and sand, which we have in some keepers to the extent of being unable to distinguish the eggs on the upper screens during floods.

The physical dimensions of our keepers are:

Length - 44 mm with a division and drop of 15 cm @ the 22 mm Mark.

Width - 1.9 m

Wall Height - 45 cm

Slope - 1 in 220 or 10 cm/leg (22 mm), normally it is 1 in 500.

We cover 50% of our keepers with vexar screen, 76 cm wide x 1.9 m long leaving the first or upper 2 m bare.

This should not be considered the ultimate criteria for keeper pond operation. It is apparent that flows and water depth are very critical since small discrepancies in the uniformity of flows by such things as stop logs not being sealed or level can cause back eddys and alevin loss.

Gerri Cook

ROBERTSON CREEK HATCHERY

CHINOOK KEEPER CHANNEL EXPERIMENT, 1981-82

DESCRIPTION OF CHANNELS

There are 3 pairs or 6 channels 12 m long by 1.9 m wide (inside). The slope is 0.15% or 1.8 cm drop over the 12 m length.

The water supply is Robertson Creek surface water.

1981-82 EXPERIMENT

Due to past problems of egg mortality and alevin smothering this experiment was designed to work towards finding the optimum bio-mass loading and flows.

A 2 x 3 factorial design involving 2 flows and 3 loading densities has been applied. The densities are 8,000, 11,500 and 15,000 alevins per square metre. Each density will have one channel flowing at 136 L/min. (30 g.p.m.) and one channel at 273 L/min. (60 g.p.m.).

Water depth is 13 cm at the inflow end and 15 cm at the outflow.

Gravel is rounded (not crushed) with a 2.5 - 6.0 cm diameter and is a single layer not quite touching.

Vexar screens (1.9 m x 0.6 m) were placed about 20 cm apart and the eggs were spread 2 - 3 eggs deep using heath tray lids.

Oxygen is being monitored 2 or 3 times daily at 3 levels in the heaviest loaded channel with the lowest flow. The levels are above the screens, below the screens and in the gravel. If the D.O. drops below 7.5 mg/L the flow will be bumped up.

OBSERVATIONS TO JAN. 19, 1982

Accumulated Temperature Units (A.T.U.) were 475-500 at loading, 560 at 85% hatch and 580 at 100% hatch. The time period was 28 days from start to finish of hatch. This was probably due to the eggs from 3 separate egg-takes being pooled giving a 30 A.T.U. difference.

Egg mortality to hatch was less than 1% though fungus was just starting to affect live eggs at the end of the hatch.

Alevins had difficulty dropping through the vexar and primarily resorted to swimming over the edge. This is probably due to their size being 45% larger than chums for which the vexar is most commonly used.

Dissolved oxygen has remained high except for one drop to 75% saturation in the gravel at about 75% hatch.

The heaviest loaded channels (15,000/m^2) have some upstream migration but is not critical, nor is expected to be for another week.

Don Lawseth

KITIMAT HATCHERY

PROGRESS REPORT

The Kitimat Hatchery is presently under construction and is due for completion in the summer of 1983. Site preparation and erection of a 35,000 ft^2 main hatchery building (pre-fab steel) has been completed. The site is located on the Kitimat River in the city of Kitimat directly across Highway 25 from the Eurocan Pulp Mill. The 4-acre site was filled with 180,000 cubic yards to an elevation of 25 ft. above the low water river level. Rip-rap armors the river side of the site for protection against flood waters.

Construction of the interior works and services in the hatchery building will begin this March. This will include offices, laboratories, shop, incubation room (Atkins boxes, Pallant boxes, Heath trays), "Cap" troughs and keeper channels.

Production goals for the hatchery (egg targets) are:

Chinook	3,000,000
Chum	11,000,000
Coho	600,000
Pink	500,000
Sockeye	500,000
Steelhead	55,000

These numbers are represented by 23 different stocks which will be incubated and reared as discreet units, and released back to the respective donor streams.

The hatchery will have several sources for water supply:

1 Infiltration gallery water (ambient or heated)
2 River water (ambient or heated)
3 Well water (ambient or heated)

Water heating will be accomplished by utilizing the Eurocan Pulp Mill's condensor system which produces a constant supply of 40°C water year round.

Intake works and concrete rearing raceway construction will proceed once their design is completed.

Costs to date:	Site Preparation	$ 700,000
	Footings and Main Building	615,000
	Total	$1,315,000

Dave McNeil

KALUM PILOT HATCHERY

Kalum Pilot Hatchery began operations in the summer of 1980. The hatchery is concerned with the distinct upper and lower system chinook stocks of the Kitsumkalum river which flows south into the Skeena river at Terrace.

The lower Kalum is about 15 miles long. Escapement has ranged from 3500 - 9300 over the past ten years with 1981 the best of those years. Chinook enter the river shortly before spawning from late August to late September.

The upper system is separated from the Lower Kalum by two small lakes, Treston and Redsand, and by 5 mile long Kitsumkalum lake. Chinook spawn in two main tributaries, Cedar river and Clear creek, which together had an escapement of 750 in 1981. That is down from a ten year high of 4250. Upper system fish enter the lakes about mid May and spawn from mid July to mid August.

The hatchery is located on Dry creek, a groundwater source which flows into the upper system just north of Kalum lake. In the first year the hatchery consisted of two gravel incubation boxes and two cap troughs supplied by a gravity feed pipeline. Only lower river stock was taken in 1980. Rearing began in early February and continued until early June. The average size of fish at release was only 1.3 grams.

Two main problems were identified; nitrogen supersaturation and cold water temperature. Nitrogen saturation of about 110% led to fin rot and generally stressfull conditions. Water temperature, which remains steady at $6^{\circ}C$ throughout incubation and early rearing, begins to drop in mid March and averages $4.5^{\circ}C$ from mid April to mid June.

Several changes were made this year. Upper system fish were incubated in heath trays to avoid the lengthy migration timing from the boxes. Expansion also provides heated and aerated water to four cap troughs (two rows of two) supplied by gravity feed from a new pipeline. Aeration is accomplished by packed columns. Fifty per cent of the water is recirculated through two 15

kilowatt electric heaters powered by a diesel generator. The heaters are expected to raise the temperature 1.5°C. As well two cap troughs were situated below a restored beaver dam downstream of the original site. It is hoped solar energy will raise the temperature of this water supply significantly.

Possibilities for expansion of the Kalum pilot beyond the current 200,000 chinook capacity are blocked by the expense of heating water.

Stu Barnetson

KITIMAT PILOT HATCHERY

BRIEF HISTORY AND FIRST HATCHERY RETURNS

History

- 1975 to 1977 - Adult migration studies within the Kitimat River system that ended with Operation Broomstick - a river-wide fence that washed out within 2 days of completion.

- 1977 - first egg take. The Pilot Hatchery is located at Eurocan Pulp Mill - a site chosen for its water availability and quality, and hatchery security.

Adult Capture

- river - beach seining and gill-netting mainly; 1981 - angling, with great success.
- tributaries - gill-netting 9(hand-set).
- green adults held in floating or sedentary pens.

Egg Takes

- Adults migrate into the river in June and July, and spawn in August.
- Chinook fecundity averages 7900 to 9000 eggs per female, with individuals varying from 5500 to 12,000. (Chum = about 3000 - 3500; Coho, approx. 3500).
- delayed fertilization. (Two emergency instances of transporting water-hardened chinook eggs yielded 18 and 30% mortalities.).
- have averaged 100,000 eggs. 1981 is an expansion year, with double the chinook egg take, and the addition of chum and coho (50,000 and 58,000, respec.)

Incubation

Heat Units (ATU ^{o}C)	Eyed	Hatch	Ponding
Chinook	300	550	950
Chum	300	550	900
Coho	250	500	750

Rearing

- Pilot I : 4 "Cap" troughs; Pilot II (1981 expansion): 8 aluminum troughs fed by production well at downstream end of permanent hatchery site.

- have had increasingly good growth over the last four years. Some possible factors: - less crowding, except for the initiation of feeding.

- less to no cover on troughs, giving better access to fish, less stress on fish from fleeing the feeders, and better lighting. Latter also aided by using a dimmer switch to gradually introduce light.

- fewer cleanings (less stress).

- tried the new "maximum feeding schedule" on 1980 brood fry. It was o.k. at a fry weight above about .9 g, but a little excessive at earlier stages.

Tagging/Release

- CWT - initially at time of release; lately, a month or so ahead.

- have improved release methods by allowing time in the river for the fry to undergo protective coloration, and recover from handling; and a gentler release.

- sites of release have varied.

- time of release has varied, with the 1981 release seeming to be right on time (according to downstream migration data gathered concurrently).

Downstream Migration Studies (a very preliminary look)

a) 2X3 Inclined Plane Data

Species	Duration	Peak (Approx.)
Chum	Feb. 17 (1st set) to May 12	(Mar.10) Mar. 25
Pink	Feb. 25 to Ar. 18	Mar. 20

(cont.)

2X3 Inclined Plane Data (cont.)

Species	Duration	Peak (Approx.)
Sockeye	Feb. 17 to May 12	Apr. 2
Coho - fry	Apr. 1 to June 7 (last set)	May 12
- smolt	Mar. 2 to Apr. 28	Apr. 28
Chinook - fry	Aprl 8 to June 3	(Apr. 8) May 4
- smolt	Mar. 25 to Apr. 28	Apr. 1 and 28

b) Gee Trap Data - needs statistical analysis

Chinook - peak numbers seen increase from late Mar. to early May (peak), than fall off.

Coho - peak numbers seen from Mar. 29 to Apr. 19, then drop to very few by May 24.

Steelhead - indeterminate (2 areas seemed to show a decline in no. thru April and May).

II First Kitimat Pilot Chinook Returns

Releases:

	Dates	Size
1977 Brood - 75,496 tagged (= total release)	5/5 to 6/23/78	4.5 - 7.1
1978 Brood - 73,436 tagged (total release = 151,771)	5/10 to 5/27	4.6 - 5.2
1979 Brood - 39,114 tagged (= total release)	5/7 to 5/9/80	4.6 - 5.4
1980 Brood - 26,932 mainstem (=total release)	5/4 to 5/5/81	5.4
- 34,000 Hirsch Ck. (=total release)	5/6/81	6.0

Recoveries:

Year	Age	Kitimat Sport Fishery	Estimated Contribution	Canadian Commercial Fishery	Alaskan Fishery
1977	'77 Brood (2's)	4 (20%)	40	12 (80%) Estimated Contribution=28	-

(cont.)

Recoveries (cont.):

Year	Age	Kitimat Sport Fishery	Estimated Contribution	Canadian Commercial Fishery	Alaskan Fishery
1980	'77 Brood (3's)	32 (47%)	170	31 (39%)	10 (14%)
	'78 Brood (2's)	50 (63%)	250	28 (36%)	1 (1%)
1981	'77 Brood (4's)	0	0	21	Not known yet
	'78 Brood (3's)	10 (to June 81)	50	14	Not known yet
	'79 Brood (2's)	0	0	8	Not known yet

1981 has been a telling year for returns to the Kitimat River. 1980 saw 25% of the jacks caught during our adult capture as being adipose-clipped. Of three sampled; 2 = 3's, 1 = 2 yr.

In the 1981 adult capture, of 93 fish caught angling:

Males = 33 marked to 40 unmarked (45%)

Females = 2 marked to 18 unmarked (10%)

Calculated contribution to the river = 900 adults, better than 2% fry-to-adult survival. (=25% - 35% of estimated escapement).

Though released from one point, 17 miles upstream from the pilot hatchery, the returning adults are distributing themselves throughout the river system. Tagged adults were retrieved from Hirsch Ck. (25% of one sample), as well as Chist Ck. and the Little Wedeene River.

Sylvia Willis

CHEHALIS RIVER HATCHERY

CHINOOK EGG COLLECTION ON THE HARRISON RIVER - 1981 BROOD

Last fall members of the Chehalis Indian band Community Development Project worked with Chehalis River Hatchery staff to collect chinook eggs from the Harrison River. Approximately 100,000 eggs were to be planted for S.E.P. training purposes in the Smokehouse Slough Hatchery, adjacent to the Harrison River, on the Chehalis Indian Reserve. An additional 500,000 eggs were to be transplanted to the Chilliwack Hatchery in an effort to increase the numbers of chinook in the Chilliwack system.

Adult Capture

Adult capture spanned the mid October to mid November period. Approximately 170 unspawned female chinook were captured during this period. Several spawned out females were also captured but were not counted. Records on adult males and jacks captured were not kept but they far outnumbered females.

Most of the fish captured were taken using a 200 foot X 20 foot deep 4 inch mesh beach seine set from a river boat with an 85 HP outboard jet. Mortality due to seining was virtually non-existent.

