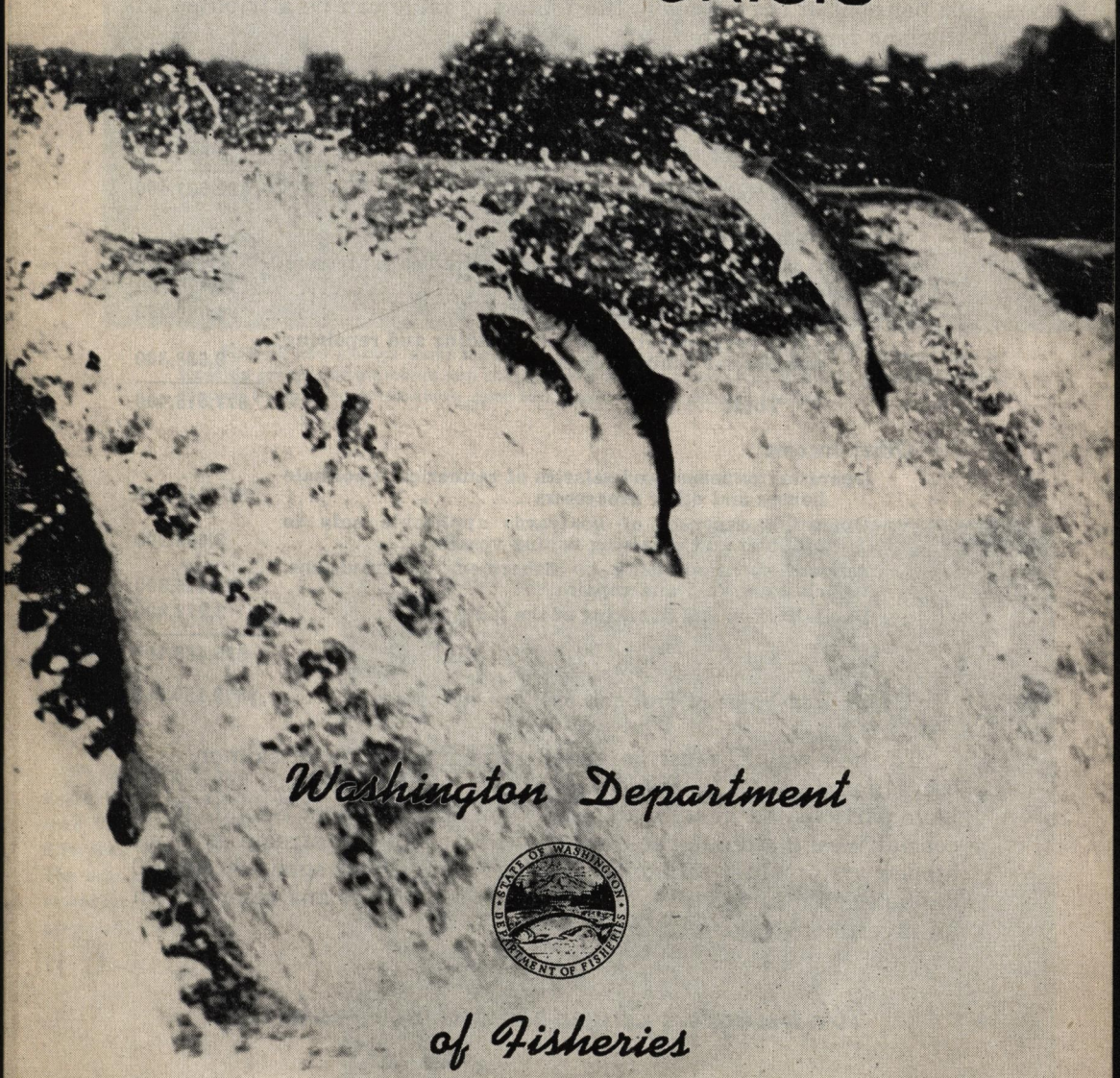
THE *Salmon* CRISIS



Washington Department

STATE OF WASHINGTON · DEPARTMENT OF FISHERIES

of Fisheries

The Salmon Resource

Salmon are one of Washington's primary food resources. They have figured in the economic growth of the state since pioneer days. Since 1900 the income derived from them runs into the billions of dollars. Today, despite factors which have depressed the supply, they remain the major component of the state's marine fisheries. In 1953 more than 10,500,000 salmon were caught for commercial sale. Another half-million were taken by sport fishermen. About 65 per cent of the values in the following table can be attributed to this one family of fish:

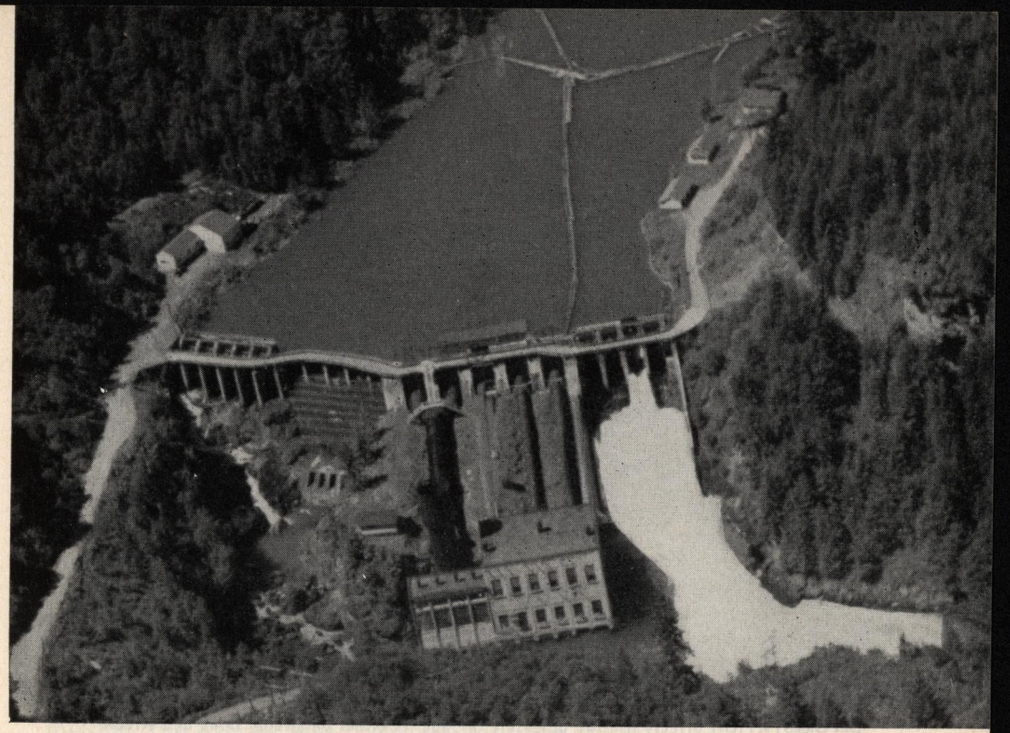
Value of Fish and Shellfish Industry—1953	
Wholesale value of Washington landings	$36,497,100
Processed value of imported products	1,190,300
Total	$37,687,400
Value of Vessels and Plants	
Plants and equipment of canneries and other processors	$21,804,100
Oyster land, including seed and stock	11,495,300
Fishing vessels and gear	34,680,700
Boatyards engaged principally in building and repairing commercial fishing vessels	9,538,300
Total	$77,518,400
Other Income	
Operating expenses and salaries of canneries, wholesale houses and other processors	$17,115,800
Operating expenses of boatyards applicable only to building and repairing fishing vessels	3,655,900
Amount spent annually by fishermen for provisions, clothing, fuel and repairs	12,445,800
Capitalization and financing of the industry	2,272,200
Total	$35,489,700
Capitalized Value of Fish and Shellfish Resources	**$679,150,000**

To these values must be added the contribution of salmon as a recreational asset. In recent years from 150,000 to 200,000 fishermen have participated in saltwater sport angling on Puget Sound, along coastal Washington, in the Columbia River as far upstream as Wenatchee, and in other salmon producing rivers. They spend $8,500,000 annually on fishing trips. There are 160 boathouses and resorts with an investment value of $12,000,000.

