FISH COMMISSION OF OREGON

SAND LAKE ESTUARY

A STUDY IN RESOURCE USE
DIVISION OF MANAGEMENT AND RESEARCH

1971 SAND LAKE ESTUARY RESOURCE USE STUDY

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Fish Commission of Oregon
Division of Management and Research

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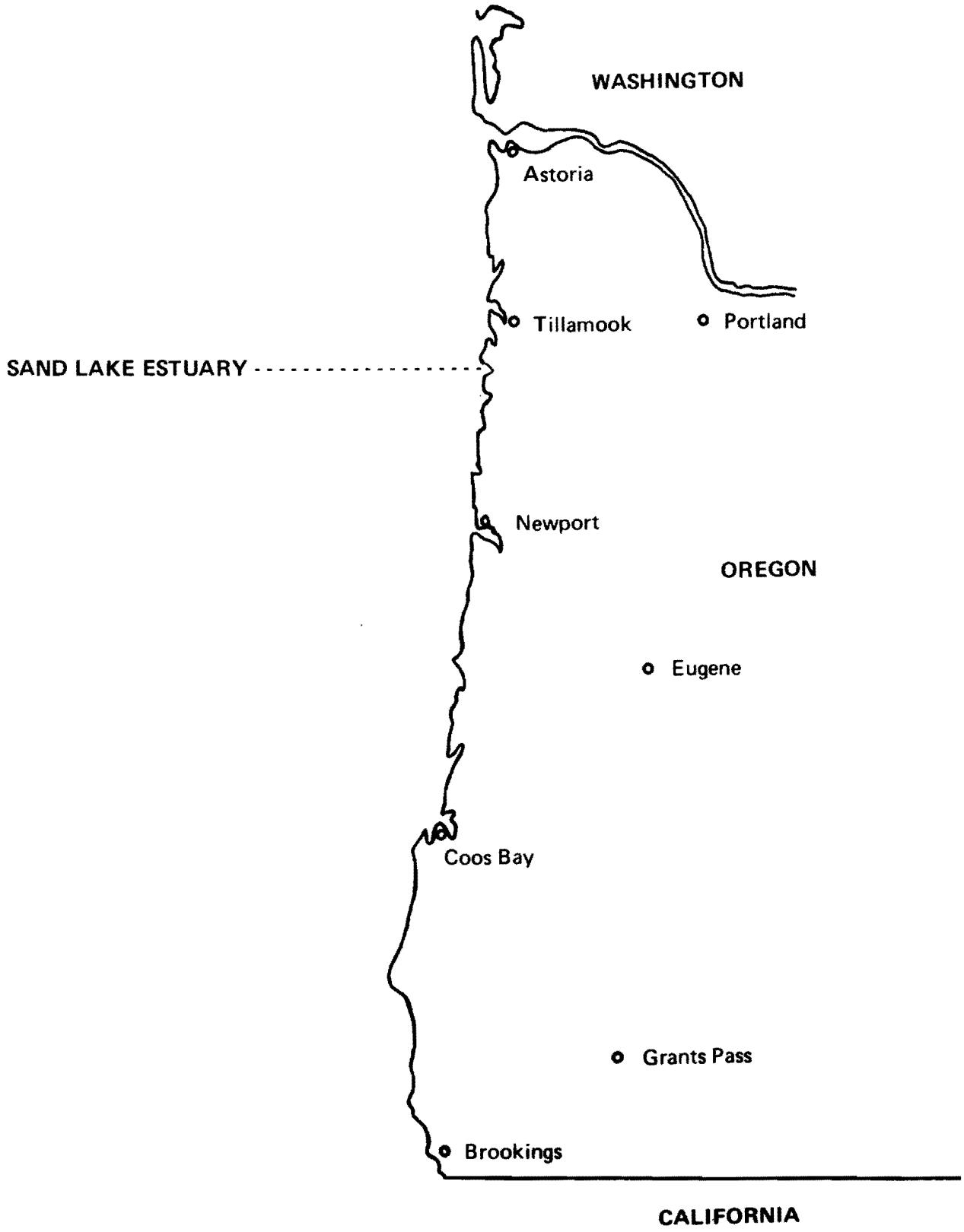

Figure 1. Location of Sand Lake Estuary.

1971 SAND LAKE ESTUARY RESOURCE USE STUDY

INTRODUCTION

In 1971 the Fish Commission of Oregon conducted a comprehensive study of the recreational use of marine food fish, shellfish, and other miscellaneous invertebrates in 16 Oregon estuaries. The anadromous sport fisheries in the upper portions of most estuaries were not included in the study due to the lack of manpower to adequately sample those areas. The study was supported by state general funds and by the National Marine Fisheries Service under the Commercial Fisheries Research and Development Act. The U.S. Army Corps of Engineers funded portions of the data processing, preparation of a series of marine resource maps, and a special report for each estuary. This report summarizes the results of the Sand Lake Estuary study.

PROCEDURE

The Sand Lake Estuary is located 90 miles south of the Columbia River (Figure 1). The 528-acre contains 397 acres of tidelands.

From March 1 through October 31, 1971, boat and shore anglers tideflat users, and scuba divers were interviewed for catch, effort, and origin data in a program designed for statistical analysis. Resource users were categorized as (1) county: people that reside west of the coast range summit within the county where the sampled estuary is found, (2) state: residents of Oregon not classified as county, and (3) nonstate: nonresidents of Oregon.

The study area included the entire estuary. Survey areas and their station numbers are outlined in Table 1 and are shown in Figure 2.

No commerical fishery exists in the Sand Lake Estuary.

The following maps were prepared using information collected in previous Fish Commission studies and the 1971 resource use survey.

