YAQUINA RIVER BASIN FISH MANAGEMENT PLAN

PUBLIC REVIEW DRAFT

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INTRODUCTION

Purpose

The Fish Management Policy of the Oregon Department of Fish and Wildlife (ODFW) directs that management plans will be prepared for each basin or management unit for the purpose of recording ongoing management and guiding future management of fish and shellfish and their habitat. The Yaquina River Basin Fish Management Plan (hereafter referred to as the Yaquina Plan or the Plan) is one part of the overall planning effort of ODFW. Individual species plans contain statewide policies, guidelines, and objectives, and provide general direction for writing basin plans. The Yaquina Plan incorporates appropriate portions of the above plans, and will be the primary document used to guide fishery management of the public resources in this basin.

The Yaquina Plan identifies objectives and activities which will be implemented by ODFW within the Yaquina basin. This plan also ranks the most important management activities. By stating objectives for managing fisheries, fish and shellfish populations, and habitat, the public and ODFW will have a better understanding of the direction being taken with these activities in the Yaquina basin. With a good understanding of stated direction within ODFW, priorities can be better and more easily assessed when developing biennial budgets, making routine work assignments, and making decisions in crisis situations. The plan can also be used to inform other agencies of our objectives so that fishery considerations can be included when planning for other land and water use activities.

The Yaquina Plan was developed through a process that included ODFW staff and two advisory committees. The main advisory committee was composed of local citizens that represented a diversity of interests in the Yaquina basin area and had input in the entire plan. The second committee worked on the habitat section only and was composed of representatives from land use agencies and major private landowners. This plan is not the final or definitive statement of fish management in the Yaquina basin. Every 2 years a ranked list of activities will be reviewed to determine the funding and staffing priorities for the next biennium and to identify which problems will be approached through the budgeting process. The entire plan will be reviewed every 10 years to evaluate progress in achieving its objectives, to set new activity priorities, and to modify the plan if necessary.

Organization

The scope of this plan is very broad. Fish and shellfish that are "target" species in recreational or commercial fisheries are addressed in individual sections. Other fish and shellfish of recreational importance as well as non-game fish, some of which comprise the major food sources for the economically important species, are covered in aggregate sections. A list of common and scientific names of all fish and shellfish covered in this plan is found in APPENDIX A. The plan also includes sections on habitat and angler access. Mammals, birds, and amphibians, which also interact with the rest of the system, are beyond the scope of their plan; however, their role in fisheries management will not be ignored.

HABITAT

Basin Description

The Yaquina basin is located 115 miles south of the Columbia River on the central Oregon coast. It is bounded to the north by the Siletz basin and to the south by the Alsea and Beaver Creek basins. Its headwaters are in the Coast Range including the northern slope of Mary's Peak. The Yaquina River is approximately 58.8 miles long and has one major tributary, Big Elk Creek, that is 29.7 miles long (Figure 1). The Yaquina River drains 253 square miles (Percy et al 1974).

Newport, at the river mouth, and Toledo, upriver 10 miles are the only incorporated cities within the Yaquina basin. Unincorporated communities scattered throughout the basin are Chitwood, Elk City, Eddyville, Harlan, Moody, Morrison, Nashville, Nortons, Oysterville, Pioneer, South Beach, Salado, Winant, and Yaquina. Most of the Yaquina Basin is in Lincoln County but small parts extend into Benton and Polk counties.

The basin consists of 87% forests, 4% cropland, 2% rangeland, and 7% "other" (Oregon State Water Resources Board 1965). Approximately 72% of the basin is in private ownership. Much of the upper basin is owned by large timber companies. Logging is a major activity in the basin and wood products processing plants are located in Toledo and Eddyville. Animal grazing and hay and other crop production occurs in many of the flat, valley areas. The most extensive agriculture lands are near Boone Slough. The economy of the lower basin is based on fishing, seafood processing, forest products export, and tourism.

The estuary is ranked fourth largest within Oregon (excluding the Columbia) based on surface area measured at high water. The bay has withstood considerable activity by man. Development is heavy along the north shore at Newport. Jetties were first constructed in the 1880s and have been rehabilitated or extended numerous times since 1919. A commercial boat basin is along the north shore and an additional boat basin was built in the early 1980s on the south shore. A large aquaculture facility and the Mark O. Hatfield Marine Science Center are other major developments on the south shore.

The bay is maintained as a deep water port by the U.S. Army Corps of Engineers. A deep draft channel is maintained, with a turning basin, to docking facilities at McLean Point. Shallow draft navigation is possible to river mile (RM) 14.4 at Toledo.

Physical and Biological Characteristics

The eastern 77% of the Yaquina Basin is in the Tyee-Flournoy formation (Snavely et al. 1976) which is mainly sandstone, shale, and conglomerates with some basaltic intrusions such as Mary's Peak. The western part of the basin is composed of north-south bands of various siltstones or mudstones. Siltstones are more erodible than sandstone as shown by the wider, flatter valleys of the lower Yaquina River and its tributaries compared to the narrow meander of the upper river (Goetze 1988).

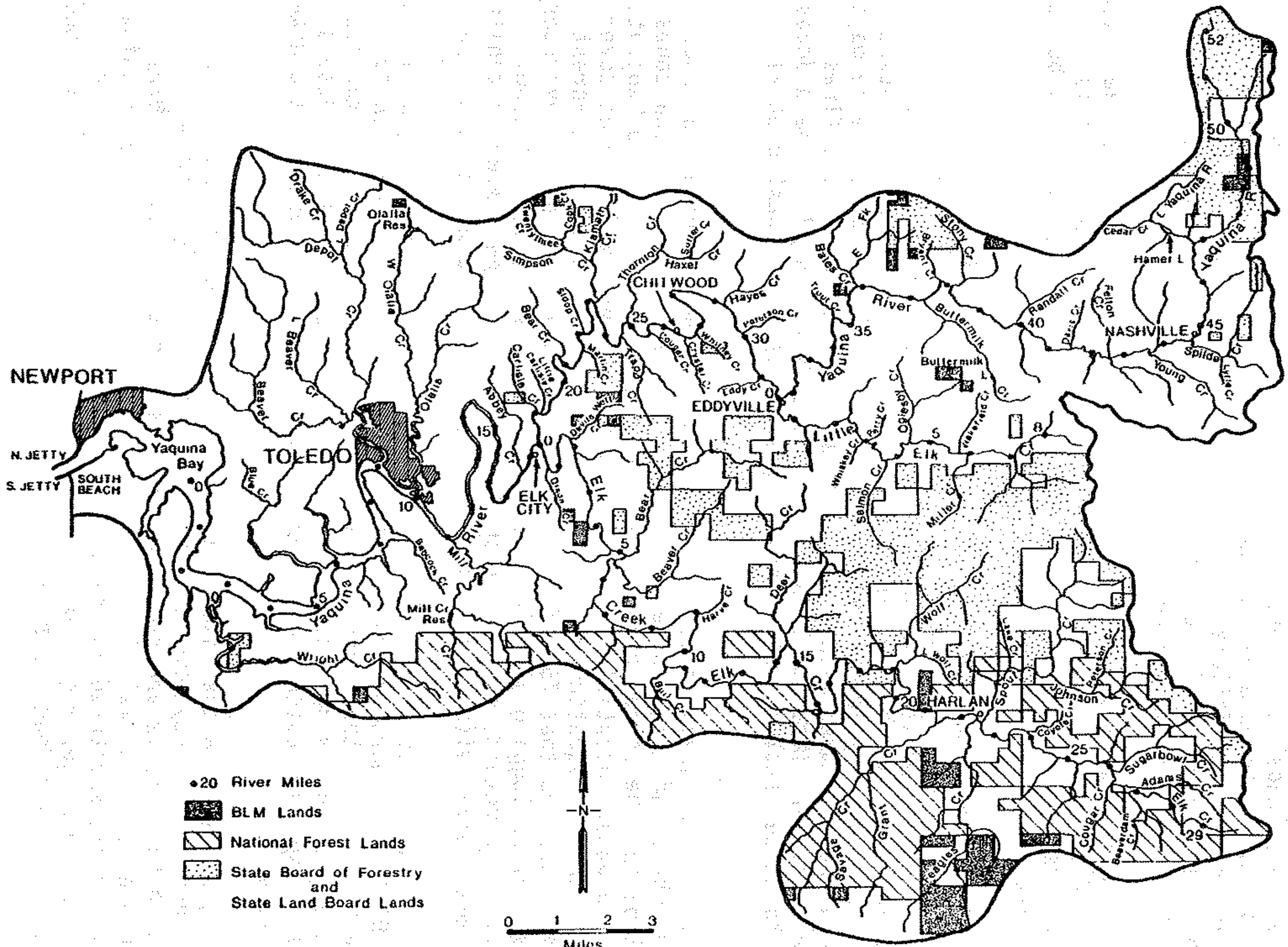

Figure 1. Map of the Yaquina basin.

Elevations range from sea level to 4,097 feet at the top of Mary's Peak. The major streams are of low gradient, falling 2 to 11 feet per mile (U.S. Army Corps of Engineers 1970). The gradient is steep only in the headwaters of the Yaquina River and Big Elk Creek where it may drop 60 to 90 feet per mile. The topography of the upper basin is considered "hummocky" indicating that it was developed by deep-seated landslides and rotational failures rather than shallow rapid landslides (Goetze 1988). Shallow landslides are frequently caused by man-made disturbance to the terrain, while deep-seated landslides and rotational failures usually have a natural cause. The lower basin has been shaped by erosion of the soft underlying rocks and by rotational failures in steeper areas (Schicker et al 1973).

Most of the land with gradient low enough to be developed is in the lower basin. Much of the level or near level land has drainage problems or is subject to floods by the river or tides. Dikes and tidegates have been built to protect some of these low areas for agriculture (USCE 1970).

There are two major plant communities in the Yaquina Basin. The spruce/shore pine vegetation zone exists in the fog belt while the hemlock/Douglas fir community is further inland. Where human activity has been extensive, alder may be the dominant tree. An alder canopy may retard fir growth for up to 80 years (Franklin and Dyrness 1973). There are no major stands of old growth timber within the Yaquina basin. Major forest fires burned huge tracts of timber in 1846 and again in 1868. In 1866, the midcoast was opened to white settlers and logging began in the basin (Castle et al. 1979).

Local vegetation areas of importance are the streamside riparian zones, estuarine marshes, and eelgrass beds within the estuary. The riparian zones serve to stabilize the stream bank, trap sediments, provide wildlife habitat, improve ground water potential, reduce stream temperature, and provide cover to the stream and its aquatic inhabitants (Bottom et al. 1985). The Forest Practices Act requires that 75% of the original shade and 50% of the overstory canopy remain after logging activities within a riparian management zone. More specific requirements such as width of the zone and the number of conifer trees that must remain within the zone depend upon the stream size and type.

Estuarine marshes cover 819 acres surrounding Yaquina estuary (Akins and Jefferson 1973). The marshes provide nutrients to the bay in addition to serving the bay much as the riparian zones serve the streams. Major marshes are located along Poole's and McCaffery's sloughs. The area between Nute's and Boone's sloughs had extensive marshes that have now been drained and diked for agriculture.

The eelgrass beds in the intertidal and subtidal areas of the estuary serve many functions. They prevent erosion in the estuary by binding sediments with their roots and reducing currents with their leaves. Many microscopic plants and animals live on the eelgrass while a variety of animals feed, rear, and are sheltered in the eelgrass beds. Black brant stop in Yaquina Bay during winter migrations to feed on eelgrass. Major eelgrass beds are located at Sally's Bend, Idaho Point, and King's Slough.

Weather in the Yaquina basin is moderated by the Pacific Ocean. Average monthly temperatures range from 57^{o} F in July to 44^{o} F in January (U.S. Army

Corps of Engineers 1970). Precipitation is mainly in the form of rain. Snow is rare in lower parts of the basin and seldom lasts more than a couple of days in the higher elevations. Heavy advection fog is common during the summer in the bay area. Newport averages 43 days of fog annually. Average annual rainfall is 66 inches in Newport and up to 110 inches in some areas high in the basin. About 70% of the annual precipitation falls between November and March (U.S. Army Corps of Engineers 1970). During the summer the prevailing winds are from the north and northwest while the prevailing winds of winter are from the east and southeast (Bureau of Government Research and Service 1969). Winds associated with winter storms are usually off the ocean from the south and southwest.

Flow in the Yaquina Basin follows the annual weather patterns (Figure 2). Mean monthly flow is highest in February with 1600 cfs and lowest in August with only 100 cfs (State Water Resources Board 1974). The annual discharge is 749,000 acre-feet. The annual discharge and size of the drainage basin are considerably smaller for the Yaquina estuary compared to other major estuaries. The Yaquina basin receives less precipitation than either the Siletz or Alsea basins because of wind and weather patterns and the relative locations of mountains (See Figure 3). The Yaquina is in the rainshadow of Table and Grass mountains during the winter and is somewhat protected to the north by Sugarloaf, Stott, and Euchre mountains during the summer (Goetze 1988). In addition, the underlying rock and soil formations are not very porous so the volume of groundwater available to supplement summer flows is small (USCE 1975). An important consequence of low flow and low gradient is that the river is unable to move large material or heavy sediment loads (Goetze 1988). To ensure sufficient water for year round mill operation, Georgia Pacific Corporation maintains water in Olalla Reservoir by pumping in water from the Siletz River (State Water Resources Board 1965).

Water quality at six sites between RM 1 and 14.3, was evaluated by Hatfield Marine Science Center personnel (1977) and was based on a variety of parameters, including temperature, dissolved oxygen, turbidity, and fecal coliforms, collected by the Environmental Protection Agency (1977). Generally, water quality ranged from acceptable to high, except in the area downstream of Toledo where turbidity and fecal coliforms were occasionally high. This area is significant for shellfish and oyster production. In 1983 the city of Toledo installed a new sewage treatment plant, however sewage problems from the city still occur during times of heavy rainfall or pump failure. Toledo has received a grant to rehabilitate old sewer lines and to install backup power systems to avoid these problems in the future (telephone communication with Fred Town, City of Toledo, February, 1990). At times there are problems within the bay due to oil and other pollutants released by ships, boats, and land industry. In general streams of the upper basin have good water quality although there are local situations where agriculture practices (animal grazing on streambanks or agriculture runoff) cause sedimentation or pollution.

Alterations to Habitat

Habitat in the Yaquina basin has been altered by diking estuarine wetlands for agriculture uses, land clearing for development or agriculture, animal grazing, filling parts of the estuary for development, dredging the river channel for navigation, jetty building for navigation, and logging for

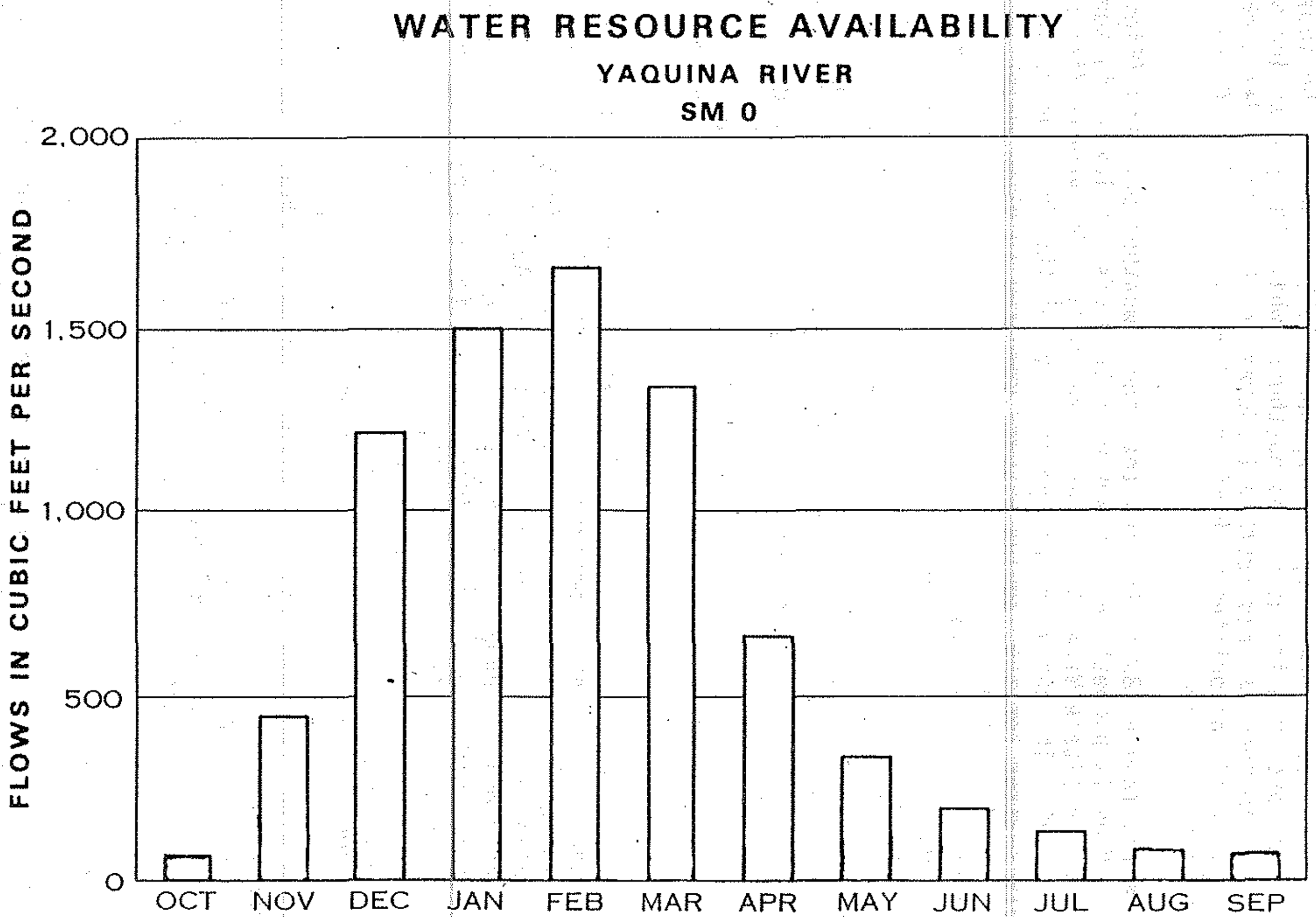

Figure 2. Mean monthly flow in the Yaquina River at river mile 0 (State Water Resource Board 1974).

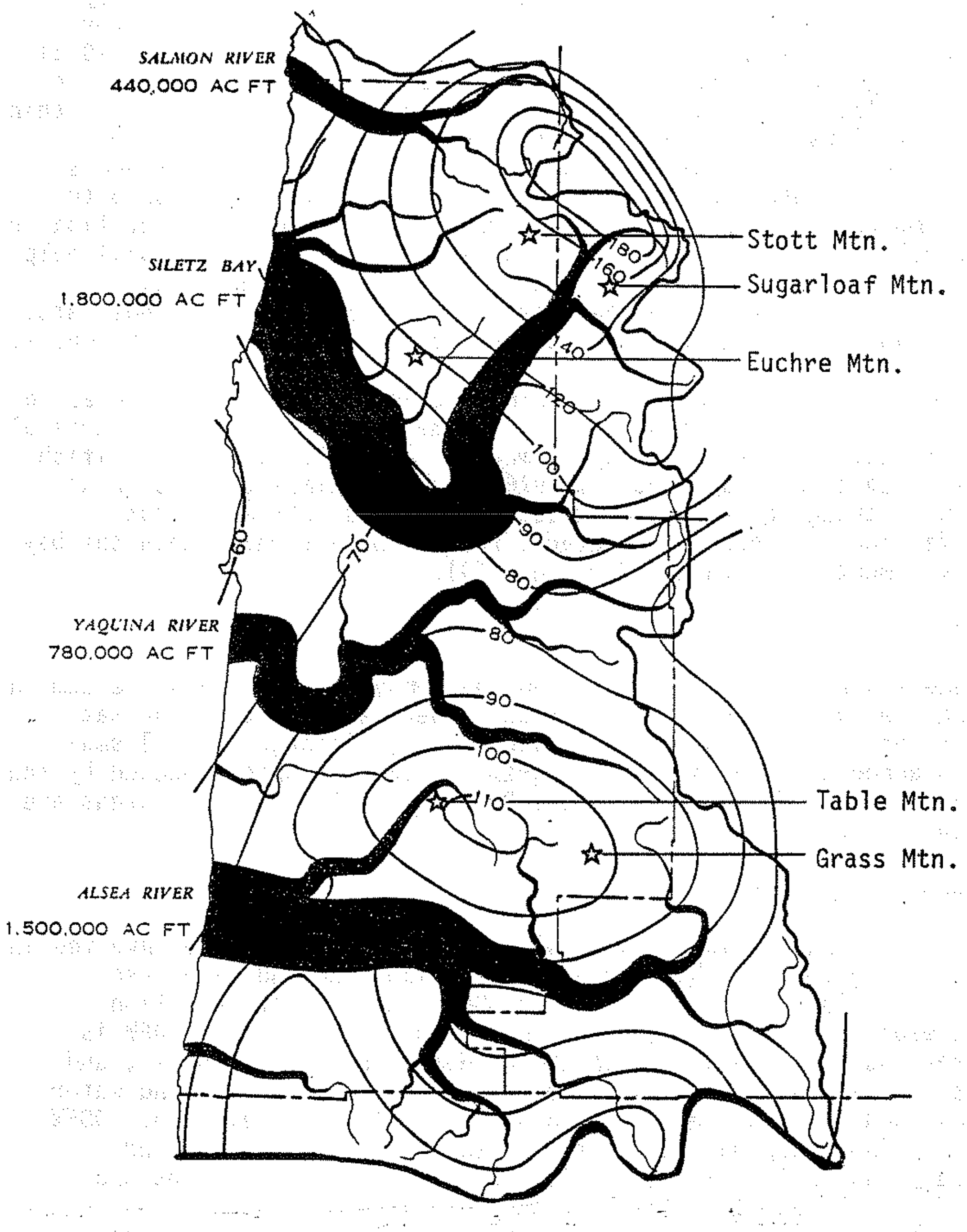

Figure 3. Precipitation (inches per year) and annual river discharge (acre feet) of Central Coast rivers (State Water Resource Board 1965).

timber production. These changes affect characteristics important to salmonids as well as other aquatic life: stream flow, water velocity, water purity, depth, temperature, dissolved oxygen, large woody material, streamside vegetation, and invertebrate production (Bottom et al. 1985).

Currently the major problems with stream and estuary habitat as they relate to fish resources are low flows during the late summer, high water temperatures during the summer in the lower river and upper bay (USACE 1975), and limited rearing habitat for juvenile salmonids. Transformation of rich marshland or tideflats into dry land has reduced the general production within the estuary. Low flows are largely a consequence of the weather in the Yaquina basin. However, various land use practices affect the watershed's ability to hold water into the summer. These activities can contribute to higher water temperatures and increased sediment when streamside vegetation is reduced. Careful preservation and rehabilitation of riparian zones will help alleviate these problems. Channel alterations that reduce complexity (incidence of pools, riffles, side channels, woody debris, beaver ponds, etc.) reduce rearing habitat for juvenile salmonids and spawning habitat for adults.

Diking and filling has reduced estuarine wetlands by about 1000 acres for a 30% reduction of these very rich habitats. Some diked marshland is marginal pasture land at best. These areas may be more valuable to fish or shellfish production as marshes (Hoffnagel et al. 1976) than to animal production as pastures. Annual dredging of the lower estuary removes bottom habitat. Dredging and filling can change the water circulation patterns within the bay (Bureau of Government Research and Service 1969).

Habitat Restoration

Fish ladders were constructed to allow anadromous fish to pass the dam on Mill Creek and the falls on Little Elk Creek. There are no major habitat restoration projects occurring in the Yaquina Basin, although several small projects are planned through the STEP program and one has been proposed by the USFS for Savage Creek. Through the Forest Practices Act all logged areas are replanted within 3 years.

Habitat Management Agencies

A number of federal, state, and local government agencies are involved in land and water management in the Yaquina basin. The land and water use activities they regulate often overlap with ODFW's habitat conservation program. Therefore, close interagency cooperation is essential. ODFW is responsible for the management of fish and wildlife on state, federal, and private lands and waters. ODFW has statutory authority over land and water use activities such as fish screens, fish ways, and fish propagation. ODFW carries out its fish management activities within its own statutes and administrative rules while being generally consistent with the rules and regulations of other agencies. The Department works with appropriate regulatory agencies to identify threats to habitat and develop necessary protective measures, to monitor some activities that affect aquatic resources, and to identify and implement habitat restoration projects. The responsibilities of the principal agencies that regulate activities that affect fish habitat are briefly described below.

United States Forest Service: The United States Forest Service (USFS) is responsible for managing the fish and wildlife habitat on lands under its administration. USFS holdings account for 13% of the land in Yaquina basin, all within the Siuslaw National Forest. Logging in the Siuslaw Forest is regulated by USFS policy as administered by the Siuslaw National Forest. The Siuslaw Forest Plan (March 1990) defines four classes of stream corridors and contains policy for riparian ecosystem management for this forest.

A memorandum of understanding between ODFW and USFS recognizes the responsibilities of each agency and states ways in which the two agencies will interact to uphold their individual responsibilities.

Bureau of Land Management: General goals have been developed by the Bureau of Land Management (BLM) to accomplish management of public lands (BLM 1980). These include providing and maintaining habitat diversity for indigenous fish and wildlife, particularly threatened, endangered, and commercially valuable species. A memorandum of understanding between ODFW and BLM provides for continued cooperative efforts for enhancement and protection of anadromous fish habitat on BLM lands.

About 3% of the land in the Yaquina basin is under jurisdiction of the Bureau of Land Management (BLM). Yaquina basin BLM lands are managed primarily for timber production. Logging is regulated by BLM policy as administered by the Salem District. BLM minimum logging standards meet or exceed the rules of Oregon's Forest Practices Act and are described in BLM's Management Framework Plan. Fish habitat requirements, the impacts of timber management activities on fish and their habitat, and various protective measures are addressed (BLM 1980, 1983).

U.S. Army Corps of Engineers: Responsibilities of the U.S. Army Corps of Engineers (USACE) include maintaining harbor and river channels and providing assistance in flood control. Section 404 of the Clean Water Act of 1977 gives USACE authority to regulate the discharge of dredged or fall materials and toxic chemicals into streams with a flow greater than 5 cfs.

Soil Conservation Service: The U.S. Soil Conservation Service (SCS) assists landowners by administering small projects for flood control, irrigation, recreation, and fish and wildlife enhancement in watersheds of less than 200,000 acres.

Soil and Water Conservation Districts: Local Soil and Water Conservation Districts are composed of elected individuals, usually landowners, who support and carry out projects often with the technical and financial assistance of the Soil Conservation Service.

Governor's Watershed Enhancement Board: This is an interagency commission charged with sponsoring coordination of watershed enhancement programs, and financial support of "grassroots" demonstration projects to enhance streamflow through watershed management practices.

Oregon Department of Forestry: The Oregon Department of Forestry (ODF) through its Forest Practices Act (FPA) enacted in 1972, is responsible for regulating logging activities on state and private lands. The rules for administering the FPA establish minimum standards for forestry activities to protect fish habitat to the extent considered practical. A set of Forest Practices Rules for western Oregon has been established to achieve the purpose of the FPA. One section deals specifically with stream and streamside protection during logging near Class I and II streams. The majority of the larger streams on state and private lands of the Yaquina basin have been evaluated for fish and domestic water use and have been identified as Class I or II streams.

Division of State Lands: The Division of State Lands (DSL) is responsible for issuing permits for removal or filling of materials in waterways. Permits are required when 50 cubic yards or more of material is moved annually. Applications for fill-removal permits are forwarded by DSL to ODFW and other resource agencies for review and comment. The ODFW may request protective measures or denial of the permit based on potential impacts on stream and fish resources. The final decision on any permit rests with DSL.

Department of Environmental Quality: Department of Environmental Quality (DEQ) is responsible for managing water quality and enforcing water standards by regulating activities that could cause violation of the set standards. The Environmental Quality Commission, as part of its State-Wide Management Plan, has adopted a water quality management plan for the Yaquina basin (OAR 340-41-322 to 335). This is primarily a pollution prevention program that states that beneficial water uses and quality standards will be protected, and that sets waste treatment criteria.

Department of Agriculture: Among other duties the Department of Agriculture regulates pesticide use, coordinates interagency investigation of pesticide "incidents" or issues through the Pesticide Analytical Committee, administers programs of the Soil and Water Conservation Districts at the state level, and administers the state's endangered plant species program, and regulates the leasing of state lands for commercial oyster cultivation.

Oregon Health Division: The Health Division monitors estuarine water quality to assure that clams and commercially cultured oysters are safe to eat.

Water Resources Department: The Oregon Water Resources Department (WRD) is responsible for developing programs for the use and control of water resources. The Water Resources Program for the Yaquina basin, adopted by the Water Resource Commission in 1966 and revised in 1975, recognizes fish production as a beneficial use and identified low summer streamflow in many basin streams as a factor limiting production of salmonids. The program established minimum streamflow requirements (MSR) to protect aquatic life for many Yaquina basin streams (Table 1). The MSR reserve certain amounts of streamflow against appropriations made subsequent to 1966. These MSR have been converted to instream water rights by subsequent legislation. Additional applications for instream water rights can be made by ODFW, DEQ, and the Parks and Recreation Department under the 1987 Public Instream Water Right Law. ODFW and WRD have entered into an agreement intended to standardize the investigation and reporting of water right applications and transfers. It describes the procedure to be followed in reviewing applications that may adversely affect fish and wildlife habitat.

Department of Land Conservation and Development (DLCD), Land Conservation and Development Commission (LCDC), and Lincoln County: ODFW has prepared an administrative rule, accepted by LCDC, to coordinate ODFW programs and activities with the state land use planning goals, local jurisdiction land use plans, and other state and federal land use programs. Lincoln County's Comprehensive Land Use Plan has been acknowledged by the State Land Conservation and Development Commission. ODFW biologists worked with Lincoln County planners during development of the plan to insure adequate recognition of fish and fish habitat needs and will be involved in periodic review of the plan. Several policies in the plan, and zoning ordinances and procedures necessary to implement the policies, recognize the importance of fish and wildlife resources and the habitat they require. However, protection and restoration of habitat and riparian vegetation is the responsibility of individual landowners.

Table 1. Instream water rights (cfs) established for selected streams in the Yaquina basin. The priority date for the water right on the Yaquina River between its mouth and Simpson Creek is July 12, 1966. The priority date for all other streams listed is March 26, 1974.

Stream	Oct 1-15	Oct 16-31	Nov 1-Dec 31	Jan 1-Apr 30	May 1-31	Jun 1-30	Jul 1-Sept 30
Elk Creek between Grant and Bear Creeks	20	40	--50--		30	20	10
Elk Creek mouth to Bear Creek	30	60	--80--		50	35	15
Yaquina River mouth to Simpson Creek	30	70	90	50	35	25	15
Yaquina River Simpson Creek to Bales Creek	20	50	90	50	35	20	10
Simpson Creek at mouth	15	30	40	30	20	15	4
Little Elk Creek at mouth	15	40	60	50/40*	30	15	5

* For dates: Jan1-Mar 31/April1-30

Policies

Operating Principle 1. Habitat protection and enhancement activities will be carried out with the guidelines of ODFW's Fish and Wildlife Habitat Protection Policy and the habitat management goals of ODFW's Anadromous Fish Management Plan.

Operating Principle 2. Habitat degradation potentially leading to losses of fish production will be minimized or prevented throughout the Yaquina basin.

Operating Principle 3. ODFW will coordinate with appropriate land- and water-use management agencies on habitat protection and enhancement activities, and will continue to act in an advisory role to such agencies to promote habitat protection.

Objectives

Objective 1. Protect estuarine habitat.