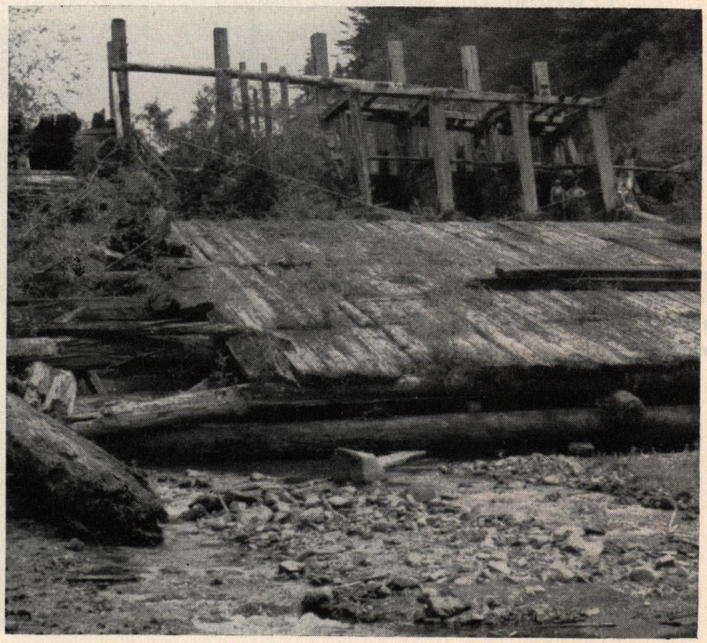
Washington Department of Fisheries

4015 20th Ave. W., Seattle 99

Edited by Don Gooding and Les Hatch. Cover photo by George Kelez. Upper picture, page 4, courtesy West Coast Lumberman's Association. Fourth printing. August 1954



POWER and storage dams have been a major factor in the depletion of salmon runs by blocking off spawning grounds and changing stream flow conditions. Research is being directed towards recapturing areas above dams with improved fish passage facilities.



SPLASH DAMS built in the heyday of logging continued to take their toll of salmon long after they were no longer in use. The dam pictured has been removed by fisheries stream improvement crews.

DEFORESTATION affects fish life adversely through its effect on stream flows and stream beds. Modern selective logging practices such as the block of seed trees left in this tract aids reforestation and a return to more normal stream conditions.

ANYTHING done to change a salmon stream or its surrounding territory will affect the fish. This creek was rendered unpalatable to fish life by a drainage project.

Causes of Depletion

Paradoxically, the progress that salmon have helped make possible in Washington has imperiled their own future.

The harvest of them was at its peak during the eight-year period from 1910 through 1917, when more than 12,300,000 cases were packed commercially in this state. Production tapered off during the next quarter century until a low of 2,350,000 cases was reached from 1938 through 1945.

This phenomenal—and costly—decline can be attributed to two causes:

Blocking of the Fraser River, principally at Hell's Gate Gorge below the main British Columbia spawning grounds of this immensely productive system, and

Constriction of spawning and rearing area in Washington streams, including the Columbia River.

The Hell's Gate block resulted from railroad construction which blasted part of a towering rock cliff into the gorge in 1913. In 1945, through efforts of the International Pacific Salmon Fisheries Commission, the barrier was breached with the aid of fishways. Since Fraser River salmon pass through American waters on their spawning trek, this has directly benefited the Washington commercial fishing fleet. Catch and escapement figures show a generous increase in Fraser salmon runs since World War II.