1. Principal boat fishing areas.
2. Clam beds.
3. Eel grass beds.
4. Food Production areas, fish feeding areas, and fish migration routes.

RESULTS

During the study 938 boat, shore, tideflat, and scuba resource user interviews were obtained to estimate catch and effort values and angler origin. The values presented in the tables are estimates and have been rounded off when used in the text.

Boat Fishery

Figure 3 shows the principal boat fishing areas of the Sand Lake Estuary. Only sport fishing areas are shown on the map since no commercial boat fishing occurs on Sand Lake. Principal species of fish and shellfish caught and peak periods of fishing activity are outlined.

An estimated 200 boat angler trips were expended on the estuary (Table 2). These anglers spent 700 hours fishing (Table 3). Peak month of activity was September.

Dungeness crab and starry flounder were the only species of marine animals identified in the boat anglers' catch (Table 4). Peak catch occurred in September (Table 5).

Shore Fishery

Interview data revealed that 6,000 shore angler trips were expended on the estuary (Table 6). Tillamook County Park and Sand Lake Camp received nearly equal fishing pressure. Shore anglers spent 12,500 hours fishing (Table 7). Peak months of activity were July and August.

Ten species of fish and one species of crab were identified in the shore anglers' catch (Table 8). Pacific staghorn sculpin and starry flounder were the principal species taken, accounting for 76% of the total number of animals caught. The peak catch occurred during July and fishing success was highest during June (Table 9).

Tideflat Fishery

Figure 4 shows the known distribution of bay clams in the Sand Lake Estuary. Only cockle clams are known to occur in the estuary.

Table 10 shows that 3,600 tideflat user trips were expended to harvest marine animals from the estuary. Tideflat users spent 2,500 hours collecting five species of miscellaneous invertebrates from the estuary (Tables 11 and 12). Ghost and mud shrimp were the principal species collected. Peak activity and catch occurred during August. Fishing success was highest during September (Table 13).

Scuba Fishery

The small number of scuba divers interviewed on the Sand Lake Estuary precluded making an estimate of catch and effort for this fishery.

Angler Origin

Eighty-three percent of the anglers interviewed were residents of Oregon living outside of Tillamook County, 13% were Tillamook County residents, and 4% were out-of-state residents.

	Angler Origin		
	County	State	Non-State
Boat	105	117	0
Shore	665	4,992	344
Tideflat	467	3,023	72
Total	**1,237**	**8,132**	**416**
Percentage	**12.6**	**83.1**	**4.3**

Combined Recreational Fisheries

A total of 9,800 resource user trips (200 boat, 6,000 shore, and 3,600 tideflat) were expended on the Sand Lake Estuary during the study (Table 14). The 9,800 user trips represented 15,700 hours of effort (700 boat, 12,500 shore, and 2,500 tideflat). Peak months of activity for the boat, shore, and tideflat fisheries were September, August, and August, respectively. Combining all fisheries, Table 15 shows that August was the peak month of activity.

Anglers of the three fisheries harvested 94,900 marine animals (88,500 shrimp, 5,800 fish, 500 crabs, and 100 miscellaneous invertebrates). Dungeness crab and starry flounder were the only identified species harvested by boat anglers. Fish were the principal animals caught by shore anglers and represented 98% of their total take. Pacific staghorn sculpin and starry flounder were the principal species caught. Ghost and mud shrimp comprised 93% of the tideflat users' total take. Comparing the catch for all three fisheries revealed that tideflat users harvested 88,900 or 94% of the total animals taken. Peak months of catch for the boat, shore, and tideflat fisheries were September, July, and August, respectively. Combining all fisheries, August was the principal month of catch.

Eel Grass Beds

Several eel grass beds are found in the Sand Lake Estuary (Figure 5). These beds are usually found in areas of shallow water and high salinities. Clams and other important marine fauna are usually an integral part of the eel grass beds.

Food Production Areas, Fish Feeding Areas, and Fish Migration Routes

Figure 6 shows the food production areas, fish feeding areas, and fish migration routes in the estuary.

Estuaries are some of the most productive lands on earth. The productivity of estuarial areas is directly related to length of shore line, depth of water, and geographical location. Within each estuary tidelands are generally more productive than deep water channel areas.

Production of food organisms occurs throughout the entire estuary. These food organisms include the microscopic phytoplankton and other algae, zooplankton, small crustaceans, mollusks, annelids, and fish which are all important in the estuarine food chain.

The fish feeding areas of the Sand Lake Estuary (for finfish and shellfish) include all areas of the estuary under tidal influence. Tideflats as well as deep water channels and rocky areas provide a variety of rearing habitat. Species of fish, numbers, and distribution within each area are generally related to type of food organisms, bottom type, water depth, and water quality.

Fish and shellfish typically found associated with the estuary tideflats include flounder, sole, perch, rockfish, crabs, shrimp, and clams. In addition to those species found on tideflats, anchovy, steelhead, and cutthroat trout reside in the estuary channels; period of residency is dependent on species, season, and location. A taxonomic list of the species of marine animals observed in this study is contained in Table 16.

Rocky areas in the estuary are restricted to the Tillamook County Park area. Perch and sculpins are the principal species residing in this area.

Fish migration routes are those areas traveled by fish to and from spawning, feeding, or rearing areas. Fish migration routes through the Sand Lake Estuary are as varied as the fish that use them. Species and age class of fish, season, water depth, and water quality all play an important role in fish migration patterns.

The use of channel areas throughout the estuary by trout, perch, flounder, and baitfish is well known. In addition, during high tide, these same fish frequently swim across tideflats to reach their destination.

