OREGON SEABIRD COLONY SURVEY, 1979

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INTRODUCTION

During the summer of 1979 the authors were engaged by the United States Fish and Wildlife Service to survey the entire coast of Oregon to determine the status of marine birds breeding in the state. Between 19 April and 28 July every offshore rock and potential coastal mainland breeding site in the state were visited and inventoried for nesting seabirds. Data on numbers and species composition for each colony site, along with descriptions and locations of colony sites, species status summaries, and other incidental information collected during this survey are provided in this report.

ACKNOWLEDGEMENTS

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We are deeply indebted to Mike R. Graybill who was a major part of the survey from beginning to end and without whose efforts the field work would not have been as complete. We also thank the flight operations officers and helicopter crews

from the U.S. Coast Guard stations in Astoria and North Bend for providing helicopter air time. Chief Robert Dixon (USCG, Cape Blanco) generously supplied logistical support on a difficult stretch of coast. Finally we acknowledge the full support of the Oregon Institute of Marine Biology (O.I.M.B.) for supplying space for a base of operations and the myriad of "nuts and bolts" needed to keep equipment in good condition.

METHODS

COLONY SITE IDENTIFICATION

To aid in the identification of colony sites we devised, prior to going into the field, a numbering system for rocks and islands appearing on 15 minute U.S. Geological Survey topographic maps (see Appendix C). The vast majority of the rocks appearing on these maps were assigned an individual number. However, even though the scale of these maps is quite large (1:62,500) there were several instances where rocks were figured in dense aggregations. In these instances groups of smaller rocks were sometimes given a single number. If once in the field one or more of the rocks in such a group was found to be occupied by breeding birds, an attempt (usually successful) was made to identify and locate the pertinent rock(s) and assign it an individual number. Mainland breeding sites were plotted as to location and numbered as they were encountered in the field.

Since Oregon topographic maps have apparently not been updated for changes in coastal topography since 1955, some slight discrepancies regarding the location number and size of rocks were noted and have been indicated. (Most of these changes are presumably due to erosion.)

Copies of the maps were taken in the field and used for locating and identifying individual sites. But, due to the vagaries associated with predicting colony site locations prior to the beginning of actual field work, the numbering system and maps employed in this report are modified versions of the ones originally used in the field. (Note: The maps in Appendix C and the data entries in Tables 4 and 5 are arranged from north to south. However, an error in sequential numbering of the original maps resulted in the northernmost rock being #85. Therefore, Rks. #1-84 are numerically out of order, but geographically in order. From Rk. #192 on the numbering is sequentially uninterrupted.)

An alphabetical listing of major colony sites is provided in Table 3. The site names are cross-referenced with our numbering system and, where possible, the Seabird Colony Catalog numbering system (Varoujean, 1979).

FIELD METHODS

Between 19 April and 28 July we visited every numbered site and surveyed all the mainland areas that could possibly

support nesting seabirds. Our itinerary and summary of effort during the field season are given in Table 1. Coastal areas surveyed by boat were from West Point, north of Tillamook Head, to Florence, on the Siuslaw River; Coos Bay to Crooked Creek, just south of Bandon; Blacklock Point, north of Cape Blanco, to the north end of Nesika Beach, just north of the Rogue River; and the south end of Nesika Beach to the California border. All omitted areas, though surveyed from the air, were sandy beaches with no offshore rocks.

Notes in the field were kept on small notepads and transcribed later. Duplicate sets of the project field notes have been deposited at the William L. Finley National Wildlife Refuge in Corvallis, Oregon, and the Western Foundation of Vertebrate Zoology, Los Angeles, California.

At-Sea and Mainland Surveys

The majority of the survey was conducted from a 14 foot inflatable boat (Zodiac) powered by a 25 hp Evinrude outboard motor. Typically we launched out of a bay or protected beach and headed south checking every rock and mainland site until sea conditions or low light levels forced us in. Using this strategy of "port hopping" we could survey 80-100 km of coastline on a good day. Larger rocks were circumnavigated and sometimes censused on foot; the largest islands were usually boarded and camped on overnight (see Table 1). Brief descriptions of all the breeding rocks and many of the non-breeding

Table 1. Itinerary and summary of effort. DHV = Daniel H. Varoujean, RLP = Robert L. Pitman, MRG = Michael R. Graybill.

Date	Personnel	Survey Area	Comments
19 Apr	DHV, RLP	Airplane survey: Astoria to Brookings and return.	Accompanied USF&WS personnel on a coastal waterfowl survey.
28 Apr	DHV, RLP, MRG	Boat survey: Coquille R. to Coos Bay.	Rks. off of Bandon inadequately surveyed due to rough seas.
30 Apr	DHV, RLP	Gregory Pt. on foot, boat survey of Bandon rks.	Good conditions; spent 20 min. on Table Rk.
2 May	DHV, RLP	Cape Blanco on foot.	Sea survey aborted due to foul weather.
15 May	DHV, RLP	Boat survey: Blacklock Pt. to Cape Blanco.	Sea conditions fair; spent 1.5 hrs. on Gull Rk.
16 May	DHV, RLP, MRG	Boat survey: Orford Reef to Port Orford.	Sea conditions fair at Orford Reef becoming good farther south.
17 May	DHV, RLP MRG	Boat survey: Port Orford to Arizona Beach (just N of Sisters Rks.). Shore survey: Port Orford to Nesika Beach.	Boat survey cut short due to bad sea conditions; 30 min. on Island Rk.
21 May	DHV	Helicopter survey: Coos Bay to Brookings and return.	All major colonies photographed.
23 May	DHV, RLP, MRG	Boat survey: Rogue R. Reef to Nesika Beach. Goat Is.	After boat survey RLP and MRG spent night on Goat Is.
24 May	DHV, RLP, MRG	Boat survey: Goat Is. to Calif. border. Shore survey: Goat Is. to N of Whalehead Is.	Sea conditions fair during boat survey.

Table 1. continued.

Date	Personnel	Survey Area	Comments
31 May	DHV, RLP	Boat survey: Rogue R. to Hunter Is.	Sea conditions good. Spent night on Hunter Is.
1 Jun	DHV, RLP	Hunter Is. to Whalehead Is.	Sea conditions to rough for survey. RLP spent night on outer Whalehead Is.
2 Jun	DHV, RLP	Boat survey: Barnacle Rk. (# 1095) to Calif. border.	Sea conditions excellent.
7 Jun	DHV	Shore survey: Sea Lion Caves to Yachats.	
8 Jun	DHV	Shore survey: Yaquina Head to Seal Rks.	
10 Jun	DHV, RLP	Boat survey: Tillamook Head to Nehalem Bay.	Sea conditions fair, becoming poor.
11 Jun	RLP, MRG	Boat survey: Cannon Beach to Netarts Bay.	Sea conditions good.
12 Jun	RLP, MRG	Boat survey: Tillamook Bay to Depoe Bay.	Sea conditions excellent, spent 3.5 hrs. censusing Three Arch Rks.
22 Jun	RLP	Helicopter survey: Astoria to Brookings and return.	Goat Is. and all major colonies N of Florence photographed.
23 Jun	RLP	Shore survey: Depoe Bay to Seal Rks.	

Table 1. continued.

Date	Personnel	Survey Area	Comments
26 Jun	RLP, MRG	Boat survey: Haystack Rk.	3 hrs. on Haystack Rk.
27 Jun	RLP, MRG	Boat survey: Depoe Bay to Siuslaw R.	Sea conditions good becoming poor S of Haceta Head.
29 Jun	DHV, RLP	Boat survey: Rogue R. to Chetco R.; Goat Is.	Sea conditions excellent during boat survey. Spent night on Goat Is.
2 Jul	RLP, MRG	Boat survey: Port Orford to Sisters Rks.	Sea conditions good.
3 Jul	RLP, MRG	Boat survey: Island Rk.	RLP on Island Rk. for 1.5 hrs.
4 Jul	RLP, MRG	Shore survey: Crook Pt.	RLP spent 1 hr. on N. Crook Pt. (#803)
5 Jul	RLP,MRG	Boat survey: Bandon rks.	RLP spent 20 min. on Table Rk. and 20 min. on Rk #399.
10 Jul	RLP	Shore survey: Haceta Head and Sea Lion Caves.	
11 Jul	DHV	Helicopter survey: Coos Bay to Brookings and return.	All major colonies photographed.
12 Jul	DHV, RLP MRG	Boat survey: Hunter Is.	RLP and MRG spent night on Hunter Is.
14 Jul	DHV, RLP MRG	Shore survey: Crook Pt.	RLP and MRG spent 2 hrs. on Saddle Rk.
16 Jul	RLP	Helicopter survey: Coos Bay to Astoria.	All major colonies photographed.

Table 1. continued.

Date	Personnel	Survey Area	Comments
23 Jul	DHV,RLP, MRG	Shore survey: Crook Pt.	RLP and MRG spent night on Saddle Rk.
25 Jul	RLP	Shore survey: Heceta Head.	Spent 30 min. on Conical Rk.
28 Jul	DHV, RLP MRG	Shore survey: Crook Pt.	RLP and MRG spent night on Saddle Rk.

rocks were recorded, including approximate height of the rock or island, presence (or absence), amount, type and relative abundance of vegetation, and any other salient features that would aid future workers in locating the site.

On days when bad weather precluded at-sea work, certain sections of the coast were surveyed from the mainland using a 20X spotting scope and standard handheld binoculars. These survey data tended to be of very limited value except for supplementing at-sea counts of sites that were too close to shore to be circumnavigated.

Aerial Surveys

Both of the authors flew the entire coastline in a single-engine Cessna on 19 April and photographed all major colony sites. This served mostly as an orientation flight, however, as the flight date was too early in the season for maximum colony counts. Moreover, the Cessna had several other disadvantages that prevented us from taking high quality photographs (e.g. high aircraft speed, small windows). We were fortunate then to have helicopters made available to us for the aerial portion of the survey. In all, four surveys were made from U.S. Coast Guard Sikorsky helicopters during regular USCG operations (see Table 1). All major colonies were photographed on at least two occassions, including nearly every Common Murre (Uria aalge) and Brandt's Cormorant (Phalacrocorax penicillatus) colony —— the two species that nest in large

numbers on the tops of islands.

During the survey both authors used Canon 35 mm SLR cameras and lenses, including 200 mm and 300 mm telephoto lenses. The bulk of the film used was either 64 ASA Kodachrome or 400 ASA Ektachrome slide film. The Kodachrome produced the better results (less grain, better definition), but both film types were shot no slower than 1/1000th of a second when the helicopter's ground speed was greater than 40-50 mph. For the best film exposure of colony sites with large white-washed areas shots were underexposed by ½ to 1 f-stop. In order to capture useable images of Common Murres on slide film we employed telephoto lenses and took overlapping frames as we encircled an island. The slides were later analyzed for (1) murre and cormorant population estimates; (2) distribution of vegetation; and (3) the calculation of island acreage used in estimating storm-petrel population sizes. These slides also provide documentation of the location and extent of many of the colonies as well as illustrating the physical conditions of the islands and rocks as encountered in 1979.

SAMPLING AND ESTIMATION

The different nesting habits and densities of the different species of breeding seabirds encountered during the survey imposed varying degrees of difficulty on making estimates of breeding populations for individual species (see Table 2 for species list). For example, surface nesters (6 species) are

Table 2. Scientific names and the codes for common names of seabirds listed in this report.

Name	Code
Fork-tailed Storm-Petrel (Oceanodroma furcata)	SPFT
Leach's Storm-Petrel (Oceanodroma leucorhoa)	SPLE
Brandt's Cormorant (Phalacrocorax penicillatus)	COBR
Double-crested Cormorant (Phalacrocorax auritus)	CODC
Pelagic Cormorant (Phalacrocorax pelagicus)	COPE
Black Oystercatcher (Haematopus bachmani)	OYBL
Western Gull* (Larus occidentalis)	GUWE
Common Murre (Uria aalge)	MUCO
Pigeon Guillemot (Cepphus columba)	GUPI
Tufted Puffin (Lunda cirrhata)	PUTU
Rhinoceros Auklet (Cerorhinca monocerata)	AURH
Cassin's Auklet (Ptychoramphus aleutica)	AUCA

* Hoffman, et al.(1978) reported Glaucous-winged Gulls (Larus glaucescens) and Glaucous-winged X Western Gull Hybrids as breeding in Oregon. We made no attempt at such distinctions in the field and report all gulls seen as Western Gulls.

much more accurately accounted for than burrowing or subsurface nesters (6 species), and burrowing species that visit colonies only at night (4 species) were much more difficult to census than species that visit nest sites during the daytime (8 species). Owing to these and other inequities (and due to limited funding and time) the data collected for each species presented in Table 4 are not strictly comparable but instead represent approximations of the relative abundances of Oregon's breeding seabird populations. The numbers given in Table 4 are of three basic types:

1. Actual nest counts or population estimates based on actual nest counts. This includes Double-crested, Brandt's, and Pelagic Cormorants, occassionally Black Oystercatchers, Western Gulls*, usually Tufted Puffins, and Leach's Storm-Petrels on Goat and Hunters Islands and Saddle Rock.

2. Population estimates based on other more subjective information, e.g. the number of individuals heard around a colony at night or the amount of "useable" habitat that was felt to be available to a particular species. Rhinoceros Auklets, Cassin's Auklets, Fork-tailed Storm-Petrels, occassionally Tufted Puffins, Pigeon Guillemots when the population was small and/or isolated, and Leach's Storm-Petrels, except as noted above, fall into this category. The annotation section (Table 5)

Note: We made no attempt to distinguish Western Gulls from Western Gull X Glaucous-winged (Larus glaucescens) Hybrids; therefore, our population figures for Western Gulls include hybrids as well.

lists background information on how individual estimates were obtained for these species.

3. Instead of a breeding population estimate just the total number of individuals associated with a given site is listed. This technique includes Black Oystercatchers in part, Common Murres, and most of the Pigeon Guillemot estimates. Even though guillemot and oystercatcher adults are often quite conspicuous around nesting colonies, their actual nest sites are difficult to locate and consequently very few nests were found. (Note: In Table 4 oystercatchers are reported as number of birds. Refer to Table 5 for the number of nesting pairs recorded.)

Common Murres are difficult to assess because thousands of breeders and non-breeders often crowd together on breeding colonies, where, from a distance, they are indistinguishable from one another. Moreover, murres construct no nest and the eggs and chicks are obscured to the point of making an determination of the actual number of nesters present a study in itself. Instead, for this species and the Black Oystercatcher and Pigeon Guillemot the total number of individuals present is felt to be the most useful (and economical) number for replication and comparison at later dates. This method is particularly useful for murres and oystercatchers; guillemot numbers, however, tend to show considerable variability at a given site on different dates.

Due to the very large number of Leach's Storm-Petrels breeding in the state, coupled with a major discrepancy between the nesting density reported by Browning and English (1972) and our initial observations, a special effort was made to determine the true status of this difficult to account for species. On Goat Island and Hunters Island, the two most important colonies, and on Saddle Rock a total of 14 individual m^2 plots were examined in a variety of habitats.

On Saddle Rock after a square meter was staked out the vegetation was trimmed back using garden shears. The number of burrow entrances was noted and then the burrows were checked for occupancy. On Goat and Hunters Islands, however, the vegetation was usually too dense to use this technique so after noting the number of entrances the staked plots were dug up entirely down to 0.25 m or more below the soil surface and the fill was carefully sifted through for birds and eggs. Adults captured during the digging operation were released and flew off to sea unharmed; eggs were saved for pesticide studies and chicks were collected for museum specimens.

Rough vegetation maps were sketched out and measurements were made of distances between prominent topological features for each of these three islands in order to derive area estimates for different habitat types. The acreage was to be determined later using projected aerial photographs of known scale (obtained from the measurements taken while on the island).

By the end of the survey, however, we had suitable aerial photographs for only Goat and Hunters Islands. Moreover, these photographs did not enable us to divide the vegetated areas into distinct habitat types. Therefore, on Goat and Hunters Islands only the acreage for habitat dominated by tall grass (Phalaris sp.) was calculated using projected slides and a gravimetric analysis of the tracings taken from the projected slides. Population estimates were then derived by multiplying the mean number of mated pairs/m^2 in Phalaris habitat times the area of this habitat type.

RESULTS AND DISCUSSION

A synopsis of our seabird colony findings is presented in Table 4, with some elaboration in the annotation section that follows (Table 5). All Marbled Murrelet and marine mammal data are presented in Appendices A and B, respectively. Location site numbers used in these tables and appendices correspond to the numbers on the maps in Appendix C.

Twelve species of breeding marine birds were encountered during our survey. Population estimates for the state with a summary of status for each species follows (listed from species with most accurate estimates to least accurate):

Pelagic Cormorant ----------	3,280 pairs
Double-crested Cormorant ----------	850 pairs
Brandt's Cormorant ----------	8,100 pairs

Western Gull	4,950 pairs
Tufted Puffin	3,300 pairs
Common Murre	255,000 birds
Rhinoceros Auklet	100 pairs
Leach's Storm-Petrel	68,000 pairs
Black Oystercatcher	210 birds
Pigeon Guillemot	2,100 birds
Cassin's Auklet	120 pairs
Fork-tailed Storm-Petrel	<500 pairs

Fork-tailed Storm-Petrel

The crevices and burrows where this species nests are difficult to locate especially when much larger numbers of nesting Leach's Storm-Petrels are also present. However, by listening at night for Fork-tailed Storm-Petrel calls and randomly checking burrows we did find 3 locations that support what appear to be small breeding populations. Accordingly, we estimate that fewer than 500 pairs breed in Oregon.

The only published breeding records for Fork-tailed Storm-Petrels are for Hunters Island (Browning and English, 1972), Three Arch Rocks (Finley, 1902) and Goat Island (Crowell and Nehls, 1973). We confirmed the presence of this species on Hunters and Goat Islands, but we were unable to determine the presence or absence of this species on Three Arch Rocks. Additionally, we established that Haystack Rock (#35, Cape Kiwanda) supports a small breeding population of this species, and that there are several islands with suitable habitat that probably support

small breeding populations (see Table 4).

There are no data on population changes for this species to which we can compare our findings.

Leach's Storm-Petrel

About 80% of the estimated 68,000 pairs of Leach's Storm-Petrels nest on Goat and Hunters Islands. Moreover, the Leach's colony at Goat Island, 36,000 pairs, is the largest such colony in the Pacific south of Alaska. There are 3 additional sites where this species nests in substantial numbers: Rk. #803 (near Crook Pt.), Saddle Rock (#821), and landward Whalehead Island (#1058). It should be noted that these 6 colonies are located in the southern third of the state and that there are less than an estimated 1,000 pairs of Leach's nesting in the northern portion of the state.

We confirmed the presence of Leach's Storm-Petrels at all the colony sites listed by Browning and English (1972), and Gabrielson and Jewett (1940: p88), except for the small colony reported at Rk. #395, Coquille Pt. Additionally, we uncovered a previously undescribed colony site at Rk. #1039 just north of Whalehead Islands.

Browning and English (1972) after conducting a survey of soiled islands in 1966-67 estimated that just over 1,000,000 Leach's Storm-Petrels breed in Oregon. But several aspects of their

survey methodology make the reliability of this estimate suspect.

They approximated the abundance of this species by first establishing the breeding density in Phalaris habitat, and then multiplying this density figure times the area of the Phalaris (derived from enlarged projections of 1:62,500 USGS topographic maps). The reported density figures were determined by assuming that a mated pair of storm-petrels was associated with each burrow entrance present. Our results show that this assumption is not valid. Specifically, we found that many of the burrows are vacant or contain adult birds only, i.e. no egg or chick was present. Furthermore, more than one entrance and burrow led to the same burrow terminus, the area where the nest is most likely located. These observations coupled with our density data translate into the following crude numerical approximation —— the number of nesting pairs is equal to about one-half the number of burrow entrances present. Similarly, Zeillemaker (in Crowell and Nehls, 1973), while working on Goat Island in July, 1973, found that there is not a 1:1 relationship between the number of burrow entrances and the number of pairs. Of the 65 storm-petrel burrows he checked only 48 (74%) contained adult birds. Since some of the adult birds he found were not incubating or brooding young, we suspect that the percent occupancy figure for nesting birds was even lower than 74%, i.e. it approached 50%.

The second problem with the Browning and English population estimate is associated with the technique used to determine the area of nesting habitat. By using enlargements of USGS topographic maps and unsurveyed island area estimates, we feel they significantly over estimated the area of the Phalaris habitat, and, consequently, over estimated storm-petrel abundance. For example, on Goat Island their area estimate for Phalaris is 8.2 acres, whereas our estimate is 6.0; on Hunters Island their estimate equals 3.2 acres, ours is 2.3.

Yet, given the faulty methods of the 1966-67 storm-petrel survey, there is still an indication that there were substantially fewer Leach's Storm-Petrels nesting in Oregon in 1979 than in 1966-67. Based on calculations using their density figures and their assumption of a 1:1 relationship of burrow entrances to mated pairs, one can derive a burrow entrance density of 7 entrances per square meter. Thus, using our 50% burrow occupancy figure, the Leach's nesting density in Phalaris during 1966-67 was 3.5 pairs/m^2. This manipulation assumes that percent burrow occupancy remains nearly constant at 50% with increasing storm-petrel abundance. While this is a conservative assumption, the 1966-67 nesting density of 3.5 pairs/m^2 is still about double the magnitude of our density estimate of 1.5 pairs/m^2.

Although the bulk of the 1966-67 overestimate of breeding population size can be attributed to faulty survey methods, the

difference in nesting density estimates suggests that there has been a decline in the abundance of Leach's Storm-Petrels over the last decade.

Double-crested Cormorant

Three of the 14 colonies found, Three Arch Rocks (#25), 213 pairs, Castle Rock (#424), 150 pairs, and Hunters Island, 115 pairs, contain about 55% of the estimated 850 pairs breeding in Oregon.

Previously, only 2 locales in Oregon were preported to support Double-crested colonies. Finely (1902) reported this species breeding on Three Arch Rocks, and Browning and English (1972) reported that of the soiled islands they examined only Haystack Rock (#35, Cape Kiwanda) supported a colony of this species. The only cormorants we observed nesting on Haystack Rock were Brandt's and Pelagic Cormorants. Moreover, the Brandt's Cormorants they noted as nesting in the Phalaris on Hunters Island were most certainly Double-crested Cormorants.

An accurate assessment of changes in abundance is not possible, for comparative data for this species are not available.

Brandt's Cormorant

Of the 3 species of cormorants nesting in Oregon, the Brandt's is by far the most numerous, with a breeding population size

of an estimated 8,100 pairs. Sixtytwo locations support Brandt's Cormorant colonies, but only 22 of these support colonies larger than 100 pairs. Thirtyfive percent (2,250 pairs) of the breeding population is nesting at Sea Lion Caves, which is the largest mainland colony ever reported for this species. Other substantially large colonies are located at: Tillamook Head (#97A), 375 pairs; Tillamook Rock (#100), 375 pairs; Bird Rocks (#129), 485 pairs; Gull Rock (#155), 400 pairs; Cascade Head (#56A), 390 pairs; Gull Rock (#424), 229 pairs; Island Rock (#534), 251 pairs; and Rk. #686, near Hubbard Mound, 212 pairs.

The 11 year average (1966-1976) for estimated numbers of cormorants present in Oregon during the breeding season is approximately 9,400 birds, which includes an adjustment for 4 years of data for the Sea Lion Caves colony (U.S. Fish and Wildlife Service, unpublished aerial survey data). Given the colony site locations and the method used to obtain these data, Brandt's probably make up 90% or more of this average figure, i.e. about 8,500 birds. This estimate is nearly one-half the magnitude of our estimate of 16,200 birds. We feel the differences in sampling techniques, largely visual estimates during the 11 year aerial census versus our method of direct counts taken from aerial photographs or while present at colony sites, do not adequately account for this disparity. Yet, without more information we can only guess at the reasons for this apparent increase in numbers.

Pelagic Cormorant

Our breeding population estimate of 3,280 pairs, the first such estimate in Oregon, is based on direct visual counts made at 47 mainland cliff locations and 101 offshore locations on rocks and islands. The largest nesting aggregation in the state, 449 pairs, is located along a 3/4 mile strip of coastline at Otter Crest (mainland site #294A). The largest offshore colony, 203 pairs, is located at Castle Rock (#422, Cape Blanco).

In general Pelagic Cormorants prefer nesting on the small rocky ledges of rather sheer cliffs. As a result of the discontinuous and limited distribution of this type of habitat, the nesting distribution of this specees is typically patchy with relatively small "colonies" occurring intermittently along rocky coasts. For example, over the length of the approximately 200 km of Oregon's rocky coast there are 148 nesting locations, with 134 (90%) of these locations each supporting less than 50 pairs. In fact, 50% of the 148 locations each support less than 10 pairs. There are no data for this species on which to base an estimate on any change in status.

Black Oystercatcher

Since this obligate coastal shorebird is a territorial nester, one would expect its numbers to be very low compared to other seabirds. This expectation is in accordance with our estimate

of 210 birds for the entire state. No data on population changes are available for comparison to our findings.

Western Gull

Seven colony sites support nearly 50% of the 4,950 pairs of Western Gulls nesting in Oregon: Haystack Rock (#134), 300 pairs; Three Arch Rocks (#25), 250 pairs; Haystack Rock (#35), 375 pairs; Table Rock (#378), 250 pairs; Island Rock (#534), 350 pairs; Hunters Island, 545 pairs, and Goat Island, 375 pairs. The rest of the breeding population is distributed over 140 other locations.

The 11 year average (1966-1976) for estimated numbers of gulls present in Oregon during the breeding season is approximately 8,000 birds (U.S. Fish and Wildlife Service, unpubl. aerial survey data.) Our estimate of 9,900 birds is higher, but we feel the disparity is largely due to differences in sampling technique. We censused many more sites than the aerial surveys covered and our island boardings allowed for the more thorough accounting of cryptically nesting gulls.

Common Murre

Our minimum estimate of 255,000 birds represents about 60%, by number, and 80% of the biomass of the seabirds breeding in Oregon.

Murres are commonly found nesting on the tops and ledges of barren rocky islands and sea-stacks. In general these islands, and, consequently, the murre colonies, are evenly distributed along Oregon's rocky coastline, with 33 sites located in the northern section of rocky coast, and 27 sites located in the southern section. Moreover, each section of coastline supports equivalent numbers of birds, 120,000 in the north and 135,000 in the south. The largest concentration of Common Murres in the Pacific south of Alaska is on the Three Arch Rocks complex, an estimated 75,000 birds. Furthermore, there are 23 other locations in Oregon that support murre colonies numbering in the thousands.

The only comparative abundance data available for Common Murres are the unpublished results of U.S. Fish and Wildlife Service aerial surveys. The 9 year average (1966-1974) for these data is approximately 122,000 birds. Though this estimate is less than half our total estimate, we feel the disparity is largely due to differences in survey techniques and, therefore, does not reflect a real trend in increasing abundance.

Pigeon Guillemot

Though guillemots are not truely colonial, where there is suitable nesting habitat they will occur in sizeable aggregations, i.e. greater than 100 birds. Aggregations of this size were associated with 4 locations: Otter Crest (#224A), 110 birds; Gregory Point (#299A), 120 birds; Gull Rock (#424),

100 birds; and Hunters Island, 150 birds. the rest of the population, approximately 1,650 birds, was rather evenly distributed over the entire rocky coast of Oregon, with the majority of sites supporting less than 20 birds. No data on population changes are available for this species.

Cassin's Auklet

Based on our findings at 3 locations, Island Rock (#534), Whalehead Island (#1057), and Goat Island, we confirmed that approximately 120 pairs of Cassin's Auklets nest in Oregon. Besides Island Rock and Goat Island, Browning and English (1972) reported 5 other colony sites for this species. Our accounting of these 5 locations follows. We found no evidence of Cassin's Auklets nesting on Haystack Rock (#35), Conical Rock (#291) and North Crook Point rock (#803). We did not land on Whalehead Island (#1058); however, we did note that the availability of suitable habitat makes it probable that Cassins's do still nest here. We did not see or hear any Cassin's Auklets on Hunters Island. But the slope of the NW corner, the area previously described by Browning and English as the colony site, showed signs of the extensive digging typical of Cassin's Auklets; so we strongly suspect that this species does nest here. Unfortunately, since we did not excavate any of the burrows in this area, we cannot make any judgement regarding the abundance of this species on Hunters.

Aside from the fact that Cassin's no longer nest at 3 locations previously supporting small populations, we suspect, given the limited availability of preferred nesting habitat, that in the past the abundance of this species was not substantially larger than it is today.

Rhinoceros Auklet

Previously, only one site in Oregon, Goat Island, was known to support nesting Rhinoceros Auklets. Nesting by this species on Goat Island was suspected as early as 1966 (Browning and English, 1968), and subsequently confirmed by several investigators in June, 1973 (Crowell and Nehls, 1973).

Our findings confirmed that Goat Island and Hunters Island, a previously undescribed site, each support approximately 50 pairs of this species. We also suspect that this species may nest in small numbers at 3 mainland locations, Otter Crest (#224A), Yaquina Head (#240A), and Sea Lion Caves (#293A).

Although there is no way of determining the past status of this species in Oregon, we suspect that, due to the limited amount of nesting habitat in the state, Rhinoceros Auklet abundance has been lower than 500 pairs for at least the last 50 years.

Tufted Puffin

There are but a few relatively large Tufted Puffin colonies in Oregon. Approximately 60%, 2,100 pairs, of the estimated 3,300 pairs of puffins nest on Three Arch Rocks and there are 4 other locations, Haystack Rock (#134), Haystack Rock (#35), Island Rock (#534) and Goat Island, that each support colonies larger than 150 pairs. The remaining 26 nesting locations we found each support colonies of less than 75 pairs.

A comparison of our findings with the 1966-67 survey results of Oregon's soiled islands by Browning and English (1972) only vaguely suggests an increase in abundance of nesting puffins over the last 12-13 years.

In addition to the species listed another seabird, the Marbled Murrelet (Brachyramphus marmoratus), undoubtedly breeds in the state, although a nest of this species has never actually been found in Oregon. From published accounts of its breeding habits elsewhere (Binford, et al., 1975) it probably nests inland in tall conifers. Appendix A lists our sightings of this species made during at-sea surveys. State-wide areas of concentration appear to be from Seal Rocks to Heceta Head and the Lincoln City/Gleneden Beach area, though some potentially important areas were not surveyed, e.g. Florence to Coos Bay. An apparent propensity for this species to concentrate off sandy beached may be real or may be an artifact of our survey methods. Rocky coastlines were surveyed

nearshore at slower speeds with out attention directed onshore. Along sandy coasts, however, we moved quickly and farther offshore, with more time to look for this species. Marbled Murrelets do not occur in dense colonies like most other marine birds, but instead are loosely scattered along most of the entire coast. Given our limited survey effort, we suspect that the breeding population of Marbled Murrelets in Oregon may only be on the order of 1000 pairs.

On 3 July we recorded a totally unexpected sighting of a single Horned Puffin (Fratercula corniculata) roosting on Island Rock. The bird was frequenting a rocky crevice which it disappeared into for up to 45 minutes while we censused the island. This species prefers nesting in rocky crevices rather than in excavated burrows that Tufted Puffins prefer. It flew from its roost, circled around the island and returned to its roost several times. The roost site was on the eastern side of the island about 150 m from the south end and twothirds of the way to the top.

Horned Puffins have only recently been documented breeding as far south as British Columbia. A large number of recent sightings of non-breeding individuals off California, Oregon and Washington coupled with the apparent recent colonization of southern British Columbia have led to the speculation that this species may be undergoing a substantial range extention. Though definitely a species to be watched, for the time

being its status in Oregon must remain only that of a potential breeder.

As can be seen from this review there is little historical information about the abundance of seabirds breeding in Oregon. Consequently, from an historical perspective little can be said regarding the status of Oregon's breeding populations. A more general evaluation of status can be made, however, by comparing the distribution and abundance of seabirds in Oregon to the results of recently conducted coastal surveys for Washington (Speich, et al., in prep.) and northern California (Sowls, et al., in prep.).

The species composition of the seabird communities is nearly the same for all 3 regions. In other words, as compared to Washington and northern California no species is consequently absent from the Oregon fauna. But dramatic differences in relative species abundances, another measure of community structure, become evident when the seabird fauna of Oregon and northern California is compared to the fauna of Washington. The populations of Brandt's Cormorants and Common Murres, species that prefer nesting on the tops of islands with little soil and sparse vegetation, are fully an order of magnitude larger in number in both Oregon and northern California than in Washington. Obversely, the populations of the larger burrowing species, Tufted Puffins, Rhinoceros Auklets, and Cassin's Auklets, are substantially larger in number (in some

instances 2 orders of magnitude larger) in Washington than in either Oregon or northern California. These differences in species abundance are not attributable, however, to long- or short-term changes in abundance. Rather they are the result of differences in coastal topography.

