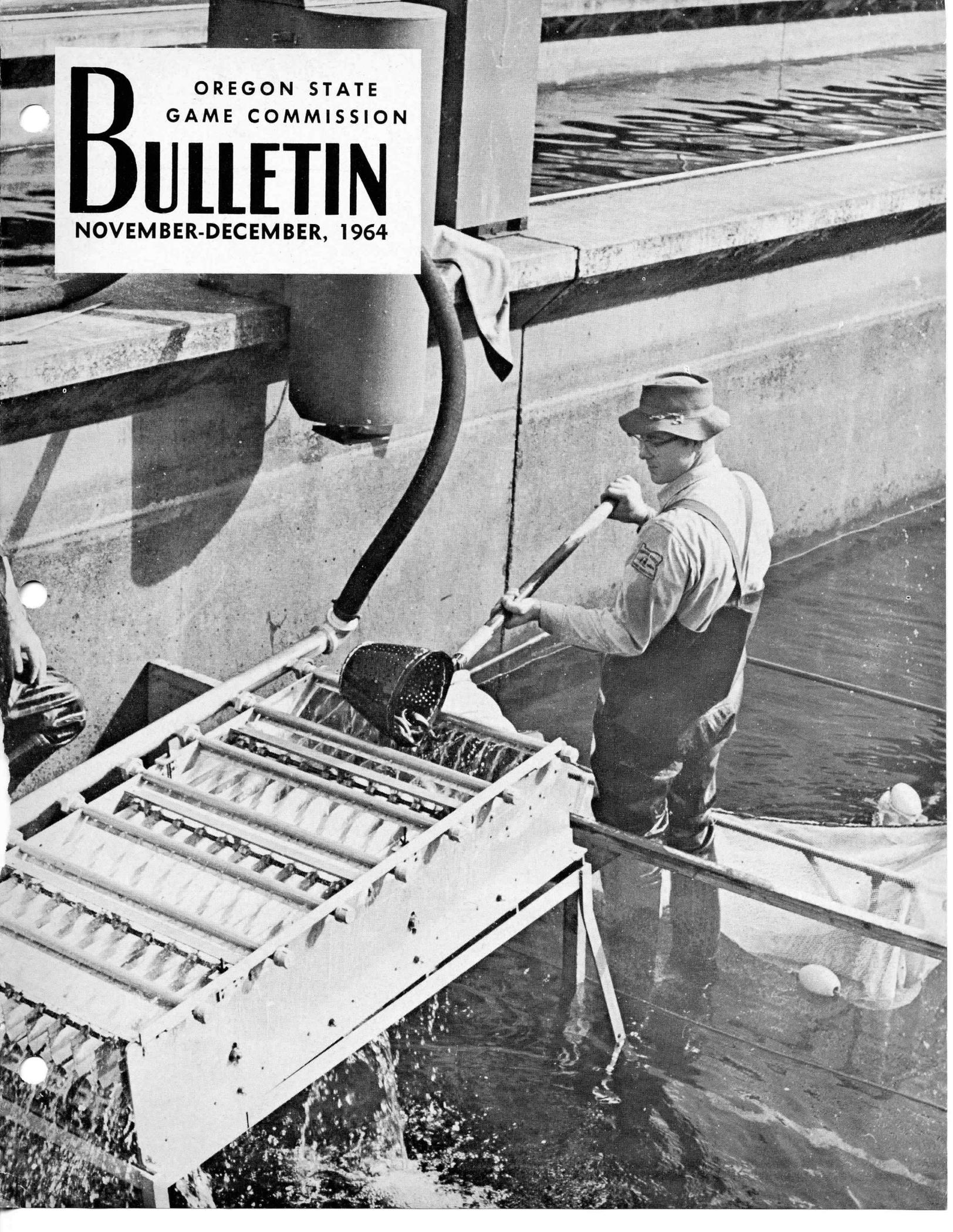


OREGON STATE
GAME COMMISSION

BULLETIN

NOVEMBER-DECEMBER, 1964



OREGON STATE GAME COMMISSION BULLETIN

November-December 1964
Number 6, Volume 19

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The Cover

Grading steelhead trout at the Gnat Creek Hatchery in Clatsop County. (Photo by Ron Shay)

BULLETIN HUNTER SAFETY TRAINING PROGRAM

Instructors Approved

Month of August	14
Month of September	54
Total to Date	3,261

Students Trained

Month of August	1,205
Month of September	4,880
Total to Date	74,474

Firearms Accidents Reported 1964

Fatal	0
Nonfatal	16

OREGON TO HOST 1965 MEETINGS

Portland has been selected as the site of the 1965 annual conferences of the American Fisheries Society and the International Association of Game, Fish and Conservation Commissioners. The International will meet on September 20-22, and the American Fisheries Society, September 22-24. Both meetings will be held at the Hilton Hotel.

NOTICE OF ANGLING REGULATION HEARINGS

The Oregon State Game Commission will hold a public hearing on angling regulations beginning at 10 a.m. Friday, November 6, at its Portland office, 1634 S.W. Alder Street.

Consideration will be given to regulations on game fish bag limits, seasons, and methods of taking.

Following the hearing tentative regulations will be announced. Final action will be taken when the hearing is reconvened at 10 a.m. Monday, November 16.

Copies of the angling regulation synopsis will be available at license agencies early in January.

NEW WATERFOWL BOOK AVAILABLE

"Waterfowl Tomorrow," a story of migratory waterfowl on the North American continent written by experts from the United States, Canada, and Mexico, will appeal to hunters, naturalists, and citizens at large. This nontechnical book details the many natural processes and the numerous activities of man which have affected these birds from glacial times to the present day. It is well illustrated with more than 150 outstanding photographs of waterfowl and contains many waterfowl drawings by Bob Hines, well known wildlife artist.

