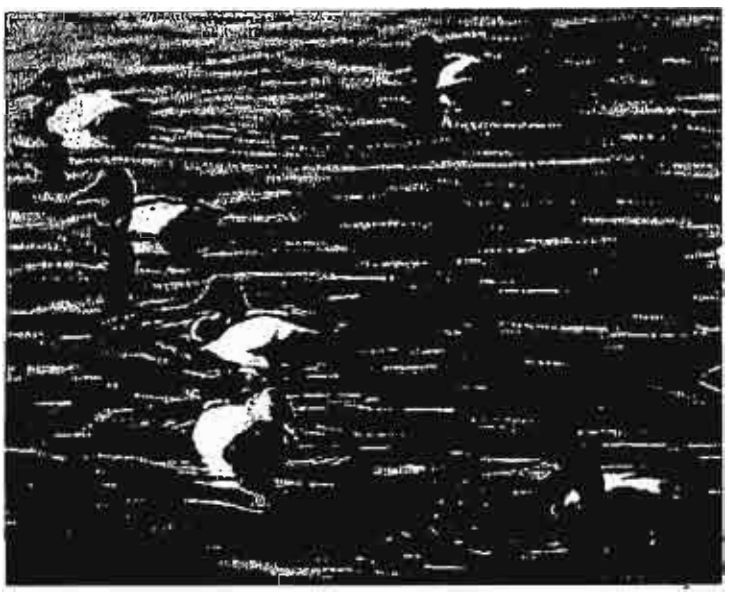
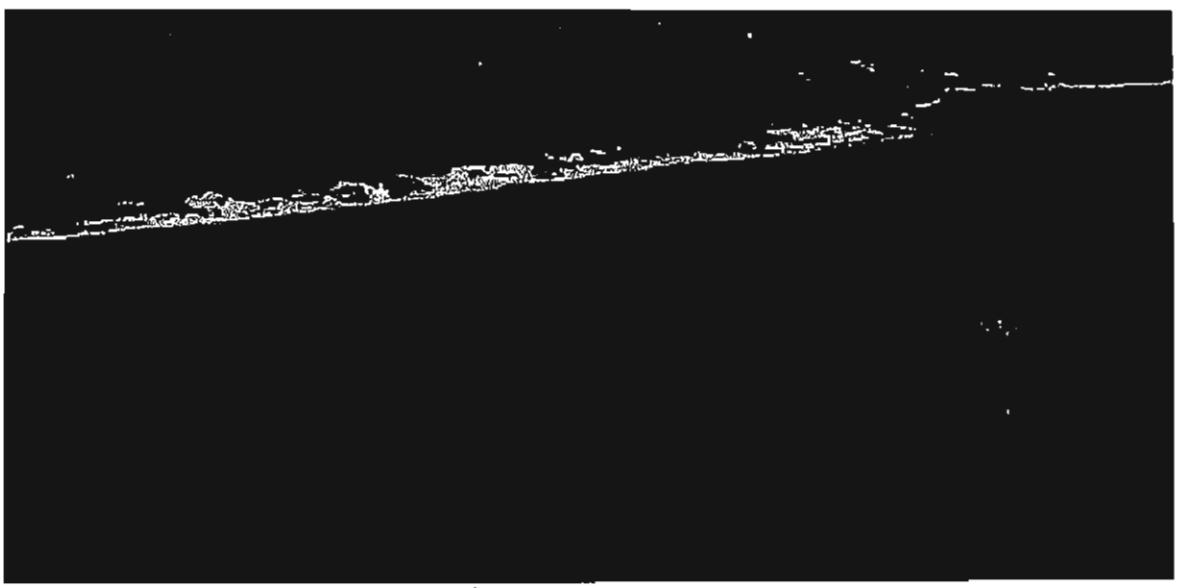
NATURAL RESOURCES
of
LAKE EARL
and the
SMITH RIVER DELTA



STATE OF CALIFORNIA

DEPARTMENT OF FISH AND GAME

MARCH, 1975



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NATURAL RESOURCES
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LAKE EARL
and the
SMITH RIVER DELTA

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March, 1975

COASTAL WETLAND SERIES - #10

LAKE
ARL

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INTRODUCTION

Prior to man's influence, California contained over 5 million acres of wetland habitat. Today, less than 500 thousand acres remain. The populations of water-associated wildlife which live on these wetlands have declined proportionately. For it is generally accepted that any given unit of land or water is only capable of supporting a specific number of fish and wildlife. If the land and its habitat is lost or its carrying capacity reduced through man's activities, the fish and wildlife will be lost or reduced in number accordingly. The idea that wildlife so displaced will just move somewhere else is erroneous since the remaining habitat generally is supporting maximum population.
In some cases, habitat loss has resulted in the near extinction of certain species. And the future of many others clearly depends on man's willingness to preserve their life requirements.

The coastal wetlands have been particularly vulnerable to changes brought about by man's activities. They have been filled and dredged for harbor development and for commercial, industrial, residential and recreational purposes to the extent that relatively few areas are capable of supporting fish and wildlife. Consequently each remaining undeveloped area assumes an even greater role in maintaining fish and wildlife resources.

The Lake Earl/Smith River Delta area is a key coastal wetland situated in northern California. The Lake and Delta have retained much of their value to wildlife and serve as an important link in a chain of such wetlands that extend southward along the Pacific Ocean from Alaska to South America. Millions of water-associated birds of the Pacific Flyway

utilize these areas as feeding and resting stops along their migration paths. In California, these wetlands also serve as a significant portion of the available wintering grounds for a major share of the birds within the flyway.

The Smith River is also one of the State's most productive salmon and steelhead streams. Anadromous fish produced here provide thousands of angler use days to sport fishermen and contribute substantially to the commercial fishing catch off the northern coast.

Because of the importance of coastal wetlands to the fish and wildlife of California, the Department of Fish and Game has initiated a high priority statewide inventory and assessment of these wetlands. This publication is an integral part of that program.

This report identifies specific resources and uses; directs attention to problems; and recommends courses of action needed to insure resource protection. It is intended as a guide for citizens, planners, administrators and other interested in the use and development of California's coastal land and waters.

The future of fish and wildlife resources rests in the hands of those who are in a position to make land and water use decisions. The action taken locally will not only affect local resources but also international resources as well. The decisions made today will determine what is saved for future generations to enjoy.

SUMMARY

Lake Earl, a picturesque coastal lagoon, and the delta of the Smith River are located in northwestern Del Norte County, between the community of Crescent City and the California-Oregon border. The lake, which covers about 2,300 acres of the Smith River coastal flood plain, was originally part of the Smith River drainage. The Delta includes approximately 8,300 acres of lands and waters in the same flood plain.

Lake Earl receives waters from a relatively small, shallow drainage basin of 32 square miles, but is periodically flooded by Smith River overflow. The Smith River drainage basin covers about 720 square miles, most of which lies in California, the remainder in southern Oregon.

Forests of coast redwood and Douglas fir cover most of the upper drainage basins. The lower areas are partly cleared for agriculture and other uses. In addition to coastal forests and agricultural land, major habitats include riparian woodland, sand dunes, salt marsh, sloughs and freshwater marsh, tidal flats, river channels and open water.

The upper Smith River is deeply incised into steep canyons forming a unique and scenic area that is now included in the Waterways Act of 1971 and Wild and Scenic Rivers Act of 1972.

The alluvial flood plain formed by the river at the foot of the Coast Range Mountains has a rainy-temperate climate with an average rainfall of about 80 to 90 inches, most of which falls between October and April.

Major industries in the area are wood products, agriculture, recreation and tourism. The land use in the upper drainage of Lake Earl and

and the Delta is devoted largely to timber production. With the exception of small urban areas near the communities of Fort Dick and Smith River and the widely scattered urban development about Lake Earl, the land uses of the flood plain are primarily agricultural. Some urban encroachment on agricultural and undeveloped lands is evident to the south of the lake and proposals have been made for recreational and residential subdivisions west of the lake.

Most of the Delta lands are in private ownership. A few commercial enterprises associated with tourist trade and recreational opportunities are located beside the river on U. S. Highway 101 and near the river's mouth. Except for some County and State Park lands, most of the land surrounding Lake Earl is in private ownership. The lake bottom is claimed both by the State and private interests and is the subject of litigation.

Because of the location and variety of habitat types, Lake Earl, the Smith River Delta and the flood plain are extremely productive in fish and wildlife resources. The dense growth of aquatic vegetation and emergent marsh plants makes Lake Earl particularly important for the many kinds of water-associated birds that migrate through and winter along the northern California coast. And, of course, the Smith River supports one of the largest runs of salmon and steelhead in the State.

Over 250 species of birds and 58 species of mammals are recorded within the Delta-Lake Earl flood plain and adjacent uplands. Water bird censuses conducted over a three-year period indicate an average annual use of almost 3,000,000 bird days at Lake Earl alone.

The Smith River and its tributaries provide 350 stream miles of spawning and nursery area for anadromous and resident salmonids. Average annual runs include 30,000 steelhead, 15,000 king salmon and 5,000 silver salmon. The delta estuary plays an important role in the life cycle of other fish such as the coastal cutthroat, green sturgeon, candlefish, shad and other marine species. Lake Earl, because of periodic opening to the sea, also supports at least 14 species of both freshwater and saltwater fish, including the king and silver salmon, coast cutthroat and rainbow trout. The two northcoast wetland areas also support a modest aquatic fauna that includes lamprey, crab, shrimp, clams, mussels, some planktonic crustaceans and a few amphibians and reptiles. The invertebrate organisms, although not presently utilized by man to any great extent, are important to the ecological stability of the area and to the food chain that supports higher fish and wildlife species.

The scenic qualities and abundance of fish and wildlife attract many outdoor recreationists to the Lake Earl-Smith River Delta region and offer outstanding opportunities for hunting, fishing, nature study, photography, camping and sight-seeing, as well as for scientific and educational use. Tourism is second only to the lumber industry in contribution to the local economy. The scenic beauty and abundance of the area's natural resources, and proximity to state and federal parks, indeed, give Lake Earl and the Smith River Delta real economic, as well as recreational, potential to Del Norte County. However, this potential can only be realized by insuring the protection of the area's natural resources and by providing maximum opportunities for public use.

Because of the relative isolation of these coastal wetlands in the northwest corner of California the problems and conflicts of use that ordinarily threaten such vital and valuable wetland areas, are more potential than actual. The water quality of Lake Earl and the Smith River Delta, for instance, is really quite good, a situation seldom existing in the coastal wetlands of southern California. On the other hand, substantial urban, commercial and/or industrial development could cause problems in the future, if adequate safeguards were not taken.

In fact, uncontrolled and unplanned urban development probably is the greatest potential threat to the area's resources. At least one subdivision of 1,500 acres has been initiated on the northwest side of Lake Earl, but as yet is undeveloped. Similar developments are being proposed in the Lake Earl-Smith River Delta flood plain. Such development would jeopardize the area's natural resources and most productive agricultural lands. In addition, subdivisions would necessitate flood control measures, which would further conflict with maintenance of the natural resources and be of questionable economic benefit to local interests.

Sedimentation, a usual problem in most river deltas and many coastal lagoons and estuaries, is one of the more serious and potential problems in the Smith River Delta. The build-up of sediments in a river delta, normally a slow, evolutionary process, has been accelerated by man's activities such as logging, road construction and development and disturbances of the watershed above the delta. Increased sedimentation has caused impaction of critical spawning gravels, destroyed deep water pools and raised water temperatures to harmful levels.

Due to limited access, the full recreational potential of Lake Earl and the resulting economic benefits that could be derived from such potential, are not now being fully realized. There is a need for public access to the lower estuary of the Delta and for additional fishing access along the river proper. There are two boat landing sites at Lake Earl, but no legal access to the shoreline or other recreationally important lands surrounding the lake. With proper access, the Lake Earl area could be one of the most popular tourist attractions in Del Norte County.

The people of Del Norte County and the State of California have a great opportunity to protect, preserve and use some of northern California's most scenic and biological assets. Lake Earl can continue to provide the necessary life requirements for thousands of migratory and resident wildlife and fishes; and, can provide countless days of public enjoyment through hunting, fishing, sightseeing and other outdoor recreational uses. The Smith River fisheries, preserved and maintained, will always attract people to the Delta; and the local economy will benefit. Public awareness of conservation needs and concern for our dwindling natural resources, together with wise land use planning and decisions by state, federal and local administrators can preserve the area's natural amenities, and, from their wise use, insure a firm economic base for communities in the area.

RECOMMENDATIONS

The Smith River Delta and Lake Earl areas provide habitat necessary for the maintenance of a wide variety of fish and wildlife. The area also supports most of Del Norte County's agricultural production. In addition, the Smith River Delta-Lake Earl area has a high potential for meeting some of California's increasing outdoor recreational needs and contributing substantially to the area's tourist-related economy.

To maintain the natural resources and aesthetic quality of the Lake Earl-Smith River Delta area and to enhance its biological and recreational potential the Department of Fish and Game recommends that:

1. A flood plain management plan be prepared for the Smith River flood plain.

   In a 1971 study of the Smith River the U. S. Army Corps of Engineers documented that a serious flood problem exists but that resolving the problem through structural measures could not be economically justified. It further concluded that flood damage reductions could be achieved through better land management, use and development of the historical flood plain.

   The Resources Agency, in comments on the aforementioned study, urged the Corps of Engineers to assist Del Norte County develop a flood plain management plan. The implementation of such a plan may require flood plain zoning by the County and/or other governmental entities having jurisdiction in the area.

2. Existing land uses of agricultural and undeveloped lands in the delta and around Lake Earl (Plate 17) be maintained.

The present pattern of land use within the area is compatible with fish and wildlife habitat requirements and also contributes to the area's natural amenities. Land uses which would significantly alter the existing relationship between the river, the lake and adjacent agricultural lands would reduce the area's value to fish and wildlife. Maintenance of existing land uses will require agricultural and open space designations in the Del Norte County and the Coastal Zone Plans and appropriate zoning by the County.

3. <u>The lake and adjacent lands (Plate 17) be acquired by a public agency and managed for fish and wildlife production and public recreational use.</u>

Proposed land use changes threaten existing fish and wildlife resources and public recreational use in the Lake Earl-Smith River Delta Area. Public acquisition is the surest means of providing the protection and maintenance for the area's biological and scenic resources. Public acquisition would also provide for and yield the greatest public use and tourist-related economic returns.

The eventual outcome of present litigation concerning conflicting claims of ownership in Lake Earl between the State and a private party will determine whether the lake bottoms will have to be purchased.

4. <u>No projects be permitted which would alter the water level or characteristics of Lake Earl in a manner adversely affecting fish and wildlife.</u>

Present ecological conditions are favorable to fish and wildlife. Any significant change in these conditions would result in damage to the existing natural resources. The periodic breaching of the barrier dune to reduce floodwater level is an acceptable practice as long as water levels are not dropped below those presently experienced.

5. Jordon Creek and other tributaries to Lake Earl, and the lower Smith River, be protected from alterations that would adversely affect their value to fish and wildlife.

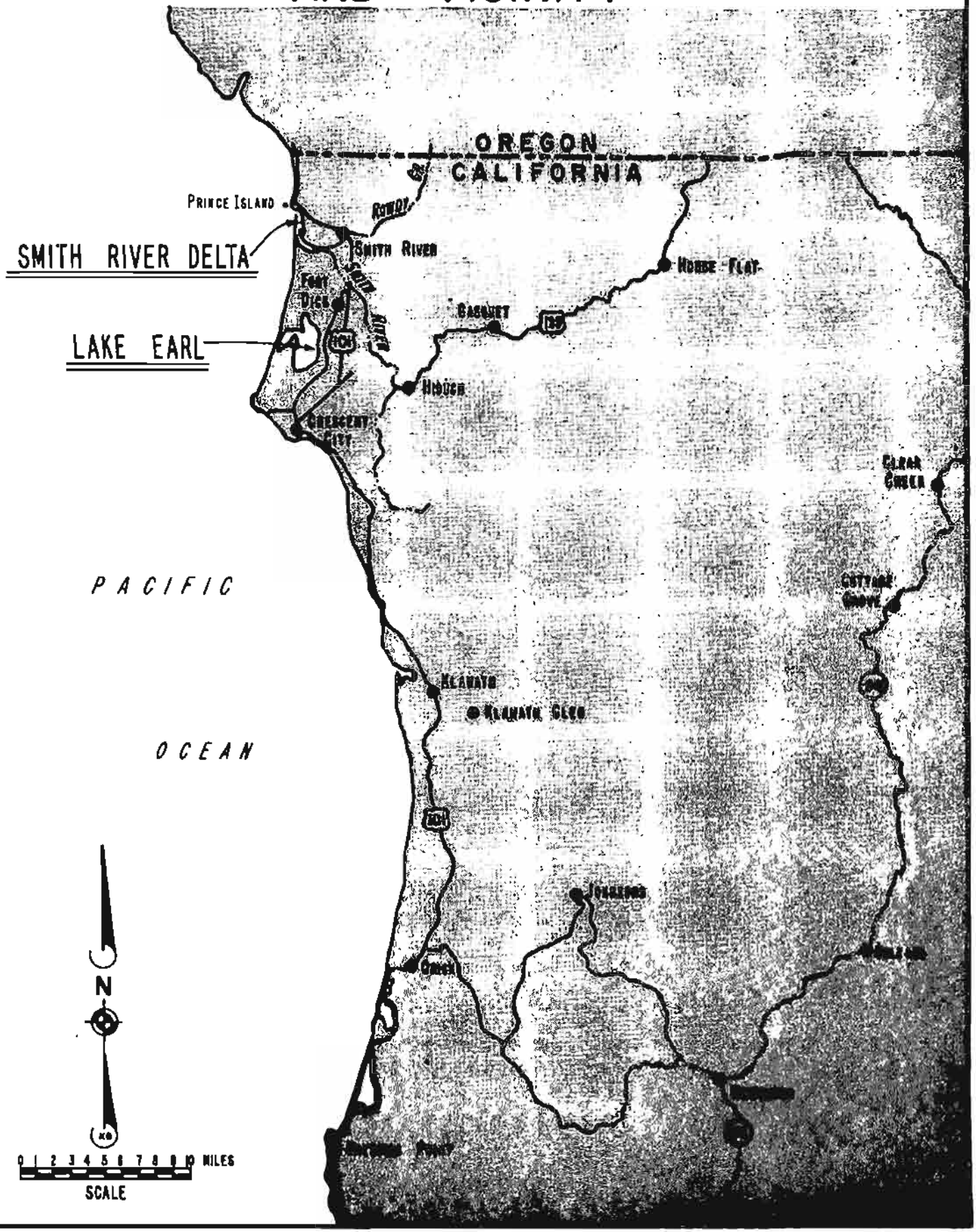
Stream spawning habitat is essential for the maintenance of salmonid populations and the sport and commercial fishery they support.

6. Public access be provided to Lake Earl and Smith River.

Legal access to Lake Earl is limited to two sites on the east shore. Two sites presently provide access to the north side of the Smith River. Recreational opportunity and use of the lake, river and delta could be increased and anticipated trespass problems minimized with more access sites and improved facilities (Plate 17).

PLATE I

LAKE EARL—SMITH RIVER DELTA AND VICINITY



THE LAKE EARL-SMITH RIVER DELTA AREA

General Description

Lake Earl and the Smith River Delta are part of a coastal plain extending from Crescent City to the California-Oregon border. The lake, located about 5 miles north of Crescent City, is actually composed of two bodies of water connected by a narrow channel. The larger of the two is called Lake Earl and the smaller is known as Lake Talawa. Lake Earl is 3.5 miles long and 1.5 miles wide with a normal surface area of 2,278 acres. Lake Talawa is much smaller with a normal surface area of 243 acres. In this report both Lake Earl and Lake Talawa are treated as a single unit.

The Smith River enters the Pacific Ocean four miles south of the California-Oregon border and 13 miles north of Crescent City, California (Plate 1). In this report the Smith River Delta is considered to be that portion of the flood plain bounded on the north and east by U. S. Highway 101 and to the south by a low ridge just south of Tryon Creek, extending northwesterly to Yontocket Slough. Streams tributary to the lower Smith are Rowdy Creek, Ritiner Creek, Delilah Creek and Morrison Creek.

The Smith River and Lake Earl have separate watersheds, but the lowland area in which Lake Earl lies is part of the historic flood plain of the Smith River. Flood waters occasionally flow over the low ridge separating the delta from the lake when river flows are exceptionally high.

The areas of primary concern and discussed in this report essentially fall within the boundaries of the flood plain of the lower Smith River and the watershed of Lake Earl. Although farm and ranch homes dot the entire valley, most of the area's population live in Crescent City and the communities of Smith River and Fort Dick.

Much of the land around the lake and in the delta is devoted to agriculture, particularly for pasture and hay production. The grazing lands and cultivated field are broken by riparian vegetation along many streams and sloughs, and by remnant stands of mature coastal forest.

Sand dunes dominate the landscape of a narrow strip from Point St. George, 15 miles north, to the mouth of the river. And foothills of the coast range border the flood plain to the east.

History

Spaniards were first to chart the northern California coast in the late 1700's. Sailors and merchants of other nations soon followed in search of furs which were obtained in trade with the coastal Indian tribes. This fur trade reached its peak in 1800 and lasted until about 1840.

The first white man known to have reached the Smith River by overland travel was Jedediah Smith who arrived in June of 1828. It was not until the gold rush of 1850 that the first permanent settlers began to establish themselves in the area.

The need for a seaport to supply the miners of the Trinity River gold fields led to exploration of the Crescent City Harbor and in February of 1853 surveyors laid out the town site of Crescent City. A sawmill

was established and the population of the new city grew to 1,000 persons within a year.

With the growing population, the demand for farm products increased and stimulated the development of the rich bottomlands of the Smith River flood plain for agricultural purposes. In August of 1853 the small community of Smith River was founded with the construction of a few farmer's cabins. The town eventually grew to include a store, hotel and other business houses.

The early day settlers of this period left a picture of abundant natural resources. Fish and game of many kinds abounded (Bledsoe, 1881). References are made to Lake Earl and its extensive marshland surrounded by brush and timber. Mention was also made of the Talawa Indians who dwelled in the village of Aichulet near Lake Earl and lived on the abundant waterfowl and the Roosevelt elk, which they captured in pits dug for that purpose.

As civilization expanded and gradually moved the Indians from their former dwelling places, the character of the land was changed. Most of the timber on the coastal plain was cut for lumber and the brush was removed to permit farming and livestock grazing. Some wildlife populations were much reduced or eliminated by these land use changes.

Lake Earl also experienced changes. It was used at one time for transporting and decking logs for one of the county's early mills. Then, in the early 1900's, it was considered as a possible freshwater port with the eventual development of a city along its shores. Experiments with devices to control the water level all failed. In time, interest

in various development schemes waned and the lake was left pretty much as it was.

During the same period a commercial salmon fishery developed on the Smith River. The salmon were processed in a cannery located on Tillas Slough. This fishery thrived until beach seines and gill nets were declared illegal by the State legislature in the early 1930's.

By 1880 the major industry in Del Norte County had changed from mining and associated activities to lumber production. The Smith River/Lake Earl area continued to supply fruit and grain for local use, as well as dairy products which had now become the primary agricultural practices. These land uses have remained virtually unchanged to the present time, although some of the crops grown have changed.

Climate

The climate is Mediterranean in character with moderate temperatures, heavy precipitation and many foggy days throughout the year.

Average summer and winter temperatures seldom vary over 10°F. Temperatures below 32°F are experienced nearly every winter and the mean low temperature in January is 36°F. Summer highs seldom exceed 80°F and the mean maximum in July is 70°F.

The area receives 90 inches of precipitation annually with over 90% occurring from October through April. Although the bulk of the rainfall comes in winter some precipitation is usually recorded during each month of the year.

Fog is common during the morning and evening hours of the summer months. Prevailing winds are from the north and northwest. However, winter storms can bring winds, generally from the south or southwest, sometimes exceeding 55-75 miles per hour. The mild winter temperatures result in a frost-free growing season of about 250 days extending from the first of April to mid-November.

Geology

Twenty-five million years ago the area now known as the Smith River plain was a part of the Coast Range Mountains. Through geologic disturbances this block separated and sank into the sea. For more than 24 million years the Smith River deposited its alluvium over this area. The alluvium was smoothed into a flat submarine plateau by wave actions and ocean currents.