Superficially, the coastal topography of the three survey regions appears similar in that each contains stretches of rugged, rocky coastline with numerous offshore sea-stacks and small islands. But a closer examination reveals that there is an important difference in island topography. Most of the islands occurring off Oregon and northern California have little soil and only sparse outcroppings of vegetation, ideal nesting habitat for murres and Brandt's Cormorants. Yet there are a number of islands in these two regions, more so in Oregon than in northern California, that have relatively shallow soil deposits and dense stands of low vegetation, mostly grasses. It is these islands that support substantially large populations of Leach's Storm-Petrels, but relatively small numbers of burrowing alcids. In contrast, many of the islands in Washington are capped with extensive deposits of soil and tall, dense stands of trees, shrubs and grasses, i.e. habitat that can support large numbers of burrowing alcids and strom-petrels, but relatively few murres and Brandt's Cormorants.

The amount of soil and the density of vegetation on the tops of islands has but a limited effect on the availabilty of

nesting habitat for Double-crested Cormorants, Pelagic Cormorants, Black Oystercatchers, gulls (Larus sp.), and Pigeon Guillemots. Consequently, due to the presence in each region of equivalent types and amounts of nesting habitat preferred by these species, the relative abundance figures are comparable for each of these species from region to region.

In general then, it appears that the species composition and relative abundances of Oregon's seabird community are wholly concordant with the amount and types of nesting habitat available in Oregon. But this accord between habitat structure and community structure should not overshadow the remarkable fact that Oregon's 436,000 seabirds represent nearly 35% of all the seabirds breeding on the west coast from Mexico to British Columbia.

Table 3. Alphabetical listing of major colony sites. The site names are cross-referenced with our numbering system and, where possible, the Seabird Colony Catalog numbering system (Varoujean, 1979).

Name	Number	
	This Survey	Catalog
Bird Rocks	128-132	219004
Blanco Reef	438-444,448,449	270011
Cape Lookout	31-34E	-
Cape Mears	15A-15D	-
Cape Perpetua	281A	-
Cascade Head	55-68	-
Castle Rock (Clatsop Co.)	149	219007
Castle Rock (Curry Co.)	422	270009
Conical Rock	291	243006
Coquille Point complex		270006
Cat and Kittens	385-387	-
Coquille Point Rocks	382,383,395	-
Crook Point Rocks	801-828	270019
Saddle Rock	821	270020
Dear Point Rocks	942-952B	270022
Face Rock	388	270007
Falcon Rock	177	219008
Goat Island	1174	270026
Gregory Point	295-313	270003
Gull Rock (Clatsop Co.)	155	243001
Gull Rock (Curry Co.)	424	270010

Table 3. Continued.

Name	Number	
	This Survey	Catalog
Gull Rock (Lincoln Co.)	228	-
Haystack Rock (Clatsop Co.)	134	219005
Haystack Rock (Tillamook Co.)	35	219013
Heceta Head	290	243005
House Rock	1096	270024
Hubbard Mound Reef	685-690	27016
Hunters Island	749	270018
Island Rock	534	270014
Jockey Cap Island	145	219006
Mack Reef	858-881	270021
Mack Arch	875	-
Otter Crest (mainland)	224A	-
Otter Rock	235	243002
Orford Reef	450-473	270012
Best Rock	459	-
Conical White Rock	463	-
Square White Rock	456	-
W Conical Rock	467	-
Parrot Rock	292	243007
Pillar Rock	15	219011
Pyramid Rock	11	219010
Redfish Rocks	505-511	270013

Table 3. Continued.

Name	Number	
	This Survey	Catalog
Rogue River Reef	710-741	270017
Double Rock	729	-
Needle Rock	731	-
Pyramid Rock	722	-
Sea Lion Caves	293A	-
Sea Lion Rock	120	219003
Seal Rocks	259-270	243004
Shore Acres	316A	270004
Sisters Rocks	883,886	270015
Table Rock	378	270005
Three Arch Rocks	25-27	219012
Three Rocks	69-71	-
Tillamook Head	93-97A	219001
Tillamook Rock	100	219002
Tower Rock	408	270008
Twin Rocks (Curry Co.)	128,129	270025
Twin Rocks (Tillamook Co.)	5,6	219009
Whalehead Islands	1057,1058	270023
Yaquina Head	237-256	243003
Yellow Rock	918	-

Table 4. Census results. Site numbers correspond to map numbers in Appendix C, and start with northermost site and proceed south. Survey data are listed as numbers of pairs, except those data in parentheses equal numbers of birds. (+ = present, but no count was made; +? = probably present)

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
85-92					- - - No Nesting - - -							
93					1		1		(5)			
94				375				(100)	(10)			
95					- - - No Nesting - - -							
96				190			3					
97							1					
97A					25		2		(47)			
98					- - - No Nesting - - -							
99				33					(5)			
99A				100								
100				375				(650)				
101-108					- - - No Nesting - - -							
108A					15	(2)			(45)			
109							1					
110-112					- - - No Nesting - - -							
113							20					
114					- - - No Nesting - - -							
114A					1		1					
115-118					3		30					
119					- - - No Nesting - - -							
120				116	4		29	(275)	(5)			
121				31	1		1	(20)				

* SPFT=Fork-tailed Storm-Petrel; SPLE=Leach's Storm-Petrel; CODC=Double-crested Cormorant; COBR=Brandt's Cormorant; COPE=Pelagic Cormorant; OYBL=Black Oystercatcher; GUWE=Western Gull; MUCO=Common Murre; GUPI=Pigeon Guillemot; AUCA=Cassin's Auklet; AURH=Rhinoceros Auklet; PUTU=Tufted Puffin.

Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
122						(1)	5		(1)			
123-126					- - - No Nesting - - -							
127							2					
128				115			15	(600)				
129				485			19	(3,750)	(3)			
130				125			20	(350)				
131						(2)	85		(2)			10
132					- - - No Nesting - - -							
133					- - - No Nesting - - -							
134	+?	+			80		300					200
135-139					- - - No Nesting - - -							
140					4	(1)	18		(6)			
141							1					
142					13		10					
143					- - - No Nesting - - -							
144						(2)	2		(5)			
145					16		20					
146-148					- - - No Nesting - - -							
149				175			12	(2,200)	(1)			
150-154					- - - No Nesting - - -							
155				400			75	(4,500)				
156					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
157					- - - No Nesting - - -							
158							1					
159-171					- - - No Nesting - - -							
172				78				(25)				
173-176					- - - No Nesting - - -							
177				60				(100)				
177A							5		(6)			
178					- - - No Nesting - - -							
179					- - - No Nesting - - -							
179A					14				(13)			
180-182					- - - No Nesting - - -							
182A					8				(14)			
183					- - - No Nesting - - -							
184					- - - No Nesting - - -							
185						(1)			(2)			
186-188					- - - No Nesting - - -							
188A					5				(8)			
189					- - - No Nesting - - -							
189A						(2)	8					
190							1		(8)			
191					- - - No Nesting - - -							
191A					24				(19)			

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
1					- - - No Nesting - - -							
1A			80				13		(20)			
1B					5							
2					- - - No Nesting - - -							
2A					11							
3					- - - No Nesting - - -							
3A					3				(35)			
4					- - - No Nesting - - -							
5				28	3		11		(11)			
6				46	3	(2)	14		(2)			
7-10					- - - No Nesting - - -							
11				50	2		5	(3,500)	(18)			
12					- - - No Nesting - - -							
12A					5				(5)			
13					- - - No Nesting - - -							
14					- - - No Nesting - - -							
14A					24		34	(80)				2
15					1			(2,900)				
15A							15	(325)				25
15B							8	(40)				12
15C							38	(200)	(35)			25
15D					33	(2)	11	(10)	(10)			45

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
16-20					- - - No Nesting - - -							
21					3		14		(3)			
22							10		(5)			
23					- - - No Nesting - - -							
24					- - - No Nesting - - -							
25	+?	+?	213	72	65		250	(20,000)	(12)			2,000
26	+?	+?		54	25	(2)	25	(10,000)	(5)			50
27				17	3		40	(45,000)	(9)			50
28					- - - No Nesting - - -							
29					- - - No Nesting - - -							
30							30		(1)			
31					- - - No Nesting - - -							
31A							7					
31B									(8)			
32					- - - No Nesting - - -							
33			3				38					
34				185			17	(600)				
34A				23			3					
34B				127	2			(135)	(10)			
34C				25				(20)				
34D				5	7	(2)	35	(50)	(20)			
34E			50		11	(2)	30	(7,500)	(56)			25

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
35	+	500		54	106		375		(27)			150
36-48					- - - No Nesting - - -							
48A						(1)	2					
49							2					
50					- - - No Nesting - - -							
50A					30		3					
51-54					- - - No Nesting - - -							
55				77				(600)				
56				4				(250)				
56A				390				(100)				
57							3	(700)	(10)			15
58				20				(7,250)				
59				35	4		2	(5,500)				
60-67					- - - No Nesting - - -							
67A					43							
68					- - - No Nesting - - -							
69					15	(2)	35		(1)			
70							5					
71						(1)	100		(1)			
72					- - - No Nesting - - -							
72A					24		3					
73					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
73A					15		1					
74-76					- - - No Nesting - - -							
77							1		(2)			
78							5					
79-84					- - - No Nesting - - -							
192-216					- - - No Nesting - - -							
217						(4)	2					
218-220					- - - No Nesting - - -							
220A					4		1					
221-223					- - - No Nesting - - -							
223A					11		1		(10)			
224					- - - No Nesting - - -							
224A					449	(3)	2		(110)		+?	25
225							15					
226					- - - No Nesting - - -							
227					- - - No Nesting - - -							
227A					1							
228						(3)	25		(15)			
229-236					- - - No Nesting - - -							
237						(2)	1					
237A					32							
238					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
238A							5					
239							2					
239A							2					
240				85	5		67	(3,000)				
240A					7		19		(40)		+?	
241					- - - No Nesting - - -							
242					9		75					
243					- - - No Nesting - - -							
244					- - - No Nesting - - -							
245							10					
246							17					
247						(2)	1		(5)			
248-250					- - - No Nesting - - -							
250A					76							
251-271					- - - No Nesting - - -							
271A						(4)	1		(15)			
271B									(4)			
272							3		(2)			
273							10					
274-281					- - - No Nesting - - -							
281A					73	(1)			(5)			
282					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
283-289					- - - No Nesting - - -							
290							5					
290A					10		2					
290B					3							
290C					3	(2)	35					1
291		12				(2)	6					
292		50					75					25
292A						(2)			(20)			
292B				23	3							
293				12			1					
293A			12	2,250		(1)	100		(24)		+?	
294				175	6		37					
294A					6							
295-299					- - - No Nesting - - -							
299A						(2)			(120)			2
300-301					- - - No Nesting - - -							
302-304					17							
305-309					- - - No Nesting - - -							
310-313						see 302-304						
314									(2)			
315					- - - No Nesting - - -							
316					- - - No Nesting - - -							

* SPFT=Fork-tailed Storm-Petrel; SPLE=Leach's Storm-Petrel; CODC=Double-crested Cormorant; COBR=Brandt's Cormorant; COPE=Pelagic Cormorant; OYBL=Black Oystercatcher; GUWE=Western Gull; MUCO=Common Murre; GUPI=Pigeon Guillemot; AUCA=Cassin's Auklet; AURH=Rhinoceros Auklet; PUTU=Tufted Puffin.

Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
316A					28	(3)						
316B									(4)			
317-357					- - - No Nesting - - -							
357A					4							
358					- - - No Nesting - - -							
359					- - - No Nesting - - -							
359A					5							
360-365					- - - No Nesting - - -							
365A					54				(65)			
366-377					- - - No Nesting - - -							
378					30	(4)	250		(30)			17
379-382					- - - No Nesting - - -							
383				133		(2)	15	(4,700)	(20)			2
383A					16	(2)	82		(35)			2
383B							5					
383C					- - - No Nesting - - -							
384					- - - No Nesting - - -							
385				+								
386					4							
387				59				(24,000)	(3)			
388				132	6	(2)	5	(3,500)				3
389					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
390-394					- - - No Nesting - - -							
395					7		62		(15)			12
396-398					- - - No Nesting - - -							
399						(3)	150					
400-407					- - - No Nesting - - -							
408					24		2	(850)	(5)			
409-415					- - - No Nesting - - -							
416					4				(1)			
417-421					- - - No Nesting - - -							
421A								+				
421B									(2)			
422			150		203	(1)	1		(10)			
422A									(5)			
422B					3							
423					- - - No Nesting - - -							
424				225	11	(5)	50	(16,100)	(100)			5
425-446					- - - No Nesting - - -							
447					6				(26)			
448-453					- - - No Nesting - - -							
454					4				(15)			
455					- - - No Nesting - - -							
456					34			(4,500)				
457					- - - No Nesting - - -							

* SPFT=Fork-tailed Storm-Petrel; SPLE=Leach's Storm-Petrel; CODC=Double-crested Cormorant; COBR=Brandt's Cormorant; COPE=Pelagic Cormorant; OYBL=Black Oystercatcher; GUWE=Western Gull; MUCO=Common Murre; GUPI=Pigeon Guillemot; AUCA=Cassin's Auklet; AURH=Rhinoceros Auklet; PUTU=Tufted Puffin.

Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
458					- - - No Nesting - - -							
459				25	75		5	(8,200)	(50)			5
460							3					
461					- - - No Nesting - - -							
462					- - - No Nesting - - -							
463				12	27			(1,000)	(1)			
464					- - - No Nesting - - -							
465					- - - No Nesting - - -							
466					56		5		(10)			
467					6		3	(450)				+?
468-473					- - - No Nesting - - -							
474							5		(20)			
475-480					- - - No Nesting - - -							
481							3					
482					2	(2)	4		(16)			
483-500					- - - No Nesting - - -							
501						(2)	20		(5)			
502						(2)	12					
503					- - - No Nesting - - -							
504					- - - No Nesting - - -							
505					18	(1)		(1,400)	(9)			
506				31	9	(2)	1	(600)	(3)			

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
507					- - - No Nesting - - -							
508				41	60	(2)	29	(3,000)	(18)			1
509				15		(2)		(1,250)				
510						(4)	20	(4,700)	(11)			
511-531					- - - No Nesting - - -							
532				8	9	(2)	3	(950)	(13)			
533					- - - No Nesting - - -							
534	+?	150		251	132	(4)	350	(6,600)	(60)	50		175
535-544					- - - No Nesting - - -							
545						(2)	8					
546					- - - No Nesting - - -							
547					- - - No Nesting - - -							
548				3	18	(2)	5					
549				17	17	(2)	1					
550					8				(17)			
551					1							
552-583					- - - No Nesting - - -							
583A					31	(1)						
583B					7							
584					- - - No Nesting - - -							
585					- - - No Nesting - - -							
586			46		54	(2)	17		(5)			

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
587-593					49	(4)			(2)			
594					- - - No Nesting - - -							
595-607					see 587-593							
608-612					- - - No Nesting - - -							
612A					2							
613-631					- - - No Nesting - - -							
632-642					4				(4)			
643-656					18	(6)						
657-672					- - - No Nesting - - -							
672A					23				(3)			
673					- - - No Nesting - - -							
674					9				(2)			
675-684					- - - No Nesting - - -							
685						(1)						
686				212		(1)		(12,200)				
687				101				(1,800)				
688-719					- - - No Nesting - - -							
720						(2)						
721					- - - No Nesting - - -							
722				25		(1)						
723-728					- - - No Nesting - - -							
729				15	4	(2)		(560)	(11)			

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
730					- - - No Nesting - - -							
731				96	45	(1)	29	(1,650)	(39)			
732-745					- - - No Nesting - - -							
745A					30							
746-748					- - - No Nesting - - -							
749	+	16,900	115		122	(6)	545		(150)	+?	50	75
750-768					- - - No Nesting - - -							
769						(4)	50		(5)			
770-772					- - - No Nesting - - -							
773-779					3		8					
780-783					- - - No Nesting - - -							
784							3					
785-791					- - - No Nesting - - -							
792-796						see 773-779						
797-802					- - - No Nesting - - -							
803		4,000	21		1	(1)	65		(45)			25
803A			9		32		20					
804-820					- - - No Nesting - - -							
821		4,000			11		65		(12)			5
821A									(8)			
822-834					- - - No Nesting - - -							
835					34							
836-857					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
858			11		8		10					
859-861					- - - No Nesting- - -							
861A			53		23		4					
861B						(4)	5		(10)			
862-867					- - - No Nesting - - -							
868					4				(7)			
869					- - - No Nesting - - -							
870					- - - No Nesting - - -							
871			74		17				(5)			
872					- - - No Nesting - - -							
873								(250)				
874						(2)						
875					103	(1)	20	(11,750)	(45)			2
876-917					- - - No Nesting - - -							
918				11		(4)	30		(6)			
919-933					- - - No Nesting - - -							
933A					23	(2)	1		(10)			
933B					4	(2)	5		(4)			
934-940					- - - No Nesting - - -							
941					7							
942A					1							
942B,C					14	(2)	6		(7)			

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
944-951					- - - No Nesting - - -							
952A,B				34	10	(2)	3		(10)			
953-955					- - - No Nesting - - -							
956-958						(2)	2		(10)			
959-963					- - - No Nesting - - -							
964					7							
965-972					- - - No Nesting - - -							
973					1							
974-980					- - - No Nesting - - -							
981					2		5		(5)			
982-985					- - - No Nesting - - -							
986					11	(2)	5					
987-990					- - - No Nesting - - -							
991					16	(1)			(15)			
992					- - - No Nesting - - -							
993					- - - No Nesting - - -							
994							25		(10)			
995-1001					- - - No Nesting - - -							
1002A,B				138	7	(1)			(10)			
1003-1029					- - - No Nesting - - -							
1030						(2)						

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
1030A					4							
1031					6							
1032-1034					- - - No Nesting - - -							
1035					2							
1036-1038					- - - No Nesting - - -							
1039		750			10				(20)			
1039A					2							
1040-1045					- - - No Nesting - - -							
1045A					1	(2)						
1045B					9				(3)			
1046-1056					- - - No Nesting - - -							
1057		350			15	(4)	85	(16,900)	(12)	50	+?	50
1058	+?	4,500	11		13		38		(41)	+?	+?	35
1059-1069					- - - No Nesting - - -							
1069A					24				(10)			
1070-1095					- - - No Nesting - - -							
1096				25	5		5					
1097					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
1098-1100					- - - No Nesting - - -							
1101						(2)	3		(8)			
1102-1127					- - - No Nesting - - -							
1128				14	10	(2)		(3,400)				
1129				5	10	(7)		(1,950)	(3)			
1130-1137					- - - No Nesting - - -							
1138					12	(1)	1	(1,200)				
1139-1140					- - - No Nesting - - -							
1141					1		3		(25)			
1142A					2							
1142B					1							
1143					12	(2)	19		(13)			
1144-1146					- - - No Nesting - - -							
1147					3							
1148					- - - No Nesting - - -							
1149					- - - No Nesting - - -							
1150						(1)	1		(4)			
1151-1162					- - - No Nesting - - -							

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Table 4. Continued.

Site Number	Species*											
	SPFT	SPLE	CODC	COBR	COPE	OYBL	GUWE	MUCO	GUPI	AUCA	AURH	PUTU
1163A							2	(575)	(4)			
1164-1173					- - - No Nesting - - -							
1174	+	36,500		54	38	(2)	375	(1,850)	(24)	20	50	200
1175-1178					- - - No Nesting - - -							
1179				1			4					
1180					- - - No Nesting - - -							
1181					- - - No Nesting - - -							
1182					28				(3)			
1183					4				(6)			
1184-1188					- - - No Nesting - - -							
1189A					17				(3)			
1189B					1							
1190					- - - No Nesting - - -							
1191					- - - No Nesting - - -							
1192					5							
1192A					2							
1193-1242					- - - No Nesting - - -							

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Table 5. Annotation section for data in Table 4. Information, listed by site number as in Table 4, was collected while censusing from a boat unless otherwise indicated, e.g. counts from aerial photographs, during island visitations, from mainland. Where counts from aerial photographs are reported as two numbers separated by a slash, the first number represents the actual count made from the photograph; the second number represents the estimated number present on the photograph. This estimate includes the actual count as a base plus an upward adjustment for the error associated with not being able to count all the birds present (due to high bird density and/or irregular substrate relief). Species codes correspond to those listed in Tables 2 and 4. Additionally, HARL = Harlequin Duck

Site Number	Comments
85-92	nothing remarkable; no nesting.
93	pinnacles
94	125', very sparse vegetation. COBR - (most likely this species) min. 60 on E face (boat); COBR - 375 nests (aerial, 22 Jun). MUCO - 100 birds (aerial 22 Jun). HARL - 1 bird roosting.
96	COBR - 190 nests along crest and down W side (aerial, 22 Jun). GUWE - 3 nests on E face.
97A	mainland site, S wall of Tillamook Head. GUPI - 12 roosting, ca. 35 others in general area.

Table 5. Continued.

99	COBR - 33 nests (aerial, 22 Jun).
99A	mainland site. COBR - 100 nests (aerial, 22 Jun). MUCO - ca. 10 roosting/ nesting?
100	Tillamook Rock, lighthouse. COBR - 356/375 nests (aerial, 22 Jun). MUCO - 561/650 birds (aerial, 22 Jun).
100A	small rock ½ way out to Tillamook Rk., awash.
101-108	all awash.
108A	on mainland at Indian Pt. COPE - 15 nests on N cliff face. OYBL - 1 pr. GUPI - 45 birds present, doubtless nesting.
109	15', tiny rock with small amount of vegetation.
110-112	all awash.
113	group of rocks, almost all awash; 1-15' rk., no nesting. 1-35' domed rk. with 20 GUWE nests.
114	awash.
114A	mainland site.
115-118	off Ecola Pt., unable to distinguish individual rks. from charts. COPE - 1 nest and 2 unidentified cormorant (probably COPE) nests. GUWE - 30 nests.
120	Sea Lion Rk. COBR - 17 nests on pinnacle, min. 12 nests on lower level S of pinnacle colony (boat); COBR - 116 nests (aerial, 22 Jun). COPE - 4 nests E side. GUWE - 14 nests on S and E sides, +15 nests elsewhere. MUCO - 248/275 birds in scattered small colonies (aerial, 22 Jun).
121	40' spike, no vegetation. COBR - 31 nests (aerial, 22 Jun).
122	group of rks., no vegetation. COBR - 11 roosting. HARL - 1 roosting.
127	2 small pinnacles.

Table 5. Continued.

128	75' rk., very sparse vegetation. COBR - min. 85 nests from S side, others apparently mixed in with MUCO (boat); COBR - 107/115 nests (aerial, 16 Jul). MUCO - 475/600 birds (aerial, 22 Jun).
129	(128,129,130,131? = Bird Rocks) 40', almost devoid of vegetation. COBR - 465/485 nests (aerial, 16 Jul). GUWE - 4 nests S side, 8 N and E, 7 W. MUCO - 3,572/3,750 birds (aerial, 16 Jul).
130	50', rocky, some patchy vegetation on N side. COBR - min. 17 nests (boat); COBR - 115/125 nests (aerial, 16 Jul). GUWE - 4 nests W side, 5 N, 11 S (E?). MUCO - 277/350 birds (aerial, 16 Jul).
131	75', some clump grass. OYBL - 1 pr. nesting. GUPI - 1 pr. seen, probably nesting. PUTU - 3 birds at burrows on NE side, est. 10 prs. breed.
132	no nesting.
133	not found; awash?
134	Haystack Rk., Cannon Beach. COPE - 18 nests S side, 62 nests along S and W side. GUWE - 87 nests S slope, N and E sides had 104 nests with 156 adults present, ca. 85 nests W side; min. total = 276 nests present, est. 300 nests. PUTU - 7 roosting in small grassy swale on S side, 87 on N slope. Vegetation much more abundant on N slope, where dozens of puffins were standing at burrow entrances; est. 200 prs. nest. Lots of storm-petrel habitat available and petrel odor detected (SPLE - present by probably the 100's and possibly a few SPFT present). Habitat for AUCA and AURH also present. Survey date 10 Jun.
139	4', awash.

Table 5. Continued.

140	75' pinnacle, very sparse vegetation. COPE - 2 nests E side, 2 SW. OYBL - 1 bird SW side. GUWE - 9 nests E side, 9 SW. GUPI - 2 E side, 4 SW roosting, some probably nest.
141	rks. 138,140-143 = The Needles.
142	75', sparse vegetation on top. COPE - 13 nests S side. GUWE - 10 nests E side.
143	awash.
144	some small amount of vegetation. OYBL - 1 pr.
145	Jockey Cap. COPE - 4 nests N side, 12 nests S. GUWE - 2 nests N side, 18 nests S. PUTU - 1 flew off. Two flat rks. just off this rk. and not on chart awash.
146	surveyed seaward side only.
147-148	awash.
149	Castle Rk. (Clatsop Co.), 100' no vegetation. COBR - 164/175 nests (aerial, 16 Jul). MUCO - 1,923/2,200 birds (aerial, 16 Jul).
150	awash.
151-153	rks. off Arch Cape, tallest pinnacle ca. 75'.
155	Gull Rk., 50' very sparse vegetation. COBR - 386/400 nests (aerial, 16 Jul). GUWE - 15 nests on N side (boat); 60 nests on W side (from mainland). MUCO - 3,366/4,500 birds (aerial, 16 Jul).
156-157	awash.
158	35', no vegetation, connected to beach at low tide.
159	not found; awash?
160-164	most are awash.

Table 5. Continued.

165-171	awash.
172	several rks. COBR - 3 colonies, from N to S, ca. 78 nests. MUCO - ca. 25 roosting/nesting? No aerial photographs.
173-176	awash
177	40', very sparse vegetation. COBR - 20 nests N end with ca. 75 birds present, 10 nests S end (boat); COBR - 51/60 nests (aerial, 16 Jul). MUCO - ca. 150 present (boat); 91/100 (aerial, 16 Jul).
177A	mainland site immediately adjacent to 177. GUWE - 5 nests scattered along cliffs.
178-179	178 = Falcon Rk., neither found; presumably awash. Rk. referred to as Falcon Rk. by USF&WS and Seabird Colony Catalog = Rk. 177.
179A	mainland site, vertical wall.
180-182	awash.
182A	mainland site, above arch.
183-184	not found; awash?
185	20' boulder.
186	rock rubble
188A	mainland site at mouth of cavern.
189	awash.
189A	mainland site.
191	awash.
191A	mainland site. COPE - 24 nests scattered in cove.
1-2	scattered rks., awash.
1A	mainland site, big white (guano) patch 100' up. GUWE - 13 nests scattered around CODC colony. GUPI - 20 scattered along mainland from 1A to 2A.

Table 5. Continued.

1B	mainland site.
3-4	awash.
3A	mainland site. Big nesting area for GUPI.
5	rks. 5 and 6 = Twin Rks. COBR - 14 nesting along ridge (boat); COBR - 28 nests (aerial, 22 Jun). COPE - 3 nests E side. GUWE - 11 nests W side.
6	COBR - 28 nests along ridge (boat); COBR - 46 nests (aerial, 22 Jun). COPE - 2 nests E side, 1 SW corner. OYBL - 1 pr. GUWE - 8 nests W side, 6 E.
9-10	not found; awash.
11	Pyramid Rk. 90' very sparse vegetation. COBR - 14 nests all N side (boat); COBR - 43/50 nests (aerial, 22 Jun). COPE - 2 nests S side. MUCO - 3,034/ 3,500 birds (aerial, 22 Jun).
12-14	awash.
12A	mainland site.
14A	mainland site, colony scattered along N cliff face of point and on connected rock. MUCO - ca. 80 birds roosting/nesting? PUTU - 2 prs. min.
15	Pillar Rk. 75' very sparse vegetation. MUCO - 2,900 birds (aerial, 22 JUN).
15B	100' around the corner of above, slide area with grassy slope. PUTU - 7 at burrows, est. 12 prs. nest. MUCO - 25, 100' up, with 15 more on an adjacent wall. No aerial photographs.
15C	mainland site, grassy outcropping. MUCO - ca. 200 on N side. PUTU - 16 seen roosting, est. 25 prs. nest. No aerial photographs.
15D	Cape Mears. COPE - 33 nests along S side. OYBL - 1 pr. GUWE - 11 prs. at W point and around S side. GUPI - 10 roosting at tip. PUTU - saw 11 at burrows along N side, est. 45 prs. nest.

Table 5. Continued.

16-17	awash.
18	on beach at low tide;thick vegetation on top.
19	awash.
20	no accounting.
21	40', no vegetation.
22	40' pinnacle, some vegetation including tuft grass.
24	no accounting.
25	westernmost of Three Arch Rks. Results of 3½ hr. boat survey of this area on 12 Jun. CODC - 4 nests NW corner, min. 209 all along S and SE sides of island nesting high up, above MUCO for the most part. COBR - est. 50 nests NE corner, 22 NW corner. COPE - 20 nests in SE corner, 39 along N side, est. total of 65 prs. nest. GUWE - 122 nests along E side, 50 N side, 90 S side, est. 250 prs. nest. MUCO - 20,000 birds (very rough est. from aerial photograph, 16 Jul). PUTU - saw 8 along S side, est. 50 prs. nest; watched N side for ½ hr., est. 2,000±1000 prs. nest there. Lots of good habitat for storm-petrels, particularly SPLE. AURH may also occur.
26	middle rock of Three Arch Rks., 12 Jun. COBR - min. 28 nests NE corner, 16 on pinnacle over N entrance to arch, 10 in westernmost swale. COPE - 6 nests over N entrance to arch, 12 S side E endof island, 5 elsewhere; est. 25 prs. nest. OYBL - 1 nest E end. GUWE - 10 nests in W swale, 2 SW tip; est. 25 prs. nest. MUCO - 10,000 birds (rough estimate from aerial photograph, 16 Jul). PUTU - 12 birds at burrows on N side mostly in area above arch entrance, 1 in grassy area over arch S side; est. 50 prs. nest. Storm-petrels probably occur, but in much less numbers than Rk. 25.

Table 5. Continued.

27	easternmost rk. of Three Arch Rks., 12 Jun. COBR - 17 nests on N side, 20 or so potential nest sites were seen along W side, birds were well spaced and appeared to be arranging nest material. COPE - 3 nests on N side over arch. GUWE - 25 nests N side, 9 S side; est. total of 40 prs. MUCO - 45,000 birds (very rough estimate from aerial photograph, 16 Jul). PUTU - saw 1 bird on E side, a fair amount of good habitat was present however; est. 50 prs. nest.
30	GUWE - min. 25 nests, est. 30.
31	15' pinnacle.
31A	mainland site, nests stretched out over almost 1 mile.
31B	GUPI - roosting in cave, probably nesting.
32	20' pinnacle.
33	vegetated, including some grass. CODC - 3 nests at S end. GUWE - 20 nests N side, 18 SW.
34	COBR - 181/185 nests (aerial, 22 Jun). GUWE - 17 nests around island with ca. 250 adults present. MUCO - 535/600 birds (aerial, 22 Jun).
34A	Cape Lookout, mainland site.
34B	mainland site. COBR - 127 nests (aerial, 22 Jun).
34C	mainland site. COBR - 25 nests. MUCO - 20 birds.
34D	mainland site, tip of Cape Lookout. COBR - 5 nests, ca. 95 roosting (most or all this species). OYBL - 1 nest. GUWE - 33 nests, ca. 75 adults roosting. 100 m around the corner (continuing S along the coast): COPE - 7 nests; GUWE - 2 nests; MUCO - 50 birds present (nesting?); GUPI - 20 flying into huge cave.

Table 5. Continued.

34E mainland site, S face of Cape Lookout. CODC - min. of 50 nests scattered along most of cliff area, most very high up and difficult to count. COPE - 11 nests, scattered. GUWE - 27 nests, scattered, est. 30. MUCO - 5,726/ 7,500 (aerial, 22 Jun), on ledges along most of S side. GUPI - 56 seen, fairly large breeding concentration here. PUTU - several seen flying around cliffs, 8 roosting; est. 25 prs. nest.

35 Haystack Rk., Cape Kiwanda. A 45 min. boat survey was conducted on 12 Jun., and a party of two spent 3 hrs. on the island on 26 Jun. SPFT - found one nest on S central side of the island, adult on egg; wings of 3 birds killed by predation were found on top of island at NW corner, and remains (mostly wings, some very fresh) of at least 4 birds were found in low area of NE corner (a low grassy area up against the sheer wall of the island proper; definitely less common than SPLE. SPLE - remains of 3 birds and an addled egg (fetus well developed) were found on NE corner described above; 8 nests were found, 5 in grassy swale areas on NW side, 3 on S side; probably nests over much of the island, rough est. 500 prs. (may be high). CODC - not found, overlooked?, this species reported as present by Browning and English. COBR - 54 nests counted around island; largest group, 34 nests, along ledges of S side. COPE - min. 96 nests on sheer NE cliff area, 10 along S side. GUWE - counted 332 nests over entire island, 12 Jun; est. 375 prs. nest. GUPI - 27 counted on and around the island, 12 Jun; on 26 Jun a group of 25 was off S end of island and 2 nests found. PUTU - a single bird was seen in small grassy area on S side of island, at least 5 were roosting on sheer NE cliff face, but by the most important nesting areas were the two green swale areas on the NW part of the island, particularly the easternmost which had a good deal more

continued next page

Table 5. Continued.

