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WASHINGTON STATE GAME DEPARTMENT FISHERY RESEARCH REPORT



THE ORIGIN AND HISTORY OF THE
TROUT BROOD STOCKS OF THE
WASHINGTON DEPARTMENT OF GAME

BY BRUCE A. CRAWFORD 1979

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THE ORIGIN AND HISTORY OF THE TROUT BROOD
STOCKS OF THE WASHINGTON DEPARTMENT OF GAME

by

Bruce A. Crawford

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FOREWORD

This is an attempt to narrate the various major events and accomplishments which led to the development of the trout stocks that have been and/or are presently cultured and planted into state waters. The evolution of fish culture and the constantly changing social and political climate in Washington helped to shape the course of brood stock development. The records are often sketchy or non-existent. Much of the information has been obtained from past and present employees of the Department of Game and the former Department of Fisheries and Game. My apologies in advance for those inaccuracies that must surely exist in the manuscript.

I. HISTORY OF GAME FISH ADMINISTRATION IN WASHINGTON

In 1889 Washington achieved statehood and the Department of Fisheries and Game was established. In 1890 James Crawford was appointed the first Fish Commissioner of the State, and between 1890 and 1898 had three deputies to assist in regulating a statewide industry. Between 1897 and 1913 A.C. Little (1899-1902), T.R. Kershaw (1902-1905) and John L. Riseland (1906-1913) were appointed Fish Commissioner. During this time numerous salmon hatcheries, oyster reserves and a few trout hatcheries were provided. Shortly after the Department of Fisheries and Game was created (1903) a county system of Game Commissions was established with each county having a game warden appointed by the Commission. Money received from county licenses went into the county game fund. However, in 1913 the new Game and Game-Fish Codes provided for a chief Game Warden for the State. This code was enacted because the sportsmen and conservationists were displeased with the Fish Commissioners who gave little attention to the game and game fish of the State (WDFG, 1916, 1st Annual Report, Chief Game Warden). In order to prohibit a separation of the food fisheries and game and game fish interests, Governor Lister appointed L.H. Darwin in 1913 as both Fish Commissioner and Chief Game Warden. Governor Lister believed that the control of game and fish should remain under one department. Darwin remained the unifying factor until 1921 when a new Civil Administration Code provided for a Director of the Department of Fisheries and Game and within this Department, the creation of the Division of Fisheries and Division of Game and Game Fish.

The Division of Game and Game Fish was administered by the Supervisor of Game and Game Fish who was appointed by the Director. The Division of Game and Game Fish also had a five member Advisory Board who were elected by the State Association of Game Commissioners and Wardens, and who met annually with the Supervisor to formulate policies. The Division of Game and Game Fish, unlike the Division of Fisheries, received no money from the state general fund, but were self supporting, relying upon hunting and fishing licenses (WDFG, Division of Game and Game Fish, 1923). This organization remained until 1932.

Due to the lack of central control found in having both county game commissions and a state game and game fish department, and to further divorce the interests of sportsmen and conservationists from those of the commercial fisheries, the legislature created in 1932 the separate Department of Fisheries and Department of Game. The Department of Game was to be headed by a Director who was appointed by a State Game Commission consisting of six members from various parts of the State. Game Commissioners were to be appointed by the Governor. The old county game commissions were disbanded and many of their assets were obtained by the new Department of Game. Funding remained on a self supported basis through the use of license fees and fines collected from game violations. This form of operation has persisted to the present. It has worked well in that it has reflected the needs and desires of the sportsmen and conservationists of the State.

II. GENERAL HISTORY OF TROUT CULTURE IN WASHINGTON

In 1903 the State Department of Fisheries and Game constructed the first trout hatchery in the state on Stehekin Creek, in Chelan County, at the upper end of Lake Chelan. The station obtained cutthroat trout from Stehekin Creek, took their spawn and distributed them to other salmon hatcheries in the State. Most, however, were planted in nearby lakes and streams. This remained the only trout hatchery until 1904 when the Little Spokane Salmon Hatchery, located at Dartford on the Little Spokane River, was converted to a trout hatchery (Washington Department Fisheries and Game, 1905). Trout for the hatchery were first obtained from Lake Chelan Hatchery (cutthroat) and eastern brook trout were obtained from private hatcheries at Penrith and from Cook's Lake.

Both the state hatchery personnel and local county game commissioners set about looking for additional local sites where spawn could be obtained for hatchery production. Lake Chelan Hatchery developed an eyeing station in 1913 at Dumpka (Dompke) Lake, which was located near the hatchery. Another eyeing station was developed about the same time (1914) at Twin Lakes in Chelan County. The Little Spokane Hatchery did not take spawn at the hatchery site so it relied upon Lake Chelan cutthroat and on eyeing stations located at Bonaparte Lake, Okanogan County, Lost Lake, Okanogan County, Fish Lake, Ferry County and Pend Oreille Lake, Stevens County, for eastern brooktrout eggs.

The third trout hatchery to be built was located in Walla Walla and was financed and built at the desire of the citizens of the city of Walla Walla (WDFG, 1907) and was located at the city park in 1906. This facility had no source of spawn at the hatchery, and, thus, also relied upon eggs obtained from Lake Chelan Hatchery and the various lakes already mentioned.

The next trout hatchery was built at Basket Creek on the East Fork Lewis River, Clark County, in 1909. Located near Wall, this hatchery was originally intended to fulfill much of the need for trout west of the Cascade Mountains. This hatchery also did not have access to spawn at the hatchery location and depended upon Lake Chelan Hatchery and other sources for eggs. This hatchery was further handicapped because it was located at a remote site 30 miles from Vancouver and good transportation routes.

The fifth trout hatchery was constructed at Lake Crescent, Clallam County, on Barnes Creek, in 1913. This site was chosen because it was determined that the Beardslee trout spawned in Barnes Creek. This hatchery was the first to have hot and cold water and a bath and toilet.

At the same time that state trout hatcheries were being established many county game commissions were establishing local hatcheries. By 1913, county hatcheries existed in Whatcom, King, Stevens and Snohomish counties. Shortly thereafter, county hatcheries were established in Skamania, Kittitas, Yakima and Pend Oreille counties.

The next state hatchery to be built was located on the Tilton River near Morton in Lewis County, in 1916. It was originally intended that this hatchery be located at Mineral Lake, however, inadequate spawn was available at this site. General reconnaissance in the area revealed a large supply of rainbow trout eggs at Packwood Lake. Due to this find, the hatchery was located at Morton (WDFG, 1917). In 1916, 700,000 resident rainbow trout eggs were obtained. As stated in the 1917 Annual Report of the State Fish Commissioner, "this is the only place in Western Washington to date where it has been possible for this department to secure this variety of eggs" (resident rainbow trout).

From 1917 to 1921 a number of county hatcheries came under state control and numerous salmon hatcheries also reared rainbow and cutthroat trout.

One of the more important facilities was the Lake Whatcom Hatchery, built in 1917. The site was donated by the Whatcom County Game Commission and became the most important source of kokanee (Oncorhynchus nerka, Walbaum) in the state. In 1918 it produced 13,000,000 fry.

In 1921 the Department of Fisheries and Game was divided into the Division of Fisheries and the Division of Game and Game Fish. At that time all trout hatcheries were placed under the Division of Game and Game Fish and their administration was no longer directly influenced by the commercial salmon industry. Among the more important acquisitions were the Chambers Creek Salmon Hatchery and the newly constructed Pend Oreille and San Poil hatcheries (WDFG, 1923). Table 1 is a list of trout hatcheries and eyeing stations in operation in 1922.

Table 1 -- Hatcheries assigned to Division of Game and Game Fish, 1922.

Chambers Creek Hatchery
Kittitas Hatchery
Pateros - Methow Hatchery
Lake Chelan Hatchery
Lake Crescent Hatchery
Spokane Hatchery
Tilton River Hatchery
Lake Whatcom Hatchery
Dartford Hatchery
San Poil Hatchery
Walla Walla Hatchery
Wenatchee Hatchery
Pend Oreille Hatchery

In 1921 it was discovered that eggs could be shipped while green and that they could be kept for longer periods of time by maintaining the temperature near 0° Centigrade. This discovery had widespread ramifications for fish culture in Washington. Prior to 1921, it was believed that eggs could not be transported until they had reached the eyed stage. As a result, hatcheries were constructed as near the egg source as possible and eyeing stations at the broodstock source were maintained. After 1921, eggs could be transported immediately to hatcheries throughout the state.

In 1933 the state legislature created the separate agencies, the Department of Game and the Department of Fisheries, each with its own director and separate responsibilities. The Department of Game inherited the hatcheries of the old Division of Game and Game Fish and the numerous county hatcheries under the now defunct county game commissions. Up to about 1945 the Department of Game was in the process of assessing the value of and refurbishing a number of old county and state hatcheries, and in building new facilities as needed. Many of our present hatcheries including the Spokane Hatchery, Yakima Hatchery, Goldendale Hatchery and Mossyrock Hatchery were built during this period. An example of the extremely poor condition of some of the old Fisheries and Game hatcheries is reflected in a letter to Director B.T. McCauley from Robert Meigs in 1942 concerning the Pend Oreille Hatchery. "The building is in very poor shape. In order to operate this much longer, it is necessary that the floor, sills and trough horses be replaced. The floor has broken through in many places and is ready to break through in many more places. --Freezing room contained spoiled fish trimmings, spoiled dogfish, spoiled horsemeat and silver trout in good condition."

The selection and culture of today's brood stocks began in the 1940s and after having reviewed briefly the history of trout culture in Washington each species of trout and the stocks involved can now be traced.

III. RAINBOW TROUT (SALMO GAIRDNERI, RICHARDSON)

III.A Rainbow Trout Culture (General History)

The rainbow trout (Salmo gairdneri, Richardson) was originally distributed in coastal streams from the Kuskokwim River, Alaska to the Rio Santo Domingo, Baja California, Mexico (Needham and Gard, 1959). Other isolated populations of rainbow trout occurred in certain inland lakes in California (Behnke, 1972). The rainbow trout throughout most of its range is anadromous wherever migration to the sea is possible. Anadromous rainbow trout, known as steelhead (S. gairdneri gairdneri), occur as a summer-run race and a winter-run race. The winter-run typically entered freshwater to spawn from February to June while the summer-run entered from April to October and spawned the following spring (February to April). In addition to the common anadromous form of S. gairdneri, populations of non-anadromous rainbow trout occurred in isolated mountain drainages and in the upper portions of some coastal rivers. Non-anadromous rainbow trout have often been placed under the sub specific heading S. gairdneri irideus. In Washington, the winter-run anadromous race occurs in all suitable coastal and Puget Sound streams from the Nooksack River on the north to the Columbia River to the south. In the Columbia winter-run fish are found upstream to the Washougal River system (Bryant and Parkhurst, 1950). These were "late" winter-run in that they spawned almost immediately upon their arrival from April to June.

Summer-run steelhead were historically found predominantly in the Columbia River drainage and its tributaries from the Cowlitz River upstream to the Arrow Lakes, British Columbia and in the Snake Clearwater-Salmon drainage to the continental divide in the Bitterroot range and south to the Nevada state line in the Owyhee River. Major drainages in Washington that contained large summer steelhead runs included the Yakima, Wenatchee, Okanogan, San Poil, and Spokane rivers. Much of the original distribution of the summer steelhead in the Columbia Basin has been reduced. The causes and probable impacts are thoroughly discussed in the Investigative Reports of Columbia River Fisheries Project (PNRC, 1976). Small populations occurred in Puget Sound. One of the more well known populations of summer steelhead occurred in Deer Creek tributary of the Stillaguamish River. DeShazo (1974)

has reviewed the past and present status of this run. Other small populations apparently existed in the Snohomish and Duwamish rivers. Some coastal streams like the Quilleute, Hoh and Queets systems also had a summer run.

Resident (non-anadromous) rainbow trout existed historically in a few lakes west of the Cascades and in the headworks of some river systems. However, in most river systems the determinations of which trout are resident and which are anadromous has remained a perplexing problem and is perhaps a moot point as all rainbow trout are capable of surviving in seawater. However, due to the historic and present confusion concerning steelhead and resident rainbow trout, their culture in Washington has been treated separately in the following chapters.