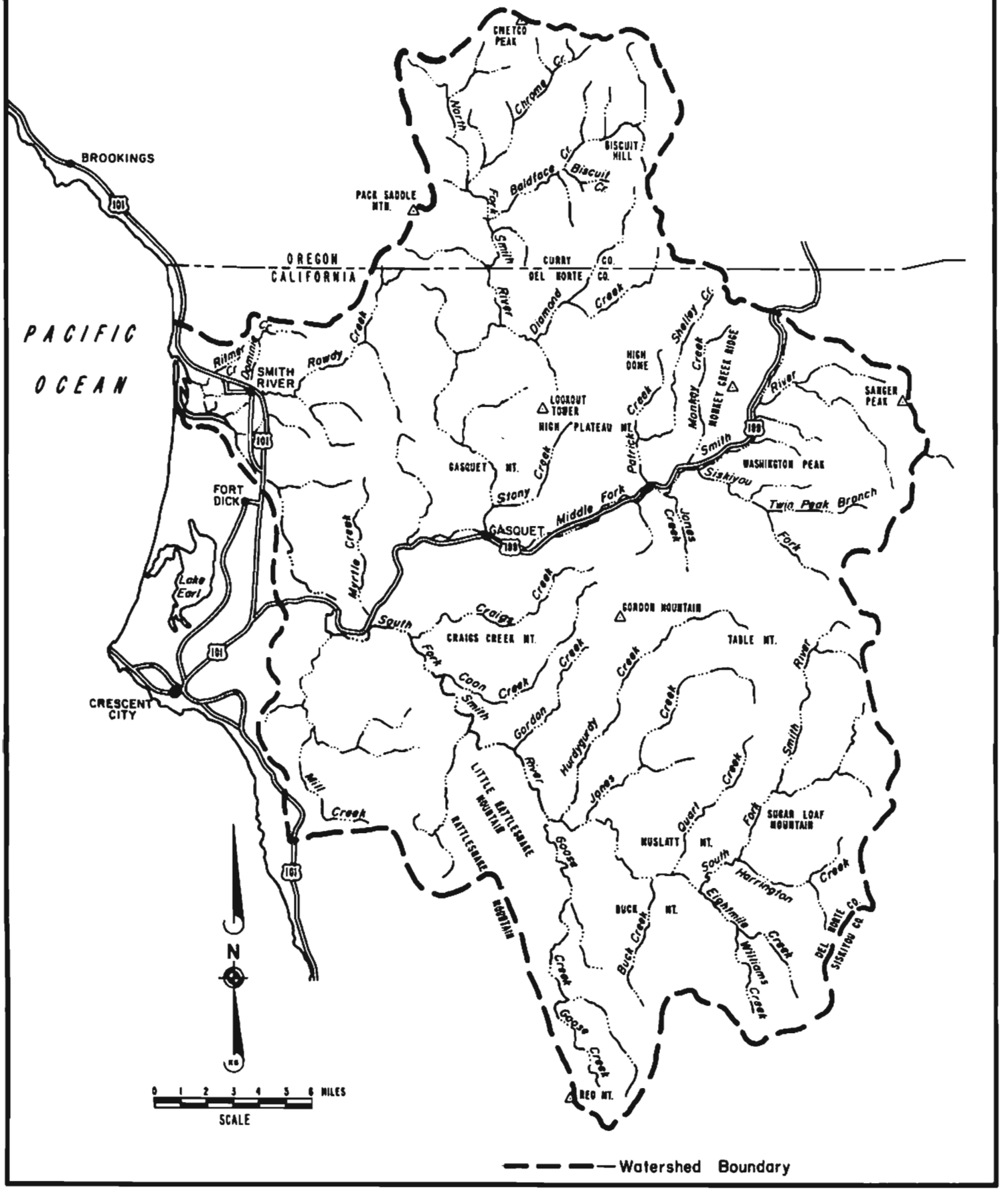
Two formations were created during this time. The first was the Saint George formation. It was deposited in Pliocene time and is 350 to 400 feet thick. Composed mainly of fine grained sediments, this formation is fairly impervious to water.

A second formation was deposited over the Saint George formation and is referred to as the Battery formation. This formation has been deposited during the last one million years and is about 35 feet thick.

During the past 200,000 years the plateau has been rising and the river has been cutting into it. At this time the plateau is about 25 feet above the river at the point where the river flows onto the plateau. Recent layers of alluvium have been deposited over the Battery formation by flood waters of the Smith River.

PLATE 2

SMITH RIVER WATERSHED



Most of the Lake Earl area is situated on the Battery formation. The northern shore rests upon unconsolidated flood plain deposits laid down by floods from the Smith River. To the west, the shore is composed of sand dunes formed by wind and wave action. Both dune sand and flood plain deposits are relatively thin and rest upon the Battery formation. Because this formation is the principal ground water aquifer, ground water is relatively close to the surface (Department of Water Resources, 1970).

Drainage

The Smith River watershed covers an area of 720 square miles, mostly in California. Parts of the northern portion of the basin extend into Curry and Josephine counties, Oregon. The drainage area is about 40 miles long and 24 miles wide (Plate 2).

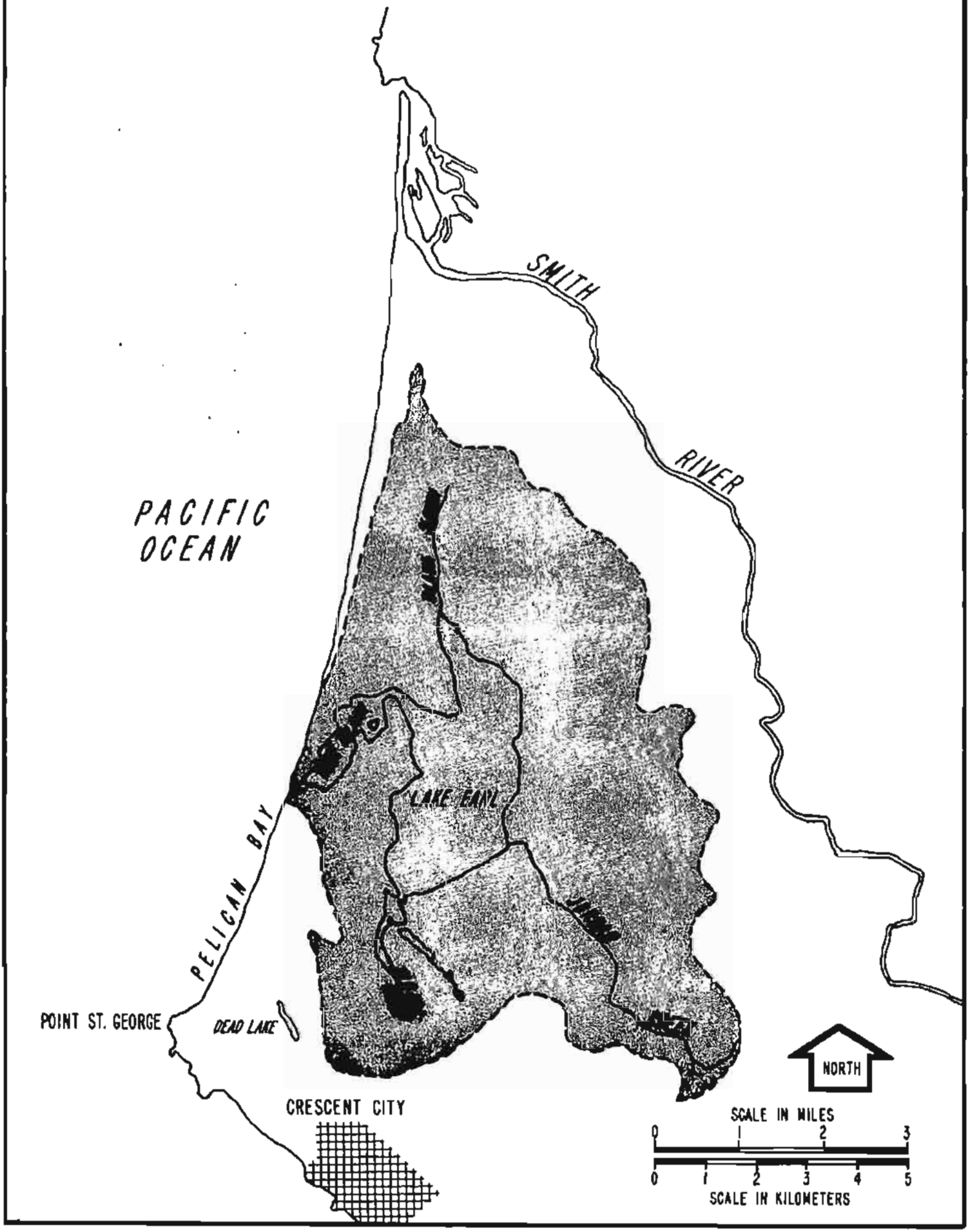
Above the coastal flood plain the drainage is typified by rugged mountainous terrain ranging from near sea level to over 6,500 feet in elevation. The watershed is well forested by old growth and second growth conifers. At lower elevations redwoods are the dominant forest type. Up-river, Douglas fir and mixed stands of hardwoods and conifers are common.

Annual precipitation ranges from 80 to 120 inches within the basin, resulting in an average annual discharge estimated at 2,900,000 acre-feet, or almost 7 acre-feet per acre per year (Corps of Engineers, 1971). This high run-off gives the Smith River the highest annual discharge per square mile of any major basin in California.

The last 4 miles of the river are influenced by the tides. Tidal characteristics at the mouth are comparable to those at Crescent City. Mean

PLATE 3

LAKE EARL WATERSHED



tide is 4.0 feet above mean lower low water (MLLW). The highest tides reach 9.0 feet above MLLW.

The flood plain of the Smith River, in addition to the delta, extends southerly to include Lakes Earl and Talawa and surrounding lowlands (Plate 15). Originally Lake Earl was part of the Smith River drainage. At one time the river flowed into the lake and then into the sea. Geophysical changes shifted the river mouth several miles to the north, separating the two drainages. During high water periods the river floods still may pass into Lake Earl via the old river channel now known as Yontocket Slough.

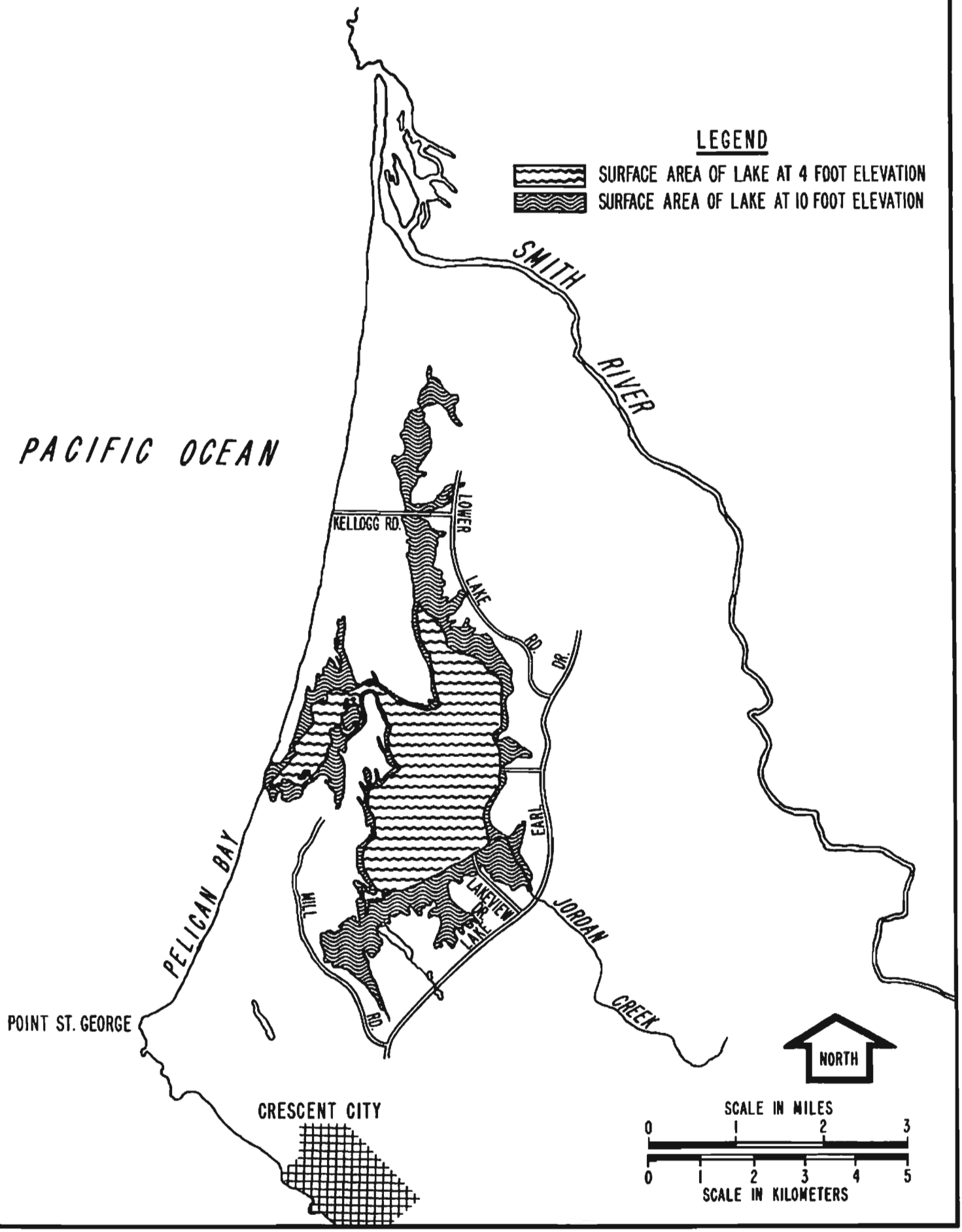
Excluding periodic floods from the Smith River, Lake Earl now receives waters from a drainage basin of 32 square miles (Department of Water Resources, 1970) (Plate 3). The only substantial tributary is Jordan Creek which enters the lake from the east. However, water volumes flowing into the lake are augmented from ground water sources. Both lakes are shallow with a mean depth of 5 feet. Maximum depths reach 18 feet in the connecting channel. The normal surface elevation is 4 feet above sea level, but seasonal flooding may raise the water levels substantially and increase the surface area of the two lakes to over 4,000 acres (Plate 4).

In order to prevent flooding of adjacent pastures around the lake, a channel is periodically opened to the sea to permit drainage. Before man provided artificial openings, the lakes undoubtedly broke open to the sea naturally when water levels were high, as do most of the other north coast lagoons. Occasionally the sand barrier is still breached naturally when lake levels, tides and winds create the necessary conditions (Corps of Engineers, 1971). When breaching occurs, either mechanically or naturally, there is an interchange of lake water and sea water as a result of drainage and tidal action making the water brackish.

WATER LEVELS IN LAKE EARL ARE LOWERED BY BULLDOZING THROUGH THE SANDDUNE BARRIER TO THE OCEAN. FOR A SHORT TIME FOLLOWING BREACHING, THE LAKE IS SUBJECT TO TIDAL INFLUENCE.
(DEPT. FISH & GAME PHOTO BY JOHN SPETH - 1974)

PLATE 4

SURFACE AREAS OF LAKE EARL



Land Ownership and Access

The Smith River Delta-Lake Earl area is mostly in private ownership (Plates 5 and 6). The largest tract of public land is a 227 parcel along the ocean between the mouth of the Smith River and Lake Earl. It is owned by the Del Norte County and known as Pala Beach Park.

Most of the State-owned lands are confined to the river channel and are designated as state tide and submerged lands. However, the State's claim to the wetlands of lakes Earl and Talawa is being contested by a private interest, which contends that these lands are not tide lands. The matter is being litigated.

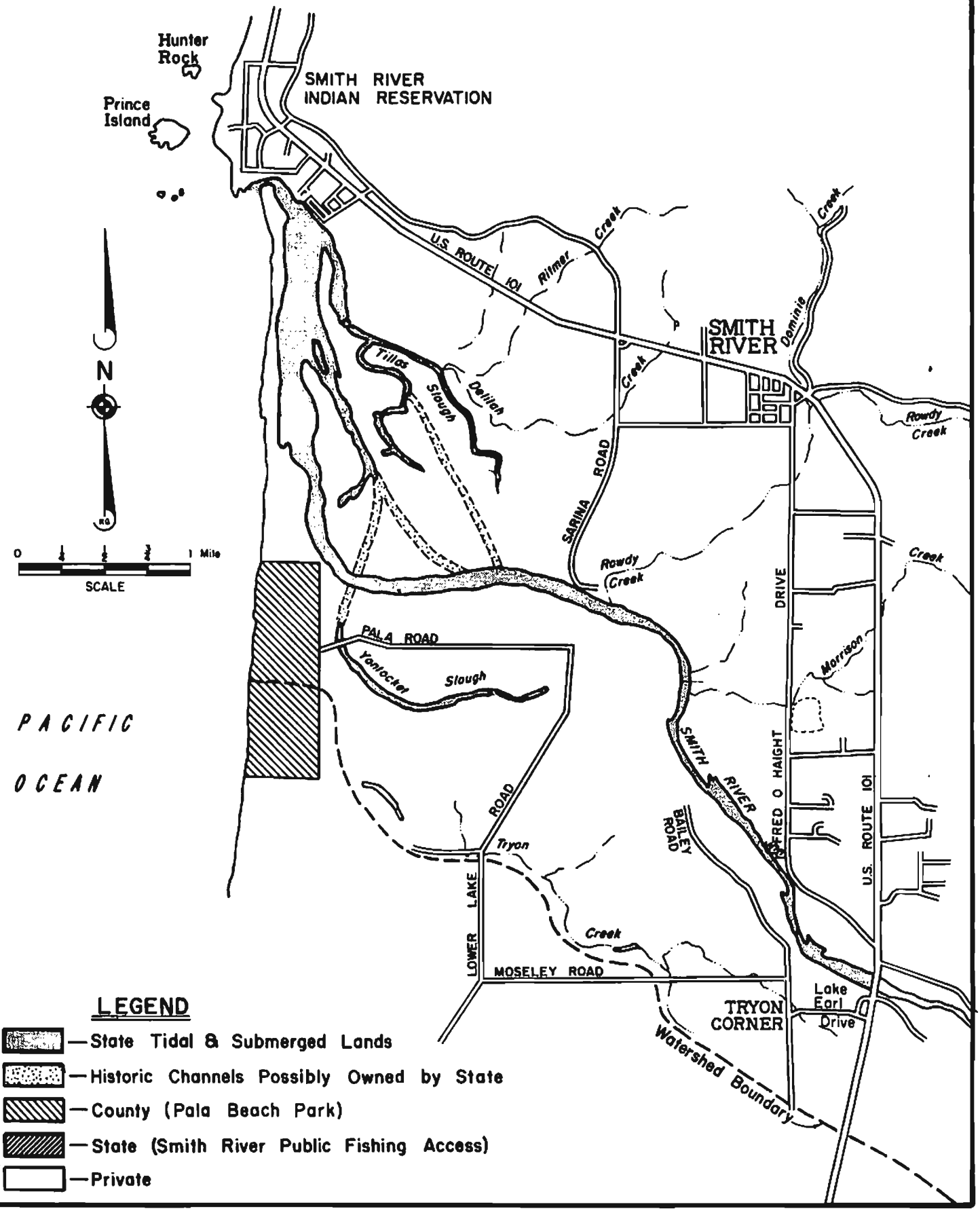
A 3.13 acre parcel purchased by The Wildlife Conservation Board is the site of the Smith River Public Fishing Access. This access facility on Fred Haight Road was constructed by the Wildlife Conservation Board and is operated by Del Norte County (Plate 17).

Access to the river is also available from the commercial facilities at Ship Ashore, located at the mouth and at the Trails End resort about one-half way between the bridge and the mouth. All available access is from the north side of the river.

Access to Lake Earl is available at the foot Buzzini Road and at the end of Lake Earl Road. Both sites are on the east side of the lake. Although shoreline access is limited, the lakes are recognized as navigable waters by the Corps of Engineers under the "Rivers and Harbors Act of 1899" and are therefore open to public use (Corps of Engineers Correspondence, 1974).

PLATE 5

LAND OWNERSHIP
SMITH RIVER DELTA

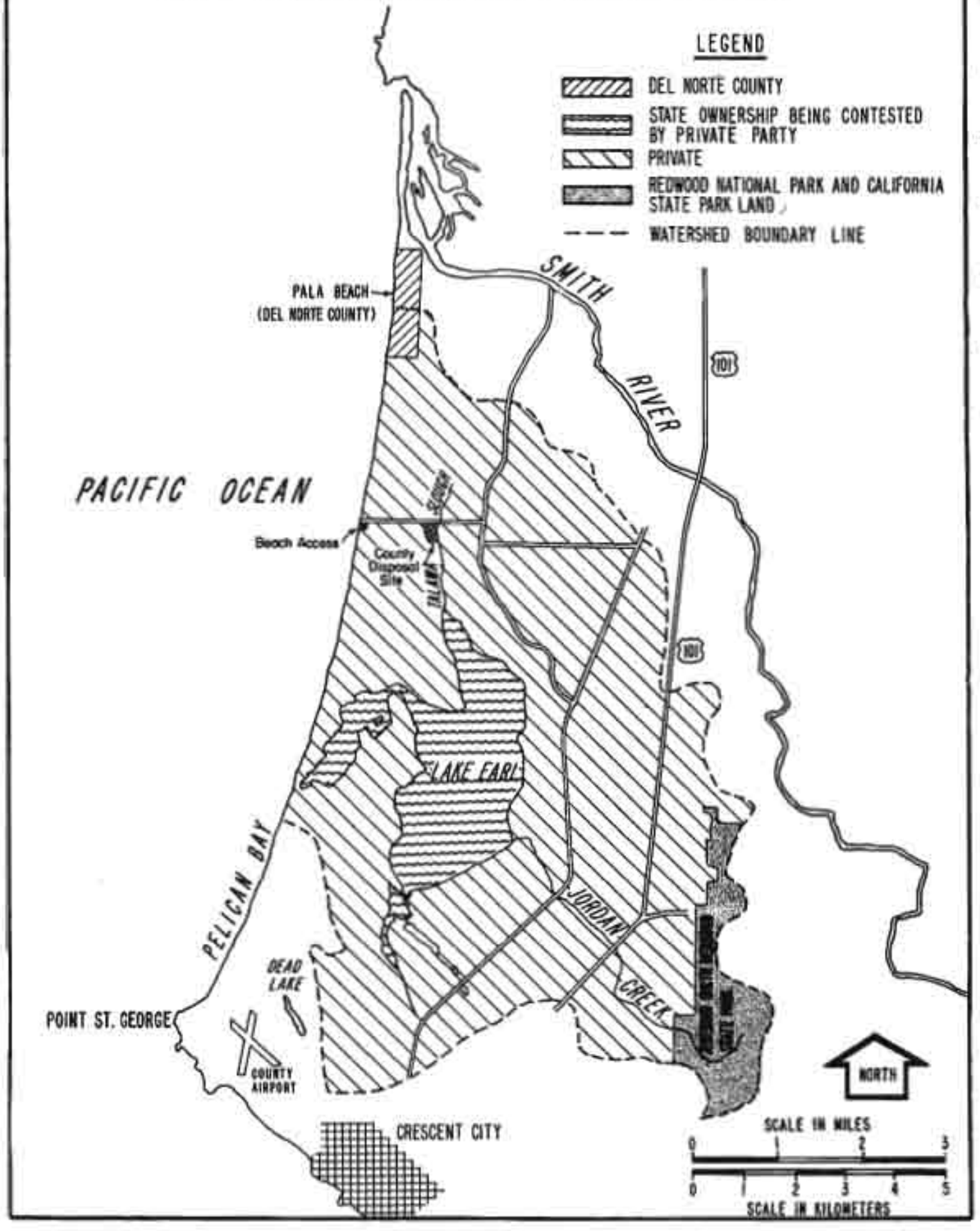


LEGEND

- State Tidal & Submerged Lands
- Historic Channels Possibly Owned by State
- County (Pala Beach Park)
- State (Smith River Public Fishing Access)
- Private

PLATE 6

LAKE EARL LAND OWNERSHIP



Land and Water Uses

Agriculture is the major land use within the area. Most of the land is used as pasture for beef and dairy livestock. Approximately 5% of the cultivated area is devoted to nursery crops such as lilies, ferns, azaleas and daffodils. Orchard and row crops are grown but only on a very limited basis (Plates 7 and 8).

Sand and gravel extraction operations are conducted along the river on suitable sites. The few other major industrial activities are associated with the lumber industry. Commercial enterprises catering to the tourist trade are found along U. S. Highway 101 and near the river mouth. Most of the tourist use is transient or is related to sport fishing. Industrial and commercial uses account for only a small portion of land use of the Smith River Delta-Lake Earl area.

Small urban developments also are present in a few locations, particularly to the south and along Lake Earl Drive. A large sub-division, undeveloped except for roads, also is situated in the sand dunes north of Lake Talawa.

Although public access is restricted throughout most of the area, outdoor recreation is an important land and water use. Fishing is by far the most notable use at present; but hunting, nature study, photography and sightseeing are also substantial.

Water for agricultural irrigation is pumped directly from the river or its tributaries at a number of locations, but the total volume used is not great. Water is also diverted from the river just upstream from U. S. Highway 101 for Crescent City and other urban areas. Rural residents usually obtain their water through wells.

