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THE STATE OF SCIENTIFIC INFORMATION RELATING TO THE BIOLOGY AND ECOLOGY OF THE GORDA RIDGE STUDY AREA, NORTHEAST PACIFIC OCEAN: SEABIRDS

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NOTICE

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The Oregon Department of Geology and Mineral Industries is publishing this paper because the subject matter is consistent with the mission of the Department. To facilitate timely distribution of information, camera-ready copy submitted by the authors has not been edited by the staff of the Oregon Department of Geology and Mineral Industries.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

THE STATE OF SCIENTIFIC INFORMATION RELATING TO THE BIOLOGY AND ECOLOGY OF THE GORDA RIDGE STUDY AREA, NORTHEAST PACIFIC OCEAN:

SEABIRDS

INTRODUCTION

Briggs, Tyler, Lewis, and Dettman (1983) conducted aerial surveys of the distribution and abundance of seabirds out to 185 km off central and northern California during 1980-1983. Their study area included the region between 40°-42°N and 125°-126.5° W, i.e., the southeastern portion of the Gorda Ridge Study Area (Figure 1). Theirs are the only systematically collected time series data on the distribution and abundance of seabirds available for the study area. Earlier investigators (e.g., Yocum 1947a and 1947b, Kenyon 1950, Thompson 1951, McHugh 1955; Hamilton 1958, Holmes 1964, and Sanger 1970) recorded numbers of birds observed from ships passing through waters off Washington, Oregon, and northern California. Their reports of maximum numbers of birds seen at any one time may be heavily biased toward species which are attracted to vessels. Wahl and Heinemann (1979) quantified the degree of attraction of 16 species (the black-footed albatross, northern fulmar, and California gull in particular) that were significantly more abundant within 6 km of fishing vessels than at greater distances. Sooty shearwaters and fork-tailed storm-petrels did not appear to be attracted to vessels.

The data of Briggs et al. (1983), summarized by Dohl et al. (1983), indicate that species predominant seaward of the 2,000 m isobath off northern California during 1980-1983 were the northern fulmar, Leach's storm-petrel, Cassin's auklet, red and red-necked phalaropes, black-legged kittiwake, and rhinoceros auklet. Overall densities were highest during spring (April-June), when breeding Leach's storm-petrels, and summer (July-September), when migrating phalaropes, were present.

Only Leach's storm-petrels and common murres nest in large numbers along the coastline inshore of the proposed lease area (Varoujean 1979, Sowls et al. 1980). The largest colonies occur at Castle Rock (41° 45' N) in northern California and Hunters, Crook Point, Whalehead, and Goat Islands (42° 03' N to 42° 18' N) and Three Arch Rock (45° 27' N) in southern and central Oregon. Densities of Leach's storm-petrels and common murres are relatively high over the shelf seaward of these islands during summer.

Some information on feeding habits is available for sooty shearwaters, Leach's storm-petrels, and common murres collected at unspecified locations off Oregon by Wiens and Scott (1975) (Table 1). Briggs et al. (1984) examined the gut contents of red and red-necked phalaropes collected from frontal zones off central California. These represent the only information available pertinent to the use of resources by seabirds in the Gorda Ridge Study Area.