Produced under the auspices of the U. S. Fish and Wildlife Service, the book is available through the Superintendent of Documents, Government Printing Office, Washington, D.C. Price is \$4.

Game Commission Chairman Tallant Greenough (far left) presents certificates to four employees, recipients of awards for suggesting improvements to department operations. From left to right the four are: Reino Koski, \$500 award for advancing the idea to use plastic prefabricated fish rearing ponds; Robert Ramsey, \$200 for suggesting more and smaller venturis in fish liberation vehicles; Eugene Morton, \$500 award for development of "Morton's Monster," a device which on the basis of hydraulic principles can pick up and move fish with great efficiency; A. B. Smith, \$125 award for suggestion regarding automotive mileage records. The State Suggestions Award Board determines awards to be made after reviewing department recommendations. Maximum award is \$500.



McKENZIE HATCHERY PROPERTY SOLD

The McKenzie River Hatchery property, declared surplus by the Game Commission, has been purchased by the Lane County Parks Department and the Eugene Electric and Water Board for development as a public park. The Game Commission had not operated the hatchery on the property for several years and had prolonged disposal of the property because of its desire to keep it in public ownership.

STATE POLICE GAME ENFORCEMENT REPORT

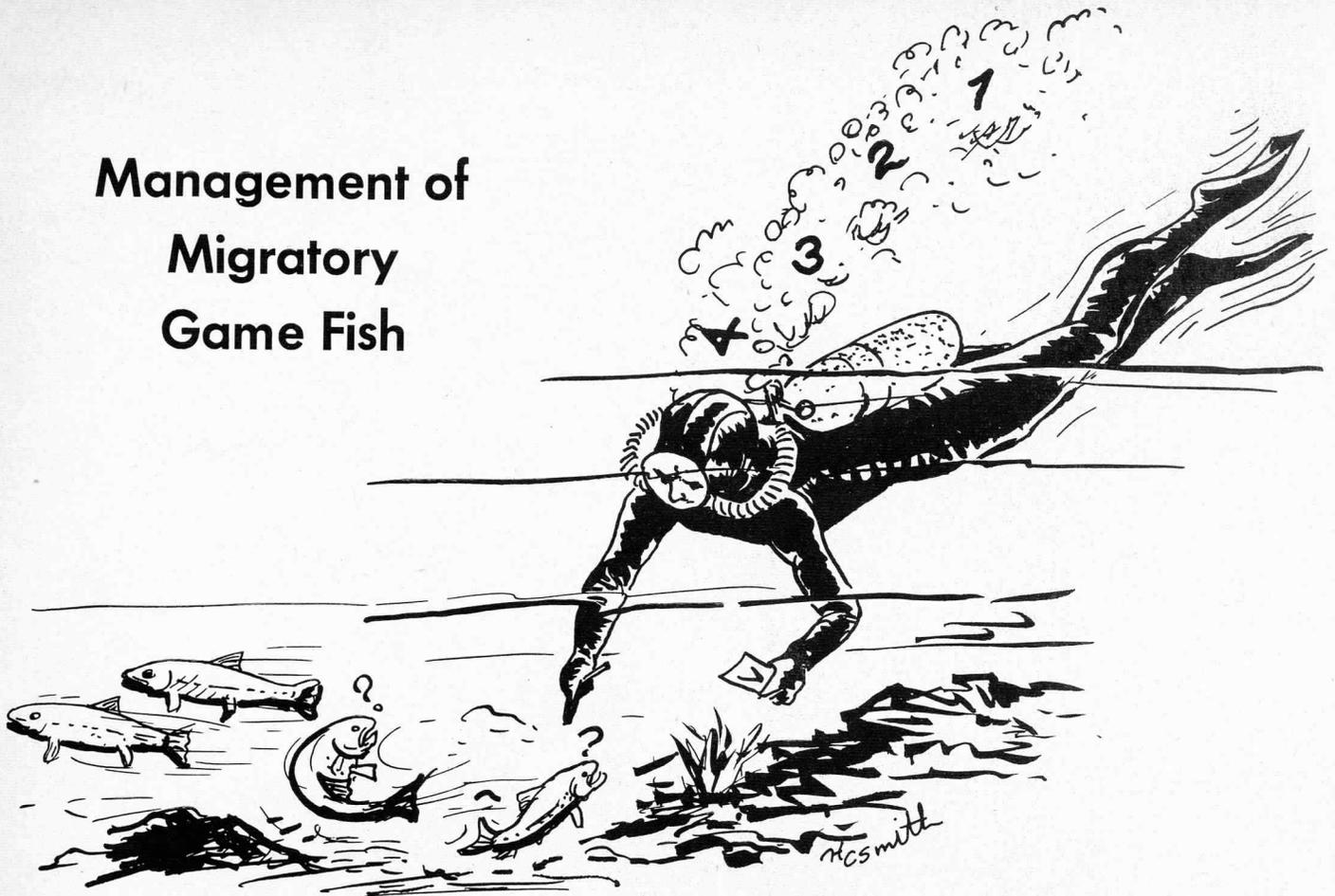
The section on fish and game law enforcement in the 1963-64 annual report issued by the Oregon State Police shows a total of 5,697 arrests made and 2,574 warnings issued. Licenses and bag limits of 175,767 other anglers and hunters were also checked.

