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UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

CLARENCE F. PAUTZKE, COMMISSIONER



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FISH AND WILDLIFE
OF
YAQUINA BAY
OREGON

A SPECIAL REPORT
ON
A PRELIMINARY SURVEY

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Clarence F. Pautzke, Commissioner

PRELIMINARY SURVEY
of
FISH and WILDLIFE
IN RELATION TO THE
ECOLOGICAL and BIOLOGICAL
ASPECTS
of
YAQUINA BAY
OREGON

Portland, Oregon
November, 1968



Yaquina Bay at an extreme low tide. This photograph graphically illustrates that Yaquina Bay-Estuary is a drowned river valley. Sallys Bend is on the left. King Slough and a part of South Beach are on the right. The dark areas on the tideflats are eelgrass beds. 1965 photo.

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INTRODUCTION

This is a special Bureau of Sport Fisheries and Wildlife report of a preliminary survey of fish and wildlife resources in relation to the ecological and biological aspects of Yaquina Bay-Estuary, Oregon.

The purpose of this report is to: (1) describe some biological and physiographical parameters of Yaquina Bay-Estuary and provide economic measures of some of the fish and wildlife resources that are dependent upon such parameters; (2) indicate areas important to various species of fish and wildlife; (3) describe factors affecting fish and wildlife resources and outline specific studies that should be completed before adequate appraisal can be made of the impact man's activities could have on fish and wildlife resources or their habitat; and (4) encourage coordinated planning and development of Yaquina Bay consistent with its natural resources.

The information contained in this report would be useful during project investigations being conducted under the authority of the Fish and Wildlife Coordination Act and the Memorandum of Understanding between the Secretary of the Interior and the Secretary of the Army dated July 13, 1967. Projects being investigated and formulated include the Corps of Engineers' Yaquina River navigation improvement project upstream from Newport to the vicinity of Toledo; the South Jetty extension, Yaquina Bay and Harbor; and continuing maintenance of existing Federal projects at Yaquina Bay, Oregon. This information could be used as supplementary material regarding applications for Department of the Army permits and by local planning groups.

Numerous conservation organizations and private citizens have expressed grave concern, at recent public hearings over the destruction of estuarine areas which provide critical habitat for a major portion of the marine sport and commercial fisheries, waterfowl, and other wildlife resources of the nation. Public Law 90-454 - estuarine protection act - was passed by the 90th Congress as a result of local, State, and National concern.

Treaties with Great Britain (for Canada) and Mexico provide for the protection and utilization of migratory birds for the purpose of sport, as well as food, commerce, and industry.

This report is a first step in designing a coordinated comprehensive plan for the development and management of Yaquina Bay. The objective of this plan would be to provide for the orderly development and management of this bay, consistent with the protection and enhancement of its valuable natural resources and environment for their educational, recreational, esthetic, scientific, and economic contributions.

The Bureau of Sport Fisheries and Wildlife, in cooperation with the Fish Commission of Oregon and the Oregon State Game Commission, collected data regarding the fish and wildlife resources of Yaquina Bay, and investigated some of the effects that dredging and filling of marsh, tide, and submerged lands and the introduction of industrial or domestic wastes can have on fish and wildlife resources or their habitat. Information supplied by the Federal Water Pollution Control Administration, Oregon State Sanitary Authority, Oregon State Board of Health, Oregon State Division of Lands, and Oregon State University's Marine Science Center was used in this preliminary survey. These agencies reviewed this report.

The Fish Commission of Oregon and the Oregon State Game Commission have endorsed this report and recommendations as indicated by the attached letters--that of October 17, 1968, from Assistant Director C. A. Weberg, Fish Commission of Oregon, and that of October 21, 1968, from Director P. W. Schneider, Oregon State Game Commission. A letter of comment from the Oregon State Division of Lands also is appended.

The Oregon State Division of Lands suggests in its letter that mean low water and mean high water line be ascertained by survey and required in proving valid title. This letter also indicates that owners of bay lands or under-water soils are subject to public rights of commerce, navigation, and fishing. Therefore, the right to control both land and water is deemed a public right, the control of which cannot be surrendered, alienated, or delegated except for some public purpose or some reasonable use which can fairly be said to be for a public benefit.

The Federal Water Pollution Control Administration in its comments on this report suggested the following:

"Contamination of aquatic life . . . is described in the most general terms This page could be improved by expansion and clarification. It would help to identify the waste sources contributing to the estuary. There are sources of water quality problems in addition to those listed. For example, land management practices have been largely responsible for gross siltation damage of oyster and other shellfish beds, particularly during the 1964-65 flood. Accidental oil spills from damaged barges have occurred in the past. Accidental discharges from the Georgia-Pacific mill at Toledo plus chronic contamination from fibers cause low dissolved oxygen problems.

"Recommendations that should also be considered if the report is broadened to include activities adversely affecting fish and wildlife are:

1. Correction of land management practices for reduction of siltation.

2. Construction of emergency holding tanks, by the Port Commission, for discharge of liquid cargoes from damaged vessels.
3. Implementation of water quality standards by the State and Federal Government for control of pollution at its source."

We endorse the recommendations of the Federal Water Pollution Control Administration.

The Regional Solicitor in his letter of comment on this report stated:

". . . anyone interested in proposed fills of tide or submerged lands of the Yaquina Bay should be required to show a valid title to the lands to be filled and an exact survey of them. Regardless of the source of title to tidelands, the owners thereof hold such title subject to the public rights of commerce, navigation, and fishing derived from English common law and the Oregon Admission Act requiring that the navigable waters of the state forever remain free and open to all citizens and occupants of the state. The extent to which these rights of the public for commerce, navigation, and fishing may be impaired by alterations of the tidelands and submerged lands of Yaquina Bay by private owners for private uses is the subject of considerable legal debate, and court adjudications may be required to determine their exact scope. In the meantime, an applicant for a Department of Army permit to fill bay lands should be required to show, in addition to the showing of ownership, either that the public interest does not extend to his lands, or that the filling thereof would not unreasonably impair the public interest."

Regarding those uses or occupancies of navigable waters that may be unreasonable:

". . . because they pollute, or because they offend our sense of aesthetics or natural beauty, or because they interfere with the right of the public to enjoy a natural resource of national significance, or because they threaten in a harmful way to upset the ecological balance of nature, or simply -- if you please -- because to permit the occupancy would confer a valuable privilege without either necessity therefor or a fair return to the public in whose name the privilege would be bestowed. Stating the matter somewhat differently, it is the applicant who must establish that the public interest will be served by bestowing this privilege."

Government agencies have a duty to protect the rights of the public.

The Bureau of Commercial Fisheries concurred in those aspects of the report concerning fishes of commercial importance or the habitat upon which they depend.

Part I

SOME ECOLOGICAL AND BIOLOGICAL ASPECTS OF YAQUINA BAY-ESTUARY

YAQUINA BAY-ESTUARY AS AN ECOSYSTEM

Yaquina Bay is located in Lincoln County, Oregon. For this report, a bay-estuary is defined as a semi-enclosed body of water which has a free connection with the open sea and within which ocean water is measurably diluted with fresh water derived from land drainage. This ecosystem includes the surrounding landscape with its plants and animals, towns and industrial complexes, and the associated ocean and atmosphere.

Physiography

Yaquina Bay-Estuary would be defined as a drowned river valley. It extends inland about 23 river miles although its fresh water head is only about 10 miles east of the Pacific Ocean. Basin drainage area is about 250 square miles. Yaquina Bay contained about 2,850 ^{1/} acres at mean high tide in 1958. It now contains about 2,700 acres at mean high tide (Plate I), while at mean lower low water it contains about 1,110 acres. About 1,590 acres of tideflats are exposed at this tide stage. Approximately 150 acres of the bay have been filled in since 1958.

Temperatures and salinities in the bay fluctuate more widely than those in the nearby ocean. For example, at the recording station located at the Oregon State University Marine Science Center intake, about river mile 1, bottom temperatures vary between 46.6° F. and 64.4° F., ^{2/} while salinities vary between 8.6 and 34.7 ^{2/} parts per thousand. At another recording station located near river mile 6 at the Oregon Oyster Company Dock, surface temperatures vary between 36° F. ^{2/} and 71° F., while salinities vary between 0 and 33.8 ^{3/} parts per thousand. Such wide ranges of salinity and temperature tend to increase the types of habitat available and permit a greater variety of species to become established than does the nearby ocean.

^{1/} The Bay Clams of Oregon, Educational Bulletin No. 2, Fish Commission of Oregon

^{2/} 1965 Marine Science Center data

^{3/} 1966-67 " " " "

Water Movements

The waters of Yaquina Bay are particularly favored by strong natural forces, causing excellent circulation in most areas. These forces include tides, runoff from land, and mixing by wind. Such circulation transports food to natural communities, removes natural wastes, renews mineral nutrients, maintains high levels of dissolved oxygen, and aids dispersal of eggs and larvae of aquatic organisms. In general, the system is well mixed from June through October, while it alternates between well mixed to partly mixed from November through May. During periods of heavy stream runoff, a considerable amount of fresh water can be found in the upper estuary.

Productivity of a Bay-Estuary

The basis of productivity is plant photosynthesis, wherein inorganic materials are combined by action of sunlight on chlorophyll to produce the organic matter of phytoplankton and higher plants.