ACKNOWLEDGMENTS

Many Fish Commision of Oregon personnel contributed in the gathering, compiling, analyzing of data, typing, and editing of this report. Special thanks are due Mrs. Linda Karlik for preparing the resource maps and Mr. Louis Fredd for his assistance in analyzing the data.

Table 1. LOCATION OF SAMPLING STATIONS
Sand Lake Estuary, 1971

Fishing Activity	Station Number	Location
Boat	B-1	Sand Lake (Mouth of estuary to head of tide)
Shore	S-1	Tillamook County Park
	S-2	Sand Lake Camp
Tideflat	T-1	All tideflats

Table 2. NUMBER OF BOAT ANGLER TRIPS
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

	Boat Fishing Area and Station Number	
Month	Sand Lake Total (B-1 Only Station)	Percentage
March	10	4.5
April	0	0.0
May	39	17.6
June	26	11.7
July	39	17.6
August	40	18.0
September	46	20.7
October	22	9.9
Total	222	100.0

Table 3. HOURS OF BOAT ANGLER USE
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

	Boat Fishing Area and Station Number	
Month	Sand Lake Total (B-1 Only Station)	Percentage
March	35	4.8
April	0	0.0
May	127	17.6
June	85	11.8
July	126	17.4
August	129	17.8
September	149	20.6
October	72	10.0
Total	723	100.0

Table 4. MARINE ANIMALS CAUGHT BY BOAT ANGLERS
Sand Lake Estuary, by Species and Area
March 1 through October 31, 1971

Species	Boat Fishing Area and Station Number Sand Lake Total (B-1 Only Station)	Percentage
Dungeness crab	92	38.0
Starry flounder	139	57.4
Unidentified fish	11	4.5
Total	242	99.9

Table 5. SPORT BOAT FISHING DATA
Sand Lake Estuary, All Areas
1971

	March	April	May	June	July	Aug.	Sept.	Oct.	Total	Percentage
Angler trips (number)	10	0	39	26	39	40	46	22	222	–
Fishing effort (hours)	35	0	127	85	126	129	149	72	723	–
Fishing success (catch/hr.)	0.29	0.00	0.34	0.33	0.33	0.34	0.34	0.33	0.33	–
Catch (number)										
Dungeness crab	4	0	16	11	16	17	19	9	92	38.0
Starry flounder	6	0	25	16	24	25	29	14	139	57.4
Unidentified fish	0	0	2	1	2	2	3	1	11	4.5
Total	10	0	43	28	42	44	51	24	242	99.9
Percentage	4.1	0.0	17.8	11.6	17.3	18.2	21.1	9.9	100.0	

Table 6. NUMBER OF SHORE ANGLER TRIPS
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

Month	Shore Fishing Area and Station Number: Tillamook County Park S-1	Shore Fishing Area and Station Number: Sand Lake Camp S-2	Total	Percentage
March	211	82	293	4.9
April	570	79	649	10.8
May	250	590	840	14.0
June	395	519	914	15.2
July	628	683	1,311	21.8
August	593	876	1,469	24.5
September	165	169	334	5.6
October	141	50	191	3.2
Total	2,953	3,048	6,001	100.0
Percentage	49.2	50.8	100.0	

Table 7. HOURS OF SHORE ANGLER USE
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

Month	Shore Fishing Area and Station Number: Tillamook County Park S-1	Shore Fishing Area and Station Number: Sand Lake Camp S-2	Total	Percentage
March	438	171	609	4.9
April	1,185	164	1,349	10.8
May	521	1,227	1,748	14.0
June	822	1,078	1,900	15.2
July	1,304	1,417	2,721	21.8
August	1,228	1,816	3,044	24.4
September	344	352	696	5.6
October	295	105	400	3.2
Total	6,137	6,330	12,467	99.9
Percentage	49.2	50.8	100.0	

Table 8. MARINE ANIMALS CAUGHT BY SHORE ANGLERS
Sand Lake Estuary, By Species and Area
March 1 through October 31, 1971

Species	Shore Fishing Area and Station Number: Tillamook County Park S-1	Shore Fishing Area and Station Number: Sand Lake Camp S-2	Total	Percentage
Dungeness crab	0	146	146	2.5
Pacific staghorn sculpin	1,949	373	2,322	40.4
Starry flounder	476	1,582	2,058	35.8
Shiner perch	442	12	454	7.9
Buffalo sculpin	42	246	288	5.0
Northern anchovy	61	0	61	1.1
Cutthroat trout	47	0	47	0.8
Black rockfish	19	0	19	0.3
Pile perch	5	12	17	0.3
Rainbow trout	13	0	13	0.2
Kelp greenling	12	0	12	0.2
Unidentified fish	306	0	306	5.3
Total	3,372	2,371	5,743	99.8
Percentage	58.7	41.3	100.0	

Table 9. SHORE FISHING DATA
Sand Lake Estuary, All Areas
1971

	March	April	May	June	July	Aug.	Sept.	Oct.	Total	Percentage
Angler trips (number)	293	649	840	914	1,311	1,469	334	191	6,001	–
Fishing effort (hours)	609	1,349	1,748	1,900	2,721	3,044	696	400	12,467	–
Fishing success (catch/hr.)	0.12	0.04	0.34	0.73	0.65	0.49	0.30	0.42	0.46	–
Catch (number)										
Dungeness crab	0	0	38	20	0	73	15	0	146	2.5
Pacific staghorn sculpin	0	0	12	531	751	809	77	142	2,322	40.4
Starry flounder	54	55	528	531	529	257	84	20	2,058	35.8
Shiner perch	0	0	0	0	209	245	0	0	454	7.9
Buffalo sculpin	6	0	0	0	282	0	0	0	288	5.0
Northern anchovy	0	0	0	0	0	61	0	0	61	1.1
Cutthroat trout	0	0	0	0	0	24	23	0	47	0.8
Black rockfish	0	0	0	0	0	12	7	0	19	0.3
Pile perch	0	0	12	0	0	0	0	5	17	0.3
Rainbow trout	13	0	0	0	0	0	0	0	13	0.2
Kelp greenling	0	0	0	0	0	12	0	0	12	0.2
Unidentified fish	0	0	0	306	0	0	0	0	306	5.3
Total	73	55	590	1,388	1,771	1,493	206	167	5,743	99.8
Percentage	1.3	1.0	10.3	24.2	30.8	26.0	3.6	2.9	100.0	

