

**COMPARATIVE CONDITION
OF HATCHERY AND WILD COHO SALMON
IN FRESHWATER AND THE OCEAN**

Don MacKinlay and Karin Howard
Fisheries & Oceans Canada
555 West Hastings St. Vancouver V6B 5G3 CANADA
E-mail: mackinlayd@pac.dfo-mpo.gc.ca

Abstract

A variety of physiological conditions of hatchery and wild coho salmon measured at the time of smolting in freshwater were compared to the same conditions measured after the fish had been rearing in the ocean for 2-6 months. The major differences between wild and hatchery fish in freshwater were in the size of the fish and the amount of fat in the mesentery and liver. These differences had disappeared after a short period of rearing in the ocean. It is concluded that the differences were caused by differences in diet and did not cause long-lasting changes once the fish were eating the same diets in the ocean.

Introduction

The purpose of this study was to determine the difference in some physiological and anatomical parameters between groups of coho salmon (*Oncorhynchus kisutch*) that had spent their first year of life either in a hatchery or in the wild. Morphological differences have been recorded between wild and hatchery fish in freshwater, but it was not known whether this difference persists once the fish migrate to the marine environment.

Study Location

Freshwater hatchery and wild coho were collected from the Chilliwack River Hatchery and nearby Angel Wing side channel in May, 2000 and 2001, and from the Tenderfoot Creek Hatchery on the Cheakamus River and from the river nearby in May 2001. The Ocean samples were collected during cruises of the W.E. Ricker research vessel in Georgia Strait (July, 2000) and in Juan de Fuca

Strait and Swiftsure Bank off the west coast of Vancouver Island (October, 2001).

Location codes on all illustrations are: F= freshwater, O= ocean, H= hatchery origin, W= wild origin, Cwk= Chilliwack stock, TF= Tenderfoot stock, GS= Georgia Strait, JdF= Juan de Fuca Strait, CA= Canadian waters, US= USA waters, Swft= Swiftsure Bank (open ocean west of Vancouver Island), 00 or 01= year sample was taken.

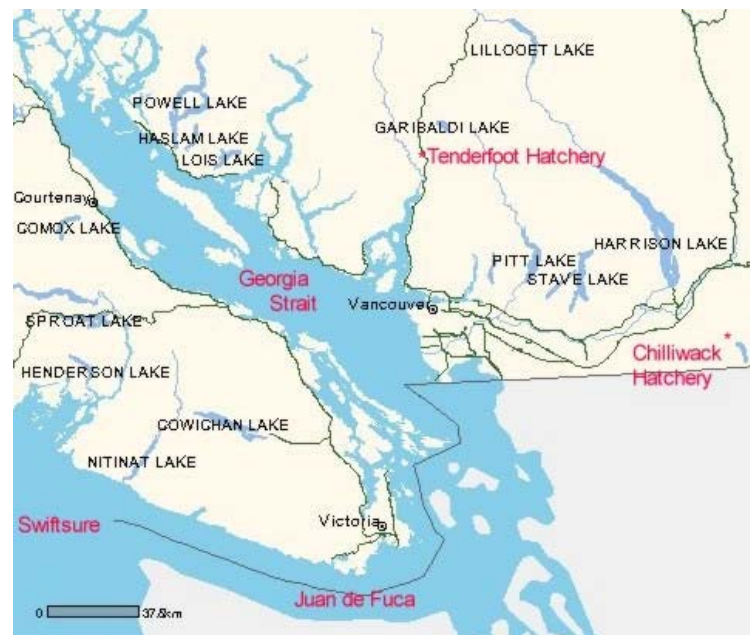


Figure 1. Map of sampling locations

Methods

The freshwater samples were euthanized with an overdose TMS anaesthetic. The ocean fish were already dead when they were taken from the trawl net. All fish were sampled within 10-30 min of death. The autopsy procedure of Goede and Barton (1990) was used with some modifications. Parameters recorded

included (with possible interpretations):