PLATE 7

PRESENT LAND USE

SMITH RIVER DELTA

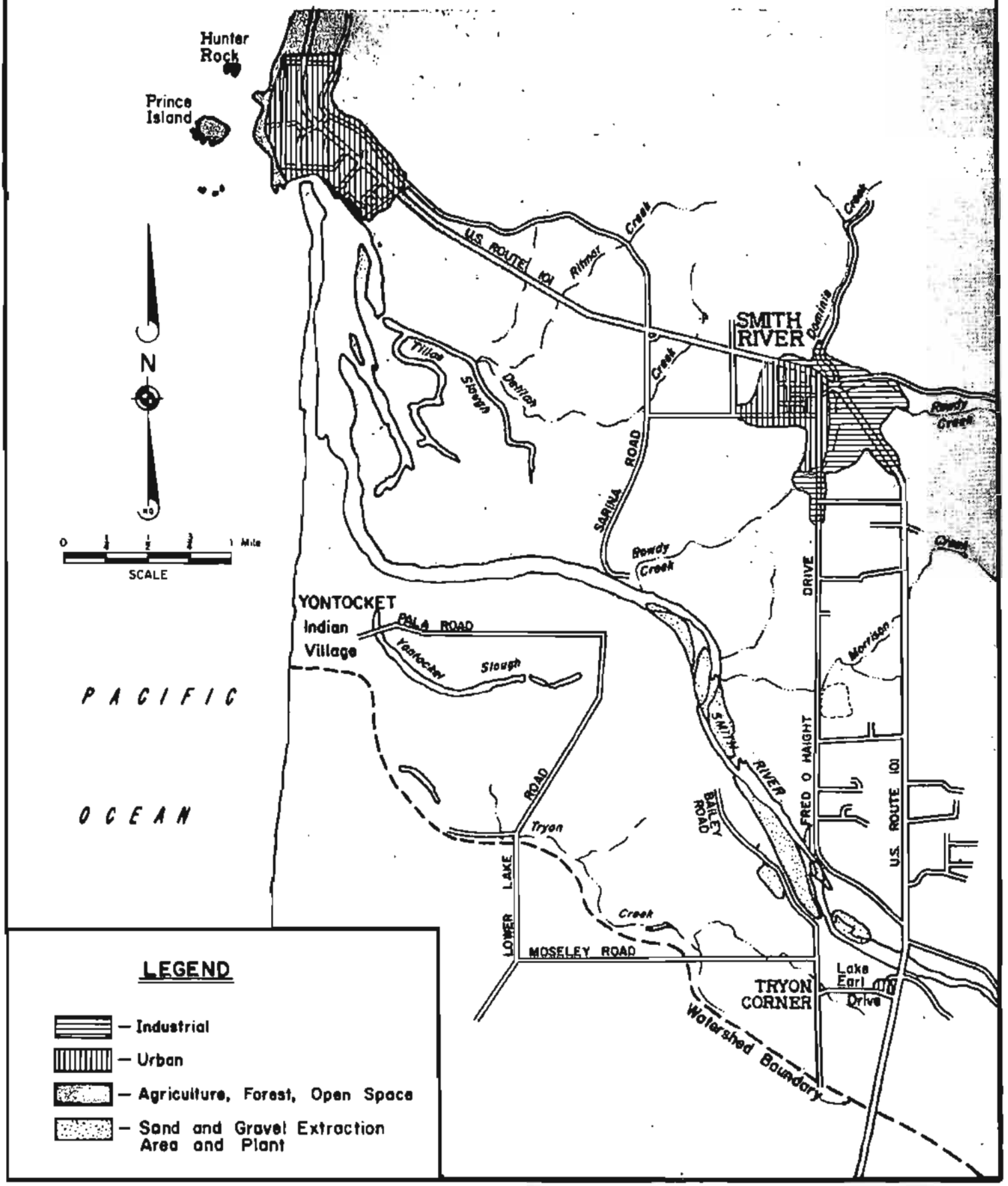
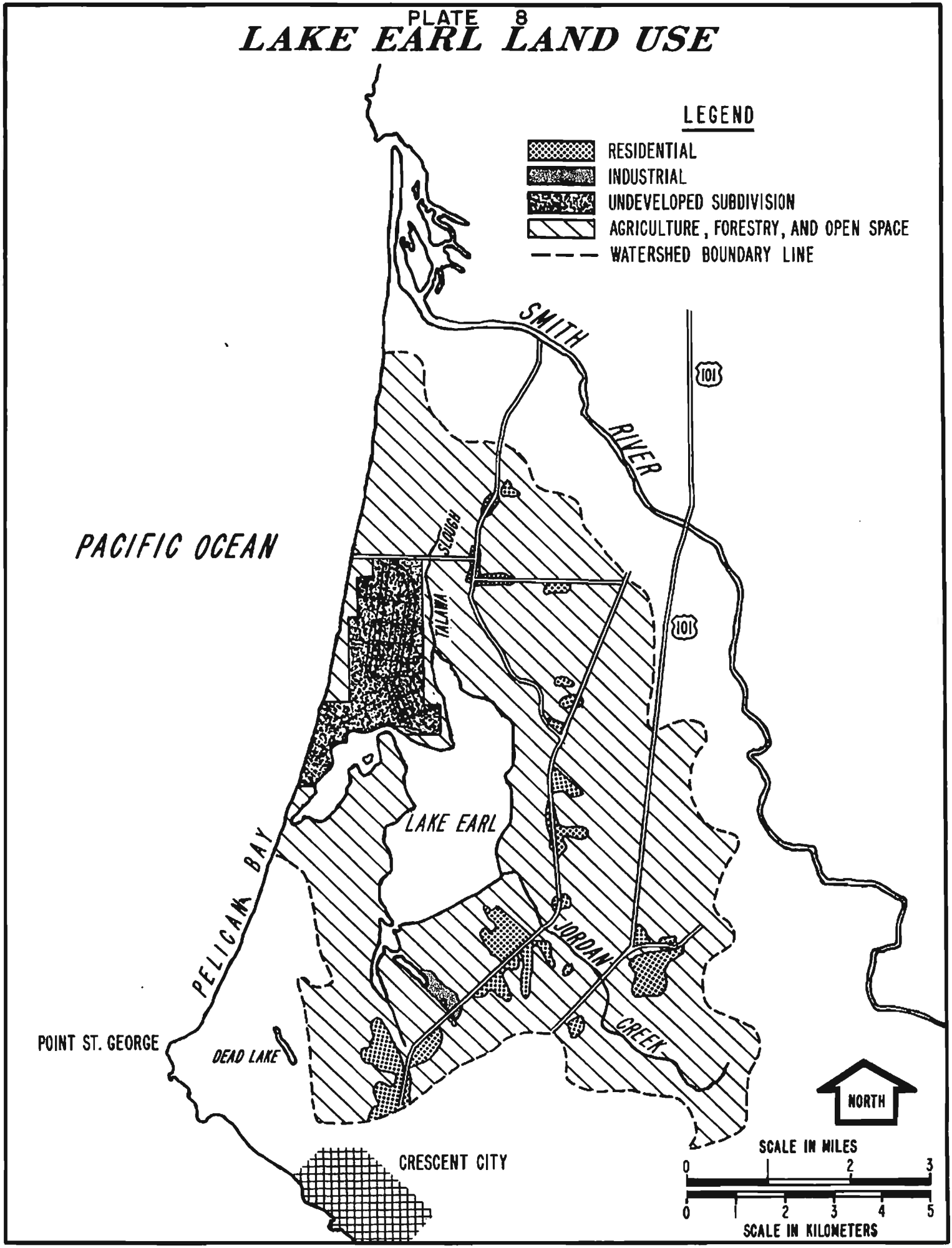


PLATE 8

LAKE EARL LAND USE



Water Quality

Water quality in the Smith River and ground water in the Smith River plain is considered to be very good. As a result of the extremely high rainfall, both water sources are low in mineral content. The high rainfall exerts a diluting effect which controls the concentration gradient of dissolved mineral particles. Although high iron concentrations have been found in local areas, both water sources are considered excellent for irrigation and domestic use.

The waters of the Smith River have a mean summer temperature of 64°F with a high of 74°F. Winter water temperatures have a mean of 46°F with a low of 39°F.

Although called lakes, the two bodies of water constituting the Lake Earl wetlands are similar to the coastal lagoons farther to the south which are only periodically open to the sea. When the dunes which separate Lake Talawa from the sea are breached, salt water is free to pass into the lakes. This mixing creates varying degrees of salinity ranging from pure sea water near the entrance to almost freshwater near the mouth of Jordan Creek. In between are many degrees of brackishness depending on the temperature, precipitation, wind and sea water intrusion.

In the deeper water of the "Narrows" between the two lakes there is often a salinity stratification. The lighter freshwater rises to the surface while the heavier salt water settles to the bottom.

Temperatures are as variable as salinity but more predictable. They fluctuate with the seasons, often approaching 70°F in the summer and

dropping to near freezing in winter. Weak thermal stratification occurs but is prevented from stabilizing over most of the lake because of the shallow water depths and almost constant wind agitation. In the deeper water of the "Narrows," however, temperature stratification does occur and is related to salinity.

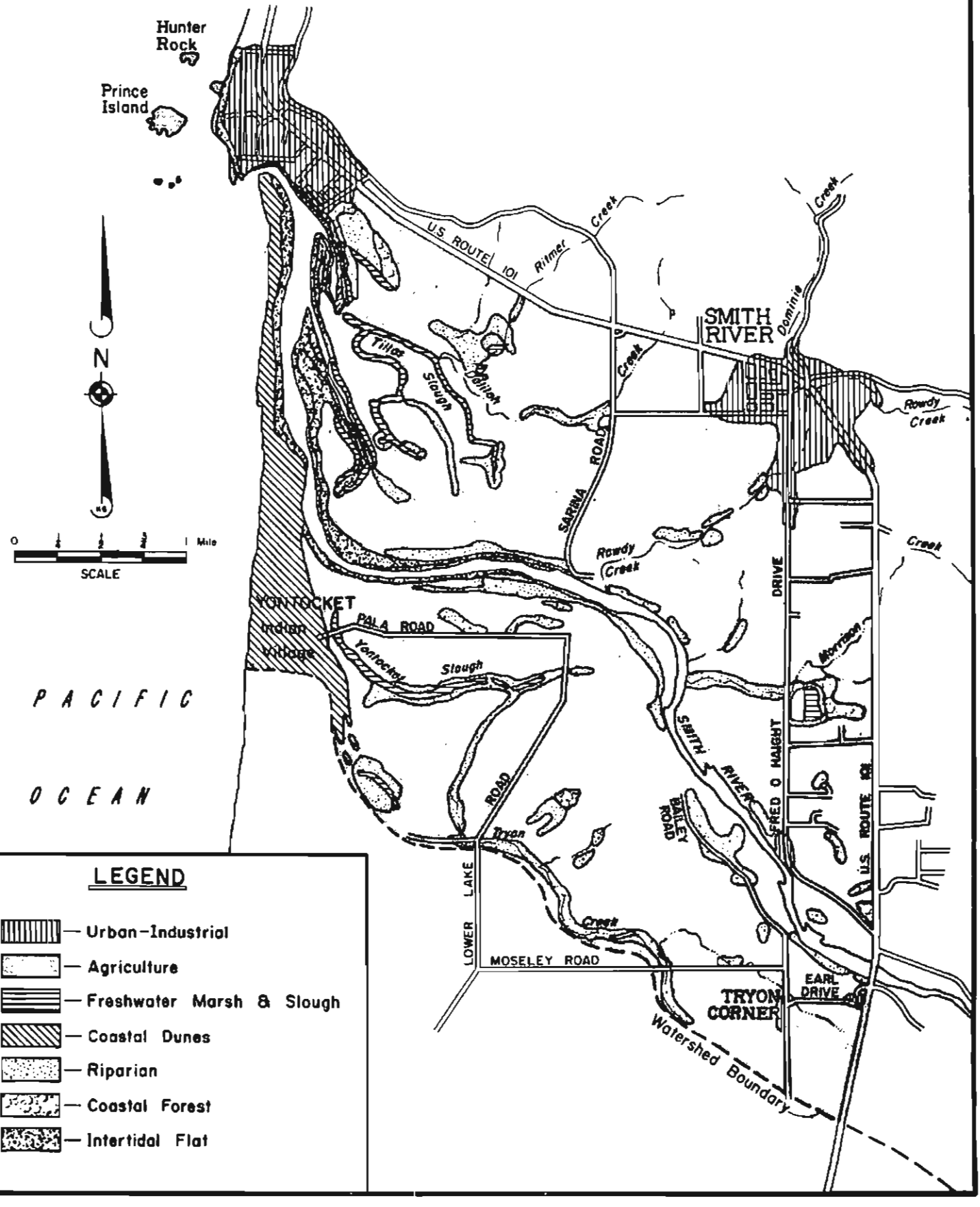
The dissolved oxygen content is suitable to support the aquatic life present. During daylight hours, when the dense submergent vegetation is producing oxygen through photosynthesis, the water may become super-saturated. When the plants are utilizing oxygen through respiration or when decomposition of dead material in winter reduces available oxygen, the oxygen level is maintained by wind and wave activated aeration.

All waste disposal facilities in the area are individual septic tank and leachfield systems, with the exception of the new sewage facilities of the Ship Ashore Resort. At this time there have been no reports of chronic failures in these systems and no evidence has been found of a deleterious effect on the bacteriological quality of local waters.

PLATE 9

HABITAT TYPES

SMITH RIVER DELTA



LEGEND

- Urban-Industrial
- Agriculture
- Freshwater Marsh & Slough
- Coastal Dunes
- Riparian
- Coastal Forest
- Intertidal Flat

NATURAL RESOURCES

Habitat

The amount and variety of habitat present in any area is the basic factor which determines the amount and variety of fish and wildlife that can live there. The influence of man's activities usually results in a decline in available habitat and a corresponding decline in carrying capacity for native species. Although this has happened to some extent in the Lake Earl-Smith River Delta area, most of the lands and waters still provide sufficient habitat to support large populations of fish and wildlife.

Of the approximate 28,600 acres that comprise flood plain area of concern in this report, about 2,800 acres have been intensely developed for industrial, commercial and residential purposes (wildlife value of those lands has been greatly reduced). The remaining lands, however, have high fish and wildlife values. The variety and interspersion of habitat types, combined with seasonal and periodic flooding, provide essential food and cover that supports both resident and migratory fish and wildlife of many kinds. The habitat types represented (Plates 9 and 10) are classified as woodland and forest, riparian, marsh, intertidal flats and channels, open water, coastal sand dunes, agriculture, and urban and industrial. Acreages are summarized as follows:

PLATE 10

LAKE EARL HABITAT TYPES

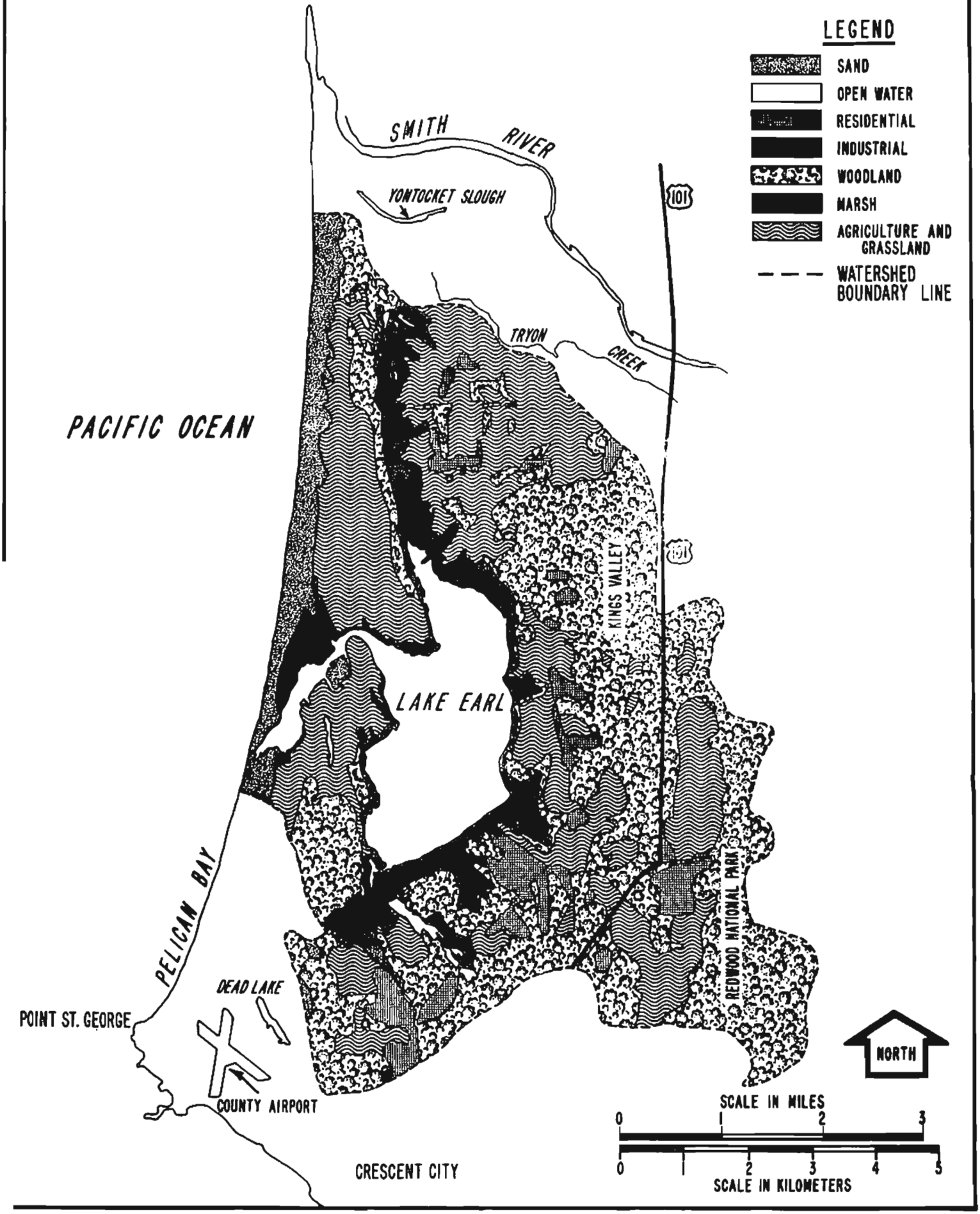


Table 1

Habitat Acreages

	Lake Earl	Smith River Delta
Woodland and Forest	8,045	102
Riparian	--	608
Marshes and Sloughs	1,357	115
Intertidal Flats and Channels	--	302
Open Water	2,611	--
Coastal Sand Dunes	1,385	362
Agriculture	4,495	6,400
Urban and Industrial	2,458	365

Woodland and Forest

Several distinct types of woodland habitat occur in the flood plain. Each type has its own particular character which is determined by soil types, exposure, moisture conditions, and plant species present. On the sandy soils between Lake Earl and the ocean, woodlands are typified by Sitka spruce, beach pine and Monterey cypress.1/ The understory of blackberry, salal, huckleberry and other shrubs usually forms very dense, almost impenetrable thickets.

Formerly coastal forests of redwood and Douglas fir covered much of the more stable soils of the coastal plain. Remnants of these forests still comprise a large percentage of the area's cover. Original old growth, and in many cases much of the second growth, has been cut for lumber in areas outside the State Park. Consequently, the remainder is in mixed, dense stands of redwoods, Douglas fir, spruce, alder, silktassel

1/ Scientific names of plants are appended (Appendix A).

and cascara, interspersed with a few groves of uncut second growth of an older age class.

Riparian

Streamside vegetation which borders most of the Smith River channel, its tributaries and flood plain sloughs, is extremely important in maintaining the abundance and variety of fish and wildlife found in the Lake Earl-Delta area. Threads of riparian vegetation along these water courses provide in some cases the only cover in otherwise open pasturelands. The most common plants associated with this habitat type include red alder, spruce, willow, blackberry and salmonberry.

Marshes and Sloughs

Salt marsh occurs in the lower estuary of the Smith River Delta only as isolated strands of edge cover between the upper tide line and higher ground. Prior to man's influence the amount of salt marsh in the Delta proper was probably somewhat greater but land reclamation and changes in the character of the lower river system have virtually eliminated this habitat type.

Freshwater marshes and isolated sloughs--those cut off from tidal influence--are scattered throughout the delta and flood plain. These habitats are subject to inundation during periods of moderate or high flows in the river or from high rainfall. Winter rains and flooding also create temporary wetlands in low pastures and grasslands. The seasonal nature of these wetlands does not detract from their value for wildlife since the time of flooding coincides with the highest use period by migrant and wintering water associated bird life. Tilas and Yontocket sloughs are the largest units of this habitat type.

More extensive marshes occur on the perimeter of Lake Earl and Lake Talawa. Closer to the influence of the ocean, the lake marsh waters tend to be saline; while further inland, they are more nearly fresh water. This saline gradient gives rise to a striking divergence or stratification in the types of marsh plants present (Plate 11).

Most of the small wetland areas found in low spots among the sand dunes are seasonal. The types of plants they support are capable of surviving relatively long periods without standing water.

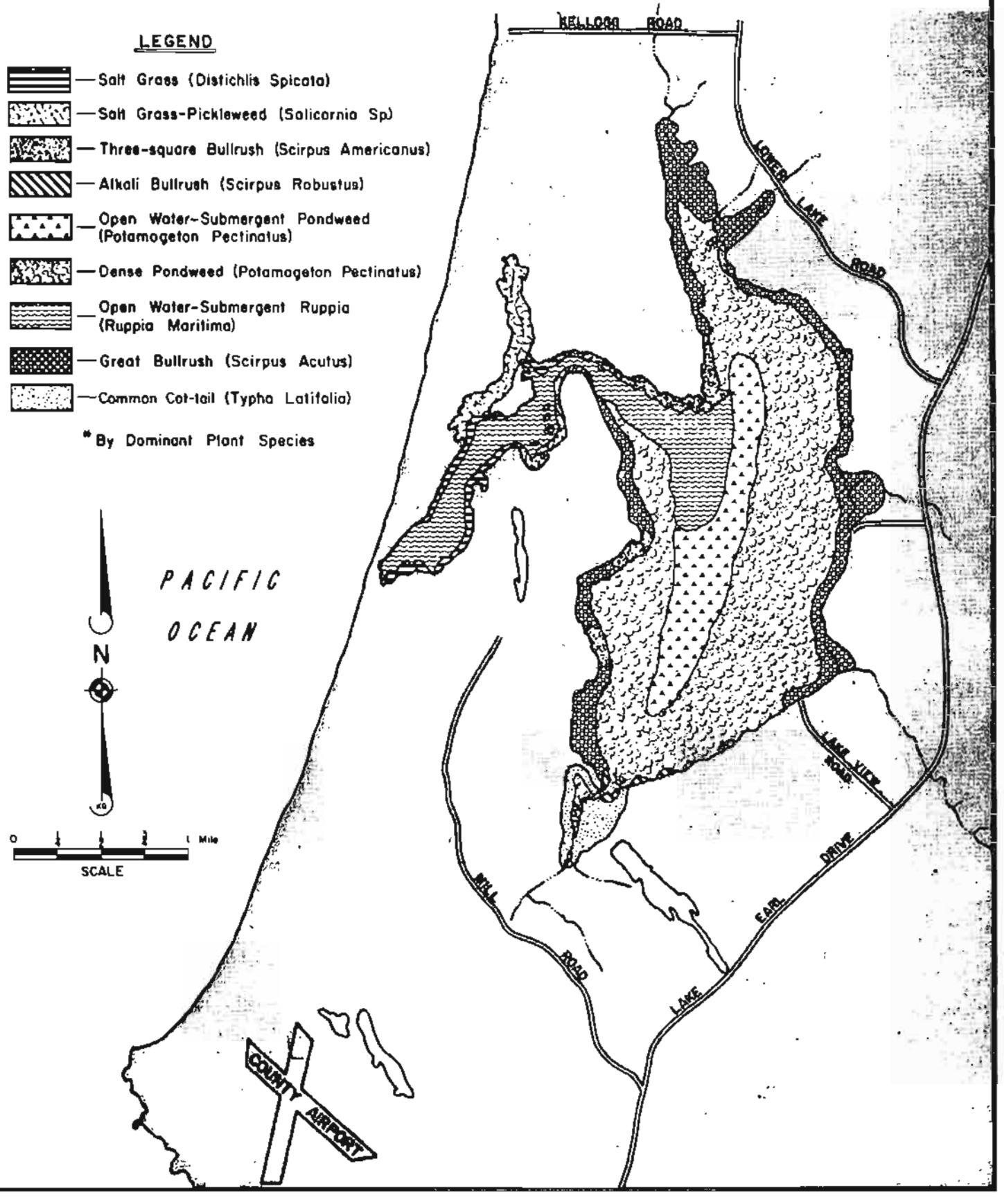
Plant species are influenced by soil types, water salinity, water depths and seasonal flooding. Consequently, marshes may display widely divergent vegetative characteristics from one site to the next. Hence, marsh vegetation is variable and includes submergents such as sago pondweed and widgeon grass; emergents like cattails, bulrushes, bur-reeds and arrow-head; and upland marsh plants such as saltgrass, pickleweed, rush, silverweed, brass buttons, sedge, dock, goosefoot, and spikerush.

Intertidal Mudflats and Channels

The lower Delta and its tributary sloughs are subject to tidal exchange from the sea. The zone between the high and low water marks is classified as intertidal flats. The river channels are deeper than the lowest tides and are always submerged. Because of the salinity, tidal fluctuation and annual scouring of the river, the channels and mudflats are bare of vegetation except for a few species of algae. *Ulva* sp. and *Enteromorpha* spp., which are green algae, are the predominant algal species. Some red and brown algae are attached to rocks at the mouth. Algae provides protective cover for many invertebrates and adds oxygen

PLATE II

LAKE EARL PLANT ZONATION*



to the ecosystem. Although vegetation is lacking, bottom sediments, particularly in the lower estuary, contain many invertebrate animal organisms which are important in the food chain that supports higher life forms.