In addition to beach seining, a 100 foot X 10 foot deep 9 1/4 inch mesh gill net was used to capture fish. The net was drifted over spawning grounds. During daylight hours few fish were captured and most of those caught were spawned out. Daylight gill netting yielded only 8 green females in several days of fishing. However, on November 5, 4 drifts were made at night. Approximately 40 chinooks were captured, 15 of which were females. Only 2 of these females were spawned out. Mortality due to gill netting was low. For example, on November 5 only the 2 spawned out females died out of the 15 netted.

Holding

Approximately 25% of the females spawned were mature when captured and did not have to be held. These fish were killed and spawned shortly after capture. Green females and males were transported in a live box to 4 - 8 X 8 X 8 foot wire mesh holding pens. The pens were attached to floats and had plywood covers and fine meshed net liners. Female holding mortality was around 8%. Although

mortality was not high, many females became badly rubbed before maturing. Fish were checked for maturity every 2 - 3 days.

Approximately 50 males were held with mortality roughly double that of females.

Spawning

Approximately 621,400 eggs were taken from 158 females during the October 14 - November 17 period. A total of 113,550 eggs, collected in 5 egg takes from October 14 - 27, were planted in the Smokehouse Slough Hatchery. The remaining 507,850 eggs were transplanted to the Chilliwack Hatchery. These eggs were collected from October 27 - November 17 in 12 egg takes, the first egg take being part of the last egg take for the Smokehouse Slough Hatchery.

The delayed fertilization and washing technique was used for 98% of the eggs collected. Eggs and sperm were taken in separate containers from 10 - 12°C Harrison River water temperatures and placed in Smokehouse Slough hatchery water, approximately 1.5°C cooler. The eggs were then either fertilized and planted at Smokehouse Slough Hatchery or transported by truck to the Chilliwack Hatchery. Eggs and sperm were kept at water temperature or slightly lower during transport. Eggs planted in the Smokehouse Slough Hatchery were generally fertilized within 1 hour after taking sperm. Eggs taken to the Chilliwack Hatchery were fertilized within 2 - 2 1/2 hours after taking sperm. On November 17, the last egg take, the immediate fertilization and delayed washing technique was used in a test run with the eggs from 3 females. The eggs reached the Chilliwack Hatchery within 2 hours.

Survivals to the eyed stage varied considerably in individual egg takes for both hatcheries. Survivals for the Smokehouse Slough Hatchery ranged from 70 - 91%. Survivals for Chilliwack, excluding the last egg take, ranged from a low of 35% to a high of 82%. Almost total mortality occurred in the eggs collected on November 17 using the immediate fertilization and delayed washing technique, with only 7% surviving to the eyed stage. Overall survivals were 76% at Smokehouse Slough Hatchery and 60% at Chilliwack Hatchery.

The mortality observed at both hatcheries appeared mainly due to unfertilized eggs. The major cause of the apparent lack of fertilization is unknown. The presence of some water hardened eggs in several females spawned would have contributed at both sites. The use of the eggs from 5 females that were recent dead (31% survival to eyed) and the eggs of 4 females that contained excess blood (22% survival to eyed) also contributed somewhat to lowered overall survival. However, these eggs amounted to only 7% of the total eggs collected. The considerably reduced survival observed at Chilliwack would appear to be due to a relationship of temperature and time.

Experimentation with different techniques is planned for the 1982 chinook egg collection.

Larry Kahl

Capilano Hatchery Experiments

Fall - Winter 1981

Three small experiments were initiated and one larger experiment (bridine disinfection of eggs) was continued from the previous year during the fall of 1981. Summaries of these experiments with Coho eggs are reported below.

Bridine Disinfection

Standard egg take procedures involve water hardening of eggs for 30-40 minutes prior to a 10 minute dip in Bridine (100 ppm. active ingredient) as an egg disinfectant. This procedure takes about an hour, per lot of eggs, to complete. Eggs were exposed to various water hardening times before Bridine disinfection to test the effect on egg fertilization. Eggs were picked at about 235 A.T.U's and the resulting survivals were tabulated. Survival for individual lots varied from 90% to 94.3% for 0; 83.4% to 94.2% for 10; and 88.6% to 95.1% for 40 minutes water hardening. Total average survival for test and production groups was comparible: 92.1% for 0; 90.4% for 10; 92.1% for 40 minutes water hardening of test groups and 90.9% for standard production groups. Colouration of "0" time eggs appeared more uniform than that of any other groups perhaps indicating Bridine was absorbed into the perivitelline space around the yolk. These tests with large groups of Coho eggs showed that egg disinfection with Bridine can take place immediately after fertilization and as a part of the water hardening process with: 1 a resulting decrease in egg take time required. 2 no decrease in egg survival. 3 more thorough disinfection than standard dip after water hardening.

Bridine Experiment Data

Individual Test Groups:

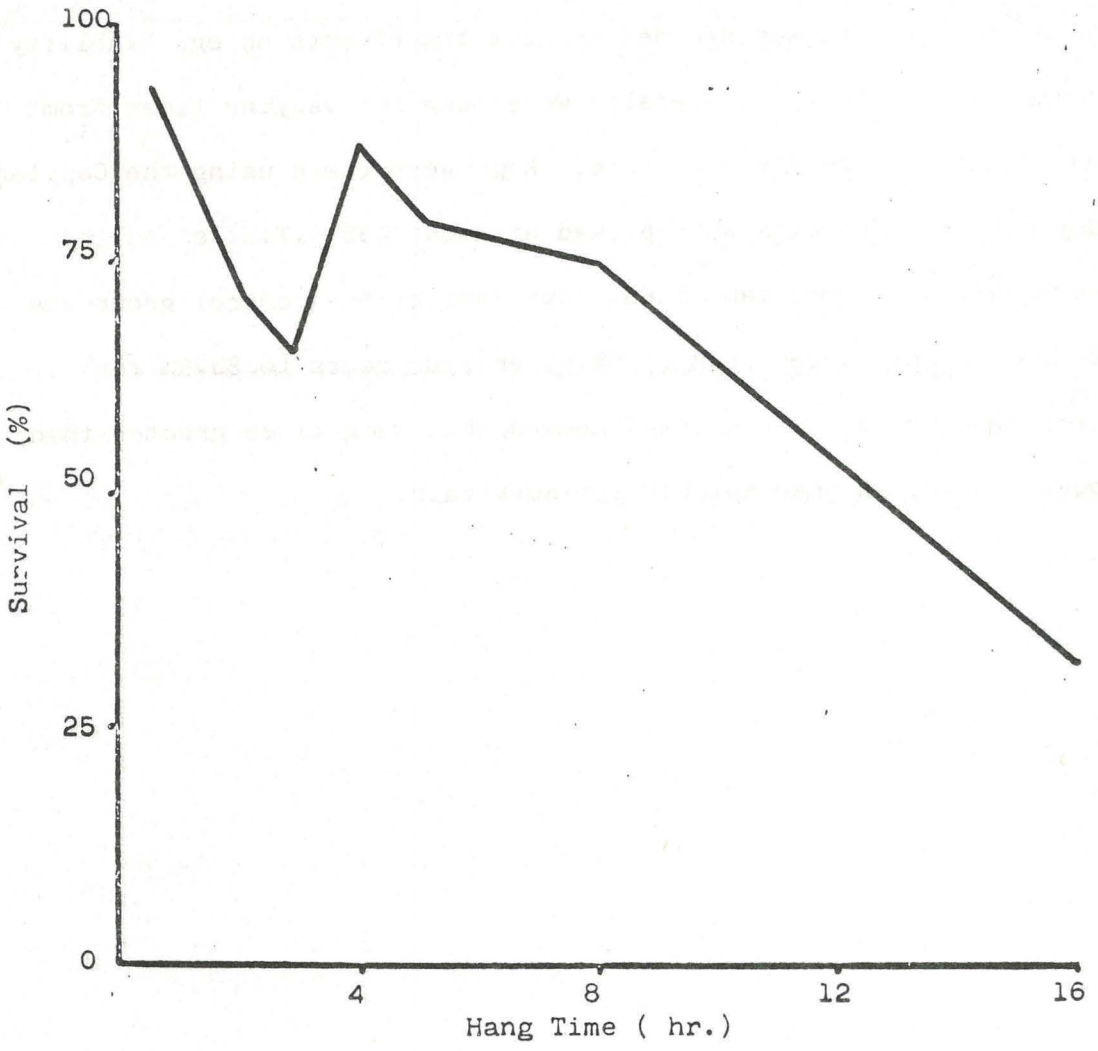
Group Number:	Water Hardening Time (minutes):	% Egg Fertilization:
09	0	94.3
	10	94.2
	40	93.2
12	0	90.0
	10	83.4
	40	88.6
13	0	91.3
	10	91.7
	40	95.1
24	0	90.6
	10	90.2
	40	92.5

Total Averages:

Test Group:	0	92.1
	10	90.4
	40	92.1
Production Group: (10,11,14,15)	40	90.9

Carcass Hang Time

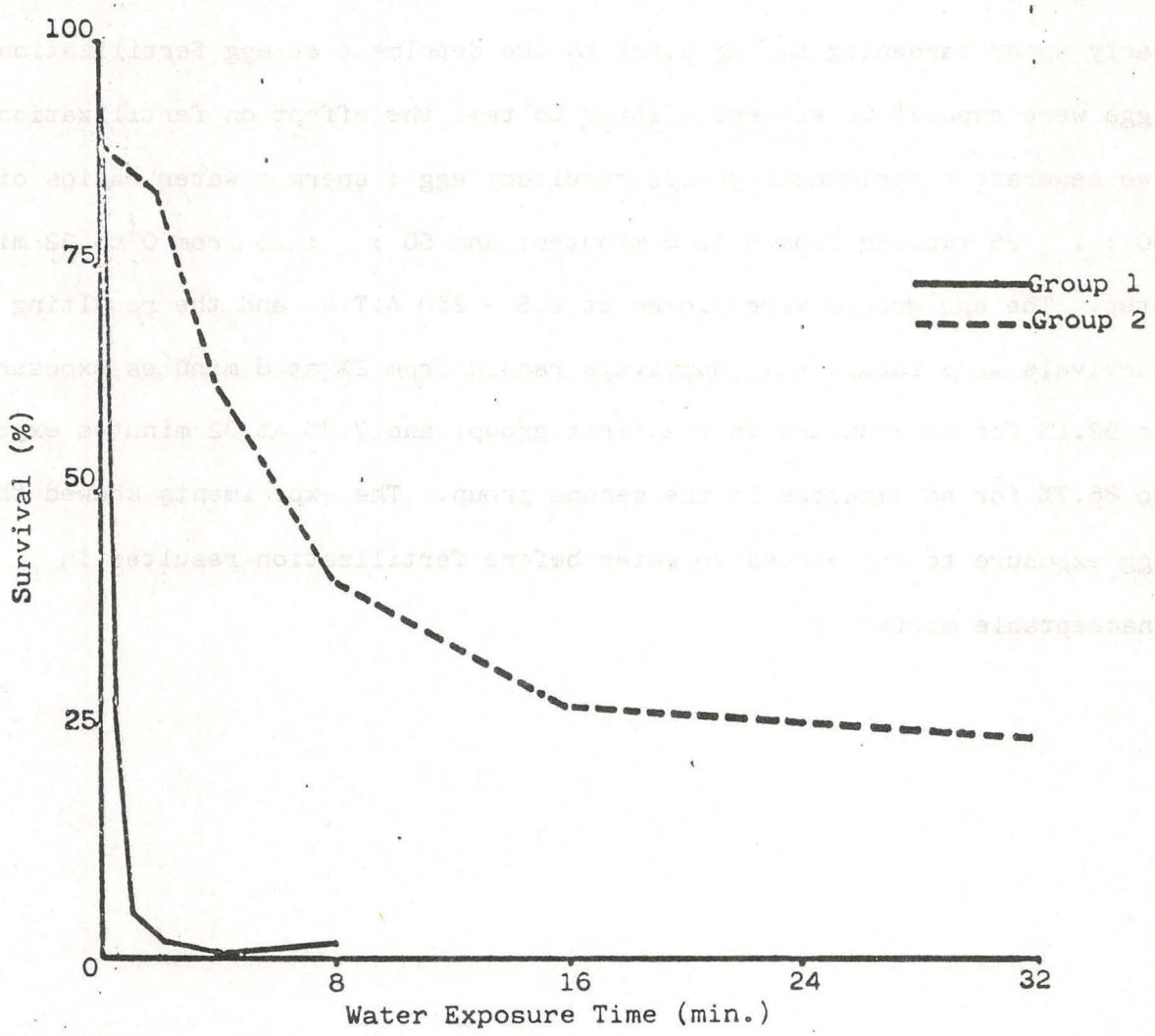
Typical hang times (ie: time elapsed between bleeding a dead female on the killing rack and stripping her eggs into the spawning pan) vary from a few minutes to a half an hour. Obviously a fish culturist would want to minimize this time, but it was decided to test the effects on egg viability of longer hang times. Groups of females were hung for varying times from half an hour (standard) to sixteen hours. Eggs were taken using the Capilano standard dry method. The eggs were picked at about 235 A.T.U.'s and the resulting egg survivals were tabulated. Survival of the control group was 93.1%, the test groups varied from 86.5% after four hours to 30.9% for overnight (sixteen hours). These test showed that hang times greater than half an hour resulted in unacceptable egg survivals.