III.B History of Steelhead Culture in Washington

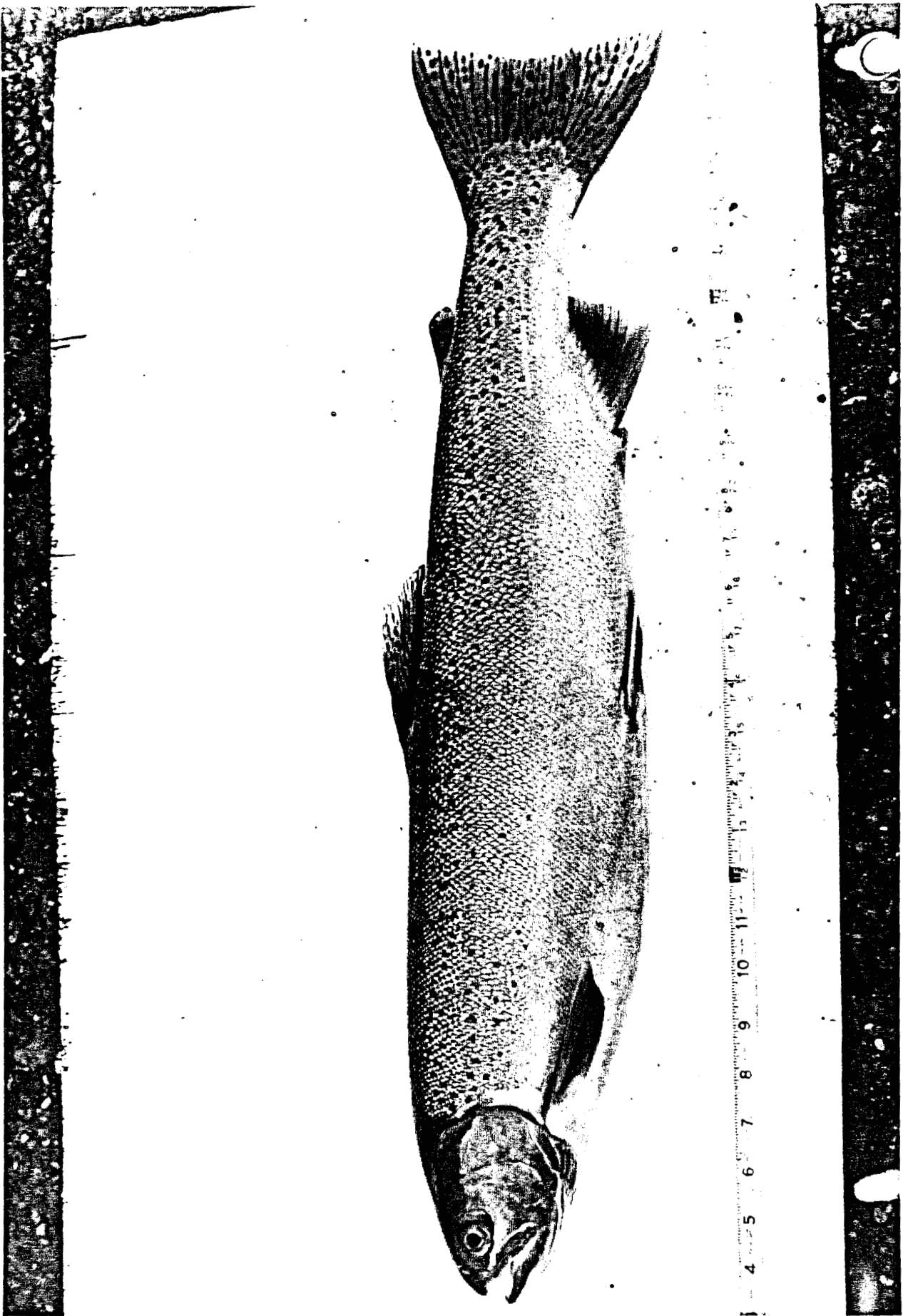
The salmon trout or steelhead (S.g. gairdneri) was considered by early fish culturists to be a form of salmon and as such they were cultured in much the same way as were true Pacific salmon (genus Oncorhynchus). In 1895 the Washington Department of Fisheries and Game built it's first two hatcheries, Chinook Hatchery, Pacific County, and Kalama Hatchery, Cowlitz County (WDFG, 1904). Shortly thereafter, other hatcheries were built on the Wind River, Wenatchee River and Methow River. None of these hatcheries reared steelhead, but by 1903, 4,298,740 winter steelhead fry were being produced from the Dungeness, White River, Snohomish, Nisqually, Willapa and Chehalis hatcheries. Early steelhead runs in the Sauk River were spawned at the Sauk River Hatchery from the first week in February until the 15th of June (WDFG, 1907). The Dungeness Hatchery was considered the best steelhead hatchery in the state and alone produced 1,384,000 fry in 1905. In 1915 the Pateros-Methow Hatchery was built and produced the first summer steelhead fry. By 1920 winter steelhead spawn was taken from eleven Puget Sound sites and four coastal sites while summer steelhead were taken at two locations in the Columbia Basin. In 1921, when the Department of Fisheries and Game was separated into the Division of Fisheries and the Division of Game and Game Fish, steelhead were placed under the Division of Game and Game Fish and an effort began to remove the steelhead from the commercial fishery. This fishery was quite extensive with 24,000 pounds of steelhead being commercially packed in 1902. The pack declined to 5,000 pounds in 1914, but the total commercial take in 1914 was 232,696 steelhead. Most of these fish were taken from the Columbia River. Under the new Division of Game and Game Fish, 73 winter steelhead were spawned at Chambers Creek Hatchery in 1921, and by 1922 steelhead spawn were also taken at the Green River Hatchery, Pateros-Methow Hatchery, Pilchuck and Tilton River hatcheries and at the Maschell Traps, Union River traps and the Brinnion Eyeing Station for a total of 1,706 females and 6,265,500 eggs. However, due to the lack of proper holding facilities, salmon trout eggs continued to be taken and reared at various salmon hatcheries to the fry stage before releasing them into the nearby rivers and streams. In 1925 the state legislature classified steelhead as a game fish above a point established by

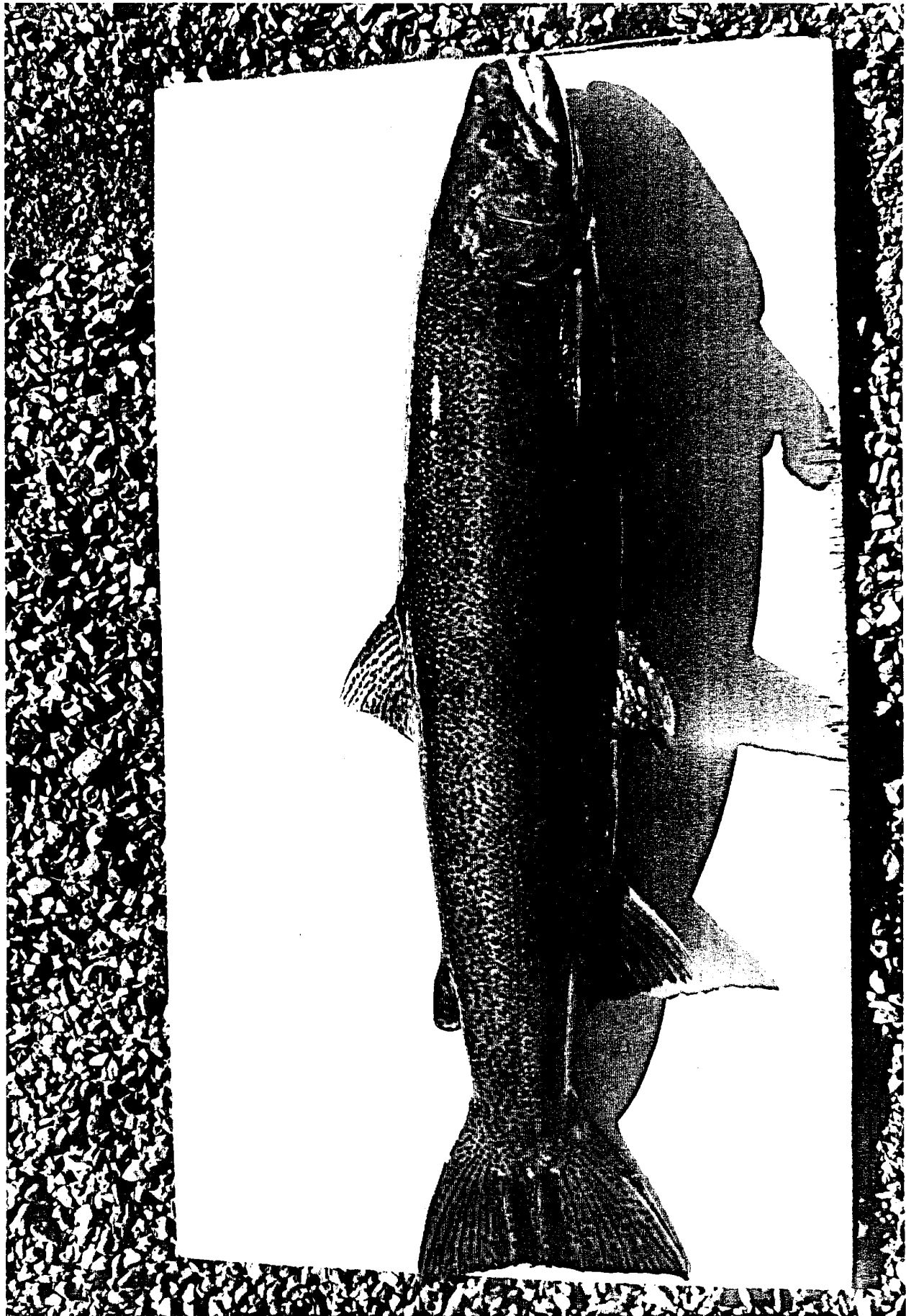
the Director of Fisheries and Game as the mouth of any river or stream. This materially aided the status of the steelhead stocks by removing it from most of the commercial catch. In 193 , when the Department of Game was formed, renewed efforts by sportsmen were made to give the steelhead gamefish status, and eliminate all commercial landings of this species in Washington in both freshwater and saltwater. This was soon accomplished by the newly formed Game Commission which prohibited the commercial catching, possession or sale of steelhead.

During the 1930s steelhead eggs were taken and the fry were released at various Game Department facilities. In addition to Game Department hatcheries, special steelhead culturists were maintained at the Department of Fisheries Samish, Humptulips, Puyallup, Willapa, Skykomish, Chehalis, Green and Nooksack hatcheries. By 1936 studies had shown that better survival of hatchery fish was obtained when they were released as fingerlings. Advances were also made in the nutritional requirements of trout. However, the greatest advance in the culture of steelhead was explored by Clarence Pautzke and Robert Meigs (Pautzke and Meigs, 1940; Meigs and Pautzke, 1941) from 1937 to 1941 and Larson and Ward (1954) between 1948 and 1953. Through various experiments, the relationship of the size of release and time of release to the percent return to the planting site was established. Prior to their work, steelhead were released as fry or fingerlings with little or no return to the point of release and correspondingly little beneficial affect upon the run size. Ironically, steelhead runs in many streams were reduced by the hatcheries that were attempting to improve their numbers. In 1940 the Department of Fisheries was no longer requested to release steelhead fry and a new era began.

III.B.1 Chambers Creek Winter Steelhead

In 1945 Clarence Pautzke, John Johansen, Charles Foster and Tom Inions began a new steelhead rearing program at the South Tacoma Hatchery. A 25 foot by 25 foot wooden box was constructed at the ladder at Chambers Creek. Arriving steelhead were taken from the trap from February through April and kept in the holding box until they could be transferred to the South Tacoma Hatchery nearby where the water temperature was approximately 56⁰ F. The eggs were kept in the warm hatchery water and were eventually released back into Chambers Creek at approximately 20 per pound. Prior to this date the standard practice for spawning steelhead had been to





trap them within the stream and determine their degree of maturation. If a captured fish was not sexually mature, it was either passed over the trap as part of the escapement (normally 50% in 1945) or put back downstream with the possibility thereby existing of recapturing the fish at a later date when mature. However, by moving the adults to the warm spring water at the hatchery they matured very rapidly, thus producing eggs much earlier than would have been the case in their natural stream environment. At first the quality of the feed and the timing of maturation of adult spawners combined to make it very difficult to rear a smolt of the proper size (6") in one year and as a result fish cultured in the 1940s and 50s were often held two years prior to their release. Before adequate information was obtained on timing of migrant wild smolts, hatchery fish were often released in November and other inappropriate times with a resultant very low return rate. However, through persistent experimentation and innovative fish culture techniques the numbers of returning steelhead increased annually. From an economic and production perspective it was desirable to raise a fish of the proper size in one year. The cost of feed, loss in numbers and quality after one year in a hatchery characteristically increased monthly. But by holding the returning adults in the warm water and by selecting for the earliest maturing fish it soon became possible to rear a steelhead to smolt size in one year. A further improvement was the development of the dry food diet around 1956. Credit for development of the modern dry diet must go to Mr. Fred Thompson who became interested in developing a dry feed for trout while working for the New Mexico Game and Fish Department. He collaborated with J. R. Clark, a poultry nutritionist who had been making dry pellets for poultry and eventually produced the first dry trout feed. (Johansen personal communication)

By this time adult returns and smolt production had increased to the point where nearby streams and rivers began to receive large numbers of hatchery reared smolts and Chambers Creek steelhead began to be utilized to start runs at other hatcheries. Among the first hatcheries to obtain and release Chambers Creek steelhead were the Green River Hatchery at the City of Tacoma headworks dam, Tokul Creek Hatchery, and Puyallup Hatchery.

Due to continuous selection for early maturing steelhead, the majority of eggs are presently taken in December and January with some taken into

March. Average fecundity is 4,443 eggs with a range from 7,425 to 2,562 depending upon the size and age of the fish. At first the females were live spawned, but as the run began to build kill spawning was adopted as it provided better egg survival and allowed the staff to take a large number of eggs in a short time.

On occasion returning adults at the Samish River, Soos Creek, and some from the Nemah River have been introduced into Chambers Creek through smolt releases. However, their contribution has been relatively small, and these runs were initially increased with Chambers Creek stock prior to their reuse at Chambers Creek. The mixture, whatever the quantity, has proven to be adaptable to Puget Sound streams. The present large sport and Indian commercial fishery on winter steelhead can be directly attributed to the extremely high success obtained with the Chambers Creek stock. As already discussed, the major winter run historically entered from February to June. Today the majority of winter steelhead are caught in December and January and are as much as 90% hatchery origin fish in some river systems.

As shown by Thorgaard (1977) Chambers Creek steelhead have two chromosome types with approximately 50% having 60 chromosomes and 50% having 59 chromosomes. Coastal steelhead populations in Washington and Oregon and summer steelhead in the Columbia River and coast of Oregon typically have 58 chromosomes. As hypothesized by Thorgaard, it apparently indicates that the Puget Sound winter steelhead is a relatively discrete group and would explain the lack of success in using this stock in the Columbia River and in coastal streams.

Although early culturists were satisfied when any increase in steelhead numbers were obtained, there is now a concern that the successful Chambers Creek hatchery program may be undermining the genetic (and thus survival) characteristics of wild populations. In response to this concern for wild stocks and also to improve the homing ability and adaptability of hatchery steelhead, the Department has begun taking eggs, rearing and replanting the smolts into the river of origin whenever economically and technically feasible. The following hatcheries and rearing ponds now rear and release winter steelhead (Table 2).