Because Lake Earl is blocked from the sea by a sand bar, the lake actually does not possess intertidal flats. However, when the bar is breached periodically to lower the level of the lake waters, some mud-flats become accessible to water birds.

Open Water

The two lakes comprise approximately 13% of the Lake Earl area. The normal summer elevation of the lakes is four feet above sea level with a surface area of about 2,500 acres. The lake surfaces, excluding adjacent marshes, are classified as "open water."

The lakes are shallow throughout the year and are rich in nutrients. Consequently they produce a rich growth of submergent aquatic vegetation. The type and density of this vegetation is determined by salinity, water depth and bottom sediment composition and results in a clearly-defined plant zonation (Plate 11).

The primary plant species in the open waters of Lake Earl are sago pondweed, widgeon grass and coontail (Wood, 1973). During the summer and early fall the vegetation becomes so dense that power boating is difficult. The abundant food source provided by the prolific plant growth on Lake Earl and Lake Talawa attracts thousands of water. On the open water surfaces of marsh ponds and sloughs in the flood plain, one often finds floating mats of yellow water lily, water water buttercup and duckweed.

Coastal Sand Dunes

The sand dunes along the coastline extend southward from the mouth of Smith River to near Point St. George. In places the dunes extend as far as 2,500 feet inland and reach elevations up to 60 feet above sea level. Formed about 5,000 years ago by littoral drift, the dunes created and maintain the natural barrier that is vital to the formation of Lake Earl and make it a lagoon rather than an estuary.

Those dunes closest to the beach are relatively free of vegetation. The inner dunes, however, generally are stabilized with plant cover and tend to hold back the less stable sand deposited by the sea (Plate 12). If the dunes were substantially altered, it is possible that the sea would inundate the lowlands now occupied by the lakes (Helly and Avertt, 1971).

Vegetation typical of the inner dunes include scattered patches of saltgrass, pickleweed, dune tansey and beach strawberry. Other common dune plants are European dunegrass, sand verbena, beachgrass, silverweed, rush and lupine. Occasional patches and stringers of willow, Sitka spruce beach pine, wax myrtle, silktassel and coyote brush dot the dunes landscape.

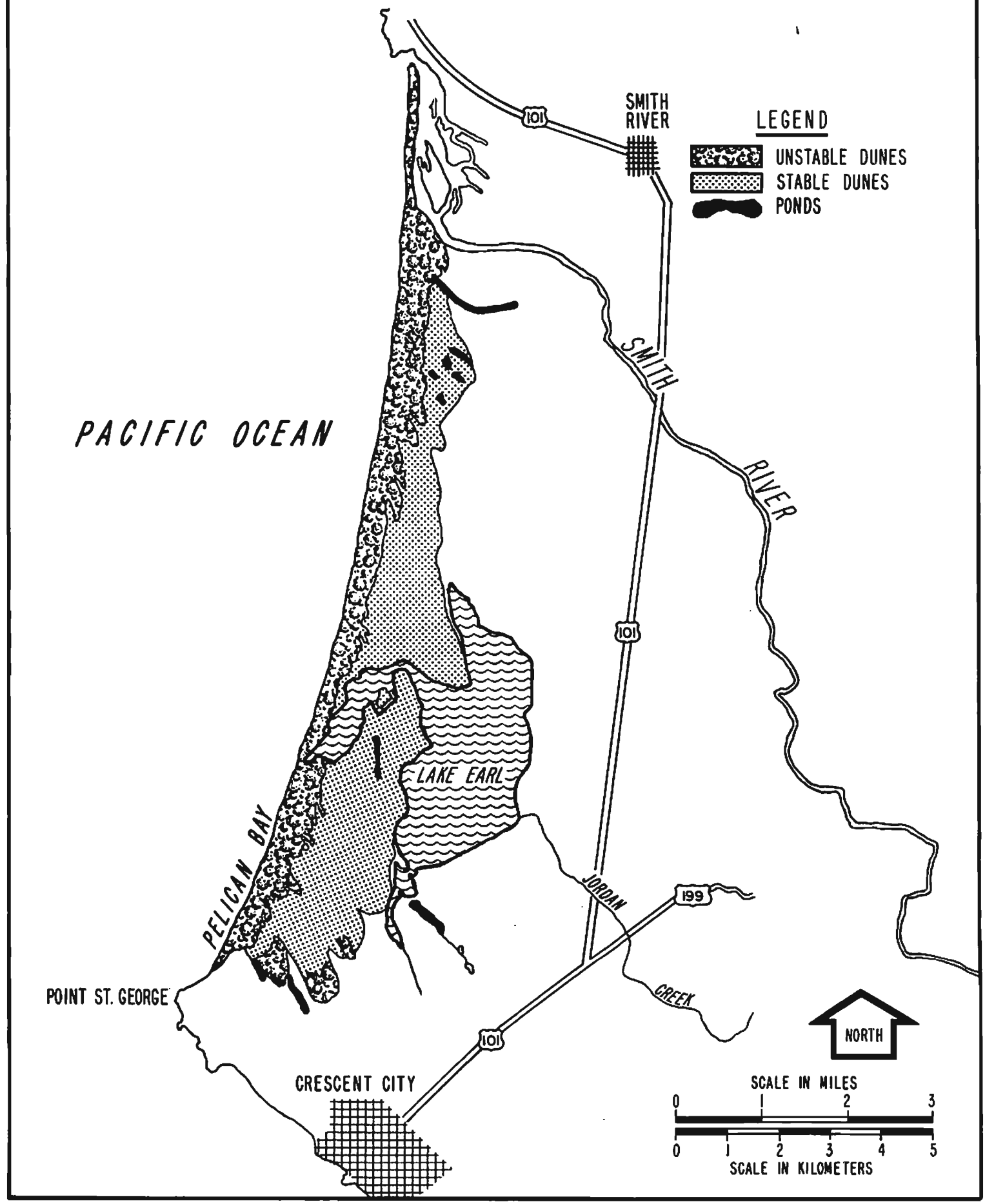
Low sites between major dune drifts, where moisture is greater, support heavy stands of sedges, rushes, sweet clover, silverweed and a variety of grasses. Standing water in many of the low areas create small fresh or brackish water marshes with submergent and emergent vegetation.

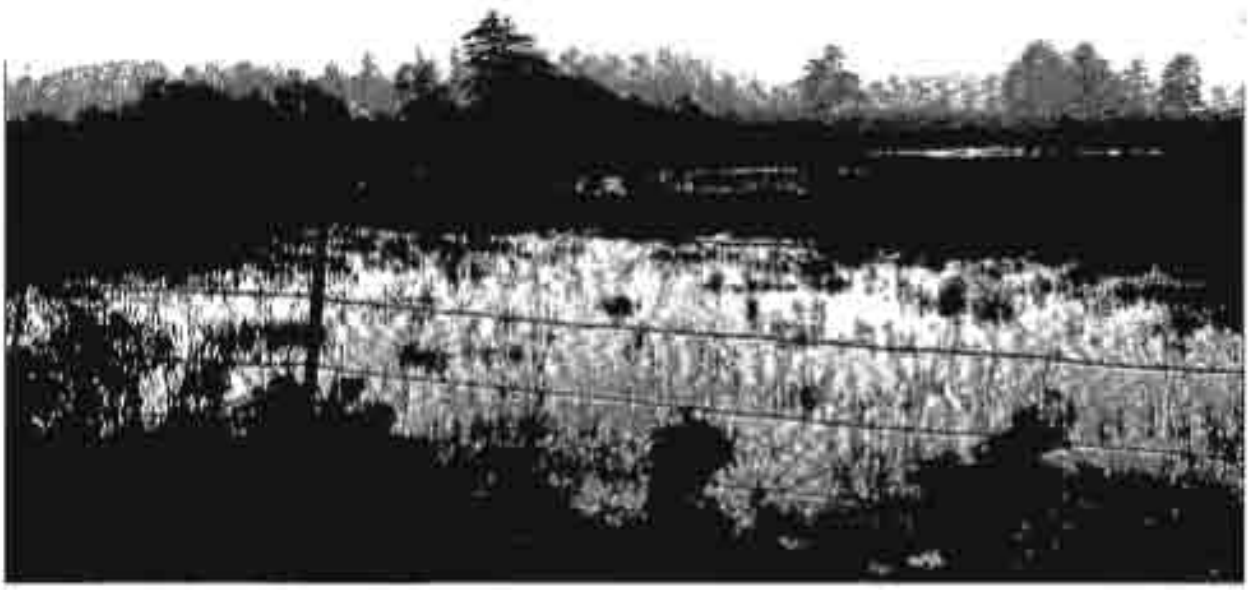
Agriculture

Most all lands devoted to agriculture are either pastures or grasslands used for livestock grazing. A few small areas are irrigated but most

PLATE 12

DUNE COMPOSITION





WELL DRAINED PASTURES ARE SUITABLE TO AGRICULTURE, POORLY DRAINED PASTURES ARE IMPORTANT HABITAT FOR MANY MIGRATORY WATER-ASSOCIATED BIRDS. (DEPT. FISH & GAME PHOTOS BY JOHN SPETH - 1974)

of the grazing operations rely on natural ground water or precipitation for moisture. There are some row crops and other cultivated crops in the flood plain, and some nursery plants, such as lilies and daffodils, growing in the Delta area. The latter crops, although on small acreage (300 acres) bring a return of $2.8 million annually, accounting for almost half of Del Norte County's farm income.

Well-drained pastures occupy higher ground in the flood plain and are often seeded to alfalfa, clovers, barley, oats, rye and fescues. Poorly-drained pastures in the lower portions of the flood plain differ from the well-drained pastures primarily in that they often contain standing water during the rainy season and are subject to frequent flooding from the river and its tributaries. Many of the same grasses and forbs are found in these lowlands, but many additional species having greater moisture tolerance are also common. These include orchardgrass, bluegrass, bentgrass, dock and varieties of sedges, rushes and reeds. The poorly-drained pastures are of particular importance to the many water-associated migratory birds which use the area during the winter.

Wildlife

The diverse mixture of habitats in the Smith River flood plain and Lake Earl support a wide variety of wildlife. And the area ranks along with Humboldt Bay and the Eel River Delta as one of California's more important coastal wetlands. Over 250 species of birds and 58 species of mammals are known to occur in the flood plain. Some are year-long residents, while others, particularly the avian species, are migrants during seasonal periods. Lake Earl provides habitat essential to the

survival of certain of the internationally significant migratory waterfowl populations.

Mammals

Over 50 species (Appendix B) of mammals are known to inhabit the coastal flood plain and adjacent foothills of the Lake Earl-Smith River Delta area. In addition, several species of marine mammals may be seen along the ocean both at the beach at Lake Earl and around the mouth of the river.

The secretive nature and nocturnal habits of most mammals make them difficult for people to see. Often the only way their presence is made known is by tracks and other signs they leave during their nightly movements. This is particularly true of the carnivores and small animals which tend to conceal themselves in areas of dense cover. Because of desire for concealment, greatest numbers and varieties of mammals are found in or near the riparian habitat.

The largest land mammal found locally is the Roosevelt elk. Formerly elk occurred in large numbers along the Del Norte coast. They were nearly exterminated through unregulated hunting and land use changes early in this century, but a few survived and still persist in scattered locations. Although by no means common in the flood plain, elk are still occasionally seen and reported.

Black-tailed deer are the most common big game mammal and are often seen throughout the delta and flood plain wherever protective cover is available. Black bear and mountain lions inhabit the surrounding forest lands but seldom venture onto the flood plain.

Water-related mammals inhabiting the marshes, streams, sloughs and riparian habitats of the Smith River-Lake Earl flood plain include the mink, river otter, muskrat and beaver. The muskrat was originally established around 1931 (Twining and Hensley, 1943). Since that time their numbers have increased and a thriving population now exists. The origin of the beavers is unknown. Other common furbearers in the area are the gray fox, coyote, bobcat, ringtail cat, raccoon, striped skunk, spotted skunk, weasel and ermine.

Marine mammals, the harbor seals, California sea lions and Steller sea lions, sometimes enter the estuary in the lower Smith River Delta but are most common in ocean waters near the river mouth. There is no indication that sea lions and seals enter Lake Earl when it is open to the sea as they do in some other lagoons and coastal streams.

Many species of small mammals such as rabbits, hares, squirrels, ground squirrels, chipmunks, rats, mice, gophers, moles, shrews, and bats occupy various habitat types throughout the flood plain. Although less noticeable than the larger animals, these animals are extremely important in the food chain which supports higher avian and mammalian species; and provide recreational opportunities to man.

Birds

Because of the mobility, bird populations are much more dynamic than the mammals. For the most part they are less secretive and more easily observed. Consequently it is easier to identify species and assess the magnitude of use within a given area.

Local breeding species present during the spring and summer tend to form a rather constant population. By fall the resident population in the flood plain is augmented by thousands of migrants which spend varying lengths of time in the area. Some migrants are summer visitors from the south. Most come from Canada and Alaska, and from as far as the Arctic Circle and Siberia. Altogether, over 250 species of birds have been recorded in the Lake Earl-Smith River Delta area (Appendix C).

According to their habits, morphological characteristics and habitat associations, birds may be logically grouped into several categories. Discussed here are the land birds, raptors and water-associated birds.

Land Birds

This category includes two large groups of birds often referred to as song birds and upland game birds. Land birds are not directly dependent on the wetland areas but often are associated with the agricultural lands, riparian cover and the dune community. Some species are highly selective in their choice of living area, but many are found in all of the above habitat types.

The song birds are most numerous and represent the greatest species variety in this category. Over 80 species are known to occur in the delta, flood plain, Lake Earl vicinity and the surrounding drainage basins. Sparrows, thrushes, flycatchers, wrens, larks, warblers, vireos, finches and juncos are examples of this group. Other land birds common to the area include crows, ravens, jays, woodpeckers, flickers, swallows and hummingbirds. Many of these land birds are residents; others are migratory.

Upland game birds which inhabit the flood plain and surrounding area are the California quail, mountain quail, blue grouse, ruffed grouse, mourning dove and band-tailed pigeon. The latter two species are migratory and usually leave the area in winter. All are hunted during the appropriate season and provide sportsmen with many days of hunting recreation.

Raptors

This group of birds includes the eagles, hawks, falcons, ospreys, kites, owls and vultures. All species are protected by law. Man has historically persecuted raptors under the erroneous belief that they damaged small game and livestock populations. This persecution, along with habitat losses, pesticides and poisons, has caused a marked decline in the numbers of many raptor species.

Raptors are high on the food chain and utilize the many smaller prey, such as rodents, birds and insects, as their primary food source. Their presence, along with other environmental controls, helps to limit rodents and other small animal populations; hence, raptors are significant to the ecological balance of the ecosystem in which they exist.

The golden eagle and bald eagle are among the largest birds of prey. Their numbers have been much reduced and even eliminated over large areas of their former range. Although rare, both species are still occasionally seen along the Smith River and over the river flood plain.

The broad-winged hawks (Buteos) are the raptors most often seen because of their habit of soaring slowly over open fields in search of food. Rodents and other small mammals make up the greatest part of their diet but reptiles and even large insects are often taken. The red-tailed

hawk is the most common but the rough-legged and red-shouldered hawks are also present in the flood plain. The red-shouldered hawk is dependent on the riparian growth and has been much reduced in numbers because of habitat destruction throughout its range in California. Marsh hawks are usually seen hunting over the coastal dunes, agricultural areas and marshes.

Smaller than the broad-winged hawks, the accipiters occupy forested and woodland areas. Accipiters in the Delta-Lake Earl area are the goshawk, Cooper's hawk and sharp-shinned hawk. They are seldom seen because of their secretive nature and occurrence in areas of dense cover. Small mammals and birds are the main food items consumed by accipiters.

Four species of falcons occur within the flood plain. The most common is the American kestrel or sparrow hawk. It is the smallest of the falcons and can be seen hovering over pastures, or perched on poles along roadsides searching for insects and mice. The merlin, or pigeon hawk, is quite similar to the kestrel but is much less common. The prairie falcon is an occasional visitor to the vicinity. The rarest of the falcons is the peregrine which is classed as an endangered species in California and the United States (Leach and Fisk, 1972). The peregrine is known to have recently nested in the Smith River drainage.

The white-tailed kite, also a hawk, is an occasional visitor to the delta and flood plain. It is usually associated with open fields and riparian areas.

The only raptor that is directly dependent on the river and other open water areas is the osprey, although the bald eagle is water-oriented and depends upon fish for most of its food. The osprey's diet is

fish exclusively. During the summer they nest in the flood plain near the river and Lake Earl and in the fall move south to Central and South America to winter.

Turkey vultures are common to the delta and like the broad-winged hawks, they spend most of their active hours soaring high overhead looking for food. Unlike the hawks, however, they do not kill their own prey, but feed exclusively on carrion.

In the flood plain ecosystem the eagles, hawks, falcons and kites are replaced during the hours of darkness by the nocturnal owls. Although both hawks and owls utilize the same food sources and hunting areas, there is little direct competition because of the difference in their periods of activity.

Locally there are nine species of owls that are relatively common. They range in size from the tiny pygmy owl to the great horned owl, which has a wing spread of up to 60 inches. Barn owls and short-eared owls are probably the most often seen. Other species are the screech, long-eared, spotted, burrowing and saw-whet owls. Some winters, the snowy owl may occur along the northern California coast in small numbers. The Smith River Delta-Lake Earl area is one they frequent during such visits.

Water-associated Birds

As coastal wetlands, Lake Earl and, to a lesser extent, the Smith River Delta, are most important to a group of birds known as water-associated birds. They are directly dependent upon wetland ecosystems for their existence. Without Lake Earl, the delta of the Smith River and similar

areas of wetland habitat along the coast, many of these highly specialized birds could not survive.

Each species or species group has developed very specialized morphological characteristics and techniques for utilizing a specific segment of the water environment to fulfill its life requirements. Because of this specialization, these birds cannot adapt to drastic habitat changes. As a result their populations have suffered many losses from man's activities. Originally there were an estimated five million acres of wetlands in California. Today less than 500 thousand acres remain.

Because of the migrant nature of most of the water-associated species, populations fluctuate drastically from season to season, month to month, and even from day to day. The highest numbers and greatest species variety are evident in the fall and winter months (Appendices D and E). A three-year (1970-1973) Department census of water birds yielded an annual total of almost three million bird days of use in the Lake Earl vicinity (Table 2).

Table 2

Average Annual Bird Days Use

1970 - 1973

Species Group	Lake Earl	Smith River
Waterfowl	1,744,992	166,878
Shorebirds	124,499	29,962
Wading Birds	9,830	1,938
Other Water-associated Birds	1,107,101	98,633
	2,986,372	297,411

Categories of water-associated birds in the Lake Earl-Smith River Delta Area are waterfowl, shorebirds, wading birds, pelagic and coastal birds.

These birds include nine orders and are represented locally by over 100 species. Although they have many structural similarities, individual species exhibit many differences in size, form and habits. In the discussion which follows, species are grouped according to their relationship with each other and/or the habitat which they occupy.

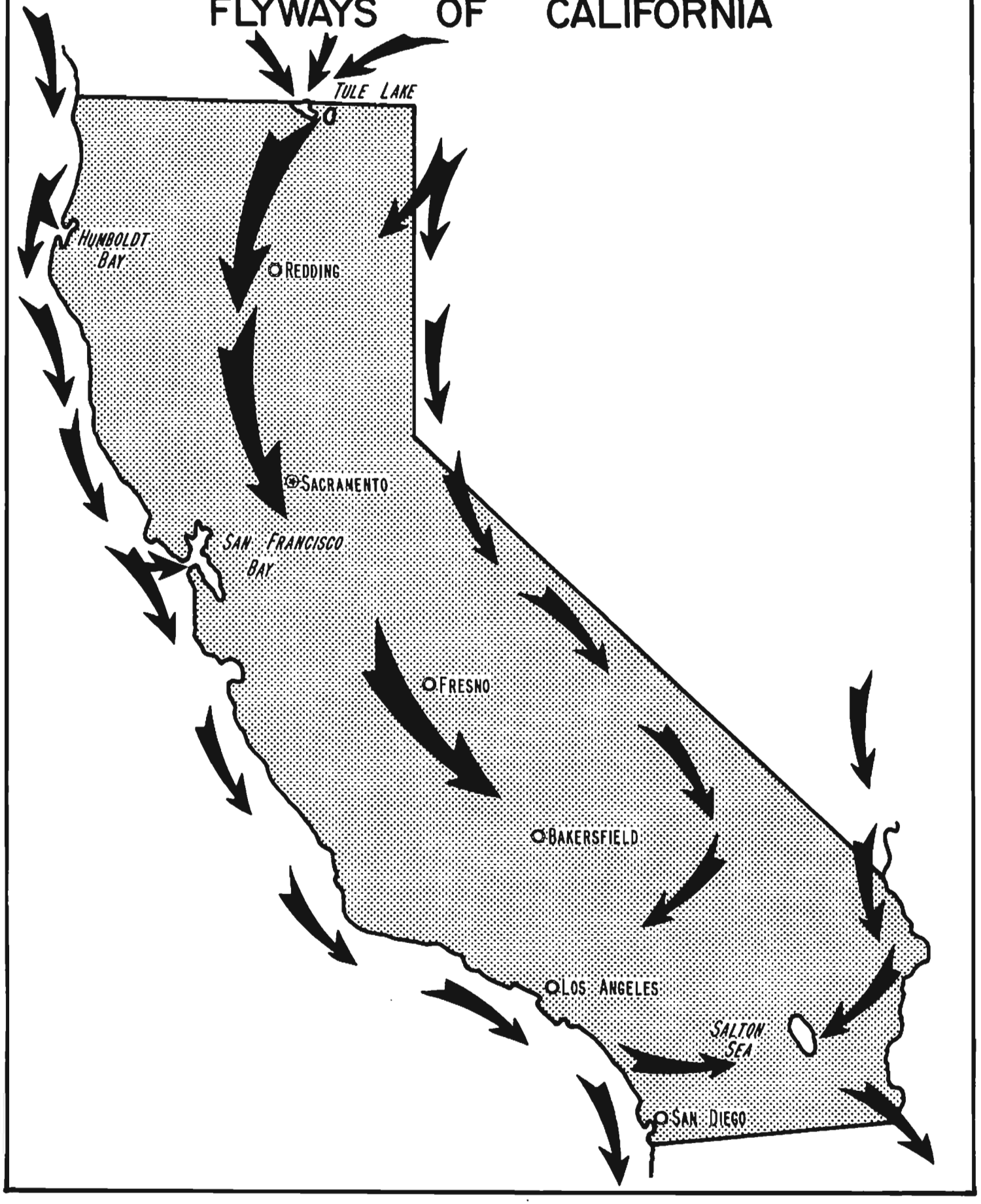
Waterfowl: This group belongs to the order Anseriformes which includes all ducks, geese and swans. Most are migratory and nest across the northern-most parts of North America and winter from the United States southward into Central and, in some cases, South America. During their fall and winter migrations millions of waterfowl move south to ancestral wintering grounds along well-defined routes described as flyways. The western states are part of the Pacific Flyway.

Birds moving into California follow three basic sub-flyways (Plate 13). The importance of California's remaining wetlands is illustrated by the fact that 68% of the entire Pacific Flyway duck population and 83% of its geese winter within the State. Lake Earl, the Smith River Delta and other nearby wetlands are important stopping points for birds using the coastal route.

There are 22 species of ducks known to occur regularly within the Lake Earl-Smith River Delta area. The puddle ducks, which feed primarily on vegetation in shallow water areas, include the mallard, gadwall, pintail, wigeon, green-winged teal, cinnamon teal, shoveller and wood duck. Diving ducks, including the canvasback, redhead, scaup, ring-necked duck, scoters, bufflehead, golden-eye and ruddy duck, prefer deeper water where

PLATE 13

MAJOR WATERFOWL FLYWAYS OF CALIFORNIA



they dive in search of the vegetable matter or aquatic organisms which make up their diet. The mergansers or fish ducks also dive and swim underwater but do not feed on vegetation. They feed on small fish which they capture with their long, narrow serrate bills.

The greatest waterfowl use occurs on lakes Earl and Talawa. Some use is recorded on small marshes lying within the sand dunes and the grazing lands surrounding the two lakes. These small marshes are used most heavily when winter rains augment the existing areas of standing water. Waterfowl use the Delta pasturelands, especially those that are poorly drained, to a great extent, and during the winter there is a daily interchange between these and other adjacent wetlands.

The most numerous duck species are wigeon, ruddy, pintail, canvasback, greater scaup, and mallard, in that order. Lake Earl is of special importance to the canvasback. Canvasback populations have been reduced substantially over the past 20 years because of the loss of key habitat. The lake now supports the highest wintering population of canvasbacks north of San Francisco Bay.

The most abundant species in the Smith River Delta area are the greater scaup and lesser scaup. Others include scoters (3 species), canvasbacks, redheads, buffleheads, ring-necked ducks, golden-eyes and ruddy ducks. None are known to nest locally.

Although geese are not numerous along the north coast, a few regularly use Lake Earl, the Delta and vicinity. Canada geese are the most common but occasionally snow geese, white-fronted geese and black brant may be seen. An occurrence of the relatively rare Aleutian Canada goose was

recorded at Lake Earl in the winter of last year (1974).[1/] Several hundred whistling swans also winter around Lake Earl and the delta. They generally arrive in November and stay until Marsh when they return to the breeding grounds in Canada and Alaska.