- Eyes*: exophthalmia, hemorrhaging, missing
(possible disease or poor rearing environment)
- Gills*: clubbing, fraying, color
(water quality or blood circulation problems)
- Fins*: erosion, hemorrhage
(rearing space or crowding problems)
- Operculae*: shortening, condition
(poor blood circulation or abrasion)
- Pseudobranchs*: swelling, color
(oxygen limitation or carbon dioxide toxicity)
- Mesenteric fat*: degree of caecae covered
(quantity and type of food)
- Spleen*: color (black, red), granular, swelling
(hemoglobin synthesis and blood storage)
- Kidney*: swelling, mottling, color
(excretory, ion-regulation or disease problems)
- Liver*: color (red, pale, coffee), nodules,
(protein metabolism, toxin removal, fat storage)
- Hindgut*: degree of inflammation
(bacterial irritation, feeding status)
- Gall Bladder*: bile color (pale yellow to dark green)
(feeding frequency, nutritional status)
- Length and Weight*: fork length, total wet weight
(growth rate, life history stage)
- Condition Factor (K_{fl})*: ratio of weight to cube of fork length
(stock specific factor influenced by feeding)
- Hematocrit*: percent red blood cells in blood volume
(index of oxygen availability, stress or disease)
- Plasma Protein*: measured with a refractometer
(disease, starvation or kidney malfunction)
- Blood Glucose*: measured with a glucometer
(energy mobilization and stress)

Results

Of the many parameters measured, the main differences were seen in the size of the fish, the amount of mesenteric fat, and the coloration of the liver. These

differences were only significant in the freshwater samples, and had disappeared after a month of rearing in the ocean.

Fish Size

The hatchery fish were larger than the wild fish in freshwater, but were of comparable size in the same locations in the ocean. The mean fish size was about 100% larger between release in May and first capture in July, and another 50% larger by October.

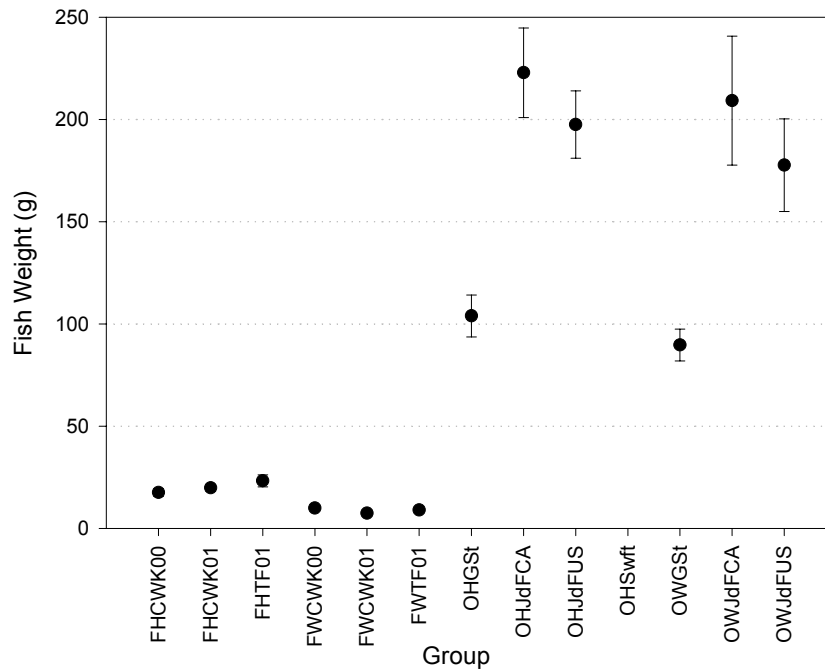
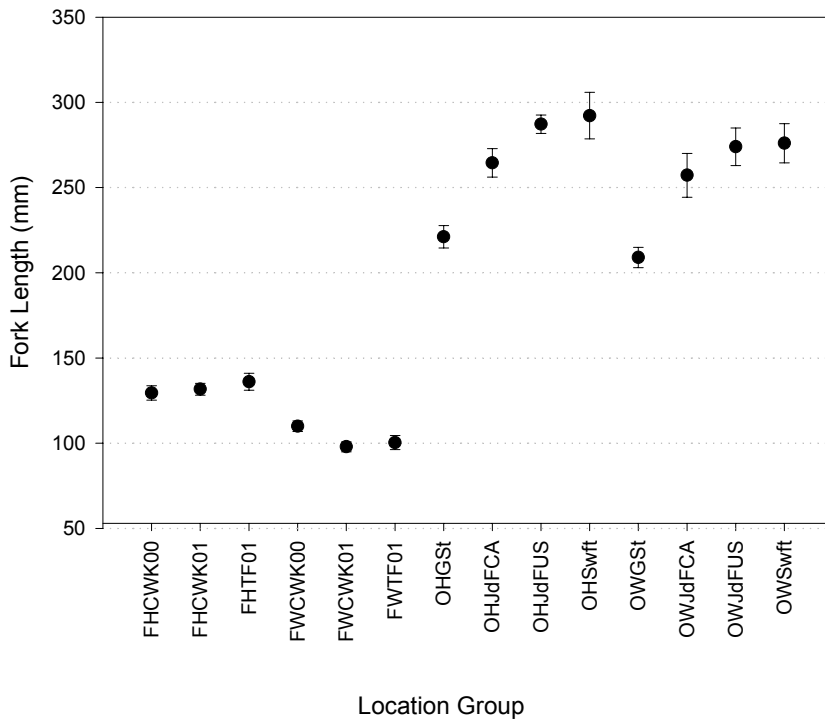


Figure 2. Mean Weight (\pm 95% confidence interval) of coho salmon collected at various locations during study.