The highest number of arrests, 1,353, was made for violation of angling seasons, prohibited areas, hours, or methods. The next highest number of arrests, 1,057, was for hunting or fishing without a license. Hunters arrested for violating regulations on seasons, area, hours, or methods totaled 1,002.

GAME BULLETIN PUBLISHED BIMONTHLY

The Game Commission Bulletin is being issued every other month instead of monthly because of lack of funds.

Management of Migratory Game Fish



By R. O. Koski
Chief of Liberations, Fisheries

THE READER WILL RECALL that in the July-August issue of the Bulletin, a thorough account of the management problems of many of Oregon's game fish was presented. That article was limited to the many activities associated with the maintenance of the stocks of nonmigratory game fish—the various trouts, charrs, landlocked salmon, and warm-water species such as bass, crappies, catfish, and perch.

We will now be concerned with the problems, the studies, the programs, and other factors which constitute the management of the valuable migratory fish which are so important to the recreational needs of an ever-increasing angling public. With more than a half-million fishing licenses presently being purchased each year, it is apparent that the demand for sport fishing is tremendous. This is double the number of licenses sold in the years just after World War II. Approximately half of the above number of anglers also purchased salmon-steelhead licenses. Other migratory-type fish do not require a special license.

The term "anadromous" is seen often in print and may tend to confuse some readers. It stems from a Greek word

meaning "running upward." Webster goes on to describe the word as meaning "ascending rivers from the sea, at certain seasons, for breeding, as shad." We have come to use the word generally in reference to the various fish which live some part of their life in marine environment but ascend into fresh waters for spawning. Extremes in the extent of their travels are steelheads and chinooks which range far to sea and end their lives hundreds of miles up in the Columbia tributaries, and the striped bass which spawn just a short distance from the sea in our coastal estuaries.

Listed below are anadromous fish which in varying degrees provide recreation and which are of concern to the Commission in its management efforts.

Migratory Fish of Oregon

Common Name	Other Names
Chinook Salmon	King, Spring, Tuley
Silver Salmon	Coho, Silverside
*Sockeye Salmon	Red, Blueback
*Chum Salmon	Dog Salmon
*Pink Salmon	Humpback
Steelhead trout	
Cutthroat trout	Blueback, Sea-run, Harvest trout
White Sturgeon	

*Green Sturgeon
Striped bass
Shad

*These species are of minor importance in the sport fishery.

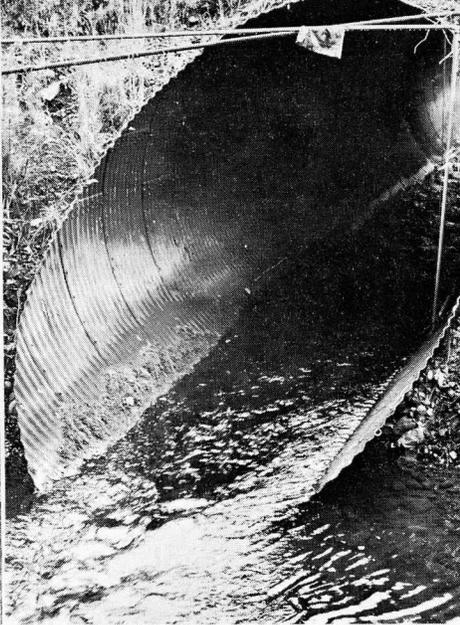
Some readers may be puzzled by the term "jack salmon." The "jack" is not a distinct species or type of salmon but a small edition of one of the other species, the most in evidence being young silvers or chinooks. The precocious small male fish, maturing usually one or two years earlier than the normal members of the run, ascend the streams during the same periods as the regular runs. In the larger streams, it is not unusual to find some jack salmon present at almost any month of the year. As mentioned, jacks are almost entirely males but occasionally early maturing females termed "jennies" are found in some runs.

In looking at the list of anadromous fish, it can be noted that almost all of the species are caught commercially also in some parts of the State. Oregon laws generally classify these fish both as game and food fish. At one time in Oregon the runs of migrant fish seemed almost inexhaustible. However, with the depletion

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Poorly designed culverts constructed prior to present-day cooperative planning required corrective measures to provide fish passage.



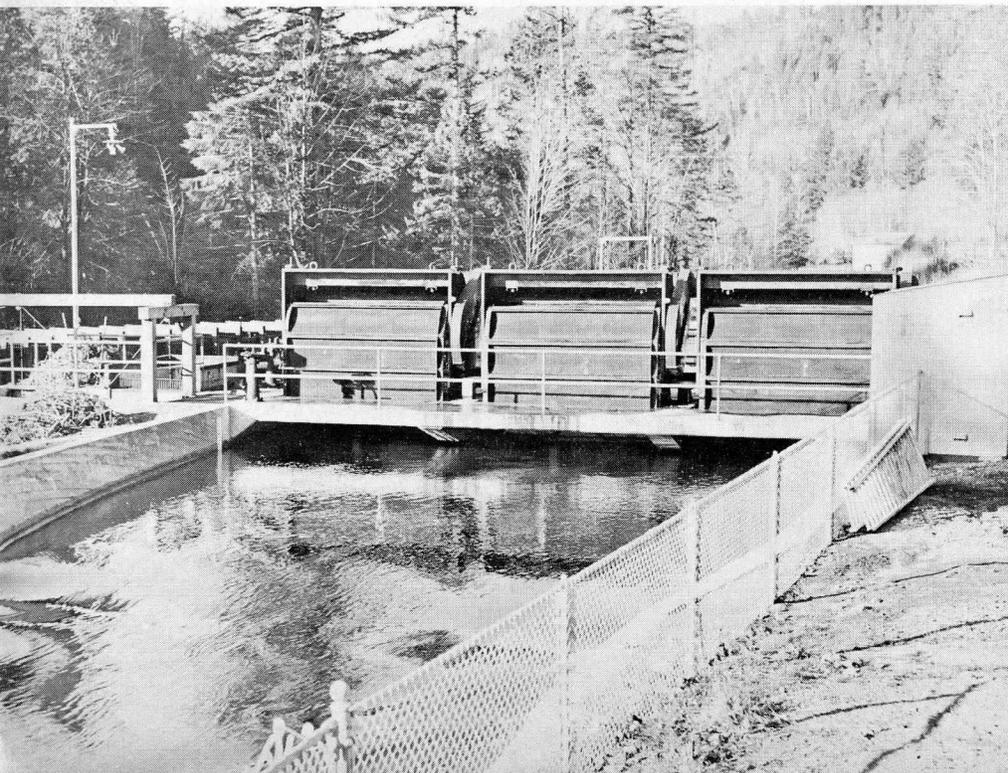
Properly designed culverts in road fills make it possible for spawners to easily reach upstream gravel beds.