Assumptions and Rationale

1. High quality, diverse, and suitable habitat is essential for optimum fish and shellfish production.

2. Species addressed in this plan require a variety of habitats in the estuary to complete all or parts of their life cycles.

3. The Yaquina estuary has been altered, and available habitat has been reduced by diking filling and other land-use practices.

Problems and Recommended Actions

Problem 1. The public is not always aware of the needs for and the benefits of good quality habitat.

Action 1.1 Develop an awareness among landowners and appropriate agencies of the benefit and need for maintaining good fish and shellfish habitat. STEP activities and the ODFW booth at the Lincoln County Fair are vehicles for this action.

Problem 2. Agencies other than ODFW are responsible for regulating activities potentially detrimental to habitat and for enforcing habitat protection laws.

Action 2.1 Promote land and water use practices that, in ODFW's judgment, would not degrade habitat.

Action 2.2 Continue to work with appropriate agencies and jurisdictions to protect habitat from undesirable land and water use activities.

Action 2.3 Continue to work with appropriate agencies, jurisdictions, and the public to promote land and water use activities that will restore or develop habitat.

Objective 2. Enhance and restore estuaries and tidewater habitat to meet the fish production and shellfish objectives for the Yaquina system.

Assumptions and Rationale

1. High water quality is essential to maintain fish and shellfish production.

2. Opportunities exist for restoration and enhancement within the estuary.

3. Estuarine restoration and enhancement will benefit and increase natural production.

Problems and Recommended Actions

Problem 1. Habitat has been lost or reduced in productivity through construction of tidegates and dikes, and through filling activities.

Action 1.1 Work with appropriate agencies and landowners to restore areas by breaching dikes or by excavating areas to create tidal marshes, etc.

Action 1.2 Identify defective tidegates, and work to eliminate unnecessary ones.

Problem 2. Residential and commercial shoreline development can reduce the quality of estuaries habitat.

Action 2.1 Work with appropriate agencies and landowners to obtain adequate mitigation to replace habitat that is lost through development.

Action 2.2 Develop an awareness among landowners and agencies of the value of shoreline habitat for fish and wildlife.

Action 2.3 Encourage landowners to protect and restore riparian habitat through the tax incentive programs or other county or state programs.

Action 2.4 Work to reduce the amount of organic material that enters the water as a result of human activities.

Problem 3. Commercial harvesting of oysters and clams is occasionally restricted because of high fecal coliform counts.

Action 3.1 Encourage DEQ and Department of Health to monitor water quality, identify pollution sources, and reduce input of pollutants.

Objective 3. Protect freshwater habitat.

Assumptions and Rationale

1. Streams flowing through residential, agricultural and forest lands provide spawning and rearing habitat for salmonids.

2. Upland and riparian areas, instream structures, and stable streamflows are essential elements that give streams their high value as fish and wildlife habitat.

3. Instream water rights and other restrictions on detrimental water use, state and federal water quality standards, and zoning restriction help protect fish habitat in the basin.

4. Freshwater habitat has been lost or degraded over time through a variety of land and water use practices.

Problems and Recommended Actions

Problem 1. Loss of riparian vegetation (grazing, wood cutting, residential development, etc.) causes erosion of stream banks, sedimentation of streambeds, and increased summer temperature.

Action 1.1 Work with appropriate agencies and jurisdictions to insure adequate protection from land-use activities.

Action 1.2 Continue to review permits, carry out on-site inspections, and perform other such activities in order to assist other agencies in protecting habitat.

Action 1.3 Promote landowner education and cooperation in protecting stream corridor riparian areas.

Problem 2. Removal, or disturbance, of large woody debris and gravel from streams destroys fish cover and pool habitat, reduces channel stability, and increases bank erosion.

Action 2.1 ODFW personnel will continue to review DSL and USACE fill and removal applications and recommend conditions to protect fish habitat.

Action 2.2 Develop and foster an awareness among landowners and agencies of the value of structural components of instream habitat including large woody debris and various substrate types.

Problem 3. Diversion of flows and pumping of water for domestic, municipal, agricultural, and industrial uses reduces available habitat and may increase water temperature.

Action 3.1 Where necessary, apply for instream water rights for fish or recommend additional sites for adoption of minimum stream flow by the WRC.

Action 3.2 Support additional legislation and regulations to protect stream flow for fish production.

Problem 4. Unscreened diversions may trap and kill juvenile fish as well as downstream migrating smolts.

Action 4.1 Work with water users to ensure that all diversion inlets are properly screened and maintained as required by the fish screen laws.

Problem 5. Current forest practices rules and guidelines may not adequately protect some streams, particularly smaller streams (class 2 by ODF classification, class 4 by USFS classification, and order 1 and 2 by BLM classification).

Action 5.1 Support refinement of timber management rules and guidelines to protect streams. Additional work is needed to identify problem areas and to develop guidelines for protection of smaller streams.

Objective 4. Restore and enhance riparian and instream habitats to help achieve natural production objectives for fish in the basin.

Assumptions and Rationale

1. Land use practices have resulted in a reduction of habitat productivity for fish.

2. Freshwater habitat restoration and enhancement will benefit and increase natural production.

3. Removal or alteration of natural barriers will be guided by the ODFW barrier removal policy and the wild fish policy.

4. Habitat improvement projects can be undertaken by ODFW, USFS, BLM, private landowners, and volunteer groups.

5. Restoration and enhancement projects can play an important role in education and consolidation of public support for fishery resources.

Problems and Recommended Actions

Problem 1. Current physical and biological stream surveys do not adequately identify habitat factors that limit production of salmonids to allow evaluation of freshwater habitat enhancement needs.

Action 1.1 In coordination with other land management agencies, private groups, and private landowners, survey previously unsurveyed streams as well as update present stream survey information.

Action 1.2 Using new and updated surveys, identify basin-wide habitat improvement priorities and opportunities for habitat enhancement projects.

Action 1.3 Identify barriers (e.g. culverts, log jams) that restrict access to historical spawning grounds by anadromous salmonids.

Action 1.4 Support continued research to identify habitat factors that limit fish production.

Problem 2. The contribution of habitat enhancement projects to fish production has not been adequately evaluated.

Action 2.1 Establish a biological evaluation program to document long-term effects of projects on salmonid production in selected streams.

Problem 3. Land management activities have reduced the age and species diversity of riparian plant communities that contribute to fish production in many tributaries.

Action 3.1 Support guidelines and standards in the Forest Practices Act and federal land management plans that actively manage for age and species diversity of vegetation in riparian management areas.

Action 3.2 Encourage landowners and land managers to manage for multiple species (e.g. cedar, fir, hemlock, and deciduous species) in riparian areas lacking diversity.

Action 3.3 Work with ODF and landowners to make creative use of the "Plan for an Alternate Practice" to give landowners incentive to improve riparian zones.

Problem 4. Residential and commercial development can reduce the quality and quantity of riparian habitat.

Action 4.1 Work with landowners and land management agencies to increase awareness of the value of riparian habitat for fish and wildlife.

Action 4.2 Encourage landowners to protect and restore riparian habitat through tax incentive programs and other county or state programs.

CHINOOK SALMON

Background and Status

Origin

Fall Chinook Salmon are native to the Yaquina Basin. Occasionally spring chinook salmon have been observed in the basin and no doubt have spawned in the basin however a natural, perpetuating population of spring chinook salmon has not developed. Hatchery production of chinook salmon began in 1902 using local broodstock. In later years fall chinook salmon of coastal, Columbia River and Willamette River stocks were released as well as coastal and McKenzie River spring chinook salmon. In 1974 Oregon Aqua-Foods (OAF) began releasing fall chinook salmon, mainly of Trask or Yaquina stock. In 1979, OAF began releasing spring chinook salmon of Trask stock and in 1986 began releasing Rogue stock. OreAqua, Inc holds a permit to release 10.6 million juvenile chinook salmon into Yaquina Bay.

Life History

Fall chinook salmon spawn in October to January with the peak of spawning in November. They spawn in the mainstem river or in the lower reaches of large tributaries. An average 4 year old female can produce 4,000 eggs. Juveniles emerge in the spring and spend 3 to 6 months in the low gradient, freshwater reaches where the adults spawned (Nicholas and Hankin 1988). By late spring the juveniles begin to drift downstream to the lower riverine and upper estuary reaches of the basin and by summer can be found rearing in the lower estuary. Most fall chinook salmon migrate to the ocean during the summer or fall as underyearling smolts. Once in the ocean, fall chinook salmon from the central and northern Oregon coast travel north as far as Alaska to feed. Fall chinook salmon may be 2 to 6 years old when they return to freshwater in the fall to spawn.

Nicholas and Hankin (1988) have tentatively classified the Yaquina Basin as having only moderate riverine rearing suggesting that the estuary is the most important habitat to juvenile chinook salmon. From July 1977 to December 1978, Myers (1980) sampled the Yaquina estuary for juvenile salmonids on a bimonthly basis. During times of peak abundance she sampled biweekly or weekly. Myers (1980) first found wild chinook salmon juveniles in the upper Yaquina estuary in late April at an average size of 6.6 cm. They were present in the lower estuary by the second week of June and peak abundance occurred in early August. Size of juveniles captured increased throughout the summer to 15.7 cm in late October and early November.

In January 1978, Myers (1980) caught 3 yearling chinook salmon indicating that the yearling smolt life history occurs but is relatively uncommon in the Yaquina population. Examination of scales from adult chinook salmon sampled on spawning grounds showed that all had migrated to the ocean as underyearling smolts (Nicholas and Hankin 1988).

Yaquina fall chinook salmon are considered north-migrating (Nicholas and Hankin 1988). Tagged fall chinook salmon produced from wild broodstock have been caught in the ocean off British Columbia and Alaska at age 3 and 4. Nicholas and Hankin (1988) classified the Yaquina fall chinook salmon as late maturing since most females returned to spawn at age 5 and 4 in 1980 and 1981, respectively. In the Yaquina, fish enter the river from August through mid-December but spawning occurs from Mid October through December with the peak of spawning occurring in late November.

Spring chinook salmon in Oregon coastal systems follow a life history very similar to that of the fall chinook salmon described above except that they return to freshwater as adults in the spring rather than the fall. Spring chinook salmon enter the river in April to June and "hold" in cool, deep water until fall when they move to the spawning grounds to spawn. The Yaquina basin does not have good "holding" water and that may be the reason a native population has not developed. The occasional spring chinook salmon seen in the Yaquina is probably a stray from the small, native populations in the Siletz and Alsea rivers or from the private hatchery.

Natural Production

Prior to 1900 the run of fall chinook salmon in the Yaquina Basin may have been over 10,000 fish based on early harvests. Before 1950, we have few records on the size of the spawning population. Ledgerwood and Reynolds (1936) estimated that the spawning population in 1934 was only 100 fish in Grant Creek and negligible elsewhere in the watershed. This may have been the all time low in the chinook salmon population. In 1934, the inriver net fishermen still harvested about 800 fish although the average annual harvest for both the preceeding and succeeding 5-year periods was about 3,000 fish.

Beginning in 1950, surveys were made to index the spawning population (Figure 4). Between 1950 and 1974, the peak counts (averaged from surveys on Grant, Feagles, Simpson, and Salmon creeks and the Upper Yaquina River) fluctuated gently around a mean of about 26 fish per mile. During that period the lowest count was 9.1 fish per mile and the highest count was 62.7 fish per mile. Between 1980 and 1988, the peak count fluctuated widely around an average of 73 fish per mile. The lowest count for this period was 26.4 fish per mile and the highest count was 155.3 fish per mile. The spawning population in Grant Creek in 1988 was estimated at nearly 800 adults (personal interview on 16 June 1989 with Steve Jacobs, ODFW, Corvallis, OR) using the Area Under the Curve method (Beidler and Nickelson 1980). In 1988 the spawning population for the whole basin was probably more than 10,000 fish.

The increase in the population size seen in the 1980s may be the result of reduced ocean harvests due to the U.S.-Canada Treaty or the increase may be the result of increased survival in either the Yaquina Basin or the ocean. Stray fall chinook salmon from OAF may also be contributing to the increase in population size, although it is thought that the large increases are mainly due to improved survival of wild fish. Other north and mid-coast chinook salmon populations that receive minimal or no hatchery influence also experienced increased counts.

Hatchery Production

The earliest hatchery was built in 1902 at Elk City on Big Elk Creek. A rack was built entirely across the creek and hundreds of chinook salmon were collected and spawned. Millions of eggs were hatched and released usually as

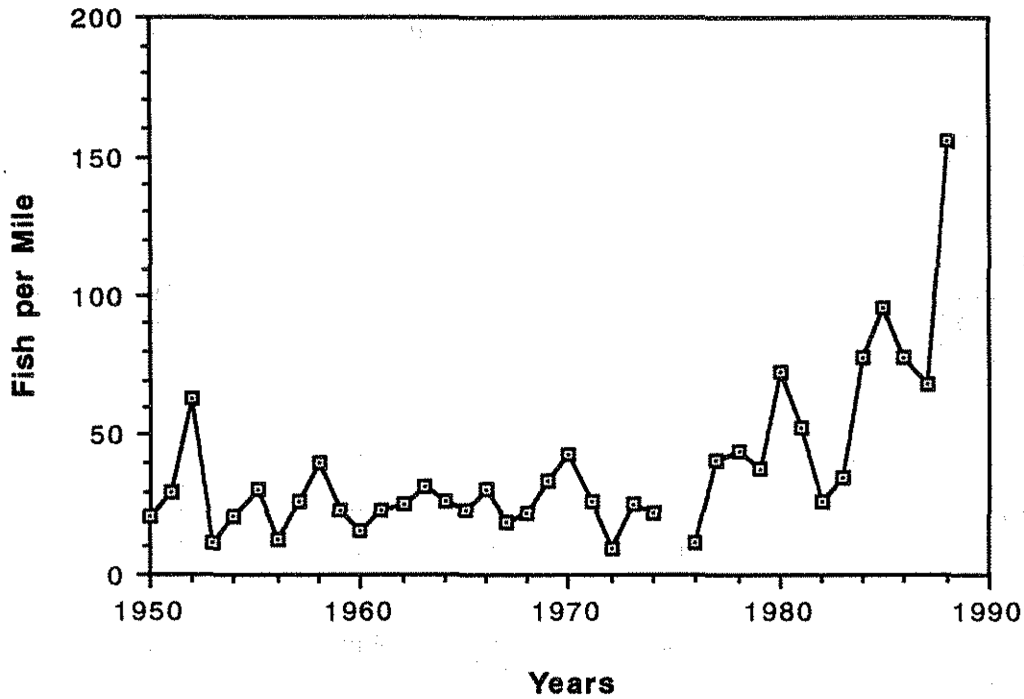

Figure 4. Peak counts of chinook salmon on selected spawning grounds in the Yaquina Basin, 1950-1988.

unfed fry. Spring chinook salmon fry were transferred from the Umpqua River in 1910. Eventually the hatchery was shut down when few chinook salmon were captured. A second hatchery was established on Simpson Creek in about 1930 but closed after one year. In 1940 hatchery facilities were again built on Simpson Creek and closed after a couple of years, although Simpson Creek continued to be used as a release site for juvenile salmon transported from Siletz or McKenzie hatcheries.

Between 1902 and 1950, there was a lot of hatchery activity in the basin (Table 2). Wild Yaquina fish were captured and spawned, and eggs or juvenile fish were brought in from other basins. It is almost certain that juveniles released as fry did not survive. Juveniles released as "presmolts" may have survived depending on where and when they were released and how healthy they were at release. Provided they survived, it is unknown what influence the non-local stocks released between 1925 and 1950 had on the wild population.

After 1950 there was very little hatchery activity with chinook salmon within the Yaquina Basin until 1974 when OAF began releasing chinook salmon. OAF has a permit to release up to 10.6 million juvenile chinook salmon annually but, compared to their coho salmon program, has maintained a very conservative program for chinook salmon (Table 3). Beginning in 1986, OAF increased their chinook salmon program with releases of spring chinook salmon from the Rogue River, but had disappointing returns. In the fall of 1990 OreAqua, Inc went out of business.

Table 2. Number of chinook salmon released into the Yaquina Basin from public hatcheries.

Brood Year	Number Released	Life Stage	Stock	Race	Hatchery	Release Location
1902	557,700	fry	Yaquina	fall	Yaquina	Big Elk
1903	153,313	fry	Yaquina	fall	Yaquina	Big Elk
1903	2,991,067	fry	Clackamas	fall	Yaquina	Big Elk
1904	1,407,470	fry	Yaquina	fall	Yaquina	Big Elk
1905	816,608	fry	Yaquina	fall	Yaquina	Big Elk
1906	1,919,047	fry	Yaquina	fall	Yaquina	Big Elk
1907	2,193,043	fry	Yaquina	fall	Yaquina	Big Elk
1908	485,500	fry	Yaquina	fall	Yaquina	Big Elk
1909	324,038	fry	Yaquina	fall	Yaquina	Big Elk
1910	82,785	fry	Yaquina	fall	Yaquina	Big Elk
1910	485,654	fry	Umpqua	spring	Yaquina	Big Elk
1911	148,992	fry	Yaquina	fall	Yaquina	Big Elk
1912	NA	NA	Yaquina	fall	Yaquina	NA
1917	177,000	NA	Bonneville	fall	Bonneville	Yaquina
1925	517,288	presmolt	Bonneville	fall	Spencer	Yaquina
1926	987,850	presmolt	Bonneville	fall	Yaquina	Simpson
1930	972,270	fry	Trask	fall	Yaquina	Yaquina
1933	131,000	presmolt	Bonneville	fall	Alsea	Yaquina
1934	99,500	presmolt	McKenzie	spring	Alsea	Yaquina
1935	120,000	presmolt	McKenzie	spring	Alsea	Yaquina
1936	204,000	presmolt	Trask	spring	Yaquina	Simpson
1937	278,750	presmolt	Yaquina	fall	Yaquina	Simpson
1937	15,000	presmolt	McKenzie	spring	McKenzie	Yaquina
1938	335,675	presmolt	Yaquina+[a]	fall	Yaquina	Simpson
1939	147,000	presmolt	Yaquina	fall	Yaquina	Simpson
1940	527,265	presmolt	Yaq, Bonne	fall	Yaquina	Simpson
1941	640,990	presmolt	Yaq, Bonne	fall	Yaquina	Simpson
1942	136,595	presmolt	Yaquina	fall	Yaquina	Simpson
1944	247,195	presmolt	Bonneville	fall	Yaquina	Simpson
1945	487,640	presmolt	Oxbow CHF	fall	Yaquina	Simpson
1946	493,979	presmolt	Bonneville	fall	Yaquina	Simpson
1947	30,000	presmolt	Bonneville	fall	Siletz	Simpson
1948	95,611	presmolt	Bonneville	fall	Siletz	Simpson
1950	200,320	presmolt	NA [b]	fall	Siletz	Yaquina, Simpson
1979	2,887	smolt	Alsea	fall	Alsea	Thornton

[a] Possibly CHS from McKenzie Hatchery.
[b] Probably Bonneville.

Table 3. Number of chinook salmon released into the Yaquina Basin by Oregon-Aqua Foods.

Brood Year	Number Released	Life Stage	Stock	Run	Release Location
1973	27,000	presmolt	Trask R	fall	Wright Cr.
1973	13,000	smolt	Elk R	fall	South Beach
1974	4,982	smolt	Trask R	fall	Wright Cr.
1975	42,169	smolt	Trask R	fall	South Beach
1975	105,493	smolt	Trask R	fall	Wright Cr.
1975	5,551	smolt	Trask	spring	South Beach
1976	12,597	smolt	Trask	spring	South Beach
1976	148,654	yearling[a]	Trask	spring	South Beach
1977	397,202	smolt	[b]	fall	South Beach
1977	13,612	smolt	Yaquina	fall	Yaquina R.
1977	42,079	smolt	Trask	spring	South Beach, Wright Cr.
1978	141,034	smolt	Yaquina	fall	South Beach
1978	24,491	smolt	Yaquina	fall	Yaquina R.
1978	15,790	smolt	Trask	spring	South Beach
1979	151,915	smolt	Trask, Yaquina	fall	South Beach
1979	886,588	smolt	Trask	spring	South Beach
1980	89,026	smolt	OAF	spring	South Beach
1980	249,254	smolt	Trask, Yaquina	fall	South Beach
1981	338,449	smolt	OAF-Yaquina	fall	South Beach
1980	89,026	smolt	OAF	spring	South Beach
1982	860,814	smolt	OAF-Yaquina	fall	South Beach
1982	55,176	smolt	OAF	spring	South Beach
1983	520,401	smolt	OAF-Yaquina	fall	South Beach
1983	354,278	smolt	OAF	spring	South Beach
1984	916,772	smolt	OAF-Yaquina	fall	South Beach
1984	39,948	smolt	OAF-Yaquina	fall	Offshore
1984	11,127	smolt	OAF-Yaquina	fall	South Beach
1984	311,987	smolt	OAF	spring	South Beach
1985	835,182	smolt	OAF-Yaquina	fall	South Beach
1985	115,120	smolt	OAF-Yaquina	fall	Offshore
1986	4,487,847	smolt	Rogue	spring	South Beach
1987	2,549,595	smolt	Rogue, OAF	spring	South Beach

[a] Smolts are usually released in the fall but may be held over the winter and released as yearlings in the spring.
[b] Univ. of Wash.,Yaquina, Fall Cr. Trask.

Table 3. Concluded.

Brood Year	Number Released	Life Stage	Stock	Run	Release Location
1988	327,328	smolt	OAF-Yaquina	fall	South Beach
1988	4,208,431	smolt	Rogue	spring	South Beach
1989	2,517,149	smolt	Rogue, Anadromous	spring	South Beach
1990	0	--	--	--	--

Harvest

Prior to 1923, record keeping was sporadic and poor. When kept, canning records appear to be fairly accurate but there were many years when there were no canneries operating in the basin. In many years a major component of the harvest was salted, smoked or sold as fresh salmon but these records are nearly non-existant. Salmon harvest occurred only in the fall and winter but not in the spring, indicating that spring chinook salmon were not present and that the entire harvest was made up of fall chinook salmon. It appears that it was common to harvest 3,000 and possibly as many as 7,000 chinook salmon around the turn of the century. In the 1920s and 1930s harvests averaged between 2,000 and 3,000 fish annually, with the lowest catch of 826 fish in 1934 and the highest catch of 6,721 fish in 1923 (Table 4). After 1940, annual catches declined to an average of 1,700 fish in the 1940s and only 675 in the 1950s. As discussed in the Coho Salmon Section, reduced catches during this latter time period may represent a more restricted in-river fishery and a shift by fishermen to ocean fishing. After 1956 it became illegal to fish commercially with nets within the Yaquina Basin (and all other coastal basins).

In 1979, OAF began harvesting chinook salmon that returned to their aquaculture facility. Total returns to OAF are given in Table 5. Fish that returned to their facility were either sold commercially or used as broodstock.

In 1949 and 1950 recreational fishermen harvested 102 and 117 adult chinook salmon, respectively (Morgan et al. 1952). In 1971, the catch was 251 adults although all of these fish were caught between the Hwy 101 bridge and the mouth and may not truly be Yaquina fish (Gaumer et al. 1974). Since 1975, recreational harvest has been estimated from salmon-steelhead tag returns (Table 6). Catches of adult-sized, fall chinook salmon in Big Elk Creek remained fairly stable over the 1975-1987 time period, but catches in the main river and the bay increased from 1985-1987 and probably reflect contribution by fall chinook salmon returning to OAF. A minor spring fishery developed in the bay as well. The largest catches were 27 and 21 adult sized spring chinook salmon in 1980 and 1987, respectively. Undoubtedly a number of jacks were also caught but were not included in these estimates.

Table 4. Pounds and estimated number of chinook salmon harvested by in-river commercial fishermen, 1923-1956. Catch year runs from April of that year through March of the following year. Pounds were converted into numbers by dividing by 22.6 pounds per fish (Cleaver 1951, Smith 1956).

Catch year	Pounds	Number	Catch year	Pounds	Number
1923	151,887	6,721	1940	51,004	2,257
1924	70,985	3,141	1941	71,358	3,157
1925	20,183	893	1942	59,367	2,627
1926	26,685	1,181	1943	330,925	1,368
1927	23,958	1,060	1944	14,778	654
1928	44,823	1,983	1945	30,089	1,331
1929	45,530	2,015	1946	22,861	1,012
1930	33,145	1,467	1947	51,918	2,297
1931	87,183	3,858	1948	37,706	1,668
1932	123,653	5,471	1949	32,983	1,459
1933	34,366	1,521	1950	31,165	1,379
1934	20,039	887	1951	11,525	510
1935	27,339	1,210	1952	11,368	503
1936	115,616	5,116	1953	24,959	1,104
1937	73,370	3,246	1954	26,717	1,182
1938	80,951	3,582	1955	12,219	541
1939	57,554	2,547	1956	4,738	210

Table 5. Number of chinook salmon that returned to OAF.

Year	Number	Year	Number
1979	199	1985	14,148
1980	920	1986	27,283
1981	1,481	1987	8,738
1982	2,860	1988	12,757
1983	1,332	1989	final draft
1984	3,164	1990	final draft

Table 6. Number of adult-sized fall chinook salmon caught in the Yaquina Basin. Numbers were estimated from returned Salmon-Steelhead tags and were corrected for non-response bias (ODFW 1989).

Year	Big Elk	Yaquina	Total
1971	--	351	351
1972	--	474	474
1973	--	331	331
1974	--	715	715
1975	206	131	337
1976	23	176	199
1977	51	472	523
1978	60	264	324
1979	72	336	408
1980	80	342	422
1981	68	409	477
1982	73	529	602
1983	41	329	370
1984	54	421	475
1985	59	787	846
1986	36	1982	2018
1987	108	1232	1340
1988	70	1354	1424
1989	90	1247	1337

Angling Distribution, Access, and Regulations

It is legal to fish for chinook salmon in the bay, in the mainstem Yaquina River up to the Eddyville-Nashville Bridge, and in Big Elk Creek upstream to the first bridge below Grant Creek. Most fishing for chinook salmon occurs in Yaquina Bay. There is bank access along both the north and south jetties and along much of South beach. Many people fish from boats in the vicinity of the fish ladder at OAF. Current regulations allow anglers with a valid license and tag to fish from January 1 to March 31 and from May 27 to December 31. The daily bag limit is 2 adult steelhead or salmon of any species, and 10 jack salmon. The weekly bag limit is 6 adults and 20 jacks.

Management Considerations

We have developed two alternatives for management of chinook salmon within the Yaquina basin. Both alternatives are compatible with the Wild Fish Management Policy (WFMP).

Neither alternative addresses ocean harvest of Yaquina chinook salmon. Most Oregon coastal fall chinook salmon are caught in the ocean off British Columbia and Alaska. Only a small portion of the run is caught off Oregon. The ocean harvest of Oregon coastal chinook salmon is managed by the Pacific Salmon Commission and the Pacific Fisheries Management Council. Ocean management of Yaquina fall chinook salmon is beyond the scope of this plan.

ODFW has previously considered the Yaquina chinook salmon as a stock of concern because of possible genetic interaction with foreign stocks used in the past in the large private hatchery program in Yaquina Bay. The private hatchery discontinued releases of chinook salmon after the fall of 1989 and closed down in October, 1990. Their release permit is currently inactive. Because all future programs will comply with the wild fish policy the Yaquina chinook salmon will no longer be a stock of concern.

Alternative 1 places highest value on the wild fall chinook salmon population and the genetic resource it represents. This alternative considers a hatchery program as a risk to the existence of the wild population so does not allow releases of hatchery chinook salmon within the basin.

Alternative 2 allows a hatchery program to occur but focuses management on wild fish. Under this alternative, the hatchery brood stock would begin from wild Yaquina stock to minimize genetic effects on wild fish if the hatchery fish stray. If wild Yaquina fish are annually infused, at a rate of 20%, into the hatchery brood stock the WFMP allows hatchery strays to comprise 50% of the natural spawning population or about 1,600 to 2,000 hatchery fish in the Yaquina basin. If the hatchery broodstock is purely a hatchery product in successive generations, then only 10% of spawners, about 300 to 400 fish, may be hatchery strays.

Under alternative 2, there can be either a public or private hatchery program for chinook salmon. It is unlikely that a private program will be started again in Yaquina Bay because this plan no longer allows use of spring chinook salmon stock because of the genetic risk it poses to other chinook salmon stocks in nearby river basins. From past experience the private hatchery has rejected the local Yaquina fall stock because they felt it did not make a good product. A public program might be started for the purpose of augmenting the inriver sport fishery. Such a program would be of little or no benefit to Oregon ocean fisheries because Yaquina chinook salmon migrate far north and are mostly caught in British Columbia and Alaskan fisheries. If the goal of the program was to produce an additional 1000 hatchery fish to the inriver fishery then the Table 7 below shows a range of number of smolts needed given different survival and inriver catch rates.

Table 7. Number of smolts needed to provide 1,000 adult chinook salmon to the inriver fishery at different in-system catch rates and different survival rates back to the basin.

In-system Catch rate	Survival rate back to basin 0.5%	1.0%	2.0%
5%	4,000,000	2,000,000	1,000,000
10%	2,000,000	1,000,000	500,000
15%	1,333,000	667,000	333,000

Based on costs at nearby hatcheries it would cost about $200,000 in basic annual production costs to produce 667,000 smolts for a fall release at a size of 10 fish/pound. There would be additional costs for transport and marking as well as construction and startup cost for facilities. This is a high cost program for 1,000 fish for a recreational fishery and may be given low priority for funding by the Chinook Plan which recommends that programs that will rehabilitate depressed stocks be given higher funding priority. The Yaquina fall chinook salmon is not a depressed stock. A program of this size may also violate the WFMP if too many hatchery fish stray into natural spawning area. There is also concern that the large chinook salmon catches of 1985-1989 were an artifact of the even larger coho salmon fishery and that without large coho salmon releases the chinook salmon fishery desired under Alternative 2 might not occur.

The ODFW staff recommends Alternative 1 because at this time there is no biological need for hatchery supplementation. The wild stock is healthy and fluctuating around a mean run size that is larger than our run-size objective. At this time we anticipate that the wild population can support the in-river recreational fishery without need of expensive hatchery supplementation. The use of hatchery fish poses an unnecessary risk to the integrity of the wild stock, and is not justified under these circumstances. Additionally, other less healthy stocks should be given priority over Yaquina fall chinook salmon for investment of public or private funds in support of hatchery programs.

Six members of the public advisory committee recommend Alternative 1, while two members recommend Alternative 2. One member supports a stronger hatchery program than Alternative 2 may allow. One member of the advisory committee was unavailable to vote.

ALTERNATIVE 1

Policies

Operating Principle 1. Fall chinook salmon shall be managed for wild production, consistent with the Wild Fish Management Policy. No hatchery chinook salmon shall be released into the basin, except that the Department may approve the use of hatchery fall chinook salmon if needed for stock restoration as defined in OAR 635-07-501.

Objectives

Objective 1. Maintain an estimated run size of 3,600 locally-adapted fall chinook salmon.

Assumptions and Rationale

1. The number of adults that return to spawn can be indexed through spawning ground counts.

2. During the period 1977-88 the run of adult chinook salmon averaged 3,600 (Nicholas and Hankin 1989).

3. The Yaquina estuary can support the current population and possibly more fall chinook salmon.

4. Habitat quality will be maintained or improved.

Problems and Recommended Actions

Problem 1. Insufficient information is available on trends in abundance of the wild population.

Action 1.1 Evaluate the need for an annual recruitment survey (juvenile seining) on Big Elk Creek, the mainstem Yaquina River and the upper estuary to detect large scale changes in the level of abundance of juvenile chinook salmon and long-term trends in natural production.

Action 1.2 Improve the spawning survey database.

Objective 2. Maintain a recreational harvest rate of 5-15% of the inriver run. If the natural spawning population appears to decline, remedial action will be considered.