Plant productivity is more directly related to surface area than to volume of the environment since photosynthesis, activated by sunlight, is a function of area. This is particularly important in turbid bay waters where illumination decreases rapidly with depth. In Yaquina Bay, this productivity occurs primarily at depths of less than 3 feet.

The most important group of plants contributing to primary productivity is the phytoplankton, such as free-floating, microscopic algae. Other algae, such as kelps, and submergent higher plants are probably of less general significance but are important in some particular locations. The algae growing on the mud tideflats is an important plant community. This community harbors many small crustaceans, including amphipods and isopods. These small crustaceans, occurring in immense numbers, are important to fish production, and together with the various types of shrimps, they constitute a large part of the food utilized by most of the valuable quality and quantity fishes supporting both inshore and offshore fisheries.

Animal matter, secondary productivity consisting of crustaceans, clams, and other herbivores, feeds on the plant base, and in turn is preyed upon by fish and other carnivores, thereby transferring energy and material through the food chain.

Observations in this area indicate that zooplankton, a diet element of young fishes, is present in greatest abundance where salinity ranges from 15 to 30 parts per thousand.

Dead plant and animal materials from the marsh and tidal communities are decomposed by microbial and scavenging components of these communities. The released nutrients and undecomposed organic materials are distributed by the tide throughout the estuarine community.

The Importance of Marshes and Intertidal Lands

The general productivity of an estuarine area is closely related to the ratio of the shoreline length to water area--the longer the shoreline per unit of water area, the greater the potential or actual biological productivity. In areas in which favorable ratios occur, not only is vegetative productivity favored, but a large, greatly cut-up, sheltered, food rich habitat, which is primarily a nursery area for many species of crustaceans and fishes, also is provided. In addition, the tides affect vegetative growth by decreasing or increasing the exposure of the microscopic mud algae and marsh plants and the quantity of phytoplankton that is favorably exposed to sunlight as the volume of water changes over the marshes and tidelands. Therefore, the length of the land-water boundary and the area and depth of the water are important factors in the productivity of an estuary.

The Eelgrass Community

Eelgrass comprises an important plant community on the intertidal lands of Yaquina Bay. This community provides an environment for numerous species of crustacea that are food for many species of fish and wildlife. Evidence collected during seining and trawling operations performed while conducting specific life history studies indicates that eelgrass areas in Sallys Bend support many more young-of-the-year fishes than do adjacent sand areas. These observations are supported by direct observations employing SCUBA. In addition, there appears to be a direct relationship between the presence of eelgrass and the abundance of gaper clams on the intertidal areas.

Eelgrass is a basic diet element for black brant that migrate through or winter here. In general, eelgrass occurs throughout the bay. Plate II indicates the location of moderate to dense stands of eelgrass.

The density of a stand of eelgrass changes from year to year, as well as seasonally. During a long growing season with favorable temperature conditions, 10° C. to 20° C. (50° F. to 68° F.), vigorous growth of turions, leaves, and reproductive stems occurs. However, soon after unfavorable conditions set in, disjuncting and dying of older stems, leaves, and rhizomes or the entire plant occur. This continues throughout the period of vegetative dormancy, which is the period when water temperature is below 10° C. (50° F.) A considerable amount of disjuncted plant debris is also evident just before the temperature reaches the critical point, at which time growth for another season begins. Storms further aggravate disjuncting of leaves, stems, and rhizomes. After such storms, leaves and fruited stems often form floating masses to be cast up in windrows on the shore.



Figure 1. Yaquina River looking to Yaquina Bay. McCafferty Slough on the left and Poles Slough and marsh area on the right are important in the overall productivity of Yaquina Bay.



Figure 2. Part of the South Beach area. This tideland area is to be used for research purposes by Oregon State University.

Part II

AN EVALUATION OF FISH AND WILDLIFE RESOURCES OF YAQUINA BAY

Yaquina Bay marshlands, tidelands, open water, and adjacent upland areas, all in close proximity, encourage both diversity and abundance of fish and wildlife species.

FISH RESOURCES

Shellfish

The Yaquina Bay supports an extensive fishery for shellfish and has a tremendous potential for additional shellfish culture.

Oysters. The native oyster and Pacific (Japanese) oyster can be cultured in most of the intertidal and subtidal waters of the bay. Bottom, basket, and rack culture are practiced. Seed of the Pacific oyster is imported chiefly from Japan. Survival of native oyster larvae is, at times, limited by the lack of shells or other suitable material on which the larvae can attach and grow. Silt also adversely affects the survival of larvae, young, and adults of both varieties of oysters. The oyster drill, a problem in many areas, is not found in Yaquina Bay. An estimated 1,800 acres of the bay are classed as suitable for oyster culture (Plate III). The Fish Commission of Oregon leases about 135 acres for oyster production. In 1965, about 20,000 pounds of oysters were produced from limited plantings on 40 acres. Yields of from 2,000 to 6,000 pounds of shucked oysters per acre per year could be reasonably expected. Yields of up to 16,000 pounds per acre could occur with more intensive management, an assured supply of oyster seed, and with favorable growing conditions.

Clams. Hardshell clams, including cockles, gapers, littlenecks, and butter clams, are present in a porous mixture of sand, gravel, and mud within the tidal zone and deep water areas (Plate IV). Sallys Bend, South Beach, and King Slough portions of the bay are the important hardshell clam areas. Softshell clams occur in the upper portion of the estuary and are most frequently found in muddy or sandy mud bottoms in the upper tidal areas.

Research reveals that littleneck clams could be increased tremendously if a thin layer of gravel were spread in the tidal zone to provide suitable environmental conditions. Under commercial development and with intensive management, yields of 10,000 pounds per acre could be realized.

The 1965 sport harvest of clams from Yaquina Bay was estimated at 90,000 pounds, which provided about 10,000 to 12,000 days of recreational clam digging. Even at this intensity, greater numbers of both hard and softshell clams could be taken annually.

Crabs. Dungeness crabs occur throughout Yaquina Bay. Immature crabs are found in abundance on the flats the year around, indicating that the bay is an important nursery area for this species which supports a significant offshore commercial fishery and inshore sport fishery. Immature crabs occur further up the bay with the summer intrusion of salt water.

In 1966, about 1,999,800 pounds of crab were landed at Newport. This poundage had a processed value of about \$600,000^{1/} to the commercial fishery.

The red crab is also found in the bay, but is not taken commercially. Yaquina bay supports a substantial sport fishery for both species of crab.

Shrimp. Seven species of shrimp, including both burrowing and free-swimming varieties, have been found in the bay. The swimming varieties move into shallow waters and tideflats with the incoming tide and return to deeper waters of the bay and sloughs at low tide. These detritus feeders are an important diet element to all fish large enough to eat them. A burrowing species (ghost shrimp) supports a minor bait fishery.

Pelagic and Forage Fishes

This group includes herring, anchovies, smelt, and shad. These are important forage for other fishes.

Pacific herring use the bay as a spawning and nursery ground. During January, February, and March, their eggs can be found adhered to rocks, pilings, seaweed, and eelgrass where they remain until hatching. Mature and immature herring can be found in the bay during spring and summer months. This species supports a sport fishery and a significant bait fishery for commercial and sport fisheries in this bay and adjacent ocean.

Northern anchovies, which spawn in the open ocean, are usually plentiful in the bay from June through September in most years. This species now supports a minor bait fishery, but could make a greater contribution.

^{1/} First processed price. Value of landings after processing.

Silver, longfin, white bait, and top smelt occur in the area. These species inhabit the plankton-rich upper water level of the bay and are in abundance over the tidal flats on the incoming tide. These species also support a minor bait fishery, especially for the tuna fleet.

American shad adults migrate through the bay during late spring and early summer on their way to upstream spawning areas. They provide a minor sport fishery.

Sturgeon

Green and white sturgeon are found in Yaquina Bay. The green sturgeon appears to be the more abundant.

These fish seek the deeper waters of the bay. Peak numbers appear to occur during the summer and early fall when salinities are high. White sturgeon are primarily limited to the lower fresh water area of Yaquina River. Sportsmen harvest a few sturgeon during the summer months.

Other Fishes

Starry flounder; English and sand sole; sand dab; striped, white, pile, walleye, redbtail, and shiner sea perch; black rockfish; kelp greenling, and related species utilize Yaquina Bay in tremendous numbers. Important fish habitat in Yaquina Bay is indicated on Plate V.

Young of these species are abundant throughout the tideflat and shallow water areas, indicating that Yaquina Bay is an important nursery area for many commercial and sport fishes. These young fish feed heavily on the immense numbers of amphipods and isopods that occur in the shallow water areas. As they mature, they migrate to the deeper waters of the bay and the ocean where they are taken in the commercial fisheries. There is a significant sport fishery for adults of these fishes in the bay and along the ocean front.

During 1964, these species provided about 22,000 fisherman-days of recreation within Yaquina Bay, involving a sportsman expenditure of about \$187,000.^{1/}

Salmon and Steelhead and Searun Cutthroat Trout

Chinook, coho, and chum salmon and steelhead and searun cutthroat trout utilize Yaquina Bay as a feeding and nursery area, as well as a

^{1/} Based on 1965 National Survey of Fishing and Hunting.

migration route to spawning areas in tributary streams. Local and transient stock of the above species occur in the bay while on food forays during the summer.