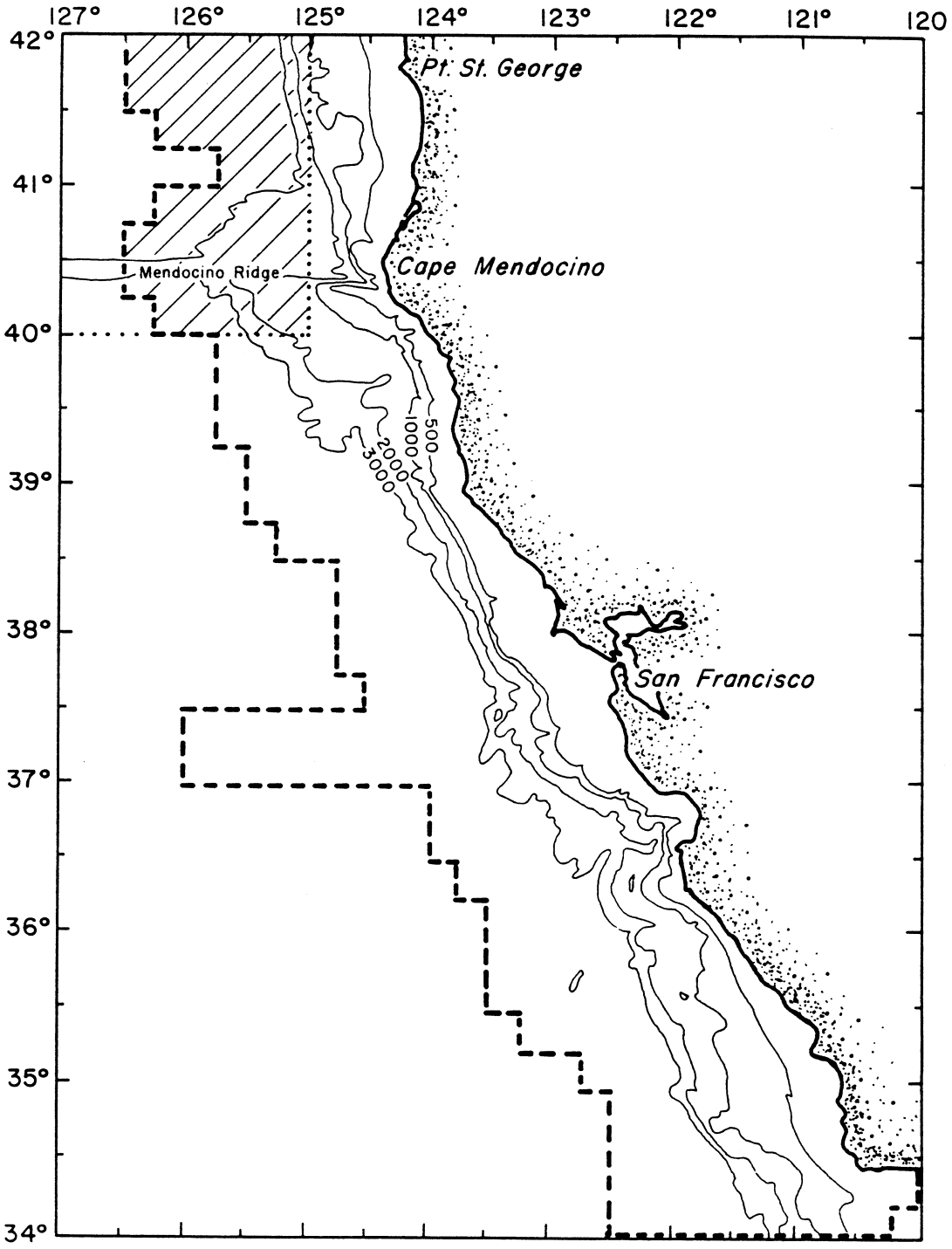

Figure 1. Area surveyed for distribution and abundance of seabirds by Briggs et al. (1
Area of overlap with the Gorda Ridge Study Area indicated by cross-hatching.

SEABIRDS

Table 1. Relevant information on the feeding habits of seabirds in the proposed Gorda Ridge Lease Area and other areas of interest.

Species	Authors	Location	Prey
Sooty Shearwater	Wiens & Scott (1975)	Oregon	no. anchovy cephalopods
Leach's Storm-petrel	Wiens & Scott (1975)	Oregon	hydrozoans euphausiids cephalopods
	Ainley & Sanger (1979)	Farallon Is., CA	euphausiids barnacles fish carrion offal
Red and Red-necked Phalaropes	Briggs et al. (1984)	47-49 km off Pt. Reyes, CA	fish eggs cypriid larvae euphausiids
		59-72 km off Pt. Montara, CA	fish eggs cypriid larvae euphausiids
		just seaward of shelf break off Davenport, CA	Calanus sp. brachyuran larvae fish eggs euphausiids
Common Murre	Wiens & Scott (1975)	Oregon	herring anchovies smelts cods sculpins

The young of most species of seabirds attain adult body weight by the time they fledge. Therefore, except for indirect effects on the foraging capabilities of adults, conditions at sea do not affect the process of growth. There are exceptions within the family Alcidae, one of which is the common murre. The chick of the common murre leaves the nest 19-24 days after hatching (Manuwal 1984). Unable to forage for itself, it is accompanied by a male parent at sea (D. Varoujean, pers. comm.). Briggs et al. (1983) noted that postfledging dispersal of parent-chick pairs began by late July each year off central and northern California. Movement was predominantly south over waters of the continental shelf.

No studies of seabird behavior have been conducted in the Gorda Ridge Study Area. The attraction of black-footed albatrosses, northern fulmars, and California gulls to vessels, as quantified by Wahl and Heineman (1979) may render them especially susceptible to fouling by oil. Similarly, the amount of time which common murres spend sitting at the surface while foraging and the flightless condition of adults and young during the late summer-early fall molt (P. Harrison 1983) may explain why this species frequently comprises more than 90% of all birds killed in oil spills (Manuwal 1984).

SEABIRD DENSITIES AND MOVEMENTS AT SEA

Observations Within The Proposed Gorda Ridge Lease Area

Briggs et al. (1983) conducted systematic surveys of the distribution and abundance of seabirds over the continental shelf and slope to 185 km off central and northern California during 1980 to 1983 (Fig. 1). Their study area overlapped the southeastern portion of the proposed Gorda Ridge Lease Area (i.e., 40°-42° N x 125°-126.5° W). Their results, with those of other authors as cited, are presented below.