35	vegetation and clump grass than the other; on 26 Jun an est. 125 PUTU were whirling around the island as we checked the colony; est. 150 prs. nest. No signs of AUCA or AURH though available habitat present.
48A	mainland site.
50A	mainland site.
55	COBR - 77 nests (aerial, 22 Jun). MUCO - 545/600 birds (aerial, 22 Jun).
56	COBR - 4 nests (aerial, 22 Jun). MUCO - 237/250 birds (aerial, 22 Jun).
56A	mainland site, directly opposite 55 and 56. COBR - 381/390 nests (aerial, 22 Jun). MUCO - 100 birds (aerial, 22 Jun).
57	some very sparse vegetation on S side. GUWE - 3 nests on S side. MUCO - 564/700 birds (aerial, 22 Jun). PUTU - 9 at burrows, est. 15 prs. nest.
58	COBR - 19/20 nests (aerial, 22 Jun). MUCO - 7,139/7,250 birds (aerial, 22 Jun).
59	COBR - nesting at N end; 35 nests (aerial, 22 Jun). MUCO - 4,944/5,500 birds (aerial, 22 Jun).
67A	mainland site.
69	50', no vegetation.
70	20', no vegetation.
71	35', no vegetation. GUWE - 75 nests counted, est. 100 prs.
72A	mainland site.
73A	mainland site.
77	35', no vegetation. 30 cormorants and 35 gulls roosting.
78	(may be 76 or 79) largest rk.(60') after first three S of small cove, sparse vegetation.
79-84	awash or no nesting.

Table 5. Continued.

192-216	awash or no nesting.
217	40', grass and short Salal on leeward side. OYBL - 2 nests found. GUWE - found 1 nest, est. 2 prs. nest. Spent 20 min. exploring this rk. on 27 Jun.
218	thick Salal and vegetation on top. Gulls and cormorants roosting but no nesting seen (a few GUWE could nest). GUPI - 3 birds present.
219	4', awash.
220A	mainland site, S side of cove. COPE - 4 nests, adults at 2 empty nests and incubating on 2 others.
221-222	awash. OYBL - 1 bird on rks.
223	awash.
223A	mainland site, in cove. COPE - 2 nests over cave, 9 other nests.
224	series of rks., all awash.
224A	mainland site, approx. 3/4 of a mile of coast including Otter Crest. N of tourist shop on top of Otter Crest: COPE - 264 nests; largest group 107 along S wall of cove just N of tourist shop. PUTU - ca. 12 associated with the area including 6 roosting below tourist shop in cove just to the N, est. 25 prs. nest here. Area S of tourist shop: COPE - 185 nests, in 5 separate colonies. GUWE - 1 nest. AURH - 1 bird 20 yds. from shore, a few could nest here.
225	25', no vegetation. COPE - 15 roosting.
226	awash.
227A	disconnected from mainland, vegetation on top including 1 small conifer. COPE - 1 nest N side.

Table 5. Continued.

228	Gull Rk., off Otter Crest. COPE - ca. 15 roosting, no nesting. GUWE - est. 25 prs., not actually counted. MUCO - 100's, roosting. PUTU - 4 roosting N end of island, nesting?
228A	rk. 200 yds. W of Gull Rk., awash, not on chart.
231-236	awash.
237	OYBL - 1 pr. nesting.
237A	mainland site, E end N side Yaquina Head.
238	awash.
239A	just SE of 239.
240	major colony off NW corner of Yaquina Head. COBR - 79/85 nests mixed in with MUCO (aerial, 22 Jun). COPE - 5 nests S side. GUWE - 45 nests visible from the mainland, 67 from lighthouse. MUCO - 2,717/ 3,000 birds (aerial, 16 Jul). PUTU - 2 roosting/nesting?
240A	mainland site, includes most of N side of Yaquina Head and W side to tip of hook. COPE - 3 nests on N side, 4 W. GUWE - 19 nests, including 10 immediately adjacent to Rk. 242. AURH - may nest here (J. Michael Scott, pers. comm.).
241	mostly awash.
242	COPE - 7 nests W side, 2 E. GUWE - rough est. of 75 prs.
243	several rks. awash.
244	awash.
245	35', grassy top.
246	15', rocky, no vegetation. GUWE - 15 nests seen, est. 17 prs.
247	group of rks., birds only on largest rk.(20', no vegetation). 10 cormorants roosting. OYBL - 1 pr.

Table 5. Continued.

248-249	awash.
250-271	260-264A all awash; 264A just S of 264, not on chart. No nesting. GUPI - 13 birds in the area.
250A	mainland site, S side of Yaquina Head from almost to the beach to ¼ mile out.
271A	large rock/peninsula, attached to mainland. OYBL - 2 prs. seen, at least 1 pr. nests in area. GUWE - 1 nest W side. GUPI - 15 in area, some probably nest.
271B	mainland site. GUPI - at least 4 birds visiting burrows in cliff face, est. 2 prs. nest.
272	rk. complex, seaward rks. all awash. GUWE - 3 nests on leeward rk.
273	rk. complex, outermost of group 25' with grassy top and 10 prs. GUWE.
274-279	all awash and/or attached to mainland.
281A	mainland site, tip of Cape Perpetua. COBR - also present, roosting in small numbers.
290	20', no vegetation.
290A	mainland site, immediately adjacent to 290.
290B	mainland site.
290C	rk. joined to mainland, 125', some grass on top. PUTU - 1 seen roosting, probably at least 1 pr. nests.
291	Conical Rk., just S of Haceta Head. Spent 45 min. on the island on 25 Jul., walked out during a fairly low tide. N side of island covered with low turf grass and some Cow Parsnip; S side with taller vegetation mostly Salal, and a dead conifer. SPLE - on central S side found one burrow empty, but with fresh feathers in it; est. 12 prs. may nest. OYBL - 1 pr. seen flying around the island and a pile of fresh mussel shells noted. GUWE - saw 3 chicks

Table 5. Continued.

291	still associated with 3 nests at W end, est. 6 prs. nested. No signs of AUCA (contra Browning and English); no signs of burrowing on N slope , except ubiquitous rodent trails. Also saw a mammal scat (thumb-size) - it was purple (berries?) and contained only seeds.
292	Parrot Rk., just S (ca. 5 yds.) of 291; 75', grass on top and E slope. Spent 20 min. on the island on 27 Jun. SPLE - found one adult on an egg, est. 50±25 prs. GUWE - est. 75 prs. nest, but no actual count. PUTU - min. of 17 birds at burrows, est. 25 prs. present, mostly on vegetated E slope. Did not see any AUCA size burrows.
292A	mainland site, near Devils Elbow. OYBL - 1 pr. possibly nesting.
292B	mainland site, N side Cape Cove.
293	30' pinnacle, no vegetation, just N of Sea Lion Caves.
293A	Sea Lion Caves. CODC - 6/12 nests (from mainland). COBR - 2,116/2,250 nests (aerial, 22 Jun and mainland count). GUWE - 94/100 (boat and mainland count). GUPI - in caves. AURH - published accounts indicate this species has nested in crevices of main cave (Crowell and Nehls, 1969, 1972).
294	65', small amount of vegetation. COBR and GUWE counts made from mainland on 7 Jun. Note: discrepancy exists, COBR - 40 nests (aerial, 22 Jun).
299A	Gregory Pt., island with Coast Guard lighthouse connected by footbridge to mainland; thickly covered with low vegetation. OYBL - at least 1 territorial pr. GUPI - 120 birds around Gregory Pt. area on 30 April; many courting and roosting, undoubtedly many more present than could possibly breed (Note: 20 birds of this species nesting on Coos Head cliff and under Charleston Bridge). PUTU - 1 burrow at NW tip, 1 probable nest site S side, est. 2 prs. present.

Table 5. Continued.

300	awash
300A	Baltimore Rk., visible only at low tide.
302-304	(and 310-313) group of 4 rks. COPE - 9 nests N side of westernmost rk.; 8 nests on next rk. in.
305-309	set of 5 rks., not awash, little vegetation. No nesting.
314	Squaw Is., connected to the mainland during low tide as well as to lots of other rks. when they are exposed during low tide. GUWE - 65 roosting on 30 Apr. GUPI - M. Graybill says at least 1 pr. nests here.
316A	40', grass and small conifers on top. COPE - 14 nests on W side, 30 Apr.; 28 nests on same side, 20 Jul.
316B	mainland site. GUPI - 2 flew off cliffs; M. Graybill says at least 2 pr. nest.
322	no accounting.
323-349	Simpson's Reef, mostly awash.
350-353	off Cape Arago.
354-357	awash.
357A	mainland site, just N of Big Devil Gulch.
359A	mainland site, mouth of Cave Cr. COPE - 5 nests on both sides of outfall.
360-365	awash.
365A	mainland site, ¼ mile N of N end of Sacchi Beach, adjacent to Rk. 365. COPE - 2 cormorant colonies (presumably COPE) ca. 200 m apart: N colony, some what scattered, with 32 nests; S colony with 22 nests. GUPI - ca. 65 birds scattered offshore Sacchi Beach, but not associated with colony.
366-373	off Fivemile Pt.

Table 5. Continued.

378	Table Rk. Spent 20 min. on the rk. on 30 Apr., and 20 min. on 5 Jul. COPE - 61 roosting and 21 nests on E side, est. 30 prs. (30 Apr). OYBL - 2 prs. present, at least 1 pr. probably nests (5 Jul). GUWE - est. 250 prs. present.
380	awash.
381	awash.
382	no accounting.
383	COBR - 133 nests (aerial, 11 Jul). MUCO - 4,574/4,700 birds (aerial, 11 Jul).
383A	GUPI - nest with chick (5 Jul). PUTU - 3 seen including 2 at burrows (30 Apr).
383B	GUWE - est. 5 prs. present.
383C	apparently no nesting.
384	awash.
385	COBR - 62 roosting with at least 5 new nests being constructed (30 Apr).
386	COPE - 14 roosting, 4 nests; more may nest later (30 Apr). COBR - 60 roosting, some may nest later (30 Apr).
387	rk. complex. COBR - 59 nests (aerial, 21 May and 11 Jul). MUCO - 24,000 (rough est. from aerials taken on 21 May and 11 Jul).
388	Face Rk. COBR - 15 nests, 48 roosting on top of N slope, ca. 20 nests, 100 roosting on top of S side (boat); COBR - 132 nests (aerial, 21 May and 11 Jul). GUWE - 38 roosting, est. 5 prs. nest. MUCO - 3,403/3,500 birds (aerial 21 May). PUTU - 1pr., 1 single, est. 2 prs. nest (boat); PUTU - 5 birds/3 prs. (aerial, 21 May).
389	turf on top, no nesting seen.
390-391	barren pinnacles.

Table 5. Continued.

392	rk. complex, several barren spikes, others awash; a few square meters of turf on the highest.
393	nothing on seaward side.
394	awash.
395	considerable soil and low vegetation on top. COPE - 7 nests, 19 roosting on W side. GUWE - 102 roosting, 54 nests seen from mainland; 42 roosting, 8 nests on W side. PUTU - max. number seen at one time = 12 birds, est. 12 prs. nest.
396-398	no accounting.
399	flat top with low vegetation. Spent 20 min. on the island on 5 Jul. E end of island riddled with rodent trails. OYBL - 3 seen, 1-2 prs. probably nest. GUWE - est. 100 prs. (5 Jul); GUWE - 150 prs. (aerial, 11 Jul). PUTU - 1 flying around island (30 Apr), 3 present (5 Jul); doubtful nesting.
400	grassy on top; no nesting evident.
401	joined to mainland during low tide; people walking on rk. both times surveyed.
402	awash.
404	awash.
405	pinnacle surrounded by rocks. GUPI - may nest.
406	probably awash.
408	Tower Rk. 175', very sparse vegetation on top. COPE - 37 birds present, 24 nests. GUWE - 12 roosting, possibly 1-2 prs. breed. MUCO - 848/850 birds (aerial, 21 May).
409	awash.
410	awash (same location as chart?).

Table 5. Continued.

411A	10', awash, not on chart.
412	COPE - 3 roosting. GUWE - 35 roosting. GUPI - 5 roosting (nesting?).
413	several small rks., awash.
414	cormorant sp. - 7 roosting. OYBL - 1 pr., probably nesting. GUWE - 2 roosting.
415	2 rks., awash.
418	100', connected to beach at low tide; no nesting apparent.
419-421	no accounting.
422	Castle Rk., at the mouth of the Sixes River. This year the island was joined by a sand spit to the mainland during low tide; ca. 175', very sparse vegetation on top and little loose soil present. CODC - 100 nests on W face, mostly along the top with some nests along oblique lines running down from the top; ca. 50 nests on E face, mostly along ridge. COPE - 57 nests on W face, 146 nests on E face. GUWE - 20 roosting, possibly 1 pr. nesting, on W face; apparently no nesting on E face. GUPI - little nesting habitat present.
422A	GUPI - 5 roosting.
422B	COPE - 3 nests E side. HARL - 3 roosting.
423	3 well spaced small rks., awash.
424	Gull Rk. and adjacent rks. Spent 1.5 hrs. on the island on 15 May, but exploration limited by ubiquitous MUCO colonies; vegetation sparce and patchy in distribution. COBR - min. 213 nests with at least 12 nests still under construction (more may have nested later); largest subcolony, ca. 95 nests, located along central S side. COPE - min. 11 nests. OYBL - min. 5 birds, including 2 prs. GUWE - 35 prs. counted around island, est. 50 prs. MUCO - 15,754/16,100 birds nesting over most of island (aerial, 11 Jul). GUPI - est.

continued next page

Table 5. Continued.

424	100 birds, or so, associated with the island; dozens roosting and flying into crevices. PUTU - 1 seen roosting and 1 pr. flew over low; est. 5 prs. nest.
425	on the beach at low tide.
426	group of rks.,highest = 20'; most awash.
427	12', awash.
428	not quite as shown on chart.
429	6', awash.
429A,B	not quite as shown on chart.
430	40' pinnacle, no vegetation and connected to mainland at low tide.
431	on the beach at low tide.
433-434	awash.
436	on the beach at low tide.
437	awash.
438	group of rks., awash.
439	rk. complex, all awash except 20' pyramid shaped rk.
440	usually awash.
441	awash.
442	12'
443	6', awash.
444	awash.
445	2 rks., largest arched and accessible from mainland at low tide.
446	on beach at low tide, tuft of grass on top.

Table 5. Continued.

447	ca. 100', with patches of vegetation over most of rk.; scats found 15-20' above sea level, contained seeds and crustaceans (Racoon tracks are fairly common on the beach - apparently they climb aboard during low tide). COPE - 6 nests, 15 roosting. GUPI - 20 roosting and 6 swimming just offshore on 11 May, none on the island and 1 in the water on 14 May; 1-2 prs. may nest.
449	10', probably awash.
450-451	awash.
452	Long Brown Rk., no vegetation. Only roosting birds seen: 2 COBR, 5 COPE, ca. 75 GUWE, and 8 GUPI (plus 4 in the water); a few prs. of GUPI may nest.
454	75', solid rock.
456	Square White Rk., 100' with no vegetation. MUCO - 4,316/4,500 birds (aerial, 11 Jul).
457	awash.
458	awash.
459	Best Rk., sparse vegetation over top. COBR - 25 nests on E side only. COPE - 75 nests located around entire island. GUWE - 40 roosting, est. 5 prs. nesting. MUCO - 7,802/8,200 birds (aerial, 22 May). GUPI - 50 birds roosting, doubtless many nesting. PUTU - 1 pr. and a single seen, est. 5 prs. nest (though not a lot of good habitat present).
460	Seal Rk. Spent 5 min. on the island on 16 May. COPE - 25 cormorants roosting, mostly this species. GUWE - saw 1 nest, est. 3 prs. nest.
461	no accounting.
462	awash.
463	Conical White Rk., 150' with no vegetation. COBR - 12 nests (aerial, 11 Jul). COPE - 27 nests (aerial, 11 Jul). MUCO - 928/1,000 birds (aerial, 11 Jul).

Table 5. Continued.

464-465	awash.
466	Arch Rk., 200' and sparse vegetation. COBR - 20 birds roosting. COPE - 56 nests, mostly on the W side.
467	W Conical Rk., 150' with no vegetation. MUCO - 438/450 birds (aerial, 11 Jul). PUTU - 1 bird flew off top, est. at least 1 pr. could nest.
468	awash.
469	cormorant spp. - 50 birds roosting. GUWE - 75 birds roosting.
470-473	awash.
474	Klooqueh Rk., 100' with very sparse vegetation. COPE - no nests seen, but rough seas precluded thorough survey. GUWE - 50 roosting, est. 5 prs. nest.
475	awash.
476-478	GUPI - present (no count made) and possibly nesting.
479-480	no accounting.
481	no vegetation.
482	Tichener Rk., 100' with very sparse vegetation.
484	GUPI - 15 scattered around S side of point.
500	GUPI - 2 birds roosting.
501	50', very sparse vegetation. OYBL - 1 pr. seen, probably nesting. GUWE - 16 nests counted, est. 20 nests present.
502	50' with no vegetation. OYBL - 1 pr. present. GUWE - 12 nests. HARL - 12 birds roosting.
503	not found, probably awash.
505	125' pillar, with very sparse vegetation. MUCO - 1,342/1,400 birds (aerial, 11 Jul).
506	125' with very sparse vegetation. COBR - 31 nests in 2 subcolonies (aerial, 11 Jul). MUCO - 581/600 birds (aerial, 11 Jul).

Table 5. Continued.

507	awash.
508	150' with sparse vegetation. COBR - 41 nests with 30 on E side. MUCO - 2,764/3,000 birds (aerial, 11 Jul). PUTU - saw 1 pr. on top of W side.
509	75' with no vegetation. COBR - 15 nests on E side. OYBL - 1 pr. copulating. GUWE - 10 roosting, no nests seen. MUCO - 1,234/1,250 birds (aerial, 11 Jul). HARL - 1 bird roosting.
510	75' with sparse vegetation at E end. OYBL - 1 pr., 2 singles. MUCO - 4,534/4,700 birds (aerial, 11 Jul). HARL - 6 birds roosting.
511	OYBL - 1 bird present.
512-531	awash or no nesting.
532	100', very sparse vegetation. COBR - ca. 8 nests at NE tip. COPE - 3 nests on NW side, 6 on SE side. OYBL - 1 chick seen, at least 1 pr. present. GUWE - est. 3 prs. nest. MUCO - 834/950 birds (aerial, 21 May).
533	not found, apparently awash.
534	Island Rk. A variety of vegetation over much of the island, including a fair amount of "tussock" grass. Terrain is very steep and rocky, with very little loose soil. Spent 30 min. on the island on 17 May and 1.5 hrs. on 3 Jul, covering most of the E side. SPFT - none found, but at least a few prs. probably occur. SPLE - after a considerable amount of searching through suitable habitat 1 adult on an egg, 3 cold eggs (sp.?) with no adults present and at least 2 additonal nest sites were located; doubtful if more than a few hundred prs. nest here, a real rough est. = 150 prs. COBR - 251 nests counted all on E side. COPE - 58 nests on W side, 74 nests E side. GUWE - 125 prs. on W side, 210 prs. on E side; est. 350 prs. MUCO - 6,427/6,600 birds (aerial, 11 Jul). GUPI - continued next page

Table 5. Continued.

534	min. 60 birds from a partial count, 6 nests found at N end. AUCA - 2 burrows found near top of NE side (1 near-fledging age young, 1 adult on egg); no other burrows seen, therefore, must be less than 50 prs. present. PUTU - 14 roosting on W side, min. 69 roosting on E side; est. 175 prs. present.
535-540	not found, awash?
542-544	jumble of rks.
545	30', a flat dome with a slight amount of vegetation. Cormorant spp. - ca. 50 roosting. OYBL - 1 pr. present, probably nest. GUWE - est. 8 prs. present.
548	35'. COBR - 3 nests on SW corner. COPE - 18 nests on S and E sides.
549	35' with a few plants, mostly succulents. COBR - 12 nests on N side, 5 on SW slope. COPE - 17 nests on S and E sides. OYBL - 1 pr. present.
550	75', sparse vegetation. GUPI - 17 birds around 548-551 rock complex.
551	35' with sparse vegetation.
555	awash.
555A	mainland site, tip of point below Lookout Rk. Whitewashed area present, but apparently no nesting.
556-557	scattered group of rks., no nesting.
578	low shrubs and grasses present.
579	low vegetation present.
581	reef, awash.
582	boulders on beach.
583	10', almost on beach.
583A	largest of Sisters Rks., solidly connected to the mainland. COPE - 11 nests on W face, 20 on S face.

Table 5. Continued.

583B	just S and E of 583A and connected to 583A and the mainland. COPE - 7 nests on SW exposure.
586	200', some vegetation: tufts of grass and fern patches. CODC - 46 nests counted, all S side. COPE - 54 nests around most of the island. OYBL - 1 pr. present. GUWE - 17 nests, including 12 on S side.
587-593	also 595-607. These rks. did not line up at all well with chart and so were lumped. Rk. 591? - 30', no vegetation: COPE - 7 nests, GUPI - 2 roosting. Rk? - 100 m S of above: COPE - 9 nests, OYBL - 1 bird. Rk. 600? - 40', no vegetation: COPE - 12 nests on SW side, OYBL - 1 bird. Rk. 606? - 75', flat with no vegetation: COPE - 20 nests, OYBL - 1 pr.
594	reef, awash.
612	awash.
612A	mainland site.
613-623	either awash or no nesting.
631	North Rk., 10' and awash.
632-642	unable to identify individual rks. On the largest, flat rk.: COPE - 4 nests, GUPI - 4 roosting.
642A	2 rks., 12' and awash. OYBL - 1 bird flew by.
643-653	also 655-656. Unable to identify individual rks. from chart. COPE - 30' rk. had 3 nests, a smaller rk. due W had 10 nests, and the next rk. N had 5 nests.
654	awash.
658	jumble of rks., awash.
671	not found, awash?
672A	mainland site, off Hubbard Mound.
673	awash.

Table 5. Continued.

674	50', no vegetation. COPE - 4 nests E side, 5 S.
675-684	no accounting in part, apparently no nesting.
685	35', no vegetation.
686	25', flat with no vegetation. COBR - 212 nests (aerial, 11 Jul). MUCO - 11,903/12,200 birds (aerial, 11 Jul).
687	15', flat with no vegetation. COBR - rough est., 75 nests (boat); COBR - 101 nests (aerial, 11 Jul). MUCO - 1,766/1,800 birds (aerial, 11 Jul).
688-692	awash.
693	20', no vegetation.
695	awash.
697	awash.
699	85', some vegetation, no nesting apparent.
706-708	awash.
709	15', no vegetation.
710-712	awash.
713-719	awash.
722	Pyramid Rk., 50' with no vegetation. COBR - 25 nests, and 100 roosting adults.
725-728	awash.
729	Double Rk., 50', craggy with no vegetation. COBR - 15 nests E end. GUWE - 11 roosting, no nesting.
730	awash.
731	Needle Rk. COBR - ca. 25 prs. top center of island, ca. 40 prs. E end (boat); COBR - 96 nests (aerial, 11 Jul). MUCO - 1,608/1,650 birds (aerial, 11 Jul).
739	3 rks. in general area; 1 a 25' pinnacle, 2 awash.

Table 5. Continued.

741A	pinnacle.
741B	2 rks., awash.
741C	awash, not on chart.
745-746	awash, appear to be just rock piles.
745A	mainland site, cove behind Rks. 745 and 746.
749	Hunters Island, a large island (ca. 7 acres) located in the southern lee of Cape Sebastian. Approximately 3 acres of the island are covered with thick stands of a tall grass of the Genus Phalaris (2.3 acres), short grasses and a number of broad-leafed plant species. The areas with little or sparse vegetation (predominately on the W side) are either flat clay/sandstone areas or low relief rocky areas. The island was visited twice, with each visit being an overnight stay: 31 May-1 Jun, 12-13 Jul. SPFT - 1-2 individuals heard, no birds or nest sites found; est. small breeding population present. SPLE - burrows distributed throughout Phalaris and intermitantly present in other types of vegetation: 6 excavated m^2 plots in Phalaris averaged 1.8 prs./m^2, with about double the number of burrow entrances present per m^2; the estimated area of SPLE habitat (taken from aerial photograph) = 9,400 m^2 ± 200 m^2, giving a breeding population estimate of 16,900 prs. ± 400 prs. CODC - a large subcolony (ca. 125 nests) present in trampled Phalaris on NNE slope, with a smaller subcolony (14 nests) present just below and to the right of main subcolony; small chicks and eggs present on 1 Jun; CODC - 115 nests in both subcolonies (aerial, 22 Jun). COPE - 35 nests on NW corner, 17 nests W side, 17 nests E side, and 53 nests SE corner; only eggs seen on 1 Jun, chicks present by Jul visit. OYBL - at least 3 prs. present, one nest found. GUWE - 545 nests: majority of nests located along W rocky slope

continued next page

Table 5. Continued.

749	and in short grass area at S end, with remainder located on island's periphery and in Phalaris; results of 1 Jun nest census (includes only nests with contents): eggs - 14 nests w/1 egg, 38 nests w/2 eggs, 141 nests w/3 eggs, 2 nests w/4 eggs; chicks - 1 nests w/1 chick, 3 nests w/3 chicks. GUPI - 150 birds seen roosting on island and in nearby waters (Jun visit). AUCA - none found, but in the future the heavily dug up area in the NW corner should be checked more thoroughly (see Browning and English, 1972). AURH - this species and PUTU, in part, nesting in 50+ burrows located along W edge of Phalaris: ca. 12 birds seen in or near burrows, raft of ca. 50 birds observed W of island; est. 50 prs. nest (Note: Remains of a min. 25 AURH found in rocky area just down from burrows. The decapitated carcasses had the skin pulled back, and all the muscle tissue and viscera were missing. Undoubtedly the work of a raptor, and, given AURH nocturnal island visitation schedule, most probably a large species of owl). PUTU - main nesting area in NW corner (20+ prs.), ca. 40 birds seen flying around island at dusk; est. 50-100 prs. nest.
750	Black Rk. OYBL - flock of 28 birds on shore adjacent to Rk. 750 on 30 May.
751	on shore at low tide.
761-764	awash.
769	Cave Rk., very small amount of grass and low vegetation along E side of island. Spent 15 min. on the island on 31 May. OYBL - 2 nests found 6' apart. GUWE - 50 nests counted. A dead deer was also found on the island; the skull was deposited at O.I.M.B. museum.
770-772	small amount of vegetation on some, no nesting.

Table 5. Continued.

773-779	also 792-796. Complex involving some very large rks. with lots of vegetation on some; unable to identify some individual rks. Rk. 773? - min. 3 COPE nests on W face. Rk. 775? - 8 GUWE nests on N tip.
784	50', lots of low vegetation; probably connected at very low tide.
801-802	awash.
803	ca. 150' with large portion of S exposure covered with rush (Juncus sp.), and 2/3 of E exposure covered with low succulents; other 1/3 and top of island are covered with Figwort (Scrophularia sp.). Spent 1 hr. on the island, mid-day 4 Jul. SPFT - none seen. SPLE - several thousands of burrows present, densities highest in Figwort though common everywhere (including succulent area); after walking around the island I estimate densities probably averaged 4-5 prs./m^2, though a lot of burrows I checked were unoccupied; rough est. = 4,000 prs. nest. (Note: remains of dozens of SPLE were found around the colony, mostly (all?) preyed upon by gulls. CODC - min. 21 nests on SW side near top of island. GUWE - est. 65 prs. nesting. AUCA - no sign of this species though specifically looked for. PUTU - min. of 16 burrows found on N and W sides; several burrows checked for AURH, but all contained PUTU; est. 25 prs. nest.
803A,B	not on chart, may originally have been part of Rk. 803.
804-820	scattered, mostly small, rks.; do not conform to chart well.
821	Saddle Rk. Vegetation dominated by rush (Juncus sp.), which covers most of the island; large areas of Iris (Iris sp.) and Figwort (Scrophularia sp.) also. Island visited 3 times: 14 Jul(2 hr. stay), 23 Jul(all day), 28-29 Jul(overnight). SPFT - none encountered. SPLE - 3 m^2 plots averaged 2 prs./m^2; a rough area estimate (not from aerial photograph) = 0.5 acres (2,000 m^2); therefore, a very rough breeding population est. = 4,000 prs. GUWE - at these late dates

continued next page

Table 5. Continued.

821	only 35 occupied nests counted on W side and below N knoll; at one time ca. 250 gulls were in the air over the colony as we inspected the island; est. 65 prs. nest. PUTU - found 2 burrows on N side, as many as 6 birds flying around island at dusk; est. 5 prs. nest.
821A	mainland site, Crook Pt. GUPI - 8 roosting on W face, 1 carring fish into nest cavity; probably a few prs. nest.
827	200' with a variety of low vegetation, small patch of grass on top. No nesting.
828	rk. complex, largest 50'. OYBL - 2 roosting. GUPI - 4 roosting.
829-833	awash.
835	85' with small amount of grass present; exact location of rk. somewhat questionable.
836	awash. HARL - 7 roosting.
837-857	most awash; location often inconsistent with chart. OYBL - 4 roosting.
858	CODC - 11 nests, 23 birds present. COPE - 8 nests on E side. GUWE - est. 10 prs.
859	no apparent nesting.
860	100' with patch of thick grass on top; no surface nesters seen. OYBL - 1 flying. GUPI - 15 birds in the area.
861A	175' with grass and other low vegetation. CODC - 53 nests at S end. COPE - 23 nests around the island. GUWE - est. 4 prs.
861B	90', no vegetation. Cormorant sp. - 30 roosting. OYBL - 4 birds, including 1 nesting pr.
861C	GUPI - 20 birds in the area.
862-865	awash.
866	not found.
867	25', no vegetation.

Table 5. Continued.

868	100'. COPE - 4 nests on W side of small cove.
871	CODC - 41 nests on top, 2-3 times as many birds roosting (boat); CODC - 74 nests (aerial, 11 Jul). COPE - 13 nests on E side, 4 SW (COPE nests may not have been on this rk.).
873	80', no vegetation. MUCO - 238/250 birds (aerial, 21 May).
874	40', no vegetation. OYBL - 1 pr. present, probably nesting.
875	Mack Arch. Very sparse vegetation, mostly succulents. COPE - 103 nests counted, mostly on N and W sides. GUWE - est. 20 prs. nest. MUCO - 11,025/11,750 birds (aerial composit, 21 May and 11 Jul). PUTU - 1 bird roosting, est. 2 prs. nest.
877	12'.
878	awash.
879	20', flat.
880-881	two rks., 30'. OYBL - 1 in the area.
882-913	most awash.
914-915	not found.
916	40', twin peak with some vegetation.
917	20', mostly awash. GUPI - 12 in the area.
918	Yellow Rk. Spent 15 min. on the rk. on 29 Jun. COBR - 7 complete nests, 4 still under constuction; 1 nest with one egg, the others were empty (very late in the season, probably not a very well established colony). OYBL - 4 birds present, at least 1 pr. nests. GUWE - est. 30 prs. nest.
933A	arched rk., some vegetation (succulents). COPE - 7 nests W side over arch, 16 nests E side over arch.

Table 5. Continued.

933B	75', a few patches of vegetation. COPE - 4 nests SE corner. GUWE - est. 5 prs.
934	20', no vegetation.
941	200' with trees and Salal on top.
942	several rocks grouped together. 942B - 90', grass on top. COPE - 8 nests on W side, 5 E. 942C - 2nd rk. W of 942B, 65'. COPE - 1 nest E side. OYBL - 1 pr. present. No nesting on other rocks.
942A	mainland site.
943	150', many conifers on top; grass and Salal also present. Did not board, but AUCA or storm-petrels possibly present.
952	group of rks. 952A - largest rk. of group, lots of low vegetation on the island; spent 15 min. on the island on 29 Jun. COPE - 10 nests present. OYBL - 1 pr. seen. GUWE - saw 1 chick, est. 3 prs. nest. GUPI - 10 birds around the island. 952B - 65', no vegetation. COBR - 25 nests (boat); COBR - 34 nests (aerial, 21 May).
956-958	locations not consistent with charts. GUWE - est. 2 prs. nest. GUPI - 10 in area, undoubtedly some nest here.
964	group of rks. Highest rk. has 7 COPE on SE side.
973	COPE - 1 nest S side over cave.
980	awash.
981	75'. GUWE - est. 5 prs. nest.
982	awash.
984	awash.
986	two rks., with no nesting on smaller rk. Larger rk.: COPE - 10 nests on N side, 1 nest on S side.
991	100' tower, nearly on the beach. COPE - 15 nests on N side, 1 S.
994	125', lots of low vegetation. GUWE - est. 25 prs. nest.

Table 5. Continued.

995	low, flat rk. OYBL - 1 bird present. GUPI - 15 in the area.
1002	group of rks. 1002A - largest of the group, 125' with grass on top. COBR - 15 nests E side, 65 nests S central side; COBR - 138 nests (aerial, 11 Jul). 1002B - ca. 75 m S of 1002A. COPE - 7 nests on SE side. Rest of the rks. awash.
1003-1019	awash.
1030A	mainland site.
1031	75', small arch with sparse vegetation.
1035	COPE - 2 nests S side.
1039	large island (ca. 1 acre) covered with lots of thick grass and vegetation. SPLE - Very strong storm-petrel odor coming off the island as we motored around it; very rough est., without having been on the island, 500-1,000 prs. (a few SPFT may also occur). COPE - 10 nests on SE side. GUPI - ca. 20 birds seen between Rks. 1017-1039. AUCA - good habitat, some probably present.
1039A	mainland site.
1045	awash.
1045A	mainland site.
1045B	mainland site.
1049	175', pyramidal (from E side) with vegetation on top.
1052-1053	awash.
1057	Whalehead Islands, the outermost rk. Spent the night of 1 Jun on the island. Though fairly small it has a very diverse assemblage of vegetation including many kinds of succulents, a Phalaris patch on top mixed with Figwort, Cow-parsnip (Heracleum sp.) and a variety of grasses. The moon was almost ½ full, the sky was clear, and there was almost no wind the night we stayed on the island. SPFT - none were heard calling over the colony at night and of ca. 20 burrows unearthed

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Table 5. Continued.