Table 2 -- Winter steelhead rearing sites

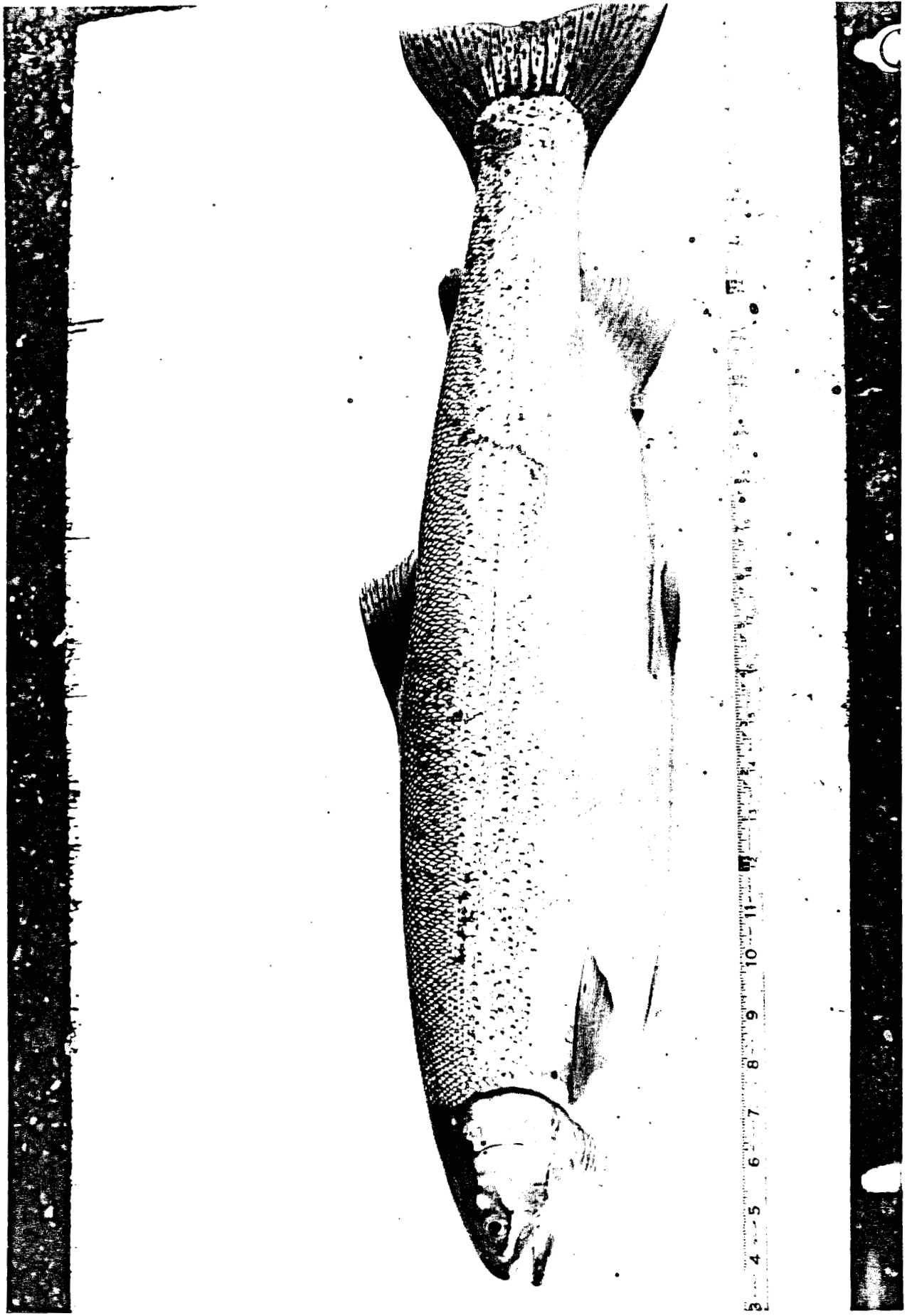
<u>Facility</u>	<u>Date of Origin</u>	<u>Initial stock source</u>	<u>Present Source</u>
Barnaby Ponds	1960	Skagit Chambers Creek	Chambers Creek
Bogachiel Pond	1967	Chambers Creek & native	returnees
Aberdeen Hatchery	1951	Chambers Creek	returnees
Beaver Creek Hatchery	1958	Elochoman, Chambers Cr. Cowlitz	Cowlitz, Elochoman
Cowlitz Hatchery	1967	50% native 50% Chambers Creek	Cowlitz
Green River Ponds	1969	Native and Chambers Creek	Green & Chambers
Puyallup Hatchery	1951	Chambers Creek	Chambers Creek
Tokul Creek Hatchery	1951	Chambers Creek	Chambers Creek
Solduc Ponds	1977	Native Solduc	Solduc
Calawah Ponds	1977	Chambers Creek	Bogachiel
Alder Creek Pond	1973	Cowlitz	Cowlitz
Wynoochee Ponds	1978	Wynoochee	Wynoochee
Skookumchuck Pond	1973	Skookumchuck	Skookumchuck
Sauk Pond	1977	Sauk	Sauk
Skykomish Ponds	1974	Chambers Creek	Skykomish & Chambers Creek

III.B.2 Skamania Summer Steelhead

As previously reviewed, efforts to rear summer steelhead date back to 1915. Early efforts hatched eggs and released fry or fingerlings with little or no measureable returns. An effort was made to culture summer steelhead from Deer Creek in 1946 (DeShazo, 1974) but met with little success. However, in 1956 with money from Columbia River Basin fishery enhancement funds administered by the National Marine Fisheries Service, the Skamania Hatchery was built on the North Fork Washougal River for the culture of summer steelhead. Under the guidance of Marvin Hull, manager, adult steelhead were trapped for egg taking in the North Fork and later at the barrier dam at the Washougal Salmon Hatchery. During 1957, 1958, 1959, and 1960 only 153, 114, 81 and 166 native Washougal summer steelhead respectively were trapped from the North Fork for spawn (Hull, unpubl. MS). Due to the small number of steelhead available for spawn, arrangements were made in 1957-59 to trap additional summer steelhead adults from the Klickitat River at fishway number 5. These fish were held at the Goldendale Hatchery until they could be transferred to Skamania Hatchery. Smolts were first released on May 22, 1957 and annually thereafter. At first all Klickitat progeny were fin clipped for identification and segregation, however, by 1963 Washougal native steelhead and Klickitat native steelhead were mixed and spawned together to produce the present Skamania summer steelhead.

Adults have been subjected to a continuous selection process. As with winter steelhead, the basic goal was to produce a smolt of adequate size in approximately one year. To meet this goal, females and males were first selected for early gonadal maturation. Of secondary importance was the continual selection of the largest females whenever possible. At first eggs were taken in small amounts over a long period of time, but after a few generations more and more eggs were taken early. Eggs were at first taken predominantly in March and April. These early progeny could not be induced to reach a proper size for smoltification. For example the smallest smolt planted averaged 15 per pound and netted only 0.02% return. Smolts were often held two years prior to their release in order to obtain an acceptable size. Early smolt releases were plagued with at least 10% of them residualizing at the planting site.

From 1957 to 1959 the fingerlings were fed a diet of frozen meat products. This was not productive so a dry diet was fed from 1960-62.



Again growth and vitality were not as desired, and in 1963 50% conversion to Oregon Moist Pellet was begun. Results were very good, and nearly total conversion took place in 1964. Oregon Moist Pellet continues to be used at present.

In 1970 a major improvement in obtaining early eggs was obtained by elongating the photoperiod with banks of spotlights. The lights were turned on in December to speed up maturation. Males were subjected to the elongated photoperiod two weeks earlier than the females in order to insure a good supply of milt. With the use of photoperiod manipulation eggs were obtained early enough and fed with the new OMP diet to easily produce a smolt of the proper size (7/1b) for a good adult return rate (4%).

Although not specifically selected for, fecundity has increased in the Skamania strain. Initially native females often contained less than 2,000 eggs. Average number of eggs per female has increased from 2,390 in 1969 to 3,450 in 1976 with some females having more than 7,000. Most eggs are presently taken in January and February with some taken as early as December.

In 1971 Marvin Hull began an experimental "higrade" program. Approximately 10% of the largest and most esthetically pleasing females were selected and spawned with a similar single male. These fish were marked and reared separately. The goal of the selection process was to produce a larger percent return of three year ocean fish and thus shift the age structure from saltwater residences of 1, 2 and 3 years to predominantly 2s and 3s. This process continued to 1977. However, due to the extreme inbreeding required and the apparent poorer survival of these "higrades", this program has been reduced in scope and intensity.

Cold Water Disease problems in 1972-74 have been overcome by transporting the eggs to Vancouver Hatchery where they are reared in 50° F water to the fry stage and later transferred back to Skamania Hatchery when the water temperature there reaches 50° F.

Approximately 5,000,000 eggs are taken annually at present and distributed to hatcheries along the Columbia River, Puget Sound and hatcheries in other states. States that have utilized this stock include Oregon, California, Idaho, Indiana, Rhode Island, and North Carolina.

According to Hull (unpubl MS.), the original Washougal River native steelhead was white colored ventrally with only pink coloration occurring on the operculum. The Klickitat strain, on the other hand, was apparently a more highly colored steelhead with red opercles and rainbow stripe. Whatever the mixture, the present strain is esthetically pleasing, an outstanding jumper and fighter, and like its cousin at Chambers Creek has proven to be amazingly versatile. Most rivers in southwestern Washington planted with this stock have enjoyed excellent returns. Skamania summer steelhead have been used as the parent stock for runs created at various rearing ponds and hatcheries throughout the state. As with winter steelhead, the Department has attempted in recent years to rear whenever possible hatchery summer steelhead that have adapted to a particular river system. Table 3 is a list of rearing ponds and hatcheries that presently trap steelhead for replanting into the river of origin.

Skamania summer steelhead have 58 chromosomes (Thorgaard, 1977), which is typical for the Columbia basin and coastal streams of Oregon and Washington.

Table 3 -- Summer steelhead rearing sites

<u>Facility</u>	<u>Date Began</u>	<u>Stock Origin</u>	<u>Present Stock</u>
Chelan PUD Hatchery	1964	Skamania & Upper Columbia	returnees
Columbia Basin Hatchery	1961	Skamania (Upper Columbia)	Skamania
Cowlitz Hatchery	1967	Skamania	returnees
Tucannon Hatchery	1963, 70	Skamania & Chelan PUD Asotin Creek	Skamania & Chelan PUD
Wells Dam Hatchery	1967	Skamania & Upper Columbia	returnees
Barnaby Slough	1960	Skamania	returnees
Green River Ponds		Skamania	returnees
Ringold Ponds	1962	Skamania & Mid Columbia	returnees
White Horse Ponds	1962	Skamania & Stillaguamish	returnees
Calawah Pond	1977	Skamania	Skamania
Skykomish Ponds	1974	Skamania & Skykomish	returnees

III.C Rainbow Trout Broodstocks

III.C.1 General History

In 1933, the newly formed Department of Game found that the county and state hatcheries that were obtained had various sources for rainbow trout. Some had relied upon wild populations in lakes and others had established brood stocks of sorts. As the public was turning more and more to hunting and fishing for recreation, the Department was determined to increase the sport fish recreation available by increasing the numbers and quality of fish planted into state waters. During this era much of the eggs taken for hatchery rearing west of the Cascades were obtained from Packwood Lake, Lewis County, near Packwood. According to John Johanson (Personal communication), these fish were much different from the domesticated California rainbow, being slim, silvery rainbows with less speckling on the body. Their greatest disadvantage was, however, their slow growth rate and susceptibility to hatchery diseases.

During this period eggs were also taken from Walupt Lake, Lewis County; Big Goose Lake, Okanogan County; Chopaka Lake, Okanogan County; Fish Lake, Ferry County; Dumpka (Dompke) Lake, Chelan County; and Curlew Lake, Ferry County. Of these stations, Packwood Lake, Walupt Lake, and Dumpka Lake consistently provided eggs into the late 1930s and early 1940s.

Wild eggs, however, were dependent upon the natural rearing conditions of the lake and its resultant variability of spawner survival from year to year. Natural variation combined with the probable insufficient reseeding of these lakes with fry caused the Department to rely more and more heavily during the 30s and 40s on eggs purchased from independent trout farmers. Between 1933 and 1946 rainbow trout eggs and fry were purchased from 21 different sources. Among the more popular eggs were those obtained from the W.S. Meader Trout Farm, Pocatello, Idaho; K.G. Drew Rainbow Ranch, Missoula, Montana; J. G. Beity, Valley, Washington; Canyon Park Trout Farm, Bothell, Washington; A. C. Playfair, Chewelah, Washington; and Wandermere Golf Course In., Colbert, Washington. Eggs were also obtained from other sources in Montana, Colorado, Wisconsin, Missouri, and Washington.

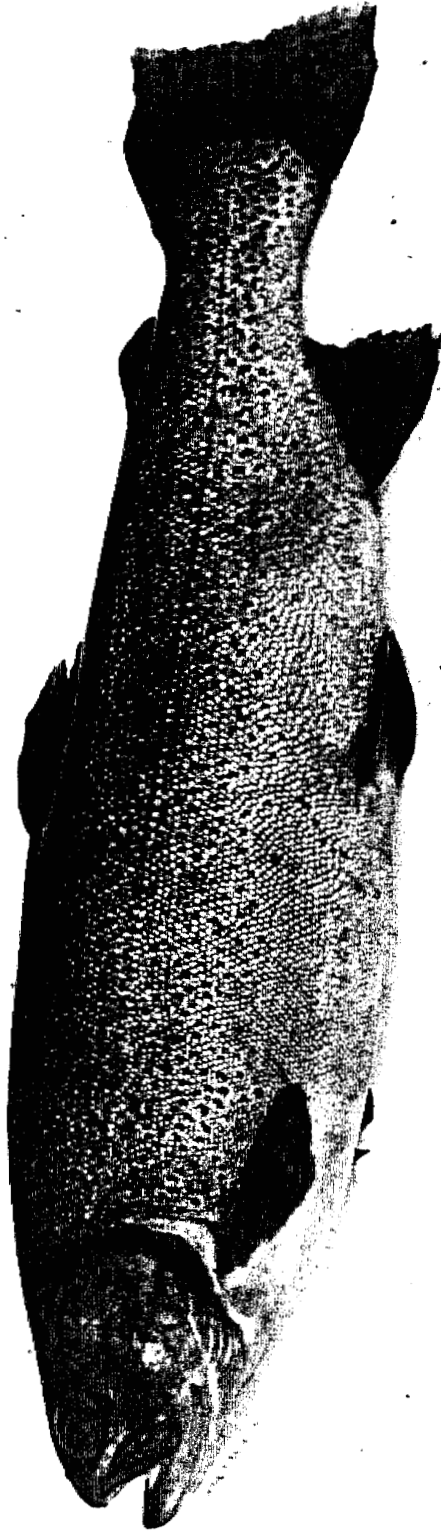
During the mid 1940s under the leadership of Clarence Pautske and later Clifford Millenbach it became apparent that in order to have a reliable

egg source for rainbow trout and other trout that the Department of Game should begin to culture and select its own brood stocks for use in the state's hatcheries and ultimately its planting programs. Numerous strains were obtained and selected for various traits, but eventually only four groups of rainbow trout were kept for propagation in Washington.

III.C.2 South Tacoma Rainbow Trout (Fall Spawning)

The Chambers Creek Hatchery was built in 1915 with \$5,500 received from the City of Tacoma in lieu of a fishway around their dam on the Nisqually River. Chambers Creek was chosen because it had an excellent salmon run (WDFG, 1917). In its first year of operation Chambers Creek reared chinook, chum, and coho salmon. By 1917, Lake Crescent cutthroat, Lake Chelan cutthroat, and Kokanee were being reared in addition to salmon. This continued as both a salmon and trout facility until 1921 when the Department of Fisheries and Game was separated into the Division of Fisheries and the Division of Game and Game Fish. At that time, Chambers Creek was assigned to the Division of Game and Game Fish and thereby became a trout hatchery (WDFG, 1923). In 1921, Chambers Creek hatched eggs from Chelan cutthroat, eastern brooktrout, Kokanee, and rainbow trout. Rainbow trout were obtained from Packwood Lake and this remained the chief source of eggs until 1935. In 1934, the Department built a new hatchery building and raceways at a large spring located at the Steilacoom State Game Farm about one mile from Chambers Creek. This spring provided 6,000 gallons per minute at a temperature of 56^o F. The Steilacoom Game Farm was obtained in 1921 by the Division of Game and Game Fish. The new buildings were renamed the South Tacoma Hatchery, and the old Chambers Creek Hatchery was sold. However, a trap continued to be used in Chambers Creek for the capture of winter steelhead.