Although the primary use by waterfowl occurs during the winter, some nesting does take place. Johnson and Yocom (1966) estimated that the total waterfowl production at Lake Earl is in excess of 1,500 birds. The principal breeding species are mallards, gadwall and cinnamon teal. But wood duck, common merganser and Canada geese broods have been recorded (Hehnke, 1969). The mallard, gadwall and teal nesting usually takes place along the lake shore, in small marshy areas and along ditches located in pastures and grasslands in the flood plain. Mergansers and wood ducks prefer streams and ponds with riparian vegetation. During the summer months small nesting populations of mallards, gadwall, cinnamon teal and common mergansers are also present in the delta area. They nest close to small marshes, irrigation ditches and streams as a rule and do not venture far until the young are capable of flight.

It is difficult to determine the actual number of individual waterfowl which use the delta because of their transitory nature and constant interchange of birds from one local area to another. However, the magnitude of use can be shown in terms of bird days use. A bird days use represents one bird present for one day. Hence 10 birds present over a five-day period can be expressed as 50 bird days of use. The average annual bird days use in the Delta is computed to be about 166,878 (Appendix D). By nature such figures tend to quite conservative because not all birds actually present can be seen from the air during census. Total waterfowl

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[1/] Paul Springer, U. S. Fish and Wildlife Service, Arcata (pers. comm.).

use days at Lake Earl averaged 1,744,992 annually during three years of aerial census counts. The September through April period accounted for 1,700,562 use days and represented 97% of the total annual use. The remaining 3% or 44,430 use days occurred from May through August (Appendix D).

Shorebirds: Over 30 species representing five families of the order Charadriiformes are known to use the Lake Earl/Smith River Delta area. They exhibit many variations in size and coloration but all share certain characteristics of form and general habits. The most common species include the dunlin, western sandpiper, black-bellied plover, short-billed dowitcher, sanderling, willet, marbled godwit, northern phalarope, black turnstone and common snipe.

They range in size from the sparrow-sized sandpiper to the long-billed curlew which may be over 19 inches in length. All have characteristically long legs and relatively long bills for moving about and feeding in soft mud and sand. They feed primarily on small invertebrate animal and insect life which they extract from the upper few inches of soil. Some species are adapted to feeding on organisms found attached to intertidal rocks. Still others, the northern phalarope for example, swim in deep water and skim larvae and insects from the surface.

Shorebirds frequent several areas of habitat including the ocean beach, marshlands, grasslands and pastures. In marsh areas, in the shallow waters of the lake shore, along the ocean beach and estuarine area of the lower Delta, they feed on small marine organisms that lie in the top few inches of the bottom sediments. In pastures and grasslands they

feed on worms, insects and insect larvae. The pastures are most heavily used during the rainy season when soils are wet and more easily penetrated by the probing bills of the shorebirds.

Most shorebirds nest in Canada and Alaska and winter in the lower United States and Central America. They seem to follow a pattern of flyways as waterfowl do, but this is not known to be sure. Some migrate through inland areas, but the majority appear to follow coastal routes and winter along California's beaches and rocky shores and on bays, estuaries, and other wetlands.

During the summer months only a small number of non-breeding birds and a few locally nesting species are present. The population increases in late summer as early migrants begin to arrive from the breeding grounds. September through April is the highest period of shorebird use. The total annual shorebird use at Lake Earl averaged 124,499 bird days, and in the Delta, 29,962 bird days use, during three years of aerial census counts.[1/] Because of the small size and drab colors of many species, and the habitat they occupy, shorebirds are difficult to census. It is therefore reasonable to assume that the actual use is much greater than recorded; and this assumption is substantiated by ground and aerial census comparisons made at Humboldt Bay.

Wading Birds: Seven species of the order Ciconiiformes are represented locally. The most common are the great blue heron, black-crowned night heron, great egret and American bittern. The snowy egret is an occasional transient visitor and the cattle egret, an old world species introduced to this country a number of years ago, has extended its range

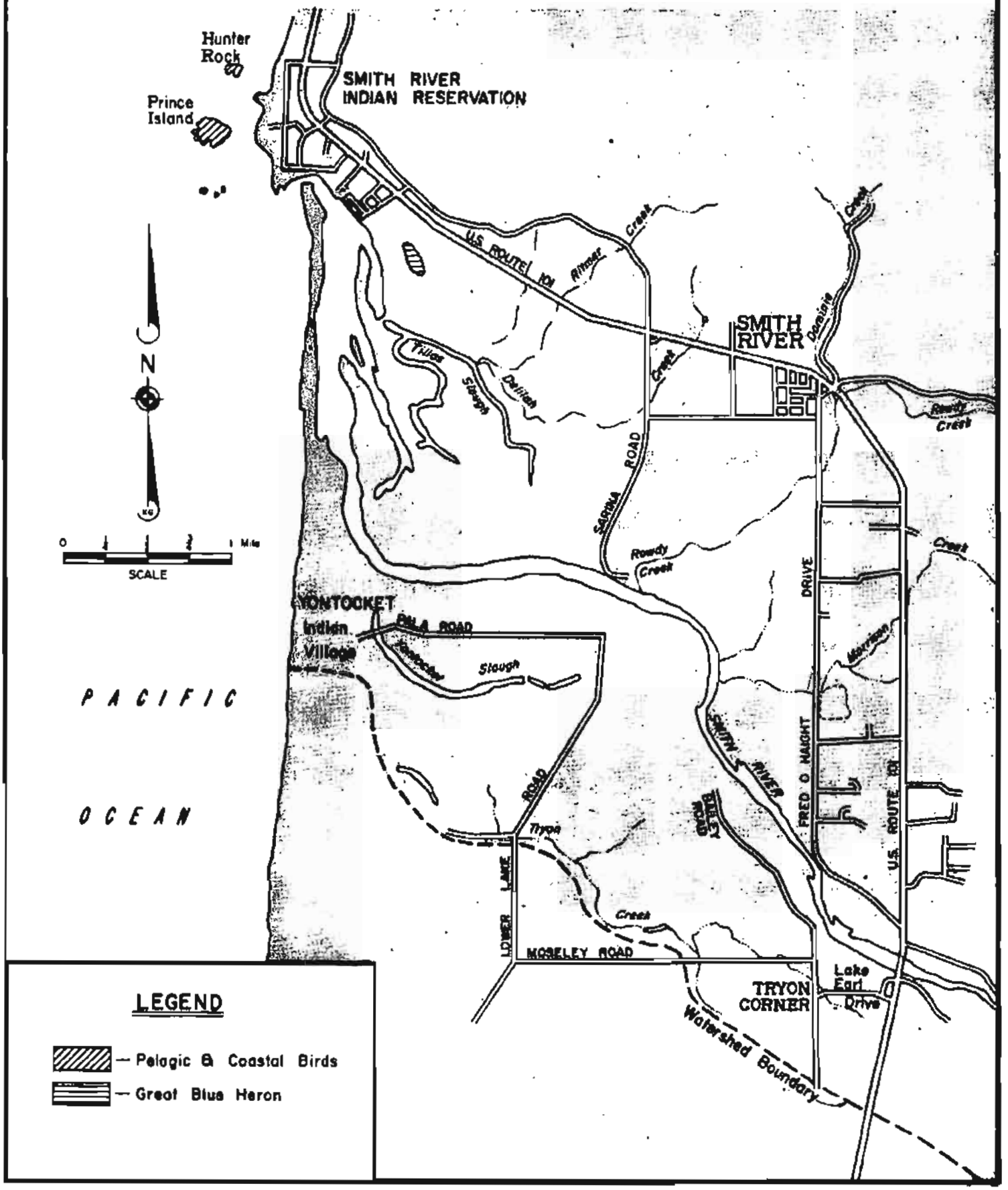
1/ Appendices D and E.

THE GREASTEST WATERFOWL USE OCCURS ON LAKES EARL AND TALAWA, BUT THE SMALL MARSHES ARE USED WHEN WINTER RAINS AUGMENT STANDING WATER SUPPLIES. (DEPT. FISH & GAME PHOTO)

THE ONLY KNOWN GREAT BLUE HERON ROOKERY IN DEL NORTE COUNTY IS LOCATED IN THE NORTHWEST PART OF THE SMITH RIVER DELTA.
(DEPT. FISH & GAME PHOTO BY PAT MCLAUGHLIN - 1974)

PLATE 14

SMITH RIVER ROOKERIES



LEGEND

- Pelagic & Coastal Birds
- Great Blue Heron

into the north coast region. Wading birds characteristically have long legs and widely spreading toes for moving about in shallow water areas with soft mud sub-strate. They also have relatively long necks and long-sharp-pointed bills for capturing prey. Small fish, amphibians, reptiles, and crustaceans are the primary items consumed by most wading birds. Herons and egrets also feed on small mammals. These birds most commonly use marsh, lake and riparian habitat but the herons and egrets also use grasslands and pastures extensively.

Egrets and herons are colonial nesters and traditionally use the same nesting sites year after year. These sites, called "rookeries," are usually located in groves of tall trees or dense riparian habitat near water. One heron rookery occurs in the Smith River Delta (Plate 14). No rookeries have been found to date in the Lake Earl vicinity, but it is probable that some nesting does take place locally since adult birds are present during the breeding season. The smaller black-crowned night heron utilizes the same habitat and food sources but is most active at night. During the day it roosts in dense riparian cover. A much rarer relative, the green heron, is also present but frequents marshes and waterways with dense vegetation where it is less apt to be seen. Both snowy egrets and cattle egrets use the area but are not common. Their food habits and habitat requirements are similar to those of the great egret and blue heron.

One of nature's real camouflage artists, the bittern, inhabits marshy areas where cattails and tules provide suitable cover. Unlike its more colorful relatives, the bittern is designed to be unobtrusive. Its streaked brown coloration blends so well with the background that it

is seldom seen by enemies. They stand motionless by the hour waiting for small fish, crustaceans and amphibians to come within reach.

Now protected by state and federal laws, some species of wading birds were nearly exterminated over much of their range in the early part of this century because of the demand for their feathers. Although their numbers have recovered from previous lows, they still face threats from pollution, pesticides and loss of habitat.

Blue herons and egrets are easily seen from the air and can be accurately censused. Because of their nocturnal feeding habits the night herons are not readily counted from an airplane. The same is true for bitterns because they tend to stay in dense marsh, vegetation. Consequently the census data available (Table 2) primarily reflect blue heron and egret populations and do not represent the total magnitude of wading bird use.

Pelagic and Coastal Birds: Most pelagic birds are only casual visitors to Lake Earl and the Delta. The petrels, fulmars, shearwaters, albatrosses and jaegers spend most of their lives far offshore. Murres, guillemots, puffins and auklets are found inshore along the beaches but seldom venture inland. Many nest on offshore rocks and islands near the Smith River (Plate 14). One of the most important sites is Prince Island which provides nesting habitat for over 450 birds.

Large numbers of gulls comprised of at least 11 species, some resident and some migratory, inhabit the flood plain. Terns are less common but several species are seasonal visitors. Three species of cormorants, the Brandts, pelagic and double-crested, are common residents. Like

many of the other coastal birds, they nest on nearby offshore rocks. During the summer months the brown pelican, now classed as an endangered species in California, can be seen in the lower estuary and along the beaches. Altogether, at least 34 species representing three orders of pelagic and coastal birds occur locally.

Other Water-associated Birds: A number of other birds dependent on an aquatic environment occupy segments of habitat provided by the Lake Earl-Smith River Delta flood plain. Each species has developed certain specialized characteristics which enables it to survive in a particular niche of that habitat.

One of the most common is the American coot, or mud hen, a member of the rail family. It utilizes virtually all aquatic habitat types but is most often seen in freshwater marshes and pastures. Coots feed on aquatic vegetation, grasses, alfalfa and other agricultural crops.

Other members of the rail family are present, but more secretive and less numerous. The dense emergent vegetation of marshes and sloughs provides habitat to their liking. Both the Virginia rail and sora rail are found within the flood plain and both nest locally.

The grebes and loons are diving birds that use open water areas. Five species of grebes--the western, red-necked, horned, eared and pied-billed--are found here, especially at Lake Earl. All grebes are migratory but some, particularly the pied-billed, are local nesters, and a nesting colony of about 20 pairs of western grebes is located in the northeast corner of the lake. The common loon, Arctic loon and red-throated loon are winter migrants which nest in Canada and Alaska. Although relatively common, they are not numerous. They prefer deeper water habitat

where they dive and swim underwater in search of the small fish and other marine organisms on which they feed.

Fishes

The Smith River and Delta support at least 25 species of fish (Appendix F) and one of the most important anadromous fisheries in the State. King salmon, silver salmon, chum salmon, steelhead trout (anadromous rainbows), coast cutthroat trout, American shad and green sturgeon all spend part of their life cycle in the ocean and then return to the Smith River system to reproduce.1/

The critical part of migration of the anadromous fish occurs in the transition between salt and freshwater that takes place in the estuarine area of the Delta. Juvenile forms also use these brackish waters for osmoregulatory adjustments before migrating to the sea. Annually 30,000 steelhead trout, 15,000 king salmon, 5,000 silver salmon and an undetermined number of other anadromous species travel through the estuary system and upstream. Progeny, numbering in the millions reverse the process, going to the ocean until they mature and repeat the spawning runs that have made the Smith such an important north coastal stream.

American shad, also anadromous, were introduced into California in 1871 in the Sacramento River and have since spread northward and are found in the Smith River estuary. Lampreys and the threespine stickleback are found in abundance. Lampreys pass through the estuary in spring during spawning runs while the stickleback is a year-round resident. The lamprey is only rarely used as food; the stickleback has no food value but serves as a forage species.

1/ Scientific names are appended (Appendix F).

THE CRITICAL PART OF ANADROMOUS FISH MIGRATION TAKES PLACE IN THE SALT AND FRESHWATER TRANSITION IN THE DELTA ESTUARY. SPAWNING OCCURS UPSTREAM. (U. S. ARMY CORPS OF ENGINEERS PHOTOS - FEBRUARY, 1973)

In addition to the anadromous fish, the estuary also hosts a variety of marine and estuarine fishes. These species are tolerant of salinities ranging from seawater to brackish water, but most will not tolerate freshwater. During the spring months, redtail surfperch and Pacific herring make spawning migrations into these waters. The herring, which deposit eggs on rocks and pilings, and the redtail are mainly found in channels close to the mouth. Surf smelt which enter the estuary during the summer also frequent the channel areas. Other resident marine and estuarine fishes commonly found in the lower Delta include the starry flounder, shiner surfperch, juvenile rockfish and staghorn and prickly sculpins. Starry flounders are relatively abundant on sandy bottoms, while shiner surfperch and juvenile rockfish are most evident in the vicinity of dock pilings close to the main channel. Both sandy and gravel bottoms abound with staghorn and prickly sculpins.

Sturgeon occasionally enter the estuary, probably to feed; there is no record of spawning in the river. They have been observed in Patrick's Creek, an upstream tributary 33 miles from the ocean.

Resident populations of coast cutthroat trout and rainbow trout may be found in the freshwater sloughs and streams behind tide gates in the flood plain near the Delta. These fish do not grow as large as the sea run varieties but they support a small local fishery. Yontocket Slough, an old river channel, is one such fishing area.

Lake Earl harbors 15 species of fish, only one of which cannot tolerate pure seawater. All are adapted to brackish water conditions and six can live and reproduce in fresh water. The most important species,

at least from a fisherman's viewpoint, are the king salmon, silver salmon, and coast cutthroat and rainbow trout. Silver salmon and coast cutthroat trout are the most numerous of these four species of anadromous salmonids. Beginning in 1969 several plants of silver salmon fingerlings were made in Lake Earl. It appears that these plants have increased the spawning population of silver salmon in Jordan Creek, the lake's largest tributary. These fish spawn in the fall. Their young hatch by early spring and migrate into the lake which they use as a nursery area. In the following or second fall and winter, when the outlet of the lake is open, the juvenile silver salmon enter the ocean to continue their growth. In two or three years they return to Jordan Creek, via Lake Earl, to spawn and die, thus completing the cycle.

The life histories of king salmon, rainbow trout, and coast cutthroat trout are similar. King salmon fingerlings may or may not spend a year or two in the lake. It is usually their habit to migrate to the ocean at an earlier age and stay there a year or two longer. Steelhead and coast cutthroat trout may never migrate to the ocean. There are usually resident and migratory individuals in the same waters. Coast cutthroat trout are also referred to as sea run cutthroat. Both trout may spawn more than once.

In addition to the anadromous salmonids, Lake Earl supports other species of anadromous fish, the green sturgeon and threespine stickleback and the Pacific lamprey. The green sturgeon, largest of the anadromous fishes, is rarely caught, and no records exist to indicate they spawn in the lake. The sturgeon enter the lake from the ocean and become trapped when the sand bar mouth closes. Being truly anadromous, they

cannot spawn in the brackish water of the lake and Jordan Creek is much too small to accommodate them.

The little threespine stickleback is the smallest of the anadromous species. In Lake Earl, it is also the most numerous. Its importance to the aquatic life of the lake is as a forage fish. The stickleback utilizes the numerous aquatic invertebrates as food and in turn serve as prey for the larger predator species.

The prickley sculpin, the only species that cannot live in the sea water, is found in the lake in low numbers, in areas of low salinity. Normally they are freshwater fish but can tolerate a brackish environment. The prickley sculpin, like the threespine stickleback and other small fish, is a link in the food chain between plants and the larger and more desirable fish species.

The Pacific lamprey is anadromous and, like salmon, dies after spawning. Fish-like, but without jaws, bones or paired fins, the lamprey is parasitic in the adult ocean dwelling stage of its life. When young, it lives in the muck at the bottom of lakes and streams and feeds on detritus. It is considered by a few people to be excellent eating but is not very popular.

The starry flounder, English sole, shiner perch, top smelt, Pacific herring, staghorn sculpin, and bay pipe fish are marine species able to thrive in brackish conditions. Pacific herring, starry flounder, and English sole enter the commercial catch and sometimes sportsmen angle for them.

Invertebrates

Not much is known of the invertebrate population of the Smith River Delta and even less about those of Lake Earl. The Smith River estuary provides a nursery area for the market crab (*Cancer magister*); and the Delta also contributes to nutrients which enter the ocean and are necessary to the development and survival of ocean crab populations generally found along the California coastline near the outflow from major river systems such as that of the Smith.

Soft shell clams (*Mya arenaria*) are present in areas of Delta mudflats. This clam, well adapted to muddy substrate and low salinity, has the ability to survive for short periods in areas low or lacking in oxygen, as is sometimes encountered in estuary mud (Rickets and Calvin, 1968). The northern razor clam (*Siliqua patula*) and a few barnacles (*Balanus* sp.) also have been identified from the area.

Assorted lesser invertebrates, which serve as food items for fish and fowl, are found throughout the estuary of the Smith River. Isopods and amphipods find shelter among the algae covering rocky and gravel bottoms. Nereid worms and burrowing amphipods exist in the muddy bottoms. Bay shrimp (*Crago* sp.) are commonly found in all areas.

Amphibians and Reptiles

Amphibians and some reptiles, although not as aquatic as the fishes, fall into the group generally classed as aquatic animals. The amphibians are represented by frogs, toads, salamanders and newts and the reptiles by lizards, snakes, and turtles.

Because of the saline environment of the Smith River estuary, none of the amphibians is found in its waters or along the immediate shoreline. However, in the numerous small freshwater ponds and nearby marshes and along the freshwater margins of Lake Earl, Pacific tree frogs and red-legged frogs abound.[1/] The Western toad also frequents these places, especially on warm summer nights when they come out of their burrows in search of insects. The salamanders and newts of which there are numerous species, inhabit the woodland areas surrounding the flood plain. Many are lungless, breathing through their sensitive skins, and cannot tolerate contact with the saline waters. They all feed on insects and are often seen at night after a rain.

The reptiles, although not as sensitive to the high salinities do not prefer saline conditions. In numbers of species, snakes dominate the reptile category. There are at least five species inhabiting the flood plain: the ring neck, gopher, Pacific rubber boa, western rattlesnake and garter snake, of which there are several sub-species. The snakes generally occupy all land and freshwater areas. They generally feed upon everything they can swallow, from insects to rodents.

Lizards usually prefer the higher and more dry parts of the Lake Earl-Smith River area. The western fence lizard, northern alligator lizard and the western or bluetail skink occur in the flood plain. In the driest part of the year fence lizards can be seen around fences, buildings and open areas. Skinks and alligator lizards occupy rockpiles and wooded areas. Lizards feed exclusively on insects and spiders.

1/ Scientific names are appended (Appendix G).

The only turtle in the Smith River area, in fact the only one in northern California, is the western pond turtle. It frequents the permanent freshwater ponds and streams where there is adequate depth to find shelter.

The amphibians and reptiles are probably the most beneficial, but least appreciated, of the endemic species. Their diet consists almost exclusively of prey species commonly considered as agriculture pests. Seldom seen, they are almost always present.

ECOLOGY

The mysteries of life have been pondered and debated by men of science, religion and philosophy since the dawn of recorded history. Until more recent times much of what we believed was based on legend, myth and speculation, unsupported by the test of time and fact. As science became more sophisticated, techniques became more refined and the store of knowledge increased, old ideas were changed or discarded and new theories were developed and tested. Piece by piece the puzzle parts have been drawn and fitted carefully to create an intricate picture of life's complex processes.

Each living thing is dependent on the environment in which it lives, and each living thing has developed very special morphological and physiological characteristics through evolutionary processes which enable it to occupy a particular niche in that environment. Some organisms have a wide range of tolerance and may exist under a variety of conditions. Others are so specific in their needs that they survive in only very limited environmental situations. Consequently, any change in any ecosystem, no matter how slight, may have far-reaching effects and can even cause the extinction of a given species within that particular system.

Any given wetland, or other type of environment, is composed of many smaller units which together form a very complex ecosystem in which all things biotic (living) and abiotic (non-living) are interdependent. Thus Lake Earl, the Smith River Delta and the flood plain that joins them are an ecosystem composed of many smaller ecological units which form together to give the area its particular character. This area is also part of a much larger ecosystem, that extends far beyond man's political boundaries or the parameters encompassed within this report.

The life blood of the ecosystem is energy, originally derived from sunlight. It enters the system through the unique process of photosynthesis in plants. Sunlight is converted to usable energy, and passed on from organism to organism through a complex food chain in the form of fats, carbohydrates and proteins. Plants are fed upon by animal organisms which in turn are consumed by larger animals. The energy ultimately is passed to the highest animals including man. The energy is returned to the system by the process of decomposition. As plants and animals die they are reduced to basic organic and inorganic compounds by bacteria, the decomposers. The breakdown products are assimilated by plants and the cycle is repeated.

The fertility of any given area is determined originally by its soils. For this reason, river deltas and lagoons are some of the most productive areas of the world. Flood waters annually carry rich soil and organic material from the watershed to the flood plain, Delta and Lake Earl delta. The rich soil stimulates lush vegetative growth which in turn provides conditions necessary for the production of animal life. In the Delta area the system is also influenced by the sea. Each tide brings nutrients as well as countless numbers of plant and animal organisms into the estuary. Fish of many kinds and descriptions move in and out with the tides, foraging for food. Seals, sea lions and coastal birds are attracted by the fish life.

On the other hand, the shallow waters of Lake Earl, together with the deposition of rich soils from the flood plain and watershed are conducive to lush aquatic plant growth. Great quantities of floating diatoms, algae and rooted plants form the basic nutrient production that supports

all other life in the lake. Small invertebrate organisms thrive in the rich layer of organic debris and soft mud that covers the lake bottom. Others swim about freely or attach themselves to the vegetation. Numbers, varieties and distribution of these organisms are determined by salinity, temperatures, bottom sediments, vegetation types and a host of other factors. Consequently different kinds of organisms are found in different locations in the lake and in varying densities, and each form utilizes the particular ecological niche for which it is best suited.

Likewise, vertebrate animals are distributed both in Lake Earl and in the Delta according to habitat preferences and the quantity and availability of food. The use and selection of habitats also is influenced by seasons, weather, flooding and other factors including human disturbance. Each species seeks out the kinds of food it requires within its own preferred habitat types. Some may consume the same food items but feed in different areas or during different time periods. Others compete directly in time and space for the same food source.

Many marine fish use or require the kinds of conditions created by the estuary and lake for special life functions. The anadromous fish, salmon and steelhead for example, enter both the river and lake to spawn. They first acclimatize themselves to the change from salt to fresh water in the estuary. After this period of adjustment they travel onward to the upper reaches of the river and its tributaries where they lay their eggs. The same phenomenon occurs in Lake Earl, but only after flood stages have broken down the dune barriers. The fish then adjust from salt to fresh water in the lake itself before moving in the tributaries to spawn. Without estuaries, lagoons, spawning streams and tributaries

such as exist in the Lake Earl and the Smith River Delta anadromous fish could soon disappear.

The multitude of invertebrate marine life and the fish from the Lake Earl-Delta ecosystem attracts thousands of birds of many species, each kind seeking out the organisms on which it feeds within its own habitat niche. In the Delta, shorebirds feed in the bottom sediments exposed at low tide. In Lake Earl shorebirds use the exposed shoreline, open mudflats and sand bars. Using their specialized bills they probe the mud for small invertebrates. During high tide periods they scatter over the pastures in the flood plain looking for worms, larvae and insects.