Survival to eyed stage of 1981 brood Capilano coho eggs after various adult female carcass hang times

Egg - Water Exposure

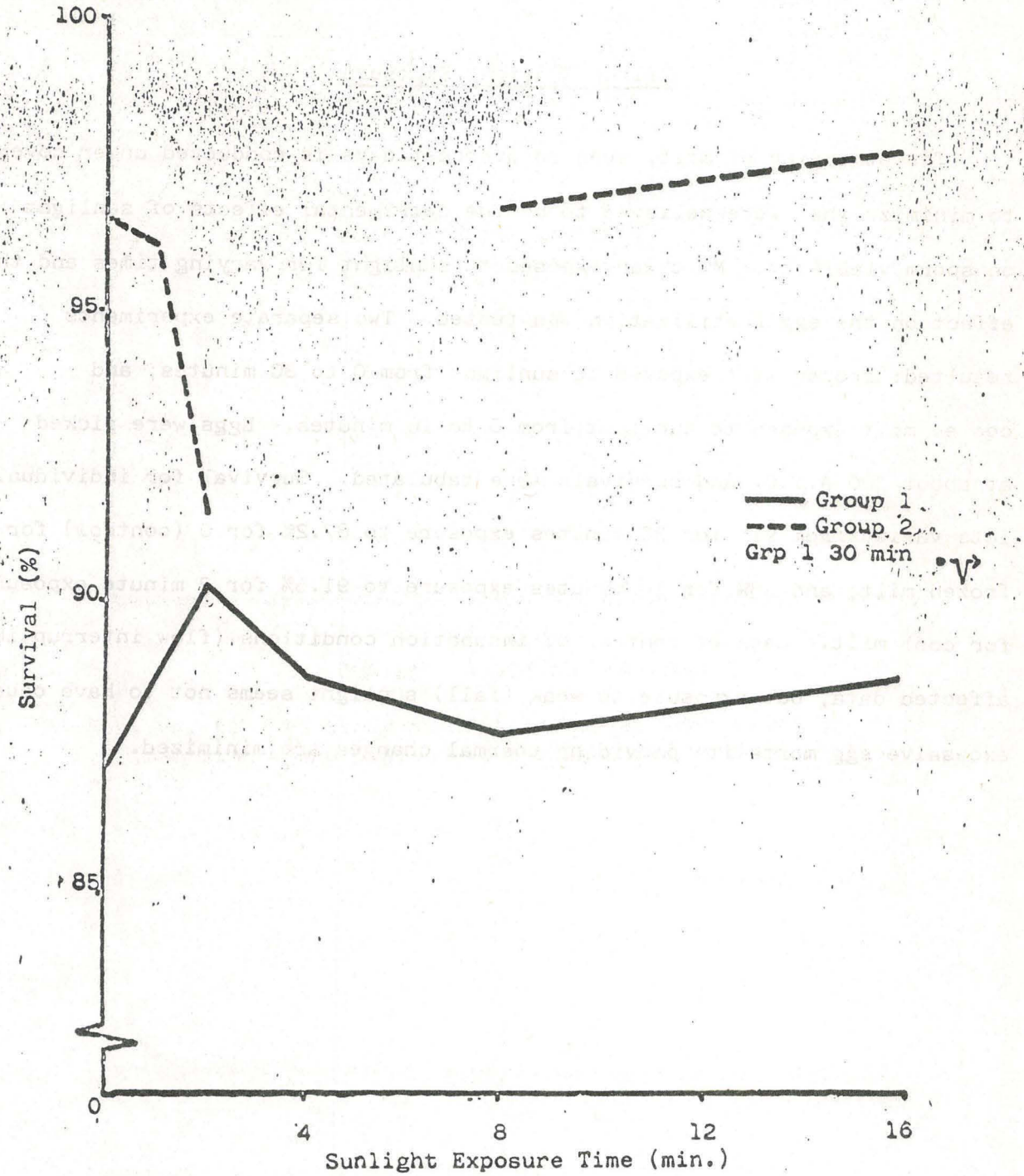
Standard egg take procedure involves the thorough drying of all egg take gear that will come in contact with the eggs as a precaution against early water hardening taking place to the detriment of egg fertilization. Eggs were exposed to excessive water to test the effect on fertilization. Two separate experimental groups resulted: egg : sperm : water ratios of 90 : 1 : 25 exposed from 0 to 8 minutes; and 50 : 1 : 25 from 0 to 32 minutes. The egg groups were picked at 235 - 250 A.T.U. and the resulting survivals were tabulated. Survivals ranged from 2% at 8 minutes exposure to 92.1% for no exposure in the first group; and 7.7% at 32 minutes exposure to 86.7% for no exposure in the second group. The experiments showed that egg exposure to any excessive water before fertilization resulted in unacceptable mortality.



Survival to eyed stage of 1981 brood Capilano coho eggs exposed to water for various lengths of time before fertilization

Milt - Sunlight Exposure

The stripping of milt, even on overcast days is conducted under cover to minimize what were believed to be the detrimental effects of sunlight on sperm viability. Milt was exposed to sunlight for varying times and the effect on the egg fertilization was tested. Two separate experiments resulted: frozen milt exposed to sunlight from 0 to 30 minutes; and cooled milt exposed to sunlight from 0 to 16 minutes. Eggs were picked at about 300 A.T.U. and survivals were tabulated. Survival for individual lots varied from 91% for 30 minutes exposure to 87.2% for 0 (control) for frozen milt; and 98% for 16 minutes exposure to 91.5% for 2 minute exposure for cool milt. Lack of control of incubation conditions (flow interruption) affected data, but exposure to weak (fall) sunlight seems not to have caused excessive egg mortality providing thermal changes are minimized.



Survival to eyed stage of 1981 brood Capilano coho eggs fertilized with sperm exposed to sunlight for various lengths of time

Randy Godin

THE SECOND B.C. COHO SIZE AND TIME OF RELEASE EXPERIMENT: PRELIMINARY RETURNS TO THE QUINSAM HATCHERY

by

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Introduction:

The first size and time of release experiment was conducted at the Rosewall Creek experimental hatchery. The results were reported at last year's conference. The second experiment was conducted at the Quinsam Hatchery, using 1978 brood coho. These preliminary results deal with only marked fish which returned to the hatchery.

Methods:

Release - During the spring of 1980, four ponds of coho smolts were released at different times. Each time of release was comprised of three size categories achieved by grading the population in each pond. Each size category was marked in triplicate but the results are pooled in this report. Each of the 12 groups released were comprised of approximately 11,000 marked smolts (Table 1).

Table 1 Tagged Coho Smolt Release Information

Release Date 1980	Size Category	Average Weight (grams)
April 20	Small	14.3
	Medium	18.7
	Large	23.7
May 10	Small	17.8
	Medium	21.5
	Large	26.0
May 30	Small	19.8
	Medium	23.9
	Large	29.5
June 19	Small	20.0
	Medium	24.7
	Large	29.3

Return - All the coho jacks and adults that returned to the Quinsam Hatchery were examined and all the marks were sampled.

Results - Of the approximately 20,000 coho jacks that returned to the Quinsam system from the 1978 brood releases, 13,270 were examined to recover 1,858 marks. Of the approximately 30,000 adults that returned, 19,900 were examined to recover 2,725 marks (Table 2).

Table 2 Percent Return of Jacks & Adults From The 1978 Brood Coho Releases

Release Date 1980	Size Category	Ave. Weight (grams)	% Marked Returns to Hatchery Jacks	Release Mean	Adults	Release Mean
April 20	Small	14.3	0.12		0.86	
	Medium	18.7	0.33	0.32	0.65	0.64
	Large	23.7	0.52		0.40	
May 10	Small	17.8	0.18		1.13	
	Medium	21.5	0.42	0.57	0.87	0.86
	Large	26.0	1.12		0.57	
May 30	Small	19.8	0.05		2.01	
	Medium	23.9	0.64	0.88	1.75	1.77
	Large	29.5	1.94		1.55	
June 19	Small	20.0	~~0~~		0.45	
	Medium	24.7	0.35	0.20	0.53	0.45
	Large	29.3	0.25		0.38	

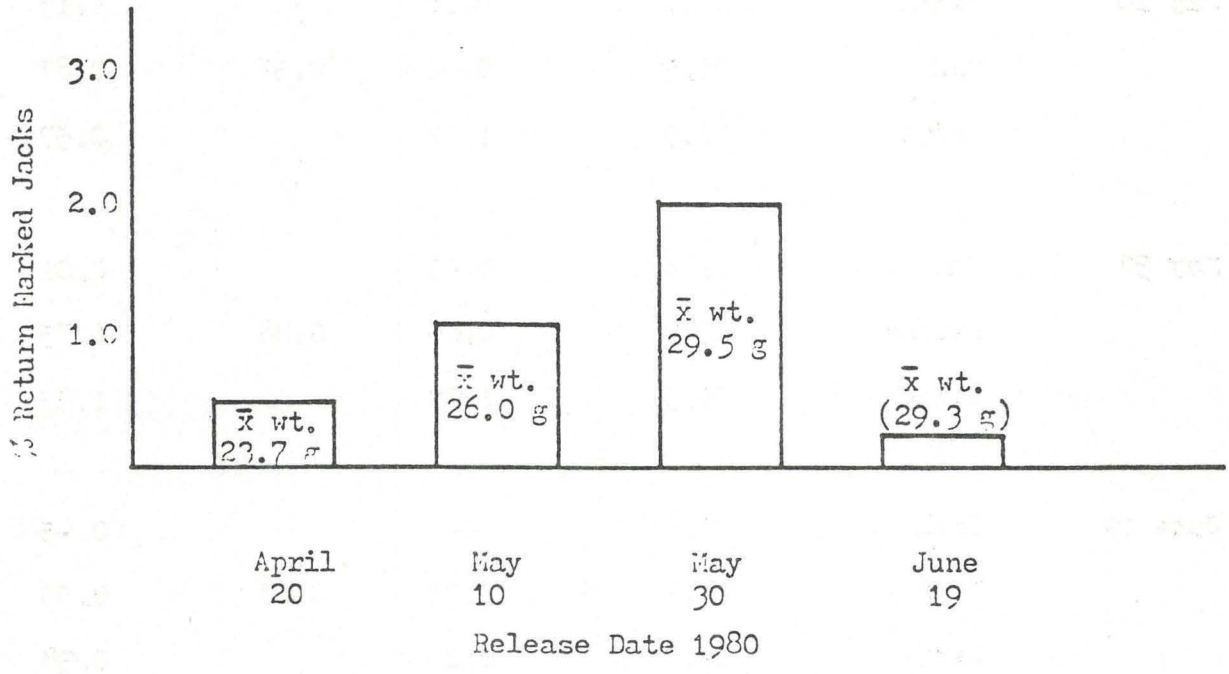
Jacks:

Size of Release - The largest smolts released at each time consistently yielded the highest percent of jack returns with the exception of the June 19 release. This group had a 30 % incident of furunculosis at release. This general deterioration of smolt health as time of release is delayed is consistent with past experience at Quinsam.

The smallest smolts released consistently yielded the lowest percent of jack returns (Table 2).

Time of Release - A comparison of only the largest smolts from each time of release indicates that the May 30 release produced the highest percent of jack returns (Figure 1).