Salmon and steelhead and cutthroat trout can be found in Yaquina Bay during most months of the year. Periods of adult use or migration for various species are: chinook salmon, July through November; coho salmon, July through December; chum salmon, October through November; steelhead, November through February; searun cutthroat trout, July through October.

Young of the various species pass to or through the bay when only a few days to a couple of years old. Juveniles, particularly of chinook salmon, utilize the bay as a nursery area throughout the year. Emigration of chinook salmon occurs during May through July; coho salmon, April through June; chum salmon, January through May; steelhead, April through June; searun cutthroat trout, April through June. Emigration of coho yearling salmon, steelhead, and cutthroat trout also occurs during early fall freshets.

Estimated Number of Salmonid Fishes that Spawn in Yaquina Bay Tributaries:

<u>Species</u>	<u>Estimated Spawning Population</u> ^{1/}
Chum salmon	200
Coho	5,640
Chinook	1,870
Steelhead	1,200
Searun cutthroat trout	7,500

^{1/} Approximate 5-year average 1961-1965.

Yaquina Bay tributaries contributed about 175,000 pounds of salmon (16,900 fish) valued at \$136,000^{2/} to the commercial ocean troll fishery in 1965. In addition, about 7,500 salmon entered the ocean and river sport fisheries, while steelhead and searun cutthroat trout totaling 650 fish entered the river sport fishery. This represents a sportsman effort of about 14,600 angler-days and an expenditure of \$229,800.^{3/}

Offshore Sport and Commercial Fisheries

This bay is also a major port for the offshore sport and commercial fisheries. In 1965, an estimated 58,800 days of recreational salmon

^{2/} First processed price. Value of landings after processing.

^{3/} Based on 1965 National Survey of Fishing and Hunting.

fishing occurred aboard charter and private boats from this port. This represents a sportsman expenditure of about \$1 million.^{1/} During 1965 and 1966, an estimated 175 commercial fishing boats ^{2/} were permanently moored in the bay, with about 350 boats moored there during the height of the fishing season. During 1966, these boats landed a total of about 12,100,000 pounds of food fish and shellfish valued at \$2,765,000.^{3/}

WILDLIFE RESOURCES

Water-Associated Birds

Yaquina Bay is a resting place, feeding area, and wintering ground for a small but important segment of the migratory bird population that uses the Oregon Coast portion of the Pacific Flyway. About 180 species of birds are resident or regular visitors to Yaquina Bay and adjacent uplands. An estimated 60 of these have been recorded as nesting in the area.

Water-associated birds found here include: waterfowl - black brant, American widgeon, pintail, green wing teal, mallard, canvasback, greater scaup, bufflehead, white winged scoter, and common scoter; shorebirds - western sandpiper, least sandpiper, sanderling, and black bellied plover; seabirds - gulls, terns, and murre; marshbirds - great blue heron and American bittern. Some birds are found solely in one habitat type; others depend upon a variety of types. Some are yearlong residents; others are visitants. Herons, bitterns, and brown pelicans, although common, cannot be considered abundant. Others, including ducks, sandpipers, and sanderlings, are present seasonally in substantial numbers.

Marshlands, tidflats, and open water are the primary habitats of Yaquina Bay and adjacent areas. Sand dunes, grasslands, forested uplands, and the cities of Newport-Toledo are also adjacent to the bay.

The major marsh areas are located along Nutes, Boone, Poole, and McCafferty sloughs. These marshes are used for nesting, feeding, and shelter by many species of wildlife.

Exposed mudflats and tidelands which occupy major portions of the bay produce snails, worms, and insects upon which shorebirds feed. In addition, tideflat and shoal areas provide an abundance of flora and invertebrate fauna which comprise the diet of many species of waterfowl that utilize the bay.

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- ^{1/} Based on 1965 National Survey of Fishing and Hunting.
^{2/} Testimony presented by Port of Toledo, Oregon - April 20, 1967.
^{3/} First processed price. Value of landings after processing.

The more open and deeper water is used by ducks, geese, cormorants, grebes, loons, gulls, murrees, and terns for feeding and resting purposes.

Waterfowl use of Yaquina Bay varies between 2 million and 6 million days annually. Peak use involves about 30,000 birds. For its size, Yaquina Bay is an important migration and rest area for waterfowl using the coastal portion of the Pacific Flyway, and it is a place for nearby residents to hunt.

Yaquina Bay is an important migration and wintering area for black brant. Sallys Bend, with its broad tideflats and extensive eelgrass beds exposed at low tide, provides food, gravel, and a place to loaf so vital to the survival of this species along this reach of the Oregon Coast.

Marine Mammals

California and Steller's sea lions are occasionally seen at the bay entrance. Harbor seals are often seen in the bay. Hauling grounds, where the young pups and adults can leave the water to rest, are needed. Hauling grounds are believed located on the rock outcropping near the mouth of the bay.

Fresh Water Mammals

The mammals of economic importance inhabiting Yaquina Bay and adjacent lands or tributary waters include beaver, muskrat, mink, otter, weasel, and raccoon. While these animals are not dependent on an estuarine environment, the loss of irreplaceable riparian or marsh-type habitat adjacent to the estuary would greatly reduce the area available to these species.

Esthetic Appreciation

Wildlife found here have an inestimable esthetic value enjoyed annually by thousands of people. The area's rich fish and wildlife resources are well known and are responsible for attracting tourists and residents alike. For example, in 1967, about 161,000 persons visited the Oregon State University's Marine Science Center to see and enjoy only a portion of the fish and wildlife of this area. Many people who neither fish nor hunt derive pleasure from observing birds, taking pictures, or merely enjoying the natural surroundings of the bay. Important wildlife habitat of Yaquina Bay is indicated on Plate VI.

Part III

FACTORS AFFECTING FISH AND WILDLIFE UTILIZATION AND VALUE OF YAQUINA BAY

Today's expanding human population and industrial complexes adjacent to estuarine areas are affecting the environment upon which fish and wildlife resources depend. Factors which define an estuary make it desirable for many aspects of our complex society. The few streams entering Yaquina Bay are sources of fresh water vital to the industrial complex and to aquatic life in the estuary. The bay and adjacent ocean absorb the various waste discharges from the community and industry. The connection to the ocean affords easy access for marine transportation.

With the expansion of communities adjacent to estuaries, ecological and biological problems with many facets occur and must be recognized and understood. Solutions to these problems must be developed, or at least considered, before any meaningful plans to manage, conserve, and develop fish and wildlife resources of this estuary can be formulated.

A few of the problems affecting Yaquina Bay are:

Destruction of tidelands and marshlands

Dredging activities

Construction of bulkhead, pier, and other waterfront structures

Contamination of aquatic life or the environment

Destruction of Tidelands and Marshlands

The destruction of tidelands and marshlands by filling and diking can have a profound impact on the physical and ecological aspects of an estuary. It is estimated that about 150 acres of Yaquina Bay marshlands and tidelands have been partially or completely lost to industry and highway purposes in the past few years. Most of this has occurred in the Sallys Bend and South Beach areas. In addition, Boone and Nute Sloughs have been cut off from tidal circulation for agricultural purposes. If present plans are an indication of what areas could be destroyed, Sallys Bend and much of South Beach could be considered as already lost because of single-purpose planning of port facilities.

Changes in the estuarine ecosystem in turn affect fish and wildlife resources. For example, destruction of the complex plant communities that occupy the marsh and intertidal areas also eliminate a food source for many species of fish and wildlife. Once filled, these areas would no longer provide ecological conditions for continued survival of numerous larval and immature forms of aquatic organisms important to the overall productivity of an estuarine area. The tidelands would no longer provide conditions favorable for shellfish culture, and the nursery areas for many species of fish would be lost. These flats would no longer provide feeding and resting areas for shore birds and waterfowl.

Landfill projects are particularly destructive because they almost invariably destroy near-shore, shallow, highly productive areas. Such projects affect the volume (intertidal storage) of water that moves in and out of the bay at each tide and interfere with the ability of the water to distribute oxygen and nutrients throughout the water depths. Areas reclaimed or diked reduce the tidal prism which alters the location of the saline-fresh water boundary. Filling of tidelands and blocking of natural channels can modify current patterns and velocities resulting in erosion in one area or shoaling in another. Such changes upset the delicate balance of an ecosystem and profoundly influence the abundance of fish and wildlife species in an area just as effectively as direct destruction of the species.

The destruction of Sallys Bend and/or the South Beach area would have a tremendous impact on fish and wildlife resources.

A reasonable biological conclusion would be that, with the habitat loss, the native Yaquina oyster and the cockle, gaper, littleneck, and butter clams now found in the bay would, for all practical purposes, be considered extinct in Yaquina Bay. The impact on other species of fish (herring and perches) and wildlife (black brant) could be just as devastating.

Dredging Activities

Some problems directly related to dredging are: (1) removal of bottom material and organisms living therein, (2) increased turbidity or toxicity, (3) siltation of adjacent areas, (4) disposal of dredged materials, and (5) modification of current patterns. These problems are further amplified after initial dredging, because annual maintenance of a navigation channel is commonplace.

Dredging and spoil disposal are usually connected with navigation channel construction and maintenance. However, filling of diked tidelands, removal of aggregate and minerals, or increasing the elevation of bay or streamside land for agricultural or industrial purposes could also involve a dredge and spoil operation.

