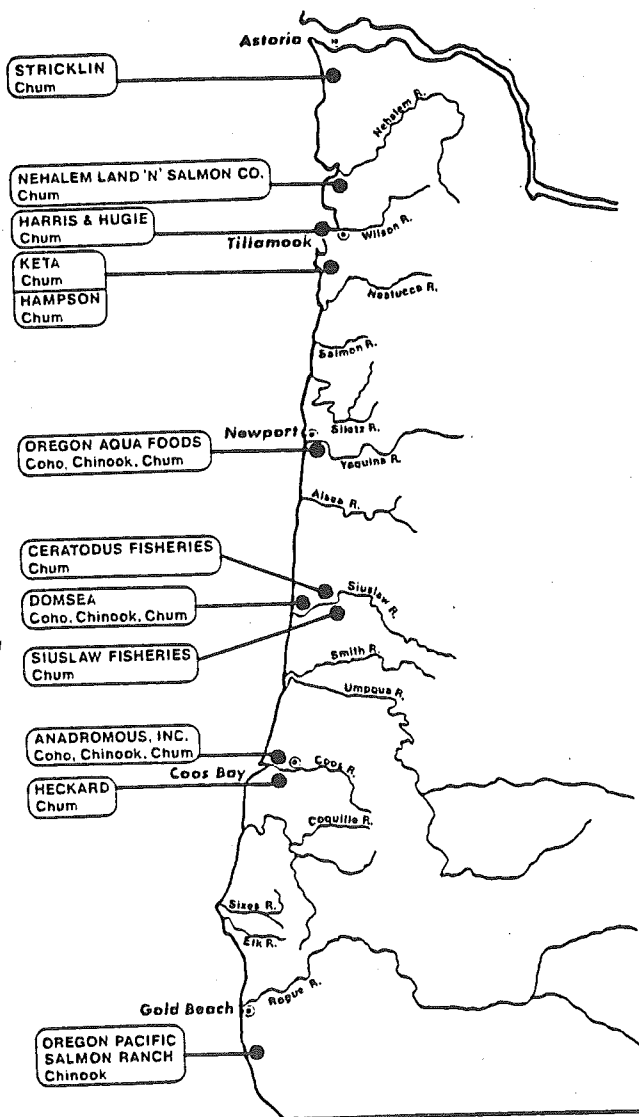


Private Salmon Hatcheries in Oregon 1985



PRIVATE SALMON HATCHERIES IN OREGON

T. Edwin Cummings

Fish Division

Oregon Department of Fish and Wildlife

November 1986

CONTENTS

	<u>Page</u>
INTRODUCTION.....	1
REGULATIONS.....	1
PERMITS.....	4
Columbia River System.....	5
Deer Island.....	5
Skipanon River.....	6
Nehalem River System.....	6
Vosberg Creek.....	6
Foley Creek.....	6
Tillamook Bay System.....	6
Dick Creek.....	6
Larson Creek.....	7
Crown Zellerbach.....	7
Sand Lake System.....	7
Jewel Creek.....	7
Sand Creek.....	8
Yaquina River System.....	8
Wright Creek.....	8
South Beach.....	8
Siuslaw River System.....	12
Sweet Creek.....	12
Divide Creek.....	12
Domsea Farms.....	12
Coos River System.....	13
North Spit.....	13
Jordan Point.....	15
Stock Slough.....	16
Burnt Hill Creek.....	16
Burnt Hill Salmon Ranch.....	16
Oregon Pacific Salmon Ranch.....	17
EVALUATION.....	18
Fish Survival.....	18
Straying.....	19

FRESHWATER PRODUCTION.....	21
OPPOSITION TO PRIVATE SALMON HATCHERIES.....	22
OUTLOOK.....	23

INTRODUCTION

In 1969 Oregon State University (OSU) began hatching and releasing chum salmon from a research facility at Whiskey Creek on Netarts Bay. Their success in using inexpensive streamside incubators to hatch large numbers of chum led to citizen interest. A bill was introduced in the 1971 Legislature to allow private rearing and release of young salmon then the harvesting of returning adults for sale. The resulting Oregon Revised Statutes (ORS) 508.700 - 508.745 authorized issue of private chum salmon hatchery permits and provided guidance for the review of applications, conduct of operations, and general requirements for termination of permits under certain conditions. The Fish Commission of Oregon (FCO) was charged with administering these laws. Since the 1975 merger of the Fish and Wildlife Commissions, the Oregon Department of Fish and Wildlife (ODFW) has been responsible for private salmon hatchery (PSH) matters.

In this report I will discuss the development of the PSH regulations, status of current permits, permits which have been terminated, applications which were turned down, and the outlook for the future. Various tables of supporting or often requested information are attached to this report.

REGULATIONS

Initially there were a variety of reasons in the public's mind to support legislation to allow the issue of permits for PSH's. Some believed salmon could be raised profitably by small companies or as an adjunct to coastal farming. Others viewed salmon ranching as a means to maintain broodstock necessary to a panfish, u-catch, or pond culture type of operation. Some people believed large self-sustaining private hatcheries would contribute fish to the ocean fisheries without the expenditure of public dollars for hatchery operation and save the state from investing in more hatchery facilities.

The program, under the FCO was regulated by applying the statutes through guidelines developed by staff. This worked well when the program included mostly individuals and a few small companies set up mainly to begin chum operations. In 1973 the Legislature added coho and chinook to the PSH statutes with a limit of two permits for the 1973-75 biennium. Applications were processed, and the two coho and chinook permits were issued after public hearings. The 1975 Legislature did not renew the limit on coho and chinook permits. Larger companies had become interested and several applications were on file when ODFW was formed by merger of FCO and the Oregon Wildlife Commission in mid-1975.

During this same period land use statutes were adopted by the Legislature and rules were promulgated by the Land Conservation and Development Commission which, in effect, restricted uses of various areas for release - recapture sites and necessitated changes in our methods for evaluating PSH applications. Other statutes have been adopted which also affect PSH's. Each Legislative session has seen efforts to change or terminate PSH regulations or operations. Most of these have not gone beyond the proposal, or bill status, and committee discussion. Some ORS's have been adopted which require people in other programs to meet certain standards or restrict their activities. One

of these is the group of Salmon and Trout Enhancement Program (STEP) statutes which require a portion of the eggs collected from wild stocks in a stream for a private hatchery be repaid in smolts. ODFW had required this type of repayment to the wild runs for some time prior to adoption of this law, however. Egg availability was affected by a distribution priority list which was for several legislative sessions included as footnotes to our biennial Budget and is now an Oregon Administrative Rule (OAR). This priority list limits the management alternatives for use of available eggs.

Thus some regulations have further restricted the Legislated program for PSH's because they limit ODFW's and the operators' ability to develop the program using the best stocks of salmon. From the hatchery operators standpoint, the development time projected in their initial business forecast may have been extended by these changes. The poor availability of money along with poor egg availability and relatively poor fish survival (until recently) at the PSH facilities or in the ocean has likely held development back more than have changes in regulations. In addition, some of the companies' business plan forecasts for development were over-optimistic or have turned out to have been based on poor facts used in their development.

Oregon statutes require management to optimize benefits of wildlife and food fish for use by present and future generations. This was interpreted by prospective PSH operators in 1978 to mean continued protection from harvest necessary to maintain natural spawners at optimum levels. If this were done, they told the Commission, the higher production rates possible with hatcheries could be expected to produce a surplus return over their needs for broodstock at the private hatchery. This surplus would provide a profit, they said.

Other people interpreted these statutes to mean optimum harvest now and pushed for more liberal seasons regardless of the numbers of wild fish available. These different interpretations of statutes gave rise to continuing dialog, uncertainty, and concern among managers, harvesters, and PSH operators as to the future directions of salmon management by the state.

Application of the statutory authority of ODFW has been a concern to at least some of the PSH operators. The law (ORS 508.710) says, in part, that no permit shall be issued: (1) which may tend to deplete any natural run of anadromous fish or any resident population of gamefish. Permit applications have been carefully reviewed to assure that the several statutory limitations or requirements would be met if the permit were issued. Things in nature are not "fixed" or "cut and dried" as the law seems to treat them and some people would like them to be, nor is our understanding of the biology of salmon and the ecosystem they are part of complete. There can be variations, unexpected changes, and natural cycles or occurrences which are not anticipated but do affect salmon survival. Thus evaluation of PSH applications must be based on use of the best current scientific knowledge at the time the permit is requested to estimate the future effects or possible effects which might accrue from a projected business plan and the proposed operation plan submitted by the applicant. We believe that even with a careful assessment before the operation begins that we are obligated to continually monitor and where necessary include more detailed study to assure the limiting requirements of the permits and statutes are met. This adds cost to the PSH operations because, in accordance with statutes, we charge the company for our

evaluation of their operations (i.e., work that we would not otherwise be doing). Billings for tag recovery, fish identification or scale analysis, inspections, and outside contracts undertaken at ODFW's request may collectively total \$50,000 to \$80,000 per year in addition to their own research budgets. ODFW establishes a budget for PSH evaluation and our expenses are billed with overhead costs to the PSH operators.

Concern has been expressed by some citizens about our reaction to evaluation results. They say that even one fish straying to or from a PSH is grounds for termination of a permit. Estimation of straying is not exact. There can be errors in sampling, in identifying fish by the scale method (misidentification), and in expanding recoveries of tagged fish to estimate the numbers of fish present or caught. It is difficult to discern between natural variation and true effects of hatcheries on runs of fish. We continue to monitor operations at PSH operators' expense to look for long-term trends. These data will help us develop a better basis of facts from which to judge individual operations and their affects on natural runs. This information also gives ODFW a better data base from which to examine future proposals for private hatcheries and to examine the effects of our own hatcheries. As more marking and recovery effort has taken place at public hatcheries we find that fish from our own hatcheries stray more than we had previously expected. However straying from PSH's is a concern because of the larger number of salmon released at one location than at public hatcheries. The origin of some of the stocks involved at private hatcheries has been a concern, but replacement and outcrossing with Oregon stocks has allied some of this concern. We are still trying to assess the possible impacts of strays to adjacent streams, however.

