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Private salmon aquaculture on the Pacific
Coast of the United States

by

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SUMMARY

The scarcity and high value of Pacific salmon (genus Oncorhynchus) have stimulated private investment in salmon aquaculture on the Pacific coast of North America. California removed legal barriers to private ownership of salmon in 1968, the first state to do so. Oregon and Washington approved legislation for private salmon farming in 1971, and Alaska approved such legislation in 1974.

Two Approaches to private salmon farming are under evaluation: (1) ocean ranching and (2) extended feedlot rearing. A number of companies are evaluating either one or both approaches.

INTRODUCTION

High demand for Pacific salmon led to full utilization of most United States stocks in the 1930's, and decreased availability of salmon became evident in the 1940's. The U.S. harvest of Pacific salmon is now at its lowest point since before the turn of the century, when the fishery was beginning.

Interest in the use of hatcheries to supplement depressed wild stocks of salmon has increased steadily in the United States, partly as a result of the success of the Columbia River Fishery Development Program which started in 1948. This program has contributed many improvements in hatchery technology for coho salmon (O. kisutch) and chinook salmon (O. tshawytscha). Catches of these two species have increased substantially because of the release of juveniles from hatcheries (Cleaver, 1969; Wahle, Vreeland, and Lander, 1974), and many surplus adults are now sold by state hatcheries to processors (Roberts, 1972).

The success of public hatcheries and the scarcity and high price of salmon have attracted private investors to salmon aquaculture. To encourage the emergence of a salmon aquaculture industry, legislative bodies in the States of California, Oregon, Washington, and Alaska recently passed laws to allow the operation of private salmon hatcheries and feedlots. Research and development programs to aid private salmon aquaculture are under way at National Marine Fisheries Service laboratories at Seattle, Washington, and Auke Bay, Alaska, and at Oregon State University and the University of Washington.

REMOVAL OF INSTITUTIONAL BARRIERS

The coast-wide move toward private salmon culture was triggered by the 1968 California Legislature, which authorized the operation of a private salmon hatchery on Waddell Creek near San Francisco. The 1971 Oregon Legislature passed a law permitting private hatcheries for chum salmon (O. keta), and the 1973 Oregon Legislature broadened the law to include coho and chinook salmon. A 1971 Washington State law was written primarily to authorize private salmon farms to grow pan-size salmon in feedlots, but the law also sanctions the release of juvenile salmon from private hatcheries for ocean ranching.

The Alaska Constitution originally prohibited an exclusive right or special privilege of fishery in the natural waters of the State. This prohibition was removed from the Constitution in 1972 to allow the development of aquaculture in Alaska and the establishment of limited entry to fisheries. A private hatchery law was subsequently approved by the 1974 Alaska Legislature. The Alaska law required that private salmon hatcheries be operated as nonprofit corporations. Income from surplus hatchery fish can be used for operating costs, including debt retirement and expansion of facilities. Any "profits" are to be expended on fishery research, salmon rehabilitation, or other fishery activities--all in cooperation with the State of Alaska. The Alaska law is designed to keep the profit incentive for private hatcheries with traditional harvesting and processing segments of the Alaska salmon industry.

Salmon from private hatcheries are public property while at sea and are harvested in common property recreational and commercial fisheries along with wild fish and fish from public hatcheries. Private hatcheries engaging in ocean ranching derive their income from the sale of adult salmon that escape the common property fisheries. The rates of exploitation by common property fisheries on hatchery fish can vary from near zero to 90%. The extent of variation depends on the species of salmon, the location of the hatchery, and the management policies for protection of intermingled wild fish against overexploitation. In Alaska the private hatchery law requires the State to manage common property fisheries to conserve wild stocks. Thus, a higher percentage of fish would return to a hatchery when wild stocks were weak and fishing was severely restricted than when wild stocks were strong and fishing was intensive.

Only California requires that salmon from private hatcheries be marked to ensure positive identification of fish returning to a hatchery stream. Other states are more flexible in permitting proprietary harvest of adult salmon returning to hatchery streams without positive determination of hatchery origin. The State of Oregon, for instance, has developed an agreement with at least one private hatchery to release a specified number of adults for natural spawning in a stream inhabited by both hatchery and wild fish.