The Yaquina Bay channels were constructed and are being maintained by hopper and pipeline dredges. However, regardless of the equipment used, all dredging activities present the same problems of how to control turbidity and siltation, when and where to dispose of spoil material, and how changes in channel location or conformation influence current patterns, velocities, and mixing of bay waters.

The most common detrimental effects usually involve direct habitat destruction through spoil deposition.

Filling of tidelands and adjacent marsh areas with spoil material can have a tremendous impact on fish or wildlife resources by destroying the environment upon which they depend; however, dryland, deep water, and ocean disposal does not usually seriously affect these resources.

Dumping of spoil in another portion of the bay is often the most convenient method for disposing of material dredged. Such disposal may smother productive shellfish areas and remove producing areas from further production by changing physical characteristics of the shore. Turbidity and siltation are ever present problems. While it is sometimes difficult to document direct loss of fish and wildlife caused by these conditions, it can be demonstrated that silt reduces egg and larval survival and inhibits photosynthesis by phytoplankton and algae. This would affect young and adult fish and shellfish through their food chain.

Dredging of channels can modify current patterns which in turn can have both an initial and long-term impact on fish and wildlife resources. Changes in current patterns and flushing characteristics alter salinity gradients, oxygen, and nutrient distribution through the estuarine community. Channel changes that increase current velocities would most likely result in erosion of the immediate channel and adjacent areas and intensify shoaling, particularly in downstream areas. If overall flushing characteristics are changed, a potential exists for flushing shellfish eggs and larvae out of the bay before they can set.

Dredging often removes shellfish from deep water areas. Gaper clams were removed in significant quantities as part of the material removed for the navigation improvement project. The seed and larvae production from deep water clam areas needed to maintain this resource in harvestable quantities is unknown. However, we believe that major clam areas depend, to a considerable degree, on the spawning and resultant larval production from clams in subtidal areas. Also through dredging, noxious gases or materials can be released to the surrounding water and can inflict a heavy toll on larvae or other immature forms of fish life.

In order to properly evaluate a proposal to dredge in the bay or bar, a better understanding of the effects such work would have on shoaling, current patterns, and resultant erosion in the immediate area or adjacent area is needed. An estimate of the amount of material to be removed initially, as well as annually, and the composition of this material is needed. Results of such studies could accompany a proposal to do such work, and could be a prerequisite for application for a Department of the Army permit.

Construction of Bulkhead, Pier, or Other Waterfront Structures

Bulkheads constructed in the bay reduce the tidal prism and alter current strengths, direction, and phasing, all of which directly affect shoaling, erosion, and mixing of nutrients and oxygen throughout the water depth and, in turn, affect the dynamic balance of the ecosystem.

Wharves and piers and associated vessels at anchor (particularly deep draft vessels) alter the waterflow in their immediate vicinity with effects mentioned above also occurring here. Two separate effects occur, one with the incoming tide and one with the outgoing tide.

The effects of such structures more often than not are adverse. Shoaling in one area may cover a shellfish bed or fill in a channel requiring maintenance dredging. Erosion in another area may destroy a shellfish bed, endanger the stability of adjacent structures, or create turbulent water conditions which could put sediment and organic material into suspension, thereby degrading a water supply used for industrial or scientific purposes.

To properly evaluate proposals to construct waterfront bulkheads, wharves, or piers, a better understanding of the effects such structures would have on shoaling or erosion in the immediate and adjacent area is needed. Results of a prerequisite study could be required to accompany the application for a Department of the Army permit to do such work.

The placement of waterfront structures or facilities, and the effects of dredging and filling activities on current patterns, shoaling, and erosion in the bay or bar area could be better understood if a hydraulic model of Yaquina Bay were constructed.

Contamination of Aquatic Life of the Environment

Domestic waste, pulpmill wastes, log storage debris, and wood chips are causing water quality problems in Yaquina River and Bay. Additional pulpmill wastes are pumped to the Pacific Ocean. Such wastes directly or indirectly affect fish and wildlife or restrict their environment. For example, a direct impact would be the killing of larval, immature, or adult fish or the imparting of a disagreeable taste or odor to shellfish or fish. Examples of indirect effects would be the accumulation of sublethal toxic materials in body tissues, leading to death at any stage during the life cycle, the increase of susceptibility to disease, the smothering or killing of otherwise normal food sources, or the contaminating of the environment leading to the prohibiting of the sale of shellfish for human consumption. Silt, as a result of land management practices, is an ever present problem in rivers and estuaries. Vessels visiting the port are potential sources of pollutants.

The potential for serious water quality problems to occur in Yaquina River and Bay is real. For example, a quarantine could be instituted against the harvesting and sale of Yaquina Bay oysters for human consumption if present enteric coliform bacteria concentrations are increased. This would be a tragic loss of a historic and enterprising industry.

Using the assimilation qualities of ocean, bay, or river waters for domestic or industrial waste disposal is not pollution abatement in the overall public interest. Measures or facilities to control pollution from domestic or industrial wastes should be instituted throughout the drainage and particularly along or near the river or bay. Monitoring of water quality must be continued, the State and Federal water quality standards must be enforced to prevent local sources of pollution from becoming serious.



Figure 3. This tideland fill in Sallys Bend destroyed shellfish beds and altered current patterns in this area. Material eroded from the area covered stands of eelgrass and shellfish beds adjacent to the fill.



Figure 4. Streamside industrial complex at Toledo, Oregon.

SUMMARY AND CONCLUSION

The productivity of Yaquina Bay can be measured by the abundance and the diversity of the flora and fauna found there. The previously mentioned problems bring one thing to light--that Yaquina Bay is truly an ecosystem in that one single modification could start a chain reaction which could affect the entire ecosystem, resulting in severe damage to certain natural resources.

In view of this fact, therefore, the fish and wildlife areas already lost through partial, piecemeal, or uncoordinated development should be fully utilized or developed for purposes compatible with the estuarine environment before other areas are destroyed. A better understanding of hydrological patterns and problems of the estuary must be gained. Ecological parameters important to the fish and wildlife resources must be investigated. Areas vital to these resources must be determined if they are to be maintained at present population levels or increased. Relationship of productivity between intertidal and open water areas must be better understood. Standing crops of fish and wildlife must be enumerated, and the rates at which oxygen and various animals and plants are produced per unit of time must be determined.

Numerous Federal and State agencies and private interests are concerned about estuarine areas and adjacent lands. Although few agencies, interests, or persons would set out to deliberately destroy an estuarine area, there appears to be insufficient concern about the effects of work accomplished by one agency on the jurisdiction or responsibility of another agency or how the works of each agency affect the entire ecosystem. Therefore, a water and land use development and management plan should be cooperatively formulated and implemented to protect the natural resources of this estuarine area. It should be emphasized, however, that before a plan can be formulated, a long look into the future will be required; one that will see immediate needs, yet remain focused on long-term objectives.

To protect the public interest in Yaquina Bay, a regional approach that includes consideration of the surrounding land, with its plants and animals, towns, and industrial complexes, is necessary. Since local planning groups also have a responsibility to the people of the State and Nation, the Bureau of Sport Fisheries and Wildlife is anxious to cooperate with other Federal, State, and local interests in formulating a plan to protect and perpetuate the total resources of this estuarine area.

During the period necessary to complete a detailed study and to prepare a plan for the conservation, management, and development of its waters and adjacent lands, any individual, corporation, or government agency wishing to place fill or structures in this estuary or its adjacent marshes, or to extract material, should be required to secure a permit from the organization formed to guide and develop the comprehensive plan. Technical liaison would be provided by representatives of the various local, State, and Federal agencies having jurisdiction over estuarine associated resources.

Permission to do this work would be granted by this organization provided the project meets the following standards:

- a. necessary to the health, safety, or welfare of the public, or
- b. of such a nature that the project would not adversely affect the comprehensive management and development plan being prepared.

Works not approved should be held in abeyance until the coordinated conservation, development, and management plan is prepared and implemented.

Measures to conserve, protect, and develop fish and wildlife resources of this estuarine area and their environment should be an integral part of any plan. The general public would be the overall beneficiary of such planning. If a coordinated program is not undertaken, there will be irreparable and lasting damage to estuarine areas and resources involved.

RECOMMENDATIONS

In the interest of protecting the fish and wildlife resources of Yaquina Bay, we recommend that:

1. The filling of tidelands, marshes, and submerged lands of the bay be prohibited until a coordinated land and water conservation, development, and management plan is formulated and implemented. We further recommend that this plan be developed cooperatively by local interests, Fish Commission of Oregon, Oregon State Game Commission, Corps of Engineers, and U.S. Fish and Wildlife Service.
2. Important fish and wildlife habitats indicated on the attached plates, and the ecological parameters discussed in the report be safeguarded.
3. The important fish and wildlife areas shown on the attached plates be classified as of primary use for fish and wildlife habitat in any coordinated water and land use plan. Moreover, only those uses which are compatible with the primary use should be permitted in these areas.
4. Proposals to dredge or modify navigation channels within the bay or bar area be evaluated for their effect on current patterns and resultant effects on shoaling, eroding, and the distribution of oxygen and nutrients within the bay system. This evaluation also could be a prerequisite for application for a Department of the Army permit to do such work.
5. Proposals for bulkhead, pier, or wharf construction under a Department of the Army permit be evaluated for shoaling, erosion, and water quality effects. This could be a prerequisite for application for a Department of the Army permit.
6. The following investigations be completed before further tideland filling and channel changes are initiated:
 - A. Hydrologic studies of Yaquina Bay be conducted to:
 1. determine circulation and tidal transport patterns.
 2. determine sediment loads, deposition, and scouring within the estuary and the oceanfront.
 3. determine flushing patterns.
 4. Improve understanding of fresh and salt water interrelationships.