In 1936, the Department of Game began importing green eggs from various commercial rainbow sources. South Tacoma received shipments from K. G. Drew Rainbow Ranch, Meader Trout Farm and other commercial sources through the late 1930s. In 1942, John Johansen was sent to the Meader Trout Farm to supervise the taking and shipping of 5 million eggs to various trout hatcheries. Chambers Creek received 500,000. This and other subsequent shipments were selected and kept for brookstock. During this time Packwood rainbows, Cape Cod rainbows and others were also reared at South Tacoma. However, by 1948, it was decided that the Game Department would no longer rely upon commercial egg sources, but would culture and hold its own broodstock. Therefore, Clifford Millenbach, General Hatchery



6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Superintendent, directed hatchery managers holding Meader strain to maintain them for broodstock and to select those females maturing at three and four years.

Today the South Tacoma Rainbow is, for the most part, of Meader origin, although some Packwood Lake and other commercial sources have undoubtedly contributed to the stock to some degree. The W. S. Meader Trout Farm was located at Papoose Springs near Pocatello, Idaho. The source of their eggs could not be directly determined through correspondence, etc., however the circumstantial evidence strongly suggests that they were originally obtained from the U. S. Fish Commission's hatchery at Springville, Utah some time between 1910 and 1930. Evidence indicating this source can be found in a few places. Kinunen and Moring (1978) found that Oregon's Roaring River rainbow strain were originally obtained from Meader and were known in Oregon as "Utah trout". In addition, stocks on hand at the old U. S. Fish Commission hatchery in Spokane in 1938 were from Springville, Utah. According to Leitritz (1972). Springville obtained their eggs in the following manner. In 1883 wild spring spawning rainbow trout were taken from the McCloud River, Shasta County, California, by the U. S. Fish Commission and shipped to its hatchery in Neosho, Missouri. After a number of years of selection for early eggs, some were transferred to the federal hatchery at Springville Utah where their warm water allowed further selection for early maturing fish. California's Hot Creek Hatchery also obtained eggs from Springville in 1933. Therefore, Washington's South Tacoma stock, Oregon's Roaring River Stock and California's Hot Creek stock were all derived from the same source.

When the stock was first obtained, egg take was predominantly in January and February at the Meader Trout Farm where the water temperature was 52° F. However, the warmer water (56° F) at South Tacoma moved spawning time up to November and December shortly after their retention as brood stock. Through constant selection for early maturation, eggs can now be obtained from August through October. By obtaining eggs as early as August, the Department can now provide legal size trout for planting into managed lakes prior to the opening of the general trout season (April) and fingerling trout plants in May for the next trout season.

By 1970 selection for early eggs for the legal trout program had succeeded to the point where selection for earlier egg takes was no longer needed. Consequently, in recent years, eggs to be used for brood stock have been obtained around the 10th of September.

In addition to timing, South Tacoma rainbows have been selected for large size, and "proper" coloration. According to Art Westrope, Manager, (personal communication), two color phases were present in South Tacoma rainbow, brown and green. The green hue has been considered the more pleasing and has been selected over the brown phase.

Females are typically spawned at age 2, 3, and 4 while males are spawned as 2s and 3s. Approximately 50 females are spawned for every 35-40 males. On the average 2 year old females will carry 1,500 eggs while 3 year olds and 4 year olds will have 2,200 and 2,700 eggs, respectively. Average loss from egg to fry is 25%. The major disease loss occurs from bacterial gill disease.

Presently, South Tacoma rainbow provide approximately one million 9 month old legal size trout and 3 - 4 million fry and fingerling trout for management programs west of the Cascades and in the Columbia basin. This strain has been the backbone of the legal trout put and take fishery in Western Washington. Its performance has been outstanding over the years, but recent increases in the egg mortality may indicate that too much inbreeding may have occurred in this stock, and that some new source of genetic variability is needed.

III.C.3 Spokane (Cape Cod) Rainbow Trout (Fall Spawning).

In 1934 the Department of Game built the present Spokane Hatchery on land once used by the U. S. Fish Commission as a hatchery and on land formerly part of the Spokane Game Farm. The hatchery obtained 10,000 gallons per minute from the Clark Spring at a temperature of 50° F. The new hatchery replaced the old Little Spokane Hatchery and Spokane Hatchery constructed by the Department of Fisheries and Game. The pond where the broodstock was kept had both rainbow trout from Bourbon Missouri, and Springville, Utah (letter in files by Harlan Cheyne, 1938) and were obtained from the U. S. Bureau of Fisheries. However, these fish did not perform well as evidenced in a letter to Director McCauley from Robert Meigs in 1942 which stated that "the broodstock set up is very poor and is a disappointment each year. The stock is quite old (8 years) and past its peak..... I would recommend planting out the present broodstock as soon as suitable conditions are made for replacements."

Consequently, the Department obtained the first shipment of a total of 2,300,000 eggs ordered from the Cape Cod Trout Company of Wareham, Massachusetts on September 2, 1942. This stock was originally obtained from the McCloud River near Mt. Shasta, California in 1882 and later selected and cultured in Massachusetts (Wahls, 1939) (Leitritz, 1976). The Cape Cod eggs were shipped to the Spokane Hatchery and later distributed to the Arlington, Goldendale and South Tacoma Hatcheries.

Through the careful efforts of James Morrow and Don Earnest, selection for size, fecundity and appearance took place. Only females maturing at 3 years of age were kept for brood stock. The resultant strain of fish have consistently shown good survival in the hatchery and in the waters planted.

Eggs are presently taken in November and December with 10,429,326 eggs taken in 1977. According to Don Earnest (personal communication) there was originally a much longer spawning period with the peak occurring near the end of December. The past practice of taking nearly all

of the eggs required in one or two days in mid December has apparently caused an earlier maturation date of about three weeks in this stock.

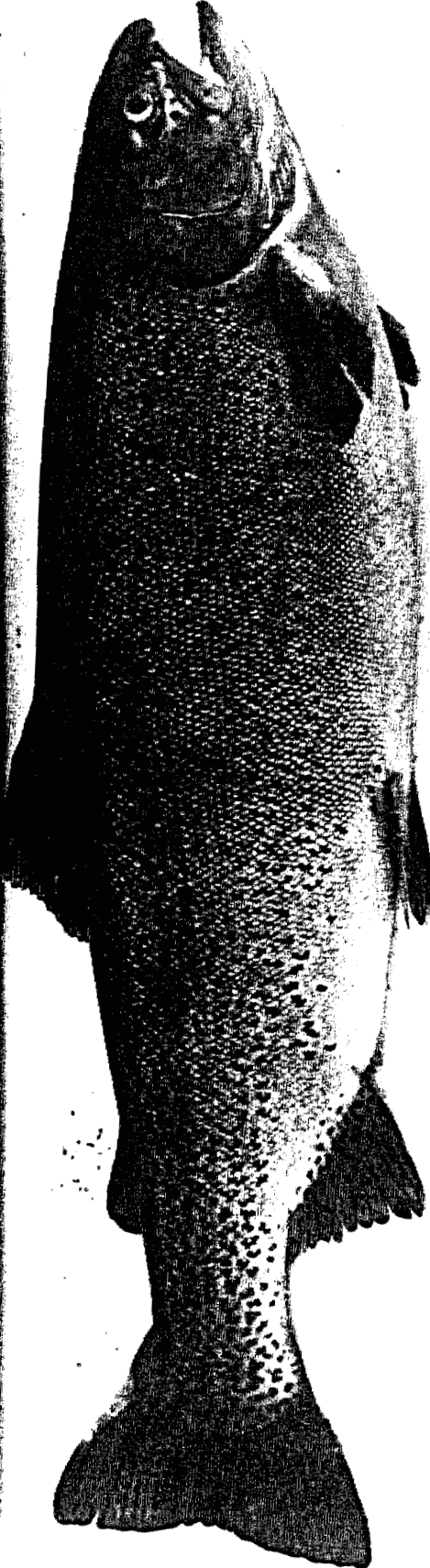
Females are spawned at 3, 4, 5, and 6 years and have an average fecundity of 2,400, 4,200, and 5,000 eggs for 3s, 4s and 5s respectively. Males are normally held separately and are spawned predominantly as 3 year olds.

This strain has had no direct mixing from other domestic rainbow groups, but has from time to time received contributions from wild trout that have entered the brood pond from the Little Spokane River or the natural pond located downstream from the brood stock pond. These fish were identified by their size, condition, and absence of broodstock fin clips.

Spokane rainbows have been used extensively in the resident trout program in the Columbia Basin, Palouse, and to a lesser degree in the western Washington lake fishery. Approximately 70% of the eggs taken are utilized for advanced fingerling plants. These are predominantly the earliest eggs, while the remainder (30%) of the later eggs are utilized for 13 - 15 month legal size plants. Most of the demand for Spokane eggs west of the Cascades are for legal programs in the lake fishery. Oregon has recently used this stock successfully in stream plants of legal size fish (Moring and Buchanon, 1978).

PLATE 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23



III.C.4 Goldendale Rainbow Trout (Fall Spawning)

The Goldendale Hatchery was built in 1938 at a large spring with a water temperature of 50⁰ F. It produced its first generation of fish in 1939 which consisted of Owhi Lake eastern brook-trout and Meader rainbow trout. The Meader trout were kept on hand as broodstock, and in 1940 a strain of rainbows from the Yakima Hatchery were also held for broodstock. By 1943, Cape Cod rainbow trout were also being held for broodstock. From 1940 to 1948 broodstocks at Goldendale were selected for the youngest mature females in an attempt to produce a greater number of eggs in fewer years. By 1948, Cape Cod fish were no longer used and both the Meader and Yakima strains were producing eggs at 2 years of age. However, it was found that early maturity tended to retard growth to some degree with the result that the average egg production per female was low. Females spawning for the first time as two year olds produced 600 - 900 eggs in comparison with 1,500 - 2,000 eggs per fish for three year olds. The small eggs produced by two year olds also produced small fry. Consequently, selection for 2 year maturity was discontinued at Goldendale in 1948. The Yakima strain and Meader strain were then combined around 1950 to form the present Goldendale rainbow stock. Records show that the Yakima strain from the Yakima Hatchery was begun in 1938 and was probably a mixture of McNott and Meader stock. Small amounts of Cape Cod strain also found its way into this stock. It is, therefore, a mixture of at least three stocks of fish.

The Goldendale rainbow has been selected for early eggs, large size, high fecundity, and overall color and vigor. Spawn is presently taken from October to February with the majority of eggs available in November and December. Females are presently spawned as 3, and 4 year olds and produce respectively 3,500 and 6,000 eggs per female. Males are spawned as three year olds and are held separately.

Goldendale broodstock produced 8,000,000 eggs in 1977. These are distributed to hatcheries throughout the mid Columbia basin and western Washington to provide both legal size and fingerling rainbow



trout for lakes, reservoirs, and streams. The majority of the early eggs are used for fingerling plants while the later eggs are used for stocking legal size fish.

III.C.5 Mt. Whitney Rainbow Trout (Spring Spawning).

In June 1962, the Department of Game obtained 54,664 eggs of Mt. Whitney strain rainbow trout from the Mt. Whitney Hatchery at Independence, California. According to Mr. Leonard E. Nixon, California Department of Fish and Game (letter in files), it is a mixture of Sacramento River rainbow and Klamath River steelhead with a possible contribution by Lahonton cutthroat from a spawning station at June Lake, Mono County, California.

Selection of this strain began in 1940 and eventually provided approximately 1,553 eggs for 2 year olds 2,200 for 3 year old females (Leitritz, 1972). The stock originally spawned in mid December in 1944, but by 1964 first spawning occurred on February 18 and continued through March.

The eggs were originally shipped to the Department's Goldendale Hatchery. However, the 52⁰ F spring water tended to cause early maturation of the spawners. The stock was then transferred to the Puyallup Hatchery in 1964 which has a water temperature of 47⁰ F. Due to inadequate facilities the broodstock were transferred to Whitehorse Rearing Ponds in 1966 and finally to Tokul Creek in May 1974. Tokul Creek Hatchery is ideally suited to rearing this strain due to both its location near the mountains and its water temperature (46⁰ F).

At present eggs are taken from December through March with the majority obtained in January. Females are presently spawned in two consecutive years as 3 and 4 year olds. Average fecundity is 2,600 eggs. Some females mature as late as four years and none mature as 2 year olds. Males are not kept separate due to lack of space. An average 3 year old spawner will weigh 2 pounds and will be 18 inches in length. Total egg take in 1977 was 768,902.

This fish is characterized by its deep body and comparatively small head. Until recently Mt. Whitney rainbows were used almost exclusively for aerial and backpack planting of Cascade alpine lakes as it is possible to rear them to approximately 500/lb by the first of June. In addition, this strain has proven to be ideal for alpine



lakes in that it grows well, over-winters well, produces naturally spawning populations when conditions are proper, and provides a good return to the creel. More information can be obtained concerning growth and survival of Mt. Whitney rainbows in alpine lakes by consulting Johnston (1972, 1973), Cummins (1973 - 75) and Williams (1972, 1974). Recently Mt. Whitney rainbow have been used in the Columbia basin for producing half pound legals for various lowland lakes.

IV CUTTHROAT TROUT (SALMO CLARKI, RICHARDSON)

IV.A General History

The cutthroat trout (Salmo clarki, Richardson) is closely related to the rainbow trout (Salmo gairdneri, Richardson). It was formerly found along the Pacific coast from Prince William Sound, Alaska to Eel River, California, and in the Columbia, Colorado, and Missouri River basins. Although recognized taxonomically as one species, it had, due to its post-glacial isolation in various watersheds, differentiated locally into numerous sub-populations by the time Europeans first entered the Pacific Northwest (Behnke, 1973). The number of distinct populations of cutthroat present at the arrival of the white man will probably never be known as many of these populations have been destroyed through hybridization with introduced strains of domestic rainbow and cutthroat trout.

Presently, there are two subspecies recognized by many taxonomists, that occur in Washington, the coastal cutthroat (S. clarki clarki) and the "west slope" cutthroat (S. clarki lewis). The coastal cutthroat is identified by its uniform speckling and anadromous tendencies while the "west slope" cutthroat can be identified by the larger spots or speckling occurring mostly above the lateral line and posteriorly and are non-anadromous. Behnke (1972) has shown that numerous other populations of cutthroat do exist or formerly existed that are distinct in various ways. Many of these forms are endangered and have been thoroughly reviewed by the U. S. Department of Agriculture's Forest Service publication Biology and Management of Threatened and Endangered Western Trouts (1976). In Washington, at least 6 races of cutthroat may have existed. These include the coastal cutthroat which occurred from the Nooksack River on the north to the Columbia River on the south and inland to the crest of the Cascades. They occurred upstream in the Columbia as far as the Klickitat River (Bryant and Parkhurst, 1950).