There is a moratorium on applications for chum, coho, and chinook permits through December 1990. Depending on one's interpretation, a moratorium may or may not be needed. This uncertainty stems from events involving the applications of Crown Zellerbach, Inc., for coho and chinook PSH permits which were heard in 1978. There were challenges to issue of these permits and intervenors were involved in the original hearing. The FWC reviewed the hearing record and directed that permits be issued to the applicant. The finding of facts to support this decision was appealed to the Court of Appeals then to the Oregon Supreme Court. The Court, in part, said that the FWC had found: "_ _ _", it is impossible to determine at the present time whether or not the issue of the proposed salmon hatchery permits would violate ORS 508.710(1) and (4) or statewide planning Goal 16." The FWC, then, had ordered issue of permits on an experimental basis. The court reversed this decision in finding that the FWC cannot grant PSH permits as a means to acquire information it needs. Some view this decision as a prohibition of future or new PSH permits under current statutes. It is not possible to say with certainty that a particular thing in nature will or will not happen under any general conditions or even under specific conditions. Trained and experienced biologists can give their best judgement as to the effects or results of a particular combination, series, or occurrence. Normally there are others just as qualified who are willing to refute the first "experts" testimony. Depending on the time and circumstances one or the other may be correct. Future permits for a new site or for expansion of an existing site could be very difficult and expensive to obtain.

PSH operators, like other businesses, need to know, understand, and be able to count on continuance of requirements which allow operation without a threat of closure. Continuing efforts by opponents to change statutes or rules through lobbying, petition, or court action could cause present operators to revise the objectives or long-range expectations. A moratorium, in part, puts off the time of decision on new permits or additions to existing permits and in effect saves prospective applicants and the state money and time during the moratorium period. Poor ocean conditions and variable production by existing operators did not allow a definitive evaluation within the first moratorium period (December 1980 through December 1985). The moratorium on private salmon hatchery permits for chum, coho, and chinook salmon was reviewed in 1985 and extended until December 31, 1990. This moratorium is an Administrative Rule adopted by the FWC and can be reviewed upon recommendation of staff, the Commission, or petition from a citizen for a rule change. No other private salmon hatchery regulations were changed in 1985. Statutes adopted by the 1985 Legislature had little effect on private salmon hatchery operations although several proposals were debated at length.

New PSH's or even survival of those now in existence may depend on clarification of the existing statutes. We know more now about what to expect from hatchery operations (both private and public) so probably could make better input to statutory language should there be an effort to clarify the laws relating to PSH's. However, at this time, it does not appear that a consensus could be reached which would lead to statutes which clearly allow PSH's to operate under specified conditions. Short of legislative clarification of the statutory meaning of PSH laws, we can look forward to larger expenditures by prospective and existing PSH operators, ODFW, other state agencies, and some segments of the public as they try to begin, continue, regulate, or oppose the PSH industry. We will likely be involved in more expensive legal action (or efforts to avoid such action) as opponents challenge our regulation of the PSH operators or as the operators challenge state regulations. For instance, the 1983 Legislature directed the Commission to adopt OAR's to regulate salmon hatchery operations (Cummings 1984). The OAR's adopted by the FWC included rules basic to fish management which were included to explain the need for and the use of hatcheries and hatchery rules. Some of these rules were challenged in court by individuals from the public, but the challenge was not sustained (Court of Appeals of the State of Oregon, CA A32761).

PERMITS

Separate PSH permits are required for each species of salmon even if they are released at the same site. Permits are specific to one site and must meet the biological, land use, and zoning criteria for that site. Should an operator want to change sites, the proposed operation at the new location would have to be evaluated independently relative to the land use issues at that site or essentially as if it were for a new permit.

Processing of an application or revision includes a number of steps: (1) when received it is examined for completeness; (2) more information is obtained if needed; (3) copies are sent to various ODFW (and other agency) personnel for comment in their respective areas of expertise; (4) the comments

are put together in a draft report which is reviewed with the applicant; (5) ODFW Portland staff and legal counsel review the application and the draft report; (6) the Commission is apprised of the application; (7) the application is processed and heard in accordance with ORS Chapter 183 and the Model Rules of Procedure; and (8) the Commission reviews the hearing results and decides whether or not to issue permits. The process may take 6 months for the initial review and finalization of the application and another 6 months for the notification, hearing, and process if there are no appeals.

Land use issues for a proposed site are addressed at local level where county plans have been accepted. ODFW must, by law, assure review and compliance with land use regulations if the local plan has not been accepted. Specifically, Goals 5, 16, 17, and 19 must be considered. The county plan should deal with Goals 5 and 17 but may not adequately address Goal 16, The Estuarine Goal, in relation to a PSH. ODFW will have to determine compliance with Goal 19, the Ocean Resource Goal, because the potential effects may or will affect areas beyond the local area of jurisdiction. These land use considerations must be specifically addressed in the review and hearing process.

Once the hearing process is completed and the hearing officer's findings and recommendations are prepared, the FWC reviews the report and in public hearing decides whether to allow issue of the requested permits. If the FWC authorizes operations at a site, the staff prepares the permits for signature by the ODFW Director. No new permits have been issued since 1979.

There have been permits issued for PSH operations at 14 sites. Orderly termination has been directed for 3 sites as a result of requests to operate at additional or alternate sites. Two chum permits were authorized for the same release site. There are now 11 PSH sites where releases are authorized (Figure 1). There is activity at 10 of the sites (Table 1). Some applications have been withdrawn prior to hearing, others are on hand for hearing should the moratorium end, if the applicant can find an acceptable egg source and then requests a hearing. Most of these are chum salmon applications. We suspect that not all would comply with present zoning regulations. The applications have been on hand for several years and some applicants may not be interested now.

The following discussion of the development and status of existing permits begins at the Columbia River and progresses south along the coast. In each stream system, as appropriate we will show or discuss applications that have been terminated, rejected after public hearing by the FWC, or rejected through court action.

Columbia River System

Deer Island

Anadromous Inc. was authorized permits for release of coho and chinook at a site on Deer Island near St. Helens, Columbia County, in 1974. As the rearing began and the company looked to expand, they found new wells would not provide additional water as expected. Columbia River water could not be used

because of disease potential there. They continued to rear and release fish here while looking for a new site (Table 2). Releases were terminated when a new site was started at Coos Bay but Deer Island was used for freshwater rearing in support of the Coos site for several years.

Skipanon River

A chum salmon permit was issued to Robert Stricklin in 1976 for a site at the outlet of Taylor Lake, Skipanon River, Clatsop Co. Mr. Stricklin proposed to purchase chum salmon eggs from the Lummi and Quinault tribes, in Washington state, but no eggs were available. The relatively low chum salmon releases in Oregon (Table 3) have not provided enough returns (Table 4) either.

Mr. Stricklin has discussed with staff the use of an alternate release site below tidegates and irrigation structures in the Skipanon. He has not made application for such a change. Mr. Stricklin plans to wait until other operators have some success and eggs are available for his operation before he makes more improvements at his incubation site or moves ahead with a release site.

Nehalem River System

Vosberg Creek

A chum salmon permit was issued to Arnold Manseth and Jon Jaqua for a site on Vosberg Creek, Nehalem Bay (Tillamook County) in 1978. In authorizing a permit for this site the FWC terminated Mr. Manseth's earlier permit for Tillamook Bay. Chum fry were first released at Vosberg Creek in 1981. The company reorganized as Nehalem Land 'n' Salmon Company in 1983 and built new incubation and rearing facilities to replace contract incubation and in-creek rearing used in 1981 and 1982. They also built a rack and recapture facility to collect adult chum.

Foley Creek

A chum salmon permit application was refused in 1977 for a site on Foley Creek (Nehalem Bay), Tillamook County. This is a stream where the state had operated a salmon hatchery for many years before building the present hatchery on the North Fork Nehalem. There were good runs of chum and coho into Foley Creek and the FWC expressed their concern about trapping and handling natural runs of salmon and steelhead. They refused to issue the permit on that basis.

Tillamook Bay System

Dick Creek

Cecil Harris and David Kelly were issued a chum permit in September 1972 for a site on Dick Creek, tributary to the west side of Tillamook Bay, Tillamook County. The water supply in Dick Creek did not appear to be good at the time of evaluation and a limit of 100,000 eggs was specified in the permit for the first 3 years of operation. OSU placed 10,000 eggs in the facility

each year from 1972 through 1974 to test the water supply. These eggs hatched comparatively well and a total of 26,600 chum fry were released over the 3-year period. Returns were expected in 1975 but none were realized. Mr. Harris' partner has changed as the property has changed ownership and this permit now belongs to Cecil Harris and Don Hugie according to our records. No eggs have been purchased on this priority for eggs from the OSU Whiskey Creek facility. A guide, set forth in OAR 635-40-015, provides priorities, sets limits, and gives other regulations for purchase of salmon eggs from (or sale by) ODFW.

Larson Creek

A permit was issued to Arnold Manseth for a site on Larson Creek, Tillamook Bay, in 1976. This site was not developed. Mr. Manseth and his partner Jon Jaqua requested that they be authorized a permit on the Nehalem system. The Larson Creek permit was terminated by the FWC when they authorized the requested permit.