1057	only SPLE was found; a few prs. could nest however. SPLE - spent a couple hrs. after the sun went down listening, not much happened, the bright moon possibly keeping activity to a minimum. Only this species heard calling as a couple dozen individuals coursed low just over top of the tall grass; waking up throughout the night, activity picked up considerably, still only SPLE heard. Rough breeding population est. = 250-500 prs. COPE - 15 nests on S and E sides. OYBL - 1 nest and 4 birds found, probably 2 prs. nest. GUWE - counted 67 nests, est. 85 prs. nest. MUCO - 15,996/16,900 birds (aerial, 21 May). GUPI - 12 birds roosting. AUCA - dug up 4 burrows on W slope near top of island and found 2 chicks, 1 addled egg, and an incubating adult; est. no more than 50 prs. nest. AURH - no evidence found of this species on the island and saw none rafting offshore at sunset; good habitat however - a pr. or two might occur. PUTU - most of the burrows were along the top of the E face, though several were nesting at the top of the W slope; a min. of 50 were flying around the colony at sundown, est. 50 prs. nest.
1058	Whalehead Islands, innermost of the two; 1057 and 1058 are almost(?) joined at very low tides. Thick stand of Phalaris on top. SPFT - may occur sparingly. SPLE - lots of good habitat available; with an area est. of 3/4 acre (3,000 m^2), not taken from an aerial photograph, and the Hunters Island SPLE density figure (= 1.5 prs./m^2), we est. ca. 4,500 prs. present. CODC - 11 nests on W face and 27 adults present. GUPI - 41 birds around the island on 2 Jun, not much habitat for nesting though. AUCA - good habitat, a small breeding population probably occurs. AURH - 1 pr. seen 5 m off the island on the morning of 2 Jun; this species could nest here in very small numbers. PUTU - 22 roosting on NW part of island, 1 pr. on E side and 5 others elsewhere; est. 35 prs. nest.

Table 5. Continued.

1069A	mainland site.
1094	awash.
1095	Barnacle Rk., 25'. OYBL - 1 pr. present, possibly nesting.
1096	House Rk., 90' with ferns in crevices. COBR - 9 nests, probably this species (boat); COBR - 25 nests (aerial, 11 Jul). GUWE - 5 nests on N side.
1101	group of rks. 1101A - next inland of westernmost rk., small amount of vegetation, mostly succulents. OYBL - 1 pr. present, probably nesting. GUWE - 3 prs. present. 1101B - 150'. GUPI - 8 birds roosting.
1128	Twin Rks., outer, 100' with very sparse vegetation. COPE - 7 nests S side, 3 E. MUCO - 3,275/3,400 birds (aerial, 11 Jul).
1129	Twin Rks., inner, 100' with very sparse vegetation. OYBL - 6 flew by, and 1 on the island. MUCO - 1,932/1,950 birds (aerial, 11 Jul). A pair of Ravens walking through MUCO colony looking for stray eggs.
1138	group of rks. 1138A - largest and westernmost of group; 100' with a few succulents present. COPE - 12 nests. OYBL - 1 bird. MUCO - 1,169/1,200 birds aerial, 11 Jul). Rk.? - GUWE - 1 nest.
1139-1140	awash.
1141	group of rks. 1141A - largest of the group, pillar with flat top and low vegetation (the chart location we have indicated may be incorrect). COPE - 1 nest. GUWE - 1 nest. GUPI - 25 roosting and in the water; good habitat, some definitely nesting. Rk.? - GUWE - 2 nests.
1142A	mainland site.
1142B	rk. on the beach.

Table 5. Continued.

1143	100', dome shaped with very sparse vegetation (almost all rock). OYBL - 1 pr. nesting.
1147	group of rks. Largest rk., directly inshore of 1143, has 3 COPE nests.
1150	White Rk. 100' with very sparse vegetation. Cormorant spp. - 30 birds roosting. HARL - 5 roosting.
1163	3 rks. 1163A - northernmost. GUWE - 2 nests. MUCO - 572/575 birds (aerial, 11 Jul). GUPI - 4 present, including at least 1 nesting pr.
1174	Goat Island, a large island (15-20 acres) located 500 m W of Harris Beach State Park. The island was visited twice, with each visit being an overnight stay: 23-24 May and 29-30 Jun. We found that the small beach used by Browning and English on the SSE section of the island was not condusive for access to the island. With calm seas the best point of access with portage is on the N end of the island. Tall grass of the Genus Phalaris covers approximately 6 acres of the island. There are various species of low growing broad-leafed plants scattered throughout large portions of the Phalaris habitat and on the periphery of the Phalaris. SPFT - a few birds heard calling, but no birds or nests found; est. small breeding population present. SPLE - burrows distributed throughout Phalaris and in broad-leafed habitat as well: 4 excavated m^2 plots in Phalaris averaged 1.5 prs./m^2; one m^2 plot in Figwort had 9 prs.; number of burrow entrances approximately 2 times the number of prs. per m^2; estimated area of SPLE habitat (taken from aerial photograph) = 24,300 m^2 ± 500 m^2, giving a breeding population estimate of 36,500 prs. ± 800 prs. COBR - min. 30 nests (Jun visit); COBR - 54 nests on S side (aerial, 11 Jul). COPE - 3 nests on N side near arroyo, ca. 5 nests along W side, and est. 30 nests on E side. OYBL - 1 pr. on N side. GUWE - much nesting along strip at N end and wide band along W side, with remainder in continued next page

Table 5. Continued.

1174	or on border of Phalaris; est. 375 nests present (aerial, 19 Apr. Note: On this date ca. 300 gulls were present on short grass area in SW corner, but during an island visit it was found that only ca. 15% of the gulls in this area are nesting. This fact was figured into our final estimate). MUCO - 2 sub-colonies on SW corner: smaller = 278/350 birds (aerial, 11 Jul); larger = 1,246/1,500 birds (aerial, 11 Jul). GUPI - 24 seen roosting on island. AUCA - 12 seen in Phalaris on N slope, several seen in S central part of island; est. 20 prs. nest. AURH - est. 25 prs. nest in small arroyo at N end, possibly another 15 prs present at S central part of island and a raft of 40-50 birds observed just offshore at dusk; est. 50 prs. nest (Note: Remains of AURH found in Arroyo. The carcasses had been stripped in the same way as ones found on Hunters Island.) PUTU - min. 125 prs. on N slope, several prs. on W side, undetermined number nesting in S central part of island, and a raft of 88 observed just offshore at dusk, while ca. 70 flying around island; est. 200 prs. nest.
1179	COBR - 1 nest, 10 roosting. CODC - 2 roosting.
1182	125', arched rk. with low and shrubby vegetation on top. GUPI - 3 roosting, probably nest here.
1183	group of rks. 1183A - tallest rk. with vegetation on top. GUPI - 6 seen, at least 1 pr. nests.
1189	group of rks. 1189A - 125', vegetation on top.
1189B	mainland site.
1192	group of rks. COPE - 5 nests on an unlocated pinnacle.
1192A	mainland site.
1193-1242	awash and/or onshore during low tide. No Nesting.

RECOMMENDATIONS

Our suggestions for future surveys along with some recommendations for management of the Oregon Islands National Wildlife Refuge fall into three overlapping catagories: Monitoring and Survey Replication, Disturbance, and Future Research.

MONITORING AND SURVEY REPLICATION

The Common Murre, the most abundant breeding seabird along the Oregon coast, and the Brandt's Cormorant can be censused adequately only from the air. Moreover, replication of our census results for these two species can be accomplished only through the analysis of aerial photographs. We found fixed-wing aircraft to be barely adequate for aerial photography; they move too fast and photographs had to be taken through small, closed windows. During the season we were fortunate in being allowed to conduct several aerial censuses from U.S. Coast Guard helicopters during their regular operations. Helicopters proved to be an ideal survey platform: photographs were taken through a large, open bay door and the air speed could be adjusted to meet the needs of the occasion. (See methods section for more detail.)

The Oregon U.S. Coast Guard stations utilized two sizes of helicopters: the Sikorsky HH52A and the larger, louder Sikorsky HH3F. The Sikorsky HH3F caused a lot of disturbance

when it approached within 300 m of a colony, flushing many birds from colony sites. If necessary, the larger helicopter could be used but a 200 mm or 300 mm telephoto lens will be needed for colony photography if the helicopter is to operate at a "safe" distance. The Sikorsky HH52A caused minimal disturbance, made less noise at low speeds and was, therefore, a much better survey craft.

As long as U.S. Coast Guard helicopters are available for use by U.S. Fish and Wildlife Service personnel all major colonies of Common Murres, Brandt's Cormorants and Double-crested Cormorants can be photographed yearly (or at least every two years). As cormorants have a high degree of colony site fidelity, particularly the Double-crested, cormorant colonies can be identified to species using the results of this report. This procedure should be carried out in the same 1-2 week period in June each year. Typically the USCG, North Bend flies the south coast and the Astoria group flies the north coast (Columbia River to North Bend). With planning the entire coast could be surveyed from helicopters in a single day, or two consecutive days.

Photographs of colonies are preferable to visual estimates (or maybe as supplements to visual estimates) as the extent of various colonies can then be directly compared over the years. This would also greatly reduce the problem of investigator bias in making estimates. In conjunction with this,

a study should be conducted sometime in the future to determine daily and seasonal fluctuations of murre numbers and the ratio of breeders to non-breeders at colony sites in order to properly interpret results from aerial photographic surveys. In addition, a more complete aerial photographic survey of the Common Murre colony at Three Arch Rocks should be undertaken next season (1980), for we could make only visual estimates, rather than counting individual birds, from the photographs taken during this season's work. Finally, the health and diversity of the seabird populations at Goat and Hunters Islands are closely associated with the extent and species composition of the vegetation present. A good photographic record of these locations through the years would be useful in understanding any faunal changes that might occur.

The remainder of the breeding seabirds cannot be effectively surveyed from the air. For these species we suggest surveys, similar to the one conducted this year, be conducted every 5 years. Tufted Puffins, Pigeon Guillemots, Black Oystercatchers and Pelagic Cormorants will require a boat survey to determine their status; Western Gulls can be censused from the air, but counts made from a boat or while on the larger islands will be much more accurate. Leach's Storm-Petrel burrow density and percent occupancy from selected habitat types should be determined on Goat and Hunters Islands and compared with our findings. (Further studies on the effectiveness of mark-and-recapture methods on this species

might result in a more efficient and more accurate means of surveying.) The remainder of the species (Rhinoceros Auklet, Cassin's Auklet, and Fork-tailed Storm Petrel) are present in numbers too low to monitor successfully or economically, therefore their status shoud be noted opportunisticly.

We feel that probably the best way to monitor seabird populations off Oregon would be to initiate a breeding bird survey similar to the one outlined above and also to implement a statewide beached bird survey. A volunteer program similar to the one being conducted by the Point Reyes Bird Observatory in California would require only the part-time efforts of a single individual to organize a statewide network; make up and distribute data forms; tabulate and store data; and write up short annual reports. (Note: To insure comparability of data the Oregon program should conform to the guidelines set forth in the soon to be released PRBO beach survey manuel.) This project would also have the added benefit of providing good information on the status of non-breeding species of marine birds along the coast, as well as marine mammals. A program such as this is highly attractive, for over the years it would provide a wealth of baseline data while involving only a minimal financial commitment.

Another topic we feel should be addressed, though it is only partly related to the monitoring of seabirds, is the potential

impact of oil spills on seabirds in Oregon. Since the vast majority of Oregon's 436,000 nesting seabirds feed and loaf along the coast in a narrow zone that extends less than 10 km from shore, a major oil spill in the coastal zone during the breeding season could have a catastrophic effect on these birds. For this reason and the fact that this narrow coastal zone is also heavily utilized by migrating and wintering seabirds, we feel that the U.S. Fish and Wildlife Service should establish (if one does not already exist) an oil spill contingency plan for Oregon. Nominally this plan should entail maintaining: (1) an up-to-date file on the latest techniques for the treatment of oil-soaked birds, (2) stores of necessary equipment and supplies for treating oiled birds (or at least provisions for quickly obtaining these materials), (3) a list of personnel to be contacted for emergency volunteer assisstance (this list could be integrated on a regional basis with those persons working on the beached bird survey), and (4) a list of those institutions that can care for oil-soaked birds.

Frankly, if there is a major oil spill most of the oiled birds will die, either before they can be administered to or during captivity after treatment. If properly processed, these dead birds would provide useful information about molt schedules, and geographical differences in morphometrics and plumage as well as provide museums with valuable specimens. Additionally then the contigency plan should entail establishing a list of

those museums and academic institutions that can properly process, house and distribute this type of material.

DISTURBANCE

During the course of our survey we did not see any human intruders on any of the refuge islands or at any other colony site. However, a number of very important colonies are easily accessible to boaters. We recommend that at least the two largest and most accessible colonies, Goat and Hunters Islands, be posted as refuges with trespassing prohibited. (Apparently this was done in the past but the only posted signs we saw were on Haystack Rock, Cannon Beach and Goat Island.)

On 12 June 1979 at ca. 1000 hrs. while we were censusing Three Arch Rocks from our boat murres started pouring off the islands. A moment later a U.S. Air Force helicopter, approaching from the south, crossed over the colony at an altitude of approximately 200 or 300 feet; a Coast Guard helicopter was "accompanying" it about ½ mile farther offshore. As they passed thousands of murres and hundereds of gulls evacuated the islands. We do not know what effect this incident had on the cormorants nesting there, as we were too busy fumbling with our cameras trying to take pictures.

The effects of this type of disturbance can range from minor to catastrophic: murres that jump quickly can dislodge and

break their eggs or possibly misplace them. Gulls, crows and ravens that constantly patrol these islands are always looking for unattended eggs and chicks to steal. (In southern California Pitman has documented that flushing of a cormorant colony once, at a critical time, can cause complete reproductive loss for a season because of gull predation on eggs.) Though the gulls at Three Arch Rocks settled back down rather quickly, on the leeward side of the disturbance at least, we were not able to determine if the murres returned immediately to their nesting areas.

The U.S. Coast Guard makes regular helicopter surveys along the coast of Oregon as part of their routine operations. Through conversations with USCG helicopter pilots and crews it was apparent to us that only a few of those personnel were aware of their potential impact on or the status of seabirds breeding along the coast. We recommend that the commanders (or flight operations officers) of the Coast Guard and the U.S. Air Force be apprised of the situation and periodically reminded of the impact they may have on seabirds. We suggest that during routine, non-emergency flights that helicopters approach no closer than ¼ mile of any large colonies. If a course must be taken directly over a colony, flying at an altitude of no less than 700 feet would greatly minimize disturbance. In one special instance, the mainland Brandt's Cormorant colony at Sea Lion Caves, these distances may not be sufficient for the larger Sikorsky HH3F and a buffer zone of 3/4 mile is recommended.

FUTURE RESEARCH

General

Aside from examining the significance of proposed research, proposals involving refuge islands should be reviewed in light of the relative importance of the seabird colony involved and the potential for impact to both the breeding birds and the habitat.

Unlike California and Washington, Oregon has no large islands which have relatively large areas uninhabited by breeding seabirds. These non-breeding areas on islands such as the Farallone and Santa Barbara Islands in California, and Destruction and Protection Islands in Washington provide suitable low-impact areas for human habitation during long-term research projects. Therefore, we feel it would probably be unwise to initiate any intensive investigations that would involve researchers staying on any of the Oregon islands for more than several days at a time during the breeding season. Exceptions could of course be made depending on the urgency of the program.

Investigations that would involve researchers moving about on an island for several days at a time would most likely result in nest abandonment and egg or chick losses in surface nesting species. Investigator disturbance, for those studies where it is necessary to wander about an island, can be reduced if the investigators stay away from gull and cormorant colonies,

particularly during daylight hours. Considerable damage to subsurface nesters (storm-petrels, auklets) can be avoided if activity is minimized in thickly vegetated areas; especially on Goat and Hunters Islands. Caving in burrows while walking around is the major concern here. Furthermore, investigators should not remain for prolonged periods of time in the vicinity of Tufted Puffin colonies or Pigeon Guillemot "clubbing" areas, where the presence of a human will disrupt normal nest visitation patterns. Wherever feasible work should be conducted from temporary blinds. During the non-breeding season the degredation of habitat by investigators would be the major concern for all species.

Baseline Studies

Resource mangers must be able to identify the causes of seabird abundance changes, if they are to properly manage seabird populations. Additionally, managers must be able to distinguish between natural fluctuations in abundance and human-caused changes in abundance. But making this distinction is often not an easy task. For example, there are several natural and human-based causes of change that can each result in a similar gradual change in abundance over a long period of time. Though the long-term result is the same the natural causes usually involve trends in global climate and large scale oceanographic changes, while causes of human-induced changes include modification of the oceanic environment by the introduction of low levels of toxic effluents over an extended period of time, the altering

of food chains by human fisheries, increased amounts of land based refuse (increases survival for wintering birds such as gulls), and continuous low level disturbance by boaters and aircraft.

An abrupt change in seabird abundance also may be the result of either natural or human-induced causes. In many instances the resultant change in abundance is the same, yet the natural causes, including collapse of a seasonal food chain, disease and parasite outbreaks, and/or unseasonable weather, are quite different from the human-induced causes, which can range from the presence of a single person with malicious intent on a large colony during the breeding season, to a major oil spill.

While a monitoring system similar to the one outlined in the Monitoring and Survey Replication section above would be very useful in detecting gradual or abrupt population changes, these survey data are of limited use when one is trying to determine the exact cause of an observed population change. When an environmental perturbation directly increases the mortality of breeding adults, abundance surveys can immediately document the change and allow the manager in some instances to deduce the cause of change, be it natural or human-induced. But abundance surveys do not adequately monitor the status of seabirds where the cause of change affects the population in less obvious ways, e.g. reduce production and recruitment of individuals into the breeding population. The major reason for this deficiency is that annual abundance data are removed, indirect measures of

productivity and recruitment when adults in the breeding population are long-lived —— the general case for seabirds. Therefore, productivity may be drastically changing over a period of years before a change in recruitment is documented by abundance surveys. Since many of the long- and short-term causes of change listed above can affect seabird productivity and recruitment without drastically affecting the mortality of breeding adults, then the lag-time in documenting change by using abundance survey data further compounds the manager's problem of identifying the causes of change.

While it is the concern of resource managers to mitigate to the extent possible the deleterious effects of man's influence on seabird communities, it can be seen from the above discussion that it can be very difficult to discern naturally occurring population trends from the effects of human enterprises. Moreover, an increase in commercial and recreational activities in Oregon's coastal zone along with the highly probable industrial and residential expansion of coastal urban areas will increase the likelyhood of man-induced perturbation of the marine environment, which in turn necessitates a sound seabird management scheme.

Therefore, we strongly recommend that, rather than depending on the results of abundance surveys which indirectly reflect changes in seabird productivity and recruitment, the U.S. Fish and Wildlife Service initiate a seabird research program in Oregon designed to gather baseline data on more proximate

biological parameters.

Ideally, this research program should entail the collecting of comprehensive data regarding seabird breeding biology and reproductive ecology, food preferences and feeding ecology, and at-sea distribution both during and after the breeding season. To be most useful this information should come from over a long enough period of time to reflect natural fluctuations in all these parameters. Generally, these kinds of data can be gathered only at great expense both to the funding agencies and the animals studied. However, since a good deal of published information is available from studies on some of the same and related species elsewhere, we suggest that at least a nominal program be initiated for the acquisition of baseline data on some of the more important species of seabirds that nest along the Oregon coast.

Cormorants breed abundantly here and are good "indicator species" due to their well-known sensitivity to toxic pollutants in the coastal food web and their sensitivity to human disturbance. The mainland Brandt's Cormorant colony at Sea Lion Caves offers a potential easy-access site for study. But since this Brandt's colony is atypical, in that it is a mainland colony, we also recommend that an additional effort be made to monitor the breeding biology of Brandt's and Double-crested colonies on several less accessible sites.

In addition we feel that Oregon's two most abundant species, the Leach's Storm-Petrel and Common Murre, should be studied in more detail. There are several reasons for this recommendation.

First, there are suitable colony sites in Oregon where detailed studies of both these species can be carried outh with minimal disturbance.

Second, more accurate population estimates are needed for both species. In order to better interpret Common Murre aerial survey results the ratio of breeders to non-breeders along with diurnal and seasonal attendance patterns on the colony site must be established. To reduce the substantial sampling error of our Leach's Storm-Petrel estimate a more intensive study of density by habitat type and additional habitat mapping must be conducted. Moreover, it is possible to devise and implement, through an intensive banding program, a valid mark-and-recapture procedure that would be of enormous value to future researchers charged with the duty of estimating Leach's Storm-Petrel abundance.

Third, virtually nothing is known about such biological factors as subadult and adult mortality rates, age of first reproduction, nest site fidelity, parental attendance schedules on the colony site, chick growth rates, and fledging success for Oregon's populations. In fact much of these data are lacking for these species throughout their breeding ranges.

Finally, one can, with little additional effort, obtain dietary information for both of these species. These data would be significant for they would provide information about seabird feeding preferences at two different trophic levels off the Oregon coast (Leach's Storm-Petrels are pelagic zooplanktivores, whereas Common Murres are primarily inshore-offshore piscivores).

Though over the long run the acquisition of data on these various biological parameters would involve some expense, annual expenditures would be quite modest. If such projects were initiated in the near future a valuable data base that will aid managers in identifying the causes of population change could be accrued over the next five to ten years.

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APPENDICES

Appendix A. Sightings of Marbled Murrelet (Brachyramphus marmaratus).

Date	Number	Location and comments
28 April	4	Off Fivemile Pt., 2 separate prs.
28 April	2	Off Sacchi Beach, pr.
28 April	2	Off Simpson's Reef, pr.
28 April	7	Off Gregory Pt., including 3 separate prs. and 1 lone bird
16 May	4	Cape Blanco to Orford Reef, 2 pr.
16 May	2	Off Rocky Pt. (N. of Port Orford), pr.
23 May	2	Near Rogue River Reef, pr.
23 May	12	Off Nesika Beach, mostly paired and within 1/2 mile of beach
23 May	2	Off Hubbard Mound, pr.
23 May	7	Off Otter Pt. (N. of Rogue River), 2 prs., 1 group of 3
23 May	6	Between Otter Pt. and Rogue River Reef, 3 prs.
31 May	1	1/2 mile N. of Cape Sebastian
31 May	2	1/2 mile S. of Hunters Island, pr.
2 June	8	1 mile S. of Brookings, 4 pr.
10 June	2	Off Castle Rk. (Cannon Beach), pr.
11 June	4	Off Silver Pt. (S. of Cannon Beach), 2 pr.
11 June	2	1/2 mile N. of Cape Falcon, pr.
11 June	11	Off sandy stretch between Manzanita and Twin Rks., 4 pr., 3 singles
11 June	6	Off Tillamook Bay, 2 pr., 2 singles
12 June	5	Off Tillamook Bay, 1 pr., group of 3
12 June	20	Between Three Arch Rks. and Cape Lookout, 1 single, 5 prs., group of 3, group of 5

Appendix A. Continued

Date	Number	Location and comments
12 June	8	Off Neskowin Beach, 3 prs., 2 singles
12 June	35	Along Lincoln City to Gleneden Beach, 14 prs., 7 singles
27 June	9	Between Yaquina Bay and Seal Rks., 4 prs, 1 single
27 June	17	Seal Rks. to Alsea Bay, 5 singles, 2 prs., group of 3, group of 5
27 June	44	Alsea Bay to Yachats, 16 singles, 15 prs., 2 groups of 3, group of 4, 2 groups of 5, group of 8
27 June	59	Yachats to Haceta Head
27 June	21	Sea Lion Point to Siuslaw River
2 July	2	Ca. 1 mile S. of Port Orford, 2 singles
3 July	5	Between Lookout Rk. and Humbug Mtn., 2 prs., 1 single

Appendix B. Marine Mammals Sighted

Grey Whale (Eschrictius robustus)

Date	Number	Location and comments
19 April	3	Heading N. just S. of Newport
19 April	2	Separate individuals 2 miles N. of Sea Lion Caves heading N.
19 April	3	10 miles N. of Sea Lion Caves heading N.
19 April	3	Just S. of Alsea Bay heading N.
19 April	1	Milling in kelp bed Cape Blanco
28 April	1	Small animal heading N. off Simpson's Reef
2 May	1	300 yards offshore just S. of Cape Blanco
16 May	2	15 miles off jetty of Port Orford
16 May	2	Heading N. off Redfish Rks. just S. of Port Orford
23 May	2	Adult and calf off Nesika Beach heading N.
1 June	1	Heading N. off W. side of Whalehead Is.
18 June	3	Off S. jetty at Florence heading N.
22 June	4	2 miles N. of Coos Bay heading N.
22 June	1	Off Yachats heading N.
23 June	1	Off Depoe Bay
27 June	1	Just N. of Yaquina Bay
27 June	1	Between Sea Lion Caves and Siuslaw River
11 July	2	At Cape Blanco heading S.
16 July	2	At Punta Head heading N.
23 July	3	At Crook Pt., two animals feeding 1/2 mile offshore, one 2 miles offshore heading N.
24 July	1	Adult heading N. just S. of Rogue River

Appendix B. Continued

Grey Whale (Eschrictius robustus)

Date	Number	Location and comments
28 July	1	Very small probably weaned this year milling and feeding just off Crook Pt. The Scottens who oversee property at Crook Pt. said Grey Whales summered there in 1978.

Harbor Porpoise (Phocoena phocoena)

Date	Number	Location and comments
31 May	1	Off S. end of Hunter Is.
21 June	9	Off Coos Bay
21 June	3	Off Coos Bay
27 June	1	Between Alsea Bay and Yachats
29 June	2	Off Crook Pt.

Harbor Seal (Phoca vitulina)

Date	Number	Location and comments
19 April	245	Tillamook Bay, hauled out on exposed sand bar
19 April	9	Netarts Bay, on shallow bar in middle of S. end of bay
19 April	1	Siletz Bay
19 April	35	Gull Rk., off Otter Crest
19 April	7	Sea Lion Rks.
19 April	25	Strawberry Hill (in #285 complex), on rocks connected to mainland

Appendix B. Continued

Harbor Seal (Phoca vitulina)

Date	Number	Location and comments
19 April	75	On rks. of Hubbard Mound
19 April		Rogue River Reef
19 April	116	#687 aerial photo
28 April	1	Coquille River mouth
30 April	37	Squaw Is., an exposed reef to the W.
30 April	1	#383 A
30 April	1	#387
2 May	3	#440
2 May	21	Black Rk., #448
15 May	3	Castle Rk., Cape Blanco
15 May	98	Gull Rk., #424, counted while circumnavigating island, including at least 20 pups
16 May	1	#469
17 May	2	Island Rk.
23 May	1	Needle Rk., #731
23 May	4	Double Rk., #729
23 May	2	Near #728
23 May	1	#642 A
23 May	2	#633
23 May	80	#687
31 May	70	Hunter Is., hauled out on N. tip and along N.E. side, at least 5 females with pups seen

Appendix B. Continued

Harbor Seal (Phoca vitulina)

Date	Number	Location and comments
1 June	15	Whalehead Is., hauled out on low shelf between the two major island, incl. at least 2 pups
2 June	2	Near Goat Is.
2 June	1	Near #1192 A
7 June	47	Strawberry Hill, rk. in #285 complex
8 June	12	#246
10 June	1	Near #115-118
10 June	1	Near #99 A
10 June	2	Near #94
11 June	1	Near #12 A
11 June	1	Near #15 B
22 June	106	Hunter Is.
23 June	36	#246 on S. side
26 June	7	Near #244
27 June	1	Near #218 in Whale Cove
27 June	7	#224 A, 4 hauled out, 3 in water
27 June	30	Gull Rk., #228, hauled out S. end
27 June	2	Otter Rk., #237 A
27 June	7	#246
29 June	2	Near #860, adult and pup
29 June	15	#861
29 June	1	#880-881
29 June	3	#942 B, including adult and pup
29 June	1	Near #952 B

Appendix B. Continued

Harbor Seal (Phoca vitulina)

Date	Number	Location and comments
29 June	25	#964 A
30 June	15	#861 C
2 July	1	Near Island Rk.
3 July	1	Island Rk.
3 July	2	Near #548
3 July	7	#507
4 July	1	Near #803
4 July	7	#860, on S. side
4 July	9	#861 A, on N. side
4 July	11	#836
4 July	21	#834
11 July	77	#387 aerial photo
12 July	75	Hunter Is., on N. end and E. side
16 July	56	#155 aerial photo

Steller's Sea Lion (Eumatopias jubata)

Date	Number	Location and comments
19 April	100-200	Castle Rk., #149, hauled out
19 April	25-35	Sea Lion Caves
19 April	7	Best Rk. in Orford Reef
19 April	530	Rogue River Reef, aerial photo
19 April	3	Rogue River at mouth
2 May	5	Black Rk., #448

Appendix B. Continued

Steller's Sea Lion (Eumatopias jubata)

Date	Number	Location and comments
16 May	20	Long Brown Rk., #452, males
16 May	3	#453
16 May	15	Best Rk., #459
16 May	62	Seal Rk., #460, incl. a male with a large harem
16 May	60	Arch Rk., #466, incl. 2 territorial males with harems
16 May	4	#467
16 May	2	#469
23 May	10	Ca. Rogue River mouth
23 May	85	Needle Rk., #731
23 May	13	Double Rk., #729
23 May	23	#710
23 May	100's	Pyramid Rk., #722, several hundred present incl. 8 territorial bulls
23 May	+	#720, present but no count
10 June	175	Sea Lion Rk., #120, incl. 3 territorial bulls
10 June	1	Near $108 A
10 June	1	Near #99 A
11 June	24	#30, 22 females, 2 males
12 June	2	#30, female with neonate
22 June	173	Sea Lion Rk., #120
22 June	350	Sea Lion Caves, 334 counted, 350 est.
29 June	7	Near #871, all females
29 June	1	#880-881, male