Washington stocks of salmon, on the other hand, show fewer signs of spontaneous rehabilitation. Individual races have disappeared or are fragmentary; some are continuing to decline in numbers, others are being maintained artificially. Production as a whole, although surprisingly stable, is still well below the level of 1900.

Why?

Salmon, because they depend upon fresh water environment to satisfy their spawning and feeding requirements, rather than merely salt water as the case with most marine fishes, are especially vulnerable to alterations in their upstream habitat.

The main causes of salmon depletion can be traced directly to the environmental changes that have taken place since the advent of civilization in the Pacific Northwest.

Major Obstructions

Hundreds of miles of spawning grounds have been cut off by the construction of power dams. Some have included no provision for the passage of fish and the area upstream from them is now totally inaccessible to salmon. The Elwha, Skokomish, Green, Sultan and Cedar are among the larger rivers belonging in this group. The Lewis, White and Baker Rivers have fish passage facilities which enable the runs to survive at a greatly diminished volume. The Columbia and its tributaries, including the Snake River system, have a growing number of dams which are either total or partial blocks.

Causes of Depletion

If all power projects now contemplated are built, most of the state's watersheds will be largely reliant upon mechanical fish passage devices and artificial propagation to perpetuate their migratory fish life.

Minor Obstructions

Spawning areas are further constricted by myriad smaller obstructions, such as splash dams left from early logging operations; flood control dams; irrigation and domestic diversion dams; road culverts; log jams and natural rock barriers.

There is a close relationship between the amount of available spawning and feeding space and the number of salmon that a stream can produce. Gradual subtraction of stream mileage has created an immense "lost frontier" which no longer produces salmon, but could if it were accessible.

Water Supply

The amount of water carried by a stream is another key factor controlling the size of salmon runs. This is most important at the time of upriver spawning migration and during the stage of freshwater growth. Chinook, sockeye and silver salmon, which remain in the stream or lake for considerable periods after hatching, are particularly dependent on water volume and food supply. Streams that have a tendency to dry in the summer are death traps for the small fingerlings; "flash" floods are destructive to egg-bearing gravel beds.

Extensive deforestation, by lowering the capacity of watersheds to retain moisture, has increased the rapidity of spring and fall runoffs and reduced the water supply available in the low-flow months. This has automatically impaired the ability of the streams to rear a normal population of fish. Drainage ditches and irrigation projects have similar effects. The adverse influence on water temperatures of the removal of foliage also must be mentioned.

A substantial toll of salmon can be attributed to environmental changes of this nature, which are more subtle than dams but equally damaging.

Pollution

Industrialization also has injected the problem of pollution into fishery management. Pollutants affect salmon most severely in estuarial areas at the mouths of rivers where downstream migrants, 2 to 8 inches long, linger while adjusting from fresh to salt water. A long-range damage to the marine food supply of salmon also is suspected, and research is being conducted to assess the extent of it. Concentrations of sulphite waste liquor are known to have killed fish life by lowering the oxygen content of the estuarial waters below a life-sustaining level. A variety of other industrial wastes, some extremely deadly to marine organisms, add to the difficulties of maintaining fish populations.

Salmon Rehabilitation

Rehabilitation as much as conservation is a central theme of the Department of Fisheries policy in dealing with the problems of salmon.

There is a vast non-productive desert behind dams, natural obstructions and in areas where water supply is critically diminished. Before more salmon can be produced naturally, some of these streams must be reopened. That is the goal of rehabilitation.

The principle of conservation applies to the control and preservation of current fish stocks and the habitat that is still accessible to them. It involves the prevention of unwise, harmful water development and other land use practices which have contributed to depletion of the salmon resource in past years.

Ultimate success of the program in these aspects will rely upon a broad, coordinated policy of resource development involving fishery, forestry, agricultural, hydro-electric and other industries.