Black-footed Albatross, Diomedea nigripes

The black-footed albatross was present year-round off northern California. Peak numbers occurred during late spring and summer when breeders and juveniles dispersed from colonies in the Northwest Hawaiian Islands (Rice 1984). Densities were generally less than 1 bird/km^2 although black-footed albatrosses have consistently been described as abundant seaward of the continental shelf by shipboard observers (Table 2). The discrepancy probably derives from the well known attraction of this species to floating objects, including ships (Yocum 1947a). Surveys conducted from airplanes (e.g., Briggs et al. 1983) avoid this bias.

Table 2. Shipboard records of black-footed albatross sightings.

Author	Pub. Date	Date & Location of Observation	Abundance
Yocum	1947	July-Sept. 1945 135°W off C. Blanco, OR	Generally abundant with maximum number observed at any one time between 53 and 95.
Kenyon	1950	Dec. 1948 Unalaska, AK to San Francisco, CA, to Cape Flattery, WA	Common ship followers
Thompson	1951	Jan., May, June-Aug., & Oct. - Dec. San Francisco, CA to Honolulu, HI	Concentrated over cold waters of the California current. Maximum number observed at any one time decreased west of 135°W.
Hamilton	1958	June 1955 Japan to Seattle, WA	Abundant in warm waters off Japan and cold waters off Seattle.
Sanger	1970	May, Aug., & Oct. 1964, & Jan. 1965.	Present year-round with peak abundance and frequency of occurence in summer, minimum in winter.

SEABIRDS

Laysan Albatross, D. immutabilis

One Laysan albatross was observed in the proposed Gorda Ridge Lease Area.

Northern Fulmar, Fulmarus glacialis

Peak numbers and the widest distribution of northern fulmars occurred off northern California from October-April. Numbers of fulmars varied widely from year to year. In years when December to January populations were low, fulmars usually disappeared from northern California waters by May. Populations that remained through mid-summer, rather than migrating north to breeding colonies in the Bering Sea and Gulf of Alaska, appeared to be remnants of above average influxes of birds the preceding winter. During autumn (October-December), fulmar densities were highest over the shelf and slope (ranging locally to 54 birds/km^2). By the end of January, densities and total numbers shifted toward slope and offshore waters (also to 54/km^2). Briggs et al. (1983) suggested that higher densities offshore in winter and early spring were due to the discharge of river water lowering surface salinities near the coast.

Sooty Shearwaters, Puffinus griseus

Sooty shearwaters migrate northward from breeding colonies in the southern hemisphere and arrive along the west coast of North America in late March. Peak abundance off northern California was reached in May-July. During this period, sooty shearwaters are among the most numerous of all seabirds in the eastern North Pacific. The size of the North Pacific wintering population has been estimated at 30 million individuals (Shallenberger 1984). Briggs et al. (1983) report that sooty shearwaters occurred primarily in cooler waters over the shelf. High densities of shearwaters (locally more than 54 birds/km^2 in June 1981) were found over the shelf off Trinidad Head. Desities were relatively low (less than 1 bird/km^2) seaward of the shelf during this period. In one year of their study Briggs et al. (1983) observed higher numbers of sooty shearwaters in August and September than in the preceding spring. This may have been the result of attraction to post-spawning aggregations of anchovies.

Fork-tailed Storm-Petrel, Oceanodroma furcata

Low numbers of fork-tailed storm-petrels were recorded in all months off northern California but relatively high densities (locally more than 54 birds/km^2, e.g., during July 1981) were found off colonies between 40.5°-41.5° N during summer. Fork-tailed storm-petrels disperse offshore and south as far as southern California in winter (Briggs et al. 1983).

SEABIRDS

Leach's Storm-Petrel, O. leucorhoa

Leach's storm-petrels were more abundant over deep water offshore than over the continental slope. Few were seen over the shelf. Densities were highest over the relatively clear, thermally stratified waters of the California Current, and high densities extended shoreward during summer to thermal fronts marking the outer margins of upwellings. Densities were high (20.00-54.29/km^2) during spring in offshore waters adjacent to breeding colonies. By midsummer, Leach's storm-petrels were widely distributed offshore at all latitudes surveyed, indicating an influx of non-breeding birds. Leach's storm-petrels were widely distributed offshore at all latitudes surveyed, indicating an influx of non-breeding birds. Leach's storm-petrels are believed to winter in tropical and subtropical waters but their migratory habits are poorly known (P. Harrison 1984).

Red Phalarope, Phalaropus fulicaria, and Red-necked Phalarope, P. lobatus

Observers are generally unable to distinguish these two species from aircraft and therefore combine them. Phalaropes concentrated near the coast of northern California in spring, over the continental shelf and slope in spring and fall, and seaward of the shelf in winter. Densities were generally less than 1 bird/km^2. Phalaropes breed in the arctic. The northeast Pacific population winters off the coast of California, Mexico, and probably South America (Briggs et al. 1983).