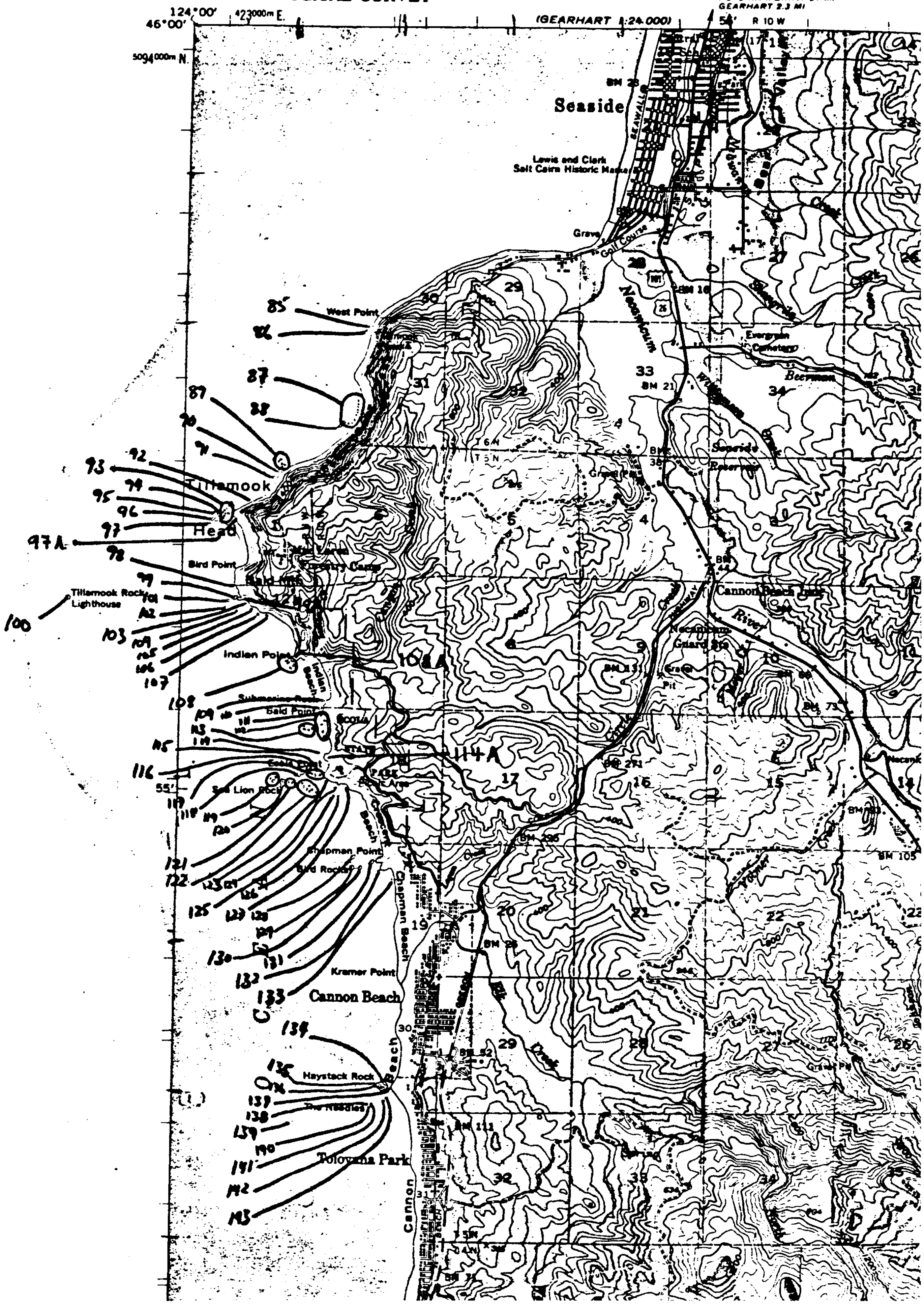
Appendix B. Continued

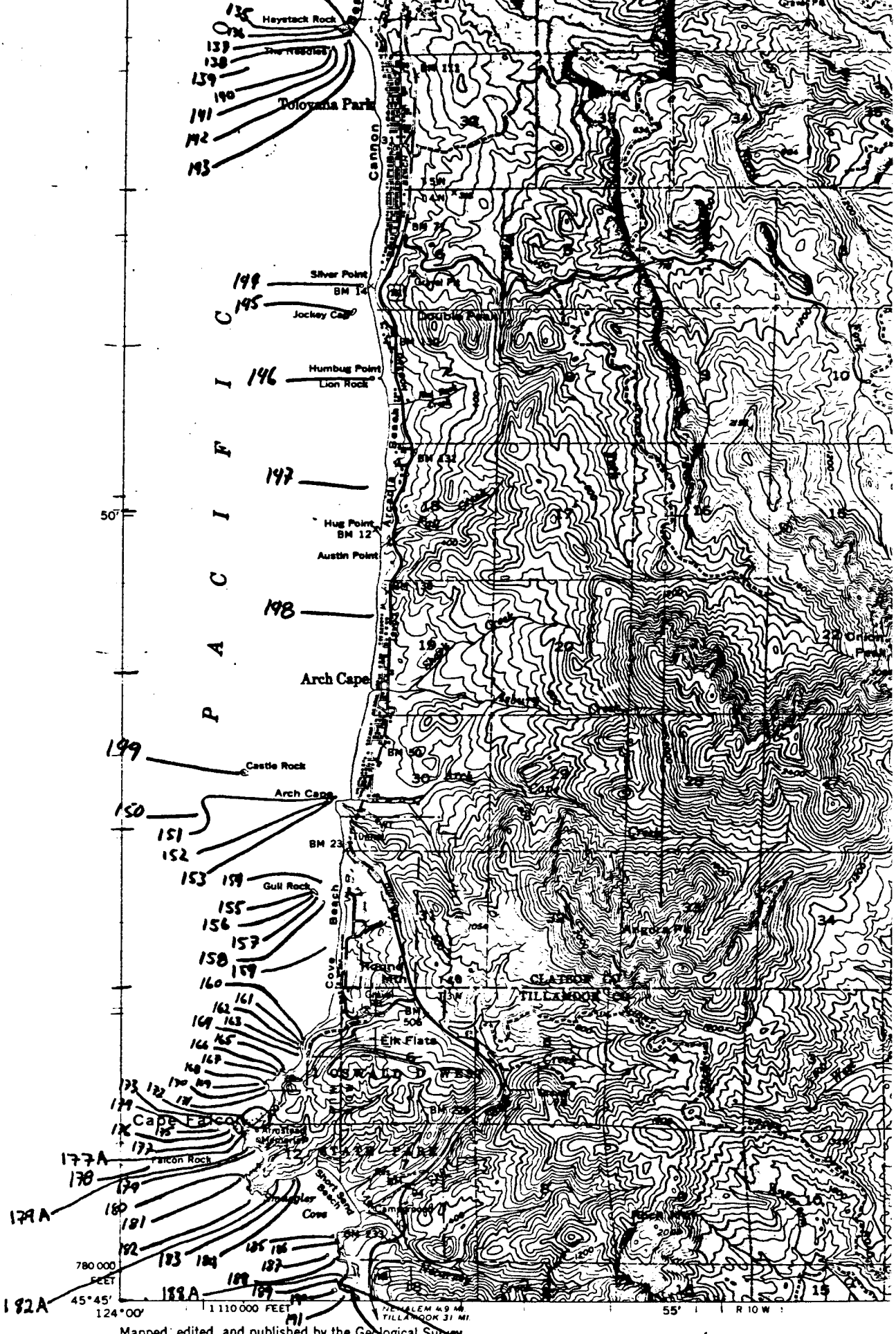
California Sea Lion (*Zalophus californianus*)

Date	Number	Location and comments
28 April	2	Coquille River mouth, males
28 April	1	Coos Bay breakwater, male
30 April	10	Coquille River mouth, all males, feeding adjacent to boat basin
2 May	2	Black Rk., #448
16 May	2	Long Brown Rk., #452, males
16 May	45	Best Rk., #459
16 May	1	Seal Rk., #460
23 May	81	Needle Rk., #731
23 May	19	Double Rk., #729
23 May	1	#728
22 June	2	Sea Lion Rk., #120

Appendix C. Survey Maps

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY





Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, State of Oregon, and Pacific Power and Light Company

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1953. Field check 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on Oregon coordinate system, north zone

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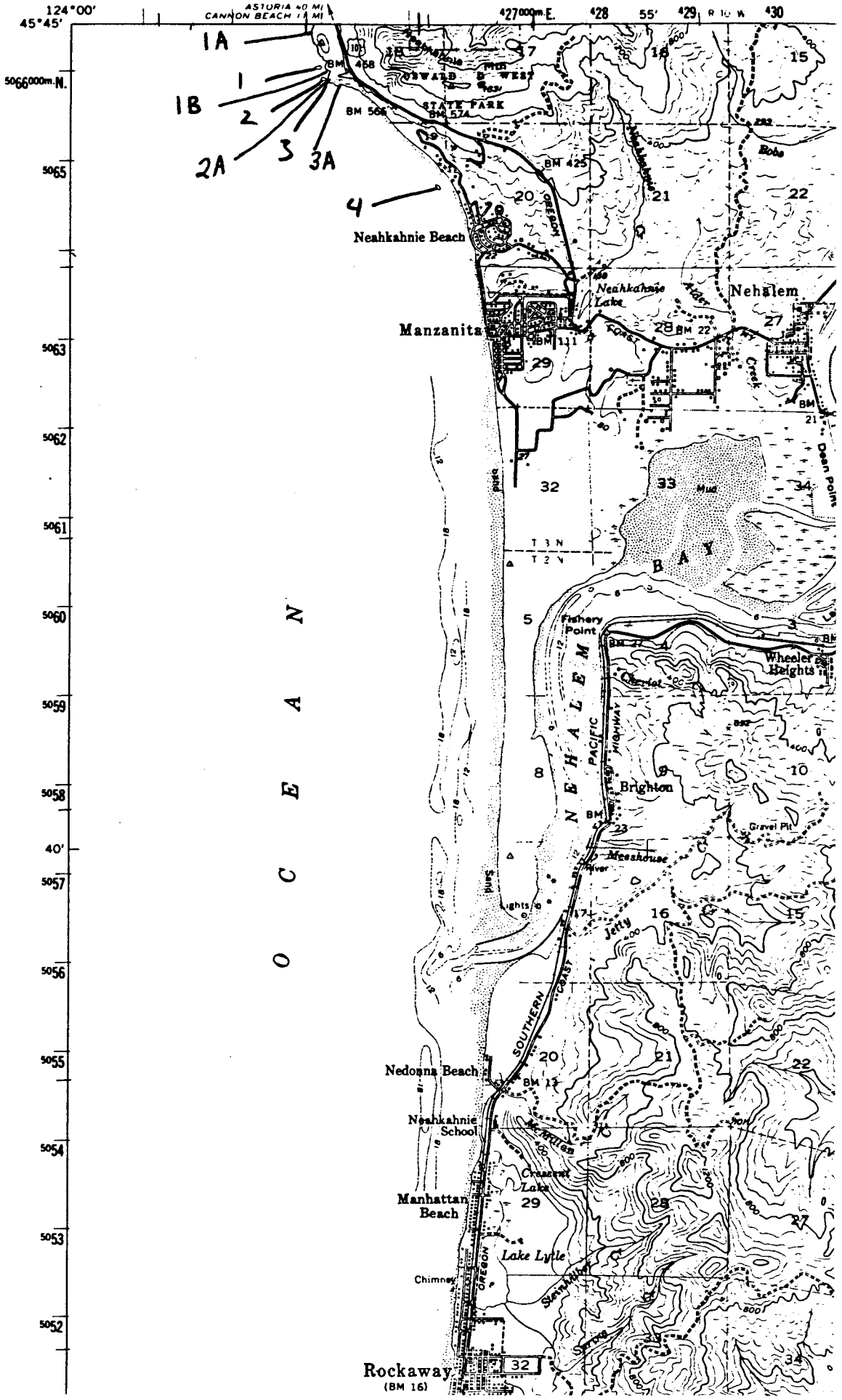
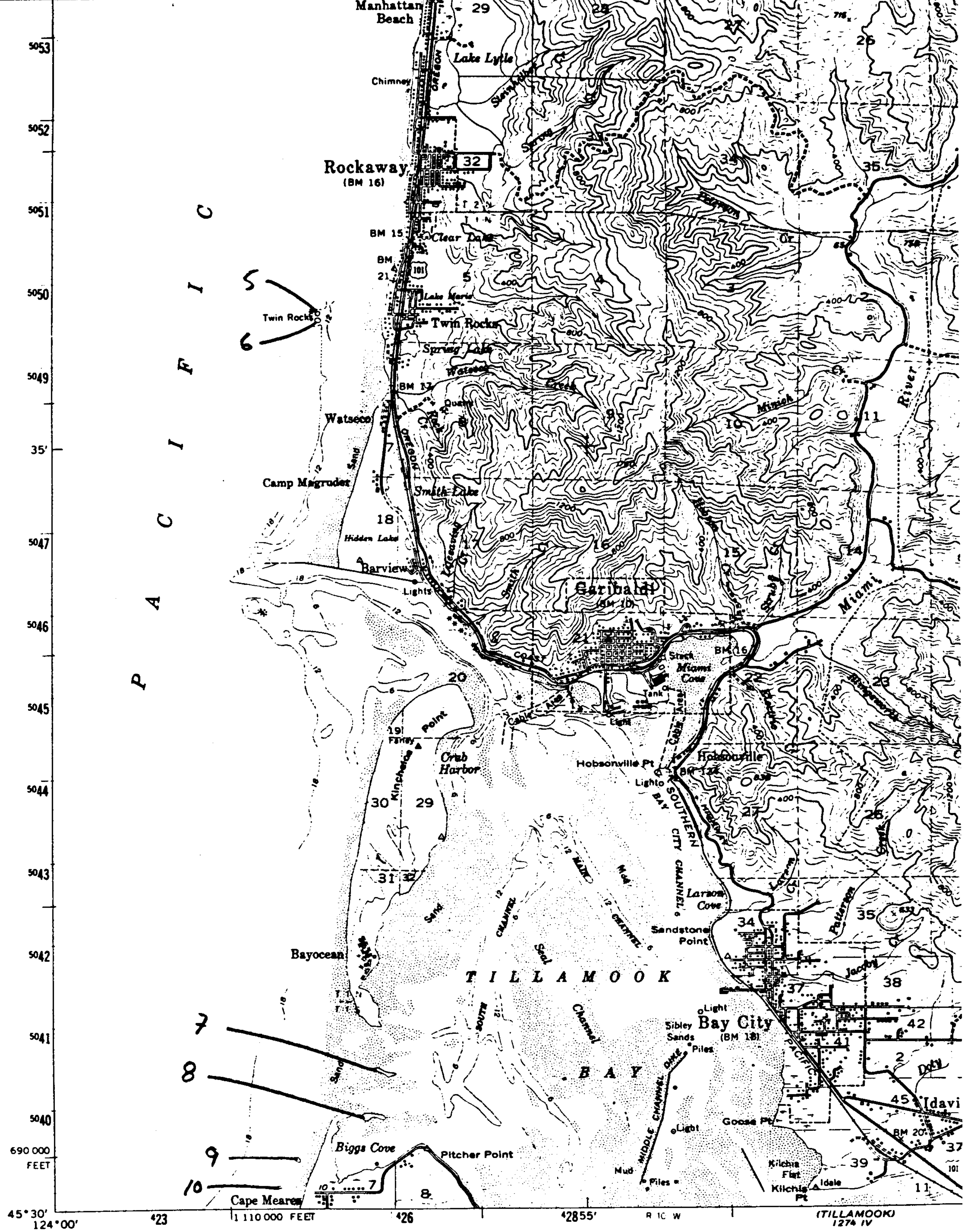
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY





Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USE, and State of Oregon

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1953. Field check 1955

Hydrography from USC&GS Charts 6112 (1953) and 6122 (1952)

Polyconic projection. 1927 North American datum
10,000-foot grid based on Oregon coordinate system, north zone

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

1000-meter Universal Transverse Mercator grid ticks,

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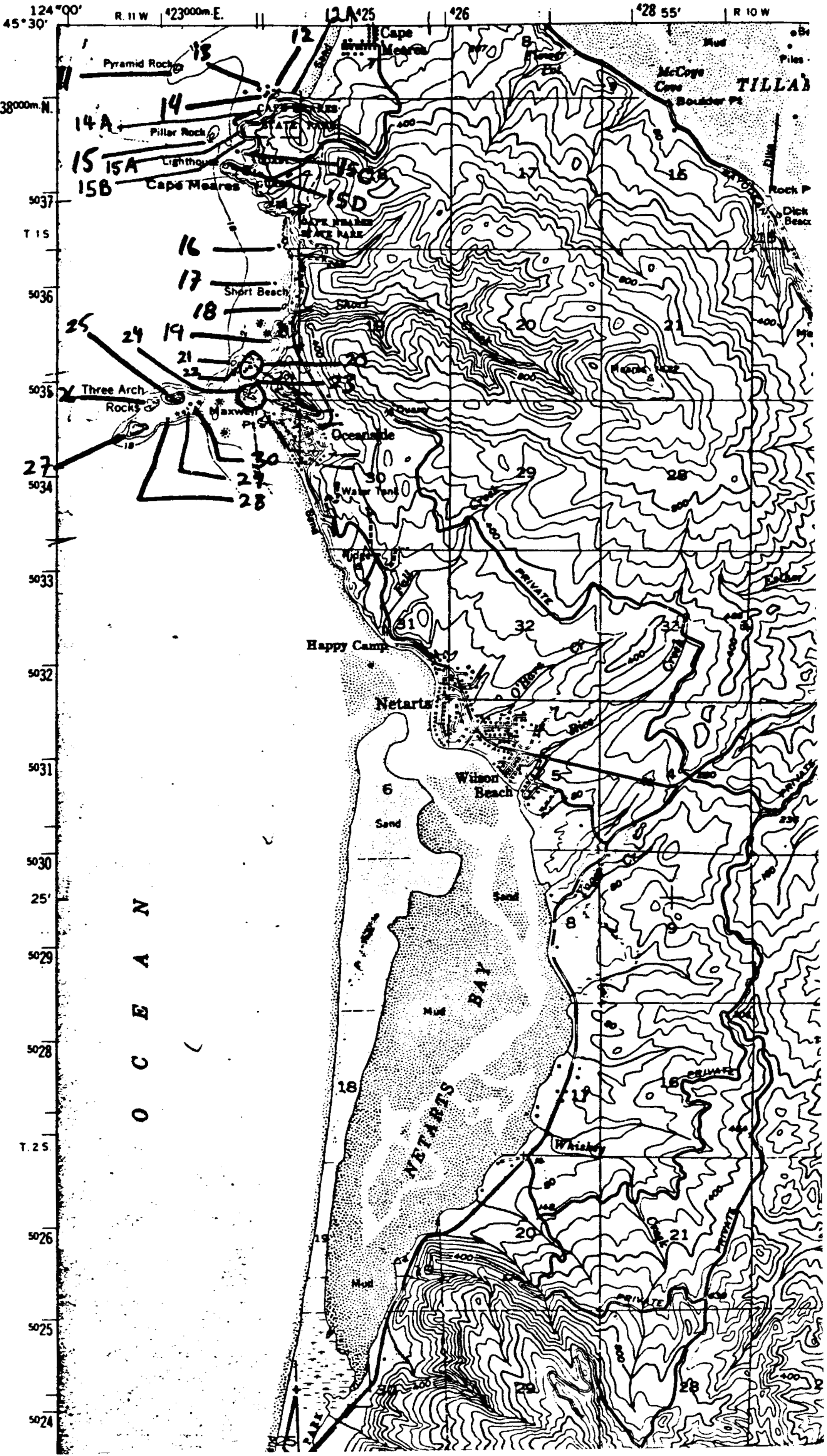
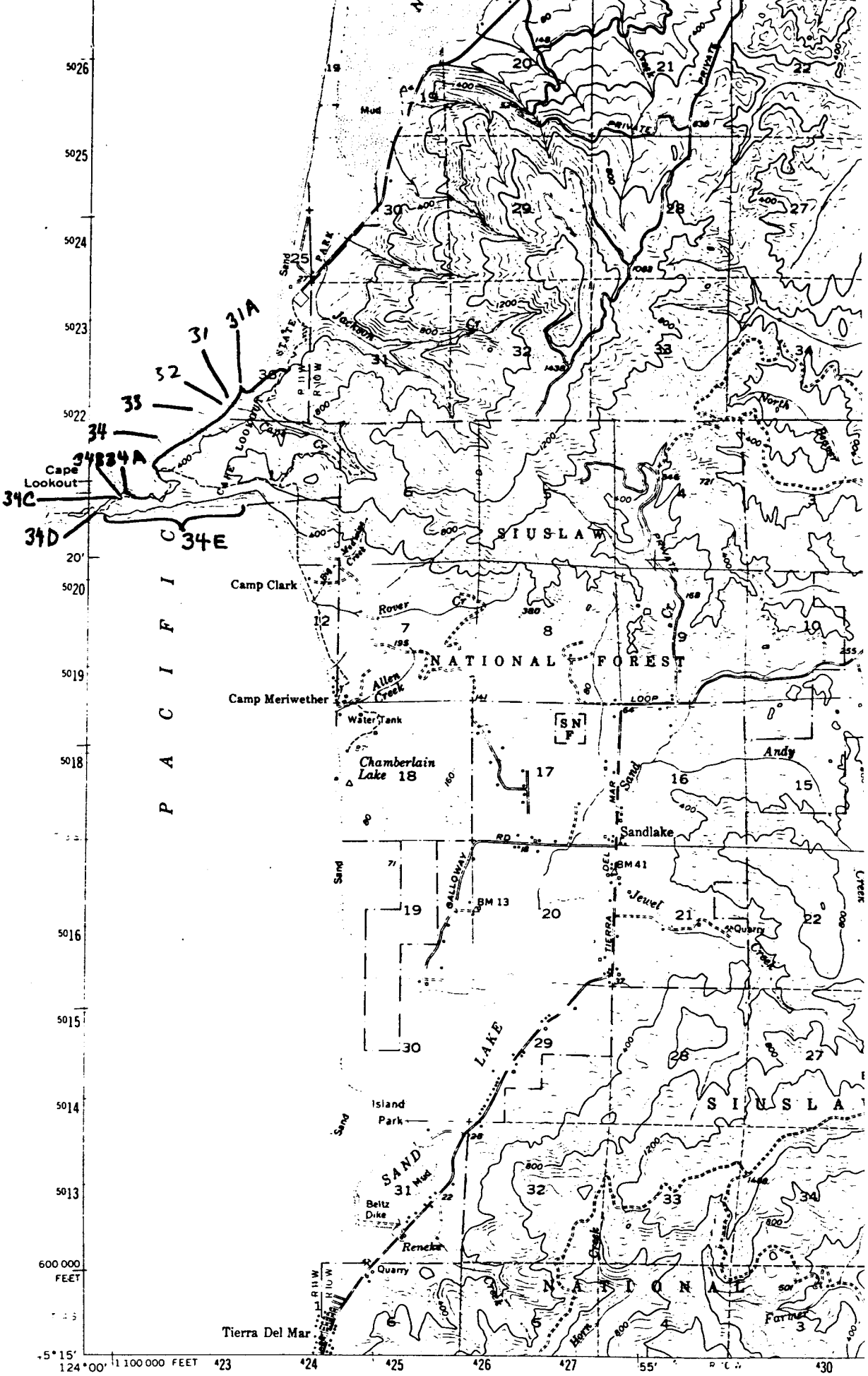
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY





Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, and State of Oregon

Topography from aerial photographs by photogrammetric methods and by planetable surveys 1955. Aerial photographs taken 1953

Polyconic projection. 1927 North American datum

10,000-foot grid based on Oregon coordinate system, north zone

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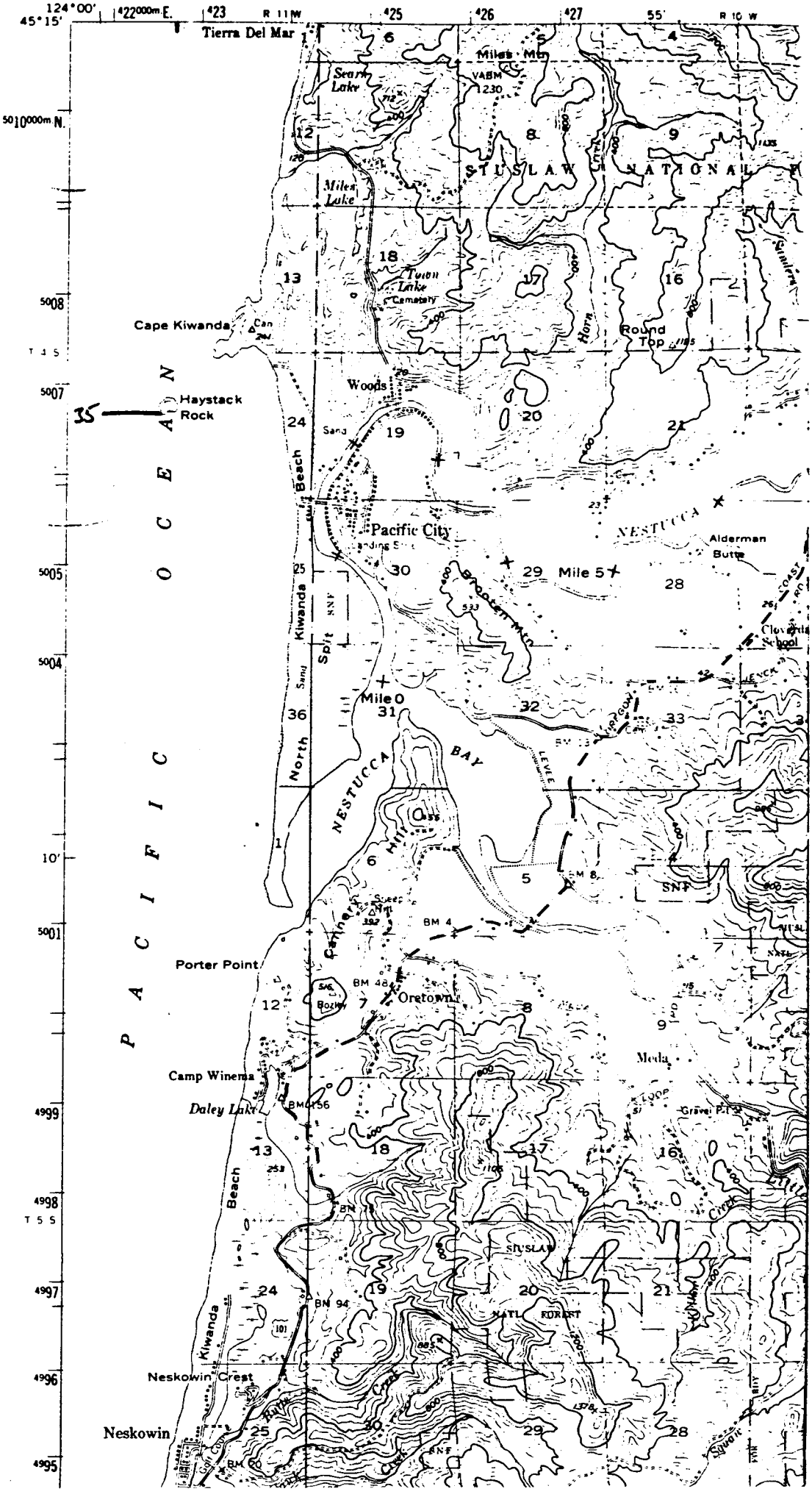
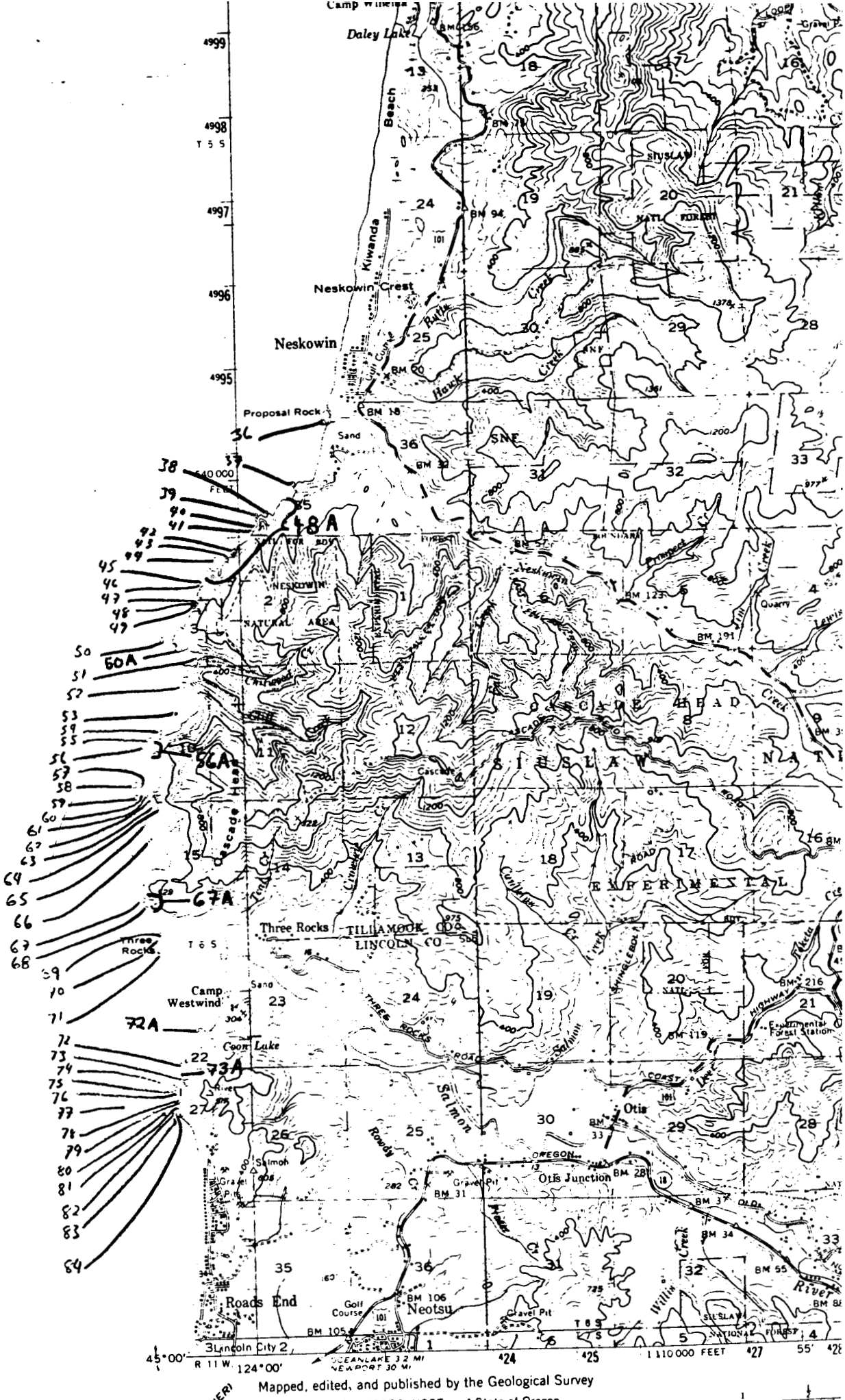
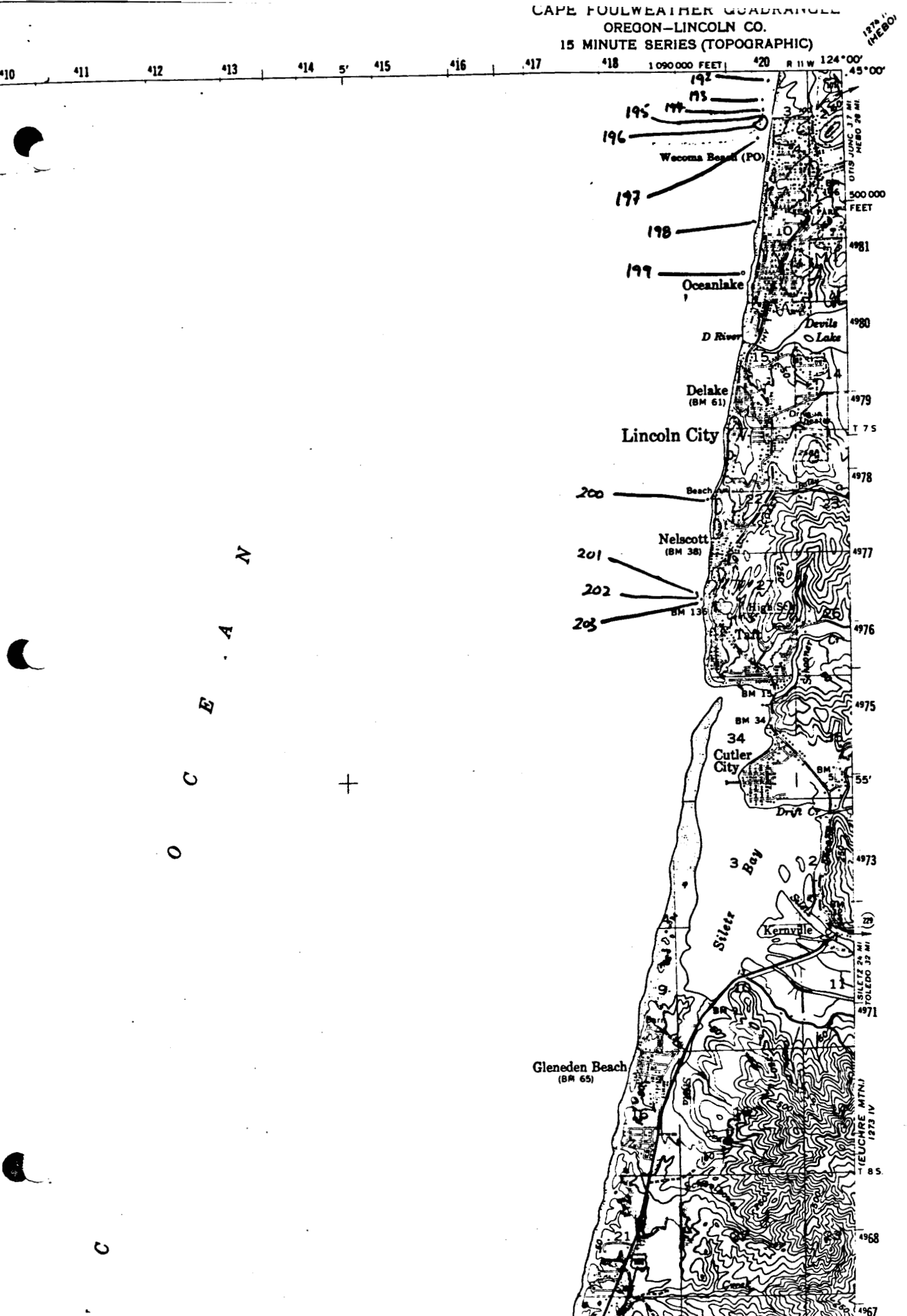
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY




Daley Lake
Neskowin Crest
Neskowin
Proposal Rock
Sand
48A
60A
56A
67A
72A
73A
Three Rocks
TILLAMOOK CO
LINCOLN CO
Camp Westwind
Coon Lake
Cascade Head
EXPERIMENTAL
Otis
Otis Junction
Roads End
Neotsu
Lincoln City 2
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, USCE, and State of Oregon
Topography from aerial photographs by multiplex methods
Aerial photographs taken 1953. Field check 1955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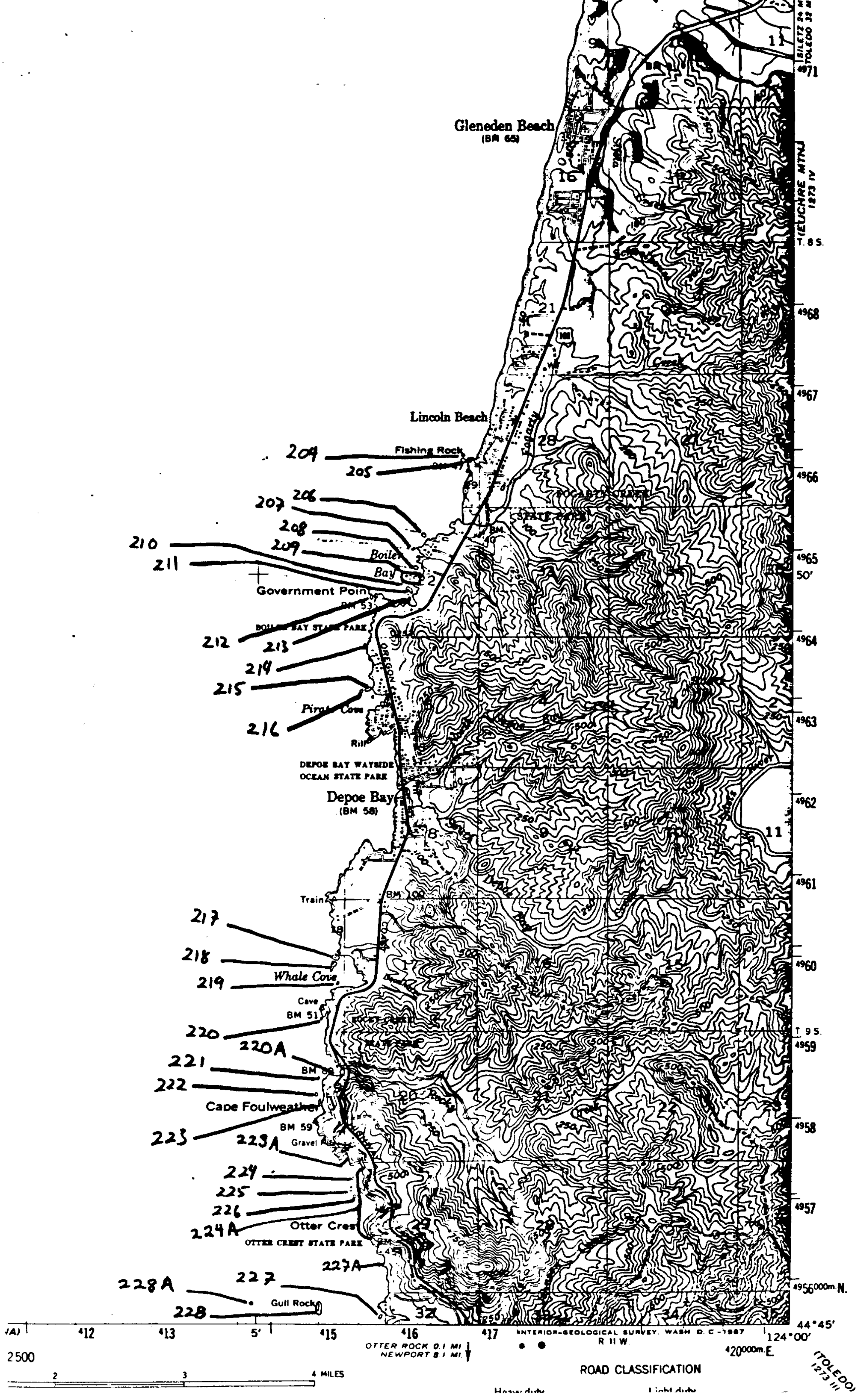
Gleneden Beach
(BM 65)
Lincoln Beach
Fishing Rock
Boiler Bay
Government Point
BM 53
BOILER BAY STATE PARK
Pirate Cove
Rill
DEPOE BAY WAYSIDE
OCEAN STATE PARK
Depoe Bay
(BM 58)
Train
Whale Cove
Cave
BM 51
Cape Foulweather
BM 59
Gravel Pit
Otter Crest
OTTER CREST STATE PARK
Gull Rock
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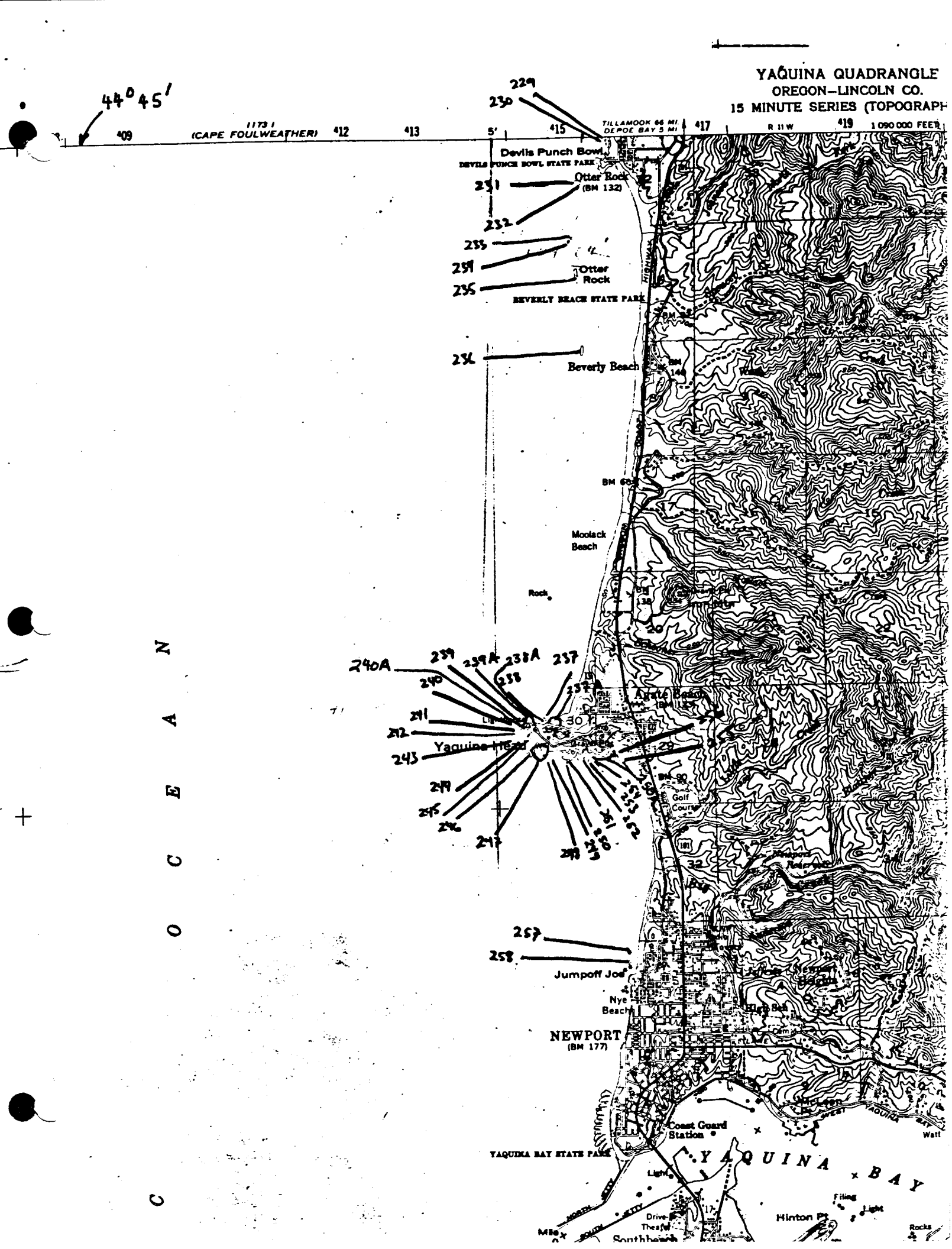
(TOLEDO)


YAQUINA QUADRANGLE
OREGON—LINCOLN CO.
15 MINUTE SERIES (TOPOGRAPH
44°45'
(CAPE FOULWEATHER)
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DEPOE BAY 5 MI.
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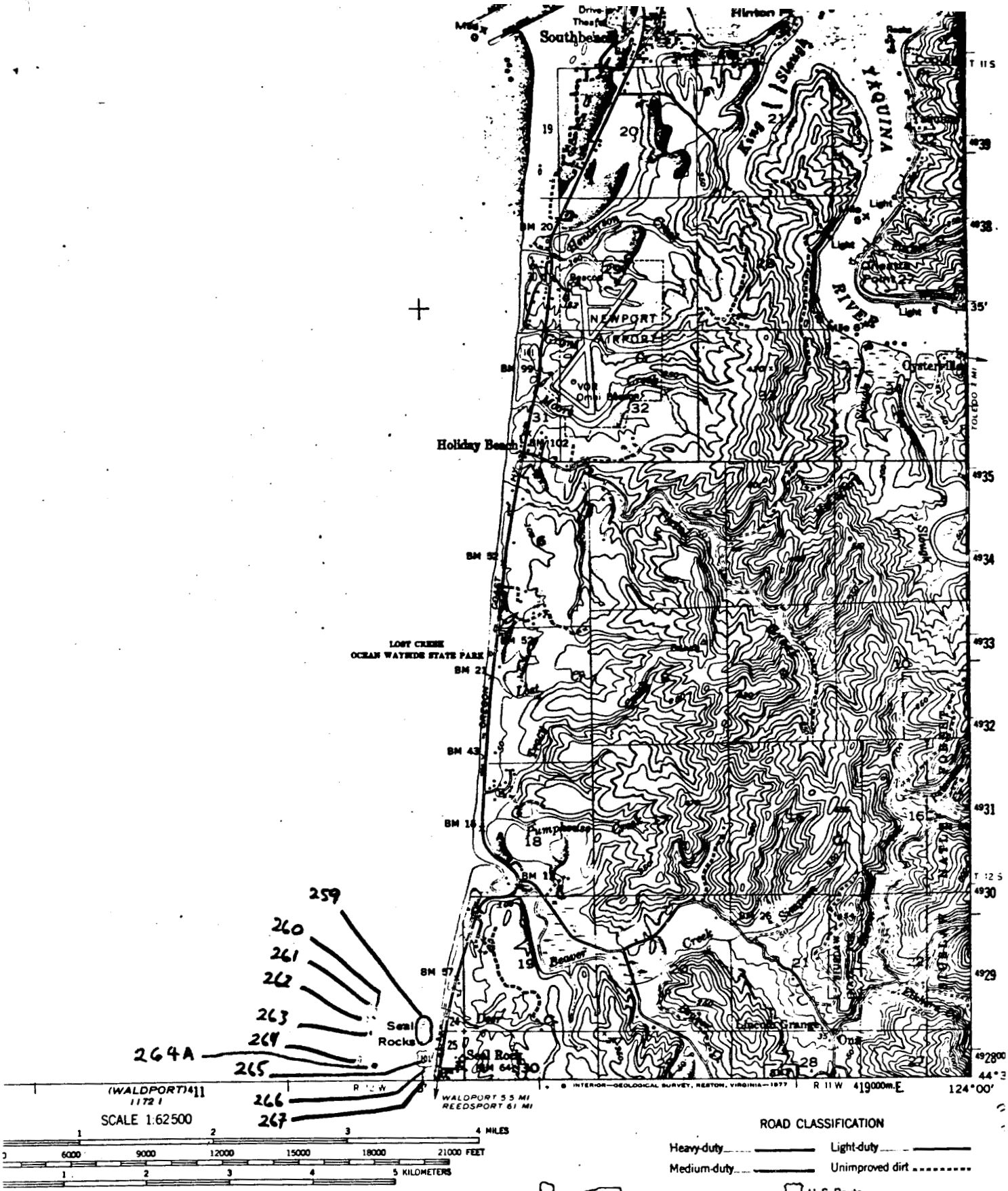
Devils Punch Bowl
DEVILS PUNCH BOWL STATE PARK
Otter Rock
(BM 132)
Otter Rock
BEVERLY BEACH STATE PARK
Beverly Beach
Moolack Beach
Rock
Yaquina Head
Agate Beach
Golf Course
Jumpoff Joe
Nye Beach
NEWPORT
(BM 177)
Coast Guard Station
YAQUINA BAY STATE PARK
YAQUINA BAY
Hinton Pt
Rocks
OCEAN



CONTOUR INTERVAL 50 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6 FEET

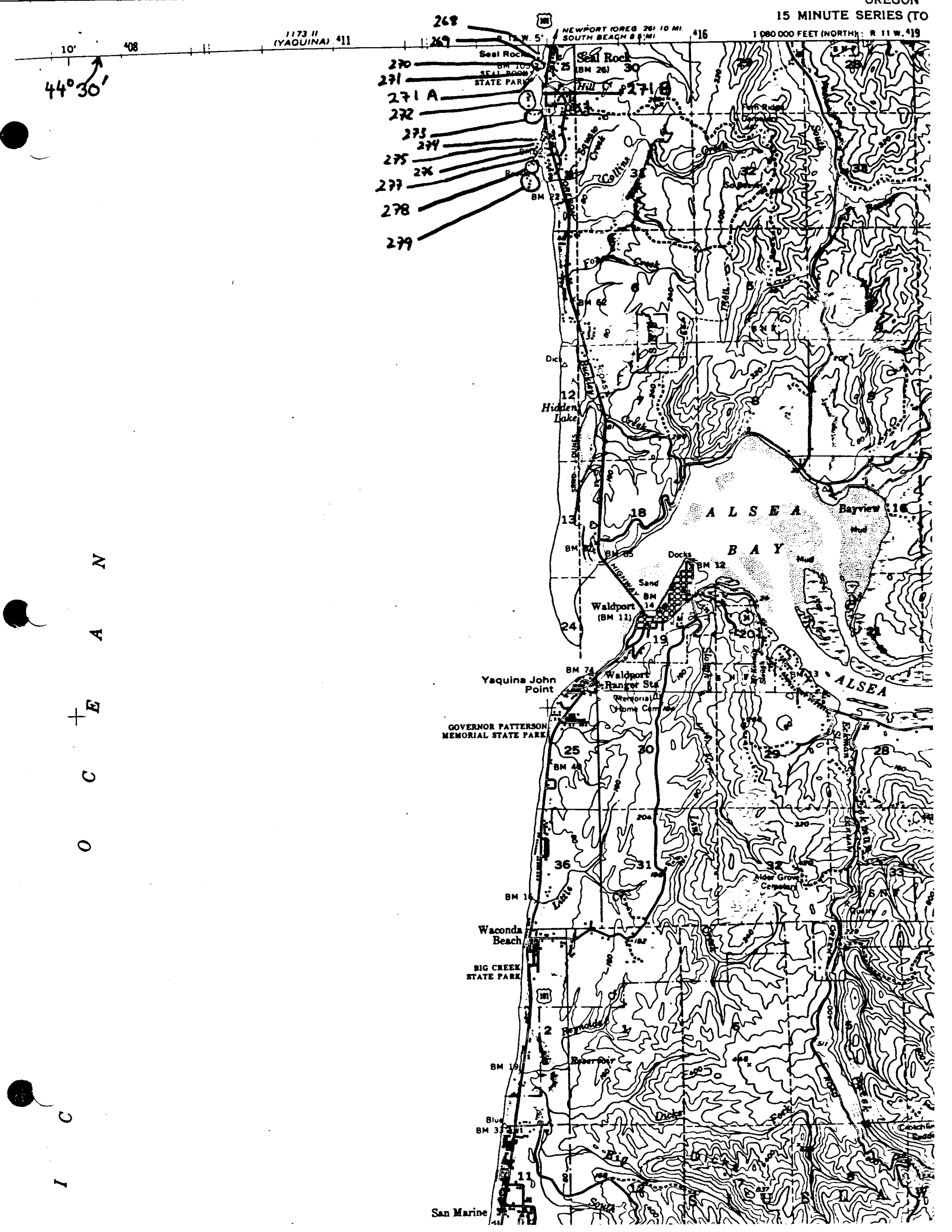
OLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

YAQUINA, OREG.

N4430—W12400/15

1957

AMS 1173 II—SERIES V792



OREGON
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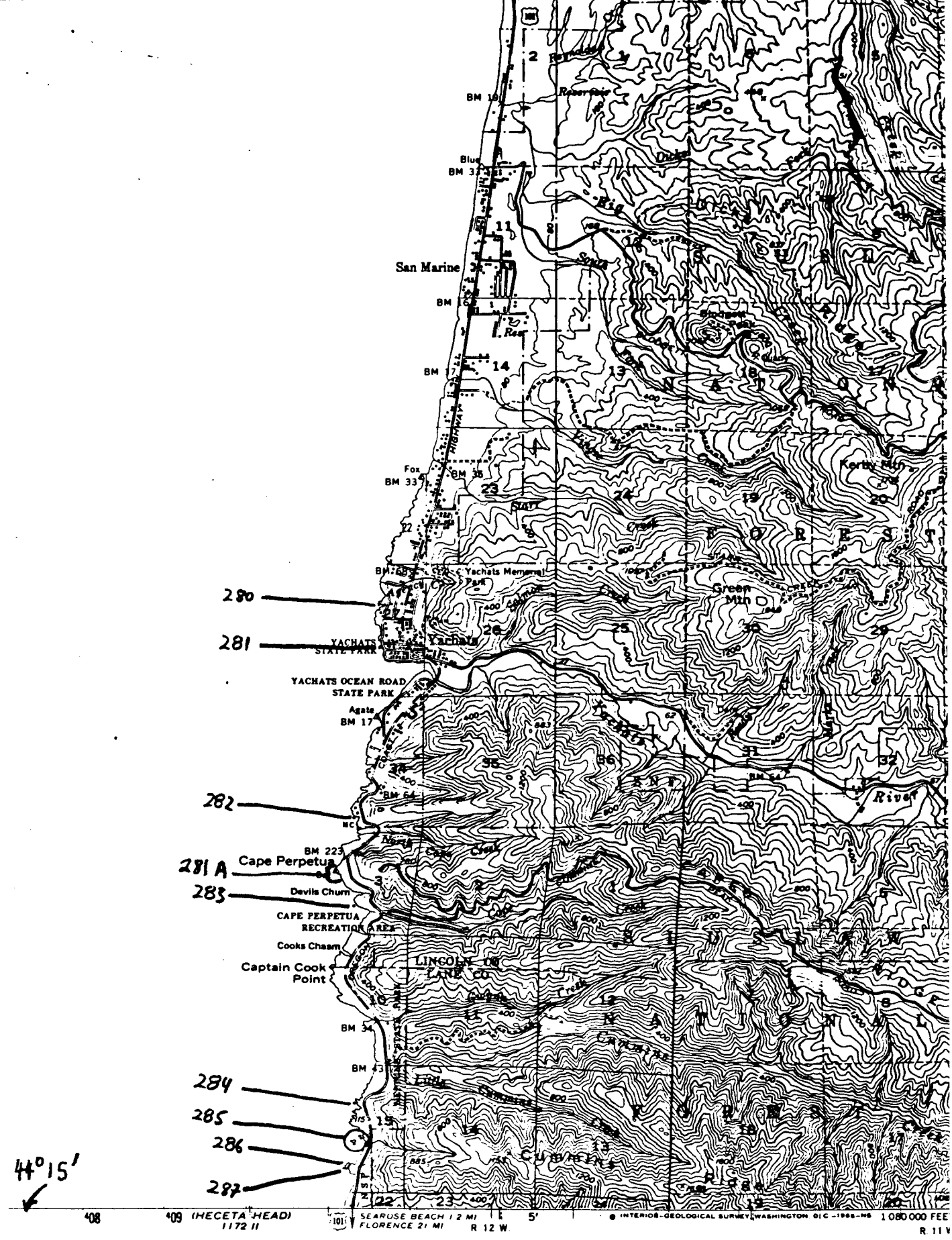
Seal Rock
Seal Rock
SEAL ROCK STATE PARK
Hill Cr
Collins
Fox Creek
Hidden Lake
Dick
ALSEA BAY
Bayview
Mud
Docks
Sand
Waldport (BM 11)
HIGHWAY
ALSEA
Yaquina John Point
Waldport Ranger Sta
Memorial Home Camp
GOVERNOR PATTERSON MEMORIAL STATE PARK
Alder Grove Cemetery
Little
Waconda Beach
BIG CREEK STATE PARK
Reservoir
Blue
Big
South
San Marine
OCEAN
PACIFIC



SCALE 1:62500

0 1 2 3 4 MILES

0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET

DATUM IS MEAN SEA LEVEL

SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

THE MEAN RANGE OF TIDE IS APPROXIMATELY 6 FEET

ROAD CLASSIFI

Medium-duty Lig

Unimproved dirt

U.S. Route

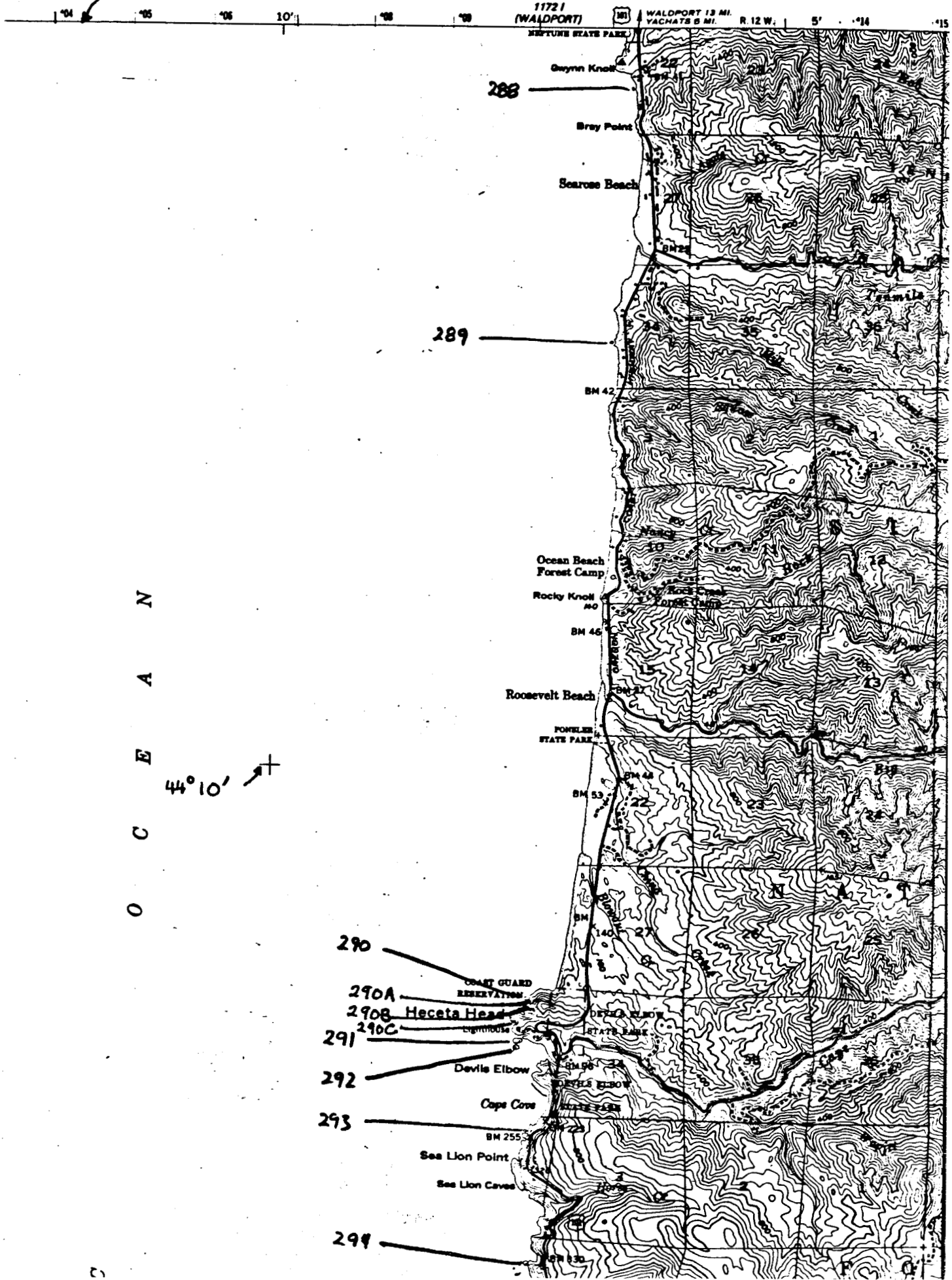
OREGON

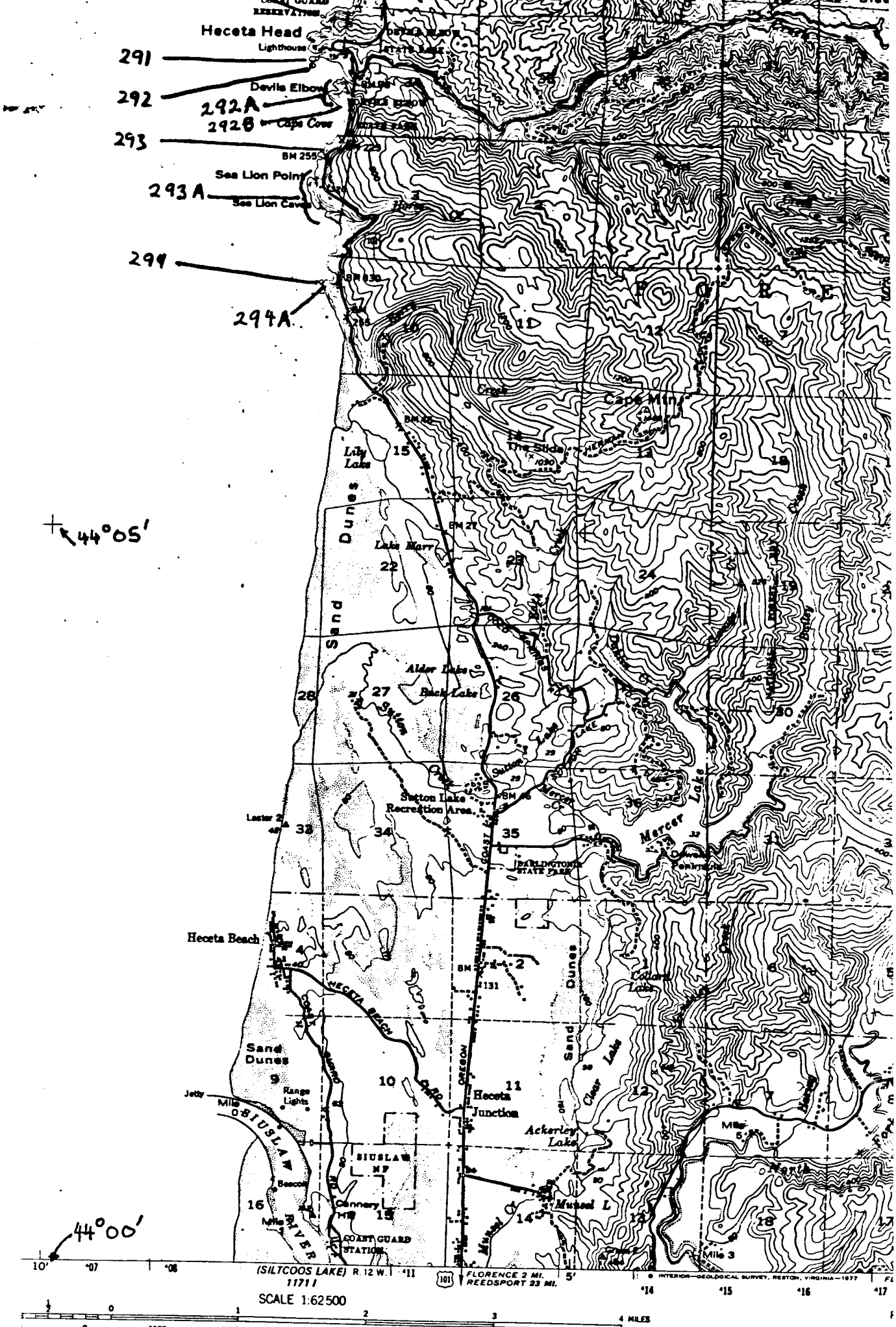
QUADRANGLE LOCATION

WAL

N4

IOR

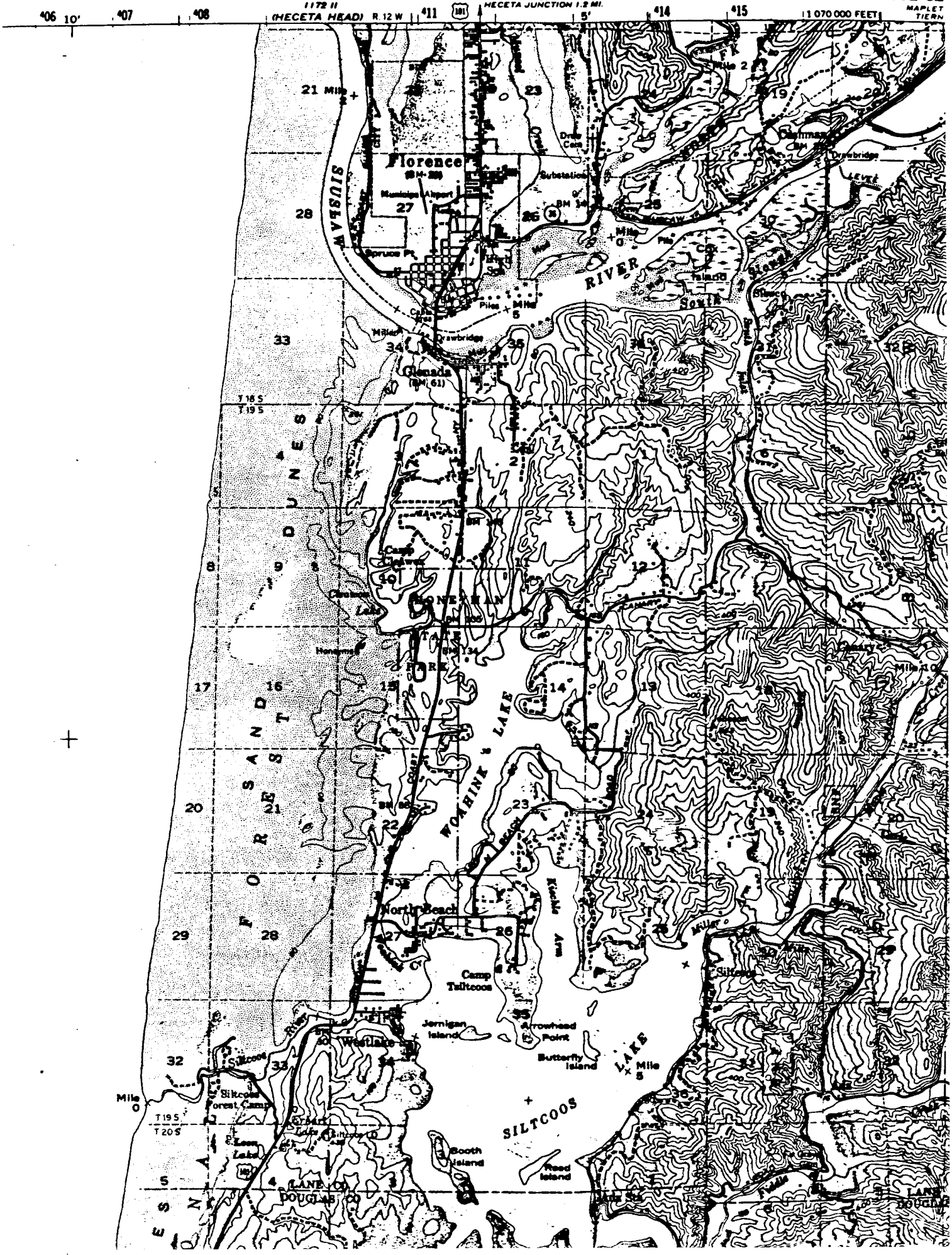

44°15'
1172 I
(WALDPORT)
WALDPORT 13 MI.
YACHATS 6 MI.
R. 12 W.
NEPTUNE STATE PARK
Guyinn Knoll
288
Bray Point
Seaross Beach
289
BM 42
Ocean Beach
Forest Camp
Rocky Knoll
BM 46
Roosevelt Beach
BM 53
44°10'
O C E A N
290
290A
COAST GUARD
RESERVATION
290B Heceta Head
Lighthouse
290C
291
292
Devils Elbow
Cape Cove
293
BM 255
Sea Lion Point
Sea Lion Caves
299