Table 10. NUMBER OF TIDEFLAT USER TRIPS
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

Month	Tideflat and Station Number All Tideflats Total (T-1 Only Station)	Percentage
March	32	0.9
April	80	2.2
May	136	3.8
June	357	10.0
July	1,372	38.5
August	1,385	38.9
September	36	1.0
October	164	4.6
Total	3,562	99.9

Table 11. HOURS OF TIDEFLAT USE
By Month and Area, Sand Lake Estuary
March 1 through October 31, 1971

Month	Tideflat and Station Number All Tideflats Total (T-1 Only Satation)	Percentage
March	37	1.5
April	34	1.4
May	145	5.9
June	211	8.5
July	882	35.7
August	993	40.2
September	37	1.5
October	129	5.2
Total	2,468	99.9

Table 12. MARINE ANIMALS CAUGHT BY TIDEFLAT USERS
Sand Lake Estuary, By Species and Area
March 1 through October 31, 1971

Species	Tideflat and Station Number All Tideflats Total (T-1 Only Station)	Percentage
Shore crab	245	0.3
Cockle clam	34	<0.1
Ghost shrimp	72,821	81.9
Mud shrimp	14,543	16.4
Unidentified shrimp	1,161	1.3
Kelp worm	64	0.1
Total	88,868	100.0

Table 13. TIDEFLAT FISHING DATA
Sand Lake Estuary, All Areas
1971

	March	April	May	June	July	Aug.	Sept.	Oct.	Total	Percentage
Angler trips (number)	32	80	136	357	1,372	1,385	36	164	3,562	
Fishing effort (hours)	37	34	145	211	882	993	37	129	2,468	
Fishing success (catch/hr.)	12.6	37.5	23.3	6.3	35.2	36.5	146.5	75.3	36.0	
Catch (number)										
Shore crab	0	0	0	0	245	0	0	0	245	0.3
Cockle clam	0	16	0	18	0	0	0	0	34	<0.1
Ghost shrimp	379	183	1,376	403	30,778	24,572	5,422	9,708	72,821	81.9
Mud shrimp	0	0	1,947	917	0	11,679	0	0	14,543	16.4
Unidentified shrimp	86	1,075	0	0	0	0	0	0	1,161	1.3
Kelp worm	0	0	64	0	0	0	0	0	64	0.1
Total	465	1,274	3,387	1,338	31,023	36,251	5,422	9,708	88,868	100.0
Percentage	0.5	1.4	3.8	1.5	34.9	40.8	6.1	10.9	99.9	

Table 14. SUMMARY
Number of Shore Angler Trips, Hours of Effort, and Animals Caught
Sand Lake Estuary, by Station
March 1 through October 31, 1971

Station Number	No. Angler Trips	Angler Hours	Catch				
			Fish	Crabs	Shrimp	Misc. Invert.	Total
B-1	222	723	150	92	0	0	242
Total	222	723	150	92	0	0	242
S-1	2,953	6,137	3,372	0	0	0	3,372
S-2	3,048	6,330	2,225	146	0	0	2,371
Total	6,001	12,467	5,597	146	0	0	5,743
T-1	3,562	2,468	0	245	88,525	98	88,868
Total	3,562	2,468	0	245	88,525	98	88,868
Grand Total	9,785	15,658	5,747	483	88,525	98	94,853

Table 15. SUMMARY
Number of Angler Trips, Hours of Effort, and Animals Caught
Sand Lake Estuary, by Month
March 1 through October 31, 1971

Fishery	Month	No. Angler Trips	Angler Hours	Catch				
				Fish	Crabs	Shrimp	Misc. Invert.	Total
Boat	March	10	35	6	4	0	0	10
	April	0	0	0	0	0	0	0
	May	39	127	27	16	0	0	43
	June	26	85	17	11	0	0	28
	July	39	126	26	16	0	0	42
	August	40	129	27	17	0	0	44
	September	46	149	32	19	0	0	51
	October	22	72	15	9	0	0	24
	Total	222	723	150	92	0	0	242
Shore	March	293	609	73	0	0	0	73
	April	649	1,349	55	0	0	0	55
	May	840	1,748	552	38	0	0	590
	June	914	1,900	1,368	20	0	0	1,388
	July	1,311	2,721	1,771	0	0	0	1,771
	August	1,469	3,044	1,420	73	0	0	1,493
	September	334	696	191	15	0	0	206
	October	191	400	167	0	0	0	167
	Total	6,001	12,467	5,597	146	0	0	5,743
Tideflat	March	32	37	0	0	465	0	465
	April	80	34	0	0	1,258	16	1,274
	May	136	145	0	0	3,323	64	3,387
	June	357	211	0	0	1,320	18	1,338
	July	1,372	882	0	245	30,778	0	31,023
	August	1,385	993	0	0	36,251	0	36,251
	September	36	37	0	0	5,422	0	5,422
	October	164	129	0	0	9,708	0	9,708
	Total	3,562	2,468	0	245	88,525	98	88,868
Combined	March	335	681	79	4	465	0	548
	April	729	1,383	55	0	1,258	16	1,329
	May	1,015	2,020	579	54	3,323	64	4,020
	June	1,297	2,196	1,385	31	1,320	18	2,754
	July	2,722	3,729	1,797	261	30,778	0	32,836
	August	2,894	4,166	1,447	90	36,251	0	37,788
	September	416	882	223	34	5,422	0	5,679
	October	377	601	182	9	9,708	0	9,899
Grand Total		9,785	15,658	5,747	483	88,525	98	94,853