Stream Management

Salmon will be unable to survive in quantity if civilization continues to make inroads on their freshwater environment at the pace which has characterized the last 25 years.

The Department of Fisheries is attempting to halt this trend and to repair past damage by—

Removing stream obstructions,

Constructing fishways around blocks that cannot be removed,

Screening irrigation ditches,

Controlling the amount of water withdrawn from a stream for domestic and industrial purposes,

Preventing pollution,

And by negotiating with local and federal agencies to insure that protection for migratory fish is included in the planning of power, flood control, reclamation, logging and other resource development projects.

Power and Salmon

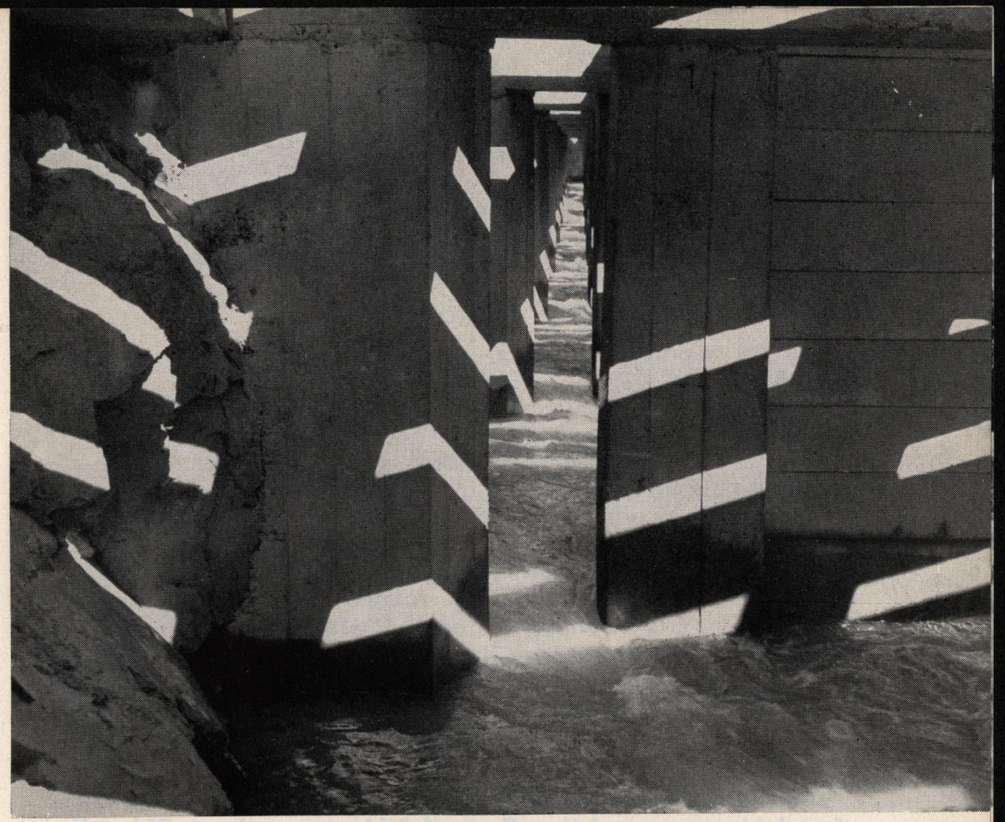
Power is the leading competitor of salmon for streams where water supply is still abundant.

The policy of the Department of Fisheries is **not** in opposition to all hydro-electric development. It is recognized that power is essential to regional and national prosperity.