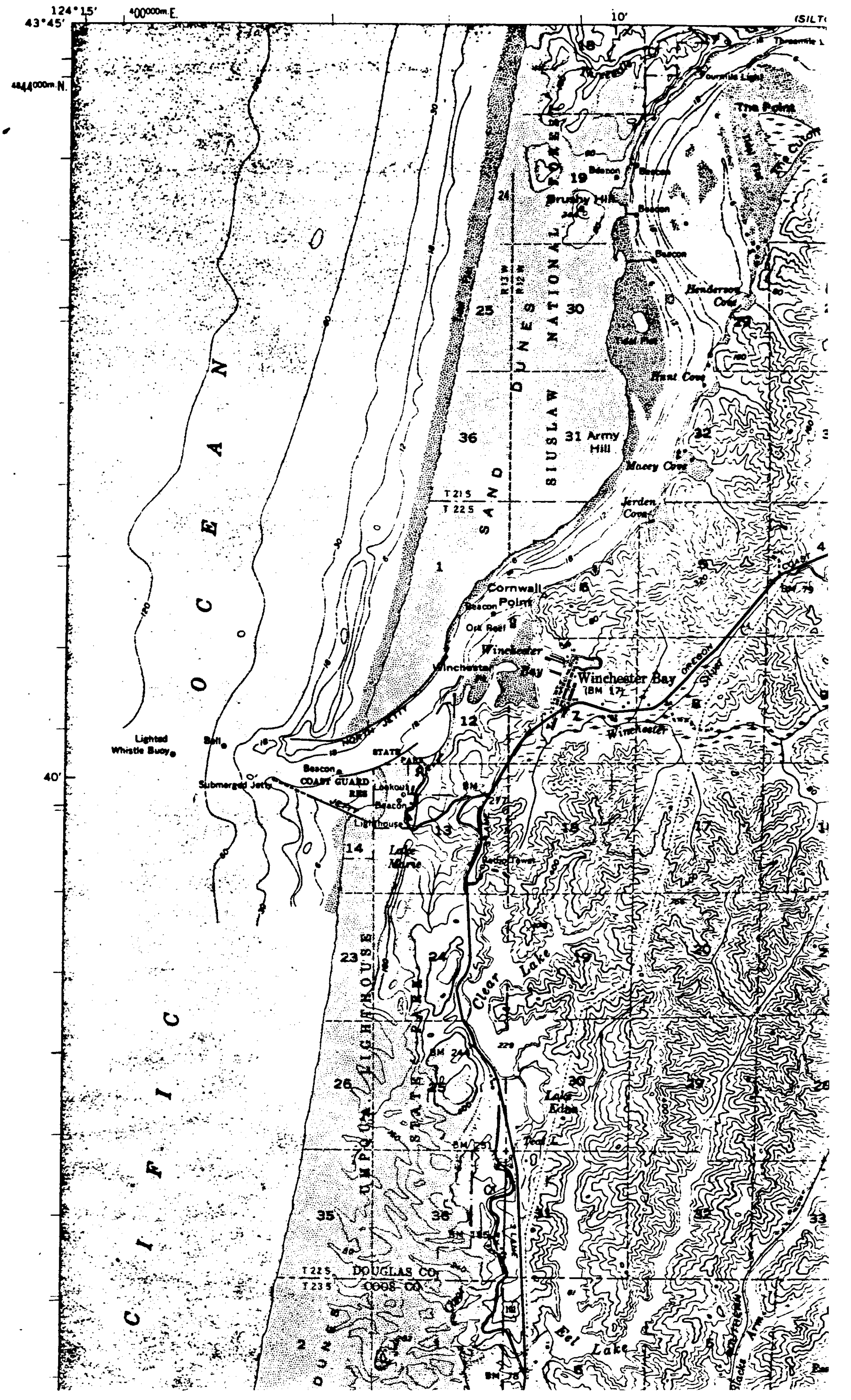


Medium-duty

Un

SILTCOOS LA
O
15 MINUTE SE

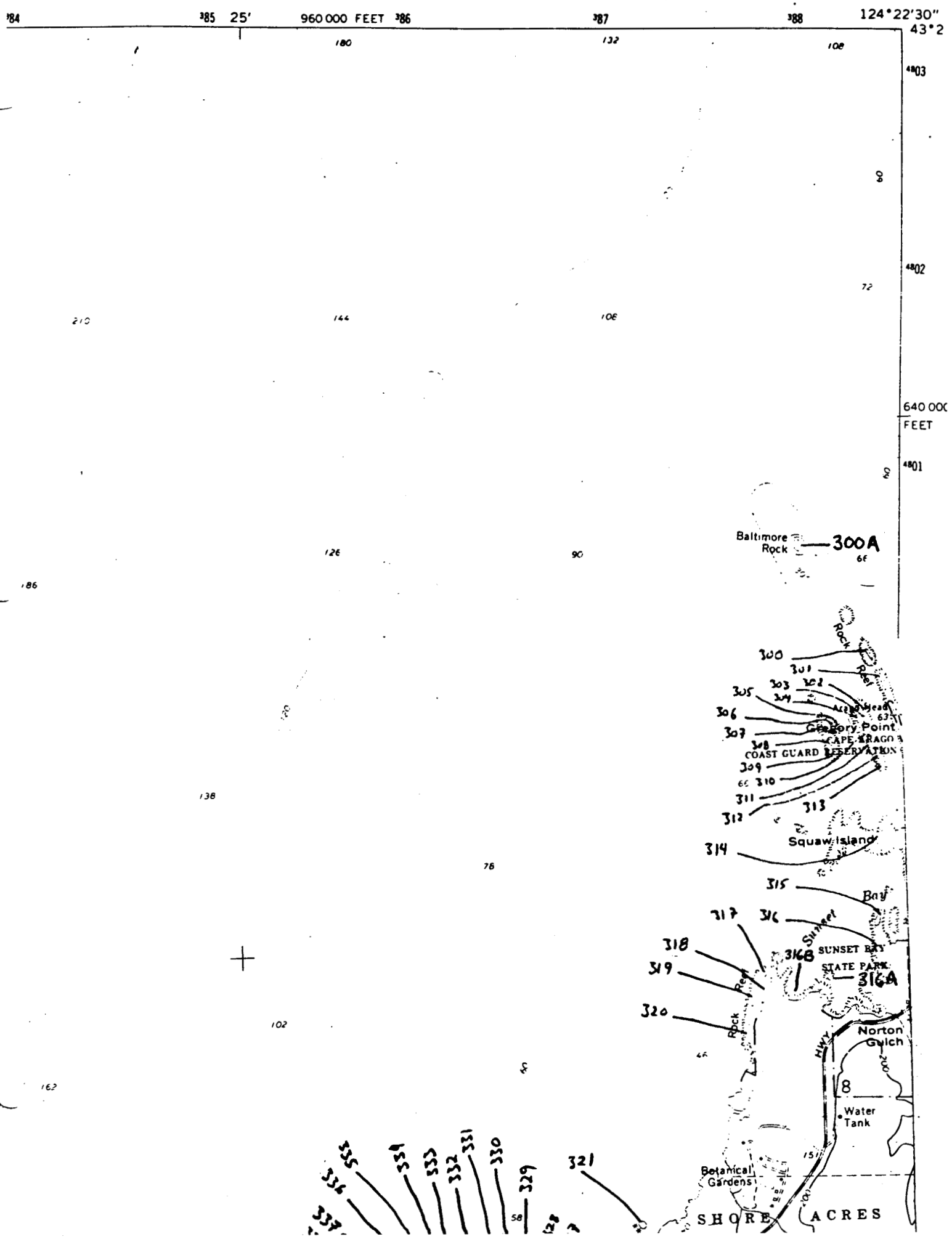


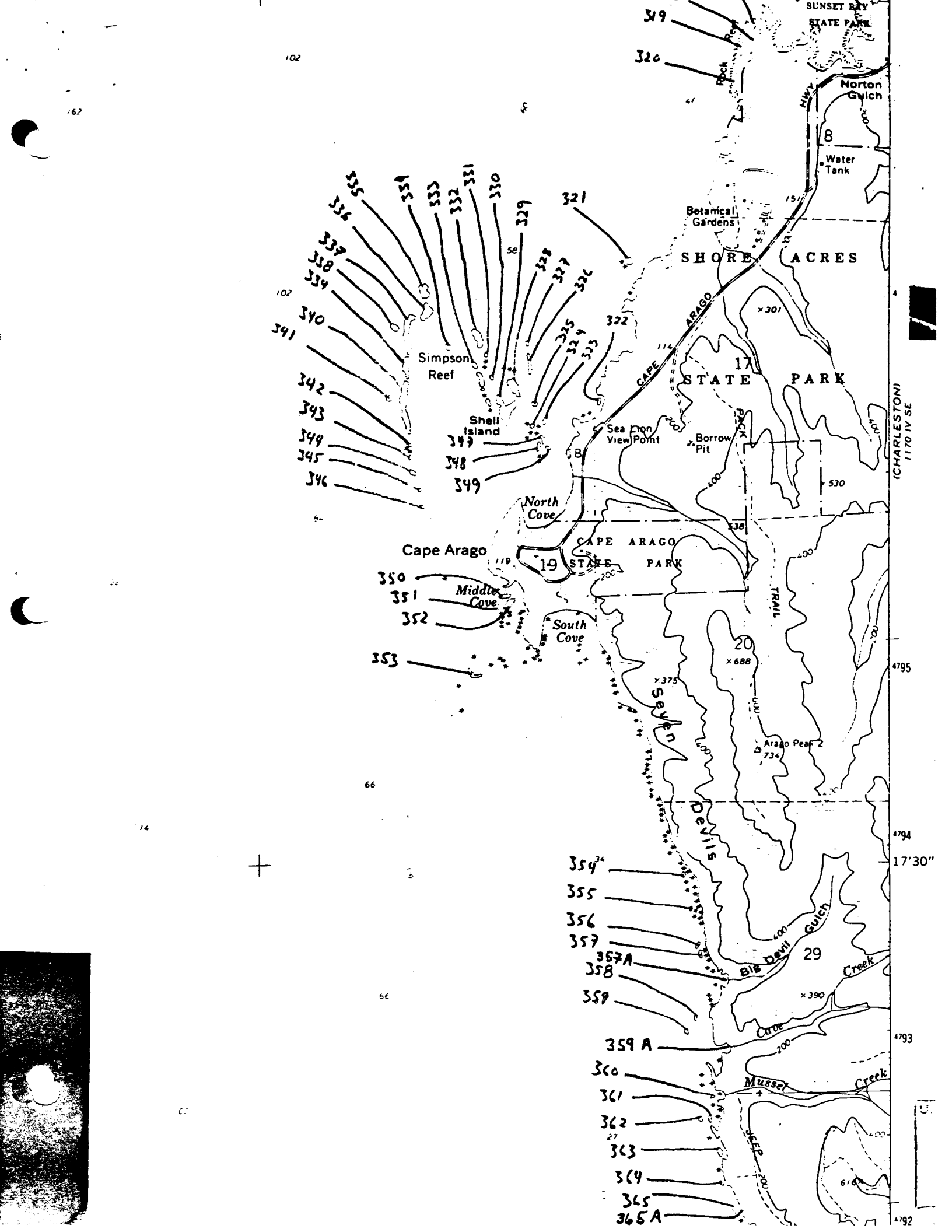


124°15'
400000m.E.
43°45'
10'
4844000m.N.
40'
PACIFIC OCEAN
SIUSLAW NATIONAL FOREST
SAND DUNES
Brushy Hill
Beacon
Henderson Cove
Tidal Flat
Hunt Cove
Army Hill
Macey Cove
Jerden Cove
The Point
T 21 S
T 22 S
Cornwall Point
Orr Reef
Winchester Bay
Winchester Bay
BM 17
NORTH JETTY
Lighted Whistle Buoy
Bell
Submerged Jetty
Beacon
COAST GUARD RES
STATE PARK
Lookout
Lighthouse
Lake Marie
Clear Lake
Lake Edna
Teal L.
UMPQUA LIGHTHOUSE STATE PARK
T 22 S
T 23 S
DOUGLAS CO
COOS CO
Eel Lake

...D STATES
OF THE INTERIOR
...ICAL SURVEY
PACIFIC OCEAN
North Beach
NORTH SPIT
JEEP TRAIL
North Beach 2
Sand Fly
Grass Mound
North Jetty
Light
South Jetty
COOS
Coos Head
US Coast Guard Lookout
Water Tank
BM 16
Oreg Inst of Marine Biology (Univ of Oreg)
COOS HEAD US NAVAL FACILITY
Tunnel Point
Beach
Bastendorff
County Park
Campground
Yoakam Point
Mussel Reef
CAPE ARAGO HY
Miner
Gregory Point
Lighthouse
CAPE ARAGO US COAST GUARD RES
Footbridge
Lighthouse Beach
SUNSET BAY STATE PARK
Sunset Bay
299
298
297
296
295
299A

OREGON – COOS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 EMPIRE 15' QUADRANGLE




SUNSET BAY
STATE PARK
Norton Gulch
Water Tank
Botanical Gardens
SHORE ACRES
CAPE ARAGO
STATE PARK
Simpson Reef
Shell Island
Sea Lion Viewpoint
Borrow Pit
North Cove
Middle Cove
South Cove
Cape Arago
Seven Devils
Arago Peak 2
Big Devil Gulch
Cave Creek
Mussel Creek
JEEP TRAIL
(CHARLESTON) 1170 IV SE
17'30"
319
326
321
322
327
328
329
330
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332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
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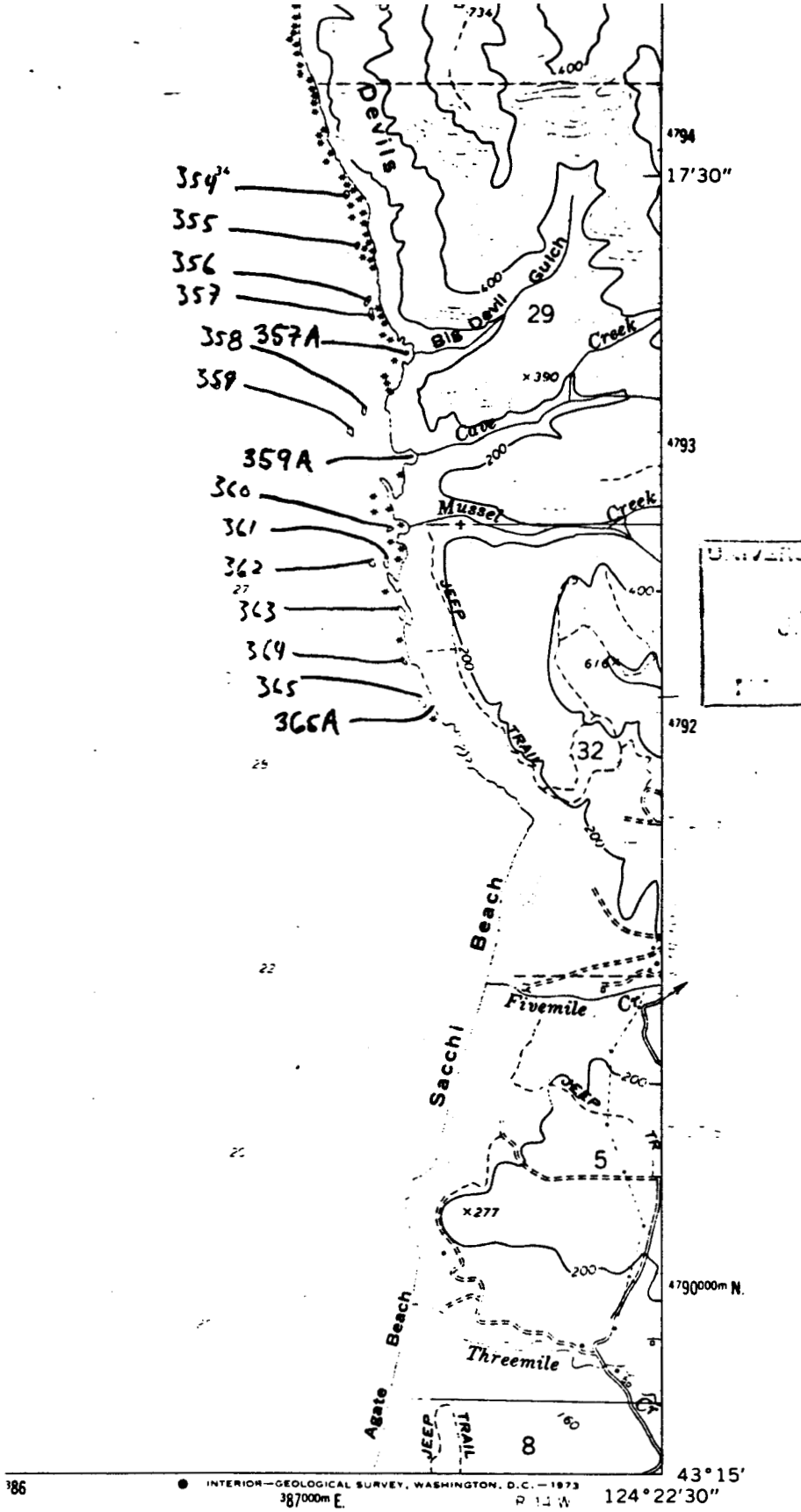
357
357A
358
359
359A
360
361
362
363
364
365
365A



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973

ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road

Interstate Route U. S. Route State Route

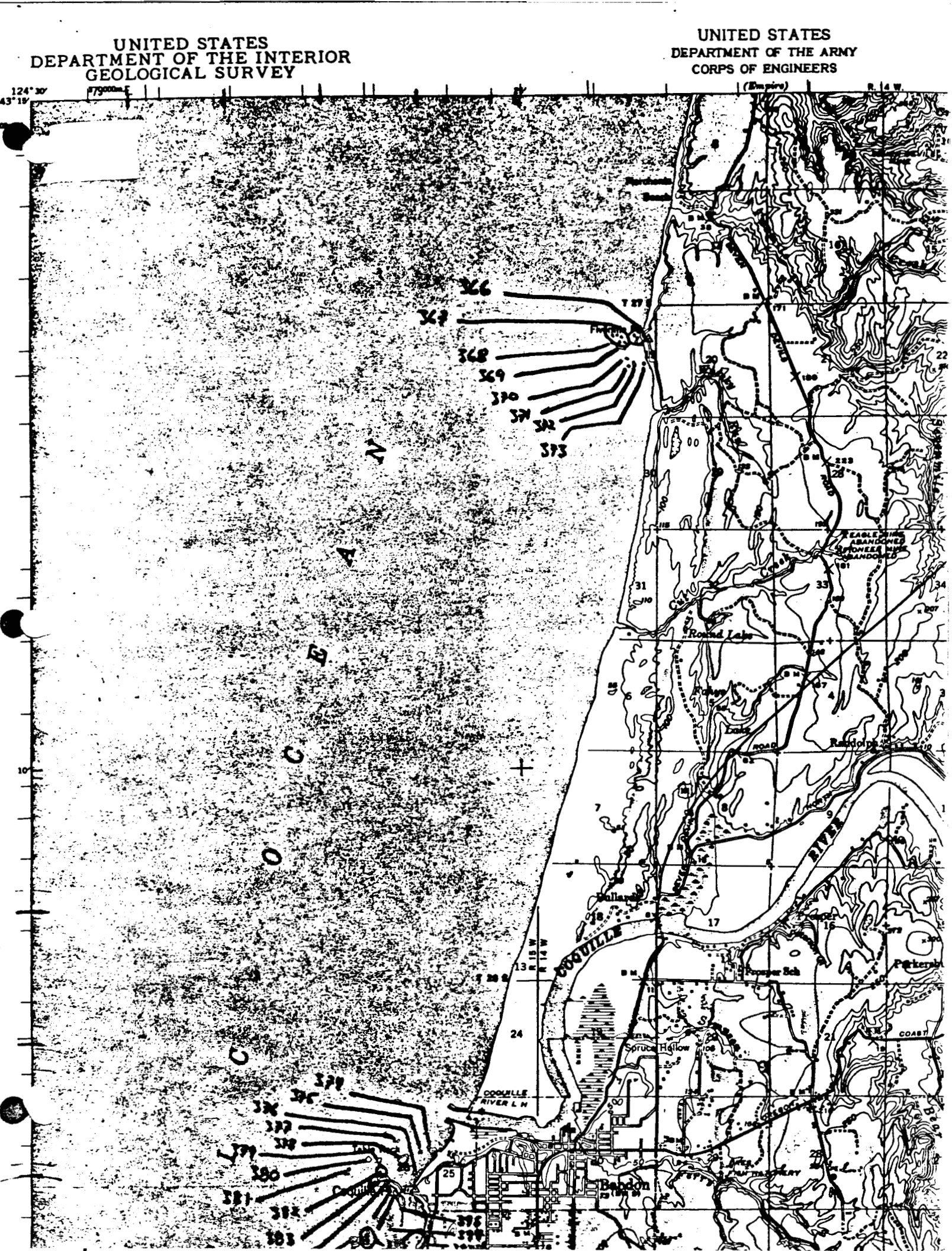
CAPE ARAGO, OREG.

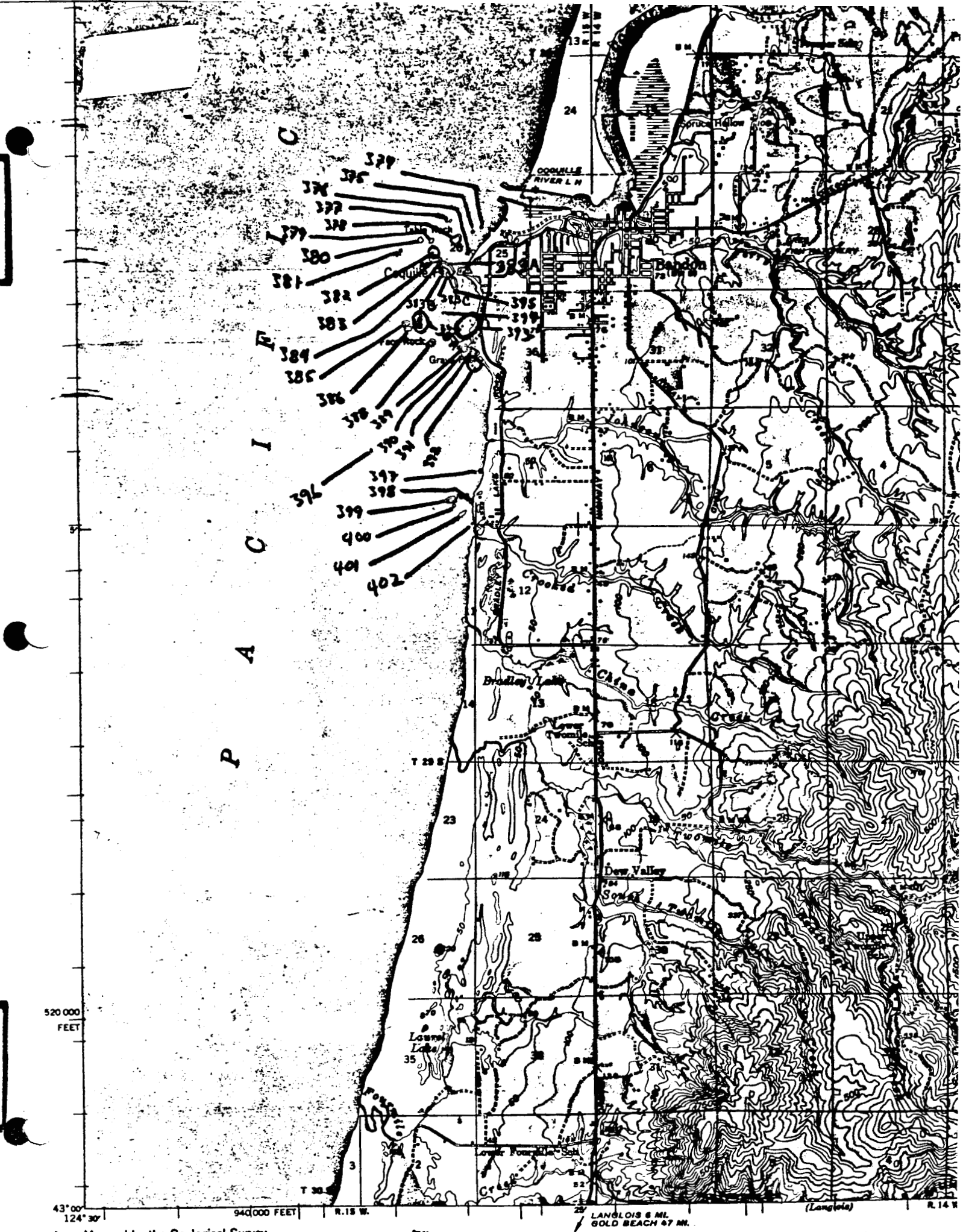
SW/4 EMPIRE 15' QUADRANGLE

N4315—W12422.5/7.5

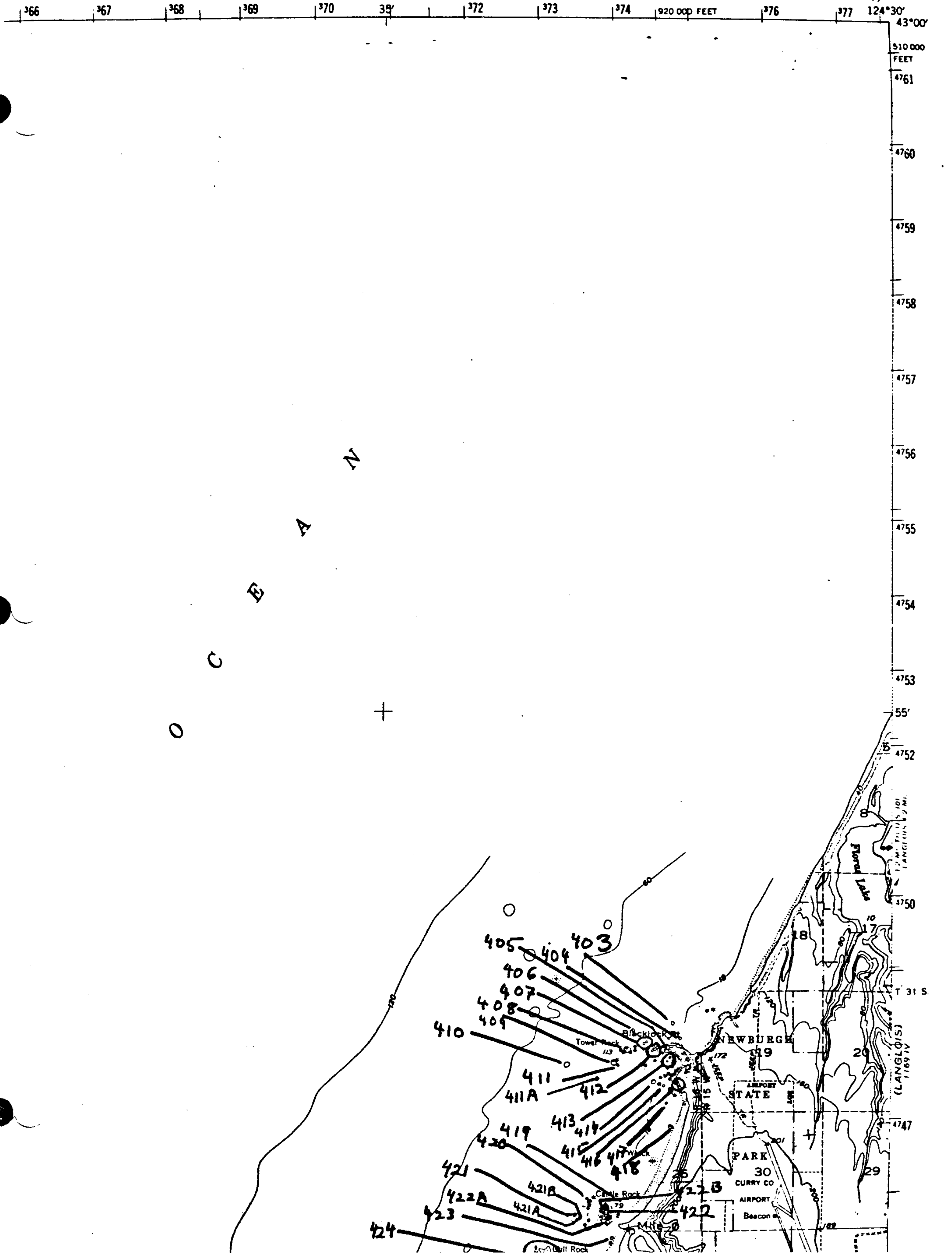
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

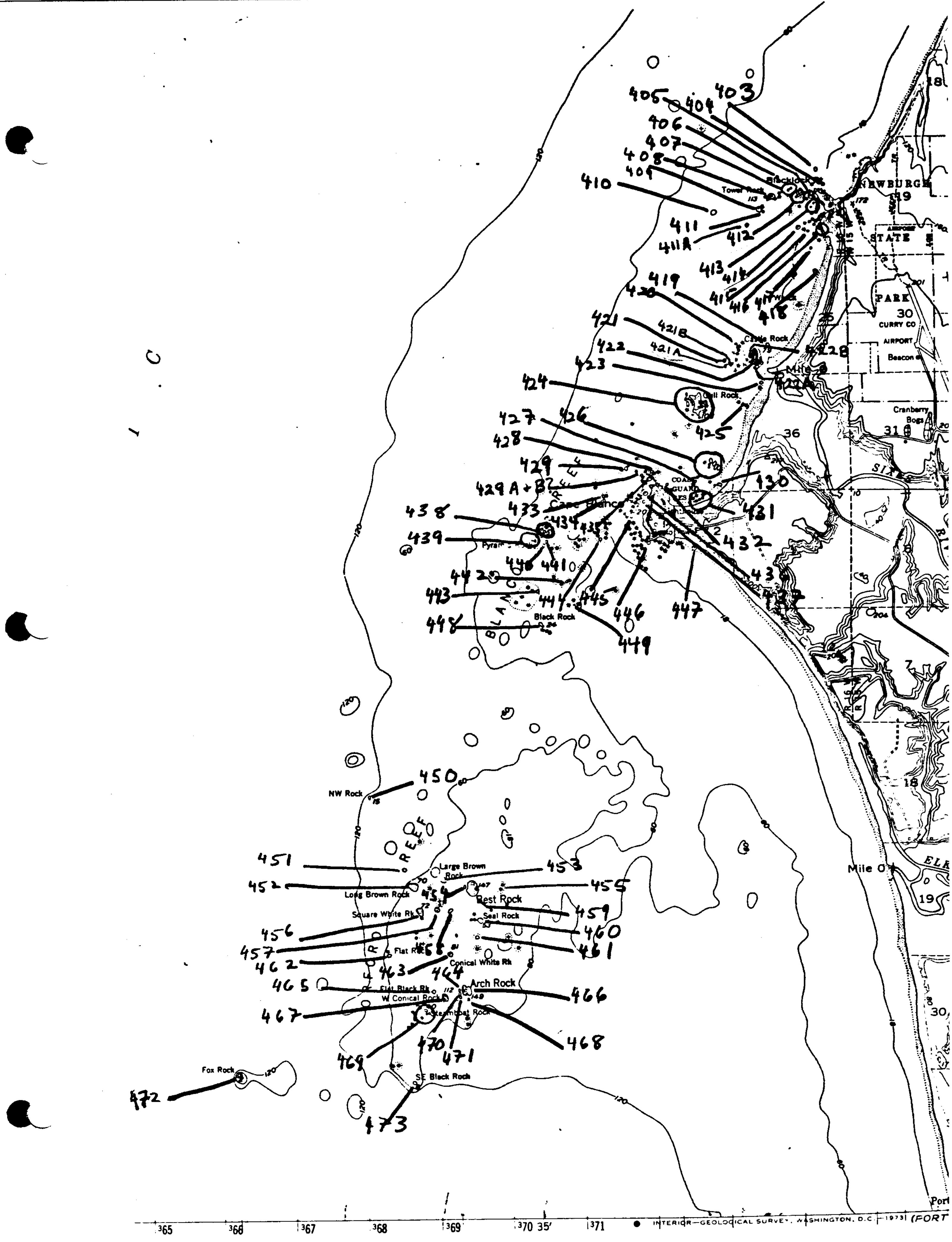
UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS




PACIFIC
Bandon
Coquille River L H
Bradley Lake
Dew Valley
Laurel Lake
Langlois 6 mi.
Gold Beach 47 mi.
520 000 FEET
940 000 FEET
43° 00'
124° 30'
R. 15 W.
R. 14 W.
T 29 S.
T 30 S.
Mapped by the Geological Survey
1942-1943
Only landmark buildings are shown
SCALE 1:62500

OREGON—CURRY CO.
15 MINUTE SERIES (TOPOGRAPHIC)