B. Biological studies of Yaquina Bay be conducted to:

1. determine fish and wildlife habitat areas necessary to maintain present population levels and future use.
2. determine the relationship of intertidal areas to the productivity of the open waters of the bay.
3. determine seasonal populations of aquatic flora and fauna of different ecological areas of the ecosystem.
4. determine the degree to which certain selected fin-fishes, shellfishes, and crustaceans and their respective food chains depend upon Yaquina Bay.
5. determine rates at which oxygen and key species of animals and plants are produced in the various ecological areas of the system.

Results of these studies must be available to help the conservation agencies determine the impact that proposed projects would have on fish and wildlife resources or the environment upon which they depend. Any consent to use the river, bay, or its waterfront does not imply the right or privilege to impair their value for other purposes.

Perpetuation of the fish and wildlife resources of estuarine areas requires only a cool, clean environment in which they can flourish. These resources need no fertilizing, feeding, spraying, nor corralling; for their food supply is in the river, bay, and ocean. These self-renewing resources require no huge investments of capital to perpetuate themselves. Treated with respect by their land neighbors and harvested with restraint, these natural resources will last forever, to be enjoyed by generation after generation, enhanced--not diminished--in value.



FISH COMMISSION

OFFICE OF THE DIRECTOR

307 STATE OFFICE BLDG. • 1400 S.W. 5th AVE. • PORTLAND, OREGON • 97201

TOM McCALL
GOVERNOR

October 17, 1968

COMMISSIONERS

EDW. G. HUFFSCHMIDT, Chairman

McKEE A. SMITH, Vice Chairman

JOSEPH I. EOFF, Member

ROBERT W. SCHONING
State Fisheries Director

Mr. John D. Findlay
Regional Director
Bureau of Sport Fisheries & Wildlife
Post Office Box 3737
Portland, Oregon 97208

Dear Mr. Findlay:

A letter dated September 27, 1968 from Mr. Ralph Imler requested that our comments on a preliminary survey report on Yaquina Bay and Estuary be sent to you by October 21, 1968. Several copies of the report accompanied Mr. Imler's letter for distribution within our agency.

Members of our staff have reviewed the report and have met on several occasions with members of the Portland Area Office to discuss our comments. We believe that the report is accurate and well written and concur with it as written. A report containing minor comments has been returned to Mr. Imler's office and it is our understanding they will be included in the final report.

The coordination between our agency and the Portland Area Office in this matter has been outstanding.

Sincerely,

Redacted for privacy

C. A. WEBERG, ASSISTANT
STATE FISHERIES DIRECTOR

cc Committee On Natural Resources, Kessler R. Cannon
Oregon State Game Commission



GAME COMMISSION

OFFICE OF THE DIRECTOR

P. O. BOX 3503 • 1634 S.W. ALDER ST. • PORTLAND, OREGON • 97208 • Ph. 222-9611

TOM McCALL
GOVERNOR

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JAMES W. WHITTAKER, Member

P. W. SCHNEIDER
State Game Director

October 21, 1968

Regional Director
U. S. Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
P. O. Box 3737
Portland, Oregon 97208

Dear Sir:

We have reviewed your draft of A Preliminary Survey of Fish and Wildlife in Relation to the Ecological and Biological Aspects of Yaquina Bay, Oregon, and are in accord with the provisions and recommendations of this report.

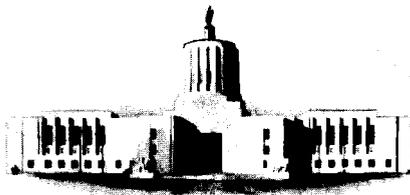
It must be understood that our concurrence with your report does not constitute a delegation of responsibilities for the management of the resources under the jurisdiction of the State of Oregon.

We appreciate this opportunity to review your report in draft form and submit these comments.

Sincerely yours,
Redacted for privacy

ms
P. W. Schneider
Director

cc: Fish Commission of Oregon
Bureau of Sport Fisheries and Wildlife - River Basin Studies
State Water Resources Board
Oregon State Sanitary Authority
Oregon State University - Department of Fisheries and Wildlife
Oregon State University - Marine Science Laboratory, Newport, Oregon
Yaquina Bay Planning Council - Newport, Oregon
Lincoln County Court - Newport, Oregon
Port of Newport - Newport, Oregon



STATE OF OREGON
DIVISION OF STATE LANDS
20 AGRICULTURE BUILDING
SALEM 97310

October 11, 1968

United States Department of the Interior
Bureau of Sport Fisheries and Wildlife
710 NE. Holladay
Portland, Oregon 97232

Attention: Mr. Ralph H. Imler
Field Supervisor

Your reference: RBS

Gentlemen:

I have reviewed your preliminary survey report with a great deal of interest and wish to compliment your staff on an important contribution to the lay understanding of the importance of coordinated planning in the development of our water-oriented lands.

Your survey does not cover such aspects as the extent of riparian ownership and the property rights attendant. From my discussions with members of your staff, I have gathered that a brief dissertation on this sensitive area may prove to be beneficial in the implementation of the overall plan.

In 1885, the state legislature granted to the Willamette Valley-Coast Railway Company all tide and overflow lands in what was then Benton County. Lincoln County was formed from parts of Benton and Polk Counties. Tidelands are defined as those lands lying between mean high and mean low tide. Thus all lands lying above the line of mean low tide in Yaquina Bay and River are no longer state owned. This line is not to be confused with the mean lower low water.

The nature of this ownership is, however, distinctly different from the ownership of lands lying above mean high tide. To trace the nature of this ownership, it is first important to recognize that Oregon is a common law state through its Constitution which states: "All laws in force in the Territory of Oregon when this Constitution takes effect and consistent therewith shall continue in force until altered or repealed." This provision has been construed as adopting the common law

of England as it existed at the time of settlement of the American Colonies and as later modified, and not in conflict with the U. S. Constitution or the enactments of legislature.

From the earliest times in England, the common law vested title and control over navigable waters in the Crown and in the Parliament. A distinction was made between title and control. Ownership of the underwater soil, analagous to ownership of dry land, was regarded as jus privatum or proprietary right and was vested in the Crown. But the right to control both land and water was deemed a jus publicum or public right. Thus the Crown could and did convey the soil under water so as to give private rights therein, but the dominion and control over the waters in the interest of commerce and navigation for the benefit of all the subjects of the kingdom could be exercised only by Parliament. After the American Revolution, the thirteen original colonies became sovereign states and, as successors to the Crown, became vested with title to all lands within their boundaries over which the tide ebbed and flowed and to the beds of inland navigable waters.

With the adoption of the Federal Constitution, the states ceded to the Federal Government certain powers, one of which was the right to regulate interstate commerce and with it the concomitant right to control navigation. No title to the tidelands nor to the submerged lands was thereby conferred. In all respects, the state has succeeded to all the rights and powers of the Crown and parliament in the navigable waters and to the soil under them.

New states entering the Union, subsequent to the adoption of the Constitution, were admitted on an equal footing with the Original States and therefore acquired the same rights, title and interest in the submersible and submerged lands. However, each state has dealt with this matter according to its own views of justice and policy.

The Federal Government, by virtue of its constitutional power to regulate interstate and foreign commerce, has paramount control for such purpose and to the extent necessary, of all navigable waters of the United States; the regulatory authority of the state being subject to such Federal control for the purpose and to the extent stated. It is generally held to be the duty of the state to retain and exercise in the public interest its control of the navigable waters within its borders. Such power or right of control is one that cannot be surrendered, alienated, or delegated except for some public purpose or some reasonable use which can fairly be said to be for a public benefit.

The paramount authority of the Federal Government in respect of the regulation of interstate and foreign commerce carries with it the primary authority and jurisdiction, as between itself and the respective states,

to improve or to provide for the improvement of the navigable waters. But the interest of the states in their own domestic commerce is such that the authority of Congress is not necessarily exclusive of state action. And in general, until Congress exercises its power over the subject, action by the state cannot be called into question by private persons. It may be observed, in this connection, that the rights existing between riparian owners are not the measure of their rights against either the Federal Government or the State in the improvement of navigation, in which case private interests must give way to a superior right.

The U. S. Supreme Court has said: "But even if the legislature granted to plaintiffs every right that the state had, still a subsequent legislature could repeal the grant, for no right can be acquired by private parties which can prevent the state from changing the use to which the soil under water shall, in the public interest, be devoted, so long as such change is made to subserve either navigation, commerce or fishery." The Oregon Supreme Court in *Lewis v. City of Portland*, 25 Or 133, commented after citing this case: "There the grant of the submerged soil of the lake was in such quantity as, in the opinion of the court, impaired the public interest in its waters, and operated, if irrepealable, as an abdication by the state of its trust over the property."