The "west slope" cutthroat is found from the Yakima River upstream in the Columbia drainage to the Pend Oreille River system and included Lake Chelan and Lake Wenatchee. Behnke (1976 unpubl MS) (U.S.D.A., 1976) has presented evidence that the Yellowstone or upper Snake River cutthroat (S. c. bouvieri) exists in the Snake River drainage and in parts of the Cascades. His claim is supported by Locke (1929). This fish has very large spots with a yellow coloration to the body and may be found in portions of southeastern Washington. Jordan (1907) has reviewed three other species of cutthroat-like trout. One, described later in the report, was from Lake Crescent, and two others S. jordani and S. declivifrons were found in Lake Sutherland. Jordan surmized that isolation within these large glacial lakes led to differentiation.

Cutthroat trout were the first non-anadromous trout cultured in Washington. When the Lake Chelan Hatchery was built on Stehekin Creek in 1903, cutthroat from the stream were used in the hatchery and the fry were planted in many of the local lakes and streams. Prior to 1903, cutthroat trout were stocked by the U. S. Bureau of Fisheries in numerous Washington streams as early as 1895. Many of the fish planted were the Yellowstone "black spotted" trout (S. c. lewisi). These were planted in lakes and streams near Spokane, Yakima, Tacoma, Bellingham, Everett, Colville, and Newport.

When the Little Spokane Hatchery began operations in 1905 it obtained spawn from the Lake Chelan hatchery for planting in the Spokane area (W.D.F.G., 1907). Also, in 1905, the Whatcom County Game Commission finished the construction of a hatchery at Lake Whatcom for the local distribution of cutthroat trout from Lake Whatcom.

In 1913, the Lake Crescent Hatchery was built by a special appropriation of the legislature. This station cultured as early as 1915 the so called long headed crescent trout and Beardslee trout described by David Starr Jordan in 1907 as S. crescentis and S. beardsleii. Both species were found in Lake Crescent, Clallam County, Washington.

The crescentii as reported by Jordan reached a weight of ten pounds and was "a deep steel-blue in color, with fine specks and without red at the throat." In later years, it became evident that the crescentii was a population or race of cutthroat, and that the beardslee was a subpopulation or race of rainbow trout.

According to Mr. Kenneth Hodgeboom, Manager of the Lake Crescent Hatchery from 1926 - 1935, both races had a distinct blue-green coloration with a silvery belly during the portion of their life within the lake. However, both fish attained the typical coloration of cutthroat and rainbow trout when they entered the stream to spawn. Originally a large population of dace existed in the lake and provided forage for the trout. This was the cause of the large size of both races. According to Mr. Hodgeboom, there was a population of small native Kokanee in the lake. In the late 1920s, there was a mysterious crash in the dace population. Thereafter, the crescentii and beardslee began to decrease in size. Kokanee were planted into the lake to replace the dace as a forage fish but met with little success. Beardslees were never obtained in great numbers, and their culture was discontinued in 1932. The crescentii was last cultured in 1940. In 1941 and 1942 the Lake Crescent Hatchery trapped cutthroat at Lake Sutherland. In 1943, the station was closed and the crescentii and beardslee were no longer cultured. The cause of the decline of these races can only be conjectured at this time. It appears, however, to have been due to the loss of a forage fish. The dace were apparently destroyed either through disease or through the introduction of Kokanee, rainbow trout, black spotted trout and steelhead into both Lakes Crescent and Sutherland between 1915 and 1943.

Eggs were formerly taken in the Lyre River in February, March, and April for the Beardslee, and in Barnes Creek from December through April with the majority taken in January for the crescentii. Beardslee females averaged 2,000 eggs while crescentii produced 1,900 per female. Lake Crescent now lies within the boundary of the Olympic National Park

and is no longer under the jurisdiction of the state.

By 1915, cutthroat were obtained from the Lake Chelan Hatchery, Lake Crescent Hatchery, Dumpka Lake eyeing station, Sullivan Lake eyeing station, and Twin Lakes eyeing station. Dumpka Lake is located on a tributary of Lake Chelan and was planted with cutthroat from Stehekin Creek. Sullivan Lake is located in Pend Oreille County and supplied the Little Spokane Hatchery with eggs. It was originally planted by the County Game Commission around 1910.

When the Department of Game was formed in 1932 and up to 1946, cutthroat were obtained from Twin Lakes Eyeing Station, Lake Whatcom, Lake Crescent, and Lake Padden. Additional cutthroat were obtained during this time from K. G. Drew, Troy Montana; U. S. Bureau of Fisheries, Yellowstone Park; Lake Washington tributaries; Cultus Lake, British Columbia; and Browns Lake, Pend Oreille County. In 1938, the Vancouver Hatchery began holding its own broodstock. These were derived from Twin Lakes cutthroat. Vancouver Hatchery remained the only installation with cutthroat broodstock until 1949 when the Tokul Creek Hatchery obtained a brood stock. In 1954, the Vancouver Hatchery no longer kept brood stock as there were repeated problems with large infestations of parasitic copepods. At present, there are three stocks of resident cutthroat and three stocks of anadromous cutthroat cultured by the Department. A further description of each stock follows.

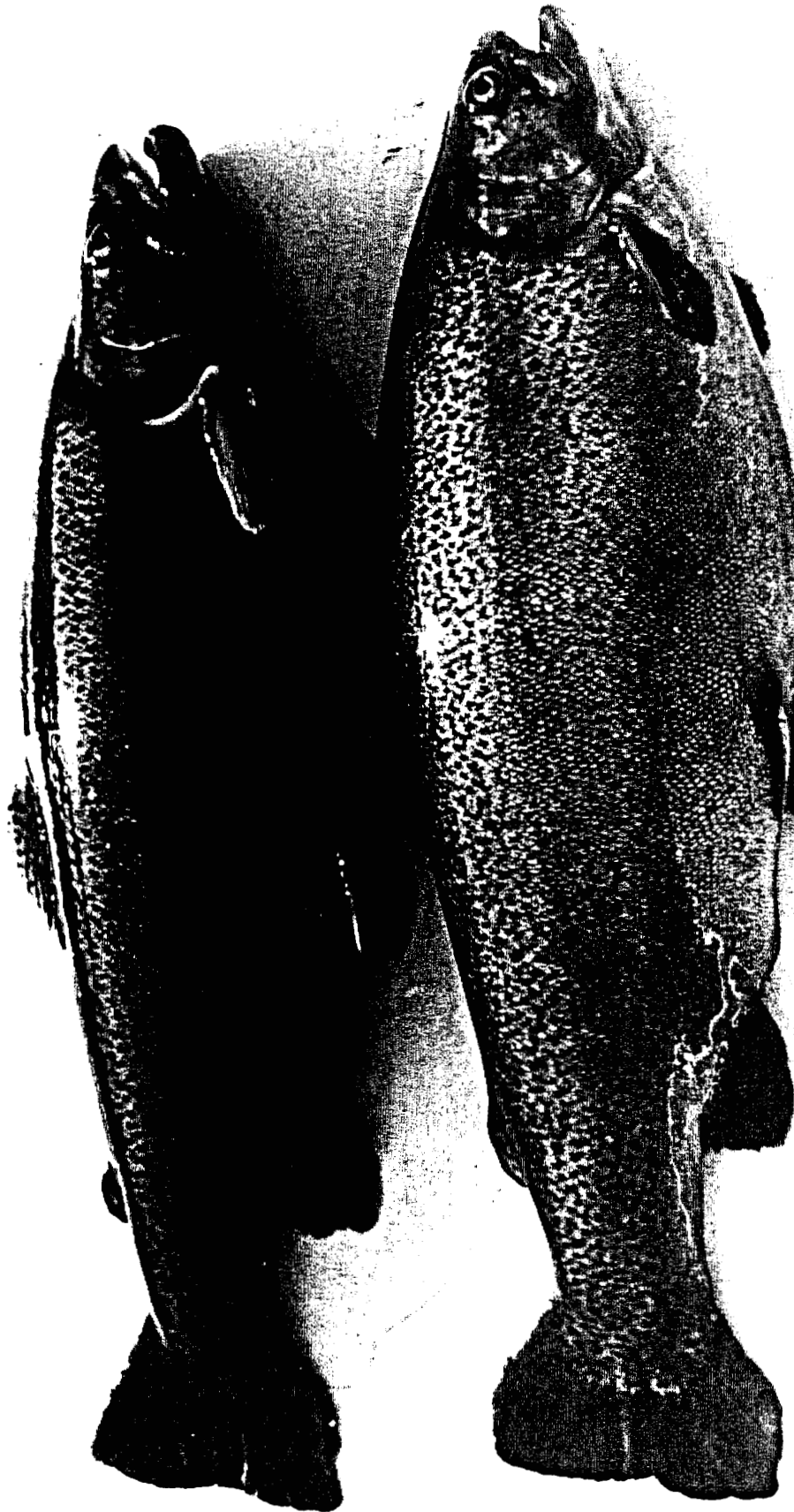
IV.B Coastal Cutthroat Trout (Salmo clarki clarki)

IV.B.1 Beaver Creek Cutthroat (*anadromous*)

A program to establish an anadromous cutthroat stock was begun in 1958 when fish from the Nemah, Green (tributary of the Toutle), and Elochoman (Beaver Creek) Rivers were trapped and their eggs taken in 1959 and reared at both the Vancouver and Beaver Creek Hatcheries. In 1960, the first plant of 500 fingerlings at 45/lb were released into Beaver Creek, and more adults were trapped for spawn. From 1961 through 1965 both Vancouver and Beaver Creek continued to rear native fish trapped from the various rivers mentioned. However, few fish returned to the point of release, and the number of eggs obtained could not be increased. In order to bolster the sagging production of sea-run cutthroat, the Department obtained 100,000 fry from the Oregon Game Commission's Bandon Hatchery. The fry were originally sent to Vancouver Hatchery on April 16, 1963 and Vancouver later transferred 92,950 fingerlings to Beaver Creek in May and June.

The fry obtained from the Bandon Hatchery were derived from wild sea-run cutthroat taken from the North Fork of the Alsea River in 1936 (John Moring, ODFW, personal communication). They had remained as captive broodstock in Oregon for approximately 25 years prior to their acquisition by the Department of Game. The stock was not mixed in Oregon with other strains of cutthroat, but has received on occasion wild fish from the North Fork Alsea River. The original Alsea stock spawned in December and January and this has remained unchanged at the Bandon Hatchery.

The "Oregon fish" were held separately until 1968. During this time, releases were made of native fish from the rivers already mentioned and the Cowlitz River; "Oregon fish", and in 1967 and 1968, a Beaver Creek native sea-run cutthroat-steelhead hybrid. By 1969, the hatchery relied solely upon captive brood stock for eggs. From 1973 to the present, no native fish have been trapped. By 1972, the "Oregon fish" and natives were combined to form one Beaver Creek stock.



Presently, females are spawned at 2, 3 and 4 years and have an average fecundity of 1,500, 3,200 and 3,800 eggs respectively. Males are likewise spawned at 2, 3 and 4 years of age with 3 females used for every one male. Eggs are presently taken from the second week in December to the end of January with the majority taken in January. Replacement broodstock are hand picked from the previous years production. Spotting and coloration are the major selection factors with fecundity also of importance. Approximately 2 million eggs are taken annually and reared at Beaver Creek until they reach approximately 50/lb. They are then transferred to the Vancouver Hatchery where they are held in a rearing pond until they reach approximately 4/lb. The resultant "smolts" are planted into numerous streams in southwestern Washington, with some being utilized near Aberdeen for a lake fishery.

As already shown, the Beaver Creek stock is a mixture of many groups of fish. The present stock has a wide range of coloration and speckling varying from truly cutthroat types to others closely resembling steelhead. The impurity of the stock can probably be traced to the hybrid releases in 1967 and 1968. The impurity of the stock coupled with practically no returns to the point of release has nullified the original intentions for the development of an anadromous stock, so that today their greatest contribution to the fishery is through a legal size put and take fishery in the Longview area.

Approximately 2,000 smolts are planted into Beaver Creek and another 7 - 8,000 are scatter planted in the upper Elochoman in a token attempt to obtain returns to the hatchery. However, in 1976 only 24 cutthroat were trapped and in 1977 a mere 14 were recovered. During the selection for brood stock replacement, "silvery cutthroat" are rejected in favor of those having the proper speckling, etc. This may help reduce the amount of steelhead influence, but it is very doubtful that it will alter the behavior of this stock.

Johnston and Mercer (1976) have reviewed the status of sea-run cutthroat in Washington and describe their attempts to revitalize the Department's anadromous cutthroat program.

IV.B.2 Cowlitz River Cutthroat (*anadromous*)

The Cowlitz Trout Hatchery was built in 1967, and in the spring of 1968 a program began to culture a run of sea-run cutthroat. To begin the program, 777,000 eggs were obtained from Beaver Creek stock and 60,000 eggs were obtained from native Cowlitz cutthroat. Each group were reared and released into Blue Creek. This procedure continued to 1975 with little returns and numerous in-hatchery mortalities from Ceratomyxa. In 1976, however, all of the fingerlings on hand were planted and only returning wild cutthroat were spawned. This procedure has continued to the present with 262 females spawned in 1976, 317 in 1977 and 358 in 1978. Total egg take in 1976 through 1978 has been 211,000; 272,000; and 325,000 eggs. Most eggs are taken in December, with some also taken in January and February. Females have approximately 857 eggs.

Although the program is new, it has shown a promising yearly increase in the number of returning spawners, and the resultant egg take. Preliminary data from adipose marked kelts indicate at least a 7% respawner recovery at the Blue Creek trap and barrier dam. Cutthroat marking experiments already in progress should provide more information in the future.

IV.B.3 Puget Sound Cutthroat (*anadromous*)

Another anadromous cutthroat stock in the developmental stage is the Puget Sound cutthroat stock. A program was begun in 1973 to develop information on the history of the sea-run cutthroat and also to develop a hatchery cutthroat stock that would return to the point of release, and be of Puget Sound origin. As a result, fish have been captured from early entering (September - October) and late entering stock (December - February). Early stock were obtained from the Stillaguamish River and have been reared at the Whitehorse Rearing Ponds. Late entering stock were captured in Hood Canal and transported and held in saltwater pens at the National Marine Fisheries Service's Aquaculture Experimental Station near Manchester, Washington. Late entering stocks have been spawned in late February and early March. Average fecundity is 893 eggs. The resultant fry have been reared at the Shelton hatchery for approximately one year prior to their movement to saltwater rearing pens at Manchester.