Pomarine Jaeger, Stercorarius pomarinus

Pomarine jaegers were recorded throughout the year. During fall migration (August-September) most birds were seen in slope and offshore waters but densities shifted to the shelf in October. From February-July, higher densities were seen offshore than on the shelf but densities were typically less than 1 bird/km^2. Pomarine jaegers nest in the arctic. The majority of the North Pacific population appears to winter off southeast Australia with smaller numbers off Hawaii and Central and South America (P. Harrison 1984).

Long-tailed Jaeger, S. longicaudus

One individual was recorded from the proposed lease area. Long-tailed jaegers also nest in the arctic and evidence suggests wide dispersal south to about 50°S during the non-breeding season (P. Harrison 1984).

South Polar Skua, Catharacta maccormicki

One skua was sighted seaward of the shelf break off Cape Mendocino. South polar skuas nest in Antarctica. Adults undertake only a limited annual migration whereas juveniles move into the North Pacific and some remain throughout the year (P. Harrison 1984).

California Gull, Larus californicus

California gulls are rarely reported seaward of the shelfbreak, although Briggs et al. (1983) saw them regularly at low densities (less than 1 bird/km^2) to at least the mid-shelf region off central California. California gulls nest inland and winter along the Pacific coast from British Columbia south to Baja California (P. Harrison 1984).

Herring Gull, L. argentatus

Herring gull densities were generally highest over the continental shelf but a substantial portion of the population occurred in slope and offshore waters during December-March. Local densities reached 20-54 birds/km^2 during winter. Herring gulls nest inland and along the coast in the subarctic and the northeast Pacific population winters along the coast south to Mexico and Panama (P. Harrison 1984).

Western Gull, L. occidentalis

Densities of western gulls off northern California were inversely correlated with distance from land and water depth, indicating a preference for neritic habitats. In late summer-early winter, western gulls occurred seaward of the shelf to the middle or outer slope (75-95 km offshore), with largest numbers seaward of the region from Point Montara to Bodega and from Eureka to the Klamath River. Local densities were typically less than 1 bird/km^2 but varied locally up to 7-20 birds/km^2 off Cape Mendocino (e.g., November 1981). Western gulls breed along the coast from British Columbia through northern California. Little north-south movement occurs outside the breeding season (P. Harrison 1984).

Glaucous-winged Gull, L. glaucescens

Densities of glaucous-winged gulls off northern California were highest over the shelf but moderate numbers visited slope and offshore waters during winter. Densities were typically less than 1 bird/km^2 (e.g., December 1980 and February 1982). Glaucous-winged gulls breed in the Bering Sea and Gulf of Alaska south to northwest Washington. Wintering birds occur north to the ice-edge in the Bering Sea and south to Baja California (P. Harrison 1984).

Black-legged Kittiwakes, Rissa tridactyla

Black-legged kittiwakes are more characteristic of pelagic waters than are other species of gulls. Mean monthly densities off northern California peaked in mid-winter (i.e., January-February). Local densities were usually 3 to 54 birds/km^2 but occasionally were nore than 54 birds/km^2 (e.g., February 1981). Black-legged kittiwakes nest in the Gulf of Alaska and

SEABIRDS

Bering Sea and winter over shelf and slope waters as far south as Baja California (Briggs et al. 1983 and P. Harrison 1984).

Sabine's Gull, Xema sabini

Sabine's gulls were recorded off northern California during April-September in 1980 and during May-October in 1981 and 1982. Except during migration, when Sabine's gulls were uniformly distributed, densities were highest over the continental slope and lowest over the shelf. Nine sightings were made of 1-5 birds each.

Arctic Tern, Sterna paradisaea

Although difficult to distinguish from common terns (S. hirundo), to moderate numbers of arctic terns migrated north past northern California in April-May and south in August-October. The ratio of arctic to common terns increased with distance from shore, although sightings barely extended into the portion of the study area which overlaps the proposed lease area. Densities ranged up to 3-7 birds/km^2. This species nests in arctic and subarctic regions and winters in the Southern Ocean (P. Harrison 1984).

Common Murre, Uria aalge

Common murres were most abundant over the continental shelf off northern California; approximately 80% of the total observed were in this zone. High densities of murres were often found near the shelf break downstream (i.e., south) and seaward of upwellings at Cape Blanco, Oregon and Cape Mendocino, California, offshore from major colonies. Local densities were typically less than 1 bird/km^2 during summer. Densities were higher during winter when immigrants from northern colonies occupied California waters and local breeders dispersed offshore. During this period, local concentrations of 60-200 birds/km^2 were common between Cape Mendocino and Point St. George.

Cassin's Auklet, Pytchoramphus aleuticus

A cyclic shift was observed in the abundance of Cassin's auklets between depth zones each year. This species was most abundant in the coastal upwelling zone during summer but resided in waters deeper than 2,000 m during winter. Local densities were typically less than 1 bird/km^2.