MANAGEMENT OF MIGRATORY GAME FISH

(Continued from Page 3)

of habitat, unrestricted harvest, environmental changes, and other factors, it became apparent that regulations would be necessary to control both the commercial and sport harvest in order to maintain this wonderful resource. Joint commissions, and later separate commissions, were established with the responsibility of managing the migrant species. At present, over 50 separate statutes in the Game Code concern anadromous fish in some manner. Besides authorizing the Commission to control the harvest by angling, through seasons, size, and bag limits, the

Thousands of downstream migrants are saved from certain death when bypassed into natural water through screening installations. This travelling screen is at Marmot Dam on the Sandy River.



statutes also provide the means for the Commission to fulfill other obligations of stewardship, such as the production of anadromous fish, the fact finding necessary for proper management, control of environmental factors, and participation in certain interstate and international agencies concerning the perpetuation of these resources.

Management of a fishery resource can be compared somewhat with a stock investment program similar to the currently popular mutual fund programs. The licensee purchases stock (his license) in the company (the Commission) and expects the company to protect his capital (the fish populations) and return to him reasonable capital gains and dividends

(adequate catches and increased fishing opportunities). The Commission, with a small portion of funds, maintains an expert managerial staff which uses additional funds to conduct research (find facts), manage the resource (apply research to production and habitat protection), protect the capital (regulations), and improve the total worth (expanding fishing opportunities) in order to perpetuate the resource for the benefit of both present and future anglers.

The extent to which the activities of the Game Commission are directed toward anadromous fish management is difficult to outline. Many of the functions involve benefits to both migrant and resident-type fish. A recent study of the activities of district fishery biologists indicated that approximately one-half of their time was devoted to work directly concerning anadromous fish. In order to arrive at a fair appraisal of the costs attributable to this program, other factors were considered. Hatchery and stocking costs were quite easily calculated for the migrant species, and some funds which are used wholly in the anadromous fish program, such as research funds from the salmon licenses and the federal Columbia River Fishery Development Program, were easily fitted in place. For further determination of expenditures, it is necessary to prorate administration, general services, information and education, and enforcement funds. Total expenditures for a typical fiscal year are shown tabulated below.

Expenditures for Anadromous Fish Fiscal year 1961-62

Inventory	\$ 97,782
Habitat Improvement	108,909
Screening Program and Sandy River Funds	76,368
Basins Investigations	47,214
Fish Production and Stocking ..	100,609
Research	455,239
General Services	110,680
Capital Construction	8,270
Information and Education	14,345
Administration	43,122
Enforcement	198,400
TOTAL	\$1,260,938

A completely accurate allocation of expenditures to either the migrant or resident fish programs would be impossible. Screens to divert steelheads from irrigation ditches would likewise protect resident trout. Diet studies to formulate better feeds for trout would similarly benefit steelhead or salmon production. Essentially, it should be recognized that anadromous fish management is costly and consumes a large part of the income derived from license sales and other

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MANAGEMENT OF MIGRATORY GAME FISH

(Continued from Page 4)

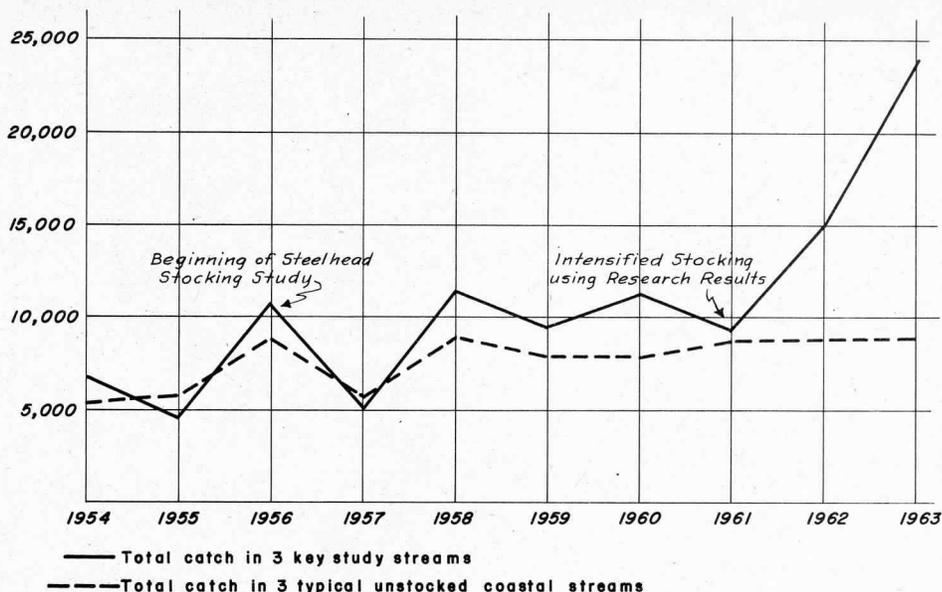
sources. How is this money expended and what are the accomplishments of the management program? Are the license buyers receiving their dividends and are the standing stocks being protected and maintained? Let's explore some of the facets of this program, observe the aims and methods used, and evaluate the accomplishments which are so far apparent.