Figure 1 Percent Return of Marked Jacks From The Large Smolt Releases



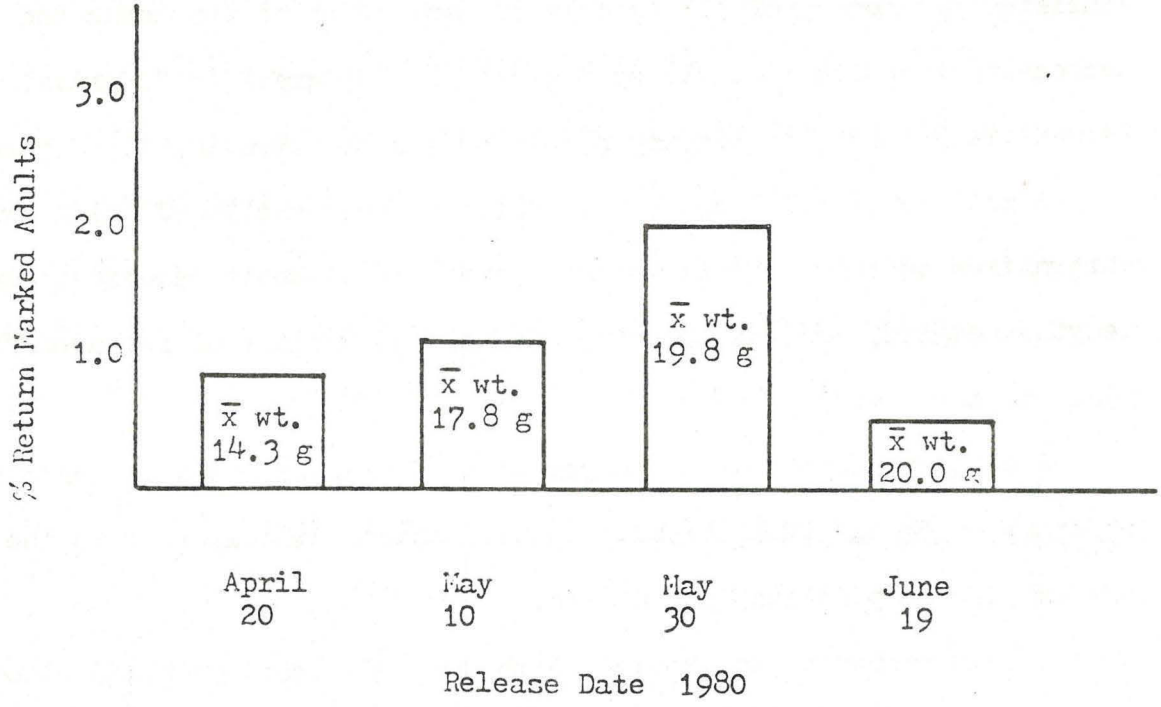
Adults:

Size of Release - For each time of release, the smallest smolts consistently yielded the highest percent of returning adults with the exception of the June 19 release (Table 2).

The largest smolts released consistently yielded the lowest percent of returning adults (Table 2).

Time of Release - A comparison of only the smallest smolts released for each time of release indicates that the highest percent of returning adults resulted from the May 30 release (Figure 2).

Figure 2 Percent Return of Marked Adults From The Small Smolt Releases



Discussion:

Grading for size has been examined extensively and no significant statistical bias has been found to date (Alderdice, Bilton, pers. comm. 1981).

A comparison of the Rosewall and Quinsam results indicates that the best time of release at Quinsam is approximately 10 days earlier, May 30 versus June 10. The best size of smolts to release is approximately 20 grams for both locations.

At Quinsam, our normal strategy has been to release 25 gram smolts approximately mid May. The results of this experiment indicate that we could expect approximately 0.6 % adult returns to the hatchery. This is confirmed by past results. By delaying our releases two weeks and by decreasing the size of smolt by 5 grams from 25 grams to 20 grams, our percent return to the hatchery should triple to approximately 2 percent.

A data report (Bilton et al. 1981) has been published which provides information on this experiment until the time of smolt release including length, weights, sex composition, health, and ability of released fish to adapt to salt water.

A complete report of the experiment is planned and will contain information on survival, biomass return, catch, distribution in the catch, age and sex composition, and health.

This experiment was repeated with the 1979 brood coho and plans are now being developed to undertake a similar experiment on 1981 brood chinook at Quinsam.

Acknowledgements:

The author wishes to express his appreciation to Mr. H.T. Bilton and Mr. A. Coburn for their efforts and sincere cooperation in designing and carrying out this experiment, and for permission to report these preliminary results. Thanks are also extended to Mr. D. Barrett and Mr. T. Perry for their assistance in preparing these results.

References:

Bilton, H.T., and A.S. Coburn. 1981. Time and Size at Release Experiment: Four Releases of Three Size Categories of Juvenile Coho Salmon From The Quinsam Hatchery in The Spring of 1980. Can. Dept. Fisheries & Oceans. R.S.B. Can. Data Report of Fish and Aquatic Sc. No. 252.

Jim VanTine

ROSEWALL CREEK HATCHERY

STEELHEAD RESEARCH

The steelhead studies at Rosewall Creek Hatchery are being conducted under the supervision of Tom Bilton, who has already reported the design of two of the experiments. This report is just to bring you up to date on what is going on.

April 30, 1979 release

This study bears on the extent to which age at return is genetically and/or environmentally controlled. Four experimental groups of steelhead smolts of Big Qualicum River stock were released from Rosewall Creek Hatchery. Two groups were progeny from 2-ocean males crossed with 3-ocean females, and two groups were progeny from 3-ocean males crossed with 3-ocean females. Each group was graded into small, medium and large size categories before marking and tagging, and each group was replicated for a total of twelve tag codes. The two-ocean fish from this release returned in the period March through May 1981 with 204 marked fish recovered. The fish were sampled for hypural and fork length, weight, sex, scale, and tag code. The replicas of the size group have been combined for this report. The 3-ocean fish from this release should return between March and May in 1982.

Results of 2-ocean return sampling

Each age cross produced more 2-ocean males than females and the largest size fish released produced the most returns. The 2 X 2 cross produced 3 times the return of the 3 X 3 cross, as 2-ocean fish. Comparing a 2 X 2 release at 40.89 g and 3 X 3 release at 40.26g, the 2 X 2 produced more 2-ocean fish.

We now have to wait for the returns this spring to find out how this one really turned out.

ROSEWALL STEELHEAD RETURNS 1981

AGE CROSS	SIZE CATEGORY	TAGGED RELEASE	$\bar{X}$ WT (g) RELEASE	RETURNS MALE	RETURNS FEMALE	RETURNS TOTAL	%
2 X 2	SMALL	15569	24.01	5	1	6	.04
2 X 2	MEDIUM	14103	40.89	28	19	47	.33
2 X 2	LARGE	15372	53.64	74	28	102	.66
		45044	39.41	107	48	155	.34%
3 X 3	SMALL	11004	12.56	0	0	0	0
3 X 3	MEDIUM	11731	27.77	7	0	7	.06
3 X 3	MARGE	12452	40.26	23	7	30	.24
		35187	27.43	30	7	37	.11%

Steelhead Release 1980

The release for 1980 was intended as a repeat of the previous experiment i.e. 2 X 2 versus 3 X 3 ocean progeny. Insufficient 3-ocean eggs ruled this out so it was used as a size and time of release experiment. All releases were graded to small, medium and large, marked and tagged. 2 X 2 crosses were released April 6 and 26, May 16 and June 5. The 3 X 3 cross was released on April 26 only. The size groups were not replicated as is usually done but it should give us a little more information on size and time plus a little on 2 X 2 ocean versus 3 X 3 ocean.

Steelhead Release 1981

The release in Rosewall on June 8, 1981 was a repeat of the original 2 X 2 versus 3 X 3 ocean fish with a single release date and a total of approximately 20,000 fish in each age class.

1981 - 1982

The experiment at Rosewall with steelhead started in 1981 is designed to measure the influence of parental steelhead ocean age on the subsequent freshwater growth of the progeny from 2 X 2, 3 X 3, 3 X 2 and 2 X 3 ocean-age parental crosses. These fish have been tagged now and the crosses, i.e. (2 ocean male X 2 ocean female) from four trials have been combined and held in 8 ft. diameter tanks for release in the spring.

Oyster River Steelhead

In 1981 approximately 30,000 nose tagged smolts, progeny of 2-ocean and 3-ocean parents from Oyster River (incubated and reared at Rosewall Creek) were released into the Oyster River. In 1982 a further plant of approximately 22,000 tagged steelhead smolts will be made in the Oyster River.

It is unlikely we will be receiving any further support from the Provincial People on our steelhead research, so continuation of this work is in doubt. I hope we will at least be able to recover the returning fish from these experiments as there should be some very interesting information available from them.

Art Coburn

Since no research work was carried out at Chilliwack this year, I've decided to present a rather general review of certain interesting areas of a report entitled "An Examination of the Anadromous Trout Program of the Washington Game Department" by Lloyd A. Royal. Mr. Royal was for many years the Director of the IPSFC, upon retiring from that position he worked a few years for the Washington State Game Department.

In March of 1971 Lloyd A. Royal was directed by Carl N. Crouse, Director of Game to review all aspects of the Washington State anadromous trout program. Mr. Royal at that time had the title of Fisheries Research Co-ordinator. Mr. Royal submitted a report on October 30, 1972 summarizing the available data and making recommendations related to the Washington State Anadromous Trout Program. I am presenting some of his findings related to size and residualism that may be of interest to those of you that are involved in culturing steelhead. Those of you who have read this report or are aware of its contents and recommendations may find this review a bit boring but please bear with me.

In reviewing data on smolt size requirements Royal first quotes works done by "Larson and Ward" on Chambers Creek in the late 1940's and early 50's. Groups of yearling steelhead averaging 50 grams and 38 grams planted in May in the Samish River apparently smolted and emigrated into Saltwater. The adult survival rate was 6.4 and 4.8% respectively. Six additional plants, involving yearly fish ranging in size from 32.0 grams to 13 grams had survival rates ranging from only 0.2% to 0.8%. Royal felt that there was a high degree of residualization in these smaller fish and as a consequence increase competition with wild fish.

Later experiments by Pautzke and Meiges at Chambers Creek showed a progressive increase in adult survival rate of 6.7% for 60 gram fish to 12.7% for 103 gram fish. Royal surmized from these studies that juvenile hatchery steelhead when planted should be as large as, or larger than, 2 - 3 year old wild smolts which averaged 7" or 53.4 grams. Additional work done by The Research Division of the Oregon State Game Commission substantiates these findings. These studies as reported by Wagner (1967) concluded that "Survival of hatchery reared steelhead in relation to size has been variable as a result of the existance of a survival when fish are released at a larger size is apparent." A summation of this data is reproduced in figure 1. Wagner further states that "Ideally, the stream is to serve only as a highway to the sea and not as a post liberation rearing area for hatchery product. In keeping with this end, it is essential that the hatchery fish migrate seaward shortly after release and not remain in the stream."

Small fish tend to residualize and stay in the stream where they are competitive at least for a time with the wild fish. Royal noted that he personally observed residualizing of thousands of hatchery steelhead yearlings up to 7½ inches in the Cowlitz River. Samples taken from late July to October appeared to be in poor condition and showed little growth in what is an important growing period.

Of 7,900 hatchery fish released in the Alsea River at 45.4 grams, a total of 2,300 failed to move downstream. These residuals were also found to be in poor condition. Other data by the Oregon Game commission showed that in one experiment larger fish (ave. 82.5 grams) 95% migrated downstream in 10 days, while it took 18 days for the

same proportion of 50 gram fish to migrate downstream. Of an 18 gram group of fish only scattered recoveries were made. Indicating that a greater number of the smaller fish residualized and presented inter and intraspecific competition with wild fish. The Oregon work also indicated that almost no adult returns resulted from these residualized fish (Wagner).

Royal further reports that juvenile summer run steelhead appear to be more sensitive to residualism than winter run steelhead. Whether this is an inherited trait or is the natural result of differences in life history was not known at the time of his report. Summer run steelhead at that time were often reared for 2 years due to their slower growth rate. Data for determining the required release size of hatchery summer run steelhead was not as extensive as for winter run fish at the time of Royals report but size requirements appeared to be the same as for winter steelhead in respect to Adult Survival.

Royal stated in summary that the importance of size in planting of hatchery smolts was well recognized by the Washington Department of Game and that the hatchery system planted fish averaging 70 grams to 53.5 grams depending on the thermal cycle of individual facilities. By 1971 the planting of pre-smolts or advanced fingerlings had been largely eliminated but occasional plants or undersized yearling (Culls) were still made since keeping the fish another year was too expensive. Royal recommended that undersized fish produce few, if any, adults and should never be released in an area where they can cause inter and intraspecific competition. He felt that if it is not practical to retain these fish as "rainbow trout" for release in reservoirs or lakes, they should be destroyed.

The foregoing data illustrates the importance of rearing fish of larger size, particularly since the average weight is just that, an average, and many fish are below the average. Conceivably, no matter how large the average size, some fish might be below the required size for smolting. The larger the average size, the smaller number of fish that will residualize. An example of this is figure 2 that presents the length frequency curves for a group of 110 yearling steelhead averaging 82.5 grams and a group of 142 fish averaging 56.8 grams. Wagner's data (Oregon Game Commission Study) on smolting indicates that 8% of the 56.8 gram average group would residualize while none of the 82.5 gram group would remain in the stream.