That water cannot rise above its source is an ancient real estate truism. As the state's ownership was subservient to the powers of Congress and the *jus publicum* which could not be disposed of, so must any ownership of the submersible lands by private interests be subservient, since that ownership derives only from a chain of title beginning with the state itself.

This dissimilitude in the nature of title to submersible lands, whether public or private, to that of uplands is made even more apparent when it is realized that with or without the consent of the title holder, Army Engineers may dredge away or fill these lands by deposition of spoil - in the name of navigational servitude. The owner of the tidelands may not object to this activity by the Federal Government when it so acts in the best interest of the public; nor may the owner claim compensation for damages to the private use he may have hitherto made of these lands granted to him by the state.

In this discussion I have probably raised more questions in your minds than I have answered, and I therefore invite your specific questions. Before closing, I might suggest that some effort should be made to ascertain, by survey, the location of the lines of mean low water and mean high water.

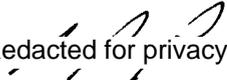
October 11, 1968

Most navigation charts use mean lower low water as a datum. This latter line bears no relationship to property lines. The 1912-1913 tidelands survey is valid only to show the locus of the low water line at that time. It would be sheer coincidence if that line and the 1968-1969 line were at the same spot.

Thank you for your kind invitation to add my comments to the many you already have gathered.

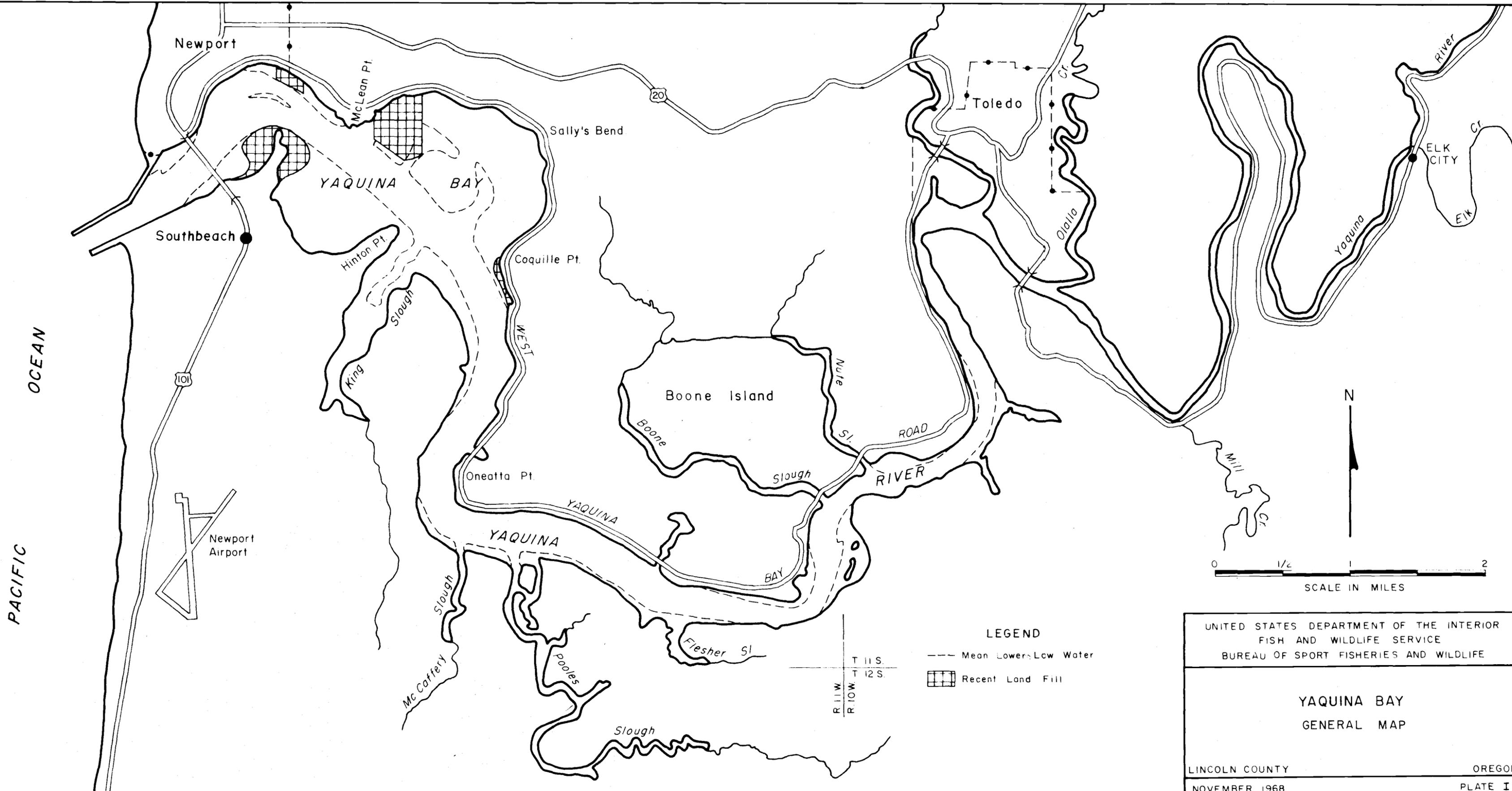
Very truly yours,

DIVISION OF STATE LANDS
Dale Mallicoat, Director


Redacted for privacy

A. R. Panissidi

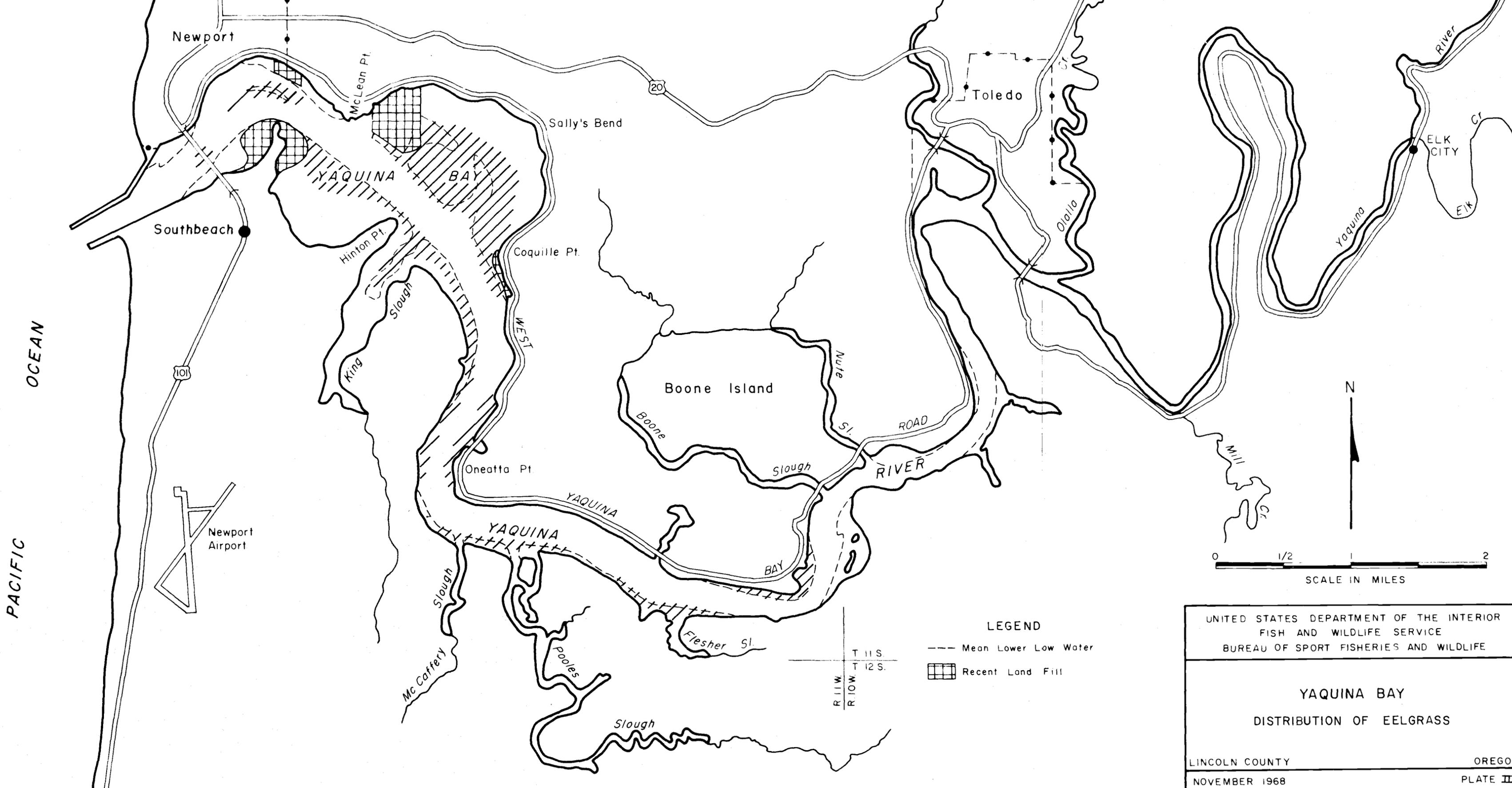
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UNITED STATES DEPARTMENT OF THE INTERIOR
 FISH AND WILDLIFE SERVICE
 BUREAU OF SPORT FISHERIES AND WILDLIFE

**YAQUINA BAY
 GENERAL MAP**

LINCOLN COUNTY OREGON
 NOVEMBER 1968 PLATE I



Newport

Southbeach

101

Newport Airport

McLean Pt.