In discussing the various studies, techniques, and methods of control, it should be kept in mind that the same factors do not always apply to all anadromous fish or to the same species in all parts of the State. In other words, spawning ground surveys are considered a valuable means of estimating salmon trends but are not usually applicable with steelhead and trout. Ladder counts at dams provide means of enumeration of steelhead, shad, and salmon but sturgeon ordinarily shun the ladders. Almost all the factors concerned with management and discussed here will apply primarily to steelhead and salmon.

To begin with, how many fish do we have? How many spawners are providing future stock? How many are caught in the streams, in the ocean, with hook and line, by nets; and how many are lost to the runs from illegal catches, turbine mortalities, and from unscreened irrigation ditches? The matter of enumerating stock is simple for the chicken farmer or the rancher. Estimating the population of resident trout in a lake becomes more complicated but can still be done with considerable reliability. Runs of anadromous fish, however, are affected by so many factors, and their differing habits contain such varied and complicated causes of population changes that accurate estimates of their numbers are extremely difficult.

Inventory of numbers is a must if we are to know the effects of management. One method used in inventory is the calculation of runs passing dams in the major streams. The Commission operates counting stations at Gold Ray Dam on the Rogue River, Winchester Dam on the North Umpqua, and Marmot Dam on the Sandy River. The Umpqua station is now equipped with a glass-walled viewing chamber which will increase the reliability of observations. Information from other agencies such as the Corps of Engineers, Portland General Electric Company, and Idaho Power Company is regularly obtained from their counting stations on other major streams, and the counts are combined with other data to provide total run estimates. Counts of upstream migrant spawners are also

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CALCULATED STEELHEAD CATCH ON SIX OREGON STREAMS
(Calendar year catch based on punchcard returns)

made at hatcheries which rear anadromous fish.

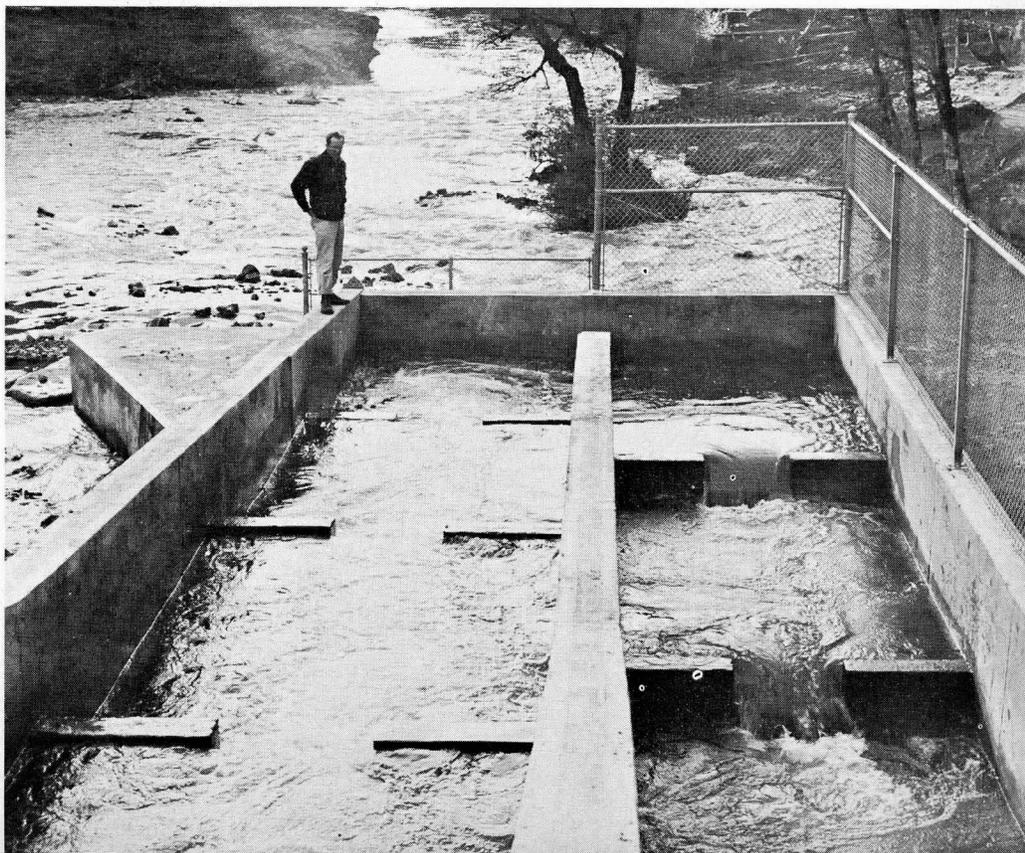
Spawning ground counts are made on many streams, primarily along the coast. No effort is made to count all spawners on a selected stream, but a typical tributary is chosen and a sample section is observed each year in the same fashion. From these counts, fairly reliable population trends can be obtained. The Oregon Fish Commission makes counts on numerous streams also and these observations