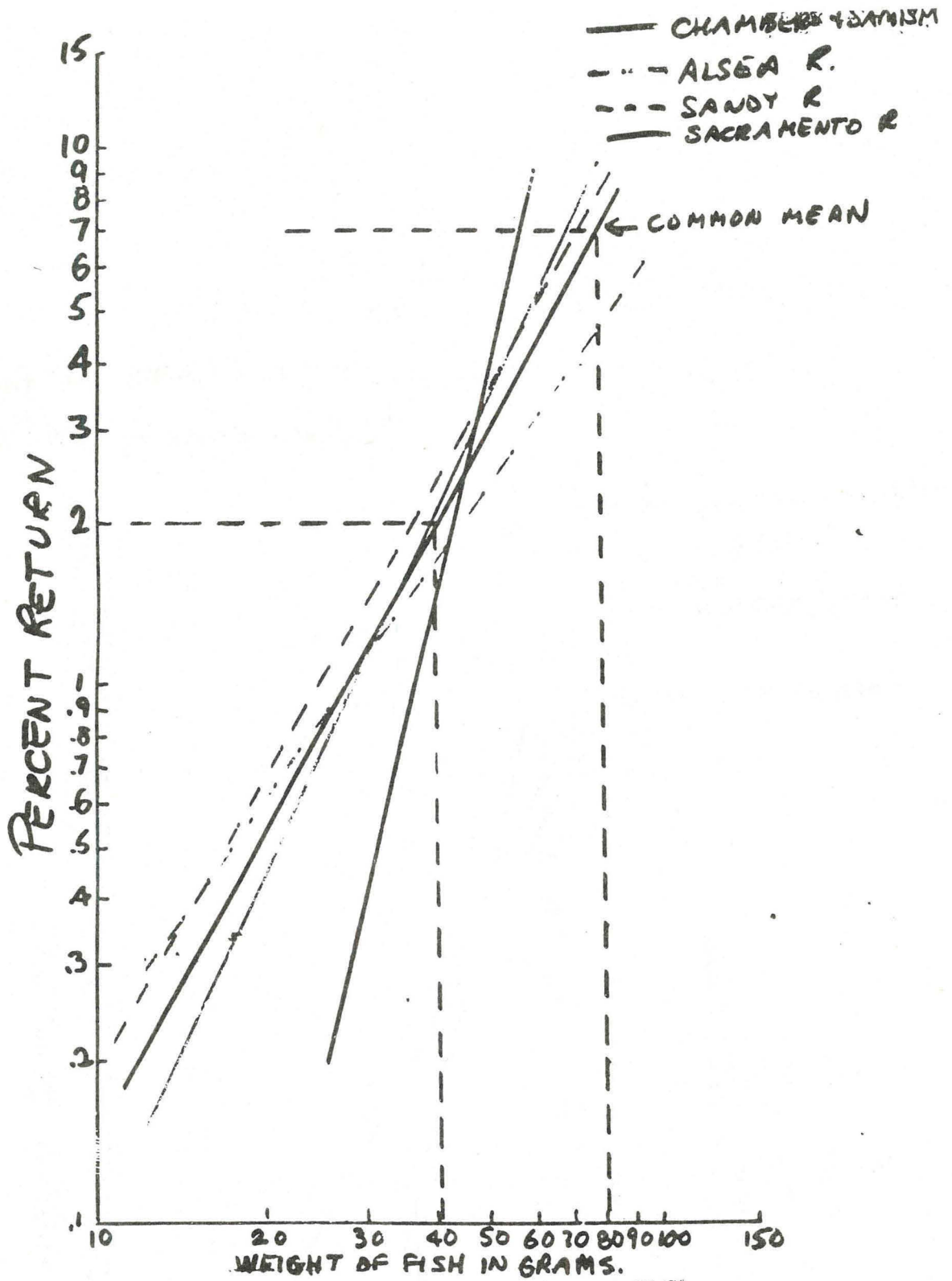
There is data to indicate that the maximum size for residualizing varies from stream to stream, i.e. 6.64" to 7.5" Cowlitz, and may not be precise, but all evidence indicates that the higher average size results in lower residualization.

1. A 55 gram average size for steelhead smolts is an absolute minimum and an 80-85 gram is probably more desirable if the thermal cycle of the facility can achieve it - Bigger is Better!

2. If the 55 gram minimum cannot be attained, it is not worth producing steelhead, raise chinooks or carp!

3. Prior to release it may be a good practice to size grade pre-smolts and only release fish above 40 grams. Release the smaller fish into a lake, pond or reservoir without access to the sea.

Don Buxton



SIZE AT RELEASE

FIGURE1 - RELATIONSHIP BETWEEN SIZE AT RELEASE AND ADULT RETURNS, WASH, ORE. CALIF.

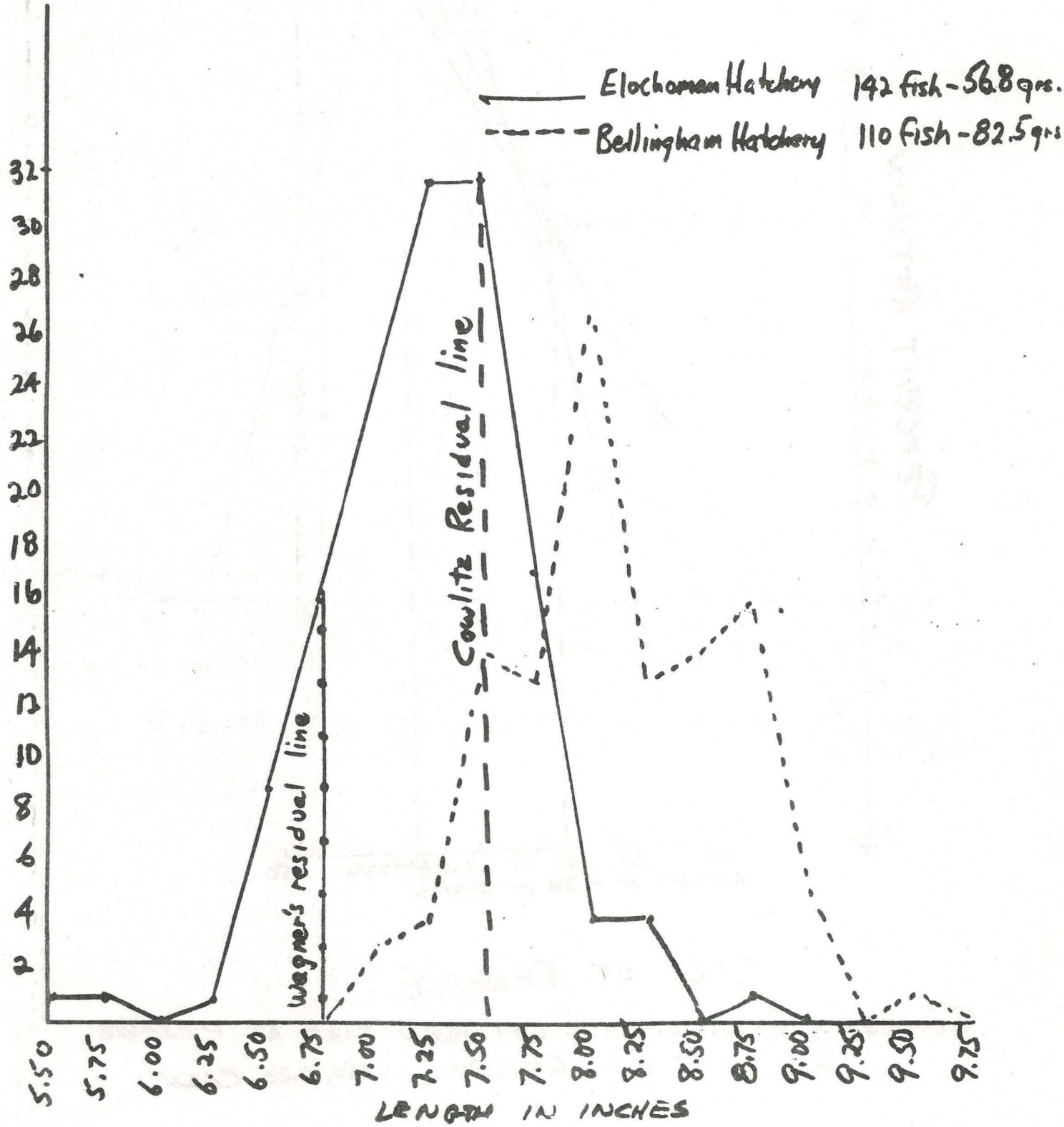


FIGURE 2 - LENGTH FREQUENCY POLYGON - YEARLING STEELHEAD.

INTERIM REPORT ON THE BELLA COOLA HATCHERY STEELHEAD PROGRAM

Progress to Date - The 1981 egg-take

Donor stock were collected in June from the Camera side channel of the Atnarko River and transported back to the Snootli Creek hatchery, where they were held until mature. A total of 22 females and 21 males were spawned. Approximately 98,000 eggs were collected and incubated in Heath trays supplied with well water at a rate of 15 - 25 lpm.

Survival to the eyed stage and to ponding

When the eggs were eyed (198 - 231 ATU's) they were shocked and picked. Survival to the eyed stage of development was 89,000 or 90.8%. After hatching, when most of the fry had buttoned up (508 - 568 ATU's) they were ponded. Survival from the eyed stage to ponding was 88,000 or 98.9%.

The Saloompt fry release

After 10 - 15 days of rearing, 1,000 fry were released to the lower Saloomt River and 38,000 to the upper Salloomt. This stocking program will be described in detail by Tom Wilkinson after assessment work is completed.

October 15/82 - 39,000 fry were released that had been dye marked with flourescent grit - 2 lots x wt. 1.4 gms x net .82 gms.

Rearing - Growth and Mortality

Table 1 summarizes growth and mortality to September 13, 1981. As the size difference between the smallest and largest fish seemed to be increasing, the fry were graded into 2 lots on September 13. After grading, the mean weight of the two groups was .49 and .78 grams. At the October release the sizes were .82 gms and 1.4 gms respectively. Overall survival to the October 13 release was 80.0%.

If the Snootli hatchery steelhead perform according to the steelhead growth modelling formula, it appears that we will be able to produce 50 gm steelhead by March 1983.

We look forward to receiving input from the Fish and Wildlife Branch regarding the extended rearing program. Perhaps we can get together with them after the October fry release to discuss rearing progress to date, and develop a plan for the future. Could you get back to us on this? Thanks.

Sandi MacLaurin

LOON CREEK HATCHERY

Situated 26 miles north of Cache Creek.

Water supply - ground water 1 CFS - 8 - 10 degrees.
- Loon Creek 6 degrees CFS
- All gravity fed

Hatchery - Incubation room, capilano troughs, 3-24 ft. circulars and 4 outside raceways.

To enhance the returning population in the Nicola, Boneparte and Deadman Rivers.

Species Raised - Steelhead and Chinook

Steelhead are angled for and trapped in the Boneparte River and angled for in the Deadman.

Chinook are collected from a Federal trap in the Nicola River and angled for in the Boneparte.

Eggs Collected /81.

Steelhead - 69,000 from Boneparte and 44,000 from the Deadman for a total of

113,000. Lost 69,000 when the water inlet from our ground water plugged one night. This left us with 39,000 on hand at the Hatchery.

Chinook - 77,000 from Nicola and 71,000 from the Boneparte for a total of

148,000. Fucundity of 3,300 and 4,700 kg. 12% loss to eyed in Nicola stock and 6% in the Boneparte - 120,000 now on hand at the hatchery.

Rainbow Trout - 2,000,000 eggs from Dragon Lake, eyed them and shipped them to

Kootenay and Summerland Hatcheries for raising.

LIBERATIONS 1981

April - 27,700 steelhead at 55 gms each were put in the Boneparte River. 55,000 Chinooks were stocked in their parent streams at 2.5/3 gms. a fish.

All these fish were nose tagged.

May/June - 1,500,000 Rainbow Trout - 115 lakes
500,000 Brook Trout - 175 lakes.

These fish are brought up from the Kootenay Hatchery and held overnight and hauled out to lakes the following day.

September - 800,000 Rainbow Trout stocked in 61 lakes by aircraft and truck.

These fish are approximately 650 /kg.

Problems: Gill disease with Steelhead in July. Treatments with potassium permanganate for three days and then once a week for a month.

Kidney disease in Steelhead in December. Treatments with erythromycin phosphate for 21 days. 9 gms of active ingredient per 100 kgs of fish.

Cseratomyxa shasta in adult chinook. Water hardens eggs in erythromycin and then disinfect in wescodyne at 100 ppm for 10 minutes prior to putting in Heath trays.

Dennis Graff

BIG QUALICUM PROJECT

BIRD PREDATION ON JUVENILE SALMONIDS IN THE BIG QUALICUM ESTUARY

During the last 3 years, a study was carried out by Pamela Mace (a graduate student at U.B.C.) to determine the impact of bird predation, particularly that of Bonapart's gulls, on juvenile coho and chinook in the Big Qualicum estuary.

The research was designed to fulfill 5 specific objectives:

1/ To estimate juvenile salmon densities and residence times throughout the period of their downstream migrations.

2/ To determine the numerical response of fish eating birds in the Big Qualicum estuary to the density of juvenile salmon.

3/ To determine the feeding response of gulls in the Big Qualicum estuary to the density of juvenile salmon.

4/ To determine the actual numbers of juvenile coho and chinook salmon taken by bird predators in the Big Qualicum in 1979, 1980, and 1981.