Rhinoceros Auklet, Cerorhinca monocerata

The distribution of wintering rhinoceros auklets off northern California in 1980-1983 was similar to that of Cassin's auklets. Rhinoceros auklets were usually found somewhat farther offshore however and most moved to breeding areas north of California during summer. Local densities

reached 3-7 birds/km² during winter (e.g., February 1981). Colonies occur discontinuously along the coast from southern Alaska to the Farallon Islands, California, and birds move somewhat south from their respective colonies during the non-breeding season (P. Harrison 1984).

Tufted Puffin, Fratercula cirrhata

Observers were not always able to distinguish tufted from horned puffins during aerial surveys but tufted puffins were occasionally recognized during February-April. A total of nine signtings of tufted and unidentified puffins were made during the three year study. Tufted puffins are thought to disperse into oceanic habitats during winter (P. Harrison 1984) so that abundances within the proposed lease area may prove to be high.

Horned Puffin, F. corniculata

Five horned puffins were sighted off central and northern California during February-May 1980-1983. Horned puffins also winter at sea but are probably much less abundant than tufted puffins in waters off Oregon (P. Harrison 1984).

Other Relevant Studies

No systematically collected time series data are available on the distribution and abundance of seabirds seaward of the continental shelf off British Columbia, Washington, or Oregon. However, the aerial surveys conducted by Briggs et al. (1983) extended south from the Oregon/California border to Point Conception. Typical densities south of 40° N as reported by these authors and shipboard sightings published by others are discussed below.

Black-footed Albatross

Black-footed albatross densities were highest over the continental slope, slightly lower over the outer shelf, and much lower farther offshore and south of Point Sur. Areas of concentration (local densities of 7-54 birds/km²) occurred off Point Reyes and Monterey Bay. During a cruise from San Francisco to Hawaii, Thompson (1951) observed that black-footed albatrosses concentrated over the cold waters of the California current and that the maximum number seen per day decreased west of 135° W.

SEABIRDS

Laysan Albatross

Most of the 33 sightings of Laysan albatrosses occurred seaward of the shelf break. All but two were made between November and April, all but five occurred north of Monterey Bay.

Sanger (1970) noted a pronounced seasonal cycle in the abundance of this species off Oregon and Washington, with peak abundance during winter. He suggested that these birds were prebreeding juveniles. Abundance appeared to be inversely correlated with sea surface temperature.

Short-tailed Albatross, D. albatrus

The short-tailed albatross was extirpated from most of its nesting islands in the western Pacific by feather hunters and is now an exceedingly rare visitor to waters off the west coast of the U.S. Only three have been sighted since 1946; the most recent was 80 km off Monterey Bay in April 1980. The world population now numbers approximately 250 individuals and is slowly increasing (Briggs et al. 1983).

Northern Fulmar

During months of maximum abundance (October-March), fulmars were most abundant from Point Pinos to Bodega and least abundant south of Point Sur. Densities ranged up to more than 54 birds/km^2 off Point Reyes in December 1981.

Sooty Shearwater

Sooty shearwaters concentrated in waters with sea surface temperatures between 11-14°C. Densities over the continental slope typically ranged from less than 1 to 20-54 birds/km^2. Hamilton (1958) reported that sooty shearwaters were most abundant between 135° W and 155° W at latitude 45° N.

Fork-tailed Storm-Petrel

During spring and summer most fork-tailed storm-petrels were observed seaward of the shelfbreak, north of Cape Mendocino. During winter, densities of 7-54 birds/km^2 were observed farther south and offshore.

Leach's Storm-Petrel

Leach's storm-petrels concentrated offshore north of Cape Mendocino during spring and dispersed seaward of the shelf later in the year. Populations were relatively low in fall and winter when the highest densities were found south of San Francisco, seaward of the continental slope.

SEABIRDS

Ducks and Geese, Order Anseriformes

Marine waterfowl occasionally stop offshore to rest during transoceanic migrations to and from breeding grounds in Alaska. Briggs et al. (1983) did not observe ducks within the proposed lease area but Yocum (1947b) sighted three green-winged teal, Anas crecca, and a flock of 200 pintail, A. acuta, at a station 860 km west of Cape Blanco, Oregon. Sanger (1970) recorded a flock of 40 Canada geese, Branta canadensis, flying 650 km off northern Washington during October 1964 and Briggs et al. (1983) reported five sightings of 1-12 brant, B. bernicla, each at distances of up to 90 km from shore during spring (March-May) and fall (November) migrations.

Red and Red-necked Phalaropes

Phalaropes were abundant seaward of the continental shelf during all seasons but summer. Densities in these waters ranged from less than 1 to greater than 54 birds/km^2 during spring and were highest south of San Francisco.

Pomarine Jaeger

The distribution of pomarine jaegers was similar throughout northern and central California. Highest numbers offshore were seen during migration (February-July and August-September) but densities were typically less than 1 bird/km^2.