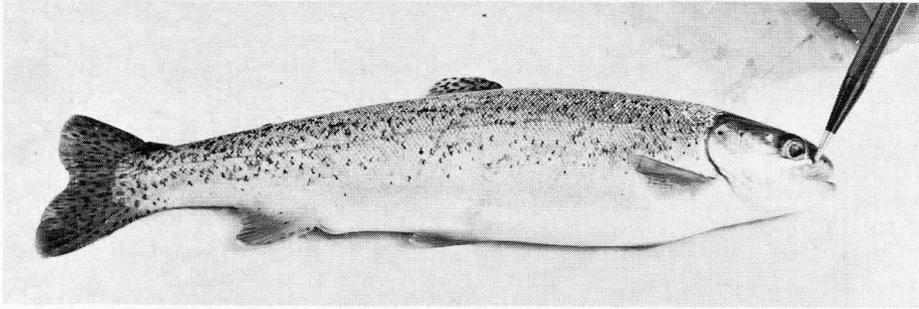
are exchanged. Duplication of information has been carefully avoided.

With spring chinooks and summer steelheads, it has been possible to make counts of adults in the resting holes where these fish sojourn prior to spawning. Reliability has been added to these estimates by the employment of underwater observations. Many biologists are trained SCUBA divers and underwater counting teams are now commonplace.

(Continued on Page 6)

South Umpqua Falls fishway. Even properly designed ladders require periodic removal of silt, rocks, and debris.





The clipped maxillary bone is often used together with clipped fins to identify hatchery stock in the wild.

MANAGEMENT OF MIGRATORY GAME FISH

(Continued from Page 5)

An added benefit is that fin-clipped fish can be easily identified, providing more useful data.

Measurement of the catch is an important part of the population inventory. Wide distribution of anglers makes personal checking a virtual impossibility. For over 10 years we have employed a punch card system in determining the angler catch of salmon and steelhead. The total catch by species can be calculated quite accurately but the estimated catch by streams becomes less accurate, especially with the smaller creeks. Overall, fairly accurate trends of population can be observed on most of the major streams. Just recently, an effort has been made to obtain a better breakdown of the catch in the coastal areas and the Columbia River. Anglers are asked to record catches from outside the jetties of any bay or stream as **ocean** caught. Fish caught below Bonneville Dam in the Columbia are entered as **lower** Columbia, and those above the dam as **upper** Columbia. If the majority of anglers conscientiously continue to record their catches properly, much more precise data will be available and the management program will benefit.

Raw data obtained from the salmon-steelhead punch cards are carefully compiled by Commission personnel and submitted to statisticians at Oregon State University, who then provide a thorough analysis and the final figures. The following table summarizes angler participation and catch for the last 11 years.

Year	Salmon and Steelhead Catch in Oregon			
	Punch Cards Issued	Salmon Catch	Steelhead Catch	Total Catch
1953	173,216	91,683	87,942	179,625
1954	170,879	98,896	74,333	173,229
1955	165,442	82,342	59,287	141,629
1956	166,386	155,823	83,845	239,668
1957	135,230	130,285	57,762	188,047
1958	215,410	127,975	90,709	218,684
1959	285,700	221,360	121,223	342,583
1960	172,332	145,758	79,851	225,609
1961	202,977	223,782	83,200	306,982
1962	221,364	237,811	126,288	364,100
*1963	236,277	302,883	115,520	418,404

Totals & Averages 2,145,213 165,327 89,087 254,414

*Preliminary Figures

Increased participation and catch are easily noticed in the above table, which

indicates that management efforts will need to be greatly expanded to keep pace with this popular fishery.

More refined catch estimates are made possible in many areas through intensive checking at the places of fishing. At Winchester Bay, Coos Bay, the mouth of the Columbia, and other major areas, catch figures are obtained from anglers as they land or from the charter skippers who regularly operate from these ports. Many of these surveys are cooperative with other organizations such as the Oregon Fish Commission, Washington Department of Fisheries, and the U. S. Fish and Wildlife Service. One such study now is in progress with all agencies concerned, determining the contribution of Columbia River salmon to the entire coastwide catch. All data obtained are compiled and provided to each cooperating agency.

Commercial catch figures likewise are obtained through the cooperation of those agencies involved and the data again combined with other population estimate factors.

Identification of fish in the various catch areas from any one stream system or hatchery would not be possible unless the fish were marked in some manner. Almost all of the migrant-sized anadromous fish released by the Commission are marked before stocking. For the 1964 release season, over 1.7 million steelhead and salmon were marked by having one or more fins clipped. To forestall confusion in the entire fishery, as other agencies also mark fish, the entire marking program on the Pacific Coast is coordinated. Thirteen fishery agencies on the coast have some type of marking program. The Pacific Marine Fisheries Commission, of which the Game Commission is a member, controls the use and allocation of the various fin clips to avoid possible duplication. All marked fish reports from both commercial and sports catch areas are carefully compiled and the final results then provided each member agency. Marked fish information is most valuable when obtained in one of the areas of intensive checking, as here a determination of the significance of any one group of marked fish to the total

catch can be obtained. When reporting the catch of a marked fish to any agency, the information is of no value unless the angler provides complete information on size, sex, location, and time as well as designating which fins are missing. The accompanying photo of a two-year-old summer steelhead shows a cleanly clipped right ventral mark, and in addition, a clipped right maxillary bone. The maxillary clip is almost always used in combination with fin marks and is generally not noticed by anglers.

After obtaining a picture of the total runs of fish by piecing together the jigsaw bits of population figures obtained by the methods described, the fishery scientists determine what measures are necessary to protect or increase those runs which need help.