Crown Zellerbach

In late 1977 ODFW received an application from Crown Zellerbach (CZ) for coho, chinook, and chum PSH permits at a site located on the old mill property at the north end of Tillamook Bay. ODFW and CZ were notified that several groups opposed issue of these permits. CZ hired consultants and prepared extensively for hearings on their applications. The hearing was the first held under contested case procedures with an appointed hearings officer. Previous hearings for other permits had been handled by the FWC because we had received no notice that anyone wanted to be a party to the hearings or to contest the possible decision. The CZ hearing lasted through 4 days of testimony with 4 sets of attorneys representing the various parties. The FWC subsequently reviewed the record of the hearing and the recommendations, listened to the intervenors during a public hearing and, after due deliberation, directed that permits for chinook and coho be issued. The intervenors appealed this decision claiming that the Commission erred in issuing permits. The Commission's action was reversed by the Court of Appeals. This reversal was upheld by the State Supreme Court.

Sand Lake System

Jewel Creek

A chum permit was issued to Keta Corporation in December 1971 for a facility located on Sand Creek and its tributary, Jewel Creek, at the north end of Sand Lake, a small estuary in Tillamook County. This was the first private chum operation established under the 1971 legislation. The facility includes a water diversion from Jewel Creek; settling or water storage pond; incubators; discharge ditch; and adult capture rack, trap, and holding area.

Keta was authorized to obtain seed stock in the initial three years of operation from the wild chum run after allowing a minimum number of adults upstream to spawn. Keta personnel recorded how many chum and other species were put above the rack, dates, etc., to provide information on the size of

natural runs into the stream and give a basis for determining how many chum should be released above the racks for natural spawning in succeeding years. Chum fry released by Keta have included offspring from wild stock, Whiskey Creek, ODFW's Coal Creek trap, and returns to Keta from their own releases. Keta's priority right to surplus Whiskey Creek eggs expired in 1979.

Sand Creek

In October 1973 Alfred Hampson was issued a chum permit which authorized: (1) a combined operation with Keta on Jewel Creek tributary to Sand Creek; (2) separate purchase of Whiskey Creek eggs in priority; and (3) identical permit restrictions as had been imposed on Keta. Mr. Hampson, now doing business as Hampson, Inc., first received chum eggs in the fall of 1980 and has completed his priority of eggs from Whiskey Creek. Operations continue to be combined with Keta.

Yaquina River System

Wright Creek

Oregon Aqua-Foods (OAF) was organized in 1972 to rear salmon and trout to pan-size in ponds and to release chum salmon. The company began operations at a site on Wright Creek just above Poole's Slough, Yaquina Bay (Lincoln County). In November 1972 they were issued a PSH permit for chum salmon. Coho and chinook PSH permits were issued in March of 1974. They intended to release salmon smolts and harvest adults as brood stock for the pond rearing operation. Salmon were released at Wright Creek from 1973 until it was phased out by OAF through a voluntary termination procedure completed in 1982.

By 1973 additional financing had been obtained and the company had ponds at both Wright Creek and on a manmade stream above the Highway 101 Bridge at South Beach.

South Beach

At South Beach near the Marine Science Center on Yaquina Bay a pumping station was installed to provide water from the bay, and large cement rearing ponds were built to raise fish to pan size. One of the two earthen ponds initially built to settle out solids from the fish rearing ponds was not needed and so was converted to a U-catch fishing operation. The U-catch pond was operated until the site was rebuilt. More coho, chum, and chinook were released and some adult coho and chinook were held in the rearing ponds to see if they would mature for egg collection in the fall of 1975 and 1976. This did not work well and the effort was abandoned. OAF also experimented with rearing juveniles to adult size to obtain eggs for brood. This experiment was abandoned before completion because they needed the pond space for rearing small fish.

Business Development: The company began as a small corporation with some stock held by people in the Newport area. Fisher Corporation became a major share holder in OAF and began to increase it's stock share in the company. Weyerhaeuser Company purchased the OAF stock in 1975 and since that time has

operated the company as a wholly owned subsidiary. They shifted from primarily pan-size salmon and trout (with some ocean ranching) to only ocean ranching of salmon at the saltwater facility. OAF shut down a processing line which had been used for pond reared fish but retained their driers and pelleting equipment for use in making fish food for the salmon operations. They later quit making fish food but installed a line for processing adult salmon for market. The adult processing operation has now been terminated.

Broodstock Development: Beginning in 1973 OAF purchased eggs surplus to ODFW's hatchery program for use in pond rearing and ocean release (Table 5). When they obtained coho and chinook permits there were coho and chinook on hand in the pond rearing program. Some of these were raised to smolts and released in 1974.

In 1977 OAF cooperated with ODFW to fund development of a Yaquina fall chinook brood stock and to determine ocean contribution and migration of these chinook in the ocean. Using funds provided by OAF we collected adult chinook to obtain eggs for rearing (Table 6). ODFW released 25,000 adipose and coded wire tag (CWT) marked chinook smolts (reared by OAF) in the Yaquina River tributaries to replace the production potential of adults collected for eggs. OAF released another 25,000 CWT marked chinook at South Beach along with the other surviving smolts which were marked with a single fin clip. These marked fish returned and were used for broodstock to replace ODFW hatchery stocks which OAF had previously used for broodstocks. Public opposition to this program forced ODFW to abandon the project before we had collected eggs for a complete cycle. However, chinook return in more than one year and OAF was able, in time, to switch to the Yaquina stock by maximizing their use of returning marked Yaquina origin stock chinook for broodstock. The company was satisfied to develop this stock slowly and now has an adequate brood stock potential for their full program using this local stock of fall chinook. The use of a local stock for brood stock development reduces the problems of interbreeding with wild stocks on the spawning grounds. However, the company is concerned because these fish are often dark and therefore less marketable at return than are stocks in some other rivers.

The OAF spring chinook stock was derived from ODFW's Trask Hatchery. These have not been a major thrust of the OAF program but here too a stock has been started for further development if the company chooses to do so. They plan to test the Rogue stock spring chinook in 1986. This is a south migrating stock so more may be caught in Oregon.

Coho smolts released by OAF before 1978 originated from ODFW hatchery surplus and OAF returns. The company could not meet its development schedule using only Oregon eggs. The plan had been reviewed by ODFW staff and the FWC when permits were considered for their second release site at Coos Bay in 1977. We examined several sources of eggs proposed by the company. Puget Sound coho eggs were available, met disease inspection restrictions, and were expected to move into the bay and streams during late August to late October or early November. This timing was expected to afford a separation from wild stocks that spawned mainly in December and January. The peak estuarine entry time of late September and early October also meant that the imported stock of fish would be available through the normal fishing season in the ocean which was a concern of several fishing groups. Thus we allowed import of eggs to

begin larger releases, but informed the companies (OAF, Anadromous and Domsea) that they must in the future develop a separate and discrete stock at each facility. OAF maintained a distinct line of Siletz stock at Yaquina, first as an experiment then to provide the Oregon brood stock base. No surplus eggs which could be used by OAF have been available from ODFW in recent years so outcrossing and replacement, with only their own Siletz group, has taken longer than hoped to accomplish. One brood year has been replaced with the Siletz stock. In 1985 Oregon Aqua Foods purchased coho eggs from surplus at ODFW's Fall Creek Hatchery. These Oregon coastal stock eggs are acceptable and provide an Oregon base for the second of OAF's brood years of coho. OAF releases zero age coho, that is, they raise coho in warm water with heavy feeding so that they attain smolt size in their first year of life and return from the ocean as adults in their second year. OAF then has only two brood years of coho instead of the three maintained at ODFW and other hatcheries where yearling programs are followed.

Chum salmon have not returned to OAF or any other of the PSH's at the rate they expected.

Operations: OAF rebuilt the South Beach facility in 1977. The outlet was changed from a natural type of stream channel (man made) at the southwest corner of the old site to a new cement fishway on the north, or channel end of the facility. This shift made way for construction of the new boat basin at South Beach. The OAF plan was to reach the production capacity for this PSH release site with 9.5 million coho, 20 million chum, and 10.6 million chinook by 1983. As OAF began to use and evaluate this facility they found that coho should be released at a larger size than was planned for when the release facility was designed. Chinook and chum also appeared to survive better when released as larger smolts. This meant more pond space would be needed or holding (acclimation) time would have to be reduced at full production level.

In 1982 OAF leased their Coos Bay release site to Anadromous, Inc. In authorizing this change in operation at Coos Bay the FWC allowed OAF to temporarily shift release of full coho production for both sites to the Yaquina facility. There were 1,284,193 pounds of salmon released through the OAF Yaquina release site in 1982 and 1,187,135 pounds in 1983. ODFW required all fish to be released prior to August 20 beginning in 1984 because there was a problem with coho released later in 1983 moving upstream instead of to the ocean. This could increase potential competition with wild coho in the Yaquina River above the bay. OAF could allow no more than 10 days per cycle of stocking, rearing for acclimation, and release. The company reported that most fish were held for 5 days before release. I believe this short acclimation time is a factor contributing to major straying of adults to streams adjacent to the Yaquina.

If (as is likely) the fish are stressed in sorting, loading, and transfer from fresh to saltwater, then it is doubtful that they could fully recover before they are released and again received a physiological stress. There is little question that these stressful situations can adversely affect survival of the fish in the wild. Heavy programming of pond space at Yaquina such as was done in 1982 and 1983 leaves little if any leeway for a fish culturist to improve either the quality or viability of the fish being cared for. Half or less of the 1983 rate appears to be a more useful loading rate, and even fewer

fish should be programmed for this facility, if survival is to be maximized through improved hatchery practices. An apparent return rate of over 4% in 1986 may satisfy company officials that husbandry practices are acceptable, however. If straying to other systems could be reduced an even better return rate could be expected during times of good ocean conditions.