Figure 3. Mean Length of coho salmon (\pm 95% confidence interval) collected during study. See text for location codes.



Mesenteric Fat

The Chilliwack River Hatchery fish in freshwater were much fatter (with the numeric mean of the category ratings, or mesenteric fat index [MSI] = 2.1) than the wild fish (MSI = 0.0), but the Tenderfoot Hatchery fish were not. In the ocean, all groups had a fat index of about 1.22.

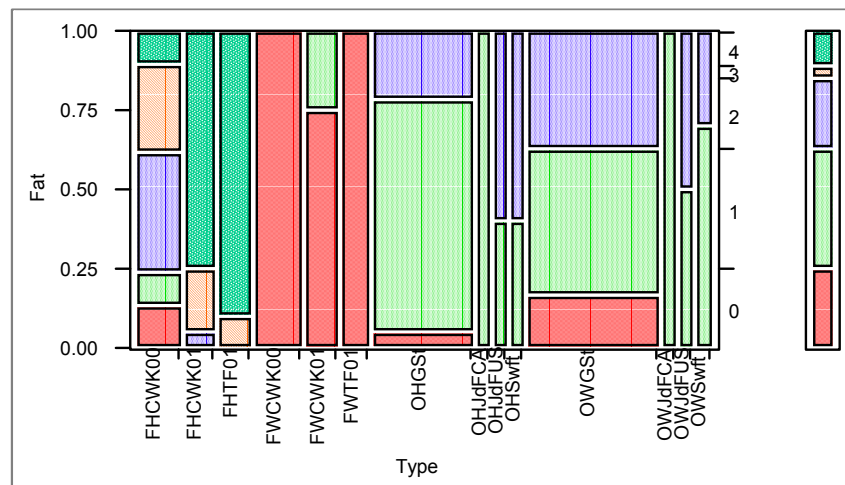


Figure 4. Amount of mesenteric fat found in study fish. Level 1= no fat, level 2 and 3 are intermediate, level 4= fat completely covers pyloric caeca.

Liver

Liver color was found to be 'coffee with cream' (Goede Index C, indicating high fat content), in a substantial proportion of the Chilliwack Hatchery fish but not the Tenderfoot Hatchery or wild freshwater fish. Some of the ocean fish groups also showed a proportion of fatty livers.

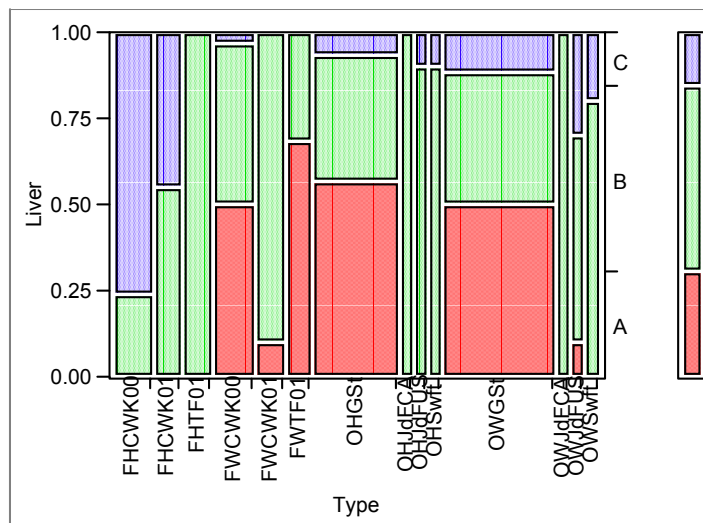


Figure 5. Liver color in coho salmon collected at various locations. A= dark red, B= light red, C= coffee and cream.

Conclusions

The major observable differences between the hatchery and wild fish in freshwater were no longer a factor after only a short period spent in the ocean. The difference in size, liver colour and fat content in the hatchery and wild

freshwater fish are likely related to diet. Therefore, these characteristics dissipate once the fish reach the ocean and have similar diets.

References

Goede, R.W. and B.A. Barton. 1990. Organismic indices of an autopsy-based assessment as indicators of health and condition of fish. American Fisheries Society Symposium 8:93-108.

Acknowledgments

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