Adult anadromous fish, having survived several years of perilous existence at sea, face countless obstacles in their efforts to reach the headwater spawning areas. Those lucky enough to arrive at their destination must then have suitable gravel beds and proper water quality in order to spawn successfully. The resultant offspring, again, must have ideal conditions in which to develop as far as the migrant stage when the long dangerous journey to sea begins anew.

To maintain proper habitat conditions, improve, and even to create new habitat is one of the necessary jobs of the Commission. Countless barriers to upstream passage of fish exist, and continual surveillance of both natural and artificial blocks is carried on through all parts of the State. Fish ladders over natural falls are expensive and on large projects it is necessary to use federal matching funds or cooperative financing. A recent example is the Illinois Falls fishway, which was financed by Dingell-Johnson money together with game funds and cost nearly

(Continued on Page 7)

STATE OF OREGON GAME COMMISSION SALMON ANGLER LICENSE & PUNCH CARD JAN 1, 1964—DEC. 31, 1964 81021					
FISHING LICENSE NO. 748074		FOR INSTRUCTIONS SEE OTHER SIDE			
KIND OF FISH		KIND OF FISH			
Check One		Salmon	Steelhead	Check One	
Date	1/12/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	ALSEA R.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date	1/18/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	WILSON R.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date	2/20/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	LONG COLUMBIA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date	4/26/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	WILSON R.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date	11/23/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	ALSEA R.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date	12/7/64	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Date	
River	ALSEA R.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	River	
Date		<input type="checkbox"/>	<input type="checkbox"/>	Date	
River		<input type="checkbox"/>	<input type="checkbox"/>	River	
Date		<input type="checkbox"/>	<input type="checkbox"/>	Date	
River		<input type="checkbox"/>	<input type="checkbox"/>	River	

Properly completed punch cards are valuable in estimating the harvest of fish by stream and time of year.

MANAGEMENT OF MIGRATORY GAME FISH

(Continued from Page 6)

\$100,000 to complete. Small dams on private storage or diversion projects also must be provided with fishways and the construction of these must be closely monitored.

Log jams, resulting both from logging activities and natural origin, sometimes are beneficial in providing habitat for resident fish. In the case of migrant fish, however, a large solid jam will prevent all spawners from going upstream. The removal of these huge jams is a difficult task as access is sometimes almost impossible for heavy equipment such as cranes and bulldozers. Many of these jams must be removed by hand or the use of explosives. In the last biennium over 340 miles of spawning streams were made available for fish through jam removal. In many of these projects local and county interests and appropriate federal land management agencies have cooperated.

For a number of years the Commission has maintained close coordination with road building agencies in the matter of protection of fish and their habitat from the effects of road construction projects. The State Highway Department, the U. S. Bureau of Public Roads, and the U. S. Bureau of Land Management have cooperated with Commission personnel from early planning phases throughout project construction.

The most serious problems encountered have been culvert installations which prevent fish passage; channel changes which hinder migration, cause erosion, and loss of streamside cover; and unprotected fills which cause damaging siltation. Advance plans of proposed projects are submitted for inspection to Commission personnel who recommend changes necessary for fish protection. Up to 150 such projects are reviewed each year. Joint field investigations are sometimes necessary with all agencies represented at the scene of the work. From these meetings agreements are often reached in providing maximum protection for fish life as well as protecting angler access to the streams.

In the last few years notable success has been enjoyed in actually creating spawning areas. The Granite Creek area of the John Day system was completely torn up by gold dredging activities many years ago. In 1961 the Commission moved to rehabilitate a four-mile section of Clear Creek in this area. With heavy equipment the stream bed was rearranged into spawning riffles and resting pools, utilizing gravel which had lain unused on the banks. Before the project the annual average number of chinooks in this section

for a five-year period was only 26 fish. Following rehabilitation spawners moved into the area in good numbers with 447 observed in 1962 on the man-made spawning beds. This past season saw 327 of the large chinooks using the new spawning area. Needless to say, as funds become available, this technique will be expanded to other similar areas.

After hatching, young salmonids must find their way to sea after varying periods of residence in the nursery areas. Obstacles encountered are the hundreds of irrigation ditches leading into dry fields and the turbines of the many hydroelectric plants on the larger streams. Approximately 1,400 irrigation screens have been installed to bypass young fish into live water. Constant servicing is necessary to keep the screens operating during the irrigation season. The annual saving in downstream migrants by use of the screens in one large tributary of the Columbia River is comparable to the output of a large modern hatchery!

Turbine losses of fish are heavy. Much effort has gone into designing bypass facilities at major dams in order to successfully pass the migrants around, and not through, the turbines. On smaller installations traveling screens have been quite successful, but continued effort on this problem is necessary on large projects. On a major stream such as the Columbia, even with small losses at each installation, the cumulative effect of many dams is tremendous. The well-staffed River Basins Section of the Commission spends almost full time on these perplexing problems.

We see then that a lot of effort goes toward helping nature take care of the migrant runs. Most of these adverse factors can be traced to man's activities. Again, man enters into the harvesting of runs, and if the harvest is controlled so that the runs can perpetuate themselves,

no harm results. As with all activities of mankind, the greedy element is at once apparent. Laws or regulations for taking fish would be far less stringent if it were not for this small group of violators.