Early entering stock were successfully held and cultured in 1977, when 23 females were spawned in February and March from the Nooback River.

This program may provide a useful sea-run cutthroat program for Puget Sound streams in the future. The greatest obstacles to success are *Vibrio*, and other disease problems in freshwater. For more information on the status of this new strain consult Johnston and Mercer (1976, 1977).

IV.B.4 Tokul Creek Cutthroat (*non-anadromous*)

Tokul Creek Hatchery is located on Tokul Creek, tributary to the Snoqualmie River near the town of Fall City, King County. In 1946, Tokul Creek Hatchery was selected as the best place for holding cutthroat brood stock as the Vancouver broodstock was diseased. Consequently 125 male and 179 female cutthroat were trapped in Brannian Creek in 1947 and in Anderson and Austin Creeks in 1948, tributaries of Lake Whatcom and the resultant 252,328 eggs were reared for broodstock. By 1950, the first eggs were taken from these fish.

Since that time, Tokul Creek cutthroat have not been mixed with other strains of cutthroat. It is possible, however, that the original coastal cutthroat stock in Lake Whatcom may have hybridized with Lake Chelan cutthroat (*S. clarki lewisi*) when 50,000 fry were placed into the lake in 1907. The stock has no apparent influence from "west slope" cutthroat as it has all of the spotting and other characteristics typical of the coastal cutthroat.

Spawn was originally taken at Lake Whatcom from December to March, but eggs are presently taken in January and February with the majority taken in January.

Females and males are presently spawned at ages 3, 4 and 5 with females characteristically having 600 - 700 eggs. The cool water temperature, averaging 44 - 46° F produces no mature 2 year old females. Three year olds average 12 - 13 inches while 5 year olds may be 14 inches. In 1977, 496,000 eggs were produced.

This stock is well adapted to the oligotrophic waters of Western Washington and is used extensively to plant lowland lakes, beaver ponds and streams.

It presently is being revitalized with new cutthroat trapped at Lake Whatcom's tributaries.



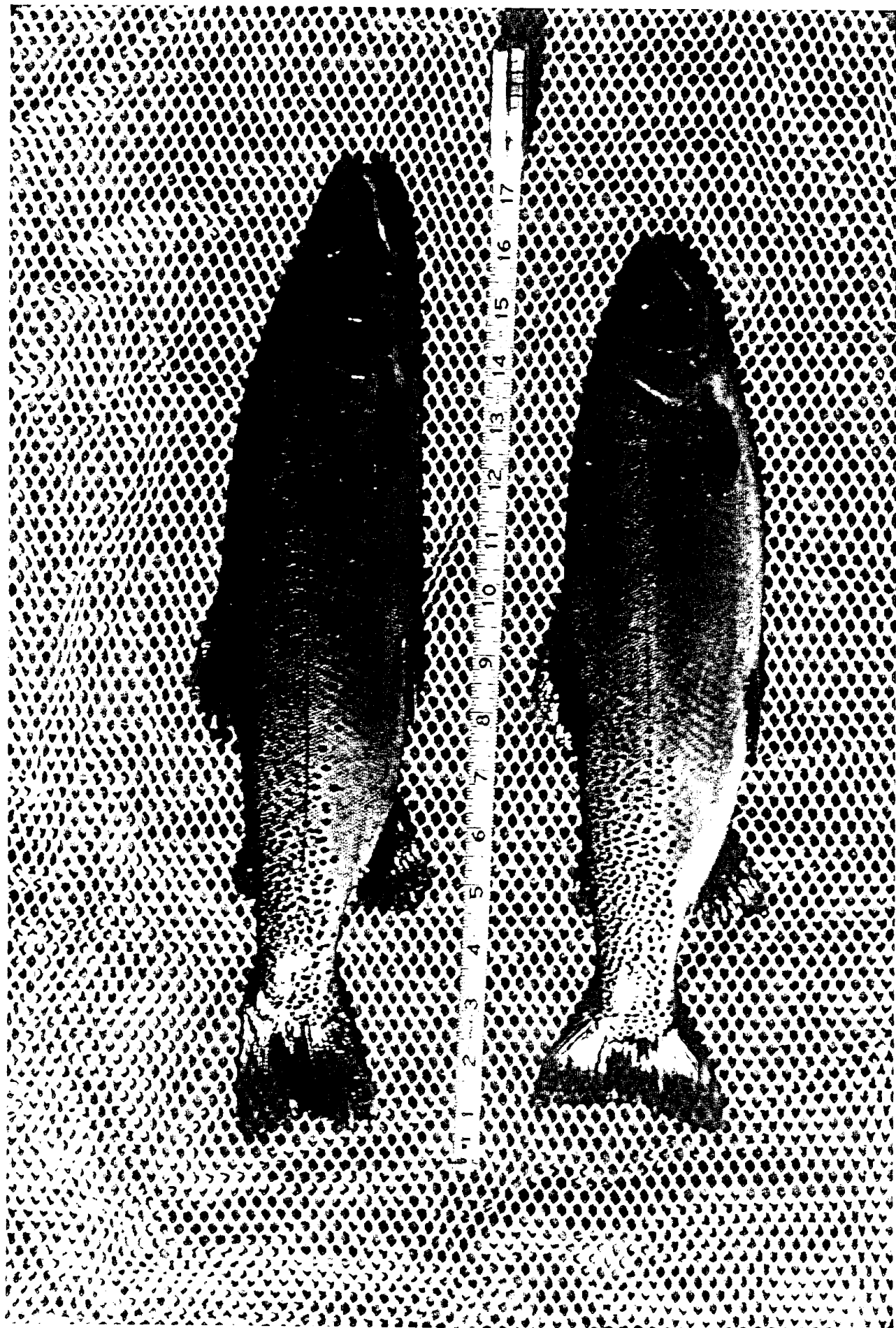
IV.C Intermontane Cutthroat (Salmo clarki lewisi)

IV.C.1 Twin Lakes Cutthroat Trout (*non-anadromous*)

Twin Lakes are located in Chelan County near the town of Leavenworth and on a tributary of the Wenatchee River. It is unclear from the records when these alpine lakes were first planted with cutthroat, however, by 1915 the Department of Fisheries and Game had established an eyeing station and took 1.4 million eggs. Although Johansen (1972) believes that the strain was obtained from the Chelan Hatchery at Stehekin Creek, I believe that the fish were more likely obtained from Wenatchee Lake or the Wenatchee River. This premise is based upon the general practice of the time of establishing a hatchery and obtaining eggs from a nearby source. The second Wenatchee Hatchery was built in 1914 at Leavenworth for the rearing of salmon. This is only a few miles from Twin Lakes and as stated in the 1916 Annual Report "In connection with the Wenatchee Hatchery it is believed there can be developed a splendid eyeing station at Twin Lakes in Chelan County. When the hatchery was built, an agreement was made with the Chelan County Game Commission that it would also rear trout. Whether Wenatchee River origin or Stehekin Creek origin, the cutthroat stock is representative of the Columbia Basin cutthroat.

Eggs are presently taken in June when ice leaves these alpine lakes, and early records from 1921 show that the timing has not changed. Eggs were originally eyed at Twin Lakes and then packed out by horse. By 1950, the eggs were transported by car to Leavenworth National Fish Hatchery for distribution to other hatcheries (Johansen, 1972). Females are spawned predominantly as 4, 5 and 6 year olds with an average fecundity of 517 eggs per female.

Although Johansen (1972) refers to Twin Lakes as Cascade stock, Behnke (1976) refers to upper Columbia stocks as "west slope" Montana cutthroat. Campton (1978) noted that the genetic information at loci for various proteins in blood and muscle indicate that the Twin Lakes



variety is not closely related to the coastal cutthroat, but is more similar to cutthroat samples from Montana and Wyoming. As shown in Figure 10, the speckling pattern of Twin Lakes cutthroat is more similar to Kings Lake cutthroat than to either Tokul Creek cutthroat or anadromous Hood Canal cutthroat. As the term "west slope" cutthroat has meaning only in Montana and Idaho, a more versatile term proposed by Don Earnest (personal communication) would be intermontane cutthroat, as it is typically found between the crest of the Cascades and the crest of the Rockies.

This stock has been used extensively for fry planting oligotrophic alpine lakes on both the east and west slopes of the Cascades. Its excellent growth rate and return to the creel have been summarized by Williams (1972). The genetic purity of this wild stock of cutthroat has been maintained for 63 years. This important source of eggs should be protected from rainbow trout hybridization and hybridization with other strains of cutthroat trout. Recently, eggs have become more difficult to obtain each year. The chief cause of the decline in numbers of mature spawners is apparently due to an increased illegal fishery. These lakes were once fairly remote, but recent road and trail systems have made them accessible to the general public. It would indeed be a tragedy if this strain of wild trout were eliminated by the greed and thoughtlessness of a few.

IV.C.2 Kings Lake Cutthroat Trout (*non-anadromous*)

During the late 1930's a suitable cutthroat brood stock was being researched for use in the Spokane area to replenish the once abundant native cutthroat. Clarence Pautske believed that Twin Lakes cutthroat might be able to fill those needs. Harlan Cheyne, District Biologist, however, stated in a letter to Pautske in 1938 that the Twin Lakes cutthroat were more similar to coastal varieties than to the variety native to Pend Oreille County and the Palouse country. A test was ultimately conducted at the Pend Oreille Hatchery in 1939 to determine if Twin Lakes cutthroat would be suitable. The Twin

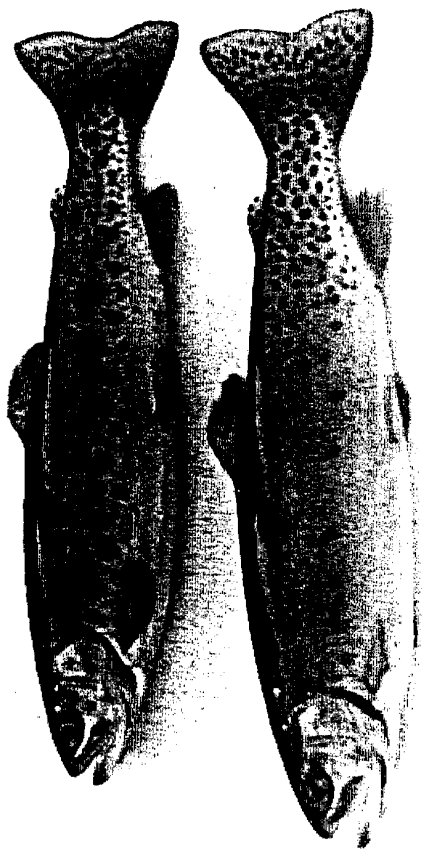


Plate 61. Salmon. 1. *Salmo gairdneri*. 2. *Salmo gairdneri*. 3. *Salmo gairdneri*. 4. *Salmo gairdneri*. 5. *Salmo gairdneri*. 6. *Salmo gairdneri*. 7. *Salmo gairdneri*. 8. *Salmo gairdneri*. 9. *Salmo gairdneri*. 10. *Salmo gairdneri*. 11. *Salmo gairdneri*. 12. *Salmo gairdneri*. 13. *Salmo gairdneri*. 14. *Salmo gairdneri*. 15. *Salmo gairdneri*. 16. *Salmo gairdneri*. 17. *Salmo gairdneri*. 18. *Salmo gairdneri*. 19. *Salmo gairdneri*. 20. *Salmo gairdneri*. 21. *Salmo gairdneri*. 22. *Salmo gairdneri*. 23. *Salmo gairdneri*. 24. *Salmo gairdneri*. 25. *Salmo gairdneri*. 26. *Salmo gairdneri*. 27. *Salmo gairdneri*. 28. *Salmo gairdneri*. 29. *Salmo gairdneri*. 30. *Salmo gairdneri*. 31. *Salmo gairdneri*. 32. *Salmo gairdneri*. 33. *Salmo gairdneri*. 34. *Salmo gairdneri*. 35. *Salmo gairdneri*. 36. *Salmo gairdneri*. 37. *Salmo gairdneri*. 38. *Salmo gairdneri*. 39. *Salmo gairdneri*. 40. *Salmo gairdneri*. 41. *Salmo gairdneri*. 42. *Salmo gairdneri*. 43. *Salmo gairdneri*. 44. *Salmo gairdneri*. 45. *Salmo gairdneri*. 46. *Salmo gairdneri*. 47. *Salmo gairdneri*. 48. *Salmo gairdneri*. 49. *Salmo gairdneri*. 50. *Salmo gairdneri*. 51. *Salmo gairdneri*. 52. *Salmo gairdneri*. 53. *Salmo gairdneri*. 54. *Salmo gairdneri*. 55. *Salmo gairdneri*. 56. *Salmo gairdneri*. 57. *Salmo gairdneri*. 58. *Salmo gairdneri*. 59. *Salmo gairdneri*. 60. *Salmo gairdneri*. 61. *Salmo gairdneri*. 62. *Salmo gairdneri*. 63. *Salmo gairdneri*. 64. *Salmo gairdneri*. 65. *Salmo gairdneri*. 66. *Salmo gairdneri*. 67. *Salmo gairdneri*. 68. *Salmo gairdneri*. 69. *Salmo gairdneri*. 70. *Salmo gairdneri*. 71. *Salmo gairdneri*. 72. *Salmo gairdneri*. 73. *Salmo gairdneri*. 74. *Salmo gairdneri*. 75. *Salmo gairdneri*. 76. *Salmo gairdneri*. 77. *Salmo gairdneri*. 78. *Salmo gairdneri*. 79. *Salmo gairdneri*. 80. *Salmo gairdneri*. 81. *Salmo gairdneri*. 82. *Salmo gairdneri*. 83. *Salmo gairdneri*. 84. *Salmo gairdneri*. 85. *Salmo gairdneri*. 86. *Salmo gairdneri*. 87. *Salmo gairdneri*. 88. *Salmo gairdneri*. 89. *Salmo gairdneri*. 90. *Salmo gairdneri*. 91. *Salmo gairdneri*. 92. *Salmo gairdneri*. 93. *Salmo gairdneri*. 94. *Salmo gairdneri*. 95. *Salmo gairdneri*. 96. *Salmo gairdneri*. 97. *Salmo gairdneri*. 98. *Salmo gairdneri*. 99. *Salmo gairdneri*. 100. *Salmo gairdneri*.