Parasitic Jaeger, S. parasiticus

Most of the 13 sightings of parasitic jaegers were made at, or seaward of, the shelfbreak. Parasitic jaegers nest in the arctic and the bulk of the Pacific population appears to winter in the littoral zone off South America (P. Harrison 1984).

Long-tailed Jaeger

Six sightings of long-tailed jaegers were made at, or seaward of, the shelf break. Long-tailed jaegers also nest in the arctic and evidence suggests wide dispersal to about 50°S during the non-breeding season (P. Harrison 1984).

South Polar Skua

Twelve south polar skuas were sighted seaward of the shelf break.

SEABIRDS

California Gull

California gulls increased in numbers in waters over the slope in fall with local densities of up to 75 birds/km^2. Density seaward of the shelf break declined 60-85% during winter as the population moved inshore.

Herring Gull

Herring gull numbers peaked during December-February. Densities were highest over the continental shelf but a substantial portion of the population visited slope and offshore waters during these months. Densities were higher north of Point Sur than farther south. Sanger (1970) reported a pronounced seasonal cycle in the abundance of herring gulls off Washington and Oregon with maximum numbers occurring in winter and none observed during summer.

Western Gull

Western gulls occurred seaward to the middle or outer continental slope in late summer to early winter with largest numbers off Point Montara to Bodega. Later in winter, western gulls were frequently seen 50-60 km off central California but in all seasons, densities were highest inshore.

Glaucous-winged Gull

Densities of glaucous-winged gulls were generally highest on shelf waters with moderate numbers over slope and offshore waters during winter. Fewer birds were seen south of Point Sur than farther north. Sanger (1970) noted that glaucous-winged gulls were surprisingly frequent and locally abundant off Oregon and Washington (130°-138° W).

Black-legged Kittiwake

Kittiwakes were abundant over and seaward of the continental slope. Densities peaked in mid-winter at approximately 3 birds/km^2. Interannual variation was seen in the north-south distribution of this species.

Sabine's Gull

Except during peak migration (April-May and September-October) when distribution was relatively uniform, Sabine's gulls were most abundant over the continental slope and least abundant over the shelf.

SEABIRDS

Arctic Tern

Arctic terns appear to frequent relatively clear, warm waters seaward of coastal upwelling. Overall densities were highest from Point Arena to Point Sur.

Common Murre

Common murres mainly occupy the continental shelf, specifically cool upwelled waters downstream (south) of major coastal promontories. In only 4 of 36 surveys were more than 20% of the murres sighted seaward of the continental shelf.

Cassin's Auklet

High density feeding flocks (100-150 birds/km^2) were seen over shelf and slope waters from Bodega to Point Ano Nuevo during late spring and summer. Peak numbers (overall mean density 4-8 birds/km^2) were recorded during winter when the bulk of the population occupied waters seaward of the shelf break.

Rhinoceros Auklet

The majority of the rhinoceros auklets sighted occupied waters seaward of the continental shelf. Average densities reached 1.5-2.0 birds/km^2 during winter when the bulk of the population occupied waters between Bodega and Point Conception.

Tufted Puffin

Tufted puffins were numerous in March and April; most occurred beyond the shelf break north of Point Sur. Sightings were made in shelf and slope waters from Point Sur to Bodega in other months. During a cruise from Japan to Seattle, Hamilton (1958) observed that tufted puffins were abundant between 155° and 165° W at latitude 45° N.

Horned Puffin

Low numbers of horned puffins were observed in February through May. Most were well offshore.

SEABIRDS

COLONY SITES AND ESTIMATES OF TOTAL POPULATIONS

Observations Within the Proposed Gorda Ridge Lease Area

Marine birds return to land to nest.

Other Relevant Studies

Black-footed Albatrosses

The world nesting population of black-legged albatrosses is reported by Rice (1984) to number 300,000 individuals. Nesting colonies occur throughout the Northwestern Hawaiian Islands and on several islands in the western Pacific (P. Harrison 1983, Rice 1984). Feather hunters extirpated colonies from Wake and Marcus Islands and from the Marshall, Volcano, and Mariana Islands in the early 1900's.

Laysan Albatross

The world nesting population is reported to number 1.5 million individuals by Rice (1984). Laysans nest on all the northwestern Hawaiian Islands and several of the main Hawaiian Islands. They were extirpated from Torshima, Wake, and Marcus Islands and Johnson Atoll in the western North Pacific but a few pairs were recently found nesting in the Bonin Islands in Japan (Rice 1984).

Northern Fulmar

Northern fulmars nest on islands in the northern Gulf of Alaska and Bering Sea. Two million are estimated to breed in Alaskan waters (Sowls et al. 1978).

Sooty Shearwater

Sooty shearwaters nest in southeast Australia, its offshore islands, Tasmania, New Zealand, and the southern headlands of South America (Shallenberger 1984). No estimates of the total world-wide breeding population are availale.