Table 16. TAXONOMIC LIST OF SPECIES HARVESTED By Estuarine Resource Users, Sand Lake Estuary March 1 through October 31, 1971

Common Name	Local Names	Scientific Name
Fish		
Black rockfish	Black sea bass, black snapper	*Sebastes melanops*
Buffalo sculpin	Bullhead	*Enophrys bison*
Cutthroat trout	Blueback, harvest trout, sea run	*Salmo clarki*
Kelp greenling	Seatrout	*Hexagrammos decagrammus*
Northern anchovy		*Engraulis mordax*
Pacific staghorn sculpin	Bullhead	*Leptocottus armatus*
Pile perch		*Rhacochilus vacca*
Rainbow trout		*Salmo gairdneri*
Shiner perch	Shiner	*Cymatogaster aggregata*
Starry flounder		*Platichthys stellatus*
Crabs		
Dungeness crab	Market crab	*Cancer magister*
Shore crab	Mud crab	*Hemigrapsus nudus and Hemigrapsus oregonensis*
Shrimp		
Ghost shrimp	Sand shrimp	*Callianassa californiensis*
Mud shrimp	Sand shrimp	*Upogebia pugettensis*
Clams		
Cockle clam	Basket cockle, steamer	*Clinocardium nuttallii*
Miscellaneous Invertebrates		
Kelp worm	Clam worm, mussel worm	*Nereis sp.*