YAQUINA BAY

Hinton Pt.

King

Slough

Sally's Bend

Coquille Pt.

WEST

Oneatta Pt.

YAQUINA

YAQUINA

Mc Caffery

Slough

Pools

Slough

20

Toledo

Olalla

Boone Island

Boone

Nute

Sl.

ROAD

RIVER

Slough

Flesher Sl.

BAY

T 11 S
T 12 S
R 11 W
R 10 W

LEGEND

- Mean Lower Low Water
- Recent Land Fill



0 1/2 1 2

SCALE IN MILES

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

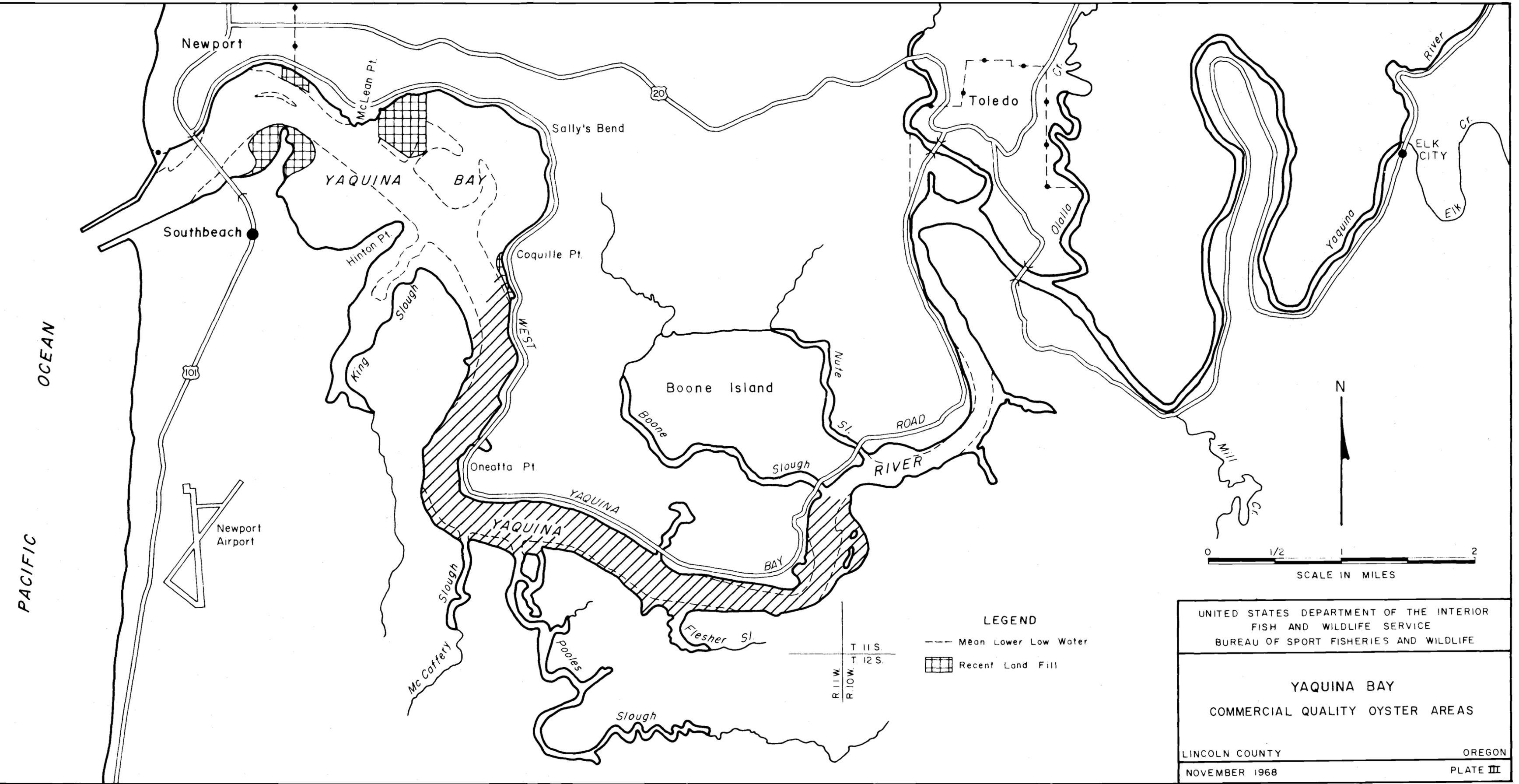
YAQUINA BAY
DISTRIBUTION OF EELGRASS

LINCOLN COUNTY

NOVEMBER 1968

OREGON

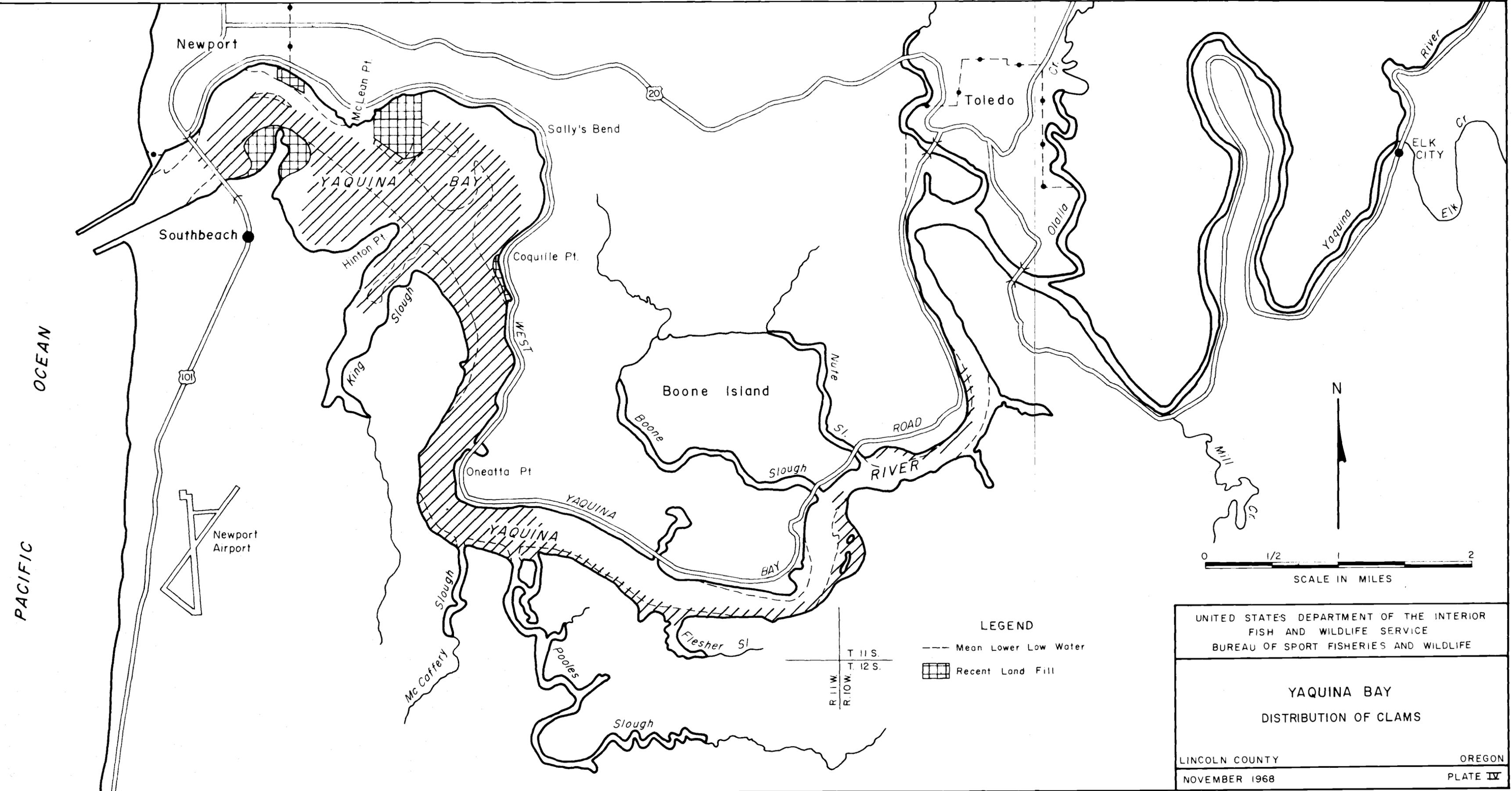
PLATE II



UNITED STATES DEPARTMENT OF THE INTERIOR
 FISH AND WILDLIFE SERVICE
 BUREAU OF SPORT FISHERIES AND WILDLIFE

YAQUINA BAY
 COMMERCIAL QUALITY OYSTER AREAS

LINCOLN COUNTY OREGON
 NOVEMBER 1968 PLATE III



PACIFIC OCEAN

Newport

Southbeach

Newport Airport

McLean Pt.

Hinton Pt.

Sally's Bend

Coquille Pt.

20

Toledo

Olalla Cr.

River

ELK CITY

Elk Cr.

