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The geographic boundaries of Chile extend between latitudes 18°S and 56°S. Its present fisheries include an animal meal fishery in the north based on anchovy, sardine and horse mackerel, a trawl fishery in the central part for meluza, and a small-scale fishery in the southern fjords for shellfish and sea urchins.

The fisheries policy of the Chilean government includes incentives for artisanal fishermen of southern Chile. The propagation of salmon for release was considered a way of improving the economy of small fishing villages there.

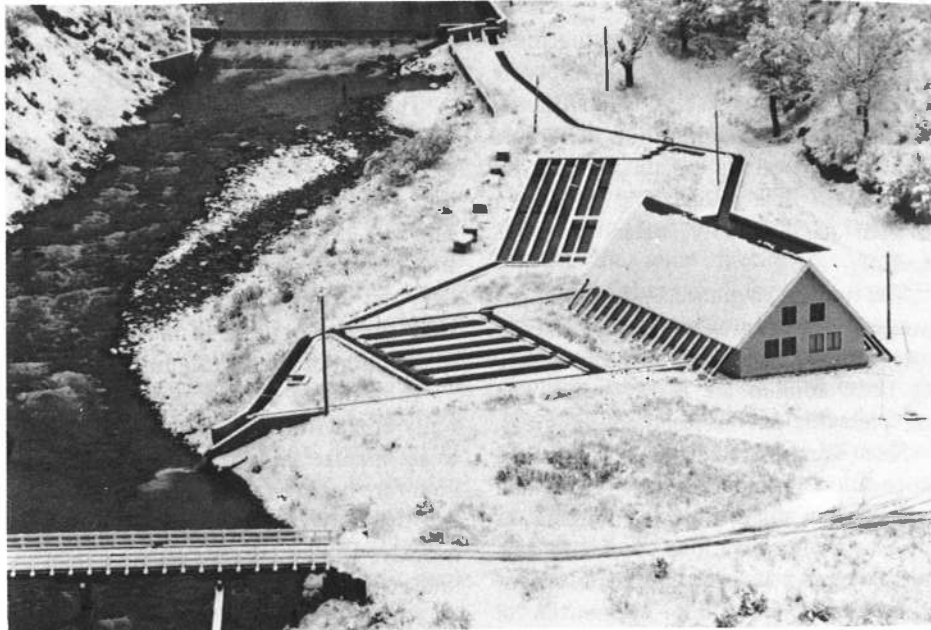
Salmon propagation in Chile has implications and applications which challenge specific biological and ecological principles. For example, can transplanted salmon adapt to an environment in which the seasons are reversed? Is the Humbolt Current that diverges on the coast of Chile a suitable environment for migrating salmon? These questions could only be answered by actual transplantation and experiment.

In 1969 and 1970, Japanese experts commissioned by the Japan Fisheries Association and biologists of the Chilean Division Pesca y Caza undertook ecological and physiochemical surveys of the water resources in Chile which offered potential for salmon acclimation and culture. After an examination of many regions, efforts were concentrated in the central province of Aysen which had considerable logistic and technical advantages in addition to a suitable environment. From 1971, the work was sponsored by the Japan International Cooperation Agency (JICA), following a request by the Chilean Government. Active cooperation on a governmental basis has continued since then.

The first species used was the cherry salmon (*Oncorhynchus masou*), found mainly in Japan. Eyed eggs were flown from Hokkaido to the field hatchery site and 85,000 fry were liberated in early 1972. Later transplantations, from 1974 to 1979, were of chum salmon eyed eggs

Salmon Ranching in Chile

The Japanese Project



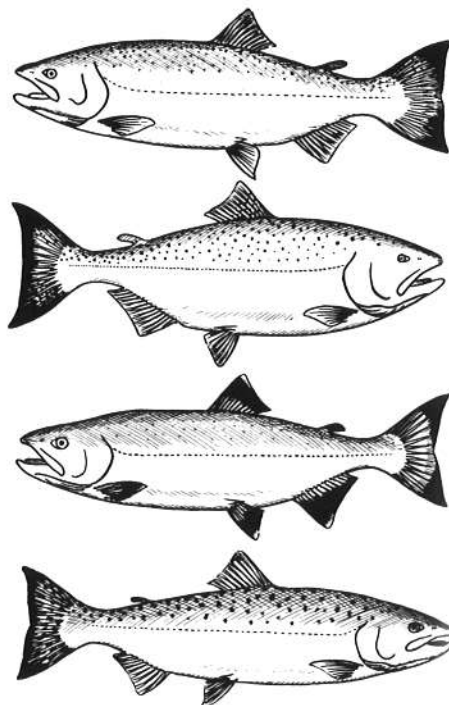
Top: Completed hatchery at Coyhaique, in winter. Left: Inside the hatchery. Below, top to bottom: Four species of Pacific salmon: coho, chinook, chum and pink.

from Japan. The fry were released into the Simpson River, Aysen Province, and totalled almost nine million.

A hatchery was built by the Chilean government in 1976 at the release site in Coyhaique, at latitude 45°35'S, which facilitated fry production and later feeding experiments.

No returns

The cherry salmon experiment yielded no returns, but was considered a preliminary effort. Chum salmon normally return to their home rivers after four years and up to six years. However, there have been no returns from the 1974-1977 releases from Coyhaique. Some fish have





Clockwise, from top: The first time wintered fingerlings were released from feeding pond, 1980. Closeup of fingerlings. First pen-feeding trial at Aysen, 1980. First feeding for the fry in incubator channel, 1978.



been apparently seen off the coast of Aysen by fishermen, but this has not been confirmed.

The reason for the failure of the salmon to return may be excessive loss due to predation on release, the small size of fish at release, and release time may not have been optimal. Furthermore, some of the winter fish may have stayed in the river too long when spring arrived.

Feeding

Improvement might have been possible by feeding the smolts at the hatchery for a longer period before release, since more larger fish survive than smaller fish, as



shown by returns to home rivers in Japan.

With the construction of the hatchery, feeding experiments began. A long feeding period for chum salmon fry is unnatural. Chum fry are inclined to migrate as soon as the yolk sac is absorbed. However, in Chile, where the seasons are opposite, this may not be the tendency. Furthermore, water temperatures along the coast are less than 20°C all-year round, suggesting a possibility to rear the smolts in local fjords. Data from salmon in the northern hemisphere show that young salmon disappear offshore when temperatures reach 17°-18°C.

The feeding experiments from 1977-1979 included pen-rearing of the smolts. The increased size of young fish at the time of release is now anticipated to increase their survival and chance of returning to the rivers. The main problem is to determine the optimal time of release and fish size for the seaward migration.

New agreement

A new cooperative agreement to provide three million chum salmon eggs each year from 1980 to 1984, was signed at Santiago by the Servicio Nacional de Pesca in Chile and JICA. It includes a change from technical assistance by resident experts to cooperation on a project basis which has substantially increased the effort, both in number of personnel and in budget. The new project is aimed at developing a model for salmon culture in Chile based on the following guidelines:

- Advancement of local hatchery techniques for more reliable releases, and establishment of local management systems to hatchery-feed in winter and liberate in spring.
- Survey of the releasing grounds to provide against predation by, for example, pen-rearing in the fjords.
- Establish a system with greater mobility to find returning salmon.
- Research on species other than chum salmon.
- Research on the time of release and sites for liberation of the fry.
- Survey sea conditions in coastal waters where the migrations and returns will occur.

As well, the Chileans are considering the release of salmon further south in the Magallanes region. JICA has offered to provide eggs of pink salmon (*O. gorbuscha*) for such an experiment. ○