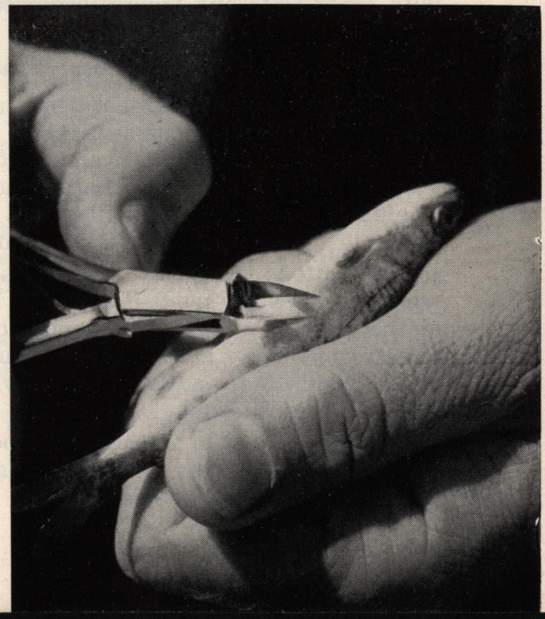
However, in view of the importance of salmon as a food, payroll industry and a recreational asset, the Department **does** insist that power projects should be limited to non-fish producing streams wherever possible, or to locations on rivers already dammed and not suitable for rehabilitation. It holds that salmon are needlessly sacrificed when dams are constructed on productive streams if other sites are available that will produce power without affecting fish life.

It also is advocated that stream power generation be considered as a source of additional electricity. This method is faster and cheaper

STREAM rehabilitation is an important adjunct of fisheries management. These scenes show a river before and after a large log jam was cleared. The jam had formed a total block below valuable spawning grounds.



FISHWAYS are a means of rehabilitating salmon runs and opening spawning grounds above natural falls. Their cost is quickly repaid by increased fish production. The structure shown is the Hell's Gate vertical baffle fishway developed by the International Sockeye Commission for the Fraser River.



FISH are marked by the removal of a fin or combination of fins to determine the migration habits of salmon and the survival rates of hatchery propagated fish.

to install, and it does not irrevocably commit an area's water supply to one utility in an age that promises eventual harnessing of constructive atomic energy.

Research

A dam or other obstruction is a visible detriment to migratory fish life.

There are other less apparent influences that contribute to the salmon problem—the availability of food in a stream, the effect of a power dam on the chemical content of river water, the extent of damage to marine life cause by industrial wastes.

The unlocking of these, the determination of the natural requirements and habits of salmon, and the improvement of techniques of artificial propagation, are dependent upon scientific research. Progress in the rehabilitation of native salmon races is closely tied to the search for greater understanding of the fish themselves.

Fisheries research studies fall into three categories:

1. The study of freshwater environment and factors limiting natural production of salmon. From this knowledge comes a basis for controlling adverse factors, if possible, and for improving hatchery production.

2. The determination of saltwater migration times and routes of each river race and the effects of fishing upon them. This tells which races are being used at a given period, so effective regulations can be applied to insure a proper catch-escapement ratio.

3. The development of fish passage facilities for up and downstream migrant salmon at power dams. This is a new phase of research begun by the Department of Fisheries in 1952 in conjunction with other state and federal agencies.

Hatchery Propagation

The salmon hatchery has been in existence in Washington state since 1895. In recent years its actual and potential benefit has been increased through the improvement of rearing methods. In mid-1954 the state had 19 salmon hatcheries and rearing stations in operation. These are capable of producing more than 30 million reared salmon annually to augment natural spawning.

The shift to emphasis on reared salmon—they are fed in freshwater or saltwater ponds for one to 12 months—has had the effect of increasing the survival chances of artificially propagated fish. Greatest mortality is at the fry or earliest stage of growth; there is less mortality in the advanced stage when the young salmon is better able to sustain itself.

Another change in hatchery methods has been the policy of planting fish back into their parent streams, or if that is not possible, into streams of like characteristics.