Assumptions and Rationale

1. We can estimate catch from Salmon-Steelhead Tags.

2. The harvest rate for the recreational fishery averaged about 15% of the run between 1978 and 1987.

ALTERNATIVE 2

Policies

Operating Principle 1. Chinook salmon shall be managed for wild production; hatchery releases shall be consistent with the Wild Fish Management Policy.

Operating Principle 2. The fall chinook salmon stock approved for use in the Yaquina basin is Yaquina. No spring chinook salmon stock is approved for release.

Objectives

Objective 1. Maintain an estimated run size of 3,600 locally adaptedfall chinook salmon.

Assumptions and Rationale

1. The number of adults that return to spawn can be indexed through spawning ground counts.

2. During the period 1977-88 the run of adult chinook salmon averaged 3,600 (Nicholas and Hankin 1989)

3. The Yaquina estuary can support the current population of juveniles and possibly more fall chinook salmon.

4. Habitat quality will be maintained or improved.

Problems and Recommended Actions

Problem 1. Insufficient information is available on trends in abundance of the wild population.

Action 1.1 Evaluate the need for an annual recruitment survey (juvenile seining) on Big Elk Creek, the mainstem Yaquina River and the upper estuary to detect large scale changes in the level of abundance of juvenile chinook salmon and long-term trends in natural production.

Action 1.2 Improve the spawning survey database.

Objective 2. Provide the opportunity for the recreational fishery to harvest 800 hatchery fish.

Assumptions and Rationale

1. We can estimate catch from returns of Salmon-Steelhead tags.

2. Prior to 1985 the recreational fishery harvested about 400 fish

annually. Between 1985 and 1989 the recreational fishery harvested an average of 1,393 chinook salmon annually.

3. The large chinook salmon catches in 1985-1989 may have been an artifact of the larger coho salmon fishery and good survival of wild chinook salmon stocks and may not occur again unless large numbers of coho salmon are available to catch.

4. Interaction (genetic or ecological) between hatchery and wild fish could be detrimental to the wild population.

5. If chinook salmon are reared in net pens without a return facility, they may stray into natural spawning areas at a higher rate than if they were released at a site also having a return facility.

Problems and recommended actions

Problem 1. The wild population historically has supported a recreational harvest of about 400 fish. Hatchery supplementation may be needed to provide the level of catch experienced between 1985 and 1989.

Action 1.1 Design and implement a hatchery program that will be compatible with the WFMP. A Yaquina broodstock would have to be developed.

Problem 2. We do not know at what rate fall chinook salmon released by the hatchery program will stray to the natural spawning areas in the basin.

Action 2.1 Mark a sufficient number of the hatchery fish so that strays can be identified.

Action 2.2 Conduct spawning surveys for chinook salmon in the Yaquina system to detect hatchery strays.

Problem 3. We do not know the contribution of hatachery or wild chinook salmon to the recreational fishery.

Action 3.1 Conduct a creel survey to estimate recreational catch and use mark recovery to evaluate hatchery and wild contribution to the catch.

COHO SALMON

Background and Status

Origin

Coho salmon are native to the Yaquina Basin. Hatchery production first began in 1903 using local broodstock. In subsequent years, coho salmon from coastal and Columbia River stocks were occasionally released. During the 1950s and 60s Alsea and Siletz stocks were released into the Yaquina Basin. In 1974 Oregon Aqua-Foods (OAF) began releasing coho salmon of Oregon coastal and Puget Sound stocks. Oregon Aqua-Foods holds a permit to release 9.5 million juvenile coho salmon in Yaquina Bay.

Life History

Coho salmon spawn from November to early February in clean gravel in low gradient tributaries. An average sized female can produce about 2,500 eggs. Fry emerge from the gravel in the spring (April) (Stein et al. 1972). Throughout their freshwater residence, juvenile coho salmon are strongly associated with pools in cool tributary streams. During the spring, Stein et al (1972) found fry in mainstem areas, however as water temperature increased in late spring and summer, juvenile coho salmon salmon were found only in cool tributaries. In the fall and winter, juvenile coho salmon moved to protected areas such as under log jams and overhanging banks (Hartman 1965).

Juvenile coho salmon are very territorial (Chapman 1962). Dominant individuals establish themselves at the prime feeding locations and they will defend their territory against each other and against other species.

In Oregon the vast majority of coho salmon migrate to the ocean in their second spring after hatching. Myers (1980) found that the peak of migration for wild coho salmon smolts in the Yaquina Basin was in May and that, unlike juvenile chinook salmon, they spent very little time in the estuary before entering the ocean.

Tagging data show that Oregon coho salmon are caught off Oregon and Northern California during their ocean residence. Most coho salmon spend 1.5 years in the ocean, returning to spawn as 3 year old adults. Jack coho salmon spend only 5-6 months in the ocean before returning to spawn as a mature, 2 year old fish.

Natural Production

Actual estimates of the original population size of coho salmon are not available but fishing records from the early 1900s suggest that the run may have been in the 20,000 to 30,000 range.

Since 1950, the population size of coho salmon has been indexed by peak counts of adults on spawning surveys. Data are shown in Figure 5. Since 1980, the peak count has been adjusted to remove stray hatchery fish from the count. Stray hatchery fish were identified using visual interpretation of scale patterns from fish sampled on the spawning grounds. Between 1950 and

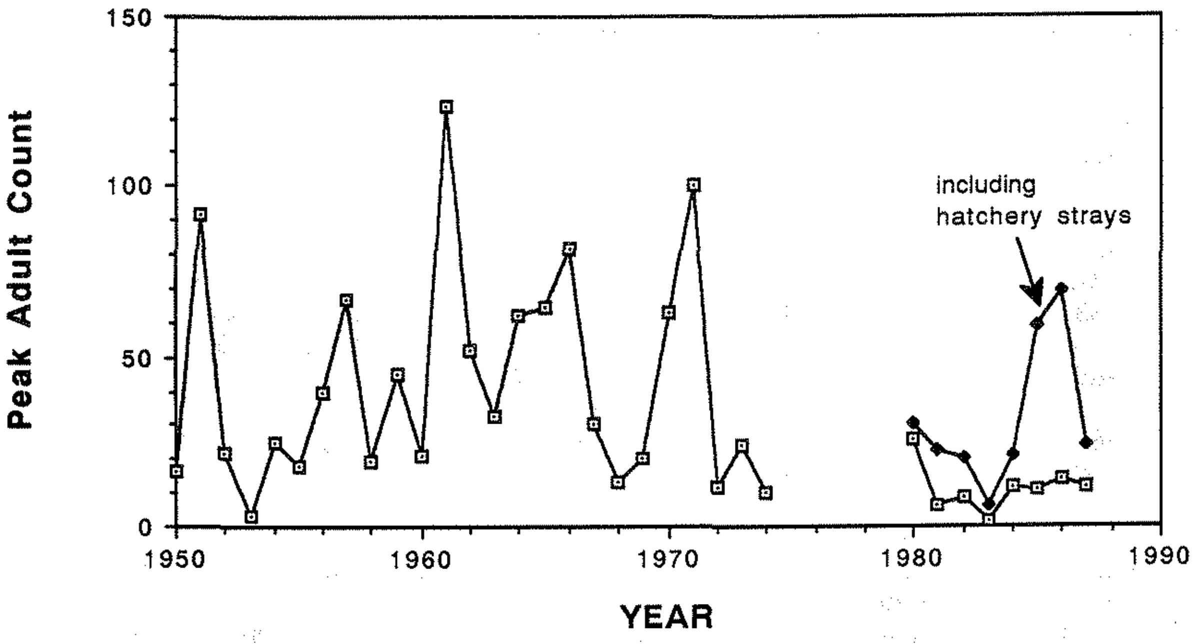

Figure 5. Peak count of adult coho salmon on spawning grounds of the Upper Yaquina River and Salmon Creek.

1974 there were wide fluctuations in the peak count. From 1950 to 1956 the peak count averaged 30.6 fish/mi while the population supported a commercial fishery that averaged 5,500 fish per year. During the 1980s the count has not shown wide fluctuations and has been low, averaging only 11.2 fish per mile.

Since 1981 ODFW has also calculated a population size using the Area Under the Curve (AUC) method described by Beidler and Nickelson (1980). The estimated population size of wild and hatchery coho salmon spawning in the Yaquina River in recent years is given in Table 8. These estimates may be maximum estimates since they are based on surveys of about 26 miles of good spawning area and are expanded to 156 miles of spawning habitat that ranges from marginal to excellent. Wild and hatchery fish were separated using scale analysis.

Hatchery Production

Hatchery production began in 1903 when a hatchery was built on Big Elk Creek near Elk City. Millions of eggs were collected and the juveniles were released as unfed fry in the spring. It is doubtful that many survived. Eventually they could no longer collect sufficient brood fish and this hatchery was converted to a trout hatchery. Residents along upper Big Elk Creek felt that the hatchery was responsible for the decline in the coho salmon run (Oregon State Fish Commission 1936). In the 1930s a new hatchery was built on Simpson Creek and they began to feed the juveniles and release them as fed fry or small presmolts in the spring. Again, it is doubtful that many survived. In the 1940s hatchery personnel learned that coho salmon juveniles survived best if reared to yearling smolt size. The hatchery on

Table 8. Extrapolated population size of wild and total (wild and hatchery stray) coho salmon spawning in the Yaquina Basin, 1981-1988.

Return Year	Wild Population	Total Population	Data Source
1981	1,147	3,900	[a]
1982	1,220	4,056	Modified from McGie (1983)
1983	210	1,671	McGie (1984)
1984	1,909	5,090	McGie (1985)
1985	1,079	11,987	Jacobs (1988)
1986	4,524	12,636	[a]
1987	3,588	4,680	Buell and Kruger (1988)
1988	2,184	2,964	[b]

[a] Personal communication with Steven Jacobs, ODFW, on 18 April 1989 in Corvallis, Oregon.

[b] Preliminary data provided by Buell & Associates on 30 March 1989 in Portland, Oregon.

Simpson Creek closed in 1946 because it did not have a sufficient water supply to hold juveniles through the entire year so that they could reach yearling smolt stage. Subsequent hatchery releases were usually of Siletz or Alsea stock from Siletz, Alsea, or Fall Creek hatcheries (Table 9).

In 1974, Oregon Aqua-Foods was issued a permit to release 9.5 million coho salmon in an ocean ranching venture. Initial releases were made from facilities on Wright Creek. Weyerhaeuser purchased OAF in 1975 and built a release facility on the bay at South Beach. Soon after, they replaced the Wright Creek hatchery with a large rearing facility in Springfield. By using special culture practices, OAF was able to accelerate the growth of juvenile coho salmon and release them as full-sized smolts that were only 8-9 months old rather than the normal yearling age. OAF was allowed to release 20.6 million and 14.9 million coho salmon in Yaquina Bay in 1982 and 1983, respectively, by combining its release permits from Yaquina and Coos bays for those 2 years only. Releases are given in Table 10.

While in the ocean OAF coho salmon were caught by recreational and commercial fishermen. A recreational fishery developed specifically for OAF coho and chinook salmon in Yaquina Bay.

Considerable controversy surrounded OAF's existence. In 1977 they were allowed to import eggs from Puget Sound. Later, the Puget Sound stock was considered undesirable because it differed from local stocks in such characteristics as area of ocean catch. There was great concern about potential interactions between the OAF strays and native fish. Coho salmon released by OAF seemed to have a greater tendency to stray than other hatchery fish. They were found throughout the Yaquina Basin and in the lower tributaries of nearby rivers. Unmarked coho salmon from OAF were identified by scale pattern interpretation. As shown in Table 8, stray hatchery fish, mostly from OAF, have comprised a major portion of the spawning run in some years. In 1987 the Oregon Fish and Wildlife Commission held a public hearing concerning OAF's operation. As a result of that hearing monitoring programs were mandated and ODFW was directed to write this basin plan.

Harvest

Commercial fishing for coho salmon in the Yaquina Basin began in the 1880s. The fishery occurred in the river between Elk City and the mouth and gillnets were the most common gear used. Data are available for the numbers and pounds of fish canned between 1892-1922 (Mullen 1981). During this period when a cannery was operating on the river, it was not uncommon for 20,000 coho salmon to be canned. Mullen (1981) estimated that in 1908 nearly 26,000 coho salmon were canned. In addition to canned fish, many fish were sold fresh or were salted but during the 1892-1922 period these data are reported sporadically or reported with all species combined so are not very useful. During this period there are quite a few years when no data are given, because no cannery operated on the river during those years. Fishing probably occurred during those years and the fish were transported to canneries along the Alsea River for processing.

Beginning in 1923, fish dealers were required to report all salmon landings for tax purposes (Mullen 1981). They were required to separate the landings by species and by area of catch: river or ocean. Landing records during this period are fairly reliable.

In the 1920s and 1930s, the coho salmon population in the Yaquina Basin frequenty supported commercial catches of more than 20,000 fish (Table 11). By the 1940s the catch had dropped to 10,000-15,000 fish, while in the 1950s, it declined to less than 11,000 fish annually. To some extent, the decline was a result of reduced fishing pressure. During the 1920s an average of 53 gillnet licenses were issued per year, while averages of 32, 28, and 21 gillnet licences were issued in the 1930s, 1940s, and 1950s, respectively (Cleaver 1951, Smith 1956). Also, the number of legal fishing days declined from 86 days in 1921 to 78 days in 1937 and further declined to 70 days in 1947. The decline in the in-river catch also reflected a decline in the population size due to habitat degradation and over-fishing as well as a shift from in-river catches to ocean catches (Johnson 1983).

In 1949 and 1950 the recreational catch, estimated from a creel program, was 273 and 110 adults, respectively (Henry and Willis 1952). Since 1969, the recreational catch of adult-sized salmon has been estimated from returned Salmon-Steelhead Tags. Prior to the 1980s inriver recreational catch was low, ranging from 90 in 1979 to 732 in 1970. In the 1980s, the sport catch increased as anglers targeted on the coho salmon returning to OAF (Table 12). During 1986 a creel survey was conducted in the bay and resulted in an estimate of 7,553 fish (Osis 1987). This number differs from the salmon-steelhead tag estimate because it includes fish less than 24 inches in length that are normally considered jacks. Scale analysis revealed that 95.5% of the coho salmon, both greater and less than 24 inches in length, were adult coho salmon from OAF (Osis 1987). Presumably a larger number of fish was caught in 1985 than is reflected in the salmon-steelhead tag estimate and most of these

Table 9. Releases of coho salmon from state hatcheries into the Yaquina Basin. Fry and presmolts were released in the year following the brood year. Smolts were released in the second year following the brood year. Adults were released 3 years after the brood year. Adults were trapped at the hatchery but may have been wild or hatchery fish. NA=data were not available.

Brood Year	Number Released	Life Stage	Stock	Hatchery	Release Location
1903	985,220	fry	Yaquina	Yaquina	Big Elk Cr.
1904	3,009,075[a]	fry	Yaquina	Yaquina	Big Elk Cr.
1905	4,178,000[b]	fry	Yaquina	Yaquina	Big Elk Cr.
1906	1,955,793	fry	Yaquina	Yaquina	Big Elk Cr.
1907	909,855	fry	Yaquina	Yaquina	Big Elk Cr.
1908	1,006,309	fry	Yaquina	Yaquina	Big Elk Cr.
1909	28,815	fry	Yaquina	Yaquina	Big Elk Cr.
1910	2,687650	fry	Yaquina	Yaquina	Big Elk Cr.
1911	317,190	fry	Yaquina	Yaquina	Big Elk Cr.
1911	1,068,212	presmolt	NA	NA	NA
1912	NA	NA	Yaquina	Yaquina	NA
1913[c]					
1925	293,125	fry	Yaquina	Yaquina	Big Elk Cr
1925	966,425	presmolt	NA	Spencer	Simpson Cr.
1926	1,091,670	presmolt	Alsea	Yaquina	Simpson Cr.
1933	NA	presmolt	Alsea	Alsea	Yaquina R.
1934	NA	presmolt	Alsea	Alsea	Yaquina R.
1935	NA	presmolt	Alsea	Alsea	Yaquina R.
1936	124,500	presmolt	NA	Yaquina	Simpson Cr.
1937	1,408,050	presmolt	Yaquina ,Alsea, Tahkenitch	Yaquina	Simpson Cr.
1938	2,260,750	presmolt	Yaquina	Yaquina	Simpson Cr.
1939	1,938,100	presmolt	Yaquina	Yaquina	Simpson Cr.
1940	1,557,160	presmolt	Yaquina	Yaquina	Simpson Cr.
1941	1,259,845	presmolt	Yaquina	Yaquina	Simpson Cr.
1942	352,550	presmolt	Yaquina + ?	Yaquina	Simpson Cr.
1943	1,037,470	presmolt	Yaquina + ?	Yaquina	Simpson Cr.
1944	727,150	presmolt	Yaquina, Klaskanine	Yaquina	Simpson Cr.
1945	213,720	presmolt	Yaquina, Klaskanine	Yaquina	Simpson Cr.
1946	49,842	presmolt	Yaquina	Yaquina	Simpson Cr.
1948	62,700	presmolt	Siletz	Siletz	Yaquina R.
1948	109,346	smolt	Siletz or Klaskanine	Siletz	Yaquina R.
1949	146,409	smolt	Siletz	Siletz	Yaq,Feagles

[a] An additional 1 million fry were hauled to the Alsea R. and released.
[b] An additional 1,785,354 fry were hauled to the Alsea R. and released.
[c] Data are missing for the years 1913 to 1918.

Table 9. Concluded.

Brood Year	Number Released	Life Stage	Stock	Hatchery	Release Location
1951	14,400	smolt	Nehalem	Nehalem	Yaquina R.
1952	30,000	smolt	NA	Alsea	Yaquina R.
1955	48,799	smolt	Siletz	Siletz	Yaquina R.
1956	43,967	presmolt	Siletz	Siletz	Yaquina R.
1957	106,018	presmolt	Siletz	Siletz	Yaquina R.
1961	58,022	presmolt	Alsea	Alsea	
1961	250	adult	Siletz		
1962	755	adult	Siletz, Alsea	Siletz	NA
1963	305	adult	Siletz	Siletz	NA
1964	70,994	presmolt	Siletz	Siletz	NA
1964	100	adult	Siletz	Siletz	NA
1965	78,635	presmolt	Siletz	Siletz	NA
1965	175	adult	Siletz	Siletz	NA
1966	310	adult	Siletz	Siletz	NA
1967	44,061	presmolt	Alsea	Siletz	NA
1967	503	adult	Siletz	Siletz	NA
1968	56,055	presmolt	Alsea	Alsea	NA
1968	200	adult	Alsea	Siletz	NA
1969	58,525	presmolt	Alsea	Alsea	NA
1970	50,055	presmolt	NA	NA	NA
1970	300	adult	Siletz	Siletz	NA
1971	30,307	presmolt	NA	NA	NA
1972	50,120	presmolt	Alsea	Alsea	
1979	116,072	presmolt	Alsea	Fall Creek, Alsea	Thornton, Wolf, Beaver
1980	184,788	presmolt	Alsea	Fall Creek	Thornton, Wolf, Beaver
1981	184,358	presmolt	Alsea	Fall Creek	Thornton, Wolf, Beaver
1982	4,000	fry (STEP)	Alsea	Alsea	Bear (Y)
1984	26,842	fry (STEP)	OAF	Siletz	Bear (Y)
1985	42,911	fry (STEP)	OAF	Siletz	Bear(BE), Bales
1986	38,318	fry (STEP)	Alsea	Alsea Wright	Bear(BE),
1987	28,000	fry (STEP)	Alsea	Alsea	Bear (Big Elk)
1989	35,344	fry (STEP)	Siletz	Salmon R.	Bear (Big Elk)

Table 10. Releases of coho salmon from Oregon Aqua-Foods into the Yaquina Basin. Yearling smolts are reared for about 16 months and released in their second spring. Accelerated smolts are reared for 6-8 months and are released in their first summer.

Release Year	Number (thousands)	Stocks	Smolt Type	Release Facility
1974	88	Siletz	Yearling	Wright Creek
1975	142	Siletz, Fall Creek	Yearling and Accelerated	Wright Creek
1976	249	Siletz, Wright Creek	Accelerated	Wright Creek
1976	922	Univ. of Wash., Siletz	Accelerated and Yearling	South Beach
1977	201	Trask, Siletz	Accelerated	Wright Creek
1977	1,175	Trask, Siletz, Univ of Washington	Accelerated and Yearling	South Beach
1978	8,898	OAF-Yaquina, Green River, Skykomish, Univ. of Wash.	Accelerated and Yearling	South Beach
1979	3,894	Purdy Cr.,Puyallup, Samish OAF-Yaquina, Skagit, Minter	Accelerated	South Beach
1980	7,585	Mixed, Minter, OAF, Elwha, Skykomish, Alsea, Green	Accelerated	South Beach
1981	11,925	OAF-Yaquina, Mixed, Rock Cr. Univ. of Wash., Siletz	Accelerated	South Beach
1982	20,589	OAF, OAF-Yaquina	Accelerated	South Beach
1983	14,889	OAF-Yaquina	Accelerated	South Beach
1984	8,647	OAF	Accelerated	South Beach
1985	4,337	OAF, OAF-Siletz	Accelerated	South Beach
1986	5,584	Mixed, OAF, OAF-Siletz, Fall Cr.	Accelerated	South Beach
1987	4,093	OAF-Siletz, OAF X Siletz	Accelerated	South Beach
1988	3,722	OAF	Accelerated	South Beach
1989	7,971	OAF	Accelerated	South Beach
1990	~2,830	OAF	Accelerated	South Beach

Table 11. Pounds and estimated numbers of coho salmon packed in the Yaquina River from 1923-1956. Canned pounds are converted from cases reported by Mullen (1981) using the conversion of 68 pounds of raw salmon per case. Numbers are estimated by dividing pounds by 10.5 pounds per fish.

Year	Pounds	Estimated Number	Year	Pounds	Estimated Number
1923	269,003	25,619	1940	134,767	12,835
1924	503,821	47,983	1941	109,367	10,416
1925	136,345	12,985	1942	78,035	7,431
1926	156,190	14,875	1943	60,508	5,763
1927	141,223	13,450	1944	163,169	15,540
1928	290,669	27,683	1945	143,026	13,622
1929	145,359	13,844	1946	119,407	11,372
1930	93,226	8,879	1947	124,465	11,854
1931	264,167	25,159	1948	121,370	11,559
1932	225,786	21,503	1949	69,389	6,608
1933	98,776	9,407	1950	90,390	8,609
1934	102,190	9,732	1951	111,488	10,618
1935	223,270	21,263	1952	48,887	4,658
1936	127,892	12,180	1953	23,840	2,270
1937	159,012	15,144	1954	32,969	3,140
1938	218,855	20,843	1955	49,012	4,668
1939	251,598	23,962	1956	48,996	4,666

Table 12. Estimated sport catch of adult-sized[a] coho salmon in the Yaquina Basin 1969-1985. Data are from Berry (1981) and Eden and Swartz (1986).

Year	Catch	Year	Catch
1971	218	1981	513
1972	226	1982	792
1973	174	1983	907
1974	333	1984	957
1975	298	1985	4,754
1976	243	1986	4,095
1977	641	1987	1058
1978	264	1988	1211
1979	90	1989	925
1980	278		

[a] Prior to 1978 adult coho salmon were defined as greater than 20 inches in length. Beginning in 1978 adult coho salmon were considered to be >24 inches in length.

fish were also from OAF.

Wild and hatchery fish from the Yaquina Basin are harvested in the ocean commercial and recreational fisheries. We have no direct information on contribution of wild fish from the Yaquina Basin to ocean fisheries but given recent harvest rates, when 2,000 fish escape to the spawning grounds, then 4,000-6,000 may have been caught in the ocean fisheries. Ocean contribution of coho salmon released by private hatcheries is reported by Jacobs (1988). Since 1980, ocean contribution by OAF has varied from 9,440 fish in 1984 to 122,626 fish in 1987. Private hatchery fish are also harvested commercially when they return to OAF (Table 13).

Angling Distribution, Access, and Regulations

It is legal to fish for coho salmon in the bay, in the mainstem Yaquina River up to the Eddyville-Nashville Bridge, and in Big Elk Creek upstream to the first bridge below Grant Creek. Most fishing for coho salmon occurs in Yaquina Bay. There is bank access along both the north and south jetties and along much of South beach. Many people fish from boats in the vicinity of the fish ladder at the private hatchery site at South Beach. Current regulations allow anglers with a valid license and tag to fish from January 1 to March 31 and from May 27 to December 31. The daily bag limit is 2 adult steelhead or salmon of any species, and 10 jack salmon. The weekly bag limit is 6 adults and 20 jacks.

Table 13. Number of coho salmon that returned to Oregon Aqua-Foods, 1976-1988.

Year	Return Number	Year	Return Number
1976	1,330	1984	108,767
1977	3,069	1985	225,045
1978	10,812	1986	175,105
1979	41,732	1987	76,696
1980	32,005	1988	105,970
1981	63,418	1989	final draft
1982	53,091	1990	final draft
1983	131,923		

Management Considerations

We have developed two alternatives for management of coho salmon within the Yaquina basin. Both alternatives are compatible with the Wild Fish Management Policy (WFMP).

Neither alternative addresses ocean exploitation of Yaquina coho salmon. The ocean fisheries are managed as a mixed stock fishery of which Yaquina coho salmon are a small part. Harvest of Yaquina coho salmon in the ocean fisheries is determined annually by the Pacific Fishery Management Council using quotas or exploitation rates that are based on the escapement goals in the Coho Salmon Plan. Management of Yaquina coho salmon in ocean fisheries is beyond the scope of this basin plan.

ODFW has considered the wild population to be a stock of concern because of past declines in abundance and possible genetic interaction with the foreign stock used in the private hatchery program. The private hatchery closed in October, 1990 although they made releases of coho salmon in 1990, which will return in 1991. Beginning 1991 all hatchery programs will comply with the wild fish policy. It is expected that the wild population will rebuild to the point that it will no longer be a stock of concern.

Alternative 1 places highest value on the wild coho salmon population and its genetic resource. This alternative considers any hatchery program as a genetic or ecological risk to the wild population so does not allow releases of hatchery coho salmon within the basin.

Alternative 2 places high value on the wild population but still allows hatchery programs to operate according to the WFMP. Under the WFMP, stray hatchery fish can comprise no more than 50% or 10% of the natural spawners during the time that wild fish are spawning, depending on the type of broodstock used in the hatchery program. For a 50% comosition the program must begin with wild Yaquina broodstock and continue to have a 20% infusion of wild Yaquina stock each year. If Siletz broodstock is used in the hatchery program, or Yaquina stock is used but there is no annual infusion of wild Yaquina fish, the hatchery composition may be only 10%.

The ODFW staff recommends Alternative 2, because it sets highest priority on managment for wild fish yet would allow the flexibility to have a hatchery program to supplement ocean and inriver fisheries.

Six members of the public advisory committee recommend Alternative 2, while three members recommend a stronger hatachery program than Alternative 2 may allow. One member of the public advisory committee was unavailable to vote.

ALTERNATIVE 1

Policies

Operating Principle 1. Coho salmon shall be managed for wild production, consistent with the Wild Fish Management Policy. No hatchery fish shall be released into the basin, except the Department may approve the use of hatchery coho salmon if needed for stock restoration as defined in OAR 635-07-501.

Objectives

Objective 1. Increase the average annual escapement of coho salmon for natural production to 10,300 fish.

Assumptions and Rationale

1. This objective is based on the escapement goal for the Yaquina basin as outlined in the Coho Salmon Plan.

2. STEP will play an essential role in enhancing naturally produced coho salmon.

3. Habitat quality will be maintained or improved

4. The number of adults that return to spawn can be indexed through spawning ground counts.

5. During the past 9 years the estimated spawning population has fluctuated between 210 and 6,000 with an average of 2,400 fish.

Problems and Recommended Actions

Problem 1. The production capacity of the Yaquina system for coho salmon and factors that limit production have not been determined.

Action 1.1 Update the physical and biological survey data base.

Action 1.2 Combine physical-biological survey information and the limiting factors analysis developed by ODFW Research Section and USFS to determine the production potential of current coho salmon habitat.

Action 1.3 Design habitat projects based on the physical-biological surveys, limiting factor analysis, and production capacity assessment of habitat in the Yaquina basin.

Problem 2. Given the current freshwater and marine environment, the production goal in the Coho Salmon Plan may be too high.

Action 2.1 Based on findings from Action 1.2 above, recommend a new production goal in the Coho Salmon Plan if needed.

In addition the following action is needed to achieve the objective:

Action 3.1 Maintain spawning fish surveys for coho salmon to measure natural escapement.

Objective 2. Maintain a recreational harvest of 5-10% of the inriver run.

Assumptions and Rationale

1. A harvest rate of 3.9% of coho salmon returning to the basin was estimated for the bay recreational fishery in 1986, based on a creel program. Most of the catch was of hatchery fish, however the hatchery fish experienced a 3.8% harvest rate while wild fish experienced a 7.0% harvest rate.

2. We can estimate catch from Salmon-Steelhead tags.

Problem 1. Because the Yaquina coho salmon population is depressed, freshwater harvest rates greater than 10% of the returning population may have detrimental effects.

Action 1.1 Monitor harvest rates.

Action 1.2 Maintain an average harvest rate of 5% until the population reaches the production goal. If harvest rates exceed 10%, remedial action will be considered

ALTERNATIVE 2

Policies

Operating Principle 1. Coho salmon shall be managed for wild production; hatchery releases shall be consistent with the Wild Fish Management Policy.

Operating Principle 2. The coho salmon stocks approved for use in the Yaquina basin are Yaquina and Siletz.

Objectives

Objective 1. Increase the spawning population to 10,300 adults where the production capacity of present or enhanced habitat allows.

Assumptions and Rationale

1. This objective is based on the escapement goal for the Yaquina basin as outlined in the Coho Salmon Plan.

3. STEP will play an essential role in maintaining and enhancing naturally produced coho salmon.

naturally produced coho salmon.

4. Habitat quality will be maintained or improved.

5. The number of adults that return to spawn can be indexed through spawning ground counts.

6. During the past 9 years the estimated spawning population has fluctuated between 210 and 6,000 with an average of 2,400 fish.

Problems and Recommended Actions

Problem 1. Hatchery strays could be counted in the estimate of wild production.

Action 1.1 Require all hatchery reared juveniles released within the Basin to be marked to allow identification of returning adults. Marks may include fin clips, tags, and unique scale patterns.

Problem 2. The production capacity of the Yaquina system for coho salmon and factors that limit production have not been determined.

Action 2.1 Update the physical and biological survey data base.

Action 2.2 Combine physical-biological survey information and the limiting factors analysis developed by ODFW Research Section and USFS to determine the production potential of current coho salmon habitat.

Action 2.3 Design habitat projects and fish stocking programs based on the physical-biological surveys, limiting factor analysis, and production capacity assessment of habitat in the Yaquina basin.

Problem 3. Given the current freshwater and marine environment, the production goal stated in the Statewide Coho Salmon Plan may be too high.

Action 3.1 Based on findings from Action 2.2 above, set a new production goal if needed.

In addition the following actions are needed to achieve the objective:

Action 4.1 Maintain spawning fish surveys for coho salmon to measure natural escapement.

Objective 2. Provide for an ocean harvest with a high contribution to Oregon and an in-river recreational fishery with a maximum wild harvest rate of 10% and a hatchery harvest rate that equals or is higher than the wild harvest rate.

Assumptions and Rationale

1. An exploitation rate of 3.9% of coho salmon returning to the basin was estimated for the bay recreational fishery in 1986, based on a creel program. Over 95% of the fish caught were from OreAqua, Inc., however OreAqua coho salmon experienced a 3.8% catch rate while wild fish experienced a 7.0% catch rate

2. We can estimate catch from Salmon-Steelhead tags.

3. Release levels will be based on the level of hatchery and wild spawning interaction and compatibility with the WFMP.

4. There can be no more than a 10% occurrence of stray hatchery fish on the spawning grounds at the same time the wild fish are spawning if Siletz broodstock are used in the hatchery program or if a Yaquina broodstock is not maintained as a "wild" broodstock.