Waterfowl tend to concentrate in the shallow estuarine bays, sloughs and marshes of the Delta; and, especially upon Lake Earl. Waterfowl of many kinds and descriptions may cover the lake with no specific pattern discernable to the human eye but each species is actually utilizing the particular area it prefers. When puddle ducks are feeding, they do so in shallow water where the tubers, leafage and seeds they seek are within reach from the surface. In contrast the diving ducks more often use deeper water areas. Some feed on the same aquatic vegetation but there is little direct competition since the divers obtain their food at depths below the reach of puddle ducks. Divers also tend to consume more animal matter. Some species feed almost exclusively on fish and small invertebrates.

Marshes and open water areas are also important to other water-associated birds such as loons, cormorants and certain of the grebes. Other grebes, as well as the rails and bitterns seek out quiet backwaters where vegetation is dense. Egrets and herons prefer shallower areas and wade in

A DIVERSITY OF HABITAT ATTRACTIVE TO A VARIETY OF WILDLIFE EXISTS WHEREVER COASTAL FORESTS MEET MARSHLANDS, PASTURES OR SANDDUNES.
(DEPT. FISH & GAME PHOTOS BY JOHN SPETH AND PAT MCLAUGHLIN - 1974)

search of small fish, crustaceans and mollusks. The wading birds search out reptiles, amphibians, insects and even small mammals in the poorly drained pasturelands found throughout the flood plain. Waterfowl and some shorebirds also forage out in the low pasturelands. Some ducks and most of the geese often graze at night on grasses, sedges, forbs and grains in flood plain lowlands and fields.

Pasture and grasslands also provide habitat food for herbivorous species like deer, rabbits, mice, song birds and upland gamebirds and a multitude of insects. In turn, some of these creatures became food for hawks, owls, egrets, herons, foxes, weasels and other flesh or insect-eating creatures. Other habitats such as brushlands and wooded areas provide cover for nesting, denning and protective purposes. Shrubs and trees provide leafage, nuts and berries required as food by many species. Riparian vegetation along streams and wet places are especially essential for mink, beaver, otter and other of the many furbearers. Flowing streams with riparian cover of willow, cottonwood and alder are preferred by beaver. Their lodges, burrows and dams can sometimes be seen on the river's tributaries. The river otter is a member of the weasel family that lives exclusively in water and feeds on fish, crustaceans and other aquatic creatures. Its close relative, the mink, is also found most commonly near water although it is not as strictly water-dependent as the otter. Riparian habitat also provides nesting and roosting cover for many forms of bird life and is essential as protective cover for both birds and mammals. The utilization of the open pasture lands of the Smith River flood plain by most wildlife is dependent on the availability of riparian cover dispersed throughout the area. The shading effect of this vegetation also helps to maintain the low water temperatures necessary to

THE SHALLOW MARGINS OF LAKE EARL PROVIDE EXCELLENT FEEDING AREAS FOR WADING BIRDS, SHOREBIRDS AND WATERFOWL.
(DEPT. FISH & GAME PHOTO BY JOHN SPETH - 1974)

RIPARIAN HABITAT ALONG THE FLOOD PLAIN SLOUGHS AND STREAMS PROVIDE NESTING, ROOSTING AND ESCAPE COVER FOR MANY WILDLIFE SPECIES.
(DEPT. FISH & GAME PHOTO BY PAT MCLAUGHLIN - 1974)

support the existing fishery. The value of the riparian, woodland, low pasturelands habitats and in fact the value of the whole flood plain ecosystem is much enhanced by the seasonal heavy rains and flooding which creates temporary habitat coinciding with the heaviest use periods by wintering migratory birds. The cessation of such flooding would greatly reduce the area's ability to support wildlife.

Over thousands of years of evolutionary processes, each creature has developed very specific needs for food, cover and other life requirements. Each lives in its own environmental niche without which it could not continue to exist. The ties between a wildlife species and the type of habitats it will occupy are so close that the kinds of wildlife that will occur in a given area can be predicted simply by knowing which types of habitats exist in a given area. Hence, destruction or alteration of a particular ecological unit will affect all living organisms within that unit. And, changes in one unit will not only affect surrounding units but eventually the entire ecosystem.

The interrelationships between organisms and their environment, then, is the key to understanding life's complex processes. And, it is only through such understanding that nature's delicate balances can be maintained in the face of man-made changes to the world around us. When a marsh is drained or filled, the plants and animals that lived there are lost unless a new marsh is created to take its place. When a patch of woodland is cut and replaced by houses, animals and birds dependent on that habitat are reduced in numbers in direct proportion to the amount of habitat lost. It is also necessary to understand that the effects of habitat losses extend far beyond the local area. The vast majority

of waterfowl which use Lake Earl for example, nest in Canada and Alaska but are dependent on wintering grounds provided by the wetlands of California. Without these wetlands the populations of waterfowl in the entire "Pacific Flyway" including Canada and Alaska, would be drastically reduced.

The success or failure of man's efforts in natural resource conservation is clearly based on his treatment of the lands and waters on which all life is dependent. It does no good to provide legal protection to any species if that species has no place to live. Land use planning, therefore, must recognize the needs of living things and provide for protection of habitats essential for their survival.

The preservation of fish and wildlife is a noble objective in its own right, but the human race has much more to gain in the process. For man is not just a bystander; he is just as much as part of the total ecosystem as any other living creature, and is subject to all the system's laws. If man is to survive he must do so in an environment that is capable of supporting all life, not just man alone.

PRIOR TO THE 1966 FLOOD, THE LOWER SMITH RIVER WAS DEEP ENOUGH FOR BOAT RACING. THE RIVER IS NOW IN THE PROCESS OF RECOVERY AND SOME FORMER FISHING HOLES ARE BECOMING REESTABLISHED.
(WILDLIFE CONSERVATION BOARD PHOTO - 1964)

RESOURCE USE

Recreational Use

The increase in leisure time and growing mobility of the American public has led to the annual migration of thousands of metropolitan area residents to the hinterlands in search of recreation. The natural beauty of the Del Norte County Coast with its redwood forests, streams, sandy beaches and rocky headlands beckons those who want to escape urban life, if only for a day. It is reasonable to assume that the current upward trend in recreative use demand will continue. For Del Norte County this will be extremely important, for the economic well being of many of its citizens will come more and more to depend on income derived from tourist trade, either directly or indirectly.

Tourism is second only to forest products in the local economy and presently accounts for about 7% of the county's income (O.E.D.P. Committee, 1974). Current visitor days use exceeds one million annually. With the absence of new industry and a general leveling off of timber products on a sustained yield basis, tourism and hence, recreation, could conceivably become the area's leading industry in the forseeable future (O.E.D.P. Committee, 1974).

Since the primary tourist attraction is open space, scenic beauty and natural resources of the area, it is readily apparent that maximum economic benefits can only be realized by preserving these amenities.

Since most recreational activities here are outdoor oriented, weather and climate play an important role in determining the kinds and periods of use. The cool climate and low ocean water temperatures preclude most water contact sports. Therefore, most recreation is dependent on the

area's scenic qualities and natural resources. Because of inclement weather during much of the winter, most sight-seeing use occurs during the summer months.

The tourist trade begins in June and extends into September. The Redwood National Park and State Parks attract many visitors who stay for varying periods to engage in such activities, as fishing, sight-seeing, camping, photography and nature study. As the tourist season draws to a close in September, the most active fishing period begins with the annual upstream spawning migration of cutthroat trout and king salmon. The runs usually begin with the first rains. This is followed by arrival of waterfowl with hunting in the delta and on Lake Earl beginning in October.

Natural resource use can be divided into two categories. Those activities that involve the actual removal of a unit of the resource, such as fish or game, are generally termed appropriative uses. Non-appropriative use are those activities that do not involve the removal of any resource units, as in photography, sight-seeing and nature study.

Through proper planning both types of uses can provide a diverse recreational opportunity without serious conflict.

Sportfishing - Smith River

Sportfishing for marine and anadromous fish species exceeds all other appropriative forms of recreational use in the Smith River Delta and Lake Earl area. The river is best known among anglers for its exceptionally large steelhead and salmon. King salmon, 50 pounds or larger, have been caught. The largest run of coast cutthroat trout is another

SPORTFISHING FOR MARINE AND ANADROMOUS FISH EXCEEDS ALL OTHER APPROPRIATIVE FORMS OF RECREATIONAL USE IN THE SMITH RIVER DELTA. (PHOTO COURTESY OF SAXTON'S, SMITH RIVER, CALIFORNIA)

angling attraction. This species also is the most popular at Lake Earl.

In 1970 the Department estimated that fishing effort for salmon was 21,400 days and 20,800 days for steelhead. Fisherman landed an average 0.4 salmon and 0.4 steelhead per angler day of effort which is considered average success for California salmon and steelhead streams. Comparable figures are not available for coast cutthroat trout.

Most fishing in the Smith River system occurs in the lower river and estuary, between Hiouchi Bridge and the mouth, a distance of about 12 miles. Access and the remoteness of the upper Smith and its tributaries are the limiting factors to greater use in that area. Access in the lower Smith is considered good for boat fishermen, with three launching locations available between the Dr. Fine Bridge and the mouth. Boat fishermen utilize virtually all navigable delta waters, but because of the dangers involved in crossing the river bar, few boats venture into the ocean. Bank fishing access on the other hand is poor. Stretches of the lower river available to the bank fisherman are limited by how far he will walk from the boating access locations. The Smith River Fishing Access (a Wildlife Conservation Board facility) and commercial facilities at the mouth are most heavily used. A third boating access point is located at Trail's End Resort but is subject to closure. Fishermen have used other access locations which require crossing private land. Such access has not been denied but with probable increases in fishing and other public use pressure, these locations are likely to be closed.

Besides salmon and trout, eulachon and shad are the only other species for which a river fishery has developed. Eulachon are caught in the

spring by both sport and commercial fisherman. Shad which were introduced into California in 1871 in the Sacramento River have since spread north and now supports a fishery in the Smith River. Shad provide angling sport during their spring spawning runs. On rare occasions a sturgeon is caught in the estuary, but because of the scarcity no fishery has developed.

Redtail perch, starry flounder and surf smelt are sought after at the mouth and along the beach fronting the study area. Hook and line are used to catch the perch and flounder, while dip nets serve to capture two members of the smelt family, commonly known as day fish and night fish. As their names imply, these are the times when these species make their spawning runs onto the beach and this is also when they are caught. Razor clams are dug from just around the inside corner of the sand spit and along the beach to the south. Soft shell clams are dug from the muddy areas near the docking facilities at the mouth.

Sport Fishing - Lake Earl

Because of the summer blooms of sago pondwood, most angling in Lake Earl occurs in the fall, winter and early spring. The only open water present in summer is in the main channels and summer angling generally occurs there. Not only does the pondweed interfere directly with the fishermen's gear but it makes boat operation extremely difficult. In the fall, pondweed begins to die and angling increases. This is the time of year when the lake is open to the ocean and the salmon and trout are beginning their annual spawning runs. And at this time of year the nearby streams are swollen and muddy and anglers seeking clean water, increase fishing pressure on the lake.

Coast cutthroat trout are probably the most sought after fish of all the species inhabiting Lake Earl. The cutthroat is the most numerous in the sportsman's creel. The average size cutthroat is slightly longer than ten inches but twenty inch specimens are not uncommon. They are landed at the rate of about .7 fish per angling hour. This rate does not, however, reflect the overall fishing success. When all other species are considered the success rate is much higher.

Anglers, for the most part, use spinning gear with bait or hardware. Trolling is conducted in the few channels and in the narrows. Otherwise lures are fished by casting and retrieving. A few local anglers have been successful fishing flies in selected areas but this is not common. King and silver salmon, rainbow trout and all other species except sturgeon and crabs, are caught in the same manner as coast cutthroat trout. Since 1969 when 30,000 silver salmon were planted in Lake Earl this fishery has been increasing and may soon surpass coast cutthroat trout in numbers caught. Most of the sturgeon fishing occurs in the narrows. Heavy tackle and great patience is necessary to catch these fish which may exceed six feet in length. Bait is usually shrimp or worms and is fished on the bottom.

Crabs are captured in traps or hoop nets baited with fish. The species taken is dungeness crab, which is highly prized. The fishery for crabs is not intensive and the crab fisherman generally are from the local areas.

A drawback to fishing Lake Earl is legal access. The general angling public has legal access at only two places: at the foot of Buzzini Road and the foot of Lakeview Road. Both sites are on the east side

of the lake and neither is suited for shore fishing. Most anglers launch their boats at these points and then fish other parts of the lake. Access in the vicinity of the narrows may be possible at some future date; Del Norte County has accepted maintenance responsibility for roads into this area and as a result public access may be assured.

The north coast of California from Fort Bragg to the Oregon border has never been utilized by fishermen to the extent that other coastal areas have, in spite of its rich fisheries resources. Poor access, bad roads and the distance from major population centers have contributed to the limitations on use. As people from metropolitan areas seeking recreation increase in numbers, and with more available leisure time and better road conditions, the fishery will become more heavily utilized. Full fishing potential, and accompanying economic benefits to local communities can only be realized if the resource is protected through preservation of the essential habitat.

Hunting

Waterfowl hunting is currently the greatest appropriative use of wildlife within the Lake Earl-Smith River Delta area. It also has the greatest potential for increasing hunter opportunity. The regular waterfowl season generally opens in October and extends into January providing an average of 93 hunting days annually.

Hunter counts conducted during the 1970-71 and 1971-72 regular waterfowl hunting seasons indicate approximately 3000 user days are expended annually on Lake Earl. The amount of hunting use of the pasture lands near the lake and in the delta has not been determined. Based on field

surveys and hunter interviews, however, it is estimated that more than 75% of all waterfowl hunting in Del Norte County takes place in the Lake Earl-Smith River Delta area. And it is also known that 75% of the hunting activity is by local residents. The remaining use comes largely from other northern California hunters but some travel here from as far away as Los Angeles.

Hunters also pursue game other than waterfowl, including quail, grouse, dove, pigeon, snipe, rabbits and deer, but no information regarding the magnitude of this use is available. In addition, other species such as coyotes, bobcats and ground squirrels are taken.

The only commercial use of wildlife is from fur trapping. Although a number of furbearing species are taken, muskrats make up the bulk of the catch.

The use demand, particularly for waterfowl hunting, is increasing. With proper planning for preserving and enhancing waterfowl habitat, and with provisions for additional public access and use especially to private lands, the Lake Earl-Smith River Delta area has the potential for increasing hunting recreation opportunities substantially.

Boating

Most boating activity in the Lake Earl-Smith River Delta area is associated with fishing or hunting. Because of cold water temperatures and the nature of the river water skiing and pleasure boating are extremely limited. The shallow waters and ever-changing shoals and sand bars further restrict use to the smaller shallow draft skiffs and outboard motor boats. In 1966 water skiing near the Smith River Fishing

Access facility was discontinued because of shallow water. And about this time, the American Legion sponsored power boat races from the mouth to Hiouchi Bridge was discontinued. The 1964 flood is thought to have contributed greatly to the shallowing of the lower river.

The shallow nature of the lakes and the profuse growth of aquatic vegetation severely limits boating there. The existing launching facilities on the lakes and river is adequate to meet present recreational boating demands.

Nature Study and Sightseeing

The growing public interest in conservation and the "Great American Outdoors" has greatly increased the numbers of people who flock to parks and other areas of scenic and natural resource significance. The Redwoods National Park, several state parks and the Six Rivers National Forest attract large numbers of visitors each year. Visitor use of these areas is tabulated below.

Area	Visitor Days Use
Jedediah Smith Redwood State Park	210,121 (FY 1974)
Del Norte Coast Redwood State Park	90,411 (FY 1974)
Redwood National Park	116,098 (FY 1974)
Six Rivers National Forest (Del Norte County)	365,300 (FY 1973)

Lakes Earl and Talawa and the Smith River Delta are attractive elements in the wide array of outdoor attractions in northwestern California. And the area is traversed by a major north-south highway potentially putting the lakes and delta within easy reach to the thousands who visit

the north state. But poor access along the lower river and around the lakes severely limits nature study and sightseeing opportunities. A first step in providing for increased visitor use of the lakes and delta is to provide more access. In preliminary plans being developed for the Smith as a scenic river, it is likely that plans will be included in the recommendations for increased public access.

Scientific and Educational Uses

All coastal wetlands offer potential for scientific and educational uses. Historically these uses have been heaviest on wetlands near population centers, particularly where colleges and universities are located. The remote location of the Lake Earl-Smith River Delta area in relation to population centers has inhibited such uses in the past. Present indications are that this type of use will, however, increase in the future.

Lake Earl provides an almost unique situation in terms of opportunity for scientific and educational use. Conditions which prevail locally are not duplicated anywhere else on the California Coast. In addition to the unusual setting and environmental conditions, there is a wealth of natural resources which make the area highly attractive for scientific study.

Several studies concerning various aspects of the Lake Earl ecosystem have been completed by students from Humboldt State University. It is anticipated that the lake and river will be increasingly used for studies to satisfy both undergraduate and post-graduate requirements. The area will also probably be used more for field trips and class exercises at the college level in the future.

In addition, local public schools utilize the area for educational purposes on a classroom and individual student basis. The magnitude of use is not known but the potential is high. As more emphasis and interest is directed toward environmental and ecological education, this type of use will become more significant.

Governmental agencies, independent foundations and private companies also make use of the area for reasons of increasing man's knowledge. Studies involving fish, wildlife, botany, geology, archeology and other fields have been conducted.

In a report entitled "Education and Research, Comprehensive Ocean Area Plan," higher educational needs for coastal wetlands resource are spelled out. The Smith River nor Lake Earl are not, however, identified in a priority listing of areas desired for research and education within the foreseeable future. But it can be anticipated that the need for natural areas for educational purposes will increase throughout the State. And such increased needs will first impact resources which are already in short supply.

Again, as with other uses, the continued value for scientific and educational uses will depend on man's desire and/or ability to preserve the natural aspects of the area.

THE SUBDIVISION LAYED OUT ON THE NORTHWEST SIDE OF LAKE EARL REMAINS UNDEVELOPED EXCEPT FOR PAVED ROADS AND POWER LINES.
(DEPT. FISH & GAME PHOTO BY JOHN SPETH - 1974)

DEL NORTE COUNTY, RECOGNIZING THAT PUBLIC DUMPS ARE NOT A COMPATABLE USE OF WETLAND RESOURCES, HAS CLOSED THIS SITE ADJACENT TO YONTUCKET SLOUGH.
(DEPT. FISH & GAME PHOTO BY JOHN SPETH - 1974)

PROBLEMS AND CONFLICTS

Urban Expansion

The greatest threat to the Lake Earl-Smith River Delta area is urban development. The value of the present natural system, including pastures, ponds, the estuary, the lakes, dunes and the scattered remnants of coastal forest, could be drastically reduced by urban encroachment.

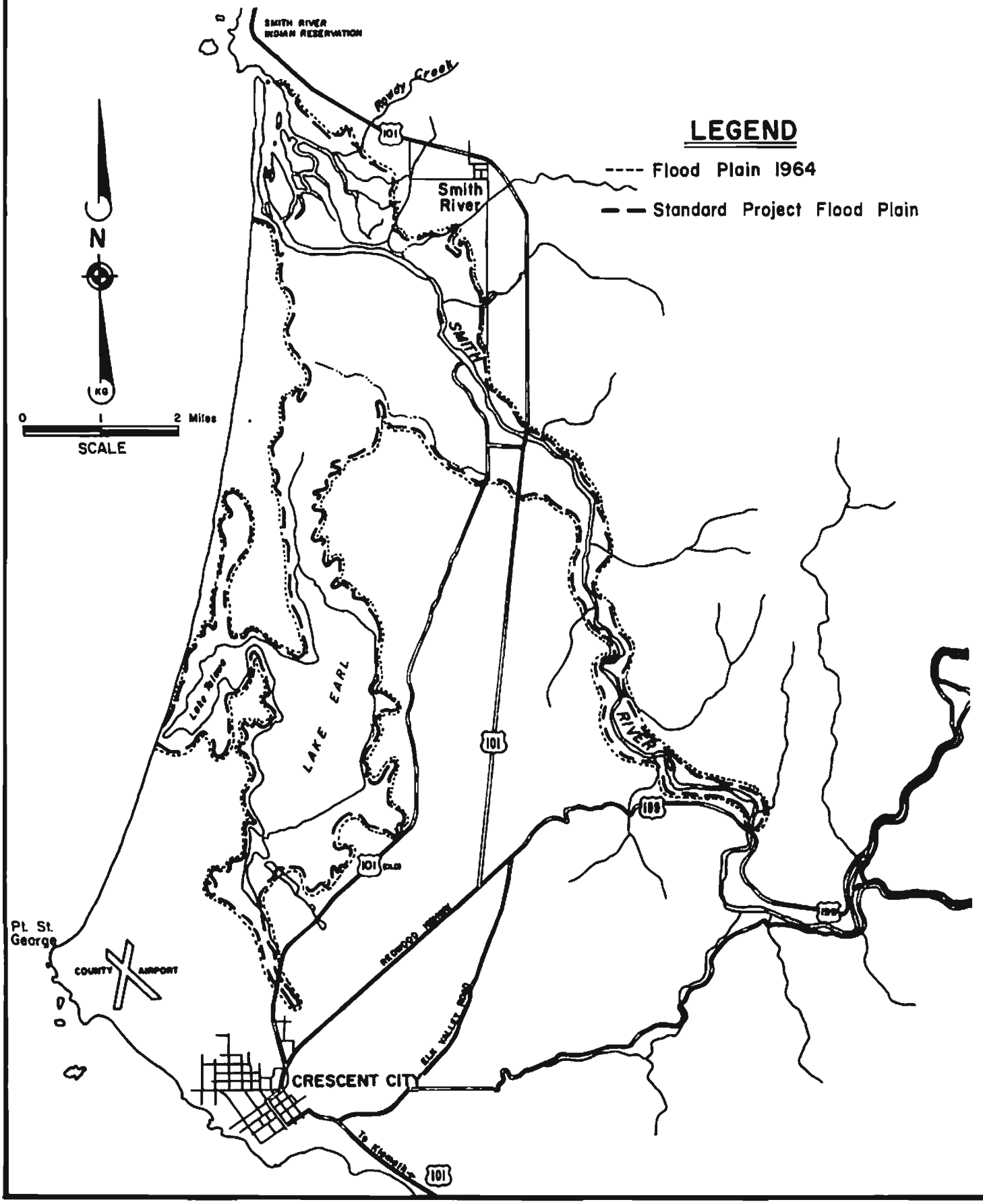
One subdivision, designated "Pacific Shores," was approved by Del Norte County in 1963, before sewage and flood control problems were adequately considered. Paved streets and electricity were provided for purchasers of subdivision lots, but to date building permits have not been granted because of sewage and flood control problems. The land, except for the roads and electric lines, remains undeveloped. However the flooding and sewage problems can be overcome and development take place.

Subsequent to the creation of Pacific Shores the same landowner engaged VTN, an Orange County architectural and engineering firm, to prepare plans covering approximately 8,000 acres along the coast between the Del Norte County Airport and the Smith River, a distance of about 10 miles. In 1970 the County received the plan, known as the "Del Norte Dunes Subdivision," but has not acted upon it, pending approval of the County's general plan (Spann, correspondence, 1975). Considered together, Pacific Shores and the proposed Del Norte Dunes Subdivision could significantly alter about 9,100 acres of the Lake Earl-Smith Delta area. The primary impact of the potential developments would be to reduce the wildlife and agricultural productivity of the area. Even if the lake or river were not greatly altered, their value to fish and wildlife would be tremendously reduced due to the loss of other

PLATE 15

SMITH RIVER FLOOD PLAIN

FROM U.S. ARMY CORPS OF ENGINEERS, 1971



elements in the ecosystem. Further degradation to the remaining natural system would result from a wide variety of indirect and long-range effects of a residential development. Increased runoff, siltation, human disturbance, pet animals and pollution are a few such potential effects.

If the present level of wildlife and agricultural productivity and the scenic and recreational opportunities of the Lake Earl-Smith River Delta area are to be maintained, local, regional or state control of urban expansion will be necessary. This can be accomplished in a number of ways, including zoning to preclude increased population density and acquisition of biologically sensitive areas. Furthermore, unrealized recreational opportunity in the area could be developed through improved access to both the river and the lakes

Drainage and Flood Control

Over the years the Smith River Delta and lands within the river's flood plain (Plate 15), including those around Lake Earl, have been diked, channeled and drained to improve agricultural and other human uses. But it appears, for the moment, that an equilibrium has been reached between the desire to further drain and channelize and the economic feasibility of doing so.