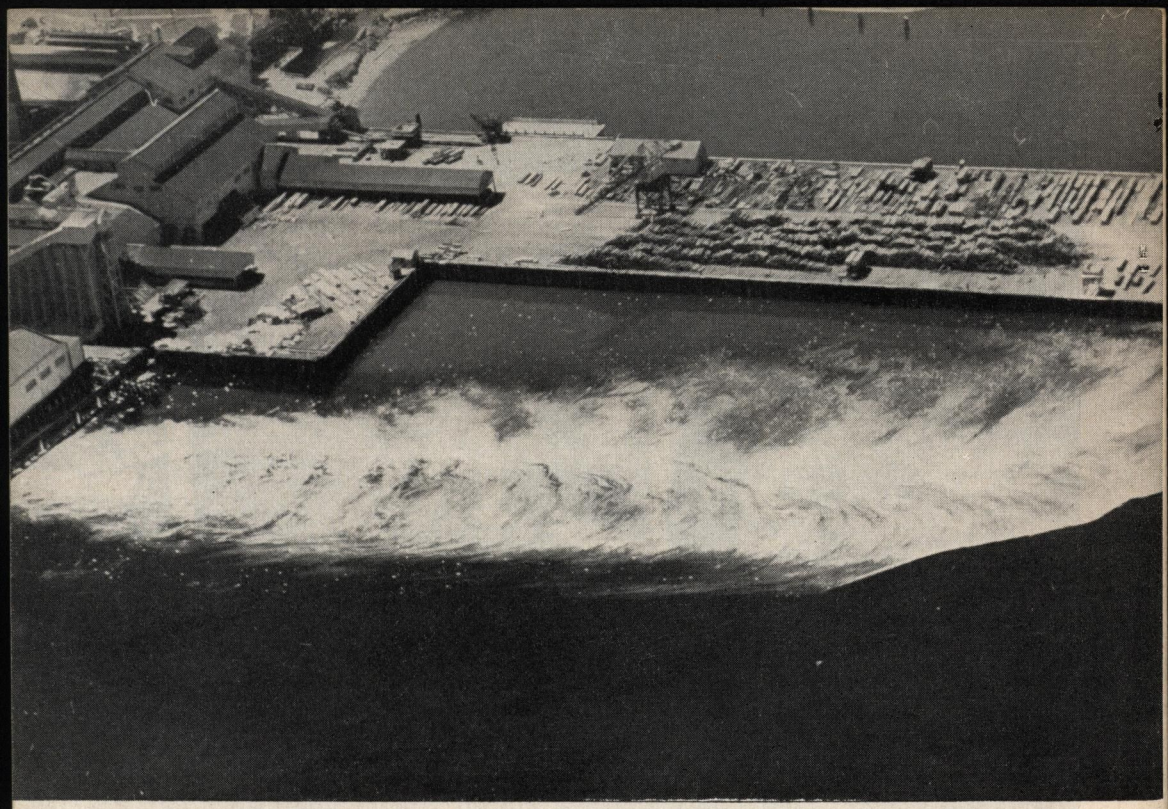
ROTARY SCREENS direct fish from irrigation ditches back into the safety of the stream down which they travel towards the sea. Before a screening program was developed heavy depletion occurred in salmon runs to many areas.

Salmon Rehabilitation

In the main, the hatchery's greatest value is in the maintenance of salmon runs adversely affected by environmental changes, and in the rapid restoration of runs in streams that have been reopened by fishways and other stream rehabilitation work.

Summary

The causes and cures of fishery depletion are largely known. However, unless vigorous attention is given to the solution of the acute problems confronting salmon, their future will remain in balance. The perpetuation of this valuable self-renewing natural resource today is a challenge to all who are concerned with the progressive growth of Washington state. The tangible progress that has been made in the last few years to recapture profitable lost production is proof that the task is far from impossible.



POLLUTION, the hand maiden to industrialization, can be detrimental to fish life unless adequate disposal controls are imposed.

SALMON GULCH. This creek is part of a lost frontier which once produced salmon in Washington state.