5. Yearling smolts acclimated for periods longer than used by OreAqua, Inc may not exhibit as high a stray rate as the accelerated smolts released by OreAqua, Inc.

Problems and Recommended Actions

Problem 1. Information of the contribution of hatchery and wild coho salmon to the Yaquina River recreational fishery is limited.

Action 1.1 Conduct creel surveys to estimate recreational catch, and use mark recovery and scale analysis to evaluate hatchery and wild contribution to the fishery.

Problem 2. Over-harvesting of the wild coho salmon will be detrimental to the existence of this stock.

Action 2.1 If the in-river recreational harvest rate of wild coho salmon becomes higher that 10%, remedial action will be considered.

Problem 3. Straying by hatchery coho salmon may be detrimental to the health of wild stocks and may violate the WFMP.

Action 3.1 Conduct a straying study for at least 5 years beginning the first year that hatchery returns are expected to determine compliance with the WFMP regarding spawning of hatchery and wild fish on the spawning grounds.

Action 3.2 Implement the best management practices and release levels that will be compatible with the WFMP.

Objective 3. Ensure that any private hatchery operation shall comply with the WFMP and meet fishery management objectives.

Asumptions and Rationale

1. The operational plan will define monitoring programs and hatchery practices necessary to minimize interaction between hatchery and wild fish and promote compliance with the WFMP.

2. Past releases by OreAqua, Inc. have resulted in development of a popular recreational fishery in Yaquina Bay.

3. With release levels as low as 4 million and 5.5 million juvenile coho salmon, OreAqua, Inc. experienced stray rates on the spawning grounds that were over 20% of total spawners.

4. It is unlikely that a private hatchery would be able to maintain a "wild" Yaquina broodstock, so by using the Siletz stock or a Yaquina hatchery stock, the allowable rate of strays in the natural spawning population would be 10%.

5. The private hatchery would also be constrained by the Private Hatchery straying rules regarding out-basin straying.

6. The current permit level is 9.5 million coho salmon released annually.

Problems and Recommended Actions

Problem 1. If the new private hatchery program uses rearing pratices differing from the OreAqua program, such as smolt age or acclimation period, it is unknown what stray rates may result.

Action 1.1 Improve and expand spawning fish surveys for coho salmon to determine stray rates by private hatchery fish. The private hatchery is required to fund the spawning surveys that are in addition to standard ODFW surveys.

Problem 2. It is unlikely that a hatchery can release 9.5 million juvenile coho salmon and keep straying under the level allowed by the WFMP and Private Hatchery Straying Rules.

Action 2.1 Compare the hatchery-wild composition to release levels and establish a release level that will comply with WFMP and the Private Hatchery Straying Rules.

In addition, the following action is needed to achieve the objective:

Action 3.1 A sufficient number of hatchery fish shall be coded-wire-tagged so that contribution to ocean fisheries can be determined.

Action 3.2 All private hatchery fish shall be marked (tags, finclips, or unique scale patterns) so that they may be identified on the spawning grounds.

CHUM SALMON

Background and Status

Origin

The Yaquina Basin has always had a native chum salmon population, although it is possible that the existing population has been supplemented by strays from Oregon Aqua-Foods (OAF). OAF had a permit to release 20 million juveniles although they never released at their full permit level (Table 14). Returns of hatchery reared chum salmon were sufficient to develop a strong chum salmon program (Table 15).

Life History

Juvenile chum salmon differ from juvenile chinook salmon and coho salmon by spending virtually no time rearing in freshwater. Upon emerging from the gravel in late winter, the fry immediately migrate to saltwater. Henry (1953) found that the fry may rear in the bay for several months before entering the ocean. In the ocean, adult chum salmon also differ from chinook and coho salmon by feeding on plankton and other small prey organisms rather than fishes and squid. The adults spend 3 to 5 years feeding in the ocean before returning to spawn. In Oregon, most chum salmon mature when 4 years old and average about 10 pounds in weight (Gharrett and Hodges 1950). Chum salmon spawn mainly in November and are found in tributaries near tidewater. Oregon is on the southern-most margin of the range of chum salmon.

Table 14. Number of juvenile chum salmon released by Oregon Aqua-Foods in Yaquina Bay (Cummings 1987).

Brood Year	Stock	Number Released
1973	Whiskey Creek	7,000
1974	Whiskey Creek, Quilcene	33,182
1975	Quilcene	323,930
1976	OAF	2,447
1977	Whiskey Creek	14,900
1978	South Puget Sound	2,174
1979	Quilcene	684,245
1980	--	0
1981	McAllister, Mixed Production	3,170,589
1982	OAF, Coal Creek, Mud Bay	243,706
1983	Whiskey Creek, Coal Creek, Mixed Production	2,957,617
1984	Whiskey Creek, Coal Creek, OAF,	1,135,755
1985	Mixed Production	289,355
1986	OAF	914,415
1987	OAF	200,822
1988-90	--	0

Table 15. Returns of adult chum salmon to Oregon Aqua-Foods in Yaquina Bay. (Telephone interview on 3 November 1988 with T. Edwin Cummings, Oregon Department of Fish and Wildlife, Portland, Oregon.)

Year	Number Returned	Year	Number Returned
1979	6	1984	260
1980	47	1985	2,194
1981	161	1986	368
1982	207	1987	654
1983	181	1988	

Production and Harvest

Between 1923 and 1949 the inriver commercial catch ranged from a high of 19,728 lbs (about 1,879 fish) in 1935 to a low of 22 pounds (about 2 fish) in 1945. The average catch was 5,063 pounds or 482 fish. These numbers do not necessarily reflect the population size since chum salmon were considered poor for canning so were probably caught incidentally in chinook and coho salmon fisheries. Also, the catch listed as chum salmon probably included chinook and coho salmon since it was a common practice for canneries to buy low quality chinook and coho salmon as chum salmon (Cleaver 1951).

Currently the majority of the run spawns in Mill Creek and its tributaries. Chum salmon also spawn in Simpson, Wright, Beaver, and Bear creeks in some years. Based on spawning fish surveys we have calculated an abundance index for chum salmon spawning in Mill and Simpson creeks in Table 16.

Table 16. Abundance index in surveyed areas of Mill and Simpson creeks calculated using the Area Under the Curve method (Beidler and Nickelson 1980).

Year	Mill Creek	Simpson Creek
1981	59	0
1982	259	0
1983	*na*	*na*
1984	168	3
1985	921	166
1986	180	116

na = not available.

Angling Distribution, Access, and Regulations

No commercial fishing for any species of salmon has been allowed within the Yaquina Basin since 1956. It is legal to fish for chum salmon in the ocean, but since chum salmon feed mainly on plankton, they are rarely caught with troll gear by either commercial or recreational fishermen. In freshwater there is not a specific recreational fishery for chum salmon but they may be caught incidentally by anglers fishing for chinook or coho salmon in the bay.

Management Considerations

Chum salmon stocks statewide, including the Yaquina stock, are considered "sensitive" because their populations have declined to such low levels. Sensitive species will be monitored closely to watch for further decline and any management activities that might cause decline will be avoided if possible. If a sensitive species shows definite decline it will be considered a candidate for the Oregon Threatened Species list.

We have developed one management strategy for chum salmon in the Yaquina basin. Chum salmon will be managed solely for wild fish under the WFMP. Hatchery fish have not been released in the Yaquina basin since 1987. Between 1973 and 1987 OreAqua, Inc released hatchery reared chum salmon but had such poor success that they suspended their chum salmon program. Yaquina chum salmon are not the target of any recreational or commercial fishery. ODFW will only consider artificial propagation of chum salmon in the Yaquina basin if the already small population should decline to the point that its existence is threatened.

Eight members of the public advisory committee approve of managing chum salmon for wild fish only. One member is unhappy that an alternative strategy for chum salmon management was not presented in this plan and would support a hatchery alternative if available. One member of the public advisory committee was unavailable to vote.

Policies

Operating Principle 1. Chum salmon will be managed for wild fish, consistent with the Wild Fish Management Policy. No hatchery fish will be released in the basin, except that the Department may approve the use of hatchery chum salmon if needed for stock restoration as defined in OAR 635-07-501.

Objectives

Objective 1. Maintain a chum salmon run of at least 100 adults to Mill Creek and its tributaries. Increase the population size if present or enhanced habitat allows.

Assumptions and Rationale

1. Enhancement efforts for the local wild stock, if undertaken and if successful, would not have adverse effects on other desired species by creating competition for food or estuarine rearing space, or from competition for spawning area.

2. An intensive recreational fishery in Yaquina Bay or any type of fishery in the ocean is not likely for chum salmon.

Problem 1. The chum salmon population has declined from historic population levels. Because there has not been an active fishery since 1956, the decline may be related to habitat degradation.

Action 1.1 Improve habitat quality and quantity where ever possible.

Action 1.2 Consider other reasons for the decline in the chum salmon population and take action to improve the situation when possible.

In addition, the following action is needed to achieve the objective:

Action 2.1 Maintain spawning fish surveys for chum salmon in Mill Creek

PINK SALMON

Background and Status

Pink salmon are the smallest of the pacific salmon, averaging only 4.8 pounds as adults (Hart 1973). They mature at 2 years of age. Pink salmon are similar to chum salmon in that they spawn in tributaries of tidewater and the fry migrate to saltwater soon after emergence.

Pink salmon are not native to the Yaquina Basin. Oregon Aqua-Foods (OAF) applied for a permit to release up to 50 million pink salmon but was unable to locate an acceptable egg source. Oregon State University made several experimental releases of pink salmon from the OAF facility in Yaquina Bay (Table 17) but only a few fish returned.

Table 17. Releases of pink salmon by Oregon State University in Yaquina Bay.

Brood Year	Stock	Release Numbers
1977	Sheldon Jackson College, Sitka, Alaska	312,343
1981	Sheldon Jackson College, Sitka, Alaska	362,180
1982	Sheldon Jackson College, Sitka, Alaska	1,300,941

WINTER STEELHEAD

Background and Status

Origin

Winter steelhead are native to the Yaquina basin, spawning in the mainstem and tributaries of the Yaquina River and Big Elk Creek. Hatchery-reared winter steelhead are also released into the Yaquina basin. Hatchery releases began in 1905 using broodstock collected at a rack on Big Elk Creek located at the head of tide. The Yaquina Hatchery, located at this site, served as the collection and rearing facility through 1939. Beginning in 1948 and continuing at present, winter steelhead were collected and reared at Alsea Hatchery and released into the Yaquina system. Alsea stock was the only non-native steelhead stock released into the Yaquina basin, except in 1968 when Big Creek stock smolts, 1967 brood year, were released. In addition to the smolt program, small numbers of Alsea stock winter steelhead fry have been released by STEP into tributaries of the Yaquina River and Big Elk Creek beginning in 1982.

Life History

The life history of winter steelhead has not been studied in the Yaquina basin, but has been studied in the Alsea basin, an adjacent watershed. Therefore, many of the general characteristics of juvenile and adult steelhead will be inferred from these studies. Wild winter steelhead eggs incubate for 35-50 days in gravel and alevins remain for another 14-21 days in gravel. The fry emerge in spring and early summer in Oregon coastal streams (ODFW 1986). The fingerlings rear in freshwater from 1 to 3 years prior to smolting and entering the ocean, the majority rear in freshwater for 2 years (Chapman 1958). Fingerling and yearling steelhead prefer streams with steep gradients, higher than 2.5%. They are most abundant in streams not inhabited by coho salmon (Mario Solazzi, Oregon Department of Fish and Wildlife, personal communication).

Distribution of juvenile winter steelhead is not well-documented as studies have not targeted on juvenile steelhead in the Yaquina basin. However, juvenile steelhead were sampled in selected streams throughout the basin during coho salmon studies in Wolf Creek (upper Big Elk Creek tributary), Deer Creek (mid-Big Elk Creek tributary), Beaver Creek (lower Big Elk Creek tributary), Salmon Creek (Little Elk Creek tributary on upper Yaquina River), Hayes Creek (mid-Yaquina River tributary), and Thorton Creek (mid-Yaquina River tribuary).

Hatchery steelhead rear in Alsea Hatchery for 1 year and are released into the Yaquina system at a size of 5-7 fish per pound. Hatchery smolts are released into Big Elk Creek in March and April near River Mile 3 and 13. The majority of the smolts move into tidewater within a week, but some residulism may occur (Kenaston and MacHugh 1983).

Wild juvenile steelhead migrate out of the Alsea system during March through June. Smolt migration in the Alsea basin peaked in mid-April through early May in Crooked Creek (Wagner 1974), peaked in April in Deer Creek (Moring and Lantz 1975), and peaked in mid-May on four major tributaries

(Chapman 1958). Wild smolts probably exhibit similar migration patterns in the Yaquina basin.

Young steelhead move quickly through the coastal zone and rear in the north Pacific Ocean (Hartt and Dell 1982; Pearcy and Masuda 1982). Adult winter steelhead spend from 6 months (jack) to 2 1/2 years in the ocean (3 salt) before returning to the Yaquina basin. The majority of adults (80%) return after two years in the ocean (Chapman 1958; Kenaston and MacHugh 1983; Kenaston and MacHugh 1986). Approximately 1.6 to 3.4% of the hatchery adultsdestined for the Yaquina basin stray back to the Alsea basin upon maturation (Kenaston and MacHugh 1986).

Native steelhead returned from late January through late April in 1905-06. The majority of winter steelhead returned to the Yaquina basin from October through March during 1975-85, with a peak in December and January, based on punchcard catch data (Figure 6); however, the fishing season is closed during April and May. Due to the lack of holding water, winter steelhead may move quickly through the mainstem Yaquina River and Big Elk Creek to the spawning grounds.

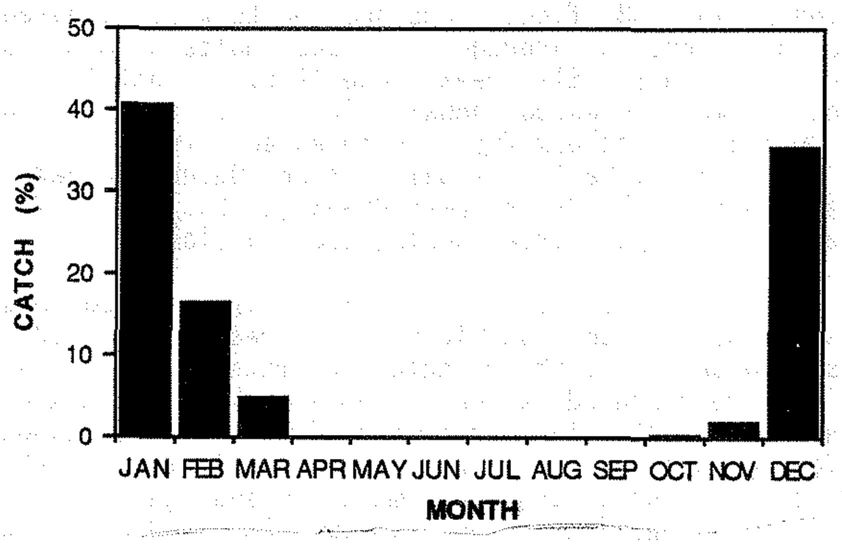

Figure 6. Percentage of winter steelhead caught each month in the Yaquina basin during 1975-76 to 1984-85 run years.

Native winter steelhead were spawned at Yaquina Hatchery in 1905 and 1906 from late January through April. Spawning occurs in the mainstem of and tributaries to Yaquina River and Big Elk Creek, and in tributaries of Yaquina Bay from December through April, and occasionally as late as June. A small proportion (3-10%) of the spawners may survive and make a second or third spawning migration (ODFW 1986). These adults are usually females. Hatchery broodstock used for the fingerling and smolt stocking program in the in the Yaquina basin are collected at the Alsea Hatchery December through March and spawned from January through March.

The number of steelhead that survive to reproduce is dependent on a number of factors including predation and harvest of juveniles and adults during their residence in the tributaries, rivers, estuary, and ocean. Predation on steelhead can occur as early as the eggs are deposited in the gravel and continue through their return to freshwater. Predators include insects, fish, birds, amphibians, and marine and terrestrial mammals, including man. The relative magnitude of predation by each of these groups and the methods to minimize predation are poorly understood.

Production and Harvest

Juvenile steelhead migrating out of the Yaquina basin include wild and hatchery smolts. No direct estimate of the production of wild steelhead smolts in the Yaquina basin has been made; however, assuming a 5% survival of wild smolts to adults and using estimates of the wild run for recent years, approximately 26,000 wild smolts are being produced in the Yaquina basin. The first hatchery releases of native steelhead began in 1905 and continued sporadically until 1939 at Yaquina Hatchery (Table 18). The largest releases consisted of unfed fry in 1905 and 1906. Fed fry were released from 1908 until 1939. Beginning in 1948, fingerlings and smolts were released into Big Elk Creek and Yaquina River. An average of 31,000 smolts of Alsea stock have been released annually into Big Elk Creek since 1978. In addition, an average of 80,000 hatchbox fry were released annually into tributaries during 1982-86 through the STEP Program. Hatchbox fry were released into Bear Creek, Sloop Creek, East Fork Bales Creek, West Fork Bales Creek, Oglesby Creek, Little Elk Creek, Olalla Creek, Buttermilk Creek, Bear Creek (tributary to Big Elk Creek), Stony Creek, and Simpson Creek during 1982-86 (Table 19).

The harvest (Figure 7) and production of adult winter steelhead in the Yaquina basin was estimated from historic hatchery records, commercial gill net catch records, and angler punchcard catch estimates. In 1905 and 1906, 383 and 329 females were captured at the hatchery rack on Big Elk Creek, respectively (Van Dusen 1907). The efficiency of the rack is unknown, but assuming a male:female ratio of 1, the run in Big Elk Creek in 1905-06 was at least 600-800 adults. Kenaston (1987) estimated an average run size of 1600 winter steelhead into the Yaquina system from 1923-28 based on the commercial gill net catch in Yaquina Bay. The runs of steelhead during this period are assumed to be predominately wild, as there was no stocking of winter steelhead in the Yaquina system from 1913 through 1931 (Table 18).

Table 18. Releases of winter steelhead into the Yaquina basin.

Brood year	Hatchery	Stock	Release period	Release location	Number released	Type
1905	Yaquina	Big Elk	4/14-6/28/05	Big Elk	780,500	unfed fry
1906	Yaquina	Big Elk	--	--	1,033,150	unfed fry
1908	Yaquina	--	--	--	376,245	fed fry
1911	Yaquina	Big Elk	7/21-8/28/11	Big Elk	621,015	fed fry
1912	Yaquina	Big Elk	--	Big Elk	7,145	fed fry
1932	--	--	1932	--	20,000	--
1933	--	--	1934	--	25,000	--
1939	Yaquina	Big Elk	--	Simpson Cr	107,000	--
1948	Alsea	Alsea	1948	Yaquina River	45,550	fingerling
1949	Alsea	Alsea	1949	Yaquina River	42,062	fingerling
	Alsea	Alsea	1950	--	5,106	smolt
1951	Alsea	Alsea	1952	--	3,003	smolt
1966	Alsea	Alsea	1966	--	124,054	fingerling
1967	Alsea	Big Creek	1968	--	9,980	smolt
1968	Alsea	Alsea	1969	--	6,006	smolt
1969	Alsea	Alsea	1970	--	24,227	smolt
1971	Alsea, Roaring R.	Alsea	1971	--	193,438	fingerling
	Alsea	Alsea	1972	--	30,117	smolt
1972	Alsea	Alsea	1973	--	20,364	smolt
1973	Alsea	Alsea	1974	--	19,180	smolt
1974	Alsea, Cedar Cr.	Alsea	1975	--	28,960	smolt
1976	Alsea	Alsea	7/76	--	66,235	fingerling
	Alsea	Alsea	12/76	--	13,090	fingerling
1977	Alsea	Alsea	4/78	Big Elk Creek	9,610	smolt
1978	Alsea	Alsea	7-9/78	Yaquina River	156,037	fingerling
	Alsea	Alsea	4/79	Big Elk Creek	30,082	smolt
1979	Alsea	Alsea	11/79	Yaquina River	34,854	fingerling
	Alsea	Alsea	4/80	Big Elk Creek	30,024	smolt
1980	Alsea	Alsea	11/80	Yaquina River	44,385	fingerling
	Alsea	Alsea	4/81	Big Elk Creek	30,316	smolt
1981	Alsea	Alsea	3/82	Big Elk Creek	28,174	smolt
1982	Alsea	Alsea	3/83	Big Elk Creek	32,146	smolt
1983	Alsea	Alsea	4/84	Big Elk Creek	33,791	smolt
1984	Alsea	Alsea	4/85	Big Elk Creek	30,451	smolt
1985	Alsea	Alsea	3/86	Big Elk Creek	34,861	smolt
1986	Alsea	Alsea	4/87	Big Elk Creek	29,853	smolt

Table 19. Releases of winter steelhead fry into the Yaquina basin by the STEP program of the ODFW. All releases were with Alsea River stock.

Incubation site	Number released	Size	Date	Release location
Bear Cr.	7,950	Fry	Apr 82	Bear Cr
	1,950	Fry	Apr 82	Sloop Cr
Bales Cr.	9,900	Fry	Apr 82	East Fork Bales Cr.
	9,900	Fry	Apr 82	West Fork Bales Cr.
Oglesby Cr.	9,500	Fry	Apr 82	Oglesby Cr.
Total 1982	39,200			
Bear Cr	7,000	Fry	1983	Bear Cr.
	2,690	Fry	1983	Sloop Cr.
Bales Cr	20,000	Fry	1983	Bales Cr.
	9,500	Fry	1983	Bear Cr.
Little Elk Cr	10,000	Fry	1983	Oglesby Cr.
	34,700	Fry	1983	Little Elk Cr.
	15,000	Fry	1983	Bear Cr.
Total 1983	98,890			
Little Elk Cr.	10,000	Fry	Apr 84	Oglesby Cr.
	40,000	Fry	Apr 84	Little Elk Cr.
Bales Cr	25,062	Fry	Apr 84	Bales Cr.
Olalla Cr.	5,000	Fry	Apr 84	Olalla Cr
Bear Cr.	7,000	Fry	May 84	Bear Cr.
	2,800	Fry	May 84	Sloop Cr.
Total 1984	89,862			
Little Elk Cr.	19,942	Fry	Mar 85	Little Elk Cr.
	40,045	Fry	Mar 85	Oglesby Cr.
	12,850	Fry	Apr 85	Buttermilk Cr.
Bales Cr.	14,000	Fry	Apr 85	East Fork Bales Cr.
	14,000	Fry	Apr 85	West Fork Bales Cr.
Olalla Cr	28,000	Fry	Apr 85	Bear Cr. (Big Elk)
Total 1985	128,837			
Olalla Cr.	24,221	Fry	Mar 86	Bear Cr.
Bales Cr.	15,000	Fry	Apr 86	East Fork Bales Cr
	9,313	Fry	Apr 86	Stony Cr.
Little Elk Cr.	9,955	Fry	Apr 86	Unnamed tributary
Unnamed Tributary	7,454	Fry	Apr 86	Simpson Cr.
Total 1986	65,943			

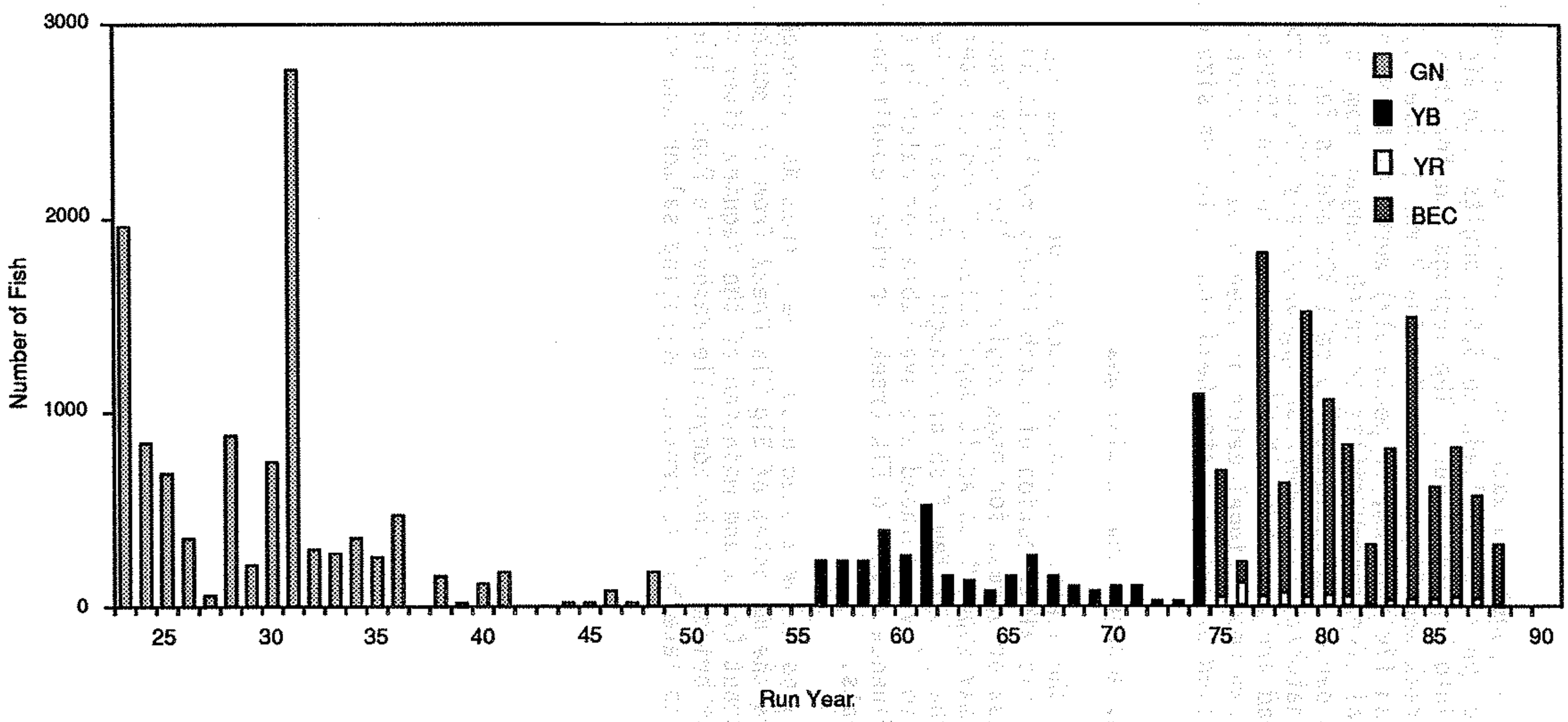

Figure 7. Catch of winter steelhead in the Yaquina basin by commercial gillnet fishery (GN) during 1923-49 run years, and recreational catch in the Yaquina basin (YB) in 1953-74 run years , and Yaquina River (YR) and Big Elk Creek (BEC) in 1975-88 run years. The run year begins in the fall of the given year and extends into the spring of the following calender year.

Estimates based on punchcard data for run years 1980-81 through 1984-85 were used to estimate run sizes of 1,442 to 6,611 adults into Big Elk Creek and 0 to 650 adults into Yaquina River. The average run for this period was 3,877 into Big Elk Creek and 370 into the Yaquina River (Table 20). The majority of these fish (70 and 67%, respectively) were hatchery-reared. Using these values, survival of hatchery smolts to catch ranged from 3% to 16%. The wild run during this period is estimated to be 1,331 adults for the Yaquina basin. Even though hatchery fish comprise approximately 70% of the run, wild adult winter steelhead are almost as abundant now as in the 1920s. Since run size is calculated from recreational catch of steelhead and catch occurs during the early portion of the wild steelhead run, wild run size may be underestimated.

Angling Distribution, Access, and Regulations

The majority of the winter steelhead catch occurs in the Big Elk Creek system (Figure 7). This distribution of catch likely reflects hatchery stocking area and ease of access for bank anglers. The upper Yaquina River and its tributaries may support an adult population of winter steelhead sufficient for a fishery, but few fish are caught. Harvest may be low because access is very limited, few steelhead are available for catch in the Yaquina River above its confluence with Big Elk Creek, or river conditions prevent angling from driftboats.

Current regulations allow a steelhead fishery from May through March. Angling is allowed in the mainstem of Big Elk Creek from the mouth up to the first bridge below Grant Creek and mainstem of the Yaquina River from the mouth up to the first bridge on the Eddyville-Nashville Road. The season is closed from 1 April to late May to protect migrating salmon and steelhead smolts.

Table 20. Wild and hatchery run of winter steelhead in the Yaquina basin, 1980-81 thr 1984-85 run years (adapted from Kenaston, unpublished).

YEAR	Yaquina River	Big Elk Creek	Total
1980-81			
Exploitation rate	.08	.19	
Catch	52	876	928
Total run	650	4,611	5,261
% wild	.41	.41	
Wild run	266	1,890	2,156
Hatchery run	384	2,271	3,105
1981-82			
Exploitation rate	.08	.19	
Catch	47	680	727
Total run	588	3,579	4,167
% wild	.33	.33	
Wild run	194	1,181	1,375
Hatchery run	394	2,398	2,792
1982-83			
Exploitation rate	.08	.19	
Catch	0	274	274
Total run	0	1,442	1,442
% wild	.19	.19	
Wild run	0	274	274
Hatchery run	0	1,168	1,168
1983-84			
Exploitation rate	.08	.19	
Catch	17	692	709
Total run	212	3,642	3,854
% wild	.23	.23	
Wild run	49	838	887
Hatchery run	163	2,804	2,967
1984-85			
Exploitation rate	.08	.19	
Catc	32	1,256	1,288
Total run	400	6,611	7,011
% wild	.28	.28	
Wild run	112	1,851	1,963
Hatchery run	288	4,760	5,048
Average (5 years)			
Catch	30	756	785
Total run	370	3,977	4,347
% wild			.31
Wild run	124	1,207	1,331
Hatchery run	246	2,770	3,016

Management Considerations

In this section we discuss 2 management alternatives. Alternative 1 is compatible with the Wild Fish Management Policy (WFMP). Alternative 2 provides time to evaluate the status of the steelhead stocks in the Yaquina system and if needed, to develop programs to bring management of winter steelhead in compliance with the WFMP.

Alternative 1 is management for wild fish only. This alternative places highest value on the genetic and aesthetic resource that the wild steelhead population represents. The wild population may contain only 1300 adults but the harvest goal is 800 fish, resulting in an exploitation rate that is too high. Under this alternative the current harvest goal must be decreased.

Alternative 2 places high value on the wild population but still allows hatchery programs to operate. We have written this alternative to put immediate emphasis on the need to evaluate the status of the wild population and the current hatchery program. Because the wild population appears to be relatively stable even though hatchery fish have been released into the basin for many years, we believe we can evaluate the status of the current management program over a 5 year period without causing harm to the wild population.

Currently we estimate wild and hatchery population sizes based on data from Salmon-Steelhead Tags returned by anglers and the hatchery to wild ratio determined from scales collected by anglers. Based on this information we estimate that the wild population has about 1300 fish and the hatchery run consists of about 3000 fish. It is likely that this estimate is biased toward hatchery fish because it is based on catch and most of the catch occurs in Big Elk Creek where hatchery steelhead are stocked. We do not think that these data adequately represent the wild steelhead that spawn in the upper Yaquina River. The WFMP states that hatchery fish are acceptable if, at the same time and location that wild fish are spawning, no more than 10% of the spawning fish are of hatchery origin. We know that wild and hatchery fish spawn at somewhat different times but we are unsure of how much the spawning times overlap.