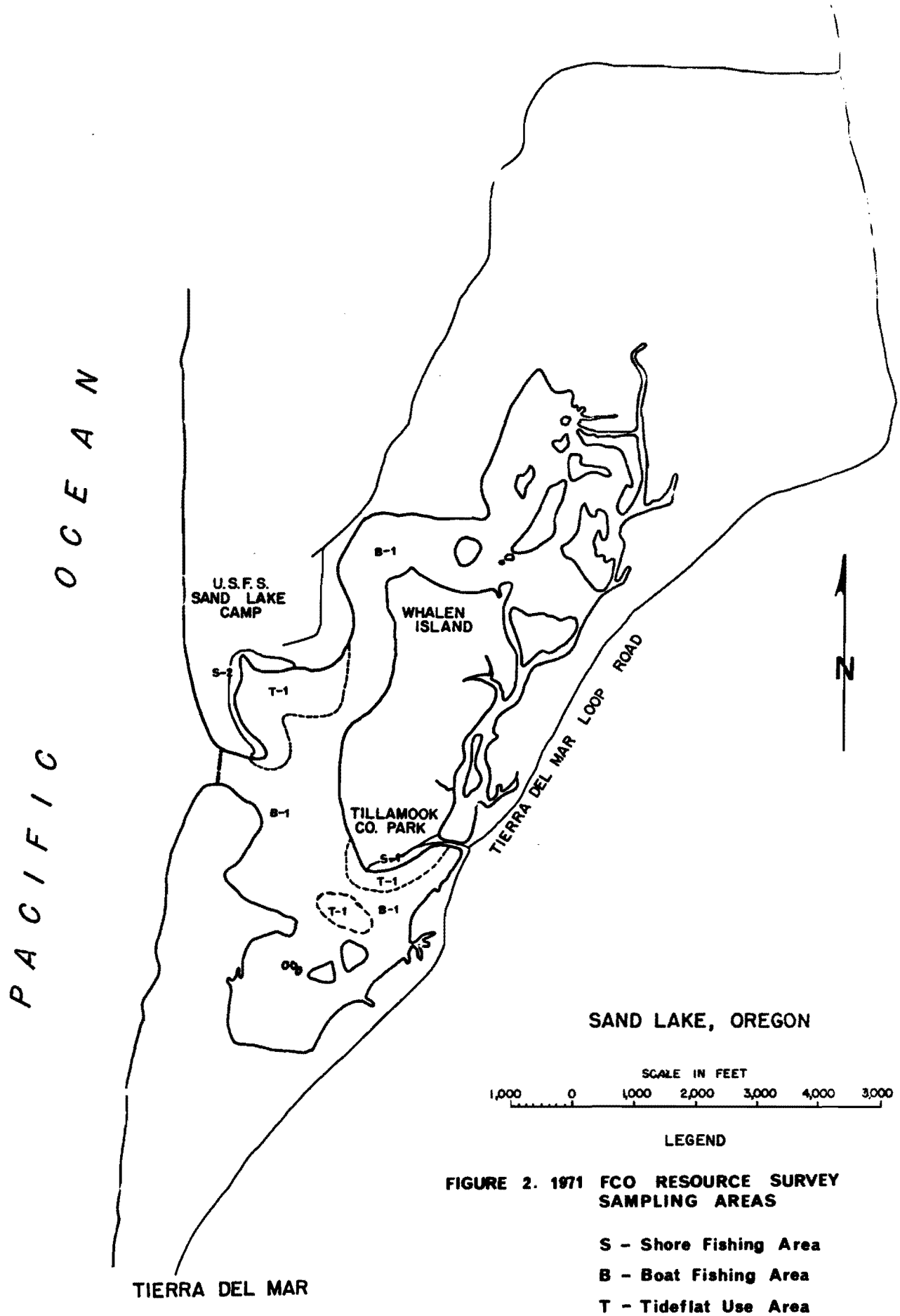

FIGURE 2. 1971 FCO RESOURCE SURVEY SAMPLING AREAS

S - Shore Fishing Area

B - Boat Fishing Area

T - Tideflat Use Area

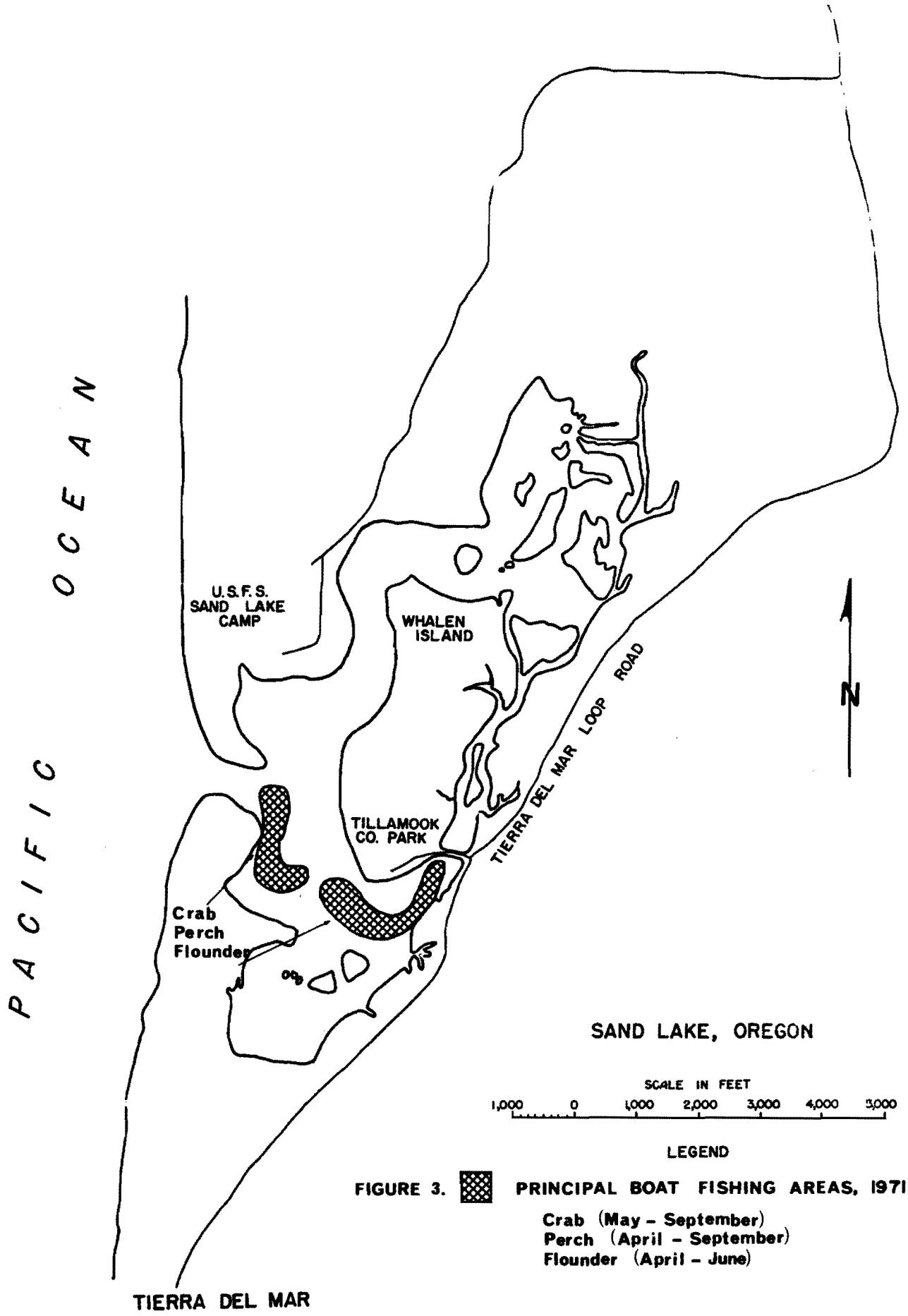

FIGURE 3. PRINCIPAL BOAT FISHING AREAS, 1971

Crab (May - September)
Perch (April - September)
Flounder (April - June)