OAF has been experimenting with releases of salmon at sea off Yaquina Bay using a barge. These experiments are similar to those being conducted by ODFW using deck tanks off Astoria and by Anadromous with a barge off Coos Bay. Early efforts gave encouraging results from some of the various groups released by OAF. Based on the results of mainly one year OAF wanted to move ahead to release several million coho offshore in 1985. ODFW staff had earlier authorized the 1985 OAF production program which included some 400,000 coho for experimental offshore release. The staff opposed increasing offshore releases without verification of the earlier years results. OAF appealed to the FWC who allowed some 800,000 total by adding the Siletz stock on hand to those allowed by staff for offshore release. Staff had a concern that the offshore releases could increase straying to other streams along the coast but the FWC felt the Siletz stock would less seriously impact other local stocks than would the progeny of earlier imports. Gradual development of offshore release levels from this point should allow for determination of potential impacts before substantially larger releases are authorized.

Releases of 83,000 coho off Newport in 1984 gave some promising results. Releases in 1985 apparently gave mixed results and require more detailed evaluation. The private operators hope that offshore releases, beyond the nearshore predators, will give a better survival with more fish for the ocean fishery and their onshore recapture station. The companies have said they need 1.5% to 2% return of fish at full production to remain in business. Production remains well below permitted levels. OAF announced that they would lay off 14 of their 24 employees in 1985 and reduce 1986 coho and chinook releases. More recently they have been negotiating to sell their whole operation.

Company officials tell us that OAF has invested nearly \$40 million in development of operations and facilities. They have also expressed concern about apparent opposition to their program in the Oregon Legislature, from some commercial and sport fishing groups, and from ODFW as they attempt to develop their aquaculture program. Some of their largest releases have been made in the face of El Nino's poor ocean conditions and obvious poor survival potential. These conditions also adversely affected smolts from public hatcheries and those from wild stocks. Despite these production problems there remain viable brood stocks at OAF and at sea from which to build larger releases in the future.

The FWC, in 1986, discussed purchase of the OAF hatchery and release facilities. They said that private operation is to be preferred but that if no private company will buy and operate OAF, and it would otherwise be closed, the State or Federal government should consider purchase to maintain the OAF production so ocean fisheries will not be further reduced. Purchase of the facilities could be an important savings to the public (depending on the asking price) rather than building other facilities which will be required to replace existing OAF production or to meet mitigation requirements for

projects in other areas. OAF continues to negotiate for a sale to private parties.

Siuslaw River System

Sweet Creek

A chum salmon permit was issued to Siuslaw Fisheries Inc. (Karl J. Manseth and Ronald F. Hichens) in April 1972 for a site located on Sweet Creek, tributary to the Siuslaw River estuary in Lane County.

The company reorganized, acquired additional funding, and built a freshwater facility near Coburg north of Springfield. They planned to rear salmon under contract for other operators and handle their own chum incubation and rearing there too. This did not work out for them and the contract operation was closed. Later, Anadromous leased this site for a few weeks to rear chinook.

Eyed chum eggs (1973 brood) were obtained by ODFW from Quilcene Hatchery on Puget Sound in 1974 to determine if they could be raised to provide a brood stock here in Oregon. Siuslaw Fisheries operating on Sweet Creek participated with ODFW in this experiment and released 221,000 fingerlings in 1974 from which some adult chum returned in 1976. Whiskey Creek eggs were available in the fall of 1974 and the company released 800,000 small chum in 1975. They released over 1 million chum in 1979 and small numbers thereafter. In 1982 and 1983 Siuslaw Fisheries sold their chum eggs to Domsea Farms. No more chum have been released at Sweet Creek. The rack and trap at this site have been removed. Any chum spawning in Sweet Creek now are from natural production. The principles of Siuslaw Fisheries tell us that they intend to retain the permit for this site and possibly again raise chum if the program proves successful elsewhere.

Divide Creek

John Marshall, Lester Nelson, and Timothy Morello (Ceratodus Fisheries, Inc.) were issued a private chum salmon permit in 1973 for a site on Divide Creek a tributary to the Siuslaw River estuary in Lane County. The company raised 500,000 Quilcene stock chum eggs in cooperation with ODFW for release in 1975. No adults returned and no more fish were released. There has been no further activity at the Divide Creek site and we have been unable to contact Mr. Marshall.

Domsea Farms

In 1977 the FWC authorized chum, chinook, and coho permits for issue to Domsea Farms for a site near the mouth of the Siuslaw River estuary in Lane County. The permits were contingent on completion of leases and compliance with zoning regulations. Permits were issued in the spring of 1978 and releases began that summer.

The company built experimental facilities using swimming pools and plastic lined dirt ponds from which they released several hundred thousand

coho from 1978 through 1980. Returns were not as large as expected. Siuslaw River fall chinook were collected for ODFW's stock assessment project and to develop a brood stock at Domsea. They marked fish for release at their site and for ODFW to release upstream to replace adults collected. The replacement group in the stream contributed well in the fishery and was said to have returned to the streams relatively well, but a definitive evaluation was not made there. The hatchery group contributed in the fishery but returned poorly to the release site. Poor attraction at the fishway is suspected to have contributed to this. Chum were released from 1981 through 1983 but at a level below that expected to provide significant returns. Few chum have returned.

Ocean conditions may have had some effect on the Domsea fish, but poor trapping facilities likely caused the major impact. Their first recapture facilities were of boards and sandbags and fish could get to it only at high water after swimming over a rock jetty. A cement fishway and trap was then installed in the jetty. This facility was modified, adapted, and adjusted each year.

OAF operated the site in 1984 to determine if it might meet their needs. They operated the recapture trap successfully and collected both chinook and chum for eggs. All coho were sold in the round to a processor however. OAF did not want the coho for brood stock because of a suspected disease at Fall Creek, the origin of this stock. The chinook and chum were acceptable stocks. Domsea had given ODFW all of the coho eggs collected in 1983 to be used in our Salmon and Trout Enhancement Program (STEP). OAF followed suit in the spring of 1985 by giving us all of the Domsea 1984 brood chinook and chum fingerlings, which resulted from returns to the Domsea trap. We planted both the chinook and chum fingerlings in Sweet Creek in the spring of 1985 for natural rearing.

Domsea operated the trap in 1985 but no returns were expected in 1986. If this site is to be reactivated new brood stocks will have to be developed. We cannot predict when suitable coho or chinook eggs might be available for use here.

Coos Bay

North Spit

In July 1976 Weyerhaeuser Company was authorized permits for a site on the North Spit of Coos Bay. The release and recapture site, located near Bay Mile 6, was to be operated with water pumped from the bay. This was the same water source that was used by Anadromous located about 3 miles up bay. During the hearing on the Weyerhaeuser permits, Anadromous protested issue of these permits predicting that adults would not properly separate and mixing of returns would occur. Weyerhaeuser representatives said they did not believe this would be a problem. They also told the FWC that if mixing occurred they would resolve the matter with Anadromous.

The North Spit facility would, according to the Weyerhaeuser proposal, be supported by a new freshwater hatchery to be built in the Willamette Valley

(see Freshwater Production, pages 21 to 22). In 1978 we were notified that Weyerhaeuser had included North Spit as one of the OAF facilities for business purposes. We had considered it as an OAF subsidiary previously so told the company the change was acceptable but that we would continue to treat North Spit, the freshwater facility, and the Yaquina release recapture site as separate parts of OAF.

OAF built several asphalt lined ponds at North Spit along with pumping facilities, a fishway, and operations and storage buildings. Temporary fish handling facilities were installed as adults began to return. The facilities were not expanded to handle the full production authorized under the permits which had been issued.

Brood Stock Development: Chum salmon were imported by Weyerhaeuser, Co. from Sakhalin Island, USSR, in 1978 after extensive testing to be certain that disease would not be imported with the eggs. The resulting fingerlings were released in 1979. Less than a dozen adults returned from the imported chum so no run was developed from the import effort. No other chum eggs have been imported from outside the United States. OAF made no further effort to release chum at Coos Bay. Part of the North Spit priority for Whiskey Creek chum eggs was exercised by OAF but they chose to release the young chum at South Beach (Yaquina Bay) with other Whiskey Creek stock already scheduled for release there. Anadromous does not plan to develop chum operations at this time.

No discrete coho brood stock was developed for Coos Bay. OAF used mainly imported Puget Sound stock at Coos Bay. When there was a choice ODFW required that smolts from Puget Sound stocks be released at Coos Bay instead of at Yaquina Bay because we wanted this North migrating Puget Sound stock released as far south as possible to increase its availability to Oregon fisheries.

Eggs were collected from fall chinook returning to Coos River. This program provided a small brood stock of marked returns. Anadromous is continuing this stock which was started by OAF, but has requested eggs and authorization from ODFW to switch to the Rogue fall chinook stock, which is not dark at return like the Coos fall chinook stock.

Spring chinook eggs were obtained when surplus stock was available at Cole Rivers Hatchery on the upper Rogue River. This is an acceptable stock for use at Coos Bay. Anadromous will continue the use of this stock as spring chinook are a major part of their program.

Operations: A floating net pen was used at Coos Bay in 1977 to release 86,000 coho. OAF made no effort to build recapture facilities for the returning adults of that release so were not allowed to release fish again until recapture facilities were built. OAF did not fully develop either the facilities at North Spit or the salmon production levels authorized by permits for that site. They used the basic phase construction of a few ponds for acclimation and release from 1979 through 1982. From these facilities releases peaked with 8.2 million chum in 1979 and a high of 10.9 million coho along with 150,000 chinook in 1981.

Jordan Point

In March of 1976 Anadromous, Inc. was authorized permits for coho and chinook at Jordan Point located near Bay Mile 9 of Coos Bay in Coos County. An orderly termination at Deer Island (Columbia River) was ordered by FWC as they authorized the permits for Coos Bay. In 1976 Anadromous released fish at Coos Bay for start up of that facility and at Deer Island in compliance with the orderly termination. Anadromous continued to improve the Jordan Point facility as they replaced temporary ponds with cement ponds for rearing fingerlings and holding adults.

Anadromous raised smolts in their own or leased facilities and purchased smolts from contract operators to get enough to begin their program. Anadromous leased the North Spit site from OAF in 1983 and have continued to release fish from there since.