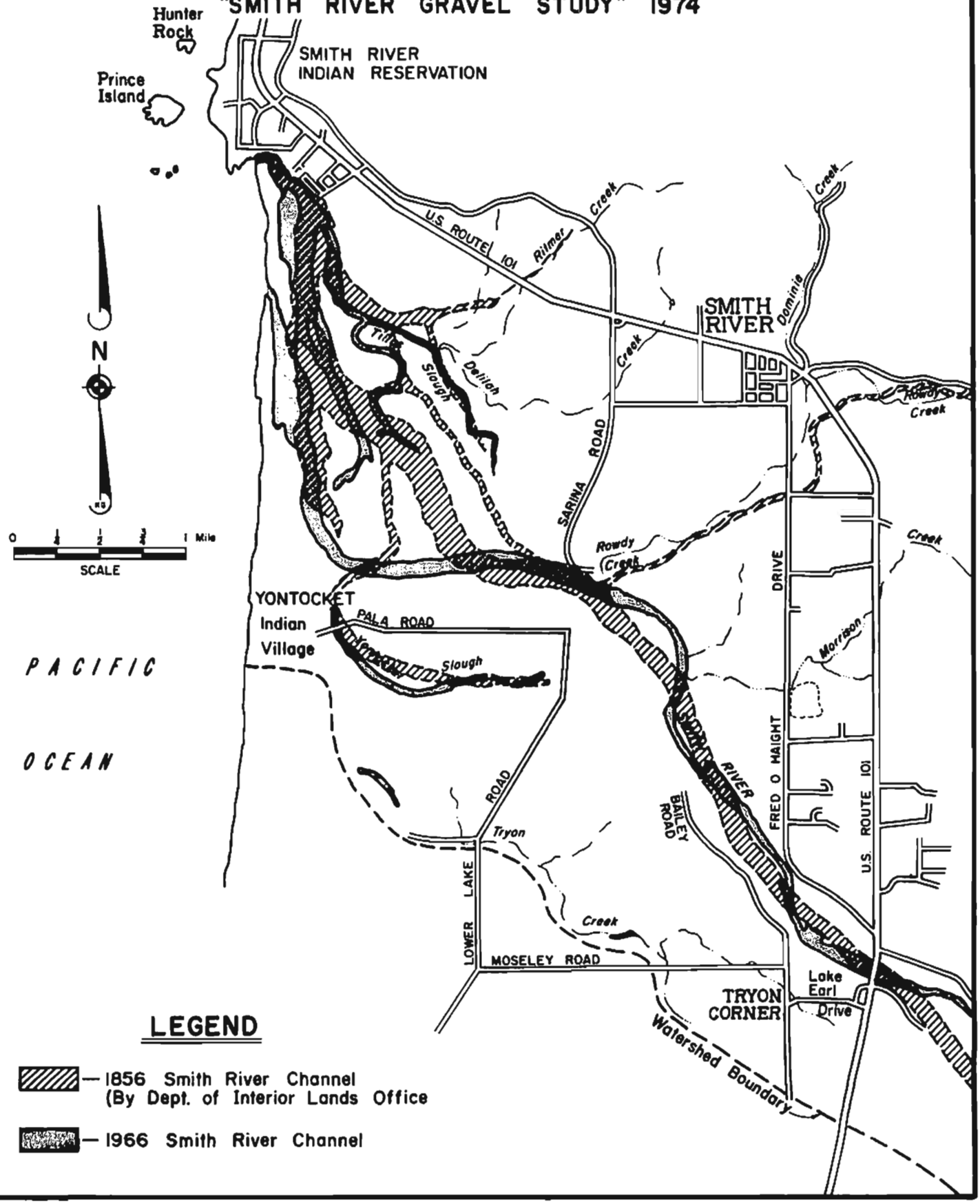
Major floods have changed the river's course through the Delta (Plate 16). This of course is a natural phenomenon. However, in comparing the 1856 channel locations to those of 1966, it is evident that the size and extent of channeling in the Delta have diminished. Land reclamation and siltation are probably the primary factors causing these changes.

PLATE 16

SMITH RIVER CHANNELS

1856 AND 1966

FROM DEPT. OF WATER RESOURCES
"SMITH RIVER GRAVEL STUDY" 1974



LEGEND

— 1856 Smith River Channel (By Dept. of Interior Lands Office

— 1966 Smith River Channel

Present land use practices will tend to maintain the existing size and alignment of the system.

The value of the Smith River flood plain and lakes Earl and Talawa for fish and wildlife is based on the drainage and flooding conditions which now prevail. Under these conditions, water courses tributary to Lake Earl and the lower Smith River tend to meander, forming pools and undercut banks with interconnecting riffles. Streamside vegetation provides shade necessary to regulate water temperatures and is the source of the insects and larvae that fish feed on. The riparian vegetation of these streams also harbor many birds and mammals that could not otherwise exist in open fields and pastures. Potholes, poorly drained pastures, seasonal marshes and permanent ponds and sloughs also are elements of this ecosystem important to fish and wildlife.

Though the demand for improved drainage, stream alteration or flood control does not appear to be great, any proposed change in land use should be closely evaluated to determine its drainage and flood control requirements. Those projects which would significantly alter existing drainage and flooding patterns should not be approved.

The Smith River flood problems have been studied by the U. S. Army Corps of Engineers. In a 1971 report, the Corps concluded that resolution of the problem through structural measures could not be economically justified and that flood damage could be reduced through better management and use of the historical flood plain (U. S. Army, 1971). This report was followed with a flood plain information report (U. S. Army, 1971a) designed to provide local jurisdiction with basic information necessary to properly plan for the use of the flood plain.

Sedimentation

Historically, all north coastal rivers have carried high sediment loads because of the geological nature of the area. The Smith River is no exception. The flora and fauna of the Smith drainage and flood plain have evolved and thrived under these conditions. However, when sedimentation is accelerated by unnatural causes these resources may not be able to adapt to the rapid changes.

Man's activities in the Smith River and Lake Earl drainages have caused increased sedimentation in the river delta and the lake. The increases and effects of sedimentation are most noticeable in the Smith River drainage.

Logging activities and the construction of roads within the Smith watershed are the primary contributors to an estimated 45 percent man-caused increase over normal conditions in the river's sediment load (U. S. Department of Agriculture, 1972). Of the three major sediment sources, streambank erosion is the greatest, followed closely by landslides. The third, sheet and gully erosion, is a relatively minor contributor to the river's sediment load, and before the arrival of man this source of sediment was almost nonexistent.

Logging activities and road building have greatly increased streambank erosion and are directly or indirectly the cause of increased landslide activity. Most land in the Smith River drainage is owned by the U. S. Forest Service, and most of the roads within the drainage are forest service roads built to support logging.

Even though logging practices have improved considerably since the early 1950's, the watershed has not fully recovered from those less enlightened practices and the river is still receiving an adverse payload of sediments as a result. Many roads which do not measure up to present standards of construction still exist. It is estimated that if the road system were corrected, sediment yield on the area treated would be reduced by 75 percent (U. S. Department of Agriculture, 1972).

Recent floods in 1964 and 1970 contributed greatly to the increased sediment in the river. However, without the impact of man's activities in the watershed, the effects of those floods would have been considerably less. The results of the 1964 flood, one of the greatest recorded for the Smith, are still evident. Sediments dumped into the river over 10 years ago are still being flushed out of holes and depressions in the river on into the ocean. A massive landslide, known as the Rattlesnake Slide, occurred on the south fork of the Smith River in 1970. This slide which is still active, was triggered by man's activities in the vicinity (Department of Fish and Game internal memorandum, 1970). Extensive tractor and cable logging directly upslope from the avalanche site probably increased the amount of surface runoff onto the area, causing the slide.

The effects of sedimentation upon the Smith River fishery are not well documented. Logically, however, it can be concluded that fish production and angling have been adversely affected. Although not quantified, the numbers of fish in the river, and angling success, appear to have decreased.

Sedimentation causes damage to fish in several ways. The filling of natural holes in the river bed reduces the habitat required by anadromous fish. It also causes compaction of spawning gravels, rendering them unsuitable for use. The river tends to become more shallow with fewer deepwater areas. The shallowing effect, along with the removal of riparian vegetation due to logging, road construction and other of man's activities, has resulted in increased water temperatures less conducive to fish growth and survival.

The 1972 USDA report contains many recommendations addressed to specific causes of erosion. Most of them concern logging practices, and road building and maintenance. In the Smith River drainage these recommendations are directed to the U. S. Forest Service as the principal land owner. Sedimentation would be significantly reduced if the recommendations were implemented.

The impact of increased sedimentation through man's activities are less apparent at lakes Earl and Talawa. The watershed is small and man's activities within it do not appear to have significantly accelerated the filling in of the lakes.

Access

Public access to the lower Smith River and Lake Earl is extremely limited and requires improvement to accommodate anticipated increases in public use. Access to the Smith from a public facility is currently provided only by Smith River Public Fishing Access. A commercial enterprise provides access to the mouth of the Smith. These sites mainly provide river access for boaters, primarily those who fish the lower

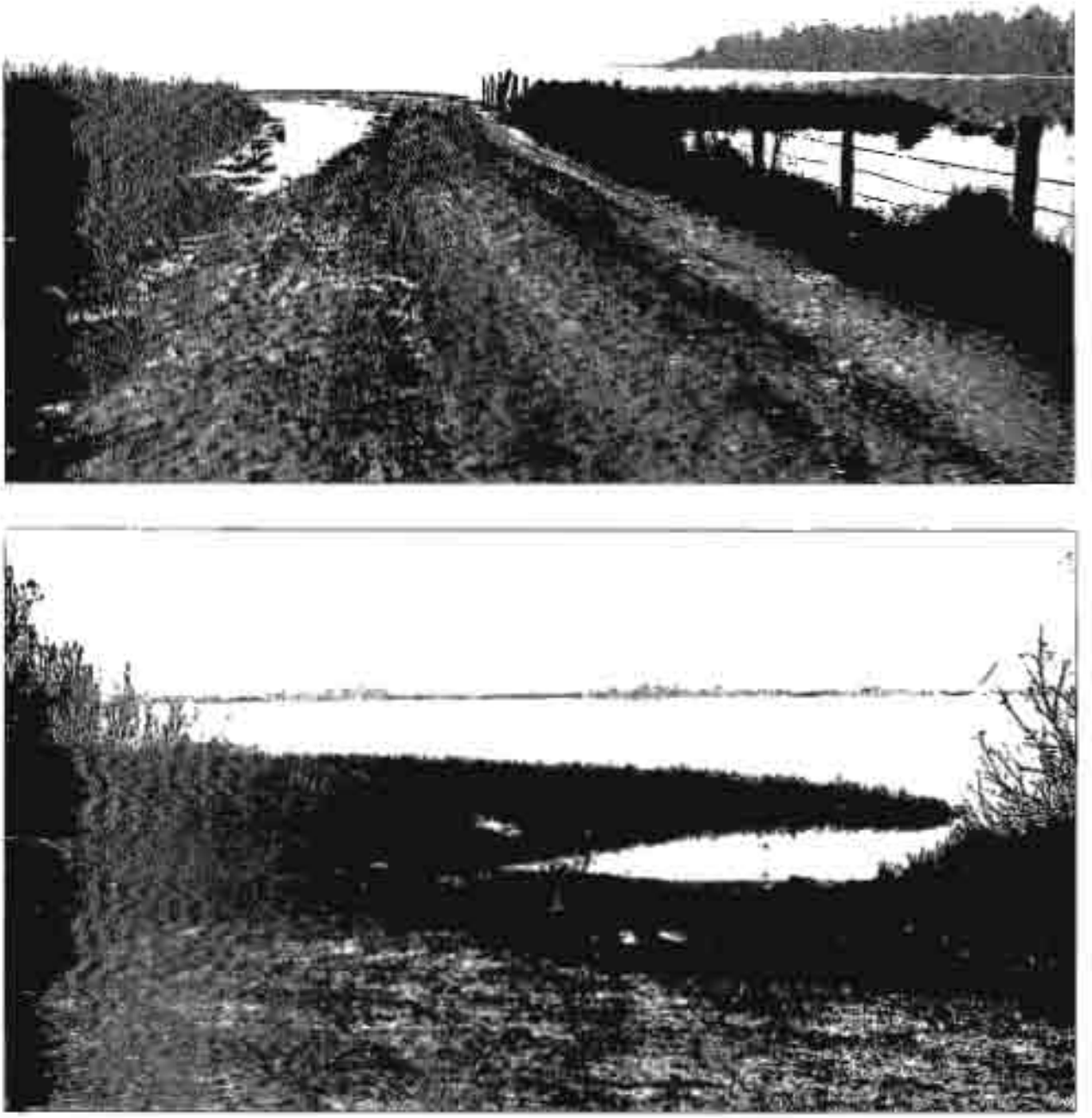
A WILDLIFE CONSERVATION BOARD PROJECT PROVIDES THE ONLY PUBLIC ACCESS FACILITY TO THE LOWER SMITH RIVER. LAKE EARL IS COMPLETELY SURROUNDED BY PRIVATE PROPERTY AND POSTED AGAINST TRESPASS.
(WILDLIFE CONSERVATION BOARD AND DEPT. FISH & GAME PHOTOS - 1964 AND 1974)

Smith and these access locations appear to be adequate for the boat fishermen needs (Plate 17).

Access to Lake Earl is available from the ends of Buzzini Road and Lakeview Drive both on the east shore of the lake. Access to the lake is simply the ends of the gravel roads with no improved ramps or other facilities provided. Local hunters also have gained access to the lake at the "narrows" and near the mouth from the ends of Surf Road and Lake Avenue. Presently the access locations around the lake appear to be adequate for hunters and fishermen who use boats to pursue their sport. However, both sites on the north shore of the lake are subject to closure by the landowners.

Existing access to both the lower Smith River and to Lake Earl is to the water surface only. There is no public access along the perimeter of the lake and only limited access for foot travel along the Smith. All of the land surrounding Lake Earl and along both sides of the Smith River are privately owned. State ownership in the river is to "mean high water." Legal access to foot travel is available along the river's edge when the tide is low, but disappears when the tide is above ordinary high water mark. What little foot travel occurs along the lower Smith is mainly by bank fishermen and it is doubtful that they limit their movements along the river below the ordinary high water mark. Encroachment onto adjoining private lands undoubtedly occurs.

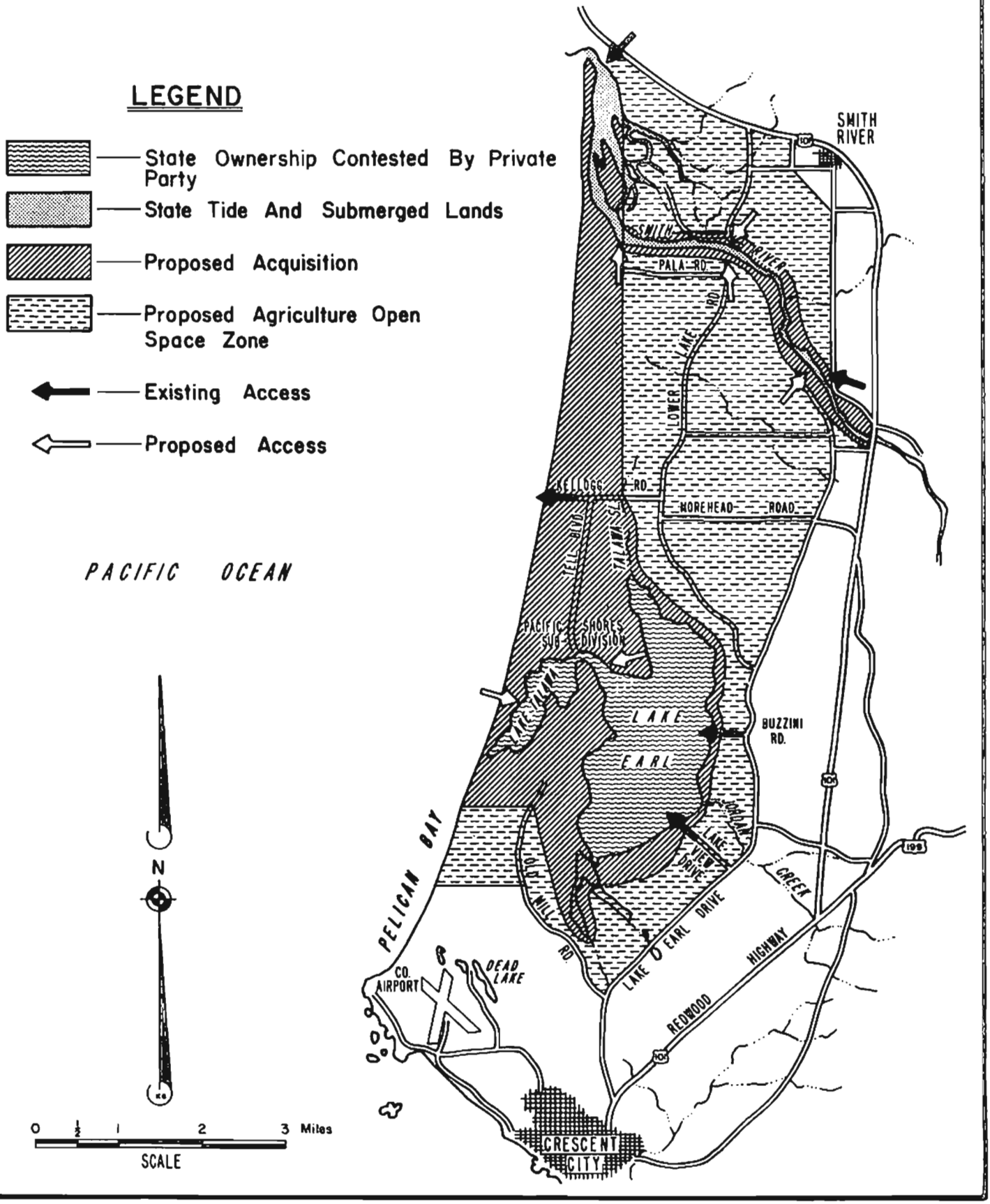
It is anticipated that as the public use of the river and lake increases, all trepass on adjoining private lands will be prohibited. To provide



LAKEVIEW DRIVE (ABOVE) AND BUZZINI ROAD (BELOW) END AT THE WATER'S EDGE AND PRESENTLY PROVIDE THE ONLY GOOD ACCESS TO LAKE EARL.
(DEPT. FISH AND GAME PHOTOS BY JOHN SPETH - 1974)

PLATE 17

PROPOSED ACQUISITION, ACCESS, & ZONING



for increased demands for use of these bodies of water, primarily by people who want to observe the natural attributes of the area, additional access will be needed. Three sites along the south side of the river and one site on the north side are suggested to meet these needs (Plate 17). The legal status of the presently used access sites to Lake Earl should be determined and public access to all four sites guaranteed. Consideration also should be given to acquisition by lease, easement or purchase, a strip of land along the edge of the river.

Water Quality

The water quality of the Smith River and lakes Earl and Talawa are presently high. The only manifestations of man's activities having an adverse impact are increased silt and turbidity in the Smith River and livestock wastes entering the lakes. However, the total impact of sedimentation in the Delta is not well documented and agricultural wastes are not thought to have any significant effect on fish and wildlife in Lake Earl.

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APPENDIX A

Common Plants of the Lake Earl Area and Smith River Delta 1/

Alder, *Alnus rubra*
Alkali bulrush, *Scirpus robustus*
American milfoil, *Myriophyllum verticillatum*
Arrow grass, *Triglochin maritima*
Arrow-head, *Sagittaria* sp.
Azolla, *Azolla mexicana*
Beachgrass, *Ammophila arenaria*
Beach pine, *Pinus contorta*
Beach strawberry, *Fragaria chiloensis*
Bearberry, *Arctostaphylos uva-ursi*
Bedstraw, *Galium trifidum*
Birds foot trefoil, *Lotus uliginosus*
Blackberry, *Rubus vitifolius*
Blue blossom, *Ceanothus thyrsiflorus*
Bracken fern, *Pteris aquilina*
Brass buttons, *Cotula coronopifolia*
Buttercup, *Ranunculus repens*
Cascara, *Rhamnus purshiana*
Cattail, *Typha latifolia*
Chain fern, *Woodwardia radicans*
Common dandelion, *Taraxacum officinale*
Coontail, *Ceratophyllum demersum*
Coulter willow, *Salix coulteri*
Cow clover, *Trifolium wormskioldii*
Coyote brush, *Baccharis pilularis*
Curly-leaved dock, *Rumex crispus*
Dock, *Rumex crassus*
Dock, *Rumex fueginus*
Douglas fir, *Pseudotsuga menziesii*
Duck potato, *Sagittaria* sp.
Dune tansey, *Tanacetum camphoratum*
Eel grass, *Zostera marina*
Elderberry, *Sambucus racemosa*
Everlasting pea, *Lathyrus latifolius*
Fireweed, *Epilobium angustifolium*
Giant bur-reed, *Sparganium eurycarpum*
Goosefoot, *Chenopodium* sp.
Greater duckweed, *Spirodela polyrhiza*
Hairgrass, *Deschampsia caespitosa*
Hardstem bulrush, *Scirpus acutus*
Himalaya blackberry, *Rubus thrysanthus*
Horsetail, *Equisetum hyemale*
Huckleberry, *Vaccinium ovatum*
Jaumea, *Jaumea carnosa*
Jointgrass, *Paspalum distichum*

1/ Scientific names from Munz's (1959) "A California Flora."

Knotweed, *Polygonum paronychia*
Lady fern, *Athyrium filix-foemina*
Leather fern, *Polypodium scouleri*
Lesser duckweed, *Lemna minor*
Licorice fern, *Polypodium vulgare*
Lupine, *Lupinus chamissionis*
Mare's-tail, *Hippurus vulgaris*
Marsh pennywort, *Hydrocotyl umbellata*
Marsh potentilla, *Potentilla palustris*
Marsh rosemary, *Limonium californicum*
Milfoil, *Myriophyllum verticillatum*
Monterey cypress, *Cupressus macrocarpa*
Morning glory, *Convolvulus solderella*
Muskgrass, *Chara*
Nut grass, *Cyperus*
Orchardgrass, *Dactylis glomerata*
Owls clover, *Orthocarpus castillejoides*
Phacelia, *Phacelia argentea*
Pickleweed, *Salicornia pacifica*
Red-flowering currant, *Ribes sanguineum*
Red-seeded dandelion, *Taraxacum laevigatum*
Redwood, *Sequoia sempervirens*
Redwood sorrel, *Oxalis oregana*
Reedgrass, *Calamagrostis*
Rush, *Juncus balticus*
Ryegrass, *Lolium multiflorum*
Sago pondweed, *Potamogeton pectinatus*
Salal, *Gaultheria shallon*
Salmonberry, *Rubus spectabilis*
Saltbush, *Atriplex*
Saltgrass, *Distichlis spicata*
Salt rush, *Juncus leseurii*
Sand verbena, *Abronia latifolia*
Scouler willow, *Salix scouleriana*
Sedge, *Carex*
Silver beachweed, *Franseria chamissonis*
Silverweed, *Potentilla anserina*
Sitka spruce, *Picea sitchensis*
Slough sedge, *Carex obnupta*
Spanish broom, *Spartium junceum*
Spike redtop bentgrass, *Agrostis exarata*
Spikerush, *Heleocharis macrostachya*
Spiraea, *Spiraea douglasii*
Star duckweed, *Lemna trisulca*
Sweet vernalgrass, *Anthoxanthum odoratum*
Thimbleberry, *Rubus parvifloris*
Three-square bulrush, *Scirpus americanus*
Timothy, *Phleum pratense*
Silk-tassel, *Garrya elliptica*
Twinberry, *Lonicera involucrata*
Velvetgrass, *Holcus lanatus*
Water hemlock, *Cicuta douglasii*
Water parsley, *Oenanthe sarmentosa*

Wax-myrtle, *Myrica californica*
White clover, *Trifolium repens*
Widgeon grass, *Ruppia maritima*
Wild buckwheat, *Eriogonum latifolium*
Wild rice, *Zizania aquatica*
Wood fern, *Aspidium spinulosum*
Yarrow, *Achillea millefolium*
Yellow pond lily, *Nuphar polysepalum*

APPENDIX B

Mammals of the Lake Earl Area and Smith River Delta[1/]

Soricidae

Pacific shrew, *Sorex pacificus*
Vagrant shrew, *Sorex vagrans*
Marsh shrew, *Sorex bendirii*
Trowbridge shrew, *Sorex trowbridgii*

Talpidae

Shrew mole, *Neurotrichus gibbsii*
Townsend mole, *Scapanus townsendii*
Coast mole, *Scapanus orarius*

Vespertilionidae

Little brown myotis, *Myotis lucifugus*
Fringed myotis, *Myotis thysanoides*
California myotis, *Myotis californicus*
Hairy-winged myotis, *Myotis volans*
Yuma myotis, *Myotis yumanensis*
Hoary bat, *Lasiurus cinereus*
Silvery-haired bat, *Lasionycteris noctivagans*
Lump-nosed bat, *Plecotus townsendii*
Big brown bat, *Eptesicus fuscus*
Brazilian free-tail bat, *Tadarida brasiliensis*

Leporidae

Black-tailed hare, *Lepus californicus*
Brush rabbit, *Sylvilagus bachmani*

Aplodontiidae

Mountain beaver, *Aplodontia rufa*

Sciuridae

Beechey ground squirrel, *Otospermophilus beecheyi*
Townsend chipmunk, *Eutamia townsendii*
Gray squirrel, *Sciurus griseus*

1/ Scientific names from Ingles' (1915), "Mammals of the Pacific States."