Lakes variety failed to perform well. As a result of this and Harlan Cheyne's 1938 recommendations, Don Earnest arranged for receipt of cutthroat from Priest Lake, Bonners County, Idaho from the Idaho Fish and Game Commission. Approximately 107,000 eggs were obtained from cutthroat spawners in Granite Creek and an additional 12,288 eggs were obtained from Kalispell Creek in May 1940. Both streams enter Priest Lake on the western shore. The additional fish received from Kalispell Creek were obtained from Idaho in exchange for smallmouth bass (Don Earnest, personal communication). The eggs were taken to the Pend Oreille Hatchery and held there until 1941. In the fall of 1940, Kings Lake (Pend Oreille County) was rehabilitated with rotenone in order to provide a brood stock lake. Kings Lake was the first rehabilitation project in the state. The Priest Lake cutthroat were then taken to Kings Lake in the spring of 1941.

The first egg take took place in May 1943 when 1.3 million eggs were taken. The time of egg taking has remained stable over the years with the majority being taken in May, with a few taken in late April and early June. The egg take in 1977 was 508,000. At present, the eggs are reared at the Colville Hatchery and distributed as needed to other facilities. Females are predominantly spawned at 3 years of age and characteristically have 500-800 eggs. In recent years the egg take at Kings Lake has steadily dwindled. It is believed that this is predominantly due to illegal fishing. In order to insure a continued supply of Kings Lake stock, 1,100 of the smallest two year old cutthroat (culls) were kept at the Ford Hatchery in May 1978 for a spawning program in 1979. These were derived from 432,000 fry received from Colville Hatchery August 4, 1976, from eggs taken at Kings Lake on May 1, 1976.

The Kings Lake cutthroat has been kept free from mixing with other cutthroat stocks, and therefore, remains representative of the native cutthroat found throughout northeastern Washington and northern Idaho.

V. EASTERN BROOK TROUT (Salvelinus Fontinalis, Mitchell)

V.A General History

The eastern brook trout was first introduced into Washington waters in 1894 when fingerlings were placed in Lakes Twin, Mountain, Kelly, Hooker, Cranberry, Johns and Washington by the U.S. Bureau of Fisheries (WDFG, 1902). Numerous other plantings occurred throughout the state including plantings into numerous lakes and streams near Wilbur and Republic Washington in subsequent years. Much of the brook trout stock was obtained from the Paradise Brook Trout Company, Henryville, Pennsylvania (WDFG, 1921). By 1913, however, a large portion of the required brook trout eggs were obtained from eyeing stations at Swan Lake, Bonaparte Lake, and Lost Lake and were reared in the Little Spokane Hatchery. By 1915, over one million brook trout fry were released from state hatcheries. Between 1915 and 1940 numerous local lakes were utilized for taking brook trout eggs. Among the most important ones were Skookum Lake and Owhi Lake.

V.B Ford Hatchery Eastern Brook Trout

This stock has been obtained from Owhi Lake, Okanogan County on the Colville Indian Reservation. Brook trout were probably placed in Owhi Lake by the U.S. Fish Commission or the local county game commissioner between 1905 and 1910 from sources near Wilbur or Republic. Eggs were first taken at Owhi Lake by the Department of Fisheries and Game in 1919 when they secured 765,000 eggs and in 1920 when 1.6 million eggs were taken. This continued on an annual basis until 1933. The maximum take during this time was in 1927 when 15 million were obtained and distributed statewide.

With the establishment of the Department of Game in 1933, egg taking continued at Owhi Lake as in previous years. The specific arrangement was that the Department would lease property from Wakista Iukes and Harry and Lucy Owhi. In turn for the use of reservation



10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

broodstock, 50% of the resultant fry were replanted into reservation waters. This agreement remained until 1964 when the Colville Indians no longer wished to continue the arrangement.

At that time, a small number of Owhi Lake eastern brook trout fry (approximately 3,000 culls) that were on hand at the Spokane Hatchery were held for brood stock. These fish were later transferred to the Ford Hatchery in the summer of 1966 where they have remained.

These fish were traditionally spawned on the reservation between November 1 and December 20, and the reservation egg take exceeded 8 million in 1951. Egg take in the hatchery today is during October and November. Total egg take in 1977 was slightly over 2 million. The stock has remained pure with no mixing from other brook trout stocks.

When the small group of brook trout were first spawned in 1967, they ranged in size from 5 to 9 inches. Replacements were selected from the first spawners and the biggest females and males in the group. In 1967, only 725 eggs per female were obtained. However, there has been an increase to where at present a 2 year old female will on the average produce 1,500; a 3 year old, 2,000; and a 4 year old, 3,100 eggs.

The greatest problem in rearing this stock has been the chronic incidence of septicemia and Kidney Disease.

Today the eggs are taken at Ford Hatchery and distributed as needed to fulfill planting requirements for lakes and beaver ponds throughout the state. In the past, Owhi eastern brook trout were used as the major trading item with California for Hot Creek rainbows and other species of trout. They have been used extensively in planting alpine lakes, although due to their prolific nature and tendency to over populate and stunt in alpine lakes there have been fewer planted in recent years. This stock is vigorous and, due to its long heritage from Owhi Lake, is well adapted to Washington's aquatic environment.

VI. KOKANEE (SILVER TROUT) Orcorhynchus nerka, Walbaum

The first recorded plant of kokanee was in 1904 when the U.S. Bureau of Fisheries planted approximately 10,000 fry in Sullivan Lake, Pend Oreille County (WDFG, 1904). The source of these eggs could not be determined. However, kokanee are native to Washington and were originally found in Lake Chelan, Lake Whatcom, Wenatchee Lake, Lake Sammamish and Lake Washington. Kokanee eggs were obtained by the Whatcom County Game Commission as early as 1911 when 200,000 were shipped to the Lewis River Trout Hatchery for hatching. By 1915 an eyeing station was in operation at Lake Whatcom where approximately 9 million eggs were obtained, and at Lake Wenatchee where 600,000 eggs were taken. Fry from these stations were planted into numerous lakes and streams. Lakes where populations were established include Lakes Samish, Padden, and Silver in Whatcom County, and Deer and Loon Lakes, Stevens County; and Cascade Lake, San Juan County. In 1919 eggs were obtained from Lake Whatcom and from a new eyeing station at Lake Sammamish. This station produced 14 million eggs by 1920. By 1921 eggs were being taken at Lake Whatcom, Lake Samish, and Sullivan Lake. Only Lake Whatcom maintained production from year to year. This was probably due to the overharvest of spawners with few fry being returned to the stream for replacement.

During the 30's and 40's, kokanee from Lake Whatcom were supplemented with eggs obtained from Pend Oreille Lake, Idaho; Loon, Deer, and Sullivan Lakes, Stevens County; Lake Stevens, Snohomish County; Bear Creek, King County; Lake Samish, Skagit County; Lake Chelan and Wenatchee, Okanogan County; Flathead Lake, Montana; an unknown source in British Columbia; and from a private hatchery owned by Ole Dybdall and operated by the state at Chapman Lake, Spokane County.

During the 1950's and 60's it became apparent that kokanee were not suitable for many lakes. As a result, the need for kokanee eggs diminished and the number of egg stations declined. Eggs have been taken exclusively at Lake Whatcom for the past ten years with an egg

take in 1977 of 19 million.

Spawn was originally taken in October and November, and has remained unchanged to the present.

Lake Whatcom kokanee mature at 3 and 4 years of age at a length of 9 3/4" - 10 3/4". Females typically have 250 eggs and are spawned as they enter Brannion Creek. Approximately 2.5 million fry are released back into Brannion Creek at 2,000 - 6,000 per pound to replenish the stream.

This stock is pure, having no known introductions from other kokanee sources. Lake Whatcom kokanee are the major source of most of the lakes in Washington where kokanee are found today, although much mixing of Lake Whatcom, Lake Chelan and Lake Wenatchee stocks has occurred in some of them. Fletcher (1976) and Pfeifer (1978) have delved into the growth and survival of Lake Whatcom and Lake Stevens kokanee.

In summary, Lake Whatcom kokanee is the only species cultured by the Department of Game where the source of eggs is still dependent upon the well being of the population of the body of water where they evolved. This stock is in excellent condition both in abundance and vitality for a population that has been used for artificial culture for 66 years. Its present abundance can probably be attributed to the protection of the Lake Whatcom tributary streams where spawning occurs, and to the consistent replanting of kokanee fry back into the lake.



VII MISCELLANEOUS TROUTS UTILIZED BY THE DEPARTMENT OF GAME

In addition to the various species of trout maintained and cultured on a recurring basis, a number of species of exotics have from time to time been introduced into the state.

VII.A Lake Trout (Makinaw) Salvelinus namaycush, Walbaum

The first known introduction of lake trout in Washington occurred in 1900 when fry were planted into Lake Washington, Newman Lake, Lake Whatcom, and Loon Lake by the U.S. Bureau of Fisheries. Six other lakes were subsequently stocked between 1901 and 1904. Various other lakes were planted from time to time through the years. Even tributary streams of Lake Sammamish and Lake Washington were planted in 1920. Most of the trout were obtained from the state of Wisconsin. The number of lake trout planted between 1921-32 is not known. However, when the Department of Game was founded in 1933, lake trout were annually planted into Deep and Loon Lakes near Spokane until 1938. Some of these fish were obtained from Ontario, Canada, Michigan and Henderson, Wisconsin. Today self-sustaining lake trout populations can be found in Loon Lake, Stevens County; Lake Washington, King County; and Lake Isabel, Snohomish County.

VII.B Artic Grayling (Thymallus arcticus, Pallus)

Grayling were probably introduced into the state in 1921 when fry were planted into the tributaries of Lake Sammamish, Bumping Lake, Yakima County; Kachess, Kechelus, Cle Elum and Fish Lakes and the Teanaway and Yakima Rivers in Kittitas County; DesChutes River, Thurston County and Puyallup River, Pierce County. I could not determine whether Grayling were introduced into the state between 1921 and 1932, but they were again planted in the state in 1945-48 when grayling were hatched at the Tokul Creek Hatchery from eggs obtained from Montana stock kept at Yellowstone Park. At present, Grayling are found in Upper Granite Lake where a small self-sustaining

population has persisted.

VII.C Brown Trout (Salmo trutta, Linnaeus)

The scottish variety of brown trout, Loch Levan, were planted into state waters as early as 1933, and were probably first planted by the counties between 1923 and 1933. Those planted in 1933 and 1934 were obtained from Montana and were kept at the Pend Oreille and Tokul Creek Hatcheries. In more recent years the so-called German brown trout has been planted into various streams in the Columbia Basin and Eastern Washington. Some examples are the Spokane and Similkameen Rivers and Okanogan Lake.

VII.D Golden Trout (Salmo aquabonita, Jordan)

Golden trout were first planted in 1959 in Washington when 10,000 eggs were obtained from the Wyoming Department of Fish and Game's hatchery at Daniel in July 1958. The eggs were shipped to Goldendale and later planted in numerous alpine lakes. Subsequent shipments occurred in ensuing years. No plants have been made recently due to a lack of availability of eggs.

VII.E Atlantic Salmon (Salmo salar, Linnaeus)

Atlantic salmon were recently introduced in May 1973 when they were planted into Chopoka Lake. More recently others were planted into an alpine lake in the Olympic Peninsula in order to determine their benefits in high lake management and still others have been planted in some lowland lakes. Due to the life history similarities between this fish and the rainbow steelhead, it has not been used in bodies of water where competition could occur.

VII.F Dolly Varden Char (Salvelinus malma, Walbaum)

Although the Dolly varden is endemic to Washington, it has neither been cultured nor planted into state waters in any large numbers. Having obtained a reputation as both a consumer of salmon and trout eggs and fry, it has been considered the stepsister of the western trouts.

Its fighting ability and flavor are not equal to the rainbow and cutthroat trouts, but anadromous individuals can reach a large size (20 lbs.) and provide enjoyment in many rivers.

VIII ACKNOWLEDGEMENTS

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APPENDIX 1

FISHERY MANAGEMENT DIVISIONFISH HATCHERIES and REARING PONDS listed by regionsREGION 1 - SPOKANE

Colville Hatchery
 Ford Hatchery
 Spokane Hatchery
 Tucannon Hatchery

REGION 4 - SEATTLE

Arlington Hatchery
 Bellingham Hatchery
 Lake Whatcom Hatchery
 Puyallup Hatchery
 Seward Park Hatchery*
 South Tacoma Hatchery
 Chambers Creek Hatchery
 Tokul Creek Hatchery

Barnaby Slough Rearing Pond
 Green River Rearing Pond
 Skykomish Rearing Pond
 Whitehorse Rearing Pond

REGION 2 - EPHRATA

Columbia Basin Hatchery
 Omak Hatchery
 Wells Hatchery

Ringold Springs Rearing Pond

REGION 5 - VANCOUVER

Beaver Creek Hatchery
 Cowlitz Hatchery
 Goldendale Hatchery
 Mossyrock Hatchery
 Skamania Hatchery
 Vancouver Hatchery