Transplantation of eggs and juvenile salmon is rigidly controlled by state fishery agencies. Periodic examination of hatchery fish by a qualified pathologist is mandatory. Oregon law requires operators to reimburse the state for inspections of private hatcheries. Eggs for private hatcheries are typically purchased from state fishery agencies for \$2 to \$6 per thousand. In some instances state and federal agencies have provided contracts or grants to private salmon farms to grow salmon for experimental purposes or to release juveniles for common property recreational and commercial fisheries.

The number of licenses and permits required to operate a private salmon farm depends on the species of salmon raised, type of husbandry, and location of the farm. In addition to a permit to raise salmon, licenses or permits are required typically for water rights, waste-water discharge, construction in navigable waters, zoning and building codes, selling fish, medications to control disease, transportation of eggs, etc. A diversified salmon farming operation that releases juveniles for ocean ranching and raises fish in captivity to market size may require permits and licenses from a dozen or more local, state, and federal agencies.

EVALUATION OF AQUACULTURE SYSTEMS

Two approaches to private salmon farming are being tried in the United States: (1) ocean ranching, where juvenile salmon are released from hatcheries and/or feedlots to grow to maturity at sea; and (2) extended feedlot rearing, where juvenile salmon are raised in captivity until they attain market size (usually one-half to three-fourths pound).

Although salmon farms generally are emphasizing one approach or the other, an aquaculture system that uses both approaches is under evaluation by Oregon Aquafoods, Inc. This company raises chum salmon fry for ocean ranching and raises coho and chinook salmon in freshwater and saltwater feedlots to three sizes: (1) smolt size for ocean ranching, (2) one-half to three-fourths pound for marketing, and (3) one pound and larger for stocking in a saltwater reservoir, which is open to public fishing for a fee.

Ocean ranching of coho salmon was first tried by a California firm, Silverking Farms, in 1968. Smolts released by Silverking Farms are raised in a freshwater feedlot for about 1 year.

The State of Oregon has issued licenses to four firms for ocean ranching of chum salmon, and additional applications for licenses are pending. One of the Oregon firms, Keta Corp., began ocean ranching of chum salmon in 1971.

The State of Washington has several active private salmon producers. Domsea Corp. began raising pan-size salmon in saltwater feedlots in Puget Sound in 1971. The company has since applied to the State of Washington for approval to produce brood fish for their extended feedlot rearing program. Several other firms and some Indian tribes have also developed extended feedlot rearing programs in Washington State. The Quinault and Lummi Indian Tribes are also engaged in ocean ranching in Washington State. The Quinaults are releasing chum salmon and sockeye salmon (O. nerka), and the Lummis are releasing coho, chinook, and chum salmon.

The Alaska private salmon hatchery bill became law in August 1974, and the State of Alaska is now reviewing applications for private hatchery permits. Native corporations, fishermen's groups, and processors are expected to engage in ocean ranching in Alaska. Pink salmon (O. gorbuscha) and chum salmon will likely become the first two important species for ocean ranching in Alaska. Considerable potential also exists for sockeye, coho, and chinook salmon.

It is still too early to determine if the salmon farming industry now emerging on the Pacific coast of the United States will become economically successful. Costs of building and operating salmon farms are highest for extended feedlot rearing; intermediate for ocean ranching of coho, chinook, and sockeye salmon; and lowest for ocean ranching of pink and chum salmon. The cost of raising pink and chum salmon is relatively low because hatchery systems are essential only for the eggs and alevins. These species can be released into the ocean as soon as they reach the fry stage. The other three species must be raised in feedlots for 3 to 12 months before they can be released.

The return on an investment in ocean ranching can be achieved within 1 year if the fish are raised to pan size in feedlots. Ocean ranching with pink salmon requires 2 years for fish to reach maturity, and other species require 3 to 5 years.

Extended feedlot rearing allows the salmon farmer to exercise control over his stock from time of fertilization of eggs to time of harvesting. Unfortunately, however, heavy losses from disease and operational problems can occur when fish remain crowded in feedlots. Moreover, the limited supply of artificial foods suitable for salmon has contributed substantially to an escalation of costs in the past 2 years.

With ocean ranching, the salmon farmer faces many uncertainties about the fate of the fish released from his hatchery or feedlot. He may suffer heavy mortality from natural causes and from fishing. Nevertheless, he minimizes the risks of disease from holding fish under crowded conditions for extended periods and avoids the necessity of feeding artificial foods in large quantity. Unfortunately, evaluation of the economic feasibility of an ocean ranching system will usually require several years, and modest annual costs can add up to a substantial investment by the time adult salmon begin to return to the hatchery stream.

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