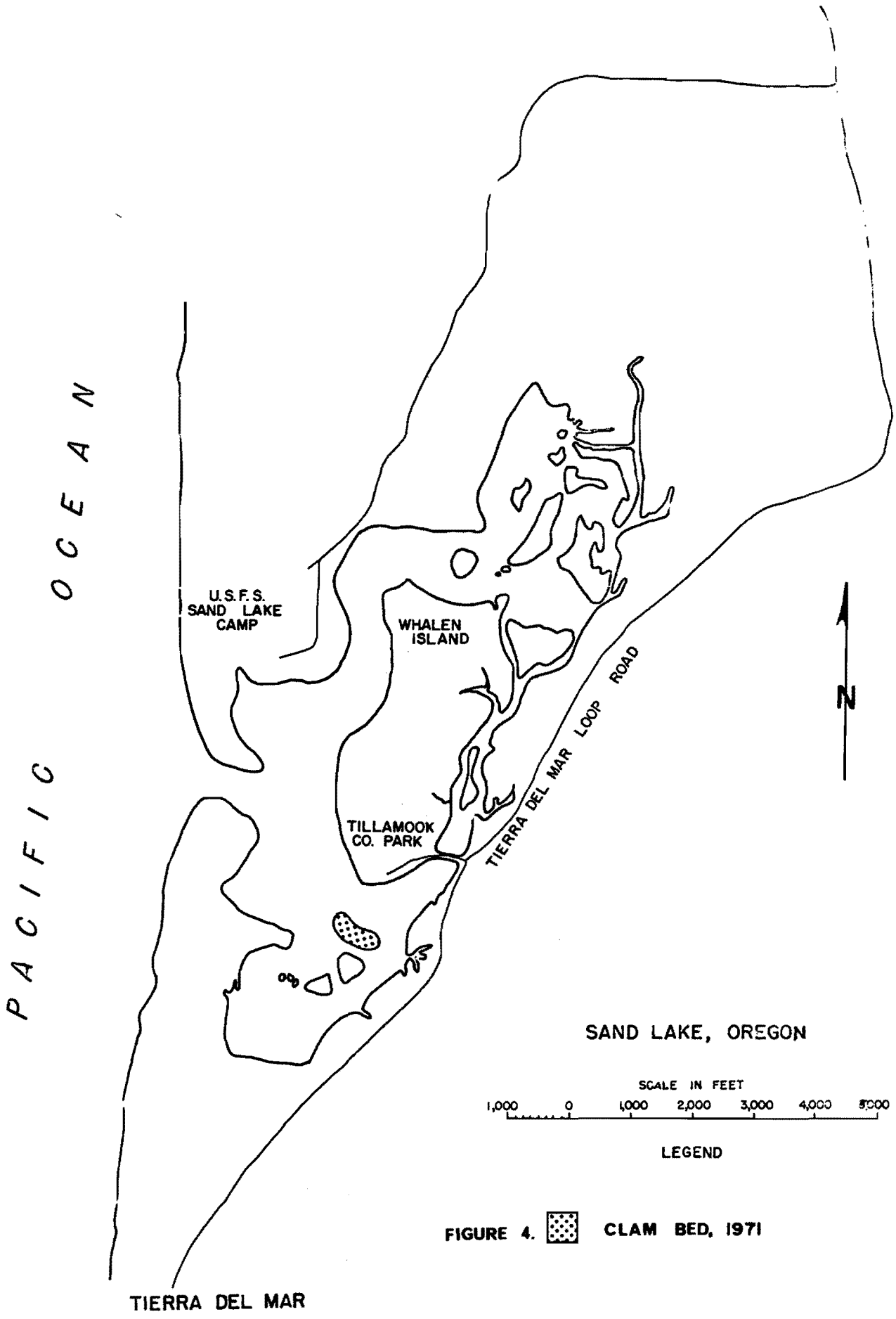

FIGURE 4. CLAM BED, 1971

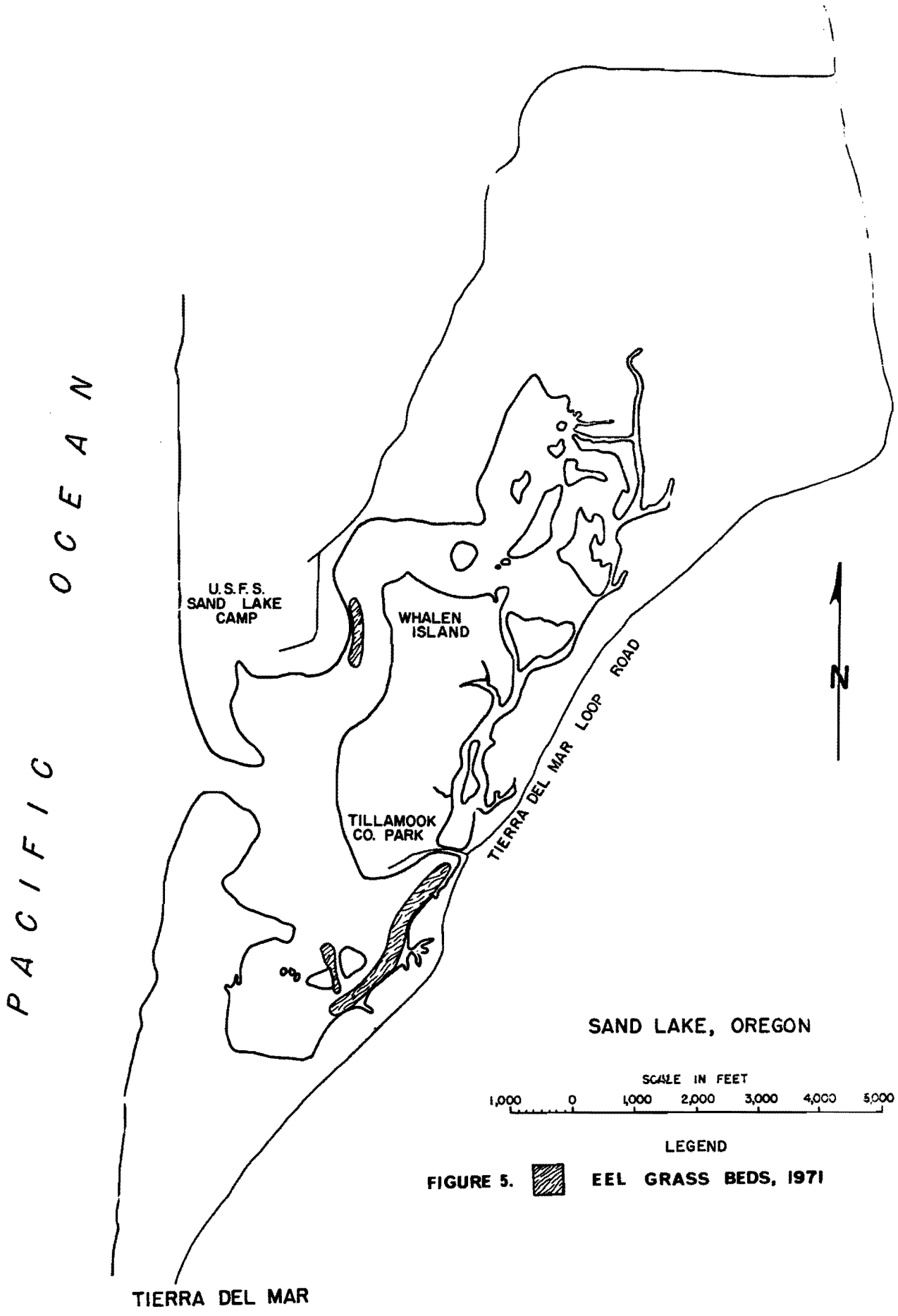
PACIFIC OCEAN
U.S.F.S.
SAND LAKE
CAMP
WHALEN
ISLAND
TILLAMOOK
CO. PARK
TIERRA DEL MAR LOOP ROAD
N
TIERRA DEL MAR
SAND LAKE, OREGON
SCALE IN FEET
1,000 0 1,000 2,000 3,000 4,000 5,000
LEGEND
EEL GRASS BEDS, 1971