403
404
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411A
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421
421A
421B
422
422B
422A
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424
425
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427
428
429
429 A + B
430
431
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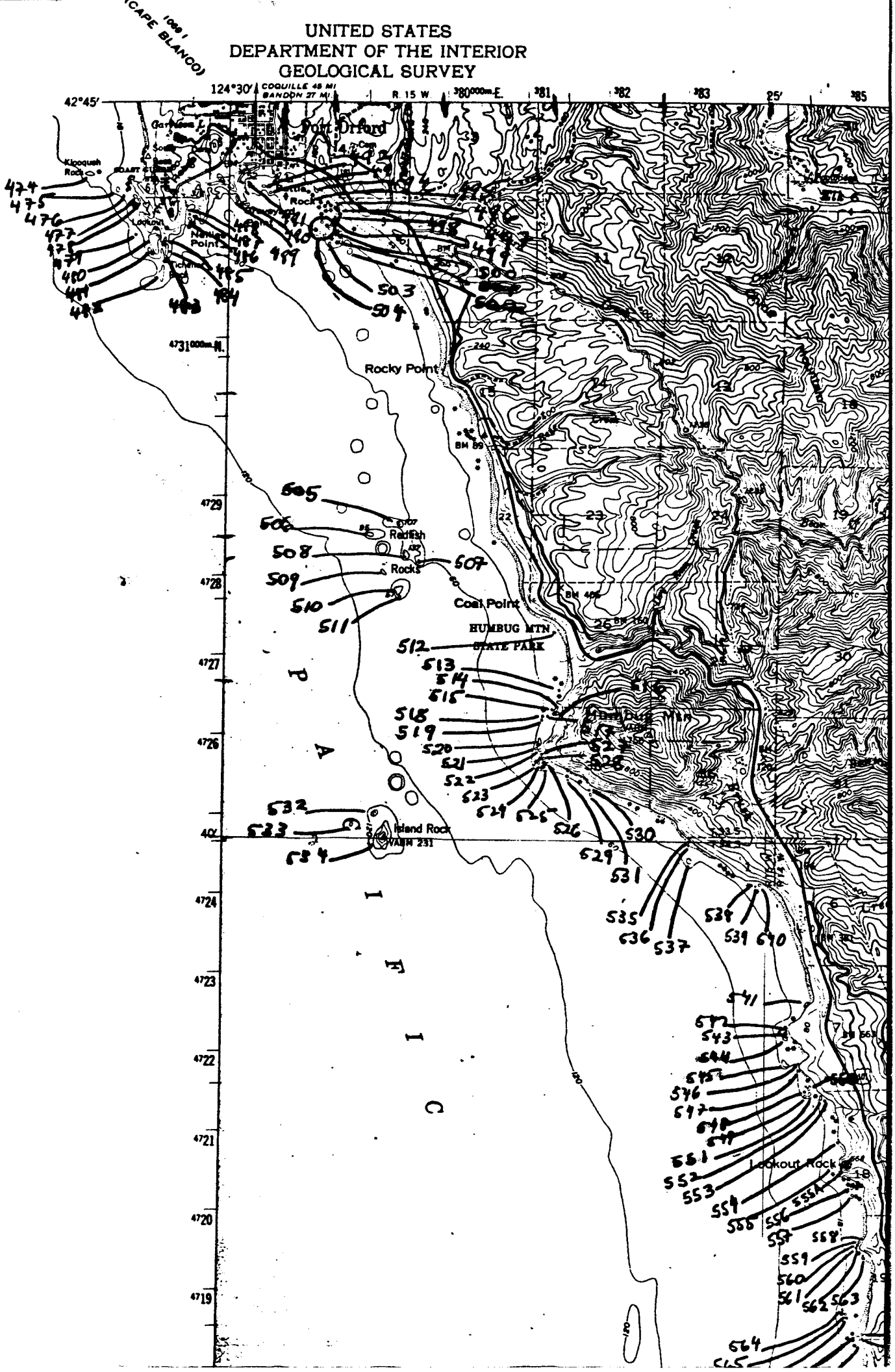
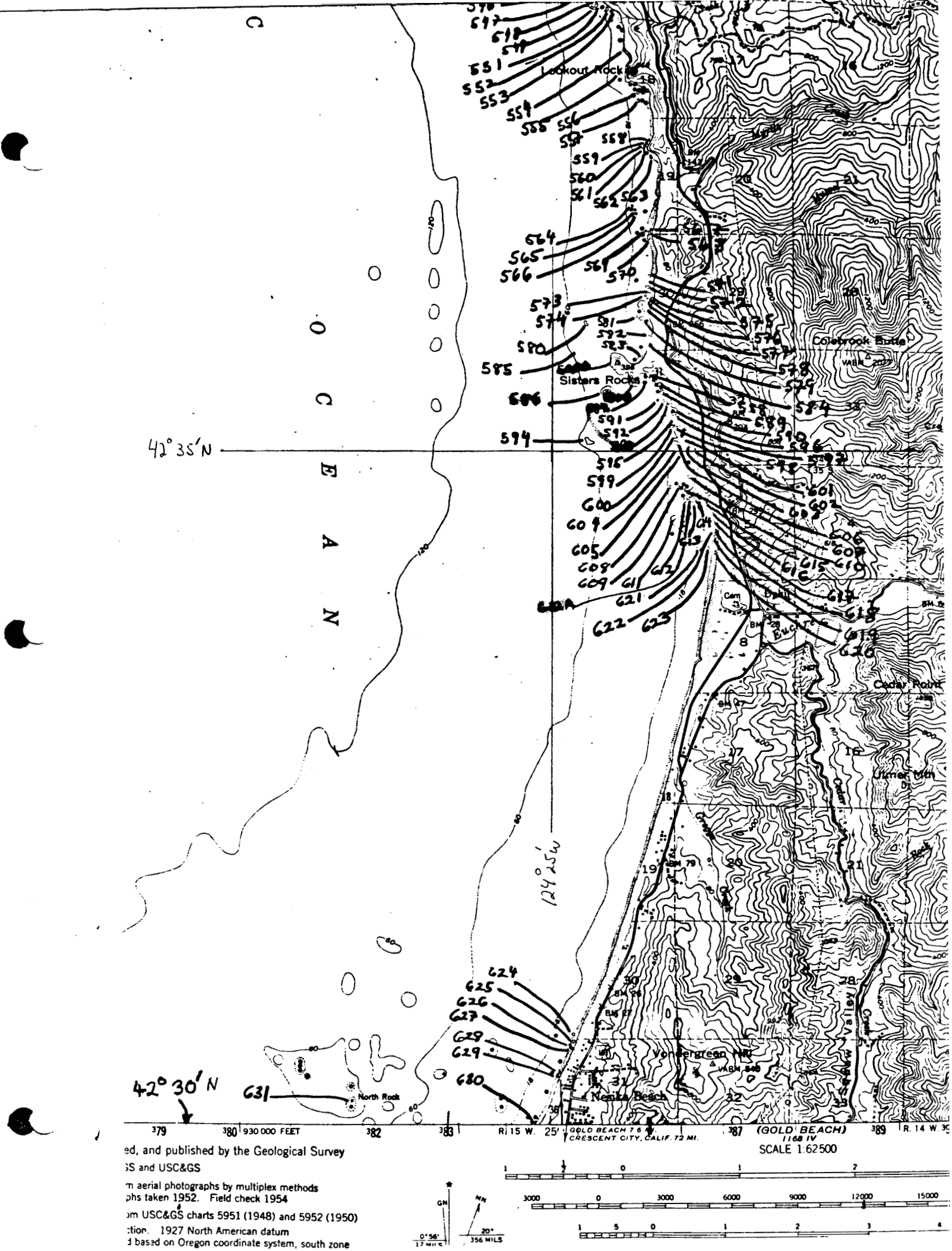
464
465
466
467
468
469
470
471
472
473
Blacklock
Tower Rock
NEWBURGH
STATE
PARK
CURRY CO
AIRPORT
Beacon
Castle Rock
Mile 8
Gull Rock
Cranberry Bogs
COAST GUARD
Cape Blanco
Pyramid
Black Rock
BLANCO
NW Rock
REEF
Large Brown Rock
Long Brown Rock
Rest Rock
Square White Rk
Seal Rock
Flat Rock
Conical White Rk
Flat Black Rk
Arch Rock
W Conical Rock
Steamboat Rock
Fox Rock
SE Black Rock
Mile 0
ELK
120
60
365
366
367
368
369
370 35′
371
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973
(FORT


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Port Orford
Rocky Point
Redfish Rocks
Coal Point
HUMBUG MTN
STATE PARK
Humbug Mtn
Island Rock
Lookout Rock
PACIFIC



ed, and published by the Geological Survey

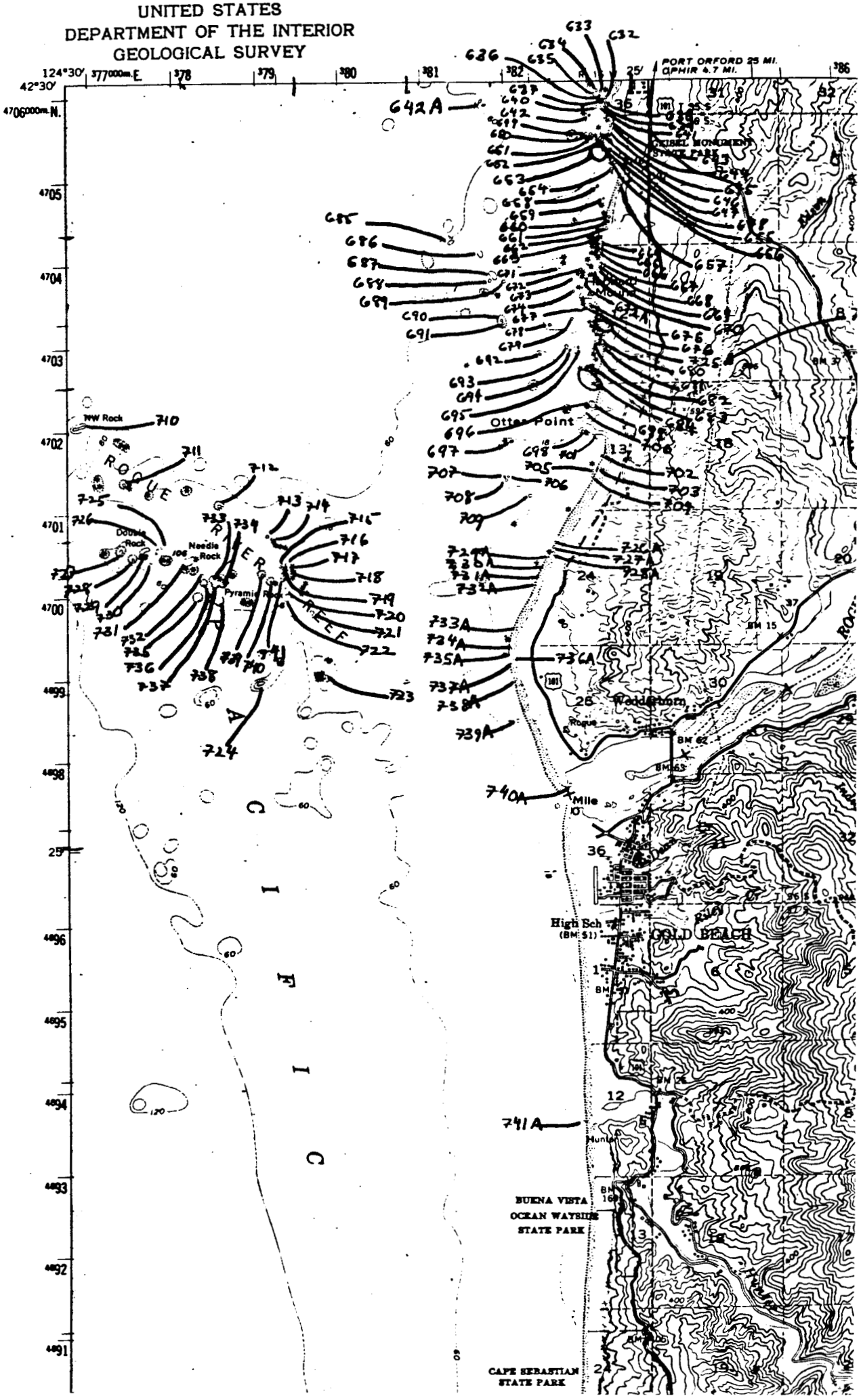
S and USC&GS

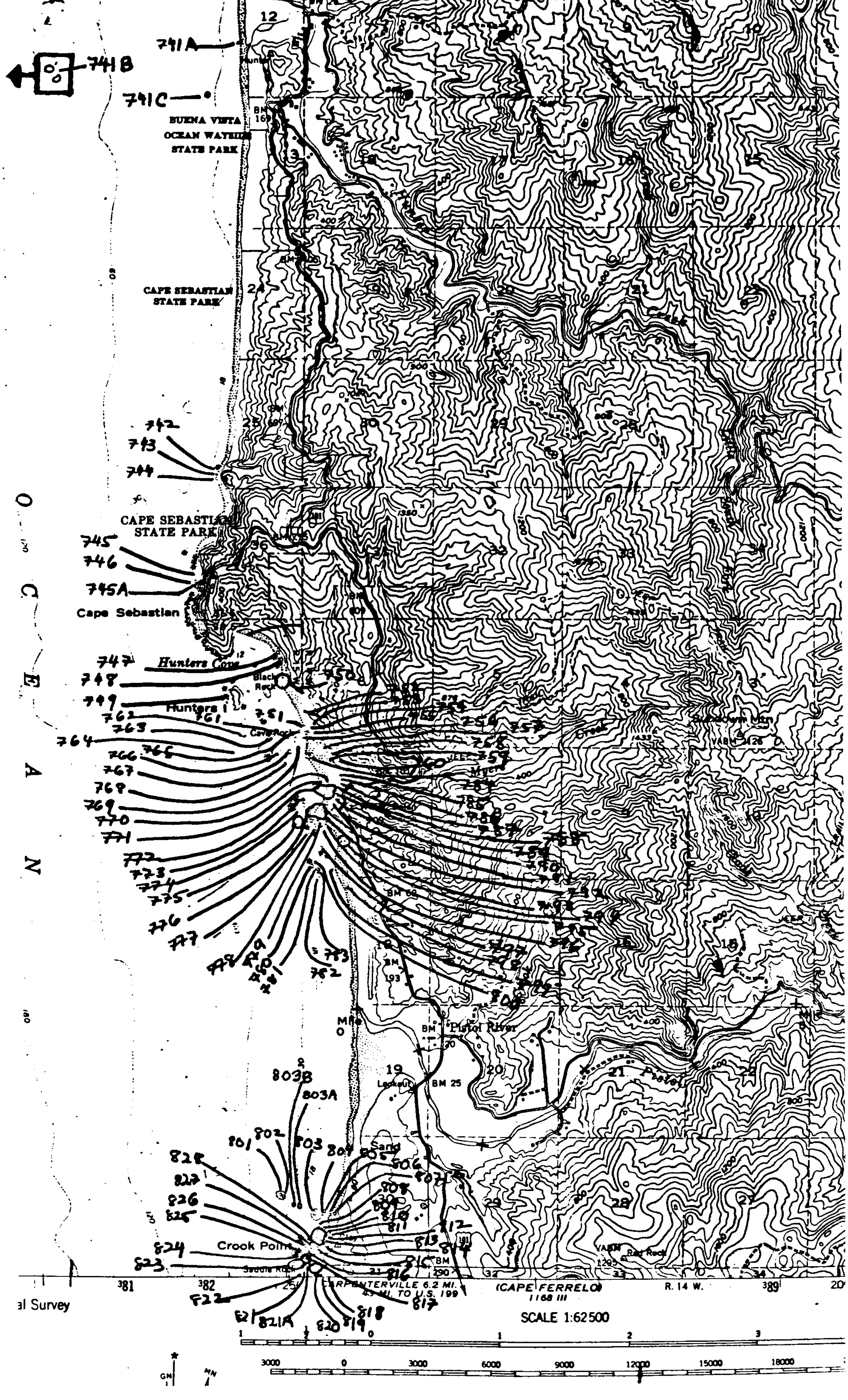
n aerial photographs by multiplex methods
phs taken 1952. Field check 1954

om USC&GS charts 5951 (1948) and 5952 (1950)

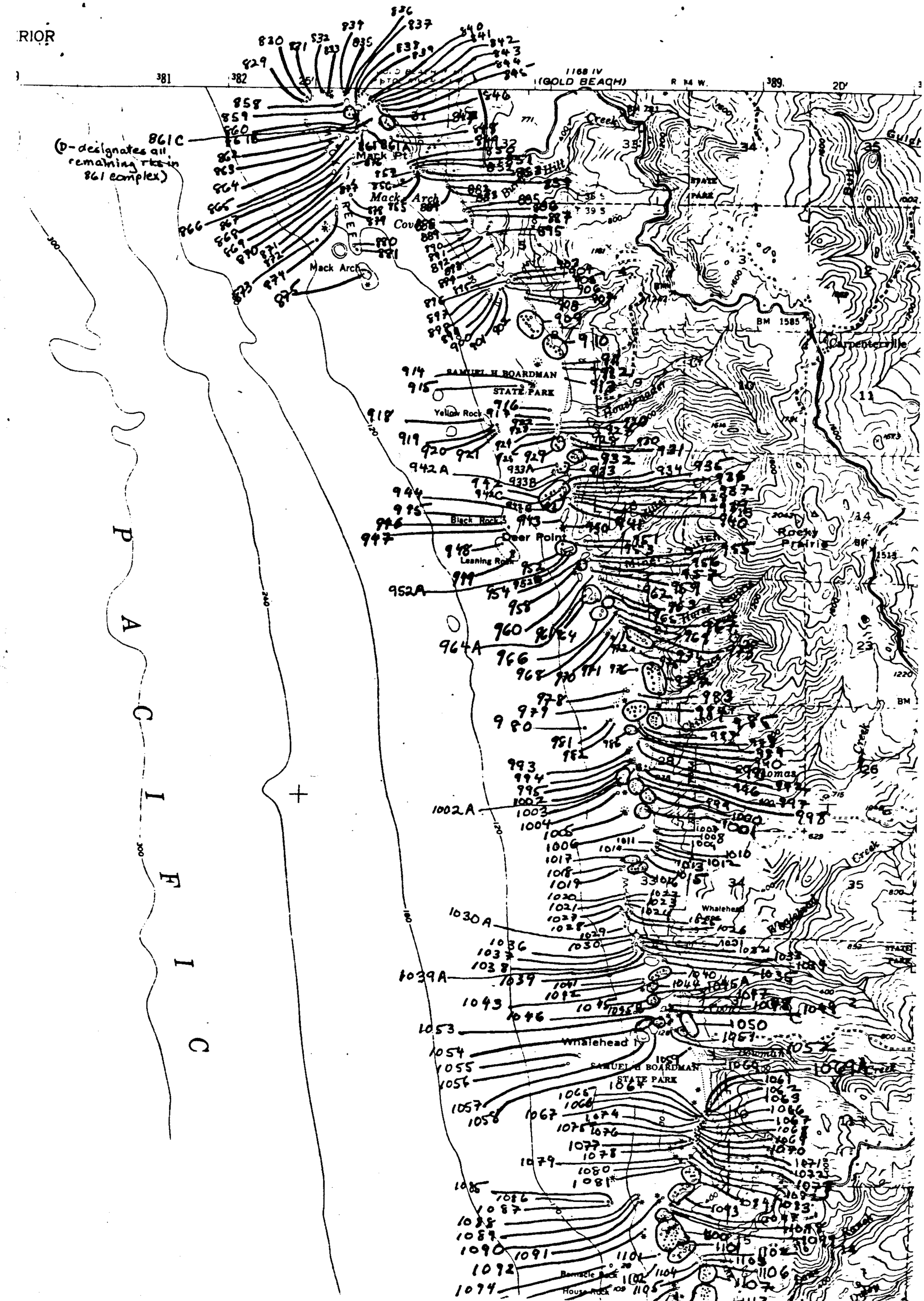
tion. 1927 North American datum

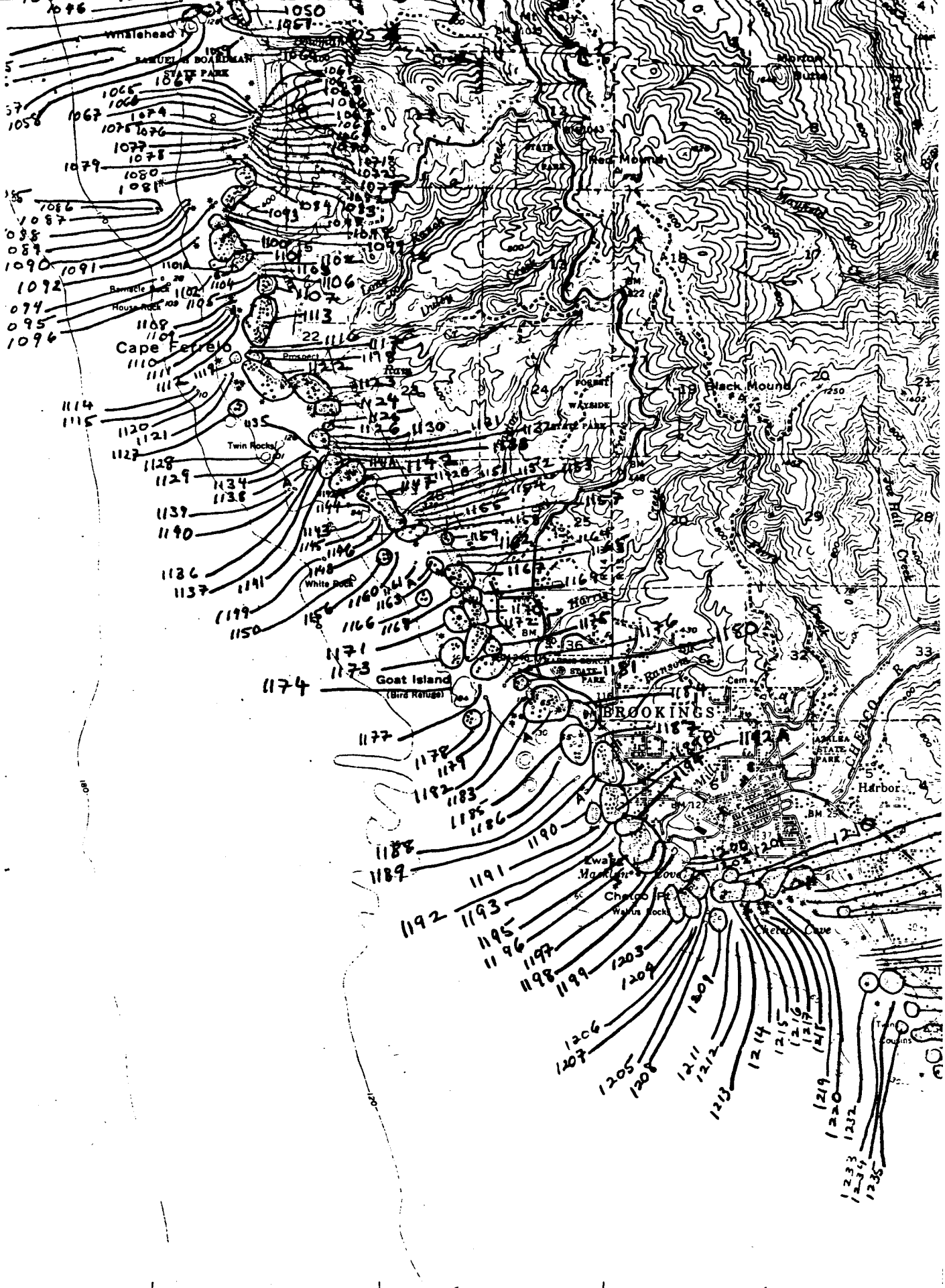
d based on Oregon coordinate system, south zone


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
124°30'
42°30'
377000m.E.
4706000m.N.
PORT ORFORD 25 MI.
OPHIR 4.7 MI.
Otter Point
NW Rock
Double Rock
Needle Rock
Pyramid Rock
ROGUE
REEF
Wedderburn
Rogue
GOLD BEACH
High Sch
(BM 51)
Mile 0
BUENA VISTA
OCEAN WAYSIDE
STATE PARK
CAPE SEBASTIAN
STATE PARK
PACIFIC OCEAN



741A
741B
741C
BUENA VISTA OCEAN WAYSIDE STATE PARK
CAPE SEBASTIAN STATE PARK
742
743
744
CAPE SEBASTIAN STATE PARK
745
746
745A
Cape Sebastian
O C E A N
Hunters Cove
747
748
749
Hunters I
Cave Rock
Black Rock
750
751
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
Sunshine Mtn
Pistol River
Lookout
Sand
803A
803B
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
821A
822
823
824
825
826
827
828
Crook Point
Saddle Rock
Bed Rock
CARPENTERVILLE 6.2 MI.
TO U.S. 199
(CAPE FERRELO)
1168 III
R. 14 W.
381
382
389
al Survey
SCALE 1:62500


1168 IV
(GOLD BEACH)
R 14 W.
381
382
389
861C
(D-designates all remaining rks in 861 complex)
Mack Pt
Mack Arch
REEF
Cove
Mack Arch
Carpenterville
SAMUEL H. BOARDMAN
STATE PARK
Yellow Rock
Black Rock
Deer Point
Leaning Rock
Rocky Prairie
Creek
Whalehead
Whalehead Is
SAMUEL H. BOARDMAN
STATE PARK
Barnacle Rock
House Rock
P A C I F I C



385 386 388 389 20' 391 395000m E.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1965

124

SCALE 1:62500

1 2 3 4 MILES

6000 9000 12000 15000 18000 21000 FEET

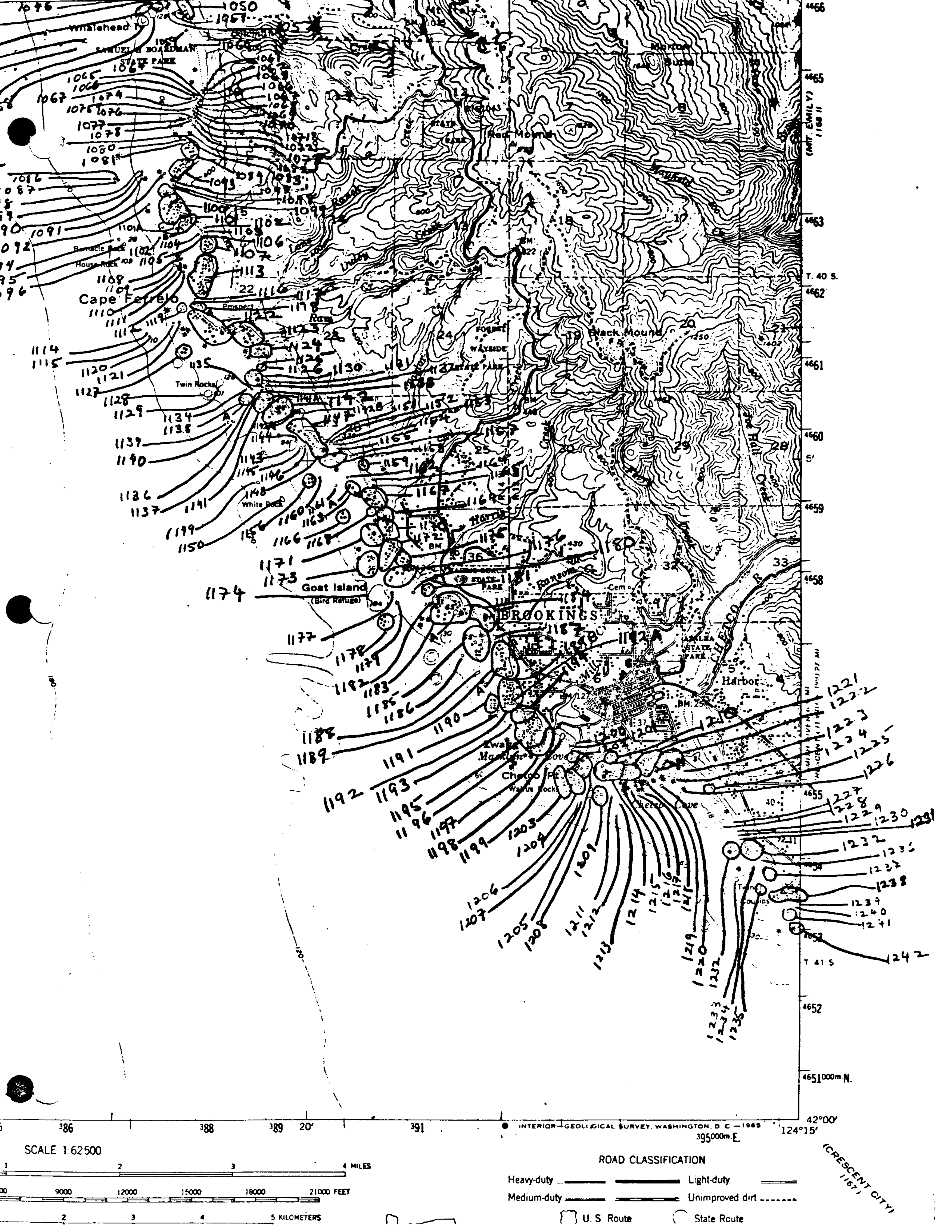
1 2 3 4 5 KILOMETERS

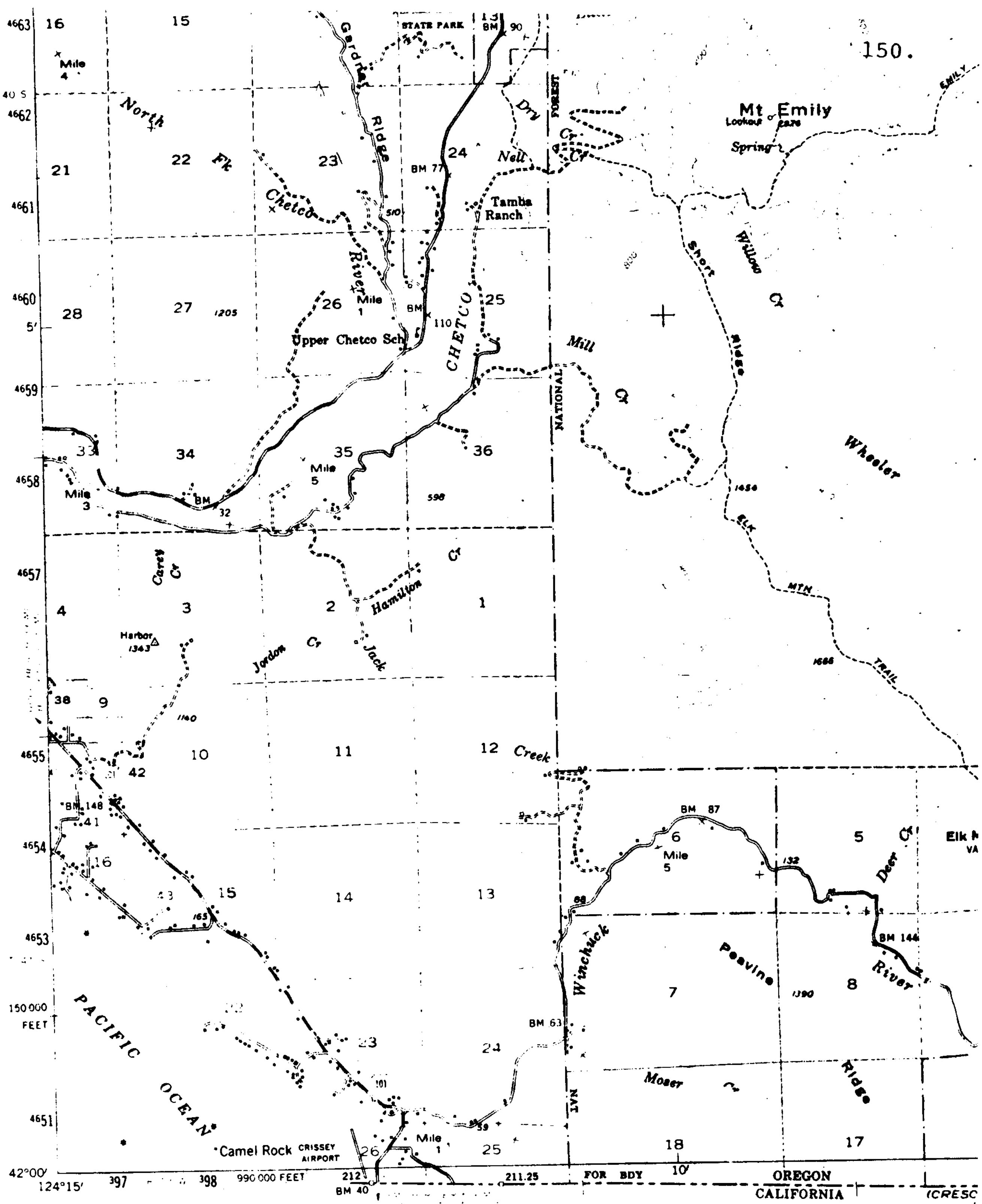
ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

U.S. Route — State Route


Whalehead
SAMUEL H BOARDMAN STATE PARK
Red Mound
Barnacle Rock
House Rock
Cape Ferrelo
Prospect
Twin Rocks
White Rock
FOREST WAYSIDE
Black Mound
Goat Island
(Bird Refuge)
BROOKINGS
HARRIS BEACH STATE PARK
AZALEA STATE PARK
CHETCO R.
Harbor
Chetco Pt
Chetco Cove
Twin Cousins
T. 40 S.
T 41 S
4651000m N.
42°00'
124°15'
395000m E.
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D C—1965
SCALE 1:62500
MILES
FEET
KILOMETERS
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U S Route
State Route
(CRESCENT CITY)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1952. Field check 1954

Hydrography compiled from USC&GS Chart 5896 (1951)

Polyconic projection. 1927 North American datum
10,000 foot grid based on Oregon coordinate system, south zone

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

1000 meter Universal Transverse Mercator grid ticks
zone 10, shown in blue

UTM GRID AND 1954 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CONTOUR IN
NATIONAL GEODETIC
DEPTH CURVES IN FEET—DA

SHORELINE SHOWN REPRESENTS THE
THE AVERAGE RANGE OF

THIS MAP COMPLIES WITH NA
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENV
A FOLDER DESCRIBING TOPOGRAPHIC M