Yaquina

N

0 1/2 1 2

SCALE IN MILES

LEGEND

- Mean Lower Low Water
- ▣ Recent Land Fill

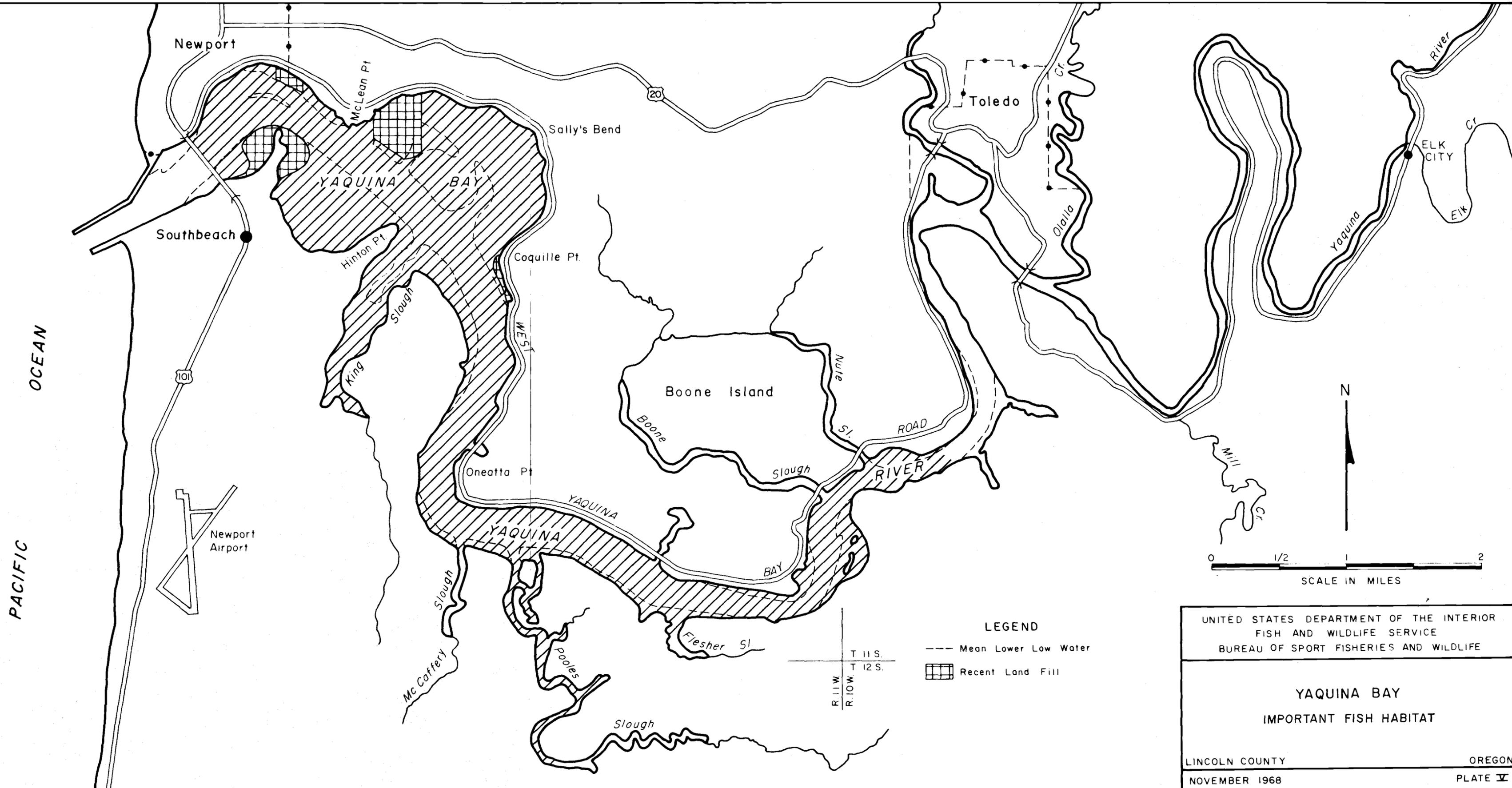
T. 11 S.
T. 12 S.
R. 11 W.
R. 10 W.

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

YAQUINA BAY
DISTRIBUTION OF CLAMS

LINCOLN COUNTY
NOVEMBER 1968

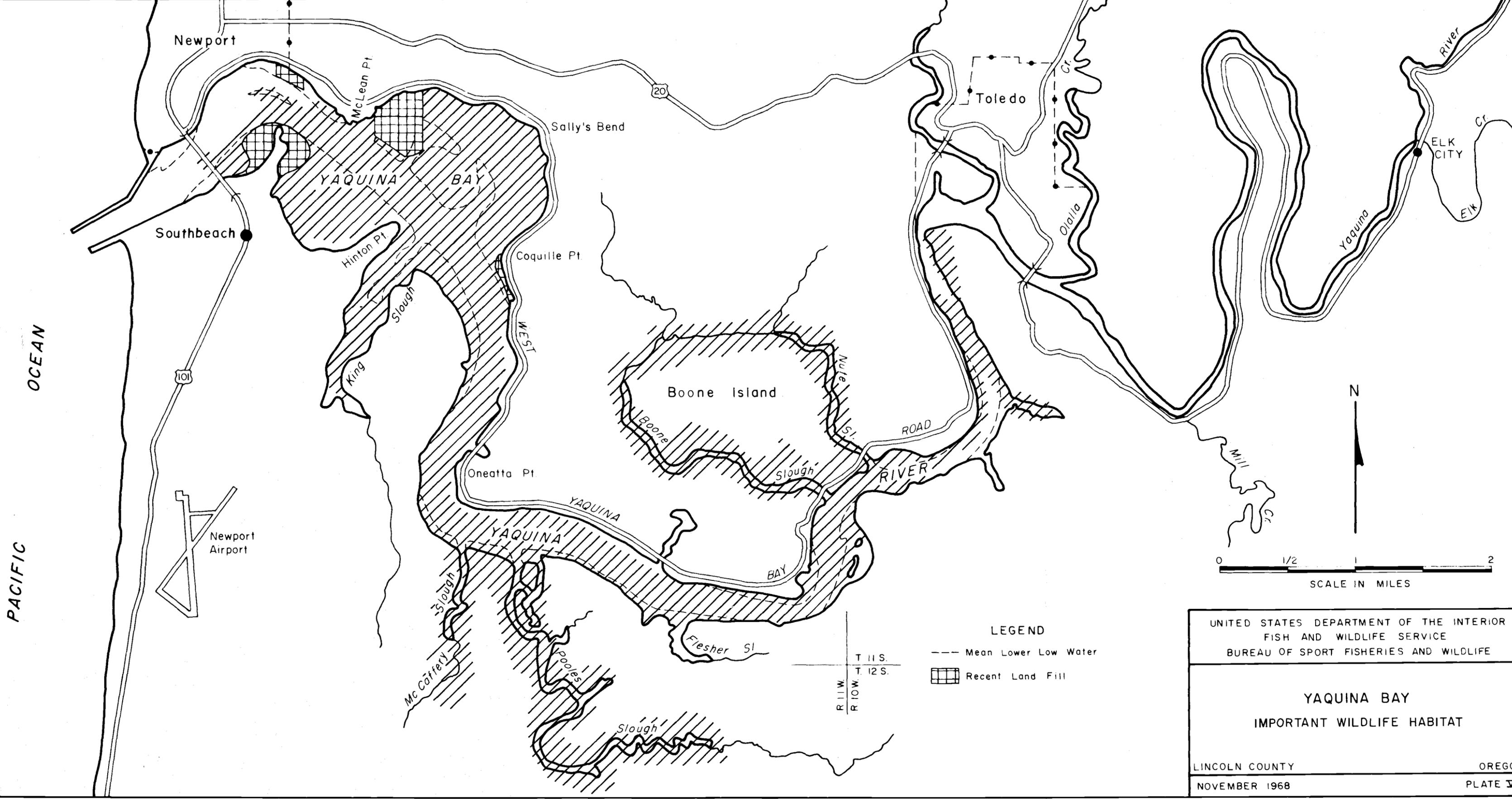
OREGON
PLATE IV



UNITED STATES DEPARTMENT OF THE INTERIOR
 FISH AND WILDLIFE SERVICE
 BUREAU OF SPORT FISHERIES AND WILDLIFE

YAQUINA BAY
 IMPORTANT FISH HABITAT

LINCOLN COUNTY OREGON
 NOVEMBER 1968 PLATE V



PACIFIC OCEAN

Newport

Southbeach

Newport Airport

YAQUINA BAY

Hinton Pt

King Slough

Coquille Pt

Oneatta Pt

YAQUINA BAY

Mc Caffery Slough

Pooles Slough

Slough

Boone Island

Boone Slough

BAY

Flesher Sl

T 11 S.
T 12 S.
R 10 W.
R 11 W.

Sally's Bend

20

Toledo

Olalla Cr.

ROAD

RIVER

Nule Sl.

N

0 1/2 1 2

SCALE IN MILES

LEGEND

--- Mean Lower Low Water

Recent Land Fill

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

YAQUINA BAY
IMPORTANT WILDLIFE HABITAT

LINCOLN COUNTY

NOVEMBER 1968

OREGON

PLATE VI