FIGURE 5.

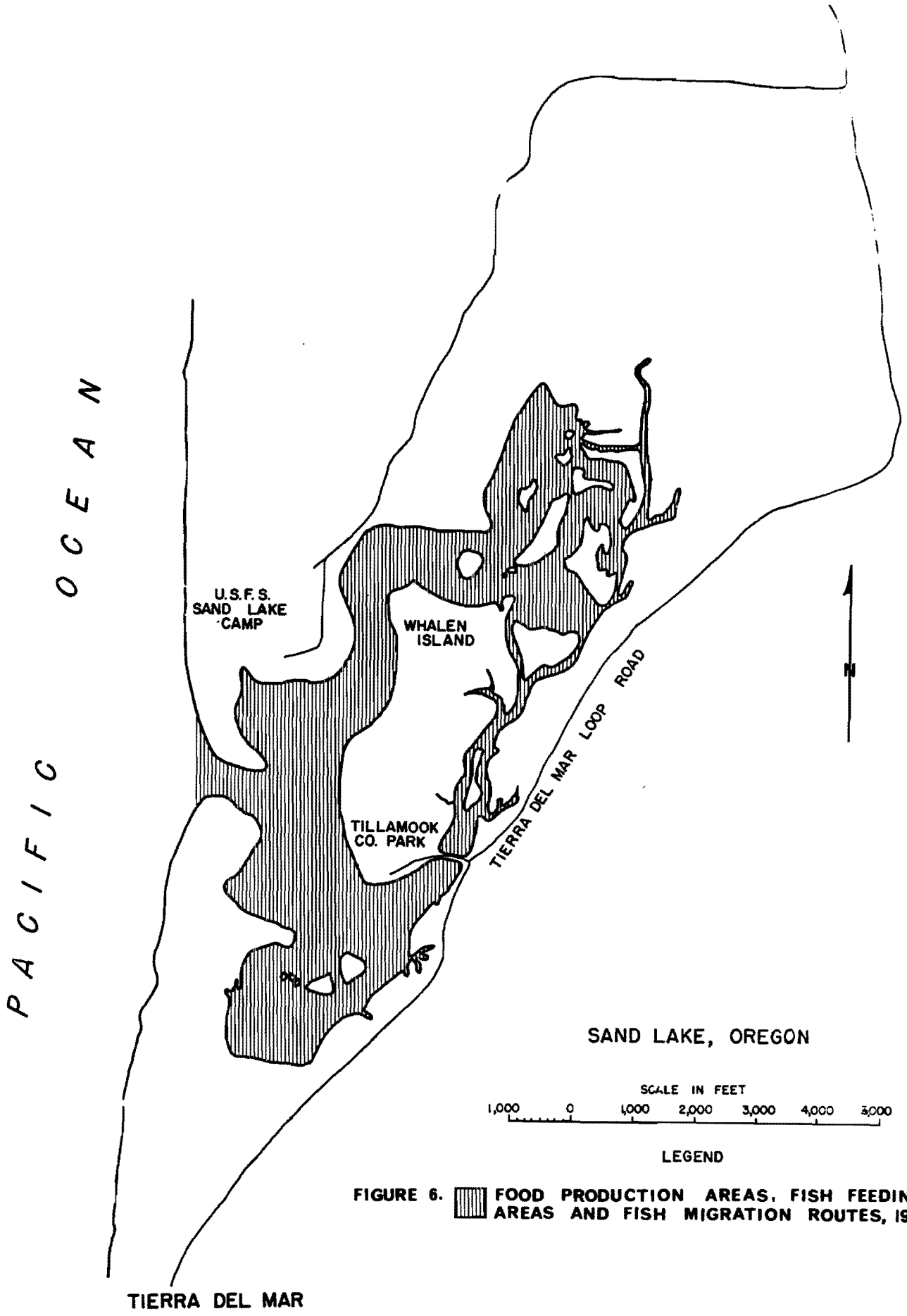

FIGURE 6. FOOD PRODUCTION AREAS, FISH FEEDING AREAS AND FISH MIGRATION ROUTES, 1971


STATE OF OREGON
THE UNION
1859