Douglas squirrel, *Tamiasciurus douglasii*
Flying squirrel, *Glaucomys sabrinus*

Geomytidae

Pocket gopher, *Thomomys bottae*

Castoridae

Beaver, *Castor canadensis*

Cricetidae

Western harvest mouse, *Reithrodontomys megalotis*
Deer mouse, *Peromyscus maniculatus*
Ducky-footed wood rat, *Neotoma fuscipes*
White-footed vole, *Phenacomys albipes*
Red tree mouse, *Phenacomys longicaudus*
Red-backed mouse, *Cleithrionomys occidentalis*
Long-tailed meadow mouse, *Microtus longicaudus*
Oregon meadow mouse, *Microtus oregoni*
California meadow mouse, *Microtus californicus*
Townsend meadow mouse, *Microtus townsendii*
Muskrat, *Ondatra zibethica*

Muridae

Norway rat, *Rattus norvegicus*
Black rat, *Rattus rattus*
House mouse, *Mus musculus*

Zapodidae

Pacific jumping mouse, *Zapus trinotatus*

Erethizontidae

Porcupine, *Erethizon dorsatum*

Delphinidae

Common dolphin, *Delphinus delphis*
Bottle-nosed dolphin, *Tursiops gillii*
Harbor porpoise, *Phocaena phocoena*

Otariidae

Steller sea lion, *Eumetopias jubata*
California sea lion, *Zalophus californianus*
Harbor seal, *Phoca vitulina*

Canidae

Gray fox, *Urocyon cinereoargenteus*
Coyote, *Canis latrans*

Ursidae

Black bear, *Ursus americanus*

Procyonidae

Raccoon, *Procyon lotor*
Ringtail cat, *Bassariscus astutus*

Mustelidae

Marten, *Martes americana* 1/
Fisher, *Martes pennanti* 1/
Mink, *Mustela vison*
Long-tailed weasel, *Mustela frenata*
Ermine, *Mustela erminea*
Striped skunk, *Mephitis mephitis*
Spotted skunk, *Spilogale putorius*
River otter, *Lutra canadensis*

Felidae

Mountain lion, *Felis concolor*
Bobcat, *Lynx rufus*

Cervidae

Black-tailed deer, *Odocoileus hemionus columbianus*
Roosevelt elk, *Cervus canadensis roosevelti*

1/ Although known to occur in the past, these species may now be absent in the Lake Earl vicinity.

APPENDIX C

Birds of the Lake Earl Area and Smith River Delta [1]

Water-associated Birds

Grebes, Loons, Pelicans and Cormorants

Common loon, *Gavia immer* (M)[2]
Arctic loon, *Gavia arctica* (M)
Red-throated loon, *Gavia stellata* (M)
Red-necked grebe, *Podiceps grisegena* (M)
Horned grebe, *Podiceps auritus* (M)
Eared grebe, *Podiceps nigricollis* (M)
Western grebe, *Aechmophorus occidentalis* (M-R)
Pied-billed grebe, *Podilymbus podiceps* (M-R)
Brown pelican, *Pelecanus occidentalis* (M)
Double-crested cormorant, *Phalacrocorax auritus* (M-R)
Brandt's cormorant, *Phalacrocorax penicillatus* (M)
Pelagic cormorant, *Phalacrocorax pelagicus* (R)

Pelagic Birds

Northern fulmar, *Fulmarus glacialis* (M)
Sooty shearwater, *Puffinus griseus* (M)
Leach's storm petrel, *Oceanodroma leucorhoa* (M)
Pomarine jaeger, *Stercorarius pomarinus* (M)
Parasitic jaeger, *Stercorarius parasiticus* (M)
Common murre, *Uria aalge* (M)
Pigeon guillemot, *Cepphus columba* (M)
Marbled murrelet, *Brachyramphus marmoratus* (M)
Ancient murrelet, *Synthliboramphus antiquum* (M)
Tufted puffin, *Lunda cirrhata* (M)

Wading Birds

Great blue heron, *Ardea herodias* (R)
Green heron, *Butorides virescens* (R)
Cattle egret, *Bubulcus ibis* (M)
Great egret, *Casmerodius albus* (M)
Snowy egret, *Egretta thula* (M)
Black-crowned night heron, *Nycticorax nycticorax* (R)
American bittern, *Botaurus lentiginosus* (R)

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[1] Scientific names from Peterson's "A Field Guide to Western Birds," and name changes that appeared in the April 1973 issue of *The Auk*.

[2] R = resident; M = migrant; M-R = both migratory birds that stay over and occasionally nest; and, summer visitors.

Marsh Birds

Virginia rail, *Rallus limicola* (M-R)
Sora rail, *Porzana carolina* (M-R)
American coot, *Fulica americana* (M-R)
Clapper rail, *Rallus longirostris* (R)

Waterfowl

Swans and Geese

Whistling swan, *Olor columbianus* (M)
Canada goose, *Branta canadensis* (M)
Black brant, *Branta nigricans* (M)
White-fronted goose, *Anser albifrons* (M)
Snow goose, *Chen caerulescens* (M)
Ross' goose, *Chen rossii* (M)
Emperor goose, *Philacte canagica* (M)

Surface Feeding Ducks

Mallard, *Anas platyrhynchos* (M-R)
Gadwall, *Anas strepera* (R)
Pintail, *Anas acuta* (M)
Green-winged teal, *Anas crecca* (M)
Blue-winged teal, *Anas discors* (M)
Cinnamon teal, *Anas cyanoptera* (M)
European wigeon, *Anas penelope* (M)
American wigeon, *Anas americana* (M)
Northern shoveler, *Anas clypeata* (M)
Wood duck, *Aix sponsa* (R)

Diving Ducks and Stiff-tailed Ducks

Redhead, *Aythya americana* (M)
Ring-necked duck, *Aythya collaris* (M)
Canvasback, *Aythya valisineria* (M)
Greater scaup, *Aythya marila* (M)
Lesser scaup, *Aythya affinis* (M)
Common goldeneye, *Bucephala clangula* (M)
Barrows goldeneye, *Bucephala islandica* (M)
Bufflehead, *Bucephala albeola* (M)
White-winged scoter, *Melanitta deglandi* (M)
Surf scoter, *Melanitta perspicillata* (M)
Black scoter, *Melanitta nigra* (M)
Harlequin duck, *Histrionicus histrionicus* (M)
Oldsquaw, *Clangula hyemalis* (M)
Ruddy duck, *Oxyura jamaicensis* (M-R)

Mergansers

Hooded merganser, *Lophodytes cucullatus* (M-R)
Common merganser, *Mergus merganser* (M-R)
Red-breasted merganser, *Mergus serrator* (M)

Shorebirds

Black oystercatcher, *Haematopus bachmani* (R)
Semipalmated plover, *Charadrius semipalmatus* (M)
Snowy plover, *Charadrius alexandrinus* (R)
Killdeer, *Charadrius vociferus* (M-R)
American golden plover, *Pluvialis dominica* (M)
Black-bellied plover, *Pluvialis squatarola* (M)
Surf bird, *Aphriza virgata* (M)
Ruddy turnstone, *Arenaria interpres* (M)
Black turnstone, *Arenia melanocephala* (M)
Common snipe, *Capella gallinago* (M)
Long-billed curlew, *Numenius americanus* (M)
Whimbrel, *Numenius phaeopus* (M)
Spotted sandpiper, *Actitis macularia* (R)
Solitary sandpiper, *Tringa solitaria* (M)
Wandering tattler, *Heteroscelus incanus* (M)
Willet, *Catoptrophorus semipalmatus* (M)
Greater yellowlegs, *Tringa melanoleucus* (M)
Lesser yellowlegs, *Tringa flavipes* (M)
Red knot, *Calidris canutus* (M)
Rock sandpiper, *Calidris ptilocnemis* (M)
Pectoral sandpiper, *Calidris melanotos* (M)
Baird's sandpiper, *Calidris bairdii* (M)
Least sandpiper, *Calidris minutilla* (M)
Dunlin, *Calidris alpina* (M)
Short-billed dowitcher, *Limnodromus griseus* (M)
Long-billed dowitcher, *Limnodromus scolopaceus* (M)
Western sandpiper, *Calidris mauri* (M)
Marbled godwit, *Limosa fedoa* (M)
Sanderling, *Calidris alba* (M)
American avocet, *Recurvirostra americana* (M)
Red phalarope, *Phalaropus fulicarius* (M)
Wilson's phalarope, *Steganopus tricolor* (M)
Northern phalarope, *Lobipes lobatus* (M)

Gulls and Terns

Glaucous gull, *Larus hyperboreus* (M)
Glaucous-winged gull, *Larus glaucescens* (M)
Western gull, *Larus occidentalis* (R)
Herring gull, *Larus argentatus* (M)
Thayer's gull, *Larus thayeri* (M)
California gull, *Larus californicus* (M)
Ring-billed gull, *Larus delawarensis* (M)
Mew gull, *Larus canus* (M)
Bonaparte's gull, *Larus philadelphia* (M)
Heermann's gull, *Larus heermanni* (M)
Sabine's gull, *Xema sabini* (M)
Foster's tern, *Sterna forsteri* (M)
Common tern, *Sterna hirundo* (M)
Elegant tern, *Thalasseus elegans* (M)
Caspian tern, *Hydroprogne caspia* (M)
Black tern, *Chlidonias niger* (M)

Raptors

Vultures

Turkey vulture, *Cathartes aura* (M)

Hawks and Kites

White-tailed kite, *Elanus leucurus* (R)
Goshawk, *Accipiter gentilis* (R)
Sharp-skinned hawk, *Accipiter striatus* (R)
Cooper's hawk, *Accipiter cooperii* (R)
Red-tailed hawk, *Buteo jamaicensis* (R)
Red-shouldered hawk, *Buteo lineatus* (R)
Rough-legged hawk, *Buteo lagopus* (M)
Golden eagle, *Aquila chrysaetos* (M)
Bald eagle, *Haliaeetus leucocephalus* (M)
Marsh hawk, *Circus cyaneus* (M)
Osprey, *Pandion haliaetus* (M-R)
Peregrine falcon, *Falco peregrinus* (M-R)
Merlin, *Falco columbarius* (M)
American kestrel, *Falco sparverius* (R)
Prairie falcon, *Falco mexicanus* (M)

Owls

Barn owl, *Tyto alba* (R)
Screech owl, *Otus asio* (R)
Great horned owl, *Bubo virginianus* (R)
Snowy owl, *Nyctea scandiaca* (M)
Pygmy owl, *Glaucidium gnoma* (R)
Long-eared owl, *Asio otus* (R)
Short-eared owl, *Asio flammeus* (M)
Saw-whet owl, *Aegolius acadicus* (R)
Burrowing owl, *Speotyto cumicularia* (M)

Land Birds

Grouse, Quail and Pheasants

Blue grouse, *Dendragapus obscurus* (R)
Ruffed grouse, *Bonasa umbellus* (R)
California quail, *Lophortyx californicus* (R)
Mountain quail, *Oreortyx pictus* (R)
Ring-necked pheasant, *Phasianus colchicus* (R)

Pigeons and Doves

Band-tailed pigeon, *Columbina fasciata* (M-R)
Rock dove, *Columbina livia* (R)
Mourning dove, *Zenaida macroura* (M)

Goatsuckers

Common nighthawk, *Chordeiles minor* (M-R)

Swifts and Hummingbirds

Black swift, *Cypseloides niger* (M)
Vaux's swift, *Chaetura vauxi* (M)
Anna's hummingbird, *Calypte anna* (M-R)
Rufous hummingbird, *Selasphorus rufus* (M-R)
Allen's hummingbird, *Selasphorus sasin* (M-R)

Kingfishers

Belted kingfisher, *Megaceryle alcyon* (R)

Woodpeckers

Common flicker, *Colaptes auratus* (R)
Pileated woodpecker, *Dryocopus pileatus* (R)
Acorn woodpecker, *Melanerpes formicivorus* (R)
Lewis woodpecker, *Asyndesmus lewis* (M)
Yellow-bellied sapsucker, *Sphyrapicus varius* (R)
Hairy woodpecker, *Dendrocopos villosus* (R)
Downy woodpecker, *Dendrocopos pubescens* (R)

Passerine Birds

Tropical kingbird, *Tyrannus melancholicus* (M)
Western kingbird, *Tyrannus verticalis* (M)
Ash-throated flycatcher, *Myiarchus cinerascens* (M)
Black phoebe, *Sayornis nigricans* (R)
Willow flycatcher, *Empidonax traillii* (M)
Hammond's flycatcher, *Empidonax hammondii* (M)
Dusky flycatcher, *Empidonax oberholseri* (M)
Western flycatcher, *Empidonax difficilis* (M)
Western wood pewee, *Contopus sordidulus* (M-R)
Olive-sided flycatcher, *Nuttallornis borealis* (M)
Horned lark, *Eremophila alpestris* (M)
Violet-green swallow, *Tachycineta thalassina* (M)
Tree swallow, *Iridoprocne bicolor* (M)
Rough-winged swallow, *Stelgidopteryx ruficollis* (M)
Barn swallow, *Hirundo rustica* (M)
Cliff swallow, *Petrochelidon pyrrhonota* (M)
Purple martin, *Progne subis* (M-R)
Steller's jay, *Cyanocitta stelleri* (R)
Scrub jay, *Aphelocoma coerulescens* (R)
Common raven, *Corvus corax* (R)
Common crow, *Corvus brachyrhynchos* (R)
Black-capped chickadee, *Parus atricapillus* (R)
Chestnut-backed chickadee, *Parus rufescens* (R)
Bushtit, *Psaltriparus minimus* (R)

Red-breasted nuthatch, *Sitta canadensis* (R)
Brown creeper, *Certhia familiaris* (R)
Wrentit, *Chamaea fasciata* (R)
Dipper, *Cinclus mexicanus* (R)
House wren, *Troglodytes aedon* (M)
Winter wren, *Troglodytes troglodytes* (R)
Bewick's wren, *Thryomanes bewickii* (R)
Long-billed marsh wren, *Telmatodytes palustris* (R)
American robin, *Turdus migratorius* (M-R)
Varied thrush, *Ixoreus naevius* (R)
Hermit thrush, *Catharus guttata* (M-R)
Swainson's thrush, *Catharus ustulata* (M)
Western bluebird, *Sealia mexicana* (M-R)
Townsend's solitaire, *Myadestes townsendi* (M-R)
Golden-crowned kinglet, *Regulus satrapa* (M-R)
Ruby-crowned kinglet, *Regulus calendula* (M-R)
Water pipit, *Anthus spinoletta* (M)
Bohemian waxwing, *Bombycilla garrulus* (M)
Cedar waxwing, *Bombycilla cedrorum* (M-R)
Northern shrike, *Lanius excubitor* (M)
Loggerhead shrike, *Lanius ludovicianus* (M)
Starling, *Sturnus vulgaris* (R)
Hutton's vireo, *Vireo huttoni* (M-R)
Solitary vireo, *Vireo solitarius* (M)
Warbling vireo, *Vireo gilvus* (M)
Orange-crowned warbler, *Vermivora celata* (R)
Nashville warbler, *Vermivora ruficapilla* (M)
Yellow warbler, *Dendroica petachia* (R)
Yellow rumped warbler, *Dendroica coronata* (M-R)
Black-throated gray warbler, *Dendroica nigrescens* (M)
Townsend's warbler, *Dendroica townsendi* (M)
Hermit warbler, *Dendroica occidentalis* (M)
Palm warbler, *Dendroica palmarum* (M)
MacGillivray's warbler, *Oporornis telmiei* (M)
Common yellowthroat, *Geothlypis trichas* (M)
Yellow-breasted chat, *Icteria virens* (M)
Wilson's warbler, *Wilsonia pusilla* (M)
House sparrow, *Passer domesticus* (R)
Western meadowlark, *Sturnella neglecta* (R)
Yellow-headed blackbird, *Xanthocephalus xanthocephalus* (M)
Red-winged blackbird, *Agelaius phoeniceus* (R)
Northern (Bullock's) oriole, *Icterus galbula* (M)
Brewer's blackbird, *Euphagus cyanocephalus* (R)
Brown-headed cowbird, *Molothrus ater* (R)
Western tanager, *Piranga ludoviciana* (M)
Black-headed grosbeak, *Pheucticus melanocephalus* (M)
Lazuli bunting, *Passerina amoena* (M)
Evening grosbeak, *Hesperiphona vespertina* (R)
Purple finch, *Carpodacus purpureus* (M-R)
Cassin's finch, *Carpodacus cassinii* (M-R)
House finch, *Carpodacus mexicanus* (R)

Pine siskin, *Spinus pinus* (R)
American goldfinch, *Spinus tristis* (R)
Lesser goldfinch, *Spinus psaltria* (R)
Red crossbill, *Loxia curvirostra* (M-R)
Rufous-sided towhee, *Pipilo erythrophthalmus* (M-R)
Brown towhee, *Pipilo fuscus* (M-R)
Savannah sparrow, *Passerculus sandwichensis* (R)
Vesper sparrow, *Pooecetes gramineus* (M)
Dark-eyed junco, *Junco hyemalis* (M-R)
Chipping sparrow, *Spizella passerina* (R)
White-crowned sparrow, *Zonotrichia leucophrys* (R)
Golden-crowned sparrow, *Zonotrichia atricapilla* (M)
White-throated sparrow, *Zonotrichia albicollis* (M)
Fox sparrow, *Passerella iliaca* (R)
Lincoln's sparrow, *Melospiza lincolnii* (M)
Song sparrow, *Melospiza melodia* (R)
Lapland longspur, *Calcarius lapponicus* (M)
Chestnut-collared longspur, *Calcarius ornatus* (M)
Snow bunting, *Plectrophenax nivalis* (M)

APPENDIX D

Water-associated Bird Census, Smith River Delta,

1970-73

	Waterfowl	Shorebirds	Wading Birds	Other Water Birds	Total Water Birds
JAN.	2,985	22	3	2,380	5,390
FEB.	760*	13	4	306	1,083
MAR.	86	54	4	19	163
APR.	7		2	10	19
MAY	7	50	1	34	92
JUNE	12	1	2	53	68
JULY	15	72	2	64	153
AUG.	33		2	109	151
SEPT.	625	56	22	117	820
OCT.	702	515	4	70	1,291
NOV.	116	180	4	67	367
DEC.	135	30	7	21	193
AVE. ANNUAL BIRD DAYS USE	166,878	29,962	1,938	98,633	297,411

* One year's data only.

APPENDIX E - Water-associated Bird Census, Lake Earl
Average Monthly Populations 1970-71-72-73

Species	Jan. Avg.(Peak)	Feb. Avg.(Peak)	Mar. Avg.(Peak)	Apr. Avg.(Peak)	May Avg. (1972)	June Avg.(Peak)	July Avg.(Peak)	Aug. Avg. (1972)	Sept. Avg.(Peak)	Oct. Avg.(Peak)	Nov. Avg.(Peak)	Dec. Avg. (1972)	Avg. Annual Bird Days Use
Swans	75(172)	54(152)	0	0	0	0	0	0	0	0	14(28)	75	
Mallard	76(229)	144(210)	28(37)	22(34)	14	6(10)	36(64)	146	165(250)	198(287)	365(605)	487	
Pintail	665(1,530)	337(500)	207(579)	21(42)	3	1(1)	0	182	505(931)	1,594(1,708)	275(500)	4,610	
Gadwall	73(230)	162(332)	19(50)	175(350)	0	10(20)	13(26)	0	23(30)	0	6(10)	50	
Green-winged teal	28(85)	6(10)	0	8(17)	0	0	0	0	45(80)	161(316)	160(200)	160	
Cinnamon teal	18(55)	7(20)	5(10)	7(8)	2	1(2)	0	0	0	0	50(100)	0	
Widgeon	267(550)	450(1,042)	12(35)	28(50)	12	4(9)	0	0	466(742)	2,769(3,920)	2,387(4,415)	12,192	
Shoveller	3(10)	16(45)	0	0	10	0	1(2)	0	0	0	96(192)	0	
Redhead	19(30)	36(89)	2(6)	0	0	0	4(8)	0	0	0	107(124)	0	
Canvasback	2,087(3,100)	429(880)	44(125)	21(35)	61	0	0	20	0	0	1,427(1,930)	2,758	
Scaup	354(625)	52(120)	27(40)	64(128)	236	4(9)	19(38)	80	84(165)	5(10)	693(1,152)	806	
Bufflehead	101(234)	371(555)	96(110)	219(407)	4	0	0	0	0	1(2)	220(272)	86	
Ruddy	2,816(5,977)	1,102(2,460)	648(1,104)	30(40)	83	2(3)	0	3	0	500(901)	2,366(2,848)	7,770	
Scoter	10(30)	87(236)	0	90(180)	240	30(61)	0	0	0	0	32(65)	30	
Merganser	44(52)	0	0	0	0	0	0	30	50(100)	0	0	0	
Unidentified	0	0	0	0	47	0	0	0	0	0	0	0	
WATERFOWL TOTAL	6,636	3,253	1,088	685	712	58	73	557	1,338	5,228	8,184	29,124	1,744,922
Godwit	0	0	8(8)	0	0	0	0	0	30(30)	12(12)	10(10)	0	
Willet	0	0	0	0	0	0	0	10	0	0	0	0	
Other shorebirds	28(28)	390(1,020)	50(50)	300(300)	1,744	53(53)	23(40)	78	840(1,350)	416(602)	0	100	
SHOREBIRDS TOTAL	28	390	58	300	1,744	53	23	88	870	428	10	100	124,449
Blue heron	5(12)	29(51)	3(5)	3(6)	2	5(6)	5(7)	4	12(17)	12(16)	8(10)	4	
Common egret	27(70)	39(71)	14(37)	5(10)	12	2(3)	1(2)	9	16(17)	18(24)	49(95)	43	
WADING BIRDS TOTAL	32	68	17	8	14	7	6	13	28		57	47	9,830
Coots	756(1,518)	805(710)	774(1,835)	749(847)	254	7(8)	5(10)	0	397(794)	2,274(2,448)	6,931(13,487)	20,430	
Grebes	177(187)	370(790)	57(90)	23(41)	50	43(55)	7(8)	32	82(159)	63(101)	297(475)	345	
Loons	0	44(44)	2(5)	0	0	13(25)	0	0	1(2)	0	7(15)	0	
Cormorant	97(151)	37(52)	50(133)	11(20)	42	62(94)	24(26)	113	33(34)	18(25)	40(52)	593	
OTHER WATER BIRDS TOTAL	1,030	1,256	883	783	346	125	36	145	513	2,355	7,275	21,368	1,107,101
WATER ASSOC. BIRDS TOTAL	7,726	4,967	2,046	1,776	2,816	243	136	803	2,749	8,041	15,526	50,639	2,986,372

APPENDIX F

Fishes Found in Lake Earl and the Smith River Estuary

	Lake Earl	Smith River
Pacific lamprey, *Lampreta tridentata* 1/	X	X
Green sturgeon, *Acipenser medirostris*	X	X
American shad, *Alosa sapidissima*		X
Chum salmon, *Oncorhynchus keta*		X
Silver salmon, *Oncorhynchus kisutch*	X	X
King salmon, *Oncorhynchus tshawytscha*	X	X
Coast cutthroat trout, *Salmo clarkii clarkii*	X	X
Rainbow trout, *Salmo gairdnerii*	X	X
Rainbow steelhead trout, *Salmo gairdnerii gairdnerii*		X
Eulachon, *Thalichthys pacificus*		X
Suckers, *Catostomus*		X
Threespine stickleback, *Gasterosteus aculeatus*	X	X
Bay pipefish, *Syngnathus leptorhynchus*	X	X
Prickley sculpin, *Cottus asper*	X	X
Pacific staghorn sculpin, *Leptocottus armatus*	X	X
Pacific herring, *Clupea harengus pallasi*	X	X
Northern anchovy, *Engraulis mordax*		X
Surf smelt, *Hypomesus pretiosus*		X
Redtail surfperch, *Amphistichus rhodoterus*		X
Shiner surfperch, *Cymatogaster aggregata*	X	X
Topsmelt, *Antherinops affinis*	X	X
Saddleback gunnel, *Pholis ornata*		X
Black rockfish, *Sebastea melanops*		X
Starry flounder, *Platichthys stellatus*	X	X
English sole, *Parophphrys vetulus*	X	
LONGFIN SMELT, SPIRINCHUS THALEICHTHYS 4/10/89	X	

1/ Scientific names from Frey and Gates (1974).

APPENDIX G

Common Amphibians and Reptiles of the Lake Earl Area
and Smith River Delta

Red-legged frog, *Rana aurora*

Pacific tree frog, *Hyla regilla*

Western toad, *Bufo boreas*

California slender salamander, *Batrachoseps attenuatus*

Pacific giant salamander, *Dicamptodon ensatus*

Painted salamander, *Ensatina eschoscholtzi picta*

Rough-skinned newt, *Taricha granulosa*

Ringneck snake, *Diadophis punctatus*

Gopher snake, *Pituophis melanoleucus*

Pacific rubber boa, *Charina bottae*

Western rattle snake, *Crotalus viridis*

Garter snakes, *Thamnophis* spp.

Western pond turtle, *Clemmys marmorata*

Western fence lizard, *Sceloporus occidentalis*

Northern alligator lizard, *Gerrhonotus coeruleus*

Western skink, *Eumeces skiltonianus*

1/ Scientific names from Stebbins (1966), "Field Guide to Western Reptiles and and Amphibians."