Swofford Rearing Pond

REGION 3 - YAKIMA

Chelan Hatchery
 Naches Hatchery
 Yakima Hatchery

REGION 6 - ABERDEEN

Aberdeen Hatchery
 Shelton Hatchery

Bogachiel Rearing Pond

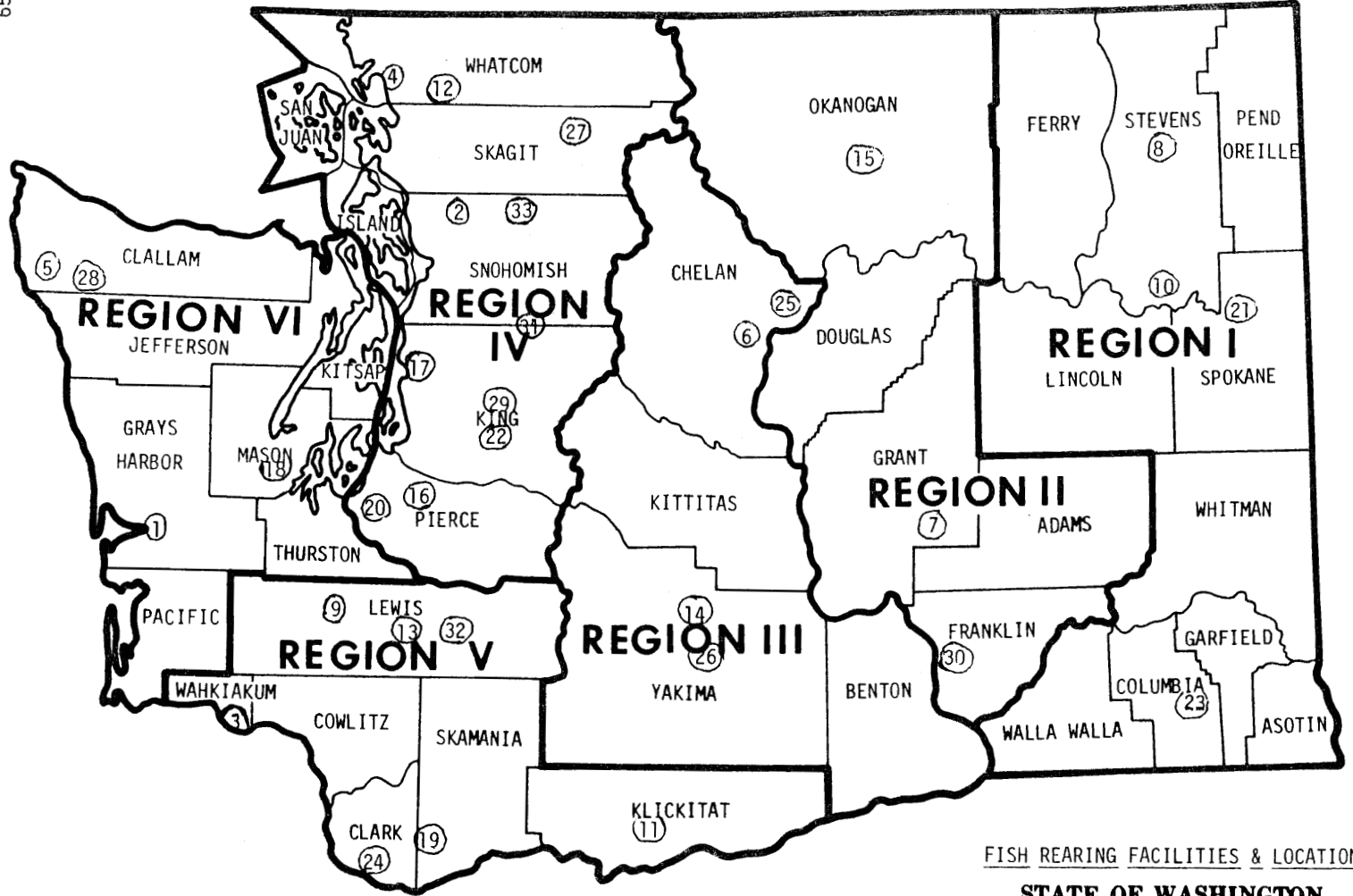
* Hatchery closed

FISH HATCHERIES and LOCATIONS

(Refer to Map)

- 1 - ABERDEEN HATCHERY - Below Aberdeen Lake north of U. S. Highway between Montesano and Aberdeen.
- 2 - ARLINGTON HATCHERY - Off Arlington-Darrington loop road.
- 3 - BEAVER CREEK HATCHERY - North of Cathlamet on Elochoman River, mouth of Beaver Creek.
- 4 - BELLINGHAM HATCHERY - City Park, Bellingham, Washington.
- 5 - CALAWAH REARING PONDS - West of Forks, Calawah River.
- 6 - CHELAN & CHELAN P.U.D. HATCHERIES - 1/2 mile above Chelan railway depot.
- 7 - COLUMBIA BASIN HATCHERY - 4 miles north of Moses Lake.
- 8 - COLVILLE HATCHERY - City of Colville, Washington.
- 9 - COWLITZ HATCHERY - South of Highway 12 and Town of Ethel.
- 10 - FORD HATCHERY - On Wellpinit Road out of Ford in Stevens County.
- 11 - GOLDENDALE HATCHERY - 5 miles west of Goldendale - North of Highway 142.
- 12 - LAKE WHATCOM EYEING STATION - Southeast end of Lake Whatcom, 10 miles Southeast Bellingham.
- 13 - MOSSYROCK HATCHERY - South side of Cowlitz River, West of Mossyrock.
- 14 - NACHES HATCHERY - 5 miles west of Yakima on south side Naches River.
- 15 - OMAK HATCHERY - West side Omak on Okanogan Road.
- 16 - PUYALLUP HATCHERY - Southwest part of Puyallup.
- 17 - SEWARD PARK - Seward Park in Seattle, Washington.*
- 18 - SHELTON HATCHERY - 12 miles from Shelton off Skokomish River Road.
- 19 - SKAMANIA HATCHERY - Washougal River, 15 miles from Camas.
- 20 - SOUTH TACOMA HATCHERY - Near north end of Steilacoom Lake.
- 21 - SPOKANE HATCHERY - 8 miles north from center of Spokane, on Little Spokane River west from Spokane Country Club.
- 22 - TOKUL CREEK HATCHERY - On old highway between Fall City and Snoqualmie near mouth of Tokul Creek.

* Hatchery closed



FISH REARING FACILITIES & LOCATION

STATE OF WASHINGTON

DEPARTMENT OF GAME

FISH HATCHERIES and LOCATIONS

(Refer to Map)

- 23 - TUCANNON HATCHERY - On Tucannon River about 23 miles south from Pomeroy.
- 24 - VANCOUVER HATCHERY - 3 miles east from Vancouver on old highway.
- 25 - WELLS HATCHERY - Adjacent to Wells Dam between Chelan and Pateros.
- 26 - YAKIMA HATCHERY - At airport in Southwest Yakima.

REARING PONDS and LOCATIONS

(Refer to Map)

- 27 - BARNABY SLOUGH REARING POND - 4 miles from Rockport, North side of Skagit River.
- 28 - BOGACHIEL REARING POND - West of Forks, Bogachiel River.
- 29 - GREEN RIVER REARING POND - 12 miles east of Auburn, above gorge, vicinity of Palmer.
- 30 - RINGOLD SPRINGS REARING POND - Near Mesa in Franklin County.
- 31 - SKYKOMISH REARING POND - Located 4 miles south and 2 miles east from Goldbar.
- 32 - SWOFFORD REARING POND - Mossyrock to Ajlune, 3 miles south to Swofford.
- 33 - WHITEHORSE REARING POND - Off Arlington-Oso Road S.F. Stillaguamish River, 4 miles west of Darrington.

FISH HATCHERIES and LOCATIONS

(Refer to Map)

- 1 - ABERDEEN HATCHERY - Below Aberdeen Lake north of U. S. Highway between Montesano and Aberdeen.
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- 4 - BELLINGHAM HATCHERY - City Park, Bellingham, Washington.
- 5 - CALAWAH REARING PONDS - West of Forks, Calawah River.
- 6 - CHELAN & CHELAN P.U.D. HATCHERIES - 1/2 mile above Chelan railway depot.
- 7 - COLUMBIA BASIN HATCHERY - 4 miles north of Moses Lake.
- 8 - COLVILLE HATCHERY - City of Colville, Washington.
- 9 - COWLITZ HATCHERY - South of Highway 12 and Town of Ethel.
- 10 - FORD HATCHERY - On Wellpinit Road out of Ford in Stevens County.
- 11 - GOLDENDALE HATCHERY - 5 miles west of Goldendale - North of Highway 142.
- 12 - LAKE WHATCOM EYEING STATION - Southeast end of Lake Whatcom, 10 miles Southeast Bellingham.
- 13 - MOSSYROCK HATCHERY - South side of Cowlitz River, West of Mossyrock.
- 14 - NACHES HATCHERY - 5 miles west of Yakima on south side Naches River.
- 15 - OMAK HATCHERY - West side Omak on Okanogan Road.
- 16 - PUYALLUP HATCHERY - Southwest part of Puyallup.
- 17 - SEWARD PARK - Seward Park in Seattle, Washington.*
- 18 - SHELTON HATCHERY - 12 miles from Shelton off Skokomish River Road.
- 19 - SKAMANIA HATCHERY - Washougal River, 15 miles from Camas.
- 20 - SOUTH TACOMA HATCHERY - Near north end of Steilacoom Lake.
- 21 - SPOKANE HATCHERY - 8 miles north from center of Spokane, on Little Spokane River west from Spokane Country Club.
- 22 - TOKUL CREEK HATCHERY - On old highway between Fall City and Snoqualmie near mouth of Tokul Creek.

* Hatchery closed

EGG TAKES AT VARIOUS STATIONS FROM 1921-1932
 DIVISION OF GAME AND GAME FISH
 WASHINGTON DEPARTMENT OF FISHERIES AND GAME

LOCATION	KOKANEE	CUTTHROAT	BROOK TROUT	STEELHEAD	RAINBOW
Bothell Traps	1922-24	1923			
Buck Creek			1930		
Chambers Creek		1926		1922-32	
Chehalis				1927-32	
Chopoca Lake		1923-30			1925-27
Crater Lake		1931			
Dumpka Lake		1924-28			1921-32
Dungeness				1927-32	
Fish Lake					1921-25
Goose Lake		1928-31	black spot		1928-31
Green R. Hatchery				1927-31	
Humptulips Hatchery				1932	
Lake Chelan Hatchery		1921-27			
Lake Crescent Hatchery		Crescentii	1921-32		Beardslee 1924-28, 1930-32
Lake St. Clair	1929-31				
Lake Whatcom	1921-31	1922-32			
Lewis R. Hatchery				1931-32	
Lost Lake Station			1921-24		
Maschelle Traps				1922-32	
Nooksack Hatchery				1927-32	
North Cr. Trap	1931				
Owhi Lake			1921-31		
Packwood Lake					1921-32
Pateros-Methow Hatchery				1922-28	
Pilchuck Hatchery	1926			1922-31	
Puyallup Hatchery				1929-32	
Samish Hatchery				1927-32	
San Poil Hatchery					1923-31
Skykomish Hatchery				1927-32	
Sullivan Lake		1921-22, 1926			
Tiffany Lake		1926, 1930-31			
Twin Lakes		1921-22, 1924-31			
Walla Walla Hatchery				1927	
Willapa Hatchery				1927-32	

Appendix 3 State operated trout hatcheries from 1903-1978.

Hatchery	Date built	Date renovated	Date closed	Water source	Location	Built by	Principal use
Aberdeen	1936		Present	Lake Aberdeen Wynoochee River	Aberdeen Grays Harbor Co.	WDG	Rainbow (<i>Salmo gairdneri</i>) Cutthroat (<i>Salmo clarki lewisi</i>)
Arlington	1940		Present	spring water	Arlington Snohomish Co.	WDG	Rainbow
Beaver Cr.	1957		Present	well Beaver Cr. Elocham River	Cathlamet	WDG	Steelhead (<i>Salmo gairdneri</i>)
Bellingham	1936		Present	Whatcom Cr.	Bellingham Whatcom Co.	WDG	Rainbow
Chambers Cr.	1915		1934	Chambers Cr.	Chambers Cr. Pierce Co.	WDFG	Steelhead Salmon [<i>Oncorhynchus</i> spp.]
Chiwaucum	1914		1954	Chiwaucum Cr.	Chiwaucum Cr. Leavenworth(near) Chelan Co.	Chelan Co.	Cutthroat
Columbia Basin	1960		Present	spring water	Moses Lake Grant Co.	WDG	Rainbow
Colville	1913	1949	Present	well	Colville Stevens Co.	Stevens Co.	Cutthroat
Cowlitz	1958	1958	Present	Cowlitz well	Winlock Lewis Co.	WDG	Steelhead Rainbow Cutthroat
Ford	1940		Present	spring water	Ford Stevens Co.	SDG	Rainbow Cutthroat Brook trout (<i>Salvelinus- fontinalis</i>)

Appendix 3 con't.

Hatchery	Date built	Date renovated	Date closed	Water source	Location	Built by	Principal use
Goldendale	1938	1954	Present	spring water	Goldendale Klickitat Co.	WDG	Rainbow
Kittitas	1915		1938		Kittitas Co.	Kittitas Co.	Rainbow Cutthroat
Lake Chelan	1903		1928	Stehekin Cr.	Stehekin Cr. Chelan Co.	WDFG	Cutthroat
Lake Crescent	1913		1943	Barnes Cr.	Lake Crescent Clallam Co.	WDFG	Crescentif Beardslee
Lake Whatcom	1905		Present	Brannian Cr.	Lake Whatcom Whatcom Co.	WDFG county	Kokanee (<i>Oncorhynchus nerka</i>) Cutthroat
Lewis River	1909		1920	Basket Cr.	Wall Clark Co.	WDFG	Cutthroat
Little Spokane (Dartford)	1904	1921	1935	spring water	Dartford Spokane Co.	WDFG	Cutthroat Brook trout
Mossyrock	1940		Present	spring water	Poneray Lewis Co.	WDG	Rainbow
Natches	1912		Present	spring water	Natches	Yakima Co.	Rainbow
New Skamania	1956	1956	Present	NF Washougal	Washougal Skamania Co.	WDG	Steelhead
Old Spokane	1915	1935	1935	Spokane River	Spokane Spokane Co.	WDFG	Rainbow Cutthroat
Old Vancouver	1911		1938	spring water	Vancouver Clark Co.	Clark Co.	Rainbow Cutthroat

Appendix 3 con't

Hatchery	Date built	Date renovated	Date closed	Water source	Location	Built by	Principal use
Omak	1950		Present	spring water	Omak Okanogan Co.	WDG	Rainbow Cutthroat
Pateras (Methow)	1915	1921	1936		Pateras Okanogan Co.	WDFG Okanogan Co.	Rainbow Cutthroat
Pend Oreille	1921	1951	1967	Skookum Cr.	Usk Pend Oreille Co.	WDFG	Cutthroat
Puyallup	1948		Present	spring water	Puyallup Pierce Co.	WDG	Rainbow
San Poil	1921	1943	1953	spring water	Republic Ferry Co.	WDFG	Cutthroat Rainbow Brook trout
Seward Park	1935		1978	Lake Washington	Seattle King Co.	Seattle (City of)	Rainbow
Shelton	1946		Present	spring water	Shelton Mason Co.	WDG	Rainbow
Skamania	1915		1937		Skamania Co.	Skamania Co.	Rainbow Cutthroat
Spokane	1934		Present	spring water	Spokane Spokane Co.	WDG	Rainbow
South Tacoma	1935		Present	Stellacoom springs 56°F	Tacoma Pierce Co.	WDG	Rainbow Steelhead
Tokol Cr.	1910	1921 1940	Present	Tokol Cr. spring water	Fall City King Co.	King Co.	Steelhead Rainbow Cutthroat
Tilton River	1916		1921 Salmon Hatchery	Tilton River	Morton Lewis Co.	WDFG	Rainbow
Tucanon	1950		Present	spring water	Pomeray Columbia Co.	WDG	Rainbow

Appendix 3 con't

Hatchery	Date built	Date renovated	Date closed	Water source	Location	Built by	Principal use
Vancouver	1937		Present	spring water	Vancouver Clark Co.	WDG	Rainbow Cutthroat
Walla Walla	1906			spring water	Walla Walla Walla Walla Co.	WDFG	Cutthroat Brook trout
Yakima	1937		Present	spring water	Yakima Yakima Co.	WDG	Rainbow

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