Broodstock: Anadromous has been a major chinook producer among the private operators. They used a mix of acceptable Oregon coastal stocks to develop their fall chinook brood. Rogue stock spring chinook is the acceptable stock for Coos Bay and is reared for release by Anadromous. They would prefer to use Rogue fall chinook, too, because they are of better market quality, but have not been allowed to do so because of genetic concerns.

Anadromous coho stock is a mix of ODFW, imported, and OAF stocks, which are well underway with outcrossing or replacement. Anadromous uses a yearling coho program but have released zero age smolts also in some years. They tell us a yearling coho program is planned for the future. Anadromous does not have a zero age coho capability at Fort Creek in the Klamath Basin, their freshwater rearing site. In 1984 eggs from Bandon Hatchery, which were surplus to the hatchery, river system, and ODFW's other needs were sold to Anadromous. These were raised for release in 1986. They returned 25,000 of the smolts to ODFW in payment for the eggs. Bandon Hatchery (Coquille River stock), Coos, and the nearby Eel Lake coho stocks are all acceptable for outcrossing or replacing Anadromous eggs. No surplus coho eggs were available in 1985.

Operations: Anadromous operations have essentially been shifted to the old OAF site which Anadromous completed purchasing in May 1985. They still operate Jordan Point to retrieve adults returning from releases there or that bypass the North Spit site. In 1985 the FWC authorized continued operation of both sites on Coos Bay for release and recapture.

Anadromous began releases in 1983 at the OAF North Spit site which they leased from OAF in 1983 and 1984 to see if the site would meet their needs. In 1983 OAF and Anadromous ran recapture operations jointly. In 1984 Anadromous was solely responsible for operation at the site. Final purchase from OAF was in May of 1985. They rebuilt the site by removing the small asphalt ponds and building large, long cement raceways.

Anadromous has expanded its production releases but at a rate which will take several years to reach the total of their permitted release. They rear coho juvenile at Fort Creek and have held adult spring chinook there. In recent years they contracted with OAF at Springfield to hold and spawn fall

chinook and coho adults for them. OAF sells the juvenile coho to Anadromous for rearing at Fort Creek and rear the fall chinook at Springfield for Anadromous until time to ship the smolts to Coos Bay.

Anadromous is participating with OAF in releasing salmon offshore from a barge. This program was authorized by ODFW and compliments another ocean release study conducted by ODFW.

Business Development: Anadromous was formed as a corporation in which most of the stock was held by its officers and associates. As the company continued operation at Deer Island and then at Coos Bay the number of stockholders increased. Charter Oil and Menasha Corporation became stockholders during the 1976-77 startup at Coos Bay. The Jordan Point facility was located on land leased from Menasha. In 1978-79 Anadromous was still owned by over 20 shareholders according to reports they provided ODFW. Charter Oil continued to purchase stock and retained controlling interest until the stock was sold to British Petroleum who now own nearly all of the stock in Anadromous.

Stock Slough

Calvin Heckard was issued a chum salmon permit in 1976 for a site on Stock Slough, tributary of Catching Slough, Coos Bay, in Coos County. Mr. Heckard planned to obtain eggs from Indian tribes in Washington state, but none were available. Temporary incubation and rearing facilities were tested with eggs provided by OSU. Chum eggs surplus to the Whiskey Creek program were purchased in 1982 and 1983 but were not available in 1984. Releases in 1985 were the young of adults which returned to Mr. Heckard's facility.

Mr. Heckard built a trap to capture returning adults in 1983 and improved it in 1984. Although few chum returned, the trap successfully collected coho which had been released from a STEP project upstream. ODFW used these coho in their STEP program to supply incubation boxes and milt was collected for use by Anadromous to outcross their production females.

Burnt Hill Creek

Burnt Hill Salmon Ranch

A PSH permit for chinook was authorized for issue to Burnt Hill Salmon Ranch, Ltd. (BHSR) in 1978. The site is located on Burnt Hill Creek in Curry County. Burnt Hill Creek is a direct ocean tributary without an estuary. The BHSR facility was constructed between a major fill (and culvert) on Highway 101 and the ocean beach. The BHSR permit was not issued until 1979, after the company had obtained financing as required by the FWC.

Business Development: BHSR was formed as a limited partnership and sold stock to fund construction and operations. All of their stock was related to the total of the release permit for 5 million chinook they had been authorized so when their \$5 million worth of stock was sold they had no fall-back position. They tried to obtain additional release permit limitation but this

fell within the limitation of the existing moratorium on additional private hatcheries or new production so this was turned down by the FWC.

The original construction at the site proved much more expensive than expected with high costs for road building and installation of their pumping station in the ocean. BHSR did not complete all of the proposed ponds for rearing fish. They leased outside facilities for holding adults and initial rearing. Their saltwater pond capacity limited their development potential to less than one-half of their permitted production of 5 million chinook.

BHSR borrowed money to operate and told us they could not repay it because their returns in 1982 and 1983 were too low. They felt El Nino contributed to this. In 1983 BHSR turned their assets over to one of their creditors who in turn sold the facility to the highest bidder. The new owner is Oregon-Pacific Salmon Ranch (OPSR).

Brood Stock Development: At first ODFW attempted to collect eggs from fall chinook which entered Lobster Creek, a tributary of the lower Rogue River, to obtain a brood stock for use by BHSR. We were not able to keep the rack operational during high flows common to this stream in the late fall and early winter. Most of the resulting smolts were released back to Lobster Creek as repayment for eggs removed in accordance with the agreement between BHSR and ODFW. BHSR also funded the trapping operation. Some fall chinook smolts were released by BHSR in 1980 and 1982. Low fall flows in Burnt Hill Creek, the expense of pumping ocean water to augment the stream flow so adults could get from the ocean to a trap in the creek above the beach, and the poor availability of eggs led BHSR to give up their plan for production of fall chinook.

Surplus spring chinook eggs were available at Cole Rivers Hatchery on the Rogue. BHSR purchased part of these to begin their production. As adults returned they were successful in holding them in fresh water for maturation and spawning. This had previously been a problem for other companies. BHSR was able to use their own broodstock to increase production but major returns could not be expected until 1985 or 1986.

Oregon Pacific Salmon Ranch

OPSR purchased the adults of Burnt Hill Salmon Ranch Ltd. in 1984 and released spring chinook and collected adults that fall. A small number of chinook were available for release in 1985.

OPSR plan to release about 1 million chinook per year to establish their brood stock. These will be raised from eggs collected at the OPSR trap on Burnt Hill Creek in 1985 and held at an isolation facility along the nearby Pistol River. They now operate the isolation facility at a temporary site and are planning to build a permanent facility for holding adults in isolation, incubation, and initial rearing.

EVALUATION

Private operators have conducted evaluations, hired private consultants, graduate students, and have paid ODFW to evaluate or monitor the effects of operations. An estimate for those costs of which ODFW has been informed is shown in Table 6.

All coho and chinook permittees are required to mark fish for evaluation monitoring purposes which includes determination of the salmon stocks migration routes and estimation of their contribution to the ocean fisheries. PSH's also mark fish for their own research. ODFW bills the operators for a portion of our projects, related to the recovery of tagged fish and tag processing based on the proportion of tagged fish each released the year prior. Other projects undertaken by ODFW which relate to a specific PSH and are billed to that permittee.

OAF expanded releases rapidly to production levels. Much of their experimentation has been done with production levels (large numbers) of fish. They produced a relatively large proportion of all the fish, particularly coho, released by PSH's. Much of our evaluation for PSH's has been with OAF releases because they have produced large numbers of zero age coho, which we needed to know more about, and they marked more fish than did other operators. We analyzed results of their experiments and required specific groups to be marked for evaluation in the ocean. Other coho and chinook operators also have marked fish for both their own experiments and as required for our evaluations.

In this section we will review some of the work that has been done and the information that has been obtained.

Fish Survival

Survival of fish reared is basic to profitability and continued operation of PSH's. Fish released at PSH's are public property while in the wild and can be taken by commercial and sport fishermen. The PSH operator is not compensated for these fish. Thus the most important component to the PSH is the return group from which he must obtain his brood stock and sales product. Returns have not been consistent partially because annual releases from PSH's have been variable. Efforts with chinook have been more toward development of broodstock than toward full authorized production. PSH's have been more active with coho, have imported coho stocks, and have raised coho for release at times other than those used by ODFW. We have concentrated our evaluations of private operations on coho.

Coho adults have returned to the private hatcheries at a lower rate than to ODFW's Fall Creek Hatchery (Cummings 1985). Reasons for relatively poor coho survival previously at the PSH's are not all known. However, survival generally improved at some stations (except during El Nino) as size at release was increased. PSH operators release far more coho than they can accommodate in their facilities at one time. To do this they release coho from May into August and have also released them in September. They found that coho must be larger than the 25 per pound originally programmed in the facility design for

OAF (chinook also had to be larger than they expected) and that size must also increase as the season progresses. Even with larger size at release for both zero age smolts (accelerated growth to reach the smolt stage in the first year instead of the second year of life) and full term coho (16 to 18 months of hatchery growth to attain the smolt stage), the adults returning from July and August releases are generally smaller than are those released at 15 per pound or larger before the end of June. Thus I conclude that: 1) coho released at small to moderate size after June tend to be smaller throughout life than those released earlier, and 2) releasing larger smolts as the summer progresses does not fully compensate for lost ocean growth, but does provide a larger adult than can be realized from the release of small coho.