Before we can state whether current management practices are in compliance with the WFMP we need to have firm data on population size, spawning time, and spawning location for wild and hatchery fish separately. If we determine the current program is very near compliance with the WFMP, then we propose that we make sufficient reduction in release of Alsea Hatchery steelhead or use earlier spawning Alsea stock to bring the program into compliance. If the current program is far from compliance with the WFMP, then we will explore several options to bring the program into compliance. Among our options are to develop a wild broodstock or to implement wild fish only management. Regardless of the status of the current management program relative to the WFMP, we support habitat maintenance and improvement and we support research into additional ways to produce hatchery fish that will not interact with wild fish.

The ODFW staff recommends Alternative 2. Nine members of the Public advisory committee also recommend Alternative 2. One member of the public advisory committee was unavailable to vote.

Alternative 1

Policies

Operating Principle 1. Winter steelhead shall be managed for wild fish, consistent with the Wild Fish Management Policy. No hatchery fish may be released within the basin.

Objectives

Objective 1. Maintain the production of wild steelhead in Yaquina basin at a average annual minimum of 1300 adults.

Assumptions and Rationale

1. Estimates of run size are based on information from returns of Salmon-Steelhead Tags and may be less accurate when predicting catch and run size in small systems such as the Yaquina basin.

2. Overall habitat quality will remain at or above its present condition.

3. STEP will play an essential role in enhancing naturally produced steelhead.

4. Maintenance of natural production will protect a diversity of life history characteristics.

Problems and Recommended Actions

Problem 1. Escapement of winter steelhead in the Yaquina basin is poorly documented.

Action 1.1 Conduct inventories to estimate distribution and abundance of the population.

Action 1.2 Encourage development of techniques to monitor annual population status and trends

Problem 2. Life history characteristics and distribution of wild juvenile and adult winter steelhead in the Yaquina basin are not accurately defined.

Action 2.1 Conduct juvenile surveys in mainstem and tributaries of Yaquina River and Big Elk Creek to determine the age-specific patterns of rearing and migration of juvenile steelhead, and spawning distribution of adults.

Action 2.2 Determine the timing of river entry, in-river holding patterns, distribution and timing of spawning, and age structure.

Problem 3. Habitat factors that may limit production in the Yaquina basin have not been established.

Action 3.1 Update physical and biological surveys.

Action 3.2 Conduct habitat use surveys to identify important habitats for steelhead production.

Action 3.3 Work with private groups and public agencies to protect freshwater steelhead habitat.

Action 3.4 Once limiting factors are identified, design and implement appropriate habitat improvement projects.

Problem 4. Predators in the Yaquina basin may reduce the numbers of wild steelhead.

Action 4.1 Encourage research described in ODFW Steelhead Management Plan (ODFW 1986, Problem 21).

Objective 2. Maintain the annual harvest rate at or below an average of 20%.

Assumptions and Rationale

1. Between 1980 and 1985 the harvest rate ranged from 17.4% to 24.0%. A catch of 270 is about 20% of the average annual run of 1330 adults.

2. Harvest will be managed to provide adequate escapement for maximum sustained natural production.

3. We can estimate harvest from Salmon-Steelhead tags.

Problem 1. Because the Yaquina steelhead population is small, harvest of more than 20% of the run could have detrimental effects on the population.

Action 1.1 If the annual harvest averages more than 20% of the run adults, restrict the fishery.

Alternative 2

Policies

Operating Principle 1. Winter steelhead shall be managed for wild fish. Any hatchery releases shall be consistent with the Wild Fish Management Policy.

Operating Principle 2. Steelhead stocks approved for use in the Yaquina basin are Alsea winter and Yaquina winter.

Operating Principle 3. Programs that challenge the limits of the Wild Fish Management Policy shall be modified or reduced proportionately to maintain compliance with the Policy.

Objectives

Objective 1. Maintain the production of wild steelhead in Yaquina basin at an average annual minimum of 1300 adults.

Assumptions and Rationale

1. Estimates of run size are based on information from returns of Salmon Steelhead Tags and may be less accurate when predicting catch and run size in small systems such as the Yaquina basin.

2. Overall habitat quality will remain at or above its present condition.

3. Maintenance of natural production will protect a diversity of life history characteristics.

Problems and Recommended Actions

Problem 1. Escapement and other life history characteristics of adult winter steelhead in the Yaquina basin are poorly documented.

Action 1.1 Conduct inventories for 5 years to estimate timing of river entry, in-river holding patterns, abundance, distribution and timing of spawning, and age structure of the adult population.

Action 1.2 Continue to estimate the hatchery:wild ratio from scale analysis or a marking program.

Action 1.3 Encourage development of techniques to monitor annual population status and trends.

Problem 2. Life history characteristics of wild juvenile winter steelhead in the Yaquina basin are not accurately defined.

Action 2.1 Conduct surveys for in mainstem and tributaries of the Yaquina River and Big Elk Creek to determine age specific patterns of rearing and migration of juvenile steelhead.

Problem 3. Habitat factors that may limit production in the Yaquina basin have not been established.

Action 3.1 Update physical and biological surveys.

Action 3.2 Conduct habitat use surveys to identify important habitats for steelhead production.

Action 3.3 Work with private groups and public agencies to protect freshwater steelhead habitat.

Action 3.4 Once limiting factors are identified, design and implement appropriate habitat improvement projects.

Problem 4. Predators in the Yaquina basin may reduce the numbers of wild steelhead.

Action 4.1 Encourage research described in ODFW Steelhead Management Plan (ODFW 1986, Problem 21).

Objective 2. Design and implement a hatchery program that will be compatible with requirements of the Wild Fish Management Policy.

Assumptions and Rationale

1. The current hatchery program is of a foreign stock and composes about 70% of the run.

2. Interbreeding with non-indigenous hatchery stock may hold production of wild fish below its potential, or alter the life history characteristics of the wild population.

3. The current hatchery program will be continued until necessary information is gathered to determine compliance with the WFMP.

4. If more than 10% of the fish spawning during the time and in the same areas as wild fish spawn are of foreign stock hatchery origin, the hatchery program does not comply with the WFMP.

5. If the hatchery stock has been maintained as a "wild" broodstock, then 50% of the fish spawning in the same time and place as the wild population may be of hatchery origin.

Problems and Recommended Action

Problem 1. Information is needed on location and time of spawning by hatchery fish to determine if the current programs violates the WFMP.

Action 1.1 Continue to mark 100% of the hatchery reared fish released into the Yaquina basin (excludes hatchbox fry).

Action 1.2 Conduct surveys and inventories for 5 years as described under Objective 1, Problem 1 to determine abundance, distribution, and timing of spawning by hatchery reared fish.

The following actions will be pursued once the status of the current hatchery program under the WFMP has been evaluated for a 5 year period.

Action 2.1 Continue the current hatchery program of releasing about 30,000 Alsea hatchery smolts annually in Big Elk Creek if in compliance with the WFMP.

Action 2.2 If the current hatchery program is very near compliance with the WFMP continue to use Alsea stock but modify the hatchery program until compliance is reached. Possible modifications include different release strategies or use of earlier spawning stock. Continue to mark all hatchery reared fish. Continue surveys to determine status of the program.

Action 2.3 If the current program is far from compliance with the WFMP, impliment measures that will bring the program into compliance, such as development of a "wild" broodstock of Yaquina stock or wild fish only management. Continue to mark all hatchery reared fish. Continue surveys to determine status of the program.

Action 2.4 Support research on development of alternate ways, such as sterilization, of producing hatchery fish that will minimize interaction between hatchery and wild fish.

Objective 3. Maintain the harvest rate at 15-20% of the run.

Assumptions and Rationale

1. Between 1980 and 1985 the harvest rate ranged from 17% to 24%.

2. Harvest will be managed to provide adequate escapement for maximum sustained natural production.

3. Under current harvest levels and run sizes, about 270 wild fish and about 530 hatchery fish are harvested.

Problems and Recommended Action

Problem 1. Because the Yaquina steelhead population is small, a harvest rate of more than 20% of wild run could have detrimental effects on the population.

Action 1.1 If average annual harvest rate increases to over 20% of the wild run or the population appears to decline, restrict the fishery.

Action 1.2 Conduct a creel survey to estimate catch, identify wild and marked hatchery fish, and to validate the estimate generated from Salmon-Steelhead tags.

CUTTHROAT TROUT

Background and Status

Origin

Sea-run and resident cutthroat trout are native to the Yaquina basin. Hatchery cutthroat trout were released into the Yaquina basin between 1912 and 1960 (Table 21). Hatchery cutthroat trout released into the Yaquina basin between 1912 and 1925 were progeny of sea-run broodstock collected in Big Elk Creek. Hatchery juveniles released from 1948-60 were derived from sea-run broodstock collected in the Alsea River in the mid-1930s (Giger 1972).

Other Trout Species

Brook trout were planted in Yaquina River in 1904, but are no longer present in the Yaquina basin. Rainbow trout were also planted in Yaquina River in 1910 and in Yaquina River and Big Elk Creek from 1950-58, although resident rainbow trout are currently present only in Olalla Reservoir, a closed system.

Juvenile Life History

The life history characteristics of wild cutthroat trout in the Yaquina basin are probably similar to the characteristics of wild cutthroat trout in other central coast basins. According to Giger (1972), populations of wild cutthroat trout in the Siuslaw, Alsea, Sand Creek, and Nestucca basins exhibit similar life history patterns. Therefore, the description of the life history of wild cutthroat trout in Yaquina basin will be based on studies conducted in other river systems (Sumner 1962; Lowry 1964; Giger 1972).

Emergence from the gravel occurs about April 1. Fry (zero-age juveniles) rear in the tributaries for the following year. During February through June, some of the fingerling (or parr), ages 1+ and 2+, migrate downstream (peak movement occurring in April or May) to rear in downstream areas, tidewater or the estuary. These trout move very little between June and November, until migrating upstream from November through February. Many return to the same pool they were in 6 months earlier. Juvenile cutthroat trout rear in freshwater from 1 to 6 years.

Smolts migrate downstream in the spring, with the largest number moving in April in freshwater, and early to mid-May through tidewater. All smolts enter the ocean by the end of May. At the time of migration, smolts reach a minimum size of 8.3 inches and average 9.8 inches and an age of 3 years. Smolts and kelts, adult cutthroat trout that have completed spawning and are moving back downstream to the ocean, feed on insect larvae at the head of tide and sand shrimp (*Crangon franciscorum*) and fish (northern anchovy, shiner perch, Pacific herring, smelt, three-spine stickleback, and staghorn sculpin) in the estuary prior to entering the ocean.

Adult Life History

Cutthroat trout remain at sea only during the summer (Giger 1972), residing throughout the coastal zone up to 20 miles offshore (Loch and Miller

1988). During their ocean residence, food habits of cutthroat trout consist primarily of fish, and a few invertebrates (Brodeur et al. 1987). The fish include northern anchovy, juvenile kelp greenling, rockfish, and occassionally salmonids. Insects and floating plant material have also been observed in stomachs which indicate they also feed at the surface. Giger (1972) suggested that predators of cutthroat trout during the summer in the ocean were hake, spiny dogfish, harbor seals, and adult salmon, although Brodeur et al. (1987) found little incidence of predation by fish on juvenile salmonids. Giger (1972) estimated the total survival of cutthroat trout in the ocean for hatchery fish at 20-40%. Survival of wild cutthroat trout is probably at least comparable.

Cutthroat trout return to the estuary of origin from late June through September, although some straying into other river systems has been observed (Giger 1972). Groups of fish tend to enter coastal streams at approximately the same time (Giger 1972). The first major group arrives during July, usually the latter half of the month, followed by a second group in the end of August and early September. No groups entered freshwater past mid-September. The earliest fish were adults that had made at least one previous spawning migration.

Sea-run adults move rapidly through the lower estuary and hold in the deeper central portion of tidewater for varying lengths of time. A few enter freshwater quickly, but others remain in tidewater for up to 4 months.

Adults migrate upriver to spawn in late October through early March, although the majority migrate during November and December. At the same time, cutthroat trout that rear in tidewater during the summer, but do not enter the ocean, also migrate upstream, some to spawn. These fish average 6 inches in length. Lowered river temperature in the fall appears to stimulate the upstream migration of cutthroat trout (Giger 1972). Spawning begins in December and peaks in February.

Adult sea-run migrants average 13.7 inches in length. Age of sea-run cutthroat trout varied from 2+ to 7+ years, but usually included 3 or 4 years of freshwater rearing and at least one summer in the ocean. Cutthroat trout cease feeding upon entering the estuary and may lose 40% of their weight by spawning time. Most spawn following one summer at sea.

Kelts migrate downstream from January through May to return to the ocean. Cutthroat trout may make 2, 3, or 4 spawning migrations during their life cycle. An average of 5-30% may make a second spawning migration, 10-40% of those may return for a third, and 8-25% of those may return for a fourth time (Giger 1972).

Production and Harvest

All juvenile cutthroat trout in the Yaquina basin since 1961 have been progeny of adults that spawned naturally. The production of wild resident or sea-run juveniles in the basin can not be estimated directly. However, the density of cutthroat trout observed in 85 sections among 6 tributaries to the Yaquina River and Big Elk Creek during sampling for coho salmon in the summer of 1985 averaged 0.008 to 0.17 fish per square meter for cutthroat trout parr and 0.01 to 0.11 fish per square meter for trout fry, some of which could also have been steelhead, in each stream (Mario Solazzi, Oregon Department of Fish and Wildlife, unpublished data).

Although the density of cutthroat trout appears low, at least two factors may contribute to these low estimates of abundance. High concentrations of cutthroat fry are not associated with the presence of juvenile coho salmon (Lowry 1964; Mario Solazzi, Oregon Department of Fish and Wildlife, personal communication) so sampling in streams inhabited by coho salmon would yield low estimates of cutthroat fry. Also, juvenile cutthroat trout can rear in very small streams, many of which would not be normally sampled during investigations for other species; for example, the most important tributary to Deer Creek (Alsea River) for cutthroat trout production had a mean annual flow of 0.65 cfs (Lowry 1964). Thus, while absolute density in tributaries during the summer may appear low on the average, not enough is known about their actual abundance and 186 miles of rearing areas are available to cutthroat trout in addition to tidewater and estuarine areas.

Production of sea-run adults was estimated by Smith and Lauman (1972) as a catch of 1,080 wild adults in the estuary and river and a spawning escapement of 7,500. Catch was also estimated in 1976 from district planning forms at 2,020 wild adult sea-run cutthroat trout. If we assume that a catch to population value of 20%, as determined for wild fish in the Alsea basin (Giger 1972), is applicable to the Yaquina basin, then the Yaquina basin may support a population of approximately 10,000 cutthroat over 8 inches.

Angling Distribution, Access, and Regulations

Anglers are allowed to fish for cutthroat trout in streams throughout the basin from the last weekend in May to 31 October for trout over 8 inches and in portions of Yaquina River and Big Elk Creek from 1 November to 31 March for trout over 12 inches. Four lakes--Olalla, Mill Creek, Hamer, and Buttermilk lakes--are open year round for trout over 6 inches.

The spring fishery is a low intensity fishery (Table 22) that takes place primarily in Big Elk Creek and the Yaquina River on opening weekend. Angler catch on opening weekend comprises 80-90% of the spring harvest (Giger 1972). Anglers catch resident cutthroat trout and downstream migrating parr, smolts, and kelts. The fishery on sea-run cutthroat trout begins as early as late June and extends through September. Popular areas for boat and bank anglers fishing for sea-run cutthroat trout include the portion of tidewater between Mill Creek and the head of tide two miles above Elk City on the Yaquina River and on Big Elk Creek up to Bear Creek. The early segment of the run includes the largest sea-run cutthroat trout, adults that are returning to spawn for a second, third, or fourth time.

Table 21. Releases of cutthroat trout in Yaquina basin, excluding Olalla Reservoir, 1925-60. Records are not complete for the years 1912-24 and 1926-47.

Year of release	Hatchery	Release Location	Number	Size (inches)
1925	Yaquina	Big Elk Creek	156,766	--
1948	Alsea	Big Elk Creek	11,050	2-4
	Alsea	Big Elk Creek	2,400	>6
	Alsea	Yaquina River	20,150	2-4
	Alsea	Yaquina River	4,912	>6
1949	Alsea	Yaquina River	76,608	0-2
	Alsea	Yaquina River	2,457	>6
1950	Alsea	Big Elk Creek	2,508	>6
	Alsea	Yaquina River	4,935	>6
1951	Alsea	Big Elk Creek	1,000	>6
	Alsea	Yaquina River	1,505	>6
1952	Alsea	Big Elk Creek	2,720	>6
	Alsea	Yaquina River	3,230	>6
1953	Alsea	Big Elk Creek	500	>6
	Alsea	Yaquina River	997	>6
1954	Alsea	Big Elk Creek	1,999	>6
	Alsea	Yaquina River	1,298	>6
1955	Alsea	Big Elk Creek	999	>6
	Alsea	Yaquina River	1,000	>6
1957	Alsea	Big Elk Creek	1,000	>6
	Alsea	Yaquina River	1,000	>6
1958	Alsea	Big Elk Creek	498	>6
	Alsea	Yaquina River	498	>6
1959	Alsea	Big Elk Creek	3,000	>6
	Alsea	Yaquina River	2,000	>6
1960	Alsea	Big Elk Creek	1,502	>8
	Alsea	Yaquina River	999	>8

Table 22. Opening weekend creel survey data collected on Big Elk Creek.[a]

Year	Number of cars[b]	Anglers interviewed	Hours fished	Cutthroat caught	Fish per hour	Fish per angler[c]
1965		11	25	16	0.6	1.5
1966		15	45	32	0.7	2.1
1967		--no data--				
1968		--no data--				
1969		23	30	8	0.3	0.4
1970		19	61	51	0.8	2.7
1971		--no data--				
1972		19	47	25	0.5	1.3
1973		--no data--				
1974		2	2	3	1.5	1.5
1975		7	32	18	0.6	2.6
1976		--no data--				
1977		3	4	1	0.3	0.3
1978		17	58	24	0.4	1.4
1979		7	14	7	0.5	1.0
1980	26	15	32	26	0.8	1.7
1981	46	10	11	16	1.5	1.6
1982	14	14	17	9	0.5	0.6
1983	15	14	23	11	0.5	0.8
1984	--	13	34	24	0.7	1.9
1985	24	26	43	28	0.7	1.1
1986	31	7	25	11	0.4	1.6
1987	34	12	16	12	0.8	1.0

[a] Majority of the interviews were done on opening day, but in some years interviews were done on both days of opening weekend.

[b] Counts were usually made between 7 and 10 a.m. from the mouth of Big Elk Creek up to Grant Creek or Harlan (approximately 22 miles).

[c] Anglers have not finished fishing for the day; fish per angler figure is an underestimate.

Management Considerations

No hatchery fish have been released into the Yaquina basin for 30 years. The recreational fishery on cutthroat trout is of low intensity and most participants are from the nearby area. Natural production appears to be supporting the fishery sufficiently that hatchery releases are not needed. The wild population is considered stable and self perpetuating.

We present only one management strategy for cutthroat trout: Cutthroat trout will be managed for wild fish under the Wild Fish Management Policy and Oregon's Trout Plan. Under the Trout Plan, Yaquina cutthroat trout will be managed for basic yield, meaning that basic harvest regulations will apply and that management of other species already existing in the basin may receive higher priority.

Policies

Operating Principle 1. Cutthroat trout will be managed for wild fish in accordance with the Wild Fish Management Policy and with Option A of the statewide Trout Plan (ODFW 1987) under the basic yield alternative.

Objectives

Objective 1. Maintain wild populations of resident and sea-run cutthroat trout at the current level.

Assumptions and Rationale

1. Estimates generated in the 1970s indicated the population may be about 8,500 to 10,000 adult fish.
2. Managing wild populations requires knowledge of the life history characteristics of resident and sea-run cutthroat trout.
3. Habitat quality will be maintained or improved.
4. No hatchery stocking will occur except in the event of a catastrophic loss in which case short term supplementation can be implemented (ODFW 1987).

Problems and Recommended Actions

Problem 1. We need better population estimates of resident and sea-run cutthroat trout than those made in the 1970s.

Action 1.1 Conduct an inventory of cutthroat trout, including relative abundance and distribution within the Yaquina basin.

Problem 2. Life history characteristics of resident and sea-run cutthroat trout have not been studied in the Yaquina basin.

Action 2.1 Determine age structure, spawning time, sex ratio, and other life history characteristics.

Objective 2. Maintain harvest at a level of approximately 20% of the harvestable population.

Assumptions and Rationale

1. Habitat quality will be maintained or improved.

2. Recreational angling effort will be highest during July, August, and September.

3. Approximately 1,000 to 2,000 cutthroat trout will be harvested each year.

Problems and Recommended Actions

Problem 1. Current harvest levels are unknown.

Action 1.1 Conduct creel surveys to determine harvest in spring and summer fisheries.

Problem 2. Characteristics of cutthroat trout which are caught have not been quantified.

Action 2.1 Measure size and determine age and condition of trout that are caught in the spring and summer fisheries.

WHITE AND GREEN STURGEON

Background

Origin

White and green sturgeon occur naturally in the Yaquina basin. Very little is known about the origin of green sturgeon in the basin, but white sturgeon in the Yaquina basin are probably fish that were spawned in the Columbia River, migrated to the ocean, moved southward along the coast, and entered Yaquina Bay (Dr. Howard Horton, Oregon State University, unpublished data). Some sturgeon may also migrate from other rivers such as the Sacramento River.

Life History

Little is known about the life history of the green sturgeon. It spends more time in the ocean than the white sturgeon but, like all sturgeons, it enters rivers to spawn. The green sturgeon reaches a maximum size of about 350 pounds (Scott and Crossman 1973).

The white sturgeon is the largest freshwater fish in North America, capable of reaching a weight of 1,800 pounds (Scott and Crossman 1973). White sturgeon are slow growing and very long lived. The largest individuals may be over 100 years old. A 36 inch sturgeon from the Columbia River will be about 9 years old (Hess 1984). Females mature at 15 to 20 years old, while males may be younger at first spawning (Bajkov 1951). Mature adults spawn in the spring or early summer in the freshwater portion of rivers that have a rocky substrate and swift current (Scott and Crossman 1973). Sturgeon may spawn many times during their lives but do not spawn every year. The time between spawning gets greater with age. Fecundity also increases with age.

Information on the life history of white sturgeon in Yaquina basin was gathered during 5 years of biweekly sampling, 1980-85 (Dr. H. Horton, Oregon State University, unpublished data). Based on tagging information, white sturgeon in Yaquina basin probably originate in the Columbia River, and they move into Yaquina Bay in the late winter and early spring. Peak catch occurs from April through mid-July. The sturgeon reside in deep holes in Yaquina River from Riverbend (RM-2) to Mill Creek (RM-11), but may move with the tide. However, individual sturgeon tend to remain in a particular area once in the river. The ideal temperature and salinity for white sturgeon in the Yaquina River is $10^{o}C$ and 10o/oo, respectively. During the late winter, spring, and early summer, white sturgeon eat staghorn sculpin, Pacific herring, small Dungeness crab, bay shrimp (Crangonidae), clams (primarily Macoma spp.), and occasionally English sole, northern anchovy, tube snouts (Aulorhynchus flavidus) and surfperches.

When water temperature rises in the summer, many of the sturgeon move to the lower bay or into the ocean. One white sturgeon tagged in the Yaquina River was recovered in the Columbia River supporting the conclusion that migration occurs between these two systems.

Production and Harvest

Studies done during 1980-85 indicate juvenile white sturgeon smaller than 24 inches in length (4-5 years old) are probably not produced or reared in the basin (Dr. H. Horton, Oregon State University, unpublished data). However, Dr. Horton estimates that the population of legal-size white sturgeon (36-72 inches in length) averaged 101 to 141 fish during 1980-85. In addition, the harvest rate was approximately 36% each year. The population size and harvest rate are apparently maintained through immigration of sturgeon from the ocean since successful reproduction is not known to occur within the basin.

Production and harvest of green sturgeon is poorly documented. The sturgeon fishery targeted on green sturgeon twenty years ago, but at present sub-legal sized green sturgeon are only occasionally caught and legal sized green sturgeon have not been reported caught (personal communication on 8 June 1988 with Jerry Butler, Oregon Department of Fish and Wildlife, Marine Region, Newport, Oregon). Apparently, the use of Yaquina Bay and tidewater by the two sturgeon species has shifted from green sturgeon to white sturgeon during the last twenty years.

Angling Distribution, Access, and Regulations

Anglers fish for sturgeon from shore and from boats in the Yaquina River from Riverbend to the mouth of Mill Creek. Access is adequate to all the popular holes.

Oregon regulations allow the taking of sturgeon 36 to 72 inches in length during daylight hours during the entire year in the Yaquina Basin. Two sturgeon are allowed each day, but no more than 6 can be taken in a period of 7 consecutive days. The annual limit is 30 sturgeon. A valid sturgeon tag or daily angling license must be in possession when angling for sturgeon.

Management Considerations

No hatchery reared sturgeon have been released into the Yaquina basin. The recreational fishery for sturgeon is of low intensity and appears to be sufficiently supported by sturgeon migrating into Yaquina River from the Columbia River.

We present only one management strategy for green and white sturgeon. Both green and white sturgeon will be managed for wild fish under the Wild Fish Management Policy. No hatchery fish will be released into the Yaquina basin. This does not preclude the possibility that hatchery sturgeon released in the Columbia River could migrate into the Yaquina basin.

Policies

Operating Principle 1. Green and white sturgeon will be managed for wild fish under the Wild Fish Management Policy. No hatchery fish will be released into the basin.

Objectives

Objective 1. Maintain the abundance of sturgeon by carrying out the habitat objectives of this plan.

Assumptions and Rationale

1. White sturgeon will continue to be the target species.
2. Habitat quality will remain at or above its present condition.
3. Successful reproduction probably does not occur in the Yaquina basin and an indigenous population is not present.
4. Population size will continue to depend on immigration of sturgeon from the ocean.
5. Harvest may increase over its present level and be dependent on sturgeon produced outside the Yaquina system.
6. A sturgeon plan will be written in the near future. Sturgeon management will be guided by the plan.

Problems and Recommended Actions

Problem 1. Sturgeon abundance will not be directly estimated.

Action 1.1 Monitor populations of legalsized sturgeon through angler punchcard information.

Action 1.2 Begin an angler logbook program.

AMERICAN SHAD

Background

Origin

American shad are native to the Atlantic coast of North America. American shad were introduced into the Columbia and Sacramento rivers in the late 1800s and quickly spread to other Pacific coast rivers.

Life History

American shad are anadromous fish that migrate into the lower reaches of freshwater in the spring to spawn. Spawning will commence when the water temperature reaches 53^{o} F (12 ^{o} C), but peak spawning occurs at 65 ^{o} F. Eggs are released and fertilized at night in open water. One fish may produce 20,000 to 150,000 eggs in one year. American shad may spawn more than once

Juveniles hatch in 8-12 days. They spend their first summer in the river and migrate to the ocean in the fall. In the ocean they exist in schools and feed on zooplankton. Shad usually mature at 5 years of age when they are about 18 inches in length.

Production and Harvest

We do not have adequate data to estimate the population size or harvest size, although the population is large enough to sustain a low intensity recreational fishery.

Angling Distribution, Access, and Regulations

American shad are mostly caught in the late spring to early summer in the Elk City area. Anglers are allowed to keep 25 shad per day and the season is open all year except from April 1 to May 25 when it is closed.

Policies

Operating Principle 1. American Shad will be managed for wild fish. No hatchery fish shall be released into the Yaquina basin.

Objective 1. Maintain a stable population of American shad while striving to increase harvest use of the species.

Assumptions and Rationale

1. The current shad population is maintaining itself at an unknown level.

2. Shad add to the diversity of fishing opportunities and provide recreational opportunities at a time of year when more popular species are not available.

3. Limited studies in other estuaries have not shown any major impacts

of shad on native species.

Because the American shad is not a native species but is maintaining a stable population while supporting a small fishery in the Yaquina basin, we do not feel that there are any problems with shad management at this time.

MISCELLANEOUS FRESHWATER AND ANADROMOUS FISH SPECIES

Species

Speckled dace	Coastrange sculpin
River lamprey	Prickly sculpin
Pacific lamprey	Reticulate sculpin
Western brook lamprey	Threespine stickleback

The species in this category are native to the Yaquina River. Little information is available on the abundance of these 8 species, but their numbers are probably large, and the populations are in ecological balance with the carrying capacity of their habitat.

The speckled dace is a freshwater fish that is able to withstand little or no salt water. They probably reached the Yaquina River at a point in earlier geologic time when there was a connection between the Yaquina River and some other freshwater river. Lampreys, sculpins and threespine sticklebacks are all secondarily derived from marine fishes and have had various opportunities to broaden their distribution by moving from system to system as sea level changes have occurred. The Pacific lamprey and the river lamprey are anadromous. In addition to these native fishes, brown bullhead, rainwater killifish, redside shiner, and longnose dace have been introduced into the Yaquina basin.

These species have limited direct food value to humans. The Pacific lamprey has been a food source for Native Americans. Red side shiners, speckled dace, and sculpins are captured in minnow traps by fishermen for use as warm water fish bait in other systems. Sculpin filets are sometimes used by fishermen as cutthroat trout bait.

Some of these species may possibly be competitors for food and space with salmonid species in the Yaquina basin, but we know of no definitive studies the determine this. At this time we do not believe that competition or predation by any of these species is a limiting factor for salmonids in the Yaquina basin. The Pacific lamprey is a known predator of salmonids in the ocean phase of its life, but the effect of mortality from this predator cannot be separated from that of other marine predators. Juvenile and adult stages of many of these species are prey items for juvenile salmonids.

Policies

Operating Principle 1. Maintain populations of the native species at an abundance consistent with their habitat requirements.

Assumptions and Rationale

1. Habitat protection efforts will help maintain habitat for these species.

2. We do not believe that any of these species is at a critical level of abundance.

3. Although these species have limited direct value to fisheries, they need to be recognized for their importance as a food source for other fish and for being a natural part of the Yaquina River basin ecosystem.

At this time we believe that there are no problems with management of these fishes.

PACIFIC HERRING

Background and Status

Origin

Pacific herring are native to the northwest coast of North America. Pacific herring use Yaquina Bay for spawning and juvenile rearing, then return to the ocean until maturity. Estuaries, such as Yaquina Bay, are the primary spawning grounds, but we do not know if the juveniles that were spawned and reared in a specific estuary will return to the same estuary to spawn. We do not know if the Yaquina Bay population of Pacific herring can be considered as a discrete stock, or whether it is a random representation of the Oregon coastal population.

Life History

Pacific herring commonly spawn in Yaquina Bay from mid-January through mid-May, during several (often 3-7) separate spawning periods (unpublished data, Jerry Butler, ODFW, Newport, Oregon). Mature Pacific herring enter the bay, spawn within a few days to two weeks, then return to the ocean. While most mature adults range from 3-7 years of age, 3- and 4-year-old fish comprise 80% of the population.

Spawning grounds are located in intertidal and subtidal areas (Figure 8). A school of fish will broadcast eggs along the shore at high tide. One female may produce 5,000-25,000 eggs. The eggs stick to rocks, vegetation, and pilings. Egg density following spawning may vary from less than 1 egg to 2,000 eggs per square inch. Egg incubation varies with temperature, but usually requires 10-15 days. Egg mortality may exceed 90% due to predation, desiccation, and heavy wave action during the incubation period.

The larvae are planktonic for approximately 6 weeks until they begin to swim. At 3 months, the juveniles are over 1 inch in length. Mortality of larvae can also exceed 90%. The juveniles may remain in the estuary until the winter and then migrate to the ocean. During the period of ocean residence, Pacific herring prefer cold (10-15^{o}C) surface temperatures and low (<30%) surface salinity (Brodeur and Pearcy 1986). They are commonly concentrated offshore of the Columbia River and Yaquina Bay.