5/ To gain general insight into the problem of predators at Big Qualicum and fisheries in general to enable us to suggest practical ways to alleviate the problem.

Density and Residence Times

It was found that coho had a slightly longer residence time than chinook, although the residence period for both species were extremely short. Up to 12.5% of the chinook entering the river from the hatchery left the estuary each hour. This means that more than 50% of the chinooks released left the estuary withing 6 hours and almost 90% left within 17 hours. There was a slight variation in residence time depending on the release procedure used, with residence time being higher for the forced chinook releases as opposed to the passive release.

Numerical Response of Birds

In 1981, a maximum of 2,348 fish eating birds was recorded during one count in the Big Qualicum estuary. Numbers of Bonapart's gulls, glaucous-winged gulls, harlequin ducks, and loons were all directly related to the abundance of chinook. In contrast, Bonapart's gulls were the only birds whose numbers were positively correlated with the numbers of chinook in 1979 and 1980. The magnitude of response to the chinook was far greater than to the coho in each of the three years.

The birds which exhibited the most striking response to smolts leaving the hatchery were the Bonapart's gulls. As an example, on June 1 at 1500 hours, 2 of the chinook channels were opened and fish were forced out. At 1610 hours, fish began to show in significant numbers in the estuary. At 1605, 72 Bonapart's were counted in the area with no additional birds being visible for 3 Km on either side of the estuary. However at 1720, an hour and 10 minutes after the appearance of the chinook, there were 619 Bonapart's present and feeding. By 2110 that evening there were 1222 Bonapart's gulls in the estuary.

The maximum number of Bonapart's gulls recorded for each release was directly related to the maximum estimated number of chinook present.

Feeding Response

There were some obvious differences in the feeding behavior of Bonapart's and glaucous-winged gulls between 1980 and 1981 that can be almost entirely attributed to the health of the chinooks. In 1979 and 1980 when fish were considered to be healthy, gulls were feeding successfully only when the tidal height was below 3 meters. However in 1981 water depth had little significance therefore the feeding period was extended twice as long.

There was also an important difference in the areas where gulls concentrated their feeding. In 1979 and 1980 at least 90% of the feeding occurred over a 110 m length of river which was the most exposed part of the estuary and the most shallow. In contrast, in 1981, feeding occurred throughout the estuary to the river mouth and often into the surf zone.

Bonapart's were extremely efficient at capturing chinook smolts. In 1980 capture successes of at least 76% of the strikes were recorded and in 1981, 93%. They were significantly less successful feeding on coho smolts with a maximum recorded success rate of 33%. Also, there was no record of any coho taken by Bonapart's at tide levels above 3.0 m.

Numbers of chinook and coho taken by birds

Estimates of the numbers of chinook and coho taken by the major fish - eating birds in the Big Qualicum River in 1979, 1980, and 1981 were based on actual feeding observations.

During the years 1979 and 1980 when chinook released were considered to be of normal quality, it was calculated that 300,000 or 10 - 12% of the chinooks were taken. In 1981 when a high percentage of the chinooks were suffering from an eye cataract condition, it was estimated that 1,000,000 or just over 25% of the release was consumed by fish eating - birds in the Big Qualicum estuary.

The amount of predation by fish eating birds on coho smolts was considerably lower than on chinook fingerlings for all three years of the study. A predation rate of about 2 - 4% of the total migration of coho smolts was recorded.

Grant Ladouceur

PALLANT CREEK HATCHERY

SEA PEN REARING

History

The initial sea pen operation for Pallant Creek commenced with the installation of three pens in Causeway Bay in 1979. These pens were positioned by large corner anchors - no breakwater boom or predator netting was used.

Fish were transported from the Hatchery in a 500 gallon tank mounted on the back of a four-wheel drive truck. Fry were then moved to the pens in plastic garbage cans in a boat and released into the net enclosures.

Problems with boat traffic and oil spills forced us to move to another location. The pens are now anchored in Deer Cove. An old mile logging spur was improved to allow road access and a walkway was constructed to link the pens to the shore. As in the past, fry will be transported to the site, however, this spring irrigation pipe will be tried in order to funnel the fry into the net enclosures. Twelve pens will be used in this Spring's program.

Improvements to the landing site have been made as well as the acquisition of a barge and aluminum walkway. Four dolphins and three single pilings have been driven thus eliminating any further use of anchors to hold the sea pens in position. Anchors will only be used for the breakwater boom.

Technical Data

The sea pens are Topper floats - eight sections per pen, held together with galvanized connecting rods. The floats are basically a plywood shell with polystyrene filled tire floats. The pen's inside diameters are 9m X 9m. Cost of each pen is approximately $9,000.

"Early introductory" nets (1m X 1m X 1m) of 6mm marquisette are used in January and February to hold the early migrating fry when freshwater temperatures are very low. These nets are used when the fry numbers are too low to stock larger nets.

"Introductory" nets (3m X 3m X 3m) of 6mm knotless nylon are used when the numbers of fry migrating do not warrant a large net. The maximum number of frys enclosed in these pens is 100,000.

"Juvenile" nets (9m X 9m X 3m) 3mm and 6mm knotless nylon and are used to rear 400,000+ fry per net. The 3mm mesh has been used in the past primarily for pink salmon.

Due to net shortages, the larger nets are not changed during a program but must be cleaned periodically with a fire pump. Originally the nets were anchored with large lead weights but now plastic bottles filled with concrete are used.

Other materials used in the past as well as today include: polypropylene rope, anchors and hardware for pens and breakwater boom.

Recently we acquired a barge - the "Fish Culture #1" - from the Ships Division in Prince Rupert. This barge is 20' x 48' and will be used as a platform for the new gangway. The cost of the barge repairs and gangway will be approximately $20,000.

In September, the Department of Public Works enabled us to eliminate the sea pen anchoring by driving dolphins and pilings at the pen sit.

The Field Services Branch - especially the "A" crew of the Arrow Post - also contributed greatly to the sea pen facilities.

Biological and Physical Parameters of Deer Cove

During the rearing period, the water temperature of Deer Cove is always a few degrees warmer than that of Pallant Creek. This is an important factor during January and February when creek water temperatures are low and it becomes difficult to feed the fry. Because of the ocean temperatures in the bay, we are able to continue feeding the Hatchery fish.

Oxygen levels in the pens are generally high because of the tidal

movements in the bay. These movements also assist in the distribution of natural foods. The salinity levels at the sea pens range from 9-30°/oo near the surface and 26-32°/oo at 2 meters depth.

At low tides the minimum water depth (15' - 20') is sufficient for proper net use. The bottom at the pen location is basically mud with very little plant life but a fair amount of logging debris exists.

Limited predation problems have been encountered in the past. Birds appear to be a minor problem; mink and weasels are non existant, and marten seem disinterested. To date, large sea mammals have not done any damage. Fish have been a problem when releasing fry from the nets.

Pallant Sea Pen Biology

The transportation of chum and pink fry to the sea pens is accomplished through the use of tank and truck. Initially, before introduction, fry were acclimitized to the saltwater. Now fry are introduced directly into saltwater without any adverse affects.

All fry are held in freshwater until feeding is initiated. Fish are fed 75% of the OMP rates in freshwater and 100% in saltwater. They are generally only fed from 0830 to 1700 hours. Growth rates vary from 2-6% body weight per day in saltwater. The fry are reared from 2-10 weeks and are released at 1-4 gms. size. Sea pen survival has been close to 100% - mortalities at the pens are removed daily with nets. Seastars have been found to be useful in keeping the nets clean as well as helping in getting rid of the mortalities.

The wild fry migration in both Pallant Creek and Cumshewa Inlet are monitored to give an indication of release times. Seapen fry have been released from the third week of April to the third week of May in the past. Caution is exercised when releasing fish because of predation problems by perch and walleye pollock. All releases are made on very dark nights.

In the summer of 1981, two lots of 35,000 coho were transplanted above

the hatchery. One group was transported above an impassable falls and the second group was taken to a stream that feeds into Mosquito Lake (Pallant Creek flows out of this Lake).

Questions of interest:

1 Saltwater marking

2 Release timing

3 Where will adults return

4 Steelhead - F & W

Pat Slobodzian

Puntledge Hatchery

Horizontal Loading of Heath Trays
Summer Chinook

The 1981 Brood Summer-Run Chinook were incubated in Heath tray incubators loaded horizontally. This experiment is to determine if a day's egg-take will develope at a uniform rate. By loading horizontal, eggs and alivens will be incubated at the same DO level and will be ponded at the same time.

By loading vertically in stacks of 7 trays, the DO levels at ponding drop from 12 ppm to 6.4 ppm, at this rate the bottom 3 to 4 trays are less developed than the top 3 trays.

Puntledge Hatchery has 15 stacks of 8 trays, by loading horizontally this will give 30 to 45 trays to develope with higher DO levels and also provide higher DO levels to the later egg-takes when the first trays are ponded. The DO levels on the remaining trays rise to much higher DO levels.

Loading horizontally will also give a safety factor for individual egg-takes in the event the supply pipe clogs up, you will only lose a few fish from each egg-take.

I would like to point out that loading horizontally is only good with small egg-takes unless you have abundant stacks.

Summer Chinook 1981 Brood

DO Readings
Winkler Method

Date	Time	Location	Intake	Outflow	Water Temp
Dec2381	14.00		12.0		6.0
Dec2381	14.00	Tr 2	11.5	11.4	6.0
Dec2381	14.00	Tr 17	11.4	10.8	6.0
Dec2381	14.00	Tr 32	10.8	10.5	6.0
Dec2381	14.00	Tr 47	10.5	10.5	6.0
Dec2381	14.00	Tr 62	10.5		6.0
Jan0582	09.30	Tr 2	12.1	11.4	4.1
Jan0582	09.30	Tr 17	11.4	10.8	4.1
Jan0582	09.30	Tr 32	10.8	10.4	4.1
Jan0582	09.30	Tr 47	10.4	10.15	4.1
Jan0582	09.30	Tr 62	10.15	10.10	4.1
Jan0882	11.45	Tr 2	12.2	11.8	4.9
Jan0882	11.45	Tr 17	11.8	11.6	4.9
Jan0882	11.45	Tr 32	11.6	11.4	4.9
Jan0882	11.45	Tr 47	11.4	11.0	4.9
Jan0882	11.45	Tr 62	11.0	10.8	4.9
Jan1282	10.30	Tr 2	12.5	11.9	5.0
Jan1282	10.30	Tr 17	11.9	11.3	5.0
Jan1282	10.30	Tr 32	11.3	10.5	5.0
Jan1282	10.30	Tr 47	10.5	10.1	5.0
Jan1282	10.30	Tr 62	10.1	10.0	5.0
Jan1582	14.30	Tr 2 (ponded)	12.0		5.5
Jan1582	14.30	Tr 17	11.7	11.0	5.5
Jan1582	14.30	Tr 32	11.0	10.5	5.5
Jan1582	14.30	Tr 47	10.5	9.9	5.5
Jan1582	14.30	Tr 62	9.9		5.5

Note: Flows set at 12 Liters per minute.

Harry Genoe

CATARACTS IN B.C. CHINOOK AND COHO: COSTS AND CURES

by

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(PRESENTED BY JIM VANTINE)

Introduction

This year a major occurrence of cataract or opacity of the lens was observed in B.C. chinook and coho hatchery stocks for the first time. Affected chinook were reported at Big Qualicum Hatchery on May 17, and subsequently at the Puntledge, Quinsam and Little Qualicum facilities. Other chinook stocks did not develop cataracts prior to release. Most of these fish were released by mid-June as typical "90-day" smolts.

Cataract amongst coho fry of the 1980 brood was found at Puntledge Hatchery in late May and has since been reported at Chilliwack, Capilano and Quinsam hatcheries. As for chinook, other hatchery populations appear free of the disease. These fish are scheduled for release in spring 1982.

Efforts have failed to produce any evidence that pathogenic organisms, water quality or stress during early rearing are related to the outbreak of cataract in B.C. Only nutritional factors have been implicated. However, nutrition and disease diagnostics specialists remain unconvinced that the cause is simply nutrition; instead they feel a complex interaction between any or all of these factors may be responsible.

The evidence implicating nutritional factors is circumstantial - cataracts occurred only in Washington and B.C. hatcheries supplied Oregon Moist Pellet fish food from Washington. Oregon stocks raised on feed from a different manufacturer did not contract the disease. The only dietary factor identifiably abnormal in some feed samples taken from affected hatcheries is a zinc deficiency in relation to unusually high calcium content. This condition has been linked to cataract development in trout. No evidence of vitamin deficiency or toxicants in the feed which may account for the outbreak has been found.