Prior to 1985 we used only adult coho (longer than 20 inches) to estimate catch and total return. Because some coho adults were small in size there was an inflated number of jacks in the records of returns. Jacks and small adults are now separated by scale analysis rather than size for biological considerations. We also used this method to revise earlier data. This changes Table 7 from those in some past reports (Cummings, 1982, 1983) in that the number of jacks shown is less. Small coho adults are now included with the other adults in most calculations of numbers of fish. Returns in 1984 improved slightly over the poor El Nino year of 1983 probably due to a shortened fishing season needed to protect natural spawners. Survival to returning adults in 1985 was better than earlier years. The operators tell us they need to obtain more than a 1% to 2% return at full permit to declare a profit after amortizing investment in research and facilities. The 1984 coho returns were the first to exceed 2%, but release levels were well below the total permitted. The operators reported preliminary figures showed returns in 1986 exceeded 6% at Anadromous and 4% at Oregon Aqua-Foods from the approximately 4 million coho released by each company in 1985. These release levels are still well below the full production for coho that the operators told us would be needed to show a profit. If the operators continue to reduce levels of coho production during improving and good ocean conditions they will not be able to build up funds necessary to compensate for financial losses due to poorer fish survival rates in times of poor ocean conditions.

Straying

Straying has been discussed by Meyers (1980), Cummings (1982, 1983, 1984), Nicholas, Van Dyke, and Buckman (1982), Nicholas and Van Dyke (1982) Nicholas and Herring (1983), Jonasson (1983) and by McGie in annual spawning fish reports (1983, 1984) and 1985 (in process), then by Jacobs (1986, in draft).

Meyers in 1978 and 1979 found some juveniles moving upbay and remaining in the bay for a period of time after release. She estimated that the juveniles were mostly out of the estuary within two weeks. Others found a few juveniles with OAF tags or distinctive scale patterns in some tidewater tributaries but the numbers were comparatively low confirming Meyers results. In 1982 a portion of the juvenile coho released by OAF were observed in tributaries of the lower Yaquina River (Jonasson 1983). We have not found any large group of coho moving above the release site since 1982.

Extensive evaluation of these 'upstream' fish in 1982 and 1983 was financed by OAF. These coho were identified from coded wire tags and scale analysis to be from OAF which had released them at their PSH across the bay from Newport. A few of these coho remained in the streams until May 1983 but their numbers generally declined during and after the December-January freshets. We found that most of these coho (92%) were released after August 25. Although there were thought to be unusual temperature conditions onshore in the ocean which may have increased upstream movement rather than out migration in 1982 we, at ODFW, informed operators that we would no longer allow production level releases of coho after August 20. Experimental releases after August 20, are allowed. The operators were particularly concerned about the ODFW restriction and reported their best survivals had come from September releases. Major upstream movement of juveniles has not been observed in other years at Yaquina Bay or in any year at Siuslaw or Coos bays where coho are also released by private operators. There have been cases reported where coho released by ODFW in freshwater have migrated upstream but these were not common and are thought to be caused by some local condition such as cooler water upstream.

Adults have been found to stray to the spawning areas above private salmon hatchery sites and to adjacent streams. For some reason this appears to be more of a problem with coho that were released as zero age smolts. This could also be a result of the shorter time that OAF holds fish prior to release. We have observed these strays above OAF's South Beach facility on Yaquina Bay, at Salmon River, and occasionally at other hatcheries. Stray adults have been found at our Eel Lake trap when adult coho returned from large releases of zero age coho made by OAF at Coos Bay. This may be a coincidence or it may be that operators have yet to release enough yearling coho at one time to make a significant showing above their facility or in a nearby stream. Adult coho from yearling releases have been found above the releasing hatchery but not at the levels found in the Yaquina above OAF's facility or at Salmon River. These data will be analyzed and made available in a separate report. As the numbers of returning coho adults from the yearling releases at Coos Bay increased in 1983 we began more concentrated efforts to examine spawning grounds there. We found strays in the Coos System but generally not at traps which we operate to capture adults in adjacent streams.

At Salmon River in 1983 scales were collected from adults to separate out strays from those being used for hatchery egg collection. ODFW scale analysts found nearly 50% of the adults which entered the Salmon River hatchery in 1983 with an accelerated scale pattern peculiar to OAF releases. Coded wire tags verified that these fish originated at OAF on the Yaquina. Other strays were also found at Salmon River but in relatively low numbers. In 1984 the accelerated scale pattern made up only 2.9% of the coho adults sampled at Salmon River Hatchery. We collected scales on the spawning grounds and found a 10.2% occurrence of accelerated scales in those collected. This is well below the estimated occurrence on the Yaquina system spawning areas. The occurrence of OAF strays increased at Salmon River in 1985, but lower levels of strays were found at other, nearby ODFW facilities. We did not do definitive studies to define the proportions at other stations, however.

On the Yaquina River spawning grounds there is a separation in time of return with most of the hatchery adults returning earlier than do the bulk of the wild coho. This tends to separate the preponderance of each run from the other and minimizes, naturally, cross breeding on the spawning grounds. There is also some separation by area with the preponderance of hatchery coho spawning in the tidewater tributaries (which are relatively small) and in the lower river and tributaries while more of the wild coho are expected to spawn in the upper Yaquina and upper Big Elk (a major Yaquina tributary). Some strays have been found throughout the system however. No stray Anadromous coho were reported from streams adjacent to Coos Bay in 1984-85 or 1985-86. We are examining the spawning grounds on Coos River, the Yaquina and adjacent streams for strays in 1986 but results are not yet available. These data will be discussed in a separate report due out in 1987.

In 1981 ODFW estimated the number of wild coho straying into OAF at Newport (Nicholas and Van Dyke 1982). Estimates in 1982 were made by Parker and Fisher (1983) of the University of Washington. These estimates were published by the University of Washington and in several ODFW reports. There was some concern as to whether or not the assumptions of these estimates were met. The estimates seem relatively large considering that no marked coho released above South Beach at Wright Creek (when that facility was operated) strayed into South Beach and that no adult coho were caught at South Beach in the years before adults were due back there from South Beach releases. One would expect hatchery fish to stray more than wild fish. We noted in 1985 that the numbers of OAF-origin adults straying into the Yaquina were fairly constant but the percentage occurrence of these adults varied considerably with changes in the escapement of wild spawners. The occurrence of so called hatchery strays on the spawning grounds has not so far been proportional to the numbers of coho released from or returning to South Beach. This is all rather confusing and certainly caution should be exercised in using the estimates of strays to the spawning grounds. These data and the scales collected at the hatchery are being reviewed now using the old-fashioned visual reading method. Preliminary results suggest that the method used in 1982 and 1983 to analyse the scales, a mechanical comparison with scales of supposedly known origin, was not as accurate as expected in this application. The results will be discussed in a separate report.

The method of estimating the numbers of strays to the spawning grounds has also been examined for accuracy. Some adjustments were made in the selection of areas in which spawning fish would be counted on the selected study streams.

FRESHWATER PRODUCTION

Water supplies at the coho and chinook release sites are too limited to allow incubation and/or early rearing at the release recapture site. Most of the available water is saltwater. Salmon do not mature to the spawning stage well in saltwater and eggs or newly hatched fish cannot be held in saltwater. All of the coho and chinook operators use inland freshwater sites to support their release recapture sites. Independent chum operators have not developed

releases to production levels. Some are able to incubate and rear chum to release size at their release site.

The coho and chinook operators operate their own support sites or contract with others to hold adults, incubate eggs, and rear fish until they are large enough to transfer to the release site. The private operators must obtain a fish propagation license for inland facilities (support sites) because these are not part of the PSH permit process or authorization. Hatchery operations at other than the PSH sites fall under fish propagation license rules and are not governed under PSH regulations. Fish propagators must follow regulations relative to their operation, fish transport, and disease control. Additional disease control examinations are required for fish destined for a PSH.

OAF built a support facility at Springfield in 1977-78. From this site they expected to support the Yaquina and Coos release sites at full production according to our discussions with them prior to construction. The facility was designed to rear coho to 25 per pound and chinook to 15 per pound in a one year rearing program, e.g., zero age coho and full term chinook. The company is now rearing chinook to 12 per pound or larger and nearly all of their coho to 20 per pound or larger. This means that they could not raise full permit levels for the two coastal release sites. OAF has made little effort to move toward rearing of full permitted numbers for chinook but instead concentrated on coho production. As we discussed in the OAF operations section there was little rearing space at the OAF coastal sites. Except for use in the winter when no releases are being made, rearing cannot be increased by use of the coastal sites unless releases there are reduced. This could leave space for holding fish for longer periods.

With the leasing of the Coos Bay site to Anadromous in 1983-84 OAF reduced production of fish for their own release site and began contract operations to support Anadromous' Fort Creek facility with juvenile coho and the Anadromous coastal site with chinook smolts. This fills up the space at Springfield so, in effect, neither company can expand without someone developing more rearing space or finding another contract facility.

Anadromous operates a support facility on Fort Creek near Fort Klamath, north of Klamath Falls. This site was designed for rearing coho to support the company's release program at Coos Bay. A temporary facility was built in 1982. In 1984 Anadromous built permanent rearing ponds at Fork Creek in the first phase of development. The company plans to build a separate facility in the Willamette Valley in which it would handle chinook maturation, incubation, and initial rearing. At this time they are contracting with OAF to handle at least some of their program in the Springfield facility to hold adults to maturation, incubate eggs, and rear part of the smolts for release at Coos Bay.

OPPOSITION TO PRIVATE SALMON HATCHERIES

Opposition to private salmon hatchery (for profit) operations takes many forms and turns up in many places, from suits in the courts to individuals illegally fishing too close to the outlet of the fishways at the recapture

sites. Each ODFW activity with the Private Salmon Hatchery program is subject to review and challenges or threat of law suit or statute revision. This has become common enough that it has become something to expect as routine. Together these give an unsettling atmosphere in which the PSH operator or board of directors do not really know what legal constraints may be imposed which could change their operations and expectations.

Opponents to PSH's have directly affected the way in which ODFW processes permits and conducts hearings on permits. We tend to continue some evaluations, at the expense of private operators, longer than we might if we were evaluating our own operations with public funds. Private salmon hatcheries also add to our problem with management of the ocean coho fisheries. They have not been around long enough so that we can use historical data as a basis for estimating their contribution to the fisheries. They have been continually changing production methods and levels as they developed their programs and now as they reduce or terminate them.