Production and Harvest

Spawning run, spawning escapement, and commercial catch of Pacific herring in Yaquina Bay is estimated annually (Table 23). The run varied from 538,000 pounds to 4,120,000 pounds during 1978-87 and catch ranged from 2 to 21% of the run.

Pacific herring is the most commonly caught marine species by number in the recreational catch, but is small compared to the commercial catch. For example, recreational anglers harvested 27,192 (approximately 600-1,000 pounds) Pacific herring between 1 October 1970 and 31 October 1971, whereas the commercial catch was 8,175 pounds during 1971 (Gaumer et al. 1974). In addition, it is unlikely that recreational catch would rise as quickly as commercial catch has since 1978.

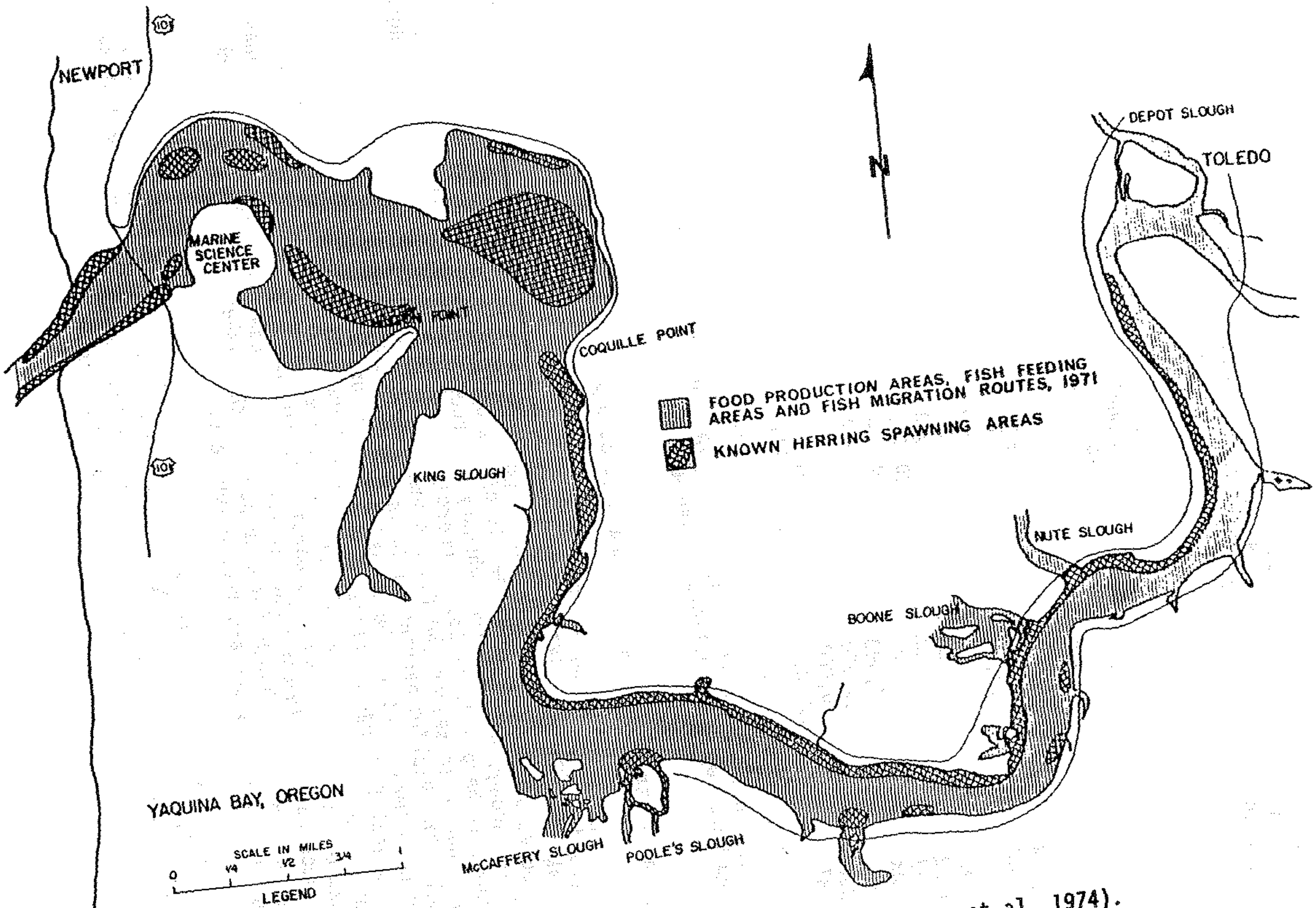

Figure 8. Areas of Yaquina Bay used for spawning by Pacific herring (Gaumer et al. 1974).

Table 23. Yaquina Bay Pacific herring spawning run, escapement, commercial catch, and catch rate, 1978-87 (unpublished data, Jerry Butler, ODFW, Newport, Oregon). Data from 1985-87 includes subtidal spawning biomass.

Year	Spawning run (lbs)	Spawning escapement (lbs)	Catch (lbs)	Catch rate (catch/run) (%)
1978	538,000	450,000	87,782	16
1979	610,000	510,000	100,200	16
1980	512,000	407,000	105,299	21
1981	531,000	440,000	91,000	17
1982	631,000	620,000	10,678[1]	2
1983	621,000	500,000	121,070	19
1984	667,000	530,000	137,191	21
1985	920,000	780,000	140,260	15
1986	4,120,000	4,000,000	124,263	3
1987	3,090,000	2,600,000	490,363	16

[1] Catch in 1982 was unusually low. Fish spawned prior to the season's opening and were not of acceptable market quality.

Fishing Distribution, Access, and Regulations

Commercial fishing on Pacific herring occurs in Yaquina Bay below Riverbend. There are two commercial fisheries. In the first fishery, herring are taken for their roe, which is largely exported to Japan where it is considered a delicacy. The roe fishery is open to 19 permit holders on Mondays through Fridays from February 1 through April 15 or until the quota is reached, if before April 15. Commercial gear includes lampara nets (no length limit) and purse seines (50 fathoms maximum length by 7 fathoms maximum depth). The Pacific herring quota is set at 20% of the previous year's spawning biomass, but may be adjusted just prior to the fishery if experimental fishing indicates that the current year's biomass is much different in size from that of the year before. After the quota is reached, the season ends. The second commercial fishery opens on May 15 and continues until December 31. Anyone with any style of gear can catch Pacific herring during this period although few take part in the fishery. Herring taken during the second fishery are frozen for bait.

Recreational anglers fish for herring primarily during February, March, and early April from boats in the channels and from shore between the jetties and the LNG plant. Each person is allowed 25 lbs per day, and gear can include dip nets, jigs, and A-frame nets at any time during the year.

Policies

Operating Principle 1. ODFW will manage the estuarine spawning population to maintain the Pacific herring resource.

Objectives

Objective 1. Commercial harvest will not exceed 20% of the available estimated spawning biomass.

Assumptions and Rationale

1. Recreational harvest of Pacific herring will continue to be small compared to the commercial harvest.

2. Adequate numbers of Pacific herring will remain to perpetuate the resource, contribute to the forage biomass, and allow recreational harvest, if commercial harvest levels remain at or below 20% of the available spawning biomass in Yaquina Bay.

Problems and Recommended Actions

Problem 1. Intertidal and subtidal spawning biomass cannot be predicted with adequate precision without a survey.

Action 1.1 Continue to monitor spawning biomass annually.

Problem 2. Pacific herring in Yaquina Bay may comprise a separate stock.

Action 2.1 Investigate the methodology that could be used to delineate stock of Pacific herring.

MARINE FISH SPECIES

Background and Status

Origin

Many of the fishes in Yaquina Bay are members of families of marine fishes common in the ocean off central Oregon. The surfperch, flounder, or scorpionfish (rockfish), and sculpin families contribute the most species. Other abundant fishes are members of the greenling, smelt, or anchovy families. These fish use Yaquina Bay during at least a portion of their life cycle for one or more of the following activities: spawning, rearing, and feeding. Fish migrate daily, seasonally, or annually between the estuary and ocean; thus the fish in Yaquina Bay are probably part of the ocean stocks rather than distinct populations.

Life History

Surfperches: The five most common surfperches found in Yaquina Bay are shiner perch, pile perch, white surfperch, walleye surfperch, and striped surfperch. All are viviparous, meaning they give birth to fully formed young rather than lay eggs. Depending on the size of the female and the species, one female may have 5-50 young per year. Breeding occurs in the bay during the spring although actual fertilization does not occur until fall. The young are born during the following summer. Surfperches are found in the bay year round except during February and are sparse during other winter months since most surfperches reside in the ocean then. Surfperches eat mussels, barnacles, crustaceans, and herring eggs. The shiner perch is the smallest but most numerous of the surfperches found in Yaquina Bay, while the pile perch is the largest, possibly reaching 19 inches in length (Wares 1971).

Flatfishes (flounder): Several species of flatfish use the bay as a nursery ground but starry flounder may also reside throughout the bay as an adult. Spawning by the starry flounder may occur in the ocean or in the lower bay during the winter to early spring. The eggs of flatfishes hatch in several days into symmetrical, upright larvae. When the larval flatfish reaches about 1 cm in length it begins to metamorphose. When it is about 2 cm long it will have settled to the bottom, both eyes will be on one side of the head, and its bottom side will become pale from lack of pigment. Starry flounders are more abundant in the spring than the fall in Yaquina Bay. They are noteworthy among flatfish in their tolerance of low salinity. Flatfishes commonly eat crustaceans, mollusks, and worms.

Rockfishes: The rockfishes use Yaquina Bay as a nursery and feeding ground for immature fish. Some of these immature fish may be large enough to be caught by anglers. The rockfishes breed in the ocean and are considered ovoviviparous, meaning they incubate and hatch the eggs within the body. The young are "born" in the late winter or spring and are 4-5 mm in length. Rockfishes are slow growing and long lived. Most species first spawn when about 30 cm long and 4-5 years of age, and may reach 30 years of age. Rockfishes eat small fish, crustaceans, jellyfish, and squid.

Sculpins: Myers found eight species of sculpin in Yaquina Bay although only the Pacific staghorn sculpin remains in the bay during the winter. Most sculpins spawn in late winter or spring. Eggs are often conspicuously colored and the eggs of the cabezon are poisonous. The small species mature in about 1 year while the cabezon will mature at age 3. Sculpins eat crustaceans, mollusks, and fish. The cabezon is the largest sculpin found in the bay. In the ocean it may reach 30 inches long although individuals found in the bay are generally much smaller. The staghorn sculpin is noteworthy because it is very abundant in the bay and because it is tolerant of very low salinity so may be found far up the bay.

Production and Harvest

Marine species considered common or abundant in Yaquina Bay include shiner perch, striped seaperch, walleye surfperch, white seaperch, pile perch, black rockfish, kelp greenling, lingcod, cabezon, prickly sculpin, buffalo sculpin, Pacific staghorn sculpin, speckled sanddab, English sole, starry flounder, northern anchovy, whitebait smelt, surf smelt, Pacific tomcod, and topsmelt (Beardsley 1969; Myers 1980). The number of species present was highest in the lower estuary compared to the upper estuary and number of species and overall density was highest during the summer and early fall (Myers 1980). Many marine species moved back into the ocean as temperature and salinity decreased in the winter. In addition, the higher temperatures during summer in the upper bay may have restricted movement of marine species into the upper bay. Because of the constant movement of fish between the estuary and ocean, estuarine production or population size of these species has not been estimated.

Harvest of marine species by recreational anglers was estimated in 1963-64 (Gnose 1968) and 1970-71 (Gaumer et al. 1974) and demonstrated that fishing for miscellaneous marine species is the most popular angling activity in the Yaquina basin in terms of angler hours and fish caught. Marine fish commonly caught by shore and boat anglers and skin divers included 5 species of surfperch, starry flounder, black rockfish, kelp greenling, lingcod, and sculpins. A total of 31 marine species and 133,624 individuals were recorded caught during 1 October 1970 through 31 October 1971 (Gaumer et al 1974). Catch was highest during May through August and lowest during the winter months.

The commercial fishery harvested 11,825 and 350 pounds of northern anchovy and smelt, respectively, in 1971 (Gaumer et al. 1974).

Angling Distribution, Access, and Regulations

The principal boat fishing areas extend from the ocean jetties upstream to approximately 1 mile above Riverbend Marina. Shore anglers are concentrated in the lower and mid-estuary along the jetties, South Beach pier, Hatfield Marine Science Center, and the LNG pier (see Angler Access section). Skin and scuba divers spearfish along the north and south jetties. Access is adequate to all these areas for boat and shore anglers and divers. Oregon sport fishing regulations allow daily catch limits of 25 pounds in aggregate of herring, anchovy, smelt, and sardines; 3 lingcod; 15 fish in aggregate of greenling, cabezon, and rockfish; and 25 fish in aggregate of flounder, surfperch, sole, and others. The season is open the entire year and at all hours.

Policies

Operating Principle 1. ODFW will manage the ocean populations of these species within optimum yield guidelines established by the Oregon legislature and Pacific Fishery Management Council.

Objectives

Objective 1. Maintain abundance of these species to continue providing recreational fisheries in the estuary at present levels, consistent with state policy and statutes.

Assumptions and Rationale

1. Abundance of these species in Yaquina Bay is dependent on condition of habitat in Yaquina Bay and abundance of these species in the ocean.
2. Habitat quality and quantity in the estuary will be maintained.
3. Abundance of ocean stocks of these species will remain high.
4. Current angling regulations will not result in a decrease in fish abundance in the estuary.

Problems and Recommended Actions

Problem 1. The abundance of marine fish in Yaquina Bay is difficult to estimate.

Action 1.1 Continue to monitor recreational catch.

Problem 2. The marine fish populations in Yaquina Bay may be dependent on immigration of fish from the ocean.

Action 2.1 Investigate the relationship of estuarine populations of marine fishes to the nearshore coastal populations.

Problem 3. There is a decrease in the abundance of starry flounder in the recreational catch.

Action 3.1 Encourage research by ODFW and other institutions to determine the cause of the decline in starry founder abundance.

MISCELLANEOUS ESTUARINE AND MARINE FISH SPECIES

Species

Marine species

Spiny dogfish	Padded sculpin
Big skate	Mosshead sculpin
High cockscomb	Tidepool sculpin
Pacific sand lance	Fluffy sculpin
Wolf-eel	Silverspotted sculpin
Pacific sandfish	Tubenose poacher
Northern clingfish	Topsmelt

Estuarine species

Snake prickleback	Bay pipefish
Saddleback gunnel	Blackeye goby
Penpoint gunnel	Arrow goby
Tube-snout	Bay goby

Background

The distribution of these fishes and their habitat preferences are varied. With the exception of the bay goby the fish species in these two groups are not dependent on estuaries for the completion of their lifecycle and even the estuarine species may spend part of their lives in the ocean. The estuarine species occur commonly in Yaquina Bay while the marine species are only seen occasionally or in some instances rarely.

Many of these species are bottom oriented. The bay goby lives on estuarine tideflats in the burrows of ghost shrimp. The tubenose poacher and Pacific sandfish prefer sandy bottoms located mostly in the lower bay. Sculpins, tubesnout, bay pipefish, gunnels, gobies, and the snake prickleback are more commonly found in the eelgrass beds in the lower bay. The abundance of fish species in the lower bay increases in the summer because of the higher salinity. The higher salinity and rocky habitat along the jetties provide favorable conditions for such species as the wolf-eel, the sculpins, and the northern clingfish.

The spiny dogfish and Pacific sand lance range throughout the water column and can be found at times over tideflats as well as in the channels of the lower bay.

In general little is known about the importance of the fishes in these two groups regarding their feeding and breeding and their interactions with other fish species in Yaquina Bay. Collectively these species represent a substantial number of fish that contribute to the structure and function of the estuarine community, but the significance of this added complexity is poorly understood. They may, for example, represent an important food source for fish of recreational or commercial value.

Policies

Operating Principle 1. Maintain self-sustaining populations of miscellaneous estuarine and marine species.

Assumptions and Rationale

1. Habitat protection efforts will help maintain habitat for these species. Estuarine habitat diversity will be maintained.

2. We believe that none of these species is at a critically low level of abundance.

At this time we believe that there are no problems with management of these species.

DUNGENESS CRAB

Background and Status

Origin

Dungeness crab larvae enter Yaquina Bay from the ocean. The juveniles rear throughout Yaquina Bay for varying lengths of time before returning to the ocean. Adult crabs enter the bay when the salinity is high and represent a very small portion of the adult population in the ocean.

Life History

Dungeness crabs mate in the coastal zone during the spring and the eggs are carried by the female until release the following winter. The larvae (zoea and megalopa) are free-swimming for 3-5 months. Many enter estuaries along the coast in late spring and early summer. The juveniles settle to the bottom throughout lower and mid-Yaquina Bay. Juveniles grow quickly in the estuary, then migrate to the ocean (Armstrong et al. 1987).

Dungeness crab mature at age 2, although males may not breed until age 3 or older. Crabs continue to molt as they grow larger, although the frequency of molting decreases with age. Females rarely molt after reaching a carapace width of 155 mm (approximately 6 inches), after which they no longer produce viable egg masses (Hankin et al. 1985). Dungeness crabs are large enough for the recreational fishery at age 3, and enter the commercial fishery at age 4.

Production and Harvest

The number of juvenile crabs rearing in Oregon estuaries relative to the ocean has not been estimated. The number of adult Dungeness crab in Yaquina Bay is dependent on the seasonal immigration of adults from the ocean.

Yaquina Bay supports a large recreational fishery and a small commercial fishery for Dungeness crab. Recreational crabbers caught approximately 43,764 and 17,255 Dungeness crab in 1971 and 1977, respectively. The majority of crabs were harvested during June through October although the season is open the entire year. Commercial crabbers harvested an average of 2,948 pounds during 1971-78 (about 2,000 crabs) and an average of 152 pounds during 1979-86 (about 100 crabs). Recreational and commercial harvest of crabs in Oregon estuaries represents approximately 1-2% of the crabs harvested in Oregon.

Angling Distribution, Access, and Regulations

Dungeness crab are harvested throughout the lower and mid-Yaquina Bay up to Riverbend by boat anglers, shore anglers, tideflat users, and skindivers (Gaumer et al. 1971). The majority are captured by crabbers using boats. Access is adequate for all users.

Current regulations allow the harvest of mature males. Recreational crabbers can keep up to 12 male crabs 5 3/4 inches or wider per day. Each crabber may use up to 3 rings or pots. Commercial crabbers may harvest male Dungenss crab 6 1/4 inches or wider on weekdays (excluding holidays) from the day following Labor Day through 31 December of each year and may use no more than 15 crab rings per vessel.

Policies

Operating Principle 1. Recreational and commercial crab fishery will be managed by the Marine Resources Program according to ODFW and Commission policies.

Objectives

Objective 1. Maintain the current level of opportunity for recreational crabbers to harvest crab.

Assumptions and Rationale

1. The abundance of Dungeness crab in Yaquina Bay will fluctuate annually and seasonally as crabs immigrate from the ocean.

2. Recreational effort will remain at a high level.

3. Commercial crabbers will harvest only a small percentage of the available Dungeness crab in Yaquina Bay.

Problems and Recommended Actions

Problem 1. Many of the Dungeness crab in the recreational catch are soft shelled and of low quality.

Action 1.1 Educate users that these crabs are of low quality and should be not be taken.

Problem 2. Many of the crabs retained by recreational crabbers are below the minimum size.

Action 2.1 Improve communication with recreational crabbers.

Problem 3. Females 6 inches and larger do not spawn, but cannot be legally taken under current regulations.

Action 3.1 Recommend changing the regulations to allow the taking of female crabs that have reached the recreational size limit.

Clams and Oysters

Origin

Yaquina Bay supports a diverse group of native and non-native clams and oysters. Common bivalve species native to Yaquina Bay include the basket cockle, gaper clam, bentnose clam, native littleneck clam, butter clam, and native oyster. Other native clams include the sand clam, irus clam, piddock clam, and pea pod borer.

Non-native oysters were first introduced to Yaquina Bay in 1896 (McGuire 1896) when 25 barrels of eastern oysters were planted. Pacific oysters were later introduced from Japan and are now the mainstay of the oyster industry. Softshell clams were introduced incidentally with eastern oysters in the late 1800s and Manila littleneck clams were introduced by the Oregon Department of Fish and Wildlife in the 1970s.

Life History

Bay clams: The recreationally important bay clams have similar life histories. They all eat plankton that they filter from the water. An individual female can produce millions of eggs and fertilization takes place in the water. Larval clams are free swimming for about 3 weeks until they settle to the bottom. Once on the bottom, the tiny clams are mobile and will search for their preferred substrate where most will burrow in for life. The basket cockle retains a very limited mobility as an adult clam and all bay clams can adjust their positions somewhat if disturbed.

The bay clams differ from each other in their preferred substrate, size, age, and spawning season as shown in Table 24. The softshell clam varies from the other clams in being tolerant of low salinites. Softshell clams are found further up the bay than other clams. The Manilla littleneck clam is found higher in the intertidal zone than other clams where it may avoid competition with other clams (Anderson et al. 1982). This is one reason this non-native clam was selected for introduction.

Oysters: Native oysters spawn in the spring as the water begins to warm. Fertlization occurs within the female's shell and the larval oysters develop there for about ten days. The larval oysters are released from the parent shell and are free swimming for several weeks before they "set" on cultch. In other words, the tiny oysters cement their left shells onto rocks, logs, or other shells. Like clams, oysters feed on plankton. In one year the native oyster matures as a male but then alternates between being female and male for the rest of its life. Oysters are fairly sensitive to salinity and temperature. Oyster beds can be smothered by heavy siltation.

The Pacific oyster differs from the native oyster in that fertilization occurs in the water column and while individuals can change sex, most maintain one sexual identity through life. The Pacific oyster is also a faster growing, larger oyster. In Yaquina Bay, this oyster is artificially propagated and the tiny seed oysters or "spat" are planted in the aquaculture areas.

Table 24. Preferred substrate, substrate depth, maximum size, maximum age, and spawning time of 5 recreationally important clams.

Common name	Preferred Substrate	Substrate depth, inches	Spawning Season	Maximum size, inches	Maximum age
Basket Cockle	Sand	1-3	Summer	4.75	15
Butter	Gravel, rock, sand	6-12	Summer	5	20
Gaper	Gravel, sand, shell, Eel grass beds	4-16	Winter	8	15
Native Littleneck	Fine sand	1-6	Spring-summer	3	14
Softshell	Mud-sand	6-12	Summer	6	10
Manila Littleneck	Pea gravel, sand, shell, mud	1-4	Spring-fall	NA	NA

Production and Harvest

Distribution and abundance of major clam species are presented in Figures 9-15, taken from Hancock et al. (1979). Actual production estimates are not available but monitoring of an 18.4 acre acrea adjacent to the Yaquina Bay bridge indicates trends in abundance from 1975-86 (Table 25). Butter clams had very high abundances during 1982-85, cockle clam and native littleneck clam numbers varied widely from year to year, gaper clam abundance dropped steadily since 1975, and *Macoma spp.* (bentnose, sand, and irus) abundance remained relatively constant except for 1985 when abundance increased dramatically. Manila littleneck clams were planted in the intertidal region of King Slough across from Coquille Point.

Commercial harvest of clams in Yaquina Bay focused on the gaper clam in the late 1970s, but has dwindled since 1979 (Table 26). Recreational clammers harvested an estimated 246,275 cockle clams, 78,402 softshell clams, 71,914 gaper clams, 2,531 bentnose clams, 1,719 native littleneck clams, and 1,451 butter clams from March 1 through October 31, 1971 (Gaumer et al. 1974). Effort remains at a high level, although no direct estimate of current harvest is available.

Private companies raise oysters in upper Yaquina Bay (Figure 16) and are regulated by the Oregon Department of Agriculture. Production has been increasing annually and currently exceeds 10,000 gallons or bushels (one bushel of oysters in the shell equals one gallon of shucked oysters) (Table 27).

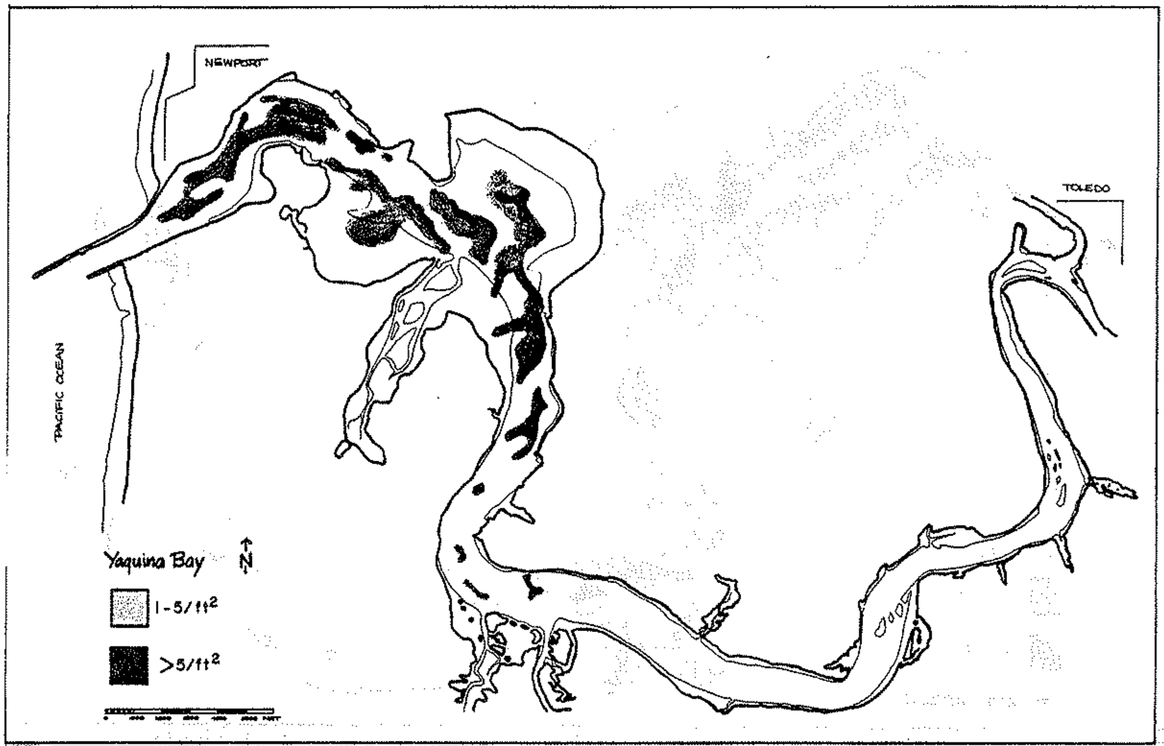

Figure 9. Distribution of gaper clams in Yaquina Bay (Hancock et al. 1979).

Figure 10. Distribution of butter clams in Yaquina Bay (Hancock et al. 1979)

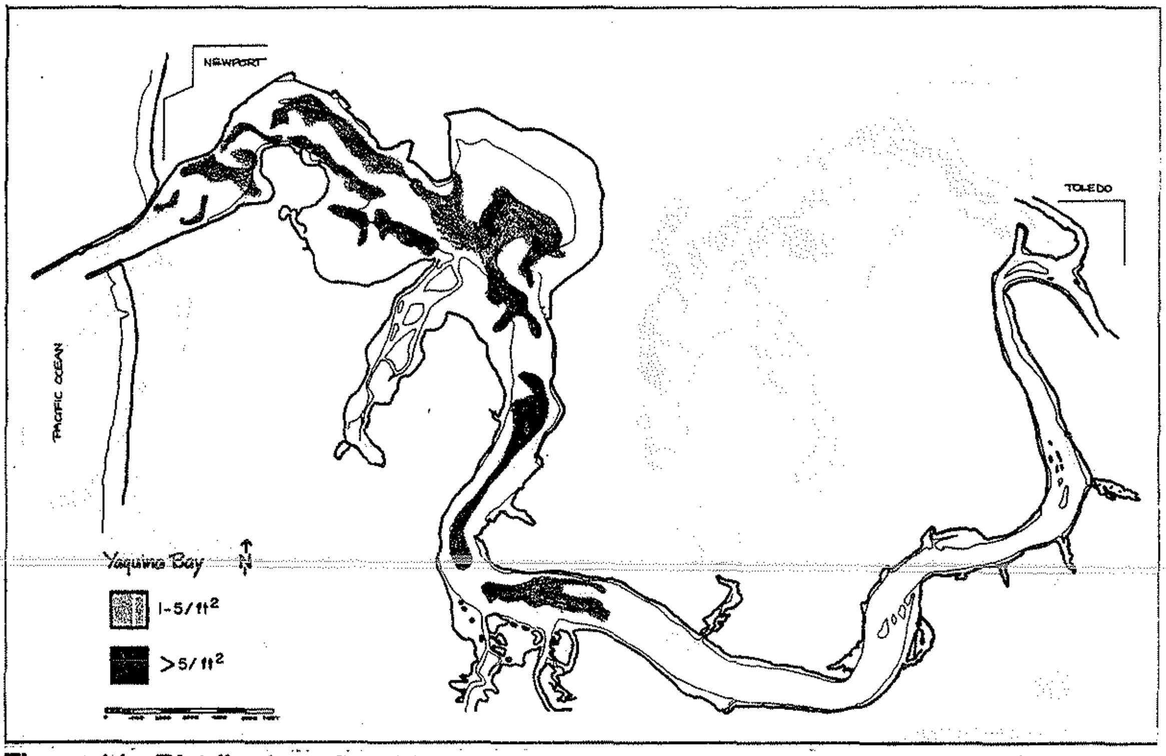

Figure 11. Distribution of cockle clams in Yaquina Bay (Hancock et al. 1979)

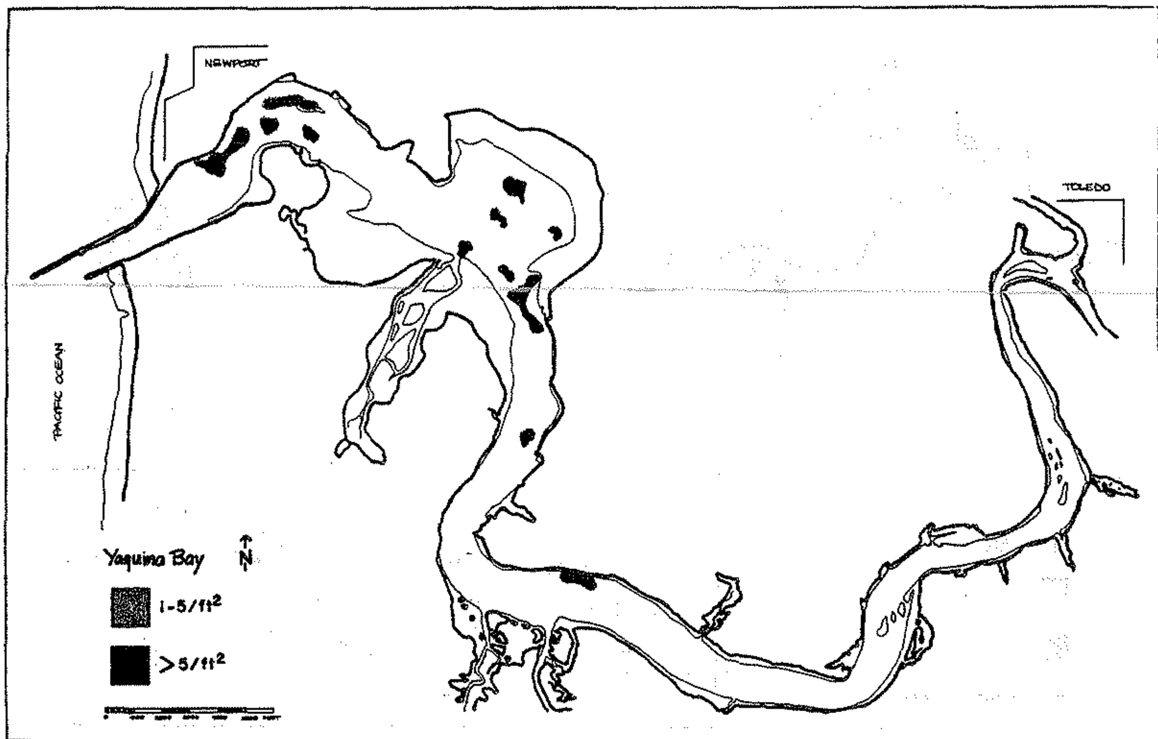

Figure 12. Distribution of littleneck clams in Yaquina Bay (Hancock et al. 1979)