Production Costs

Approximately 2.4 million chinook smolts released in 1981 had cataract. Fifty percent of these fish had pinpoint or partial lens opacity while the remainder were severely affected. There seems to be no doubt that fish with complete lens opacity will not survive. They are unresponsive to visual stimuli and unable to find food. Unhealthy chinook transferred from Big Qualicum to saltwater pens for 30 days at the Pacific Biological Station failed to improve, although the problem did not get noticeably worse. A control group of unaffected chinook also did not suffer any major development of cataract over the 30 day period. During this trial, the mortality rate was 1% amongst the healthy fish and 10% among the unhealthy fish.

On the other hand, 5000 fall chinook held for 3 months beyond normal release date at Puntledge Hatchery in troughs showed a marked increase in the number of severely affected fish and a corresponding decrease in the number of healthy fish despite the fact they were fed OMP supplemented with vitamin C and zinc (Table 1). This suggests chinooks released in a healthy condition may have degenerated during ensuing months.

The susceptibility of fish with cataracts to predators was illustrated rather dramatically in the Big Qualicum system. Post-release loss of chinook smolts in the Qualicum estuary was estimated to be approximately 300,000 in both 1979 and 1980. But, in 1981, predation increased to 1,000,000 (Pamela Mace, pers. comm.). Heavier losses were linked directly to the absence of predator avoidance behaviour in blind smolts which made them prey to normally ineffective bird species and which resulted in failure to use refugia available at greater water depths on high tidal cycles.

Given this information, it is probable that chinook smolts with severe cataract will not contribute to production and those with partial cataract may not contribute. In the worst case, delayed cataract development may reduce viability of some "healtny" smolts.

Preliminary data suggests that up to 800,000 of the 3.5 million coho rearing at Puntledge, Quinsam, Chilliwack and Capilano hatcheries may have experienced some degree of lens opacity. The incidence of severe cases is relatively low compared to chinook with pinpoint or partial opacity accounting for over 95% of all cases. Another difference between the coho and chinook outbreaks is the high incidence of one eye cataract in coho - virtually all affected chinook had bilateral lens cataract.

The prognosis for coho is uncertain. Groups of fish with no cataract or with pinpoint cataract isolated in troughs at Quinsam have shown significant degeneration over a two month period despite feeding with a zinc and vitamin C - enriched diet (Table 2). However, repetitive sampling at monthly intervals in a larger rearing unit (standard Burrows pond) has failed to demonstrate a significant change in cataract incidence over a four month period. Hatchery managers have observed that fingerlings with pinpoint or partial cataract seem to be equal to healthy fish in terms of in-pond holding locations, feeding activity and growth.

It is probable that most blind coho will perish before release. At Puntledge, for example, a furunculosis outbreak amongst fry with cataract resulted in loss of 70,000 fish leaving the balance of the population free of the disease. Less severely affected coho may well survive and contribute to production with the net result of very little impact on 1980 brood yield.

Cures

Prevention seems to be the only solution to cataract disease. Diet enrichment or a change in rearing environment does not appear to reverse disease development after initiation. Since diet has been most clearly implicated in the cataract problem, the Department of Fisheries and Oceans will implement an intensive feed quality control program in 1982.

This program will be improved over similar earlier programs:

- ingredients and finished diet will be tested before the feed is used
- chemical analysis will be more intensive

Samples of marine oils, fish meal and processed diet will be obtained during manufacture and returned directly to Vancouver. A verbal report on critical quality control parameters will be available within four days at which time feed of the tested production lot en route to B.C. or stored at the plant will be cleared for use.

Thorough chemical analysis (Table 3) is considered a prerequisite to a successful quality control program. The program previously in place in B.C. would not have identified the metals problem which occurred this spring and there is little point in running a skeleton program which gives only false assurance.

All agencies using OMP (and other feed types) should work together to determine parameters necessary for quality control of meals, oils and processed diet (ie., upgrade Table 3) and to develop reasonable specifications for these parameters. Ingredients could then be tested prior to purchase by the manufacturer and all processed feed could go through a single quality control laboratory. This would relieve the pressure on each agency to sample and test feed lots produced for their requirements and make the manufacturer's job easier by eliminating the need to satisfy multiple sets of standards.

Conclusion

Production lost to the fishery due to the 1981 cataract outbreak in B.C. will be at least 30,000 chinook. Coho losses will be substantial if cataract formation continues in partially affected fingerlings but the likelihood of further degeneration is uncertain.

There have been costs other than those related to production. The results of some chinook marking experiments carried out in spring 1981 will be invalidated and planned coho rearing/release studies have been discontinued at one hatchery. Most important, the cataract problem has demoralized hatchery staff and has definitely not been good for public relations. Prevention of a future outbreak is a top priority, and can be achieved most efficiently through cooperative development of diet quality control specifications and procedures.

TABLE 1. Cataract incidence amongst fall chinook salmon held at Puntledge River Hatchery. (100 fish were sampled weekly from a population of 5000 - data from H. Genoe).

Condition	Frequencey (%) in Samples Taken During May/June	July/August
Normal	36	16
Partial cataract	38	28
Severe cataract	26	56
TOTAL	100	100

TABLE 2. Change in cataract incidence and severity amongst segregated healthy and pinpoint cataract subpopulations of coho fingerlings at Quinsam Hatchery. (Data from J. Van Tine and G. Hoskins).

Group	Date	Incidence (%) Healthy	Pinpoint	Partial	Severe
Healthy	Sept. 18	100	0	0	0
	Nov. 11	54	42	4	0
Pinpoint	Sept. 18	0	100	0	0
	Nov. 11	0	36	63	1

TABLE 3. Parameters for quality control of Fish meals, marine oils and fish feed. (Developed in co-operation with the West Vancouver Laboratory).

Sample	Parameter	Sample	Parameter
Fish food	crude protein	Marine oil	peroxide value
	crude lipid		iodine number
	moisture		free fatty acids
	ash		
	crude fiber	Fish meal	crude protein
	gross caloric content		moisture
			ash
			minerals
	peroxide value		available lysine
	iodine number		
	vitamin C (ascorbic acid)		
	vitamin E (α tocopherol)		
	riboflavin		
	vitamin A		
	minerals (Ca, Mg, P, Zn, Fe, Cu, Na, Cd, Se, K, Mn, I, Hg, Pb)		

GENERAL DISCUSSION

Compensatory Leave

At the present time the period for compensatory leave is restricted from April to March. For some facilities (i.e. South Coast) Sept. to August could be preferable. D. Lawseth will be putting this motion forward at the South Coast annual meeting in February 1982. Managers of the North and Fraser units are to contact D. Lawseth by mid-February if they wish to have their compensatory leave period changed simultaneously with South Coast.

Contracting Out

There were no viable suggestions to battle this problem. The problems of contracting remain clear to managers (i.e. contracting is more expensive).

Executive/Advisory Committee 82/83

A need has been identified again to reassemble an executive/advisory committee.

Elected members for 82/83 are: Harry Genoe
Eldon Stone
Karl Petersen
Don Buxton

Next Meeting

Suggestions for next year's meeting:

1. Agenda
2. Time slot for each facility
3. Room for plenty of discussion
4. Less project reports
5. Business section outside of fish culture for the purpose of arriving at decisions as a whole

Elected members for 1983 meeting are:

Chairman - D. Buxton
- G. Dixon
- P. Slobodzian
- C. Wilson
- E. Stone

The location of the 1983 meeting will be left up to the executive.

Recorded by T.Malmer

NITINAT HATCHERY: G. COOK

KEEPER CHANNELS

Overcrowding and suffocation at the upper ends of the keepers was overcome by loading 16,600 eggs per square metre. Flows were increased to 500 LPM and water depth was 7.6 inches. Gravel size was 19 to 25 mm and was arranged with 15% voids. Total length of each keeper is 44 m with a 15 cm drop over 22 mm. The width of each keeper is 1.9 m and depth is 45 cm.

Eyed eggs were put into the keepers at about 460 ATU's. Poor fitting stop logs in the keepers caused back eddies and non uniform flows. It was found that increased voids caused increased alevin crowding.

ROBERTSON CREEK HATCHERY: D. LAWSETH

KEEPER CHANNELS

An experiment was conducted which compared 3 densities - 1) 8,000; 2) 12,000; 3) 15,000 chinook eggs and two flows 30 and 60 GPM.

The keeper channels sloped 1.8 cm over a 12 m length. The water depth was 13 to 15 cm. Round gravel at 1" to 2.5" diameter was placed into the keeper with very little space between gravel. Eggs were loaded 1 to 2 egg layers deep.

Oxygen was monitored closely at three areas: 1) at the screen; 2) in the screen; and 3) in the gravel. Mortalities were only approximately 1%. There was crowding at the top end of the keeper when densities were higher than the suggested levels. D. Buxton commented on this crowding and felt that if the gravel is placed one layer thick then the alevins will distribute themselves all around the gravel rather than piling up. The chum alevins seem to like a rough substrate so why have voids? It was suggested that one advantage to the keepers being sloped was that this created areas of fast and slow flows.

CAPILANO HATCHERY: E. STONE

COHO EXPERIMENT

Two egg densities were used in this experiment: 10,800 eggs in .5 cubic feet of gravel and 10,500 eggs in 1.5 cubic feet of gravel. All alevins went right to the bottom of the gravel after hatching and as they develop, then they start moving around. Emergence timing was only 3 days difference between the groups. It was found that fry from the .5 cubic feet of gravel were longer than those from the other group. Fry from the 1.5 cubic feet of gravel were heavier than the other group.

KITIMAT HATCHERY: D. MCNEIL

A SUMMARY

At Kitimat 100% of their water is pumped, there is no gravity feed system. They have the capability to heat the water and water sources can be used in combination. Heated water is available from Eurocan. This water is at 40 degrees centigrade but can be cooled via a heat exchanger. Aeration of the water is accomplished by 144 packed columns. The wells have a 500 GPM capacity. There are a series of keeper channels which are under cover, 64 Capilano troughs; 8 rearing raceways (100' x 15'). The egg targets when the hatchery comes into production are: 3 million chinook; 11 million pink; .6 million coho; .5 million sockeye; and 55,000 steelhead.

QUESNEL, EAGLE, AND PENNY: R. DICKSON

A SUMMARY

The chinook fry at Penny are reared on a groundwater source which goes down to 1°C. The Capilano troughs are actually set up in a barn. The egg capacity here at present is 3 to 4 thousand in Heath trays. Last year, 60,000 chinook were incubated in gravel incubators. The fry are released in July, a proportion of the fry overwinter and there is good intermingling with wild fry that are overwintering. At Slim Creek on average about 1500 chinook adults return per year.

At the Bowron site there is an incubation box in a trench in the ground. Siltation problems occurred and the water was also very cold. The fry were only at 1.2 grams at the time of release in August. This project will be discontinued because conditions are too harsh. The Quesnel Hatchery has been contracted out for the remainder of the year. Access to the hatchery is very poor and weather conditions are quite severe. This creates problems as everything is outdoors. The water temperature is from 7 to 10°C but the weather conditions are difficult to work under.

The egg capacity is 4 million. There are 32 Capilano troughs and there are a number of rearing raceways as well. The eggs are taken from 5 to 6 different streams and much helicopter work is necessary. The adult chinook are held in the raceways using a groundwater source. This year 100,000 chinook eggs were taken. Taking a larger number of eggs was avoided because the backup system condition was poor. Some problems were experienced when holding the adults in river water. The temperature of the river reached 17°C at the time of holding and this caused poor fertilization.

This year the ponding of the fry was held back so that all groups could be ponded at once. This resulted in a loss of 6 to 7 percent of the fry as they developed fin rot and there were problems with initiating the feeding. The fry are taken back to their streams of origin for imprinting via helicopter. Release occurs at the end of April. In 1982/83 the plan

is to continue with Penny/Eagle River Hatchery and to rear the chinook to 2 grams for an early release and to 5 grams for a late release.

KALUM PILOT: S. BARNETSON

A SUMMARY

The Kitsumkalum pilot has two stocks of chinook. The lower river run occurs in late August into late September with about 9,000 returning adults. The upper river run occurs from May to mid-August with 600 returning adults. In 1980, 86,000 eggs were taken. The hatchery water supply is a groundwater source. Aeration is accomplished by means of two segmented packed columns. The water temperature is 4.5 to 6 ^{o}C. They have the ability to heat the water by 1.5 ^{o}C. In 1981 200,000 eggs were taken. The fry are released in May at the time of wild fry peak migration.

BABINE: C. HARRISON

GRAVEL CLEANING OF SPAWNING CHANNELS

There are two sets of channels, Pinkut and Fulton. It has been observed that if these channels are left uncleaned then conditions become extremely poor within 5 years. To clean the channels, water is first pumped into a header. The water then goes through several pipes which go down into the gravel and the gravel is flushed. The machinery used for this process is towed along the channel using a Cat. Silty water from cleaning is run down the bipass channels so a large silt build up will not occur, as the cleaning apparatus is towed down the channel.

Channel #1 at Fulton experienced survivals below normal after 5 years of operation. To clean the gravel it was all removed, cleaned, and put back in. Colin feels that the channel cleaning should be done each year.