One of the major factors which has affected the coho operators has been a lack of acceptable Oregon eggs with which to develop their brood stock. Two things have caused this, first a major decline in survival and returns of coho from the ocean during the early 1980's, so fewer eggs were available. Secondly, legislative direction on how eggs surplus to Department needs are to be used was changed in the late 1970's.

OUTLOOK

We can look forward to further reductions in private coho and fall chinook production according to recent reports from the operators as they continue to balance cost and returns. OAF wishes to sell out immediately but is going ahead with plans to maintain broodstock with releases of 1 million coho and 3 million each fall and spring chinook, and 1 million chum salmon if eggs are available. OAF takes additional coho eggs to sell these could be used to increase production if they decide to do so. Anadromous has been expanding production of both coho and fall chinook since rebuilding the north spit site but recently told us they are funded for production of about 1 million each yearling coho smolts and fall chinook for release in 1987. This is a minimum brood stock program with about 10% of the number previously planned for release by 1987. Both companies tell us they would increase the numbers of spring chinook if suitable eggs were available. Like OAF, Anadromous will collect additional eggs in case they get funding to rear them. OPSR plans to raise 1 million spring chinook per year. Domsea is not going to release any salmon in the near future but say they still intend to eventually reactivate or sell their Siuslaw facility.

REFERENCES

- Cummings, T. E., 1982. Private salmon hatcheries in Oregon. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- Cummings, T. E., 1983. Private salmon hatcheries in Oregon. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- Cummings, T. E., 1984. Private salmon hatcheries in Oregon. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- Cummings, T. E., 1985. Private salmon hatcheries in Oregon. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- Jonasson, Brian, 1983. Upstream movement and distribution of private hatchery produced coho salmon smolts into Yaquina River tributaries. Oregon Department of Fish and Wildlife, Research and Development Section. Information Report 83-13, Corvallis, Oregon, USA.
- McGie, A. M., 1983. Spawning salmon surveys and straying of private hatchery coho salmon from Yaquina Bay in coastal watersheds of Oregon, 1982. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- McGie, A.M., 1984. Oregon coastal spawning surveys and straying of private hatchery coho salmon from Yaquina and Coos bays, 1983. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- McGie, A.M., 1985. Oregon coastal salmon spawning surveys and straying of private hatchery coho salmon from Yaquina and Coos bays, 1984. Oregon Department of Fish and Wildlife, Fish Division, Portland, Oregon, USA.
- Meyers, K. W. W., 1980. An investigation of the utilization of four study areas in Yaquina Bay, Oregon, by hatchery and wild juvenile salmonids. MS thesis, Oregon State University, Corvallis, Oregon, USA.
- Mullarkey, W. G., 1985. The extent of coho salmon released from the Anadromous, Inc. facility. North spit, Coos Bay and returning in 1984. Oregon Department of Fish and Wildlife, in process.
- Nicholas, J. W. and M. L. Herring, 1983. Distribution and relative abundance of hatchery and wild salmon juveniles in study areas of the Yaquina, Siuslaw and Coos River. Oregon Department of Fish and Wildlife, Research and Development Section. Information Report 83-7, Corvallis, Oregon, USA.
- Nicholas, J. W. and L. VanDyke, 1982. Straying of adult coho salmon to and from a private hatchery at Yaquina Bay, Oregon. Oregon Department of Fish and Wildlife, Research and Development Section. Information Report 82-10, Corvallis, Oregon, USA.

Nicholas, J. W., L. VanDyke, and R. C. Buckman, 1982. Straying by hatchery-reared coho salmon released in Yaquina Bay, Oregon. Oregon Department of Fish and Wildlife, Research and Development Section. Information Report 82-6, Corvallis, Oregon, USA.

Parker, S. P. and J. P. Fisher, 1983. Identification of wild coho salmon strays in the coho return to Oregon Aqua Foods at Yaquina Bay in 1982. University of Washington FRI-UW-8312, Seattle, Washington, USA.

L3-5

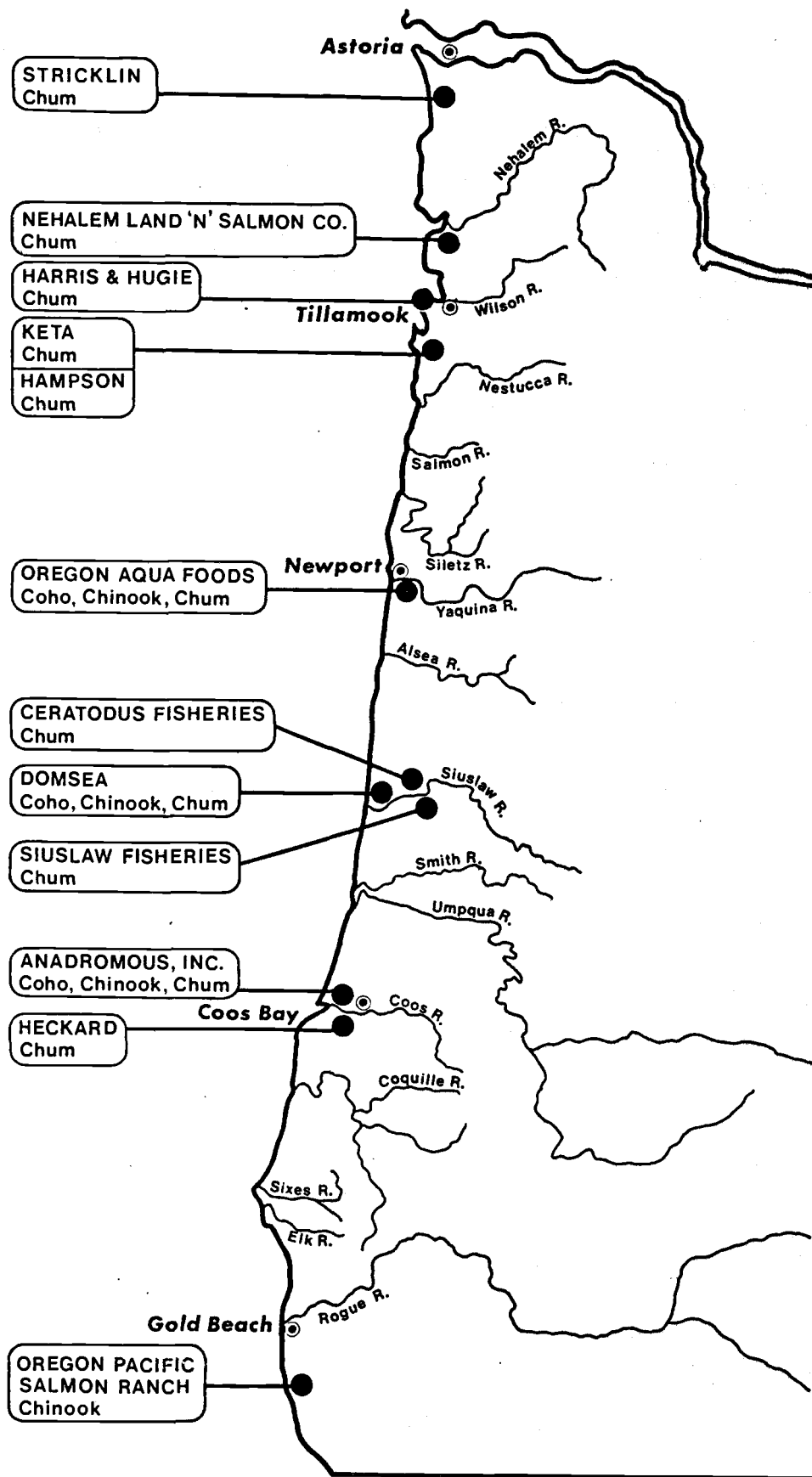


Figure 1. Location of Authorized Private Salmon Hatcheries in Oregon.

Table 1. Oregon private salmon hatcheries, March 1986.

Name and Address of Operator	Location of Hatchery	Permit Date	Release limit by brood and species (millions)			
			Coho	Chinook	Chum	Pink
Robert Stricklin Rt. 1, Box 538 Warrenton, OR 97146	Unnamed Trib., Skipanon R.	03/04/76			5.0	
Nehalem Land n' Salmon PO Box 54 Wheeler, OR 97147	Vosberg Cr., Nehalem Bay	03/04/76			5.0	
Cecil Harris and Don Hugie 1985 Bayocean Rd., NW Tillamook, OR 97141	Dick Cr., Tillamook Bay	08/23/72			0.1	
Keta, Inc. c/o 2650 Garfield St. Eugene, OR 97405	Sand Cr., Sand Lake	12/01/71			5.0	
Alfred Hampson 707 SW Washington Suite 300 Portland, OR 97205	Sand Cr., Sand Lake (with Keta)	10/31/73			5.0	
Oregon Aqua-Foods, Inc. 88700 Marcola Rd. Springfield, OR 97477	Manmade Trib., Yaquina Bay	11/01/72 03/19/74	9.5	10.6	20.0	
Ceratodus Fisheries 6523 E. Street Springfield, OR 97477	Divide Cr., Siuslaw R.	12/18/73			5.0	
Domsea Farms, Inc. 4398 West Old Belfair Hwy. Bremerton, WA 98310	Manmade Trib., Siuslaw Bay	05/05/78	12.0	12.0	25.0	
Siuslaw Fisheries, Inc. 32047 Coburg Bottom Loop Rd. Eugene, OR 97401	Sweet Cr., Siuslaw R.	03/19/72			5.0	
Anadromous, Inc. ^a 500 SW Madison St. Corvallis, OR 97333	Manmade Trib., Coos Bay	07/30/76	11.3	9.4	20.4	
Calvin Beckard 1281 West Catching Slough Rd. Coos Bay, OR 97420	Unnamed Trib., Coos Bay	03/04/76			5.0	
Oregon-Pacific Salmon Ranch Inc. ^b 23154 U.S. Hwy. 101 North Brookings, OR 97415	Burnt Hill Cr. (Direct ocean tributary)	04/25/78 ^e		5.0		
Total release limits			32.8	37.0	100.5	

^a Permits transferred from Oregon Aqua-Foods to Anadromous effective May 1985.^b Permit transferred to Oregon Pacific effective March 1984.