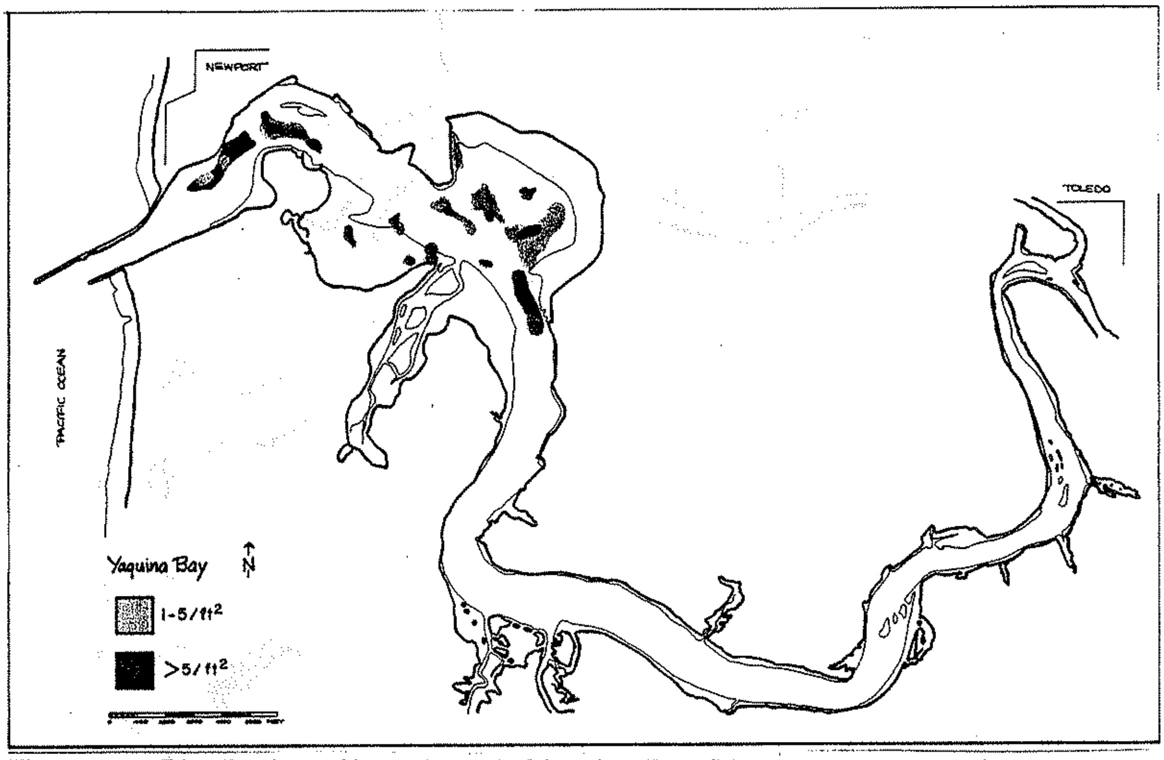

Figure 13. Distribution of irus clams in Yaquina Bay (Hancock et al. 1979)

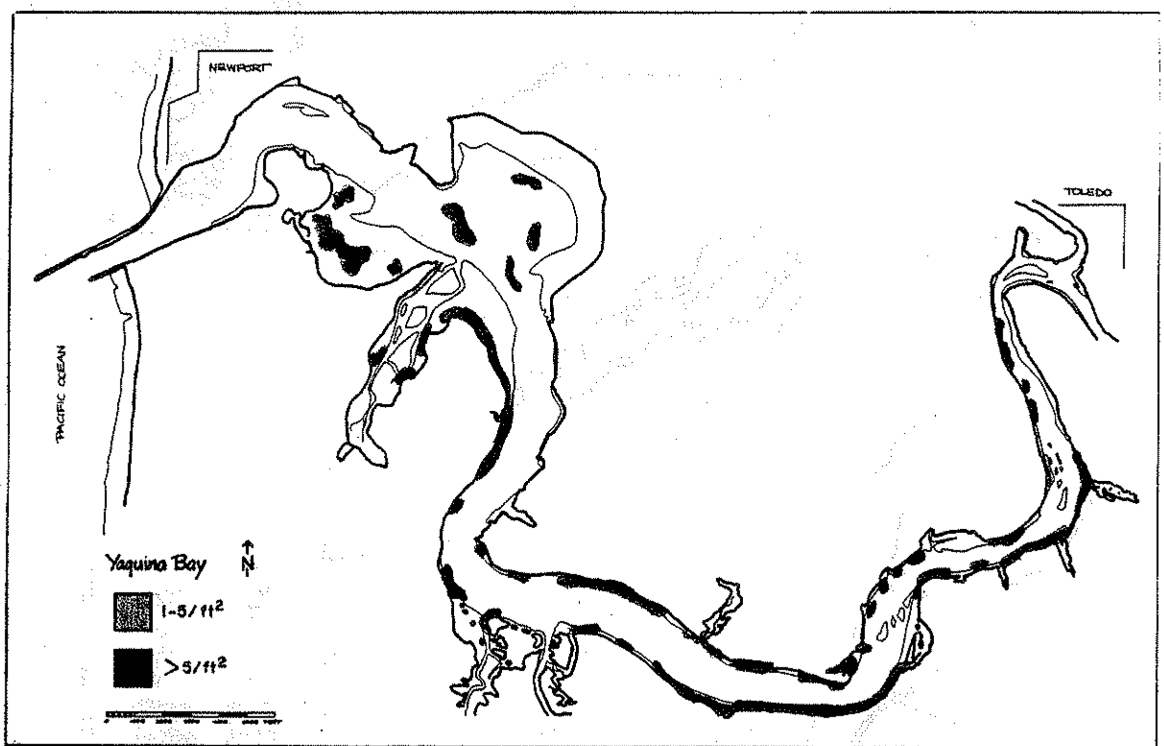

Figure 14. Distribution of softshell clams in Yaquina Bay (Hancock et al. 1979)

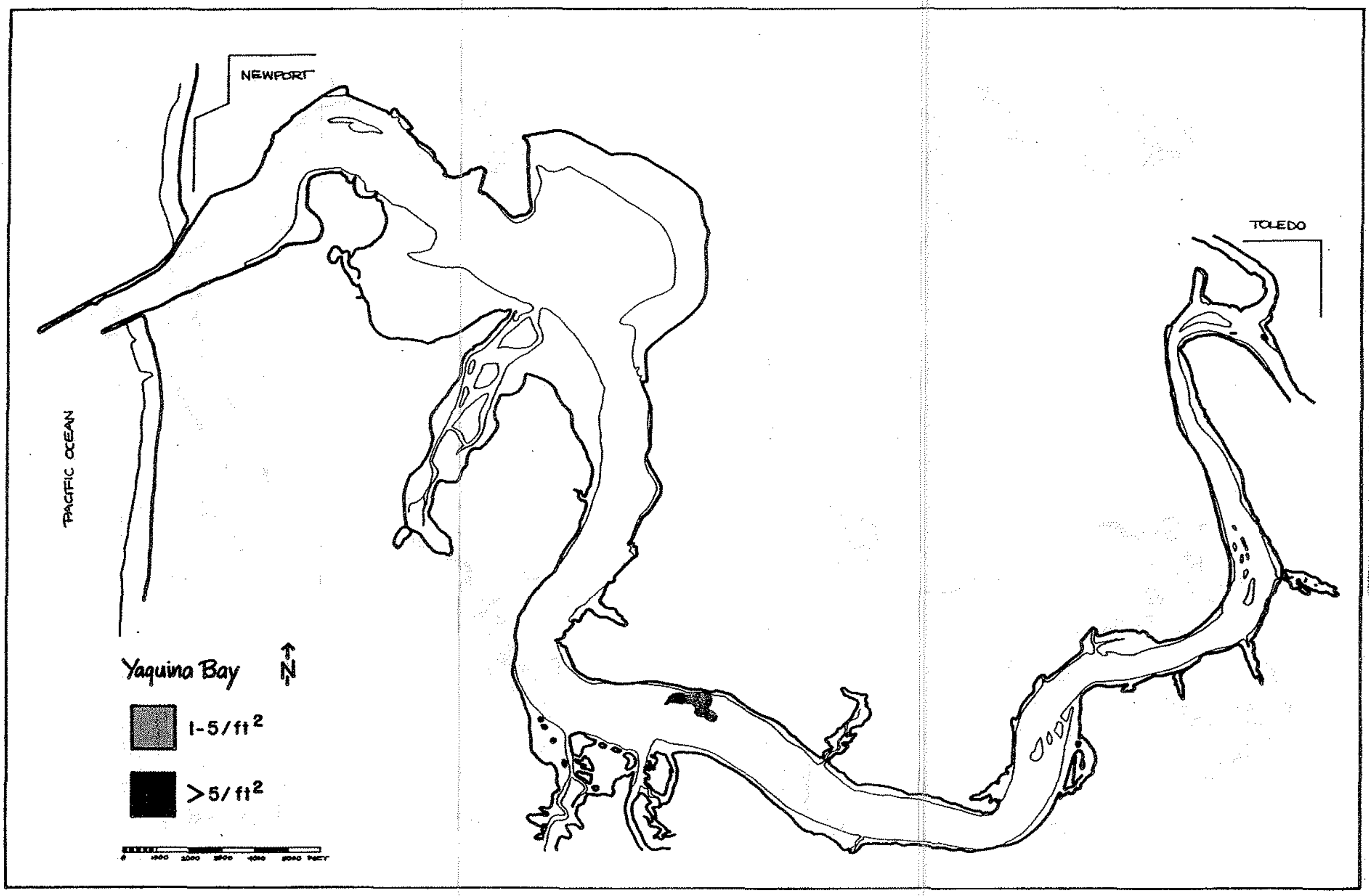

Figure 15. Distribution of native oysters in Yaquina Bay (Hancock et al. 1979)

Table 25. Summary of population estimates (X 1000) of subtidal clams in an 18.4 acre study area of Yaquina Bay, 1975-1986.

Year	Butter	Cockle	Littleneck	Gaper	Macoma spp	Other spp	Total
1975	416	183	366	36,300	13,533	1,700	52,498
1976	333	17	216	25,566	20,566	0	46,700
1977	200		116	29,316	12,050	0	41,682
1978	240	32	48	10,560	11,200	0	22,080
1979	200	17	133	11,117	10,100	0	21,567
1980	367		67	11,050	10,100	0	21,583
1981	200		120	6,160	5,968	0	12,448
1982	2,080	240	880	6,320	27,840	0	37,280
1983	1,040	80	960	7,680	37,760	0	47,440
1984	1,000	80	440	5,600	14,360	40	21,520
1985	2,000	360	2,360	6,480	47,960	40	59,200
1986	520	80	240	5,920	16,600	80	23,440

Table 26. Commercial bay clam harvest in pounds, 1969-1987. NLN = Native littleneck.

Year	Cockle	Gaper	Butter	Softshell	NLN	Irus (Macoma)	Total
1969	1,581	0	0	0	0	0	1,581
1970	444	0	0	0	0	0	444
1971	1,819	0	0	0	0	0	1,819
1972	57	0	0	0	0	0	57
1973	0	0	0	0	0	0	0
1974	0	0	0	398	0	0	398
1975	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0
1977	85	69,331	547	505	182	363	71,013
1978	0	171,898	149	0	0	0	172,047
1979	0	73,959	606	0	0	0	74,565
1980	244	0	0	0	0	0	244
1981	128	0	0	0	0	0	128
1982	0	15	0	0	0	0	15
1983	0	5,247	0	0	0	0	5,253
1984	20	2	0	0	0	0	22
1985	0	0	0	0	0	0	0
1986	6	0	0	0	0	0	6
1987	0	0	0	0	0	0	0

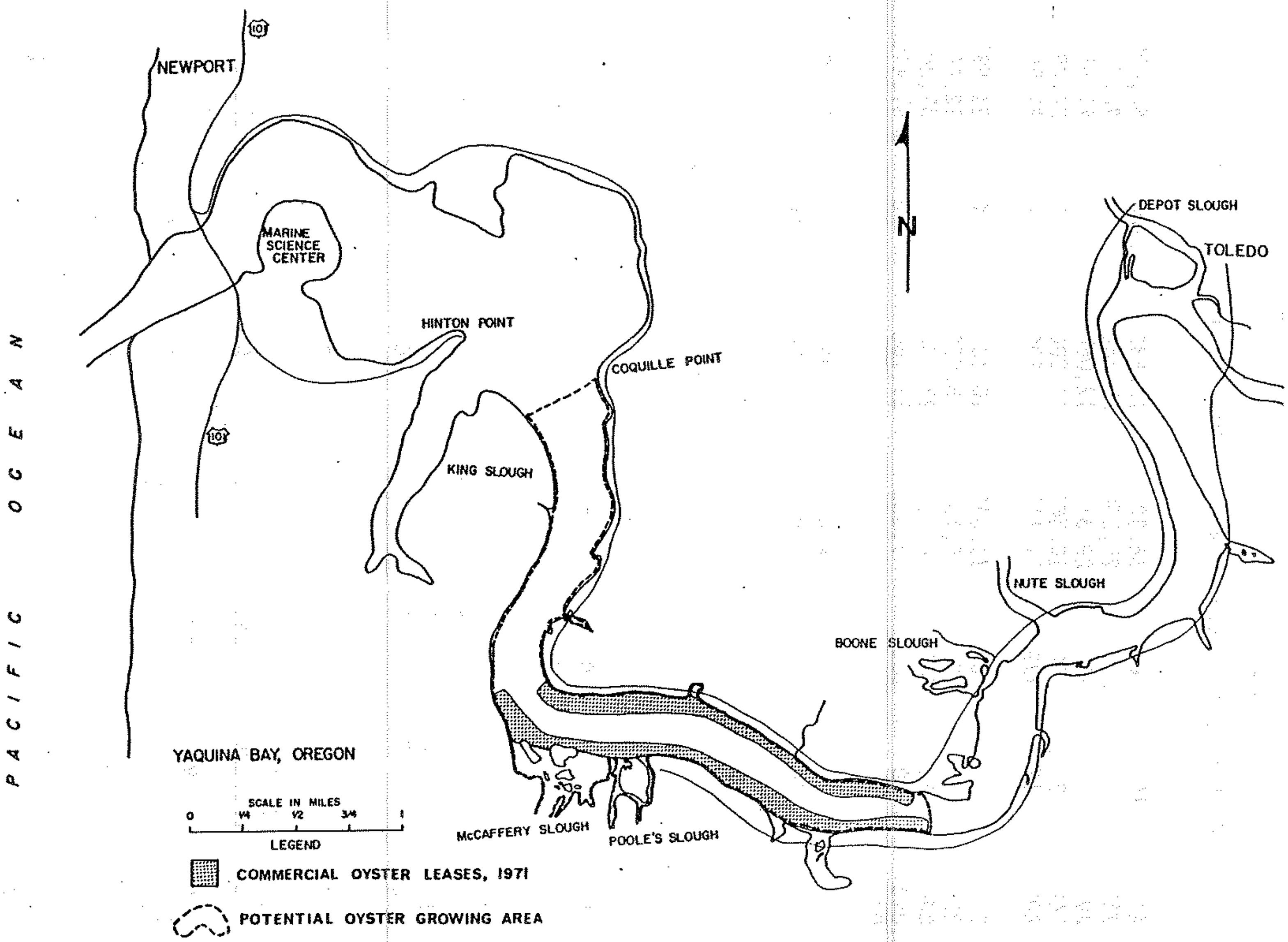

Figure 16. Location of commercial oyster leases (Gaumer et al. 1974).

Table 27. Gallons of shucked Pacific oysters produced in Yaquina Bay.

Year	Pacific	Kumomoto[1]	Eastern	Native	Total
1966	0	0	0	77	77
1967	343	800	0	122	1,265
1968	990	741	0	150	1,881
1969	3,104	721	0	167	3,992
1970	4,868	469	0	95	5,432
1971	3,366	1,496	0	83	4,945
1972	2,861	1,517	0	193	4,571
1973	5,466	1,522	0	359	7,347
1974	5,080	1,708	0	105	6,893
1975	6,245	1,038	0	6	7,289
1976	3,938	986	0	3	4,927
1977	5,725	728	1	16	6,470
1978	6,214	477	77	0	6,768
1979	7,744	2	0	0	8,106
1980	6,240	1	0	0	6,241
1981	7,020	0	0	0	7,020
1985	10,911	0	0	0	10,911
1986	12,353	0	0	0	12,353

[1] Kumomoto is a variety of Pacific oyster.

Angling Distribution, Access, and Regulations

Clam digging areas are located from the ocean jetties to Toledo (Figure 17). Access is adequate to all areas by either boat or shore, although parking is limited in some areas. Recreational clam diggers may take in aggregate 20 butter, littleneck, cockle, and gaper clams of which only 12 may be gaper clams per day. The first 36 softshell and other clams and the first 36 piddocks may be kept per day. Oysters are private property and may not be taken without the owner's permission. There is currently a small commercial clam fishery in Yaquina Bay.

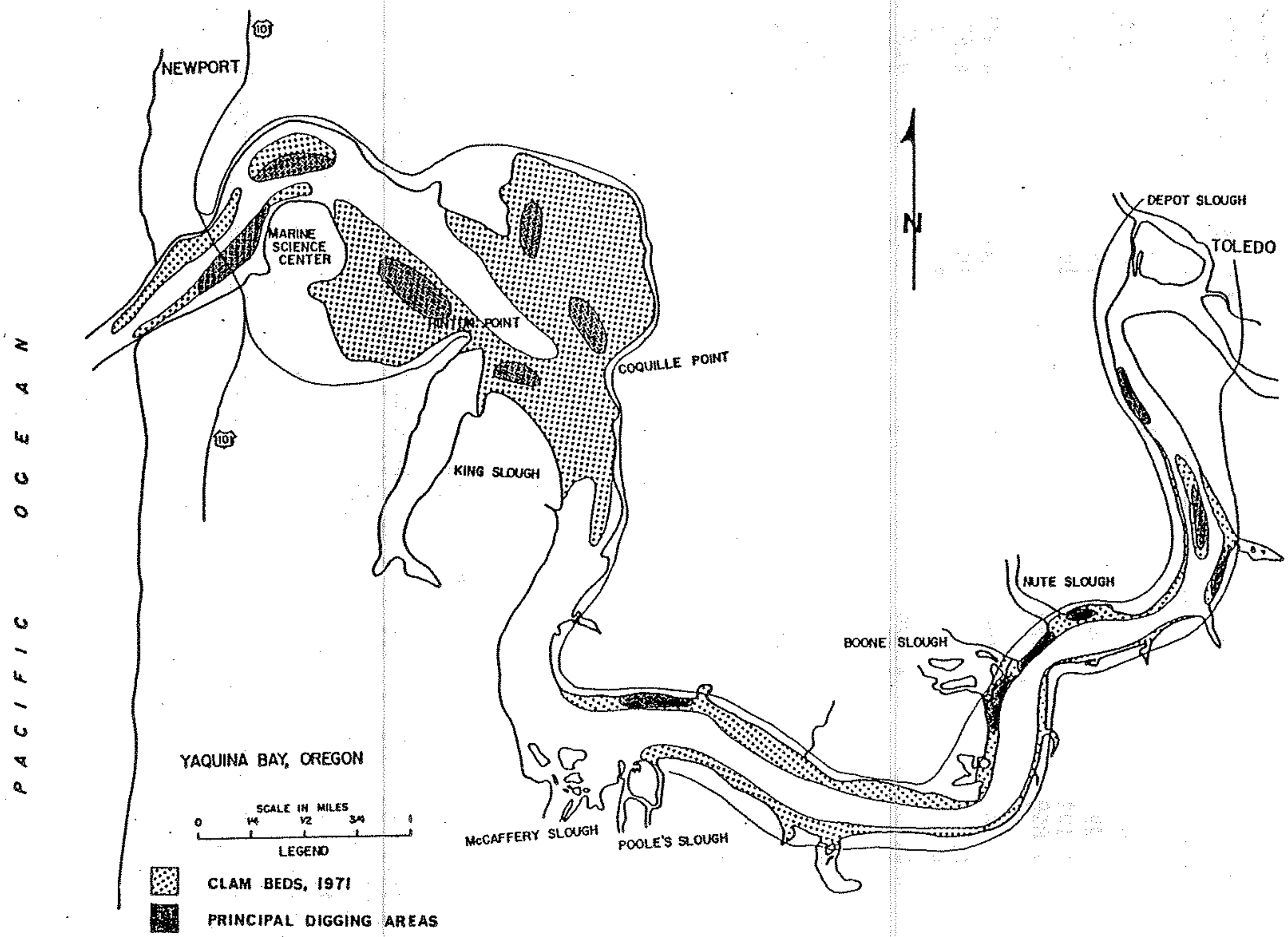

Figure 17. Location of major clam digging areas (Gaumer et al. 1974).

Policies

Operating Principle 1. ODFW will promote optimum use of the clam resource.

Objectives

Objective 1. Maintain the abundance, diversity, and habitat of each clam species in Yaquina Bay.

Assumptions and Rationale

1. Clamming will continue to be a popular activity in Yaquina Bay.

Problems and Recommended Actions

Problem 1. Gaper clam recruitment has been poor since 1975.

Action 1.1 Continue to monitor recruitment and juvenile growth.

Problem 2. No clams are available for harvest in the upper intertidal zone.

Action 2.1 Continue with research to artificially spawn the Manila littleneck clam.

GHOST AND MUD SHRIMP

Background and Status

Origin

Ghost and mud shrimp are native to and widely distributed throughout Yaquina Bay.

Life History

Ghost shrimp live in the intertidal zone in a fine sand sediment. Mud shrimp occur in the intertidal and subtidal regions of Yaquina Bay in sandy mud sediment. Both live in burrows and can be found several feet deep in the substrate.

Both species feed on detritus filtered from the water, although ghost shrimp can also ingest mud. Ghost shrimp produce 3 or 4 broods during the summer months and mud shrimp reproduce in winter. Larvae of both species are planktonic for several weeks. Life span may reach 15 years.

Production and Harvest

Ghost and mud shrimp are present on all the tideflats from below the Yaquina Bay bridge to just below Toledo (Figure 18). A limited recreational and commercial fishery exists on ghost and mud shrimp in Yaquina Bay. Both shrimp are harvested for use as bait in other fisheries.

Angling Distribution, Access, and Regulations

Shrimp are harvested on the tideflats by recreational shrimpers using clam or shrimp guns. Access to the tideflats is adequate. Recreational shrimpers may take as many shrimp as desired each day, but must use hand or hand-powered tools. Permits are available for shrimpers who prefer to use mechanical equipment.

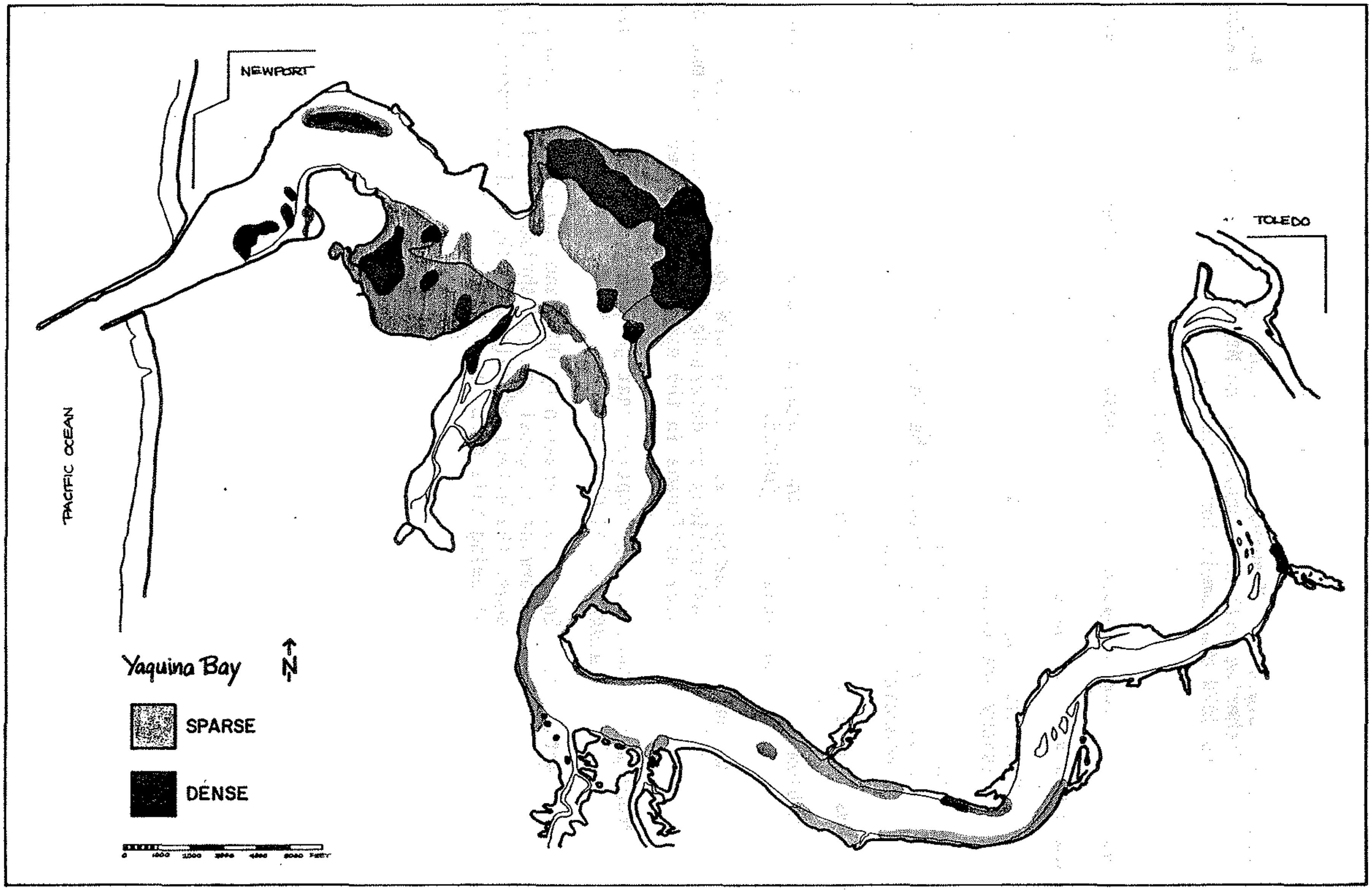

Figure 18. Distribution of ghost and mud shrimp in Yaquina Bay (Hancock et al. 1979)

Policies

Operating Principle 1. Yaquina Bay ghost and mud shrimp resources and fisheries will be managed by the Marine Resources Program according to ODFW and Commission policies.

Objectives

Objective 1. Promote optimum use of ghost and mud shrimp in bait fisheries.

Assumptions and Rationale

1. Biological and ecological problems associated with the current fishery are minimal.
2. The fishery will continue to be self-regulating, and much of the population will continue to be inaccessible to recreational or commercial shrimpers.

Problems and Recommended Actions

Problem 1. Information on the ecological role of ghost and mud shrimp in the estuary is limited.

Action 1.1 Encourage research by ODFW and other agencies or institutions to determine the role ghost and mud shrimp play as forage in the estuarine food web.

Problem 2. There is a perception that ghost and mud shrimp are invading and destroying clam beds.

Action 2.1 Encourage research by ODFW and other institutions to determine if ghost and mud shrimp are invading clam beds, the extent of this problem, and the conditions allowing this problem to occur.

OTHER SHELLFISH AND INVERTEBRATE SPECIES

Species

Other shellfish important to the Yaquina basin not previously discussed are listed in APPENDIX A.

Background

These species, and numerous others not listed, function in a number of ecological roles in the Yaquina system, primarily in the estuary. Some of these species are valuable as food items for important fish species. These organisms also act as indicators of the overall health of the ecosystem. In addition crayfish, bay mussels, and red rock crab are harvested recreationally.

The abundance, distribution and habitat preferences of these shellfishes are varied. Most are benthic, and the group as a whole tolerates a wide range of salinities.

Bag limits exist for many of these miscellaneous species. One person may take 100 crayfish per day at any time of year. The limit on mussels is 72 per day and they must be taken by hand or with a hand powered tool. The limit for red rock crab is 24 per day of any size or sex taken by any method legal for Dungeness crab. There is no limit on sand crabs, kelp worms, or turban snails but the limit on starfish, urchins, snails, and similar animals is 10 in aggregate.

A very small commercial fishery exists for crayfish.The fishery occurs from April 1 through October 31. Fishermen must use pots or traps and can keep crayfish that are 3 5/8 inches from tip of nose to end of tail or larger. No crayfish with eggs attached may be kept. Landings are recorded by county so exact landings for the Yaquina basin do not exist. In 1989 there were 652 lbs of crayfish landed in Lincoln County.

Policies

Operating Principle 1. Maintain the abundance of crayfish, mussels, and red rock crabs as well as other miscellaneous shellfish and invertebrates.

Assumptions and Rationale

1. Daily catch limits will prevent overharvest of those species harvested recreationally.

2. Estuarine habitat protection measures will help maintain the required habitat for these species.

3. The commercial fishery is self-limiting.

At this time we believe that there are no problems with management of these species.

ANGLER ACCESS

Background and Status

The majority of angling in the Yaquina basin occurs in Yaquina Bay, mainstem Yaquina River, mainstem Big Elk Creek, and in four lakes in the basin--Olalla, Mill Creek, Hamer, and Buttermilk lakes. Angling opportunities in Yaquina Bay and tidewater are accessible to both bank and boat anglers. Most angling above tidewater is from shore.

Access for bank angling and clamming in Yaquina Bay is good. Anglers can fish from the north and south ocean jetties, a public fishing pier and breakwater at South Beach, and a platform at the LNG plant on the north side of the bay (Figure 19). People seeking clams, ghost shrimp, or mud shrimp also have easy access to mud flats, although parking areas are limited.

Boat anglers and crabbers have good access to Yaquina Bay and tidewater. Seven ramps or slings exist from South Beach near the mouth to Elk City near the head of tidewater (Figure 19).

Boat anglers are limited above tidewater. River conditions are not condusive to fishing from driftboats and bankanglers are restricted by private property in the watershed. Bank anglers can obtain access to Big Elk Creek presently, but access along the Yaquina River above tidewater is extremely limited. Olalla Reservoir and Hamer Lake are easily accessed, Buttermilk Lake is accessible by private logging road, and Mill Creek Reservoir can be reached only by walking on a private road leading up to the reservoir or through private timberland above the reservoir.