Fork-tailed Storm-Petrel

Fork-tailed storm-petrels have been identified at six colonies north of Eureka, California (Sowls et al. 1980). The total breeding population numbers approximately 310 birds. Less than a dozen are in Oregon (Varoujean

1979).

Leach's Storm-Petrel

Of the approximately 18,000 Leach's storm-petrels known to breed in California, 91% nest at colonies near Crescent City and Trinidad, California (41° 57'N and 41° 03'N, respectively) (Sowls et al. 1980). More than one million nest on islands along the coast of Oregon between the California border and 42° 19'N (Varoujean 1979). Consequently, most of the California and all of the Oregon breeding population (a total of 1.03 million birds) nest inshore of the proposed lease area.

Red and Red-necked Phalaropes

Phalaropes nest in arctic regions of North America and the Soviet Union (P. Harrison 1984). No estimates of total population size are available.

Pomarine, Parasitic, and Long-tailed Jaegers

Pomarine, parasitic, long-tailed jaegers nest in coastal regions of arctic and subarctic Alaska and Siberia. Jaegers leave their breeding grounds as early as July and migrate to wintering grounds in the southern hemisphere (Maher 1984). No estimates of total population size are available.

South Polar Skua

The south polar skua nests in the Antarctic and migrates as far as the northern Gulf of Alaska each year. No estimates of total population size are available.

California Gull

California gulls nest inland, throughout the Rocky Mountain and desert states east of the Sierra Nevada (Drury 1984) and winter along the Pacific coast from southern British Columbia to the Gulf of California (Briggs et al. 1983). No estimates of total population size are available.

Herring Gull

Herring gulls nest on inland lakes and rivers in northwestern America and Siberia (Drury 1984). They winter on the Pacific coast of North America between Vancouver, B.C., and San Diego, CA. No estimates of total population size are available.

SEABIRDS

Western Gull

According to Varoujean (1979), approximately 1,700 western gulls breed in Oregon. Varoujean and Pitman (1979, cited in Briggs et al. 1983) estimate that the total population in Oregon numbers 9,900 individuals. An additional 3,000 nest along the California coast north of 40°N (Sowls et al. 1980).

Glaucous-winged Gull

Glaucous-winged gulls nest ubiquitously from the Commander Islands (U.S.S.R.) and islands of the southern Bering Sea to northwestern Washington (Sowls et al. 1978). The Alaskan breeding population numbers approximately 500,000 birds.

Black-legged Kittiwake

The majority of the black-legged kittiwake population in the northeastern Pacific breeds along the southern coast of Alaska from Prince William Sound westward to the tip of the Alaska Peninsula (Sowls et al. 1978). A few small colonies occur in southeast Alaska. Sowls et al. (1978) estimate that the total Alaskan population numbers 2,500,000 individuals. As young birds fledge in summer, adult kittiwakes move offshore to shelf and slope waters (Briggs et al. 1983). Juvenile kittiwakes move further south, into southern California waters, by November or early December, especially in warmer years (Briggs et al. 1983).

Sabine's Gull

The breeding distribution of the Sabine's gull is circumpolar in the high arctic (P. Harrison 1984). No estimates of the size of the Alaskan population are available.

Arctic Tern

Arctic terns breed in arctic and subarctic regions of North America, southward along the Pacific coast to British Columbia. The estimated Alaskan coastal breeding population numbers approximately 25,000 birds (Sowls et al. 1978). Arctic terns complete a 35,400 km annual migration, occupying Antarctic waters during the austral summer (C. Harrison 1984).

Common Murre

Common murres are the most abundant seabirds nesting inshore of the proposed lease area. Approximately 236,000 nest in northern California, north of 41°N, more than half at Castle Rock (47° 45'N, 124° 15'W) (Sowls et al. 1980). Another 168,500 nest in Oregon, with the largest colonies at

Cape Meares (45° 30'N) and Cape Blanco (43° 45'N) (Varoujean 1979). Sowls et al. (1978) estimate that the Alaskan breeding population numbers 5 million birds. The California subspecies (U. a. californica) remains near the breeding colonies throughout the year while populations from Alaska and British Columbia (U. a. inornata) move south into northern California during winter (Briggs et al. 1983). Following nesting in Oregon and California, non-breeders and parent-chick pairs move south over the shelf (Briggs et al. 1983).

Cassin's Auklet

Cassin's auklets nest along the Pacific coast from the Aleutian Islands to Mexico. The coasts of Washington, Oregon, and northern California (i.e., shoreward of the proposed lease area) represent a hiatus in their distribution; only 0.25% of the 1.8 million Cassin's auklets which occupy colonies from Alaska to southern California occur there (Sowls et al. 1978).

Rhinoceros Auklet

According to Briggs et al. (1983), approximately 380,000 rhinoceros auklets nest in the northeast Pacific Ocean between Buldir Island, Alaska, and Point Arguello, California. Of these, only 400 nest inshore of the proposed lease area.