Anadromous fish regulations make up the largest portion of the angling regulations. Protection of the resource while allowing for a fair harvest is a complicated matter. If rules regarding anadromous fish were eliminated from the angling synopsis, the pamphlet could be reduced from 47 to 17 pages. The intermingling of the various runs in the streams, with some fish near spawning while new arrivals are prime fish, and the presence of resident trout in the same water are some of the complicating factors. Often it is necessary to close small sections of coastal streams to protect spring chinooks for a short period of time, while allowing anglers to fish for fresh-run fall chinooks, cohos, and early steelhead in the lower sections of the same streams. Some streams have the lower reaches closed to trout angling to protect downstream migrants. Although this has not been very popular with trout anglers, anadromous runs have benefited greatly. Continual study of the results and effects of regulations in each area is carried on by the district biologists. Recommendations are made annually to the Commission, which each winter at regulatory meetings decides how best to provide maximum recreation and still provide ample seed stock.

Even with the help afforded by the assists to nature discussed above, anadromous fish runs sometimes need further assistance. In early days, when declining runs were noticed, it was thought by most people that the simple expedient of hatching millions of fry and releasing them immediately into the stream would provide enormous returns. Nothing was

(Continued on Page 8)

Log jams, both natural and those caused by logging activities, must be removed before salmon and steelhead can reach spawning areas. This large jam was on the North Fork of the Trask River.



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(Continued from Page 7)

further from the truth. Even the most expert fish culturists, who had experienced excellent results in trout production, waited vainly for the great surge of artificially produced upstream migrants. Less than a dozen years ago, over 40 hatcheries on the Pacific Coast were producing salmon without provable contributions to the runs. In recent years, research in both nutrition and disease and applied research in stocking techniques have helped hatcheries to become an effective tool in maintaining and even establishing runs of anadromous fish.

The Game Commission, long successful in operating high caliber trout hatcheries, has for a number of years handled anadromous fish on an essentially experimental basis. In the last few years, excellent results achieved have caused the Commission to expand the program within the limits of available funds. It should be emphasized that other agencies, both State and Federal, are operating large and excellent hatchery facilities.

The Commission's Research Division has supplied the answers to many problems of proper techniques of culture and stocking of anadromous fish and is continually exploring other avenues which will benefit hatchery production. The determination of the proper timing of release and the attainment of the correct size and condition of migrant-sized steelhead through proper hatchery methods have been a boon to the many steelhead streams which are stocked. The best results with steelhead, for example, are obtained when fish are reared to a size of about seven inches and can be released at that size in early spring. This is now accomplished in a year's time in our hatcheries and duplicates the results of two or three years' rearing under natural conditions. Primarily, work has been concentrated on three study streams, but the program is now being expanded. The accompanying graph showing catches in several popular streams illustrates the contribution of this program.

The summer steelhead production program is being accelerated and results to date have been encouraging. Just this year, an excellent fishery has been developed in the Nestucca River through the contribution of hatchery-reared stock. The following table illustrates the in-

creased production efforts with anadromous fish in the last few years.

**Comparison of Numbers of Salmon
and Steelhead Yearlings Stocked**

Year	Yearling Steelhead	Yearling Salmon	Total
1960	381,164	103,453	484,617
1961	777,464	269,978	1,047,442
1962	881,302	166,432	1,047,734
1963	882,002	235,658	1,117,660
1964	1,289,000	155,000	1,444,000

The hatchery program is expensive and although the Commission has succeeded in the seemingly impossible task of actually reducing the costs of producing fish, other avenues of fish production have been explored.

The use of artificially created lakes as nursery areas is presently under study. Regarded earlier as a panacea by some individuals, the program has been fraught with difficulties. Predation by birds, temperature and oxygen problems, pollution from outside sources have been a few of the problems encountered. Lately, it appears that we have solved most of these and rearing ponds may become a valuable contribution to production. Survival to migrant size in one of the ponds has been as high as 80 percent. Three of these ponds are now in operation in southwestern Oregon. A relatively new concept in rearing ponds is the Lint Slough impoundment on the lower Alsea River. A cleverly designed water system allows the rearing of salmonids in any range of water quality from fresh to highly saline bay water. Extremely nutritious water flows into the lake from Alsea Bay and has been responsible for tremendous growth in the young fish. It may be possible to rear successive groups of various species because of the rapid growth.

Another way of building the total runs is by means of transplanting surplus adult fish from hatchery streams. At some stations the return of marked hatchery fish has been so great that insufficient facilities are available to rear all the potential offspring. Steelheads almost ready to spawn have been distributed by tankers from Alsea Hatchery to such stream areas as the upper Siuslaw and the upper Yamhill. Alsea tributaries which have impassable barriers have also been stocked with these fish. Successful spawning and the resultant juvenile fish have been observed in all areas.

Just recently, the Game Commission cooperated with the Fish Commission and



Immature white sturgeon require seven or eight years of growth before reaching the legal length of 36 inches.

the U. S. Fish and Wildlife Service in transporting surplus coho adults to such areas as the upper Sandy River tributaries, upper John Day River, and the upper Hood River system. These streams, once harboring good runs of the sporty coho, offer excellent potential for providing homes for the newly introduced runs.

As mentioned earlier, most of the management efforts have centered on the popular steelhead and salmon. Striped bass, sturgeon, and shad must still be considered as of minor importance. Although these species benefit along with salmonids from proper management, primary emphasis has been on regulations and studies of the sport fishery on them. Increased attention has been given to this group by anglers and eventually more precise management will be necessary. As more and more anglers seek the available fish, many will turn to the lesser species as they learn more about them. The Information and Education Division has prepared informational leaflets on all the anadromous fish. These leaflets may be obtained free of charge.

Summarization of such a lengthy article risks needless repetition, so it should suffice to say: The Commission expends great effort in maintaining the runs of anadromous fish while attempting to provide a fair and orderly harvest for all anglers.

Good Fishing!

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