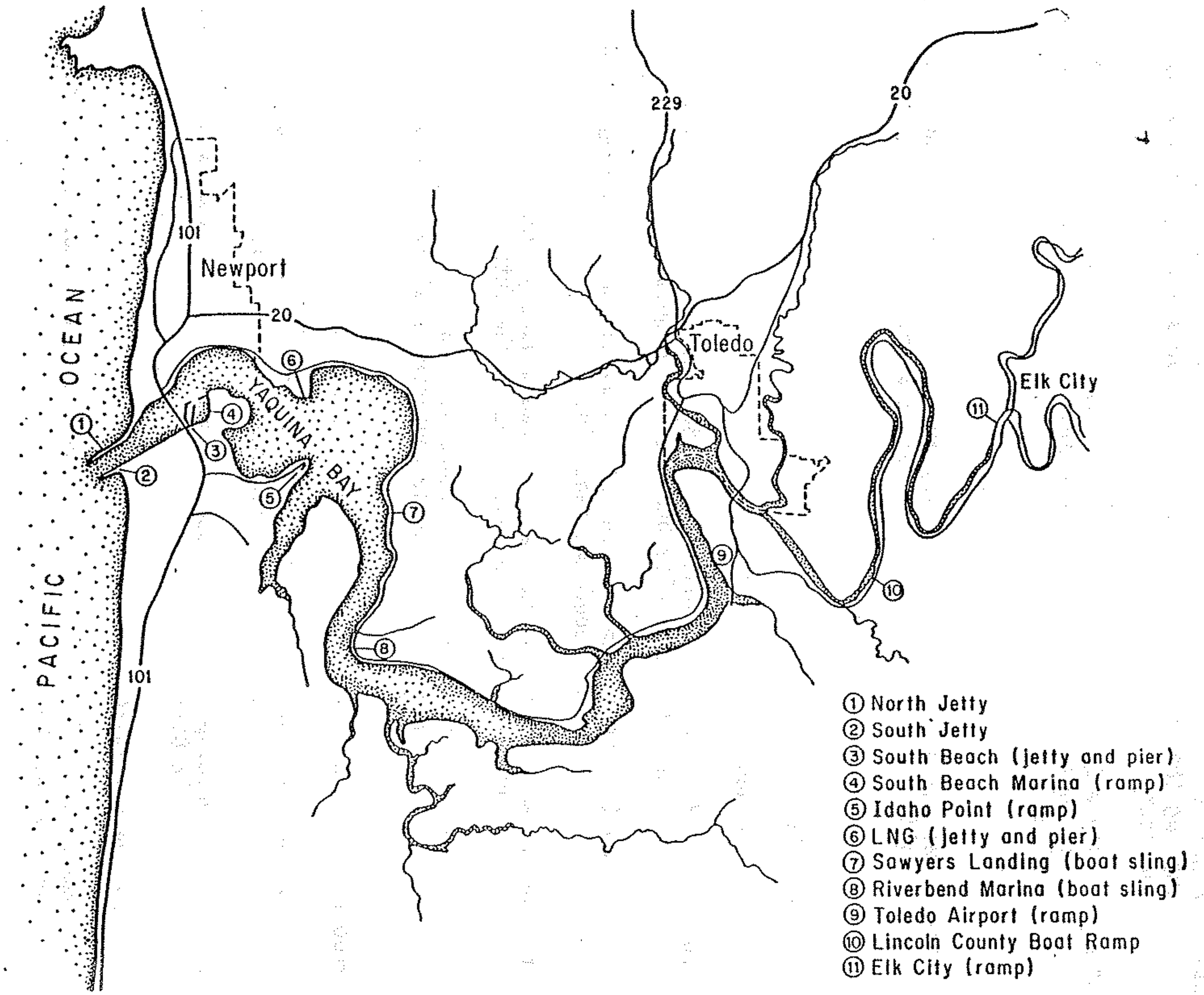

Figure 19. Major access sites for resource users in the Yaquina basin.

Policies

Operating Principle 1. ODFW will seek to provide access for boat and bank angling that will satisfy public need for a variety of angling opportunities.

Operating Principle 2. Aquisition and development of access sites will be consistent with guidelines and objectives for fish species and for habitat.

Objectives

Objective 1. Maintain and improve existing acccess sites in Yaquina Bay, tidewater regions, and along Big Elk Creek.

Assumptions and Rationale

1. Existing sites allow good access for anglers, crabbers, and clammers.

Problems and Recommended Actions

Problem 1. Parking areas along Yaquina Bay and Hwy 20, particularly at some sites near clam beds, are inadequate.

Action 1.1 Encourage improvement and expansion of parking areas where needed and feasible.

Problem 2. Access to Big Elk Creek is predominantly through private land and may become more restricted in the future.

Action 2.1 Encourage private landowners whose holdings border rivers or streams to continue to allow entry onto their land.

Problem 3. Access sites are not under jurisdiction of ODFW.

Action 3.1 Inform managing agency or private group of status of access sites and recommend improvements.

Objective 2. Develop additional access sites along the Yaquina River above Elk City.

Assumptions and Rationale

1. Additional access sites would allow increased opportunities for bank anglers and small boats.

Problems and Recommended Actions

Problem 1. Opportunities for developing bank access are limited.

Action 1.1 Explore all cooperative efforts between landowners and ODFW and negotiate with landowners to gain additional access and maintain or improve existing access. Include the use of incentives that encourage donation of sites.

Problem 2. Agencies other than ODFW control land and water development at some identified potential access sites.

Action 2.1 Work with other agencies to identify and develop access sites.

Problem 3. Funds are limited for purchasing or maintaining access sites.

Action 3.1 Work with angler groups to encourage donations of funds, access sites, or volunteer labor.

Implementation and Review

Once this plan is completed as a result of staff and public interaction and general public review, it will be considered at public hearing before the Oregon Fish and Wildlife Commission. Upon adoption by the Commission the policies and objectives will become Oregon Administrative Rules (OAR's). These OAR's will guide management until such time as those OAR's are changed. As conditions for the resources and the desires of the public change, and as new information is obtained, the plan must be responsive and evolve as well. The entire plan will be formally reviewed and revised every 10 years. Emergency changes in administrative rules can be made by the Commission in accordance with the Administrative Procedures Act when needed.

Progress made towards implementing the actions in the plan will be reported by the Department every 2 years. At that time implementation priorities will also be reexamined and adjustments made where necessary.

Priorities

The Yaquina Plan discusses many more actions than could be completed with existing budgets. Some parts of this plan are already on-going activities of ODFW, are part of the base budget, and only need to be continued or modified in some way. Other parts of the plan are new and need to be budgeted before they can be implemented. In order to achieve the objectives of this plan within ODFW's budgetary and staff limitations, priorities for funds and effort must be identified.

The priorities are organized into two groups. The first group contains general actions that may be common to more than one species and are given highest priority. The second group (Table 28) contains actions listed in priority order for each species.

The following are considered the highest priority actions for the Yaquina basin:

--Complete updated physical and biological surveys for the basin.

--Protect, restore, and improve the quality of freshwater and estuarine habitat.

--Collect baseline data on the cutthroat trout and steelhead populations.

--Ensure that all hatchery programs in the basin comply with the Wild Fish Management Policy.

The management priorities and their funding status for habitat, each of the species or species groups, angler access, and general management needs are listed in Table 28. These priorities are ranked on the basis of (1) the importance of the problem or objective, (2) the likelihood that the problem can be solved or substantial progress can be made during the next 6 years, and (3) availability of funding. The funding status is listed in Table 28 for each action. A "yes" in the currently funded column denotes that funding for that activity is presently budgeted at some level, but does not indicate the adequacy of the funding. This table will be reviewed and updated by ODFW staff and the public every 2 years to determine the funding and staffing priorities for the following biennium and to identify which problems will be approached through the budgeting process.

Table 28. Priority listing of actions for habitat, each species or species group, and angler access. Actions are listed in parentheses. Action numbers refer to the objective, problem, and action, respectively as found in Objectives pages for each section.

Action	Requires action by other agencies	Currently funded
HABITAT		
Update Physical and biological surveys to identify best opportunities to improve habitat. (Actions 4.1.1,4.1.2,4.1.3,4.2.1)	X	Partially
Improve interagency coordination for habitat protection and land-use planning.	X	Partially
Discourage land-use activities that will degrade habitat. (Actions 1.2.2, 2.2.2, 2.2.4, 3.2.1, 3.5.1, 3.4.1, 3.5.1)		Yes
Encourage landowners to maintain existing fish habitat. (Actions 1.1.1, 1.2.1, 2.2.3, 2.3.1, 3.1.1, 3.1.2, 3.1.3, 3.3.1, 3.3.2, 4.4.1, 4.4.2)		Partially
Promote activities that will increase or improve fish habitat. (Actions 2.1.1, 2.1.2, 2.2.1, 4.1.4, 4.3.1, 4.3.2, 4.3.3)		Partially
FALL CHINOOK SALMON (Alternative 1)		
Monitor adult escapement. (Action 1.1.2)		Yes
Collect baseline data on juvenile recruitment. (Action 1.1.1)		No

Table 28. Continued.

Action	Requires action by other agencies	Currently funded
COHO SALMON (Alternative 2)		
Mark hatchery fish to allow identification in fisheries and on spawning grounds. (Actions 1.1.1, 3.3.1, 3.3.2)	X	No
Monitor spawning populations for abundance of wild fish and strays from hatchery releases. (Actions 1.4.1, 2.3.1, 3.1.1)		Yes
Measure current production potential and design programs to increase production. (Actions 1.2.1, 1.2.2, 1.2.3)		Partially
Ensure that hatchery programs comply with the Wild Fish Management Policy. (Actions 2.3.1, 2.3.2, 3.2.1)		Partially
Estimate recreational catch. (Actions 2.1.1, 2.2.1)		No
CHUM SALMON (Alternative 1)		
Monitor adult escapement. (Action 1.2.1)		Yes
Maintain habitat quality and quantity. (Action 1.1.1)		Partially
WINTER STEELHEAD (Alternative 2)		
Improve the inventory base for juvenile and adult steelhead. (Actions 1.1.1, 1.1.2, 1.1.3, 1.2.1, 1.4.1, 2.1.2)		No
Conduct habitat use surveys, design and implement habitat projects to increase production. (Actions 1.3.1, 1.3.2, 1.3.3, 1.3.4)		No
Conduct a creel survey to estimate size and hatchery/wild composition of catch. (Action 3.1.2)		Partially

Table 28. Continued.

Action	Requires action by other agencies	Currently funded
WINTER STEELHEAD (continued)		
Design a hatchery program that complies with the Wild Fish Management Policy. (Actions 2.1.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4)		No
CUTTHROAT TROUT		
Improve the inventory base for the cutthroat trout population. (Action 1.1.1)		No
Determine the life history of the local population. (Action 1.2.1)		No
Conduct creel surveys to determine size and life history parameters of catch. (Action 2.1.1, 2.2.1)		Partially
WHITE AND GREEN STURGEON		
Monitor recreational catch through sturgeon punchcards or an angler logbook program.		Partially
MARINE AND ESTUARINE FISH AND SHELLFISH		
Monitor recreational and commercial catch.		Partially
Monitor clam recruitment.		Yes
Increase public awareness of utilization of and regulations for estarine species.		Partially
Encourage research involving estuarine species.	X	No

Table 28. Concluded.

Action	Requires action by other agencies	Currently funded
ANGLER ACCESS		
Maintain, improve, and increase access on private and public land. (Actions 1.2.1, 1.3.1, 2.1.1, 2.2.1)	X	Partially
Increase parking in the bay area. (Action 1.1.1)	X	No
Encourage the public to donate funds, sites, or labor to improve access. (Action 2.1.1, 2.3.1)		No

REFERENCES

Akins, G.J. and C.A. Jefferson. 1973. Coastal wetlands of Oregon. Coastal Conservation and Development Commission. Corvallis, Oregon.

Anderson, G.J., M.B. Miller, K.K. Chew. 1982. A guide to Manila clam aquaculture in Puget Sound. University of Washington Sea Grant College Program, WSG 82-4, Seattle.

Armstrong, D.A., T.C. Wainwright, J. Orensanz, P.A. Dinnel, and B.R. Dumbauld. 1987. Model of dredging impact on Dungeness crab in Grays Harbor, Washington. University of Washington School of Fisheries, Fisheries Research Institute, FRI-UW-8702, Seattle.

Bajkov, A.D. 1949. A preliminary report on the Columbia River Sturgeon. Fish Commission of Oregon, Fish Commission Research Briefs, Volume 2 Number 2. Portland, Oregon.

Beardsley, A.J. 1969. Movement and angler use of four foodfishes in Yaquina Bay, Oregon. Doctoral dissertation, Oregon State University, Corvallis.

Beidler, W.M. and T.E. Nickelson. 1980. An evaluation of the Oregon Department of Fish and Wildlife standard fish survey system for coho salmon. Oregon Department of Fish and Wildlife, Information Reports (Fish) 80-9, Portland, Oregon.

Berry, R. 1981. Salmon and steelhead sport catch statistics 1971-1980. Oregon Department of Fish and Wildlife, Processed Report, Portland.

Bottom, D.L., P.J. Howell, and J.D. Rodgers. 1985. The effects of stream alterations on salmon and trout habitat in Oregon. Oregon Department of Fish and Wildlife. Portland, Oregon.

Brodeur, R.D., and W.G. Pearcy. 1986. Distribution and relative abundance of pelagic nonsalmonid nekton off Oregon and Washington, 1979-84. National Marine Fisheries Service, NOAA Technical Report NMFS 46, Seattle.

Brodeur, R.D., H.V. Lorz, and W.G. Pearcy. 1987. Food habits and dietary variability of pelagic nekton off Oregon and Washington, 1979-1984. National Marine Fisheries Service, NOAA Technical Report NMFS 57, Seattle, Washington.

Buell, J.W. and R.L. Kruger. 1988. Oregon coastal coho salmon surveys 1987-88 season. Data Report for Lincoln Fisheries District. Buell & Associates, Inc., Beaverton, Oregon.

Bureau of Government Research and Service. 1969. Central Oregon Coast Volume I, Physical Conditions and Present Development (A-6).

Burt, W.V. and W.B. McAlister. 1959. Recent studies in hydrography of Oregon estuaries. Research Briefs, Fish Commission of Oregon. Portland.

Castle, D., B. Eddleman, M. Hughes, R. Hughes, and P. Thomson. 1979. Yaquina Bay 1778-1978. Old Town Printers, Waldport, Oregon. -or-The Lincoln County Historical Society, Newport, Oregon.

Chapman, D.W. 1958. Studies on the life history of Alsea River steelhead. Journal of Wildlife Management 22(2):123-134.

Chapman, D.W. 1962. Aggressive behavior in juvenile coho salmon as a cause of emigration. Journal of the Fisheries Research Board of Canada 19:1047-1080.

Cleaver, F.C. 1951. Fisheries statistics of Oregon. Oregon Fish Commission, Contribution Number 16. Portland, Oregon.

Cummings, T.E. 1987. Private salmon hatcheries in Oregon. Oregon Department of Fish and Wildlife. Portland, Oregon.

Eden, M. and D. Swartz. Salmon and steelhead sport catch statistics 1975-1984. Oregon Department of Fish and Wildlife, Processed Report, Portland.

Franklin, J.F. and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. United States Department of Agriculture Forest Service General Technical Report PNW-8.

Gaumer, T., D. Demory, L. Osis, amd C. Walters. 1974. 1970-71 Yaquina Bay resource use study. Fish Commission of Oregon, Division of Management and Research, Portland.

Gharrett, J.T. and J.I. Hodges. 1950. Salmon fisheries of the coastal rivers of Oregon south of the Columbia. Oregon Fish Commission, Contribution Number 13. Portland, Oregon.

Giger, R.D. 1972. Ecology and management of coastal cutthroat trout in Oregon. Oregon State Game Commission, Fishery Research Report Number 6, Project F-72-R, Corvallis.

Gnose, C.E. 1968. Ecology of the striped seaperch, Embiotoca lateralis, in Yaquina Bay, Oregon. Masters thesis, Oregon State University, Corvallis.

Goetze, B.R. 1988. Contextual systems description of an Oregon coastal watershed. Doctoral dissertation, Oregon State University. Corvallis, Oregon.

Hancock, D.R., T.F. Gaumer, G.B. Willege, G.P. Robart, and J. Flynn. 1979. Subtidal clam populations: Distribution, abundance, amd ecology. Oregon State University, Sea Grant College Program, publication number ORESU-T-79-002, Corvallis.

Hankin, D.G., N. Diamond, M. Mohr, and J. Ianelli. 1985. Molt increments, annual molting probabilities, fecundity and survival rates of adult female Dungeness crabs in northern California. Pages 189-208 in B.R. Melteff, symposium coordinator. Proceedings of the symposium on Dungness crab biology and management. University of Alaska, Alaska Sea Grant Report 85-3, Fairbanks.

Hart, J.L. 1973. Pacific fishes of Canada. Fisheries Research Board of Canada, Bulletin 180. Ottawa, Ontario.

Hartman, G.F. 1965. The role of behavior in the ecology and interaction of underyearling coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 22:1035-1081.

Hartt, A.C., and M.B. Dell. 1986. Early oceanic migrations and growth of juvenile Pacific salmon and steelhead trout. International North Pacific Fisheries Commission, Bulletin Number 46, Vancouver, British Columbia.

Henry, K.A. 1953. Age and growth of Tillamook Bay chum salmon (*Oncorhynchus keta*). Oregon Fish Commission, Contribution Number 18. Portland, Oregon.

Hess, S.S. 1984. Age and growth of white sturgeon in the lower Columbia River 1980-83. Oregon Department of Fish and Wildlife. Portland, Oregon.

Hoffnagel, J. and 10 others. 1976. A comparative study of salt marches in the Coos Bay estuary. National Science Foundation.

Jacobs, S.E. 1988. Fishery contribution of coho salmon released from Oregon coastal private hatcheries. Oregon Department of Fish and Wildlife, Portland.

Jacobs, S.E. 1988. Straying in Oregon by adult salmon of hatchery origin, 1985. Oregon Department of Fish and Wildlife Information Report Number (Fish) 88-5, Portland.

Johnson, K. 1983. A history of coho fisheries and management in Oregon through 1982. Oregon Department of Fish and Wildlife Information Report (Fish) 84-12, Portland.

Kenaston, K.R. 1989. Estimated run size of winter steelhead in Oregon coastal streams, 1980-85. Oregon Department of Fish and Wildlife Information Report (Fish) 89-1, Portland.

Kenaston, K.R., and N.M. MacHugh. 1983. Steelhead production factors. Oregon Department of Fish and Wildlife, Fish Research Project 2-4-0-740-10, Portland.

Kenaston, K.R., and N.M. MacHugh. 1986. Coastal steelhead production factors. Oregon Department of Fish and Wildlife, Fish Research Project F-120-R, Portland.

Ledgerwood, E. and J.L. Reynolds. 1936. Report on "Yaquina River". Oregon State Fish Commission.

Loch, J.J. and D.R. Miller. 1988. Distribution and abundance of sea-run cutthroat captured in and adjacent to the Columbia River plume. Northwest Science 62(1):41-48.

Lowry, G.R. 1964. Movement of cutthroat trout, *Salmo clarki clarki* (Richardson), in three Oregon coastal streams. Transactions of the American Fisheries Society 94(4):334-338.

Lowry, G.R. 1966. Production and food of cutthroat trout in three Oregon coastal streams. Journal of Wildlife Management 30(4):754-767.

McGie, A.M. 1983. Salmon spawning surveys and straying of private hatchery coho salmon from Yaquina Bay in coastal watersheds of Oregon, 1982. Oregon Department of Fish and Wildlife, Processed Report, Portland.

McGie, A.M. 1984. Oregon coastal salmon spawning surveys and straying of private hatchery coho salmon from Yaquina and Coos bays, 1983. Oregon Department of Fish and Wildlife, Processed Reports, Charleston.

McGie, A.M. 1984. Oregon coastal salmon spawning surveys and straying of private hatchery coho salmon from Yaquina and Coos bays, 1984. Oregon Department of Fish and Wildlife, Processed Reports, Charleston.

McGuire, H.D. 1896. Third and fourth annual reports of the state fish and game protector of the state of Oregon. Salem.

Morgan A.R., R. N. Breuser, K.A. Henry, and R.A. Willis. 1952. Salmon catch by the sport fishery on certain coastal rivers, 1951 and 1952. Fish Commission of Oregon, Processed Reports.

Moring, J.R. and R.L. Lantz. 1975. The Alsea watershed study: effects of logging on the aquatic resources of three headwater streams of the Alsea River, Oregon. Part I - biological studies. Oregon Department of Fish and Wildlife, Fishery Research Report Number 9, Federal Aid to Fish Restoration Project AFS-58, Corvallis.

Mullen, R.E. 1981. Oregon's commercial harvest of coho salmon, *Oncorhynchus kisutch* (Walbaum), 1892-1960. Oregon Department of Fish and Wildlife Information Report (Fish) 81-3, Portland.

Myers, K.W.W. 1980. An investigation of the utilization of four study areas in Yaquina Bay, Oregon, by hatchery and wild juvenile salmonids. Masters thesis, Oregon State University, Corvallis.

Nicholas, J.W. and D. G. Hankin. 1988. Chinook salmon Populations in Oregon coastal river basins: Description of life histories and assessment of recent trends in run strengths. Oregon Department of Fish and Wildlife, Information reports (Fish) 88-1. Oregon State University Agricultural Communications, Corvallis.

Oregon Department of Fish and Wildlife. 1977. Annual report of fisheries. Oregon Department of Fish and Wildlife, Portland.

Oregon Department of Fish and Wildlife. 1986. Steelhead management plan. Oregon Department of Fish and Wildlife, Portland.

Oregon Department of Fish and Wildlife. 1987. Trout plan. Oregon Department of Fish and Wildlife, Portland.

Oregon Department of Fish and Wildlife. 1989. Salmon and steelhead sport catch statistics 1975-1987. Processed Report, Portland.

Oregon State Water Resources Board. 1965. Mid-coast basin. Salem.

Osis, L. 1987. Yaquina Bay salmon creel census, 1986. Oregon Department of Fish and Wildlife, preliminary report. Newport.

Pearcy, W.G., and K. Masuda. 1982. Tagged steelhead trout (*Salmo gairdneri* Richardson) collected in the North Pacific by the Oshoro-Maru, 1980-1981. Bulletin of the Faculty of Fisheries, Hokkaido University 33(4):249-254.

Percy, K.L., C. Sutterlin, D.A. Bella, and P.C. Klingeman. 1974. Description and information sources for Oregon's estuaries. Oregon State University Sea Grant Program. Corvallis, Oregon.

Schlicker, H.G., R.J. Deacon, G.W. Olcott, and J.D. Beaulieu. 1973. Environmental geology of Lincoln County. Oregon State Department of Geology and Mineral Industries, Bulletin 81.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin 184. Ottawa, Ontario.

Smith, A.K. and J.E. Lauman. 1972. Fish and wildlife resources of the middle coast basin, Oregon, and their water requirements (revised). Oregon State Game Commission, Federal Aid to Fish Restoration, Completion Report, Project F-69-R-8, Job 15, Portland.

Smith, H.S. 1956. Fisheries Statistics of Oregon. Fish Commission of Oregon, Contribution Number 22. Portland.

Stein, R.A., P.E. Reimers, and J.D. Hall. 1972. Social interaction between juvenile coho (*Oncorhynchus kisutch*) and fall chinook salmon (*Oncorhynchus tschawytscha*) in Sixes River, Oregon. Journal of the Fisheries Research Board of Canada 29:1737:1748.

Sumner, F.H. 1962. Migration and growth of the coastal cutthroat trout in Tillamook County, Oregon. Transactions of the American Fisheries Society 91:77-83.

United States Army Corps of Engineers. 1970. Yaquina River and tributaries, Oregon. Portland, Oregon.

United States Army Corps of Engineers. 1975. Final environmental impact statement, operation and maintenance of the channels and breakwaters in Yaquina Bay and River. Portland, Oregon.

Van Dusen, H.G. 1907. Annual reports of the Department of Fisheries of the state of Oregon. Department of Fisheries, Salem, Oregon.

Wagner, H.H. 1974. Photoperiod and temperature regulation of smolting in steelhead trout (*Salmo gairdneri*). Canadian Journal of Zoology 52:219-234.

Wares, P.G. 1971 Biology of the pile perch (*Rhocochilus vacca*) in Yaquina Bay, Oregon. United States Bureau of Sport Fisheries and Wildlife, Technical Paper 57. Washington D.C.

APPENDIX A

Fish and Shellfish Included in this Plan

FISH SPECIES

Table 1. Fish species occurring in the Yaquina River basin.

Common name	Scientific name
Lampreys	Petromyzontidae
Pacific lamprey	*Lampetra tridentata*
River lamprey	*Lampetra ayresi*
Western brook lamprey	*Lampetra richardsoni*
Dogfish sharks	Squalidae
Spiny dogfish	*Squalus acanthias*
Skates	Rajidae
Big Skate	*Raja binoculata*
Sturgeons	Acipenseridae
Green sturgeon	*Acipenser medirostris*
White sturgeon	*Acipenser transmontanus*
Herrings	Clupeidae
American shad	*Alosa sapidissima*
Pacific herring	*Clupea harengus pallasi*
Anchovies	Engraulidae
Northern anchovy	*Engraulis mordax*
Trouts	Salmonidae
Pink salmon	*Oncorhynchus gorbuscha*
Chum salmon	*Oncorhynchus keta*
Coho salmon	*Oncorhynchus kisutch*
Chinook salmon	*Oncorhynchus tshawytscha*
Cutthroat trout	*Oncorhynchus clarki*
Steelhead	*Oncorhynchus mykiss*
Smelts	Osmeridae
Whitebait smelt	*Allosmerus elongatus*
Surf smelt	*Hypomesus pretiosus*
Rainbow smelt	*Osmerus mordax*
Night smelt	*Spirinchus starksi*
Longfin smelt	*Spirinchus thaleichthys*
Eulecon	*Thaleichthys pacificus*

Table 1. Continued

Common name	Scientific name
Carps and minnows	Cyprinidae
Longnose dace	*Rhinichthys cataractae*
Speckled dace	*Rhinichthys osculus*
Redside shiner	*Richardsonius balteatus*
Bullhead catfishes	Ictaluridae
Brown Bullhead	*Ictalurus nebulosus*
Clingfishes	Gabiesocidae
Northern clingfish	*Gobiesox maeandricus*
Killifishes	Cyprinodontidae
Rainwater killifish	*Lucanis parva*
Codfishes	Gadidae
Pacific tomcod	*Microgadus proximus*
Silversides	Atherinidae
Topsmelt	*Atherinops affinis*
Jacksmelt	*Atherinopsis californiensis*
Stickelbacks	Gasterosteidae
Tube-snout	*Aulorhynchus flavidus*
Threespine stickleback	*Gasterosteus aculeatus*
Pipefishes	Syngnathidae
Bay pipefish	*Syngnathus leptorhynchus*
Surfperches	Embiotocidae
Redtail surfperch	*Amphistichus rhodoterus*
Shiner perch	*Cymatogaster aggregata*
Striped seaperch	*Embiotoca lateralis*
Walleye surfperch	*Hyperprosopon argenteum*
Silver surfperch	*Hyperprosopon ellipticum*
Sharpnose seaperch	*Phanerodon atripes*
White seaperch	*Phanerodon furcatus*
Pile perch	*Rhacochilus vacca*
Sandfishes	Trichodontidae
Pacific sandfish	*Trichodon trichodon*
Prickelbacks	Stichaeidae
High cockscomb	*Anoplarchus purpurescens*
Monkeyface pricklebach	*Cebidichthys violaceus*
Snake prickleback	*Lumpenus sagitta*
Ribbon prickleback	*Phytichthys chirus*

Table 1. Continued.

Common name	Scientific name
Gunnels	Pholidae
Penpoint gunnel	*Apodichthys flavidus*
Saddleback gunnel	*Pholis ornata*
Wolffishes	Anarhichadidae
Wolf-eel	*Anarrhichthys ocellatus*
Wrymouths	Cryptacantodidae
Giant wrymouth	*Delolepis gigantea*
Sand lance	Ammodytidae
Pacific sand lance	*Ammodytes hexapterus*
Gobies	Gobiidae
Arrow goby	*Clevelandia ios*
Blackey goby	*Coryphopterus nicholsi*
Bay goby	*Lepidogobius lepidus*
Scorpionfishes	Scorpaenidae
Copper rockfish	*Sebastes caurinus*
Splitnose rockfish	*Sebastes diploproa*
Yellowtail rockfish	*Sebastes flavidus*
Black rockfish	*Sebastes melanops*
Vermilion rockfish	*Sebastes miniatus*
Blue rockfish	*Sebastes mystinus*
Tiger rockfish	*Sebastes nigrocinctus*
Bocaccio	*Sebastes paucispinis*
Canary rockfish	*Sebastes pinniger*
Grass rockfish	*Sebastes rastrelliger*
Sablefishes	Anoplopomatidae
Sablefish	*Anoplopoma fimbria*
Greenling	Hexagrammidae
Kelp greenling	*Hexagrammos decagrammus*
Rock greenling	*Hexagrammos lagocephalus*
Whitespotted greenling	*Hexagrammos stelleri*
Lingcod	*Ophiodon elongatus*
Painted greenling	*Oxylebius pictus*

Table 1. Concluded.

Common name	Scientific name
Sculpins	Cottidae
Padded sculpin	*Artedius fenestralis*
Smoothhead sculpin	*Artedius lateralis*
Rosylip sculpin	*Ascelichthys rhodorus*
Silverspotted sculpin	*Blepsias cirrhosus*
Sharpnose sculpin	*Clinocottus acuticeps*
Mosshead sculpin	*Clinocottus globiceps*
Coastrange sculpin	*Cottus aleuticus*
Prickly sculpin	*Cottus asper*
Buffalo sculpin	*Enophrys bison*
Red Irish lord	*Hemilepidotus hemilepidotus*
Brown Irish lord	*Hemilepidotus spinosus*
Pacific staghorn sculpin	*Leptocottus armatus*
Tidepool sculpin	*Oligocottus maculosus*
Fluffy sculpin	*Oligocottus snyderi*
Cabezon	*Scorpaenichthys marmoratus*
Poachers	Agonidae
Tubenose poacher	*Pallasina barbata*
Snailfishes	Cyclopteridae
Tidepool snailfish	*Liparis florae*
Ringtail snailfish	*Liparis rutteri*
Lefteye flounders	Bothidae
Speckled sanddab	*Citharichthys stigmaeus*
Righteye flounders	Pleuronectidae
Slender sole	*Lyopsetta exilis*
English sole	*Parophrys vetulus*
Starry flounder	*Platichthys stellatus*
C-O sole	*Pleuronichthys coenosus*
Sand sole	*Psettichthys melanostictus*

Table 2. Key invertebrate species occurring in the Yaquina River basin.

Common name	Scientific name
Clams, mussels, and oysters	Bivalvia
Pea pod borer	*Adula californiensis*
Basket cockle	*Clinocardium nuttallii*
Pacific oyster	*Crassostrea gigas*
False mya	*Cryptomya californica*
Nestling saxicave	*Hiatella arctica*
Baltic Macoma clam	*Macoma balthica*
Irus clam	*Macoma inquinata*
Bentnose clam	*Macoma nasuta*
Freshwater mussel	*Margaritifera margaritifera*
Soft-shell clam	*Mya arenaria*
Bay mussel	*Mytilus edulis*
Native oyster	*Ostrea lurida*
Common piddock	*Penitella penita*
Native littleneck clam	*Protothaca staminea*
Butter clam	*Saxidomus giganteus*
Northern razor clam	*Siliqua patula*
Jacknife clam	*Solen sicarius*
Manila littleneck clam	*Tapes philippinarum*
Bodega tellen	*Tellina bodegensis*
Gaper clam	*Tresus capax*
Rough piddock	*Zirfaea pilsbryi*
Crustaceans	Crustacea
Crabs and shrimps	Decapoda
Ghost shrimp	*Callianassa californiensis*
Dungeness crab	*Cancer magister*
Red rock crab	*Cancer productus*
Alaskan gray shrimp	*Crangon alaskensis*
Common gray shrimp	*Crangon franciscorum*
Bay shrimp	*Crangon nigricauda*
Sand shrimp	*Crangon stylirostris*
Hairy shore crab	*Hemigrapsus oregonensis*
Lined shore crab	*Pachygrapsus crassipes*
Native crayfish	*Pacifastacus leniusculus*
Japanese shrimp	*Palaemon macrodactylus*
Kelp crab	*Pugettia producta*
Mud shrimp	*Upogebia pugettensis*