Table 2. Numbers of salmon released by individual private salmon hatchery hatchery operators, in thousands, 1972-85.

	Year of Release						
	1972	1973	1974	1975	1976	1977	1978
<u>Spring chinook salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	--	--	--	6	161	42	16
Oregon Aqua-Foods, Inc. (Coos)	--	--	--	--	--	--	--
Anadromous, Inc. ^a	--	--	--	--	--	--	--
Oregon-Pacific Salmon Ranch, Inc. ^b	--	--	--	--	--	--	--
<u>Fall chinook salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	--	--	27	18	148	--	393
Domsea Farms, Inc.	--	--	--	--	--	--	--
Oregon Aqua-Foods, Inc. (Coos)	--	--	--	--	--	--	--
Anadromous, Inc.	--	--	--	991	--	--	129
Oregon-Pacific Salmon Ranch, Inc.	--	--	--	--	--	--	--
<u>Coho salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	--	--	88	142	1,171	1,376	8,898
Domsea Farms, Inc.	--	--	--	--	--	--	400
Oregon Aqua-Foods, Inc. (Coos)	--	--	--	--	--	86	--
Anadromous, Inc.	--	--	--	--	909	908	610
<u>Chum salmon:</u>							
Nehalem Land'n'Salmon Co	--	--	--	--	--	--	--
Harris & Hugie	--	8	10	9	--	--	--
Keta Corp ^d	51	252	311	1,160	--	98	403
Oregon Aqua-Foods, Inc. (Yaquina)	--	7	33	324	2	15	2
Ceratodus Fisheries	--	--	--	500	--	--	--
Domsea Farms, Inc.	--	--	--	--	--	--	--
Siuslaw Fisheries, Inc.	--	10	221	800	--	8	60
Oregon Aqua-Foods, Inc. (Coos)	--	--	--	--	--	--	--
Heckard	--	--	--	--	--	--	--

^a 1975 and part of 1976 releases were made at Columbia River location prior to Columbia River permit being terminated. Anadromous operated the OreAqua site in 1983 and released all fish there. Permits and site transferred to Anadromous in 1985.

^b Formerly Burnt Hill Salmon Ranch, Ltd.

^c Includes smolts released offshore.

^d Includes releases made on permit issued to Alfred Hampson.

^e Preliminary data.

Table 2 (continued)

	Year of Release						
	1979	1980	1981	1982	1983 ^c	1984 ^c	1985 ^{ce}
<u>Spring chinook salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	887	--	89	--	55	354	312
Oregon Aqua-Foods, Inc. (Coos)	313	--	112	--	--	--	--
Anadromous, Inc. ^a	198	623	616	93	924	1,159	427
Oregon-Pacific Salmon Ranch, Inc. ^b	--	635	939	258	1,006	194	18
<u>Fall chinook salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	141	152	249	338	861	520	957
Domsea Farms, Inc.	62	91	34	74	22	--	--
Oregon Aqua-Foods, Inc. (Coos)	--	--	43	--	--	--	--
Anadromous, Inc.	19	96	174	159	311	815	1,039
Oregon-Pacific Salmon Ranch, Inc.	--	99	--	59	--	--	--
<u>Coho salmon:</u>							
Oregon Aqua-Foods, Inc. (Yaquina)	3,894	7,585	11,925	20,589	14,889	8,647	4,337
Domsea Farms, Inc.	738	241	158	61	47	--	--
Oregon Aqua-Foods, Inc. (Coos)	242	5,446	10,870	803	--	2,272	--
Anadromous, Inc.	937	1,546	899	1,655	1,341	--	4,250
<u>Chum salmon:</u>							
Nehalem Land'n'Salmon Co	--	--	650	578	893	118	275
Harris & Hugie	--	--	--	--	--	--	--
Keta Corp ^d	1,005	--	1,413	770	1,190	75	150
Oregon Aqua-Foods, Inc. (Yaquina)	684	--	3,180	244	2,958	1,136	289
Ceratodus Fisheries	--	--	--	--	--	--	--
Domsea Farms, Inc.	--	241	176	58	212	--	--
Siuslaw Fisheries, Inc.	1,039	8	110	--	--	--	--
Oregon Aqua-Foods, Inc. (Coos)	8,212	--	--	--	--	--	--
Heckard	--	--	--	--	350	140	4

Table 3. Numbers of salmon released by Oregon private salmon hatchery operators, in thousands, 1972-85.

Year	Coho	Spring Chinook	Fall Chinook	Chum
1972				51
1973				276
1974	88		27	575
1975	142	6	1,009	2,793
1976	2,080	161	148	2
1977	2,371	42		120
1978	9,908	16	522	465
1979	5,812	1,397	223	10,940
1980	14,817	1,269	438	8
1981	23,852	1,756	500	5,529
1982	23,107	351	631	1,649
1983	16,277	1,985	1,194	5,603
1984	10,919	1,707	1,336	1,469
1985 ^a	8,587	758	1,995	718

^a Preliminary data.

D#3-10

Table 4. Return of Salmon to Private Facilities, Sites Combined, 1978-85

Year return	Chinook Adult	Chinook ^a Jack	Coho Adults	Coho ^a Jack	Chum
1978					
Numbers	213	31	8,069	6,557	539
Pounds	3,952	23	38,903	15,736	4,841
1979					
Numbers	271	145	47,726	1,445	14
Pounds	2,872	519	225,105	2,224	110
1980					
Numbers	752	2,642	27,745	15,639	545
Pounds	9,386	7,179	145,614	31,922	4,815
1981					
Numbers	2,588	2,499	98,681	19,098	477
Pounds	35,860	6,046	631,619	42,070	4,053
1982					
Numbers	7,644	4,439	165,034	19,687	1,132
Pounds	87,654	13,657	932,886	48,356	9,133
1983					
Numbers	5,117	974	127,845	6,098	515
Pounds	54,441	2,052	504,685	10,210	3,961
1984					
Numbers	3,571	2,728	84,501	30,902	821
Pounds	55,196	8,208	458,235	89,363	7,561
1985 ^b					
Numbers	9,288	25,387	288,488	43,564	3,220
Pounds	118,929	113,878	1,631,704	101,986	21,470

^a Number (includes chinook adults less than 24" in length and coho adults less than 20")

^b Preliminary data

D3-11

Table 5. Salmon eggs taken at ODFW coastal hatcheries and numbers sold to private operators, 1973-85 broods in thousands.

Species	Fall Chinook			Spring Chinook			Coho		
Brood year	Eggs taken	Eggs sold	% ^a	Eggs taken	Eggs sold	%	Eggs taken	Eggs sold	%
1973	4,367	511 ^b	11.7	2,069	0	0	9,613	509	5.3
1974	2,422	0	0	1,985	125	6.3	8,348	751	9.0
1975	3,488	726	20.8	2,610	308	11.8	5,668	317	5.6
1976	437	0	0	2,592	262	10.1	9,167	2,310	25.2
1977	3,832	540	14.1	2,949	209	7.1	7,394	81	1.1
1978	3,214	0	0	4,845	2,151	44.4	6,223	12	0.2
1979	3,857	395	10.2	4,839	1,934	40.2	22,668	5,867	25.9
1980	3,135	406	12.9	6,548	2,576	39.1	19,836	2,847	14.4
1981	2,780	0	0	3,252	412	12.6	12,184	0	0
1982	4,264	0	0	6,220	3,720	59.8	10,693	0	0
1983	4,733	0	0	3,264	0	0	5,586	0	0
1984	4,676	0	0	3,626	0	0	16,820	500	3.0
1985 ^c	4,830	0	0	5,438	568 ^d	10.4	14,075	1,301	9.2

^a Percentages sold: Percentages are misleading in some cases because additional eggs were taken specifically for sale as viable eggs as opposed to selling unspawned carcasses.

^b 27,000 released as smolts with the remainder harvested for sale as pan-size juveniles.

^c Preliminary data.

^d Includes presmolts (eggs or unfed fry only = 285).

D3-11

Table 6. Estimate of funding for ODFW and other contract evaluation of private salmon hatchery related activities, FY 1981-86.

Fiscal Year	Amount Including Overhead
1981	\$ 78,500
1982	95,700
1983	55,960
1984	86,500
1985	61,630
1986 (projected)	<u>81,250</u>
Estimated total \$459,540	

Table 7. Coho released by private salmon hatchery operators, estimated catch in the ocean, and return, all sites combined by year of release, 1978-85.

Year (N) ^a Released	Thousands Released ^b	Catch in the Ocean (N+1) ^a	Return to Hatchery		% Catch and Return	
			Jacks ^c (N)	Adults (N+1) ^a	Hatchery	Total ^d
1978	9,908	63,000	3,852	48,497	0.53	1.16
1979	5,812	53,600	674	39,182	0.69	1.61
1980	14,817	142,000	4,202	111,264	0.78	1.74
1981	23,852	122,100	6,575	176,936	0.77	1.28
1982	23,107	110,300	7,785	133,108	0.61	1.09
1983	16,277	35,000	835	114,913	0.71	0.93
1984	10,919	75,385	490	313,266	2.87	3.56
1985	8,585	--	18,779	--		

^a N is year released (including summer and fall); N+1 is 2nd summer and fall after release

^b Includes yearling and zero-age coho released that year

^c Jacks only (separated from small adults by scale analysis)

^d Includes jacks (year N) and adults (year N+1)