KITIMAT PILOT: S. WILLIS

A SUMMARY

The Kitimat Pilot uses a groundwater source and the water is aerated with a showerhead type system. There are 4 troughs at the pilot site and 8 troughs at the pilot 2 site. Adult capture is by gillnet and beach seine. Fence traps are not practical as the water conditions fluctuate quite a bit. Adults are transported to circular holding tubs by boat. They are released at 4.5 to 5.5 grams in mid May to the end of June. All of the facility effluent goes into the Eurocan effluent ponds so there is no hatchery water source for the fry to imprint on. The fry are released at different sites in the Kitimat River and the returning adults have been homing in on these release sites. At one of the release sites in the river, 24% of the adults captured were hatchery fish. The scale patterns

of the adults are studied to see what the proportion of overwintering fry is. This data is used to determine whether or not a stock can be successfully overwintered.

Overwintering was discussed and it was felt that overwintering fry which had tendencies to leave after 90 days caused some problems. Descaling occurs in many stocks even after smolting and so marking is done prior to smolting. Scale loss allows fungus growth as well. Many of the fry overwintered, when sampled, are mature and end up dying.

CHEHALIS HATCHERY: L. KAHL

CAPTURE AND HOLDING OF ADULT CHINOOKS

Adult chinook capture took place on the Harrison River by gillnetting and seining over the spawning grounds. Few fish were captured during daylight and night fishing was much more successful ie, 40 adults in 4 sets. The adults were transported in a live box to holding pens in the river. 75% of the females required holding. The fish were checked for ripeness every 2 to 3 days. Holding mortalities were 8% and the male mortalities were twice that of the females.

Fertilization was by the delayed fertilization and washing method. Eggs and sperm were taken in different containers to the Chilliwack Hatchery. Transport took from 2 to 3 hours. Eggs and sperm were kept at least at river water temperature and sometimes ice was used. For the last egg take the immediate fertilization and delayed washing method was used as poor fertilization was suspected with the previous method.

Females that had been held only 3 to 4 days prior to taking eggs, had the highest egg survivals. These eggs went to the Smokehouse Slough Hatchery. In general poor fertilization was experienced. This could be due to too much stress during transport and handling when checking for ripeness. Adding oxygen to the sperm containers may have helped as well.

The immediate fertilization method had very low fertilization rates. It was suggested that if eggs are left for 2 hours after fertilization high mortalities will result.

CAPILANO HATCHERY: R. GODIN

THREE EXPERIMENTS

THE EFFECT OF VARYING HANG TIMES ON FEMALE COHO

40 female coho were killed and split into groups of six, seven, or eight females. They were hung for varying lengths of time. Each time eggs were fertilized fresh males were used and eggs were all water hardened for

30 minutes. The results were that percent fertilization drops over hang time, dropping rapidly after 2 hours. (Hang time was up to 17 hours). At 17 hours hang time, the egg-to-eyed-egg survival was 45%. Next year the effects on fertilization of dead females kept in water will be studied.

PERCENT FERTILIZATION VS WATER EXPOSURE TIME OF EGGS BEFORE INTRODUCTION OF SPERM

If eggs are exposed to water before introduction of sperm, fertilization will be initiated due to premature water hardening of the eggs. The normal procedure at Capilano Hatchery is: 1 litre of eggs + 10 mls of sperm + 250 mls of water. Some eggs were put in 250 mls of water for 32 minutes prior to the addition of sperm and there was still 30% survival. In one other case a large volume of eggs put into 250 mls of water and the eggs soaked up all the water. Sperm was added 16 minutes later and egg survival was 30%

The consensus is that a bit of water in the eggs will not hurt but letting eggs sit in water for a length of time will inhibit fertilization. At Nitinat in some cases the eggs are left sitting in the female chum for 6 hours. These eggs had better survivals than eggs which sat in a bucket for 6 hours.

EXPOSURE OF SPERM TO SUNLIGHT VS PERCENT FERTILIZATION

We suspect that sunlight on sperm reduces its viability. 6 lots of sperm were exposed to sunlight then were all used simultaneously. The group of sperm exposed to sunlight for 30 minutes gave a survival of 91% to eyeing. Although survival to eyeing seems good, the total effect is not yet known ie, maybe sperm exposure to sunlight for 30 minutes causes sterile adults or other unmeasurable defects.

TIME OF WATER HARDENING AND BRIDINE DISINFECTION

This experiment was done on coho at 100 ppm Bridine. The affects of various water hardening times before disinfection were tested. The standard procedure at Capilano is 30 minutes of water hardening and then a 30 minute disinfection in Bridine. The following were tested: water hardening in a Bridine bath which resulted in a 10% mortality to the eyed stage. 10 minutes water hardening and then into a Bridine bath and this resulted in a 6% to 17% mortality to the eyed stage. 30 to 40 minute water hardening and then into a Bridine bath for 10 minutes. The result here was 6% to 12% mortality to the eyed stage.

When the eggs are put diretly into the Bridine, the eggs become brownish in colour ie, it appears that the Bridine is absorbed right into the egg. Possibly this is a more efficient disinfection procedure. Overall though, there does not appear to be too much difference between the methods. It has been suggested in the past that the iodine molecule cannot permeate the egg. At Kitimat Hatchery, Bridine is added at the beginning of water

hardening and they got adults back at a 2% survival. At Capilano Hatchery 30% of the returning adults have kidney disease but kidney disease is very hard to find in the juveniles and this could be a result of the Bridine disinfection.

QUINSAM HATCHERY: J. VANTINE

SIZE AND TIME OF RELEASE FOR COHO

This experiment was done on 11,000 supersmolts. Each time of release had 3 size groups: small, medium, and large. The mean weight for the April release was 14.3 grams and the mean weight for May 20 and June 19 releases was 29.5 grams. The largest smolts released yielded the highest percent of jack returns regardless of the time of release. The smallest smolts released yielded fewer jacks. Comparing these release dates: April 20/May 10/May 30 and June 19, the May 30 release produced the greatest number of jacks and adults as compared to other release times. Comparing small smolts over all release time, the May 30 release yielded the highest number of returning adults. It therefore seems advantageous to release 20 gram smolts on May 30. This time is 2 weeks later than the wild fry migration.

At Capilano Hatchery they found that the early release time (April 20) had the lowest jack contribution and the May releases had the highest jack contributions. They also found that the June and July releases gave lower jack contributions that May releases but not as low as the April release.

STEELHEAD AT ROSEWALL CREEK

Ocean steelhead return as 2 or 3 year olds. At Rosewall Creek various age crosses were done to see the effects on fresh water progeny. The juveniles were reared to the 40 to 50 gram size and these sizes produced good returns.

CHILLIWACK HATCHERY: D. BUXTON

STEELHEAD: SIZE AND RESIDUALISM

From research done on various releasing steelhead under 40 gram yields extremely poor returns. It is desirable for hatchery steelhead to move to the ocean for rearing. There is a tendency for smaller fish to residualize in the streams where growth will be poorer. Fish released at a size of 82.5 grams had 95% downstream migration just after release. If hatchery steelhead residualize after release they create interspecific competition for rearing area with coho juveniles etc. Summer steelhead seem to be more prone to residualism as compared to winter steelhead. In Washington hatcheries it is felt that fish under the required size should be destroyed rather than released.

At Chilliwack Hatchery, the Fish and Wildlife Branch say steelhead should be reared to the 55 gram size. In order to rear steelhead to this size a hatchery must have a warm water supply. Even at the 55 gram size there will still be 10 to 20 percent residualism. If the hatchery has a cold water supply (8 to 10 degrees), then possibly only the early part of the run could be used for broodstock. This would allow a little more time for rearing but would eventually produce a skewed adult migration as only the early portion would be enhanced. At Capilano Hatchery they have been trying to improve the steelhead run for 10 years and the results are essentially zero. It was suggested that if a hatchery does not have the thermal cycle to produce a fish of the appropriate release size, then that hatchery should not produce steelhead.

FRASER VALLEY TROUT HATCHERY: R. MCMILLAN

They are responsible for stocking Lower Mainland and Island lakes. The stocked lakes are often fished out within 6 days of stocking. Buntzen Lake is stocked with cutthroat trout, Stump Lake with steelhead. Brown trout are released into some of the lakes as well. Before they can be released, disease checks are done on them and when they are "passed" they can be released. Many of the rivers are swum to see what the smolting ratios are.

Steelhead adults are angled and cutthroat adults are captured by electroshocking. The steelhead fecundities have decreased from 9,000 to 6,000 eggs per female.

SNOOTLI CREEK: S. MACLAURIN

STEELHEAD PROGRAM

Initial egg target was 100,000 eggs. Half the fry that resulted were to be reared and half were to be released as unfed fry. Broodstock were angled and initial holding was in circular tubs. Water temperature is about 6 degrees and the water source is groundwater. Adults were later held in isolation boxes. The males held in the isolation stopped giving sperm and when moved back to the circular tubs they began giving sperm again. In all, 22 females were spawned and each female was held to a maximum of 5 days. The adults were not malachited during holding until a Saprolegnia break-out occurred. A malachite swab treatment was done. The fish were separated into 4 groups depending on degree of infection and were treated with malachite on 3 consecutive days.

An informal experiment was done on the eggs. 3 stacks of eggs were used and a different disinfectant was used on each: Bridine, Wescodyne and no disinfection of eggs. There was no difference between the 3 stacks. The eggs are not malachited during development as the water supply is so clean it is not necessary. Prior to releasing the fry, they were spray dyed either green or orange. The spray dye is seen when U.V. light hits

it. The fry were transported in plastic bags with water and oxygen. They were released into several different areas by helicopter. In this system there is a 21 km area which is impassable to adults because of a fall but the area above the falls is prime rearing area for juveniles and a number of fish were released here. 7,000 steelhead juveniles were kept to be reared for 2 years before releasing and the effect on adult returns will be studied.

LOON CREEK HATCHERY: D. GRAFF

Steelhead and chinook are reared here. Rearing is done in Capilano troughs and in circular tubs and some of the rearing units are inside. There is a gravity feed system and there have been problems with the intake ie, plugging. Water temperature ranges from 8 to 10 degrees.

BIG QUALICUM: G. LADOUCEUR

PREDATION BY BIRDS IN THE ESTUARY

Coho and chinook residence in the estuary is quite short, with 50% of the chinook leaving the estuary within 9 hours of release. Bonaparate gulls are adament feeders on chinook during chinook release. In 1980 it was estimated that Bonaparte gulls took 10.12% of the released chinook. In 1981, the chinook had an eye cataract condition and the birds took an estimated 25% of the release. The estimated number of coho smolts taken by gulls was 2 to 4 % at release. To alleviate the predation by gulls upon release: 1) release at night at high tide; 2) delay the releases and this reduces predation by the gulls as they have left for breeding. Other predators have been observed as well - a heron was observed taking 20 fingerlings per early morning and late evening. Kingfishers if nesting nearby will return every 20 minutes to take fish.

MARICULTURE: B. HOPE

There are no government restrictions on which chemicals can be used to treat the fish, no quality checks on the fish and there is no checking on who should get a fish farming license. There is no contact between D.F.O. and the farmers. The fish farmers often get early run coho as smolting will occur earlier and so they can be transferred to the net pens earlier where growth is better. When the fish reach the 3 gram size they are put into an immersion bath to prevent vibrio. Shortly after they are put into the net pens and are reared to 3 years of age then marketed. Euphasid feed is used and gives good growth, good meat colour and a quality which is quite acceptable.

B. Hope suggest that a Canadian feed mill would be desirable. He also suggests that farmed fish should not be sold where there are fresh salmon on the market.

PALLANT CREEK: S. SLOBODZIAN

A SUMMARY

Net pen rearing of pinks is done. The pens are anchored in salt water and can be reached by boat. The pen size is 30'x30'x15' and there are 3 different net sizes used. The cost per pen is $9,000 and the cost per net is $3,000. Oxygen levels and water circulation are good in the pens and there are no bird predation problems. Fry are held at the pens until their feeding response is good. They are acclimated to salt water and are transferred to the net pens. Rearing in the net pens goes for 2 to 10 weeks and the fry are released at the 1 to 4 gram size. Wild fry are monitored to indicate when the hatchery fry should be released. It will be interesting to see if the adults home in on the fresh water or the sea pens.

CATARACT PROBLEMS: J. VANTINE

Cataracts occurred in chinook especially on the island. PBS found that once fish had cataracts then any additional stress worsened the problem. The fish at Quinsam were affected by cataracts in November 1981, therefore, the problem could not be totally due to the 2 to 3 weeks of bad food in March and April. At the Chilliwack Hatchery, cataracts was caused by overcrowding and other stress factors added to the problem. Cataracts were also occurring in wild fry. At Capilano Hatchery they feel that the "cataract causing feed" could not induce cataracts.

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