Tufted Puffins

An estimated 4 million tufted puffins nest in Alaskan waters (Sowls et al. 1978) compared to 620 which nest off Oregon (Varoujean 1979) and 130 off northern California (Sowls et al. 1980).

Horned Puffins

An estimated 1.5 million horned puffins nest in Alaska (Sowls et al. 1978). Forrester Island, in southeast Alaska, is the southernmost island in the breeding range of the horned puffin in the eastern North Pacific.

FEEDING HABITS

Observations Within the Proposed Gorda Ridge Lease Area

There are no published accounts of the feeding habits of seabirds in the proposed Gorda Ridge Lease Area.

SEABIRDS

Other Relevant Studies

Black-footed Albatross

Ainley and Sanger (1979) list cephalopods, fish (including rockfish, Sebastes sp.), decapods, and carrion as major prey of juvenile and adult black-footed albatrosses in the oceanic and more neritic offshore waters of the northeastern Pacific.

Laysan Albatross

Ainley and Sanger (1979) list only cephalopods as prey of Laysan albatrosses in the North Pacific.

Northern Fulmar

One northern fulmar collected "off the coast of Oregon" in the early 1900's contained bits of beaks and eye lenses of squid (Gabrielson and Jewett 1940). Hunt et al. (1981) described the diets of 10 northern fulmars collected in the Bering Sea. Cephalopods and fish (especially walleye pollock, Theragra chalcogramma) were important prey. But because fulmars are highly attracted to ships, it is not possible to determine the extent to which fish were captured naturally versus scavenged from fishing and processing vessels.

Sooty Shearwater

No data are available on the feeding habits of sooty shearwaters in the proposed Gorda Ridge Lease Area. Low densities seaward of the shelf indicate that little feeding activity occurs there. Extensive data on feeding habits in inshore waters (Monterey Bay, California, Chu 1984, Kodiak Island, Krasnow and Sanger, in press) indicate that sooty shearwaters prey on abundant varieties of schooling fish (anchovies, Engraulis mordax, juvenile rockfishes, Sebastes spp., capelin, Mallotus villosus, and sand lance, Ammodytes hexapterus), euphausiids (Euphausia and Thysanoessa spp.), and squids (Loligo opalescens, Onchoteuthis and Gonatus spp).

Fork-tailed Storm-Petrel

Few accounts have been published of the feeding habits of fork-tailed storm-petrels. Prey were described by Ainley and Sanger (1979) as euphausiids, "fish", and carrion.

Leach's Storm-Petrel

The pattern of visitation of nests at the Farallons (including neglect of eggs and chicks for up to several days at a time), together with the distribution of sightings of birds at sea early in the nesting season, imply that adults range up to 300 miles from the colonies (Briggs et al. 1985).

Most foraging appears to take place over the outer slope, up to 200 mi from the colony.

Storm-petrels feed by seizing items from the surface or "dipping" the bill just below the surface. It is generally thought that storm-petrels do not dive for food. Small, slow moving prey such as planktonic mollusks and crustaceans, larval fish and squid, and dead organisms, fish oil and offal are the major components of their diet off California (Briggs et al. 1985).

Red and Red-necked Phalaropes

At sea, phalaropes feed by dabbling small organisms from the surface of the water. Briggs et al. (1984) reported that phalaropes concentrated just seaward of the shelf break (i.e., the mid-slope region) off central California in autumn. Most feeding activity was associated with slicks, color boundaries, and other indications of convergence downstream from active centers of upwelling. Fish eggs, Calanus spp., cypriid larvae, brachyuran larvae, and euphausiids were the most important prey.

Pomarine, Parasitic, and Long-tailed Jaegers, and South Polar Skua

Jaegers and skuas consume fish and crustaceans, but are best known for their habit of pirating food from other birds (Maher 1984). It is not known to what extent these species catch food on their own while at sea. Most observations have been made at breeding colonies or other locations along the coast.

Gulls

No information is available on the feeding habits of gulls in offshore waters of the northeast Pacific. Along the coast, gulls eat a combination of natural prey (particularly intertidal invertebrates, squids, and some nearshore schooling fish) fish slurry from processing plants, and garbage (Ainley and Sanger 1979, Morejohn et al. 1978, and Drury 1984).

Black-legged Kittiwake

Although kittiwakes are the most pelagic of the gulls in the northeast Pacific, nothing is known of their feeding habits in oceanic waters. Baltz and Morejohn (1977) found that the foods of kittiwakes collected in Monterey Bay between December and April were predominately market squid, Loligo opalescens, and northern anchovy, Engraulis mordax.

Sabine's Gull

No information is available on feeding habits of Sabine's gulls in the eastern North Pacific.

SEABIRDS

Arctic Tern

No information is available on feeding habits of arctic terns in offshore waters of the eastern North Pacific.

Common Murre

Published studies of the feeding habits of common murres have been summarized by Briggs et al. (1985). Data are available for a variety of inshore areas along the west coast of North America but no collections have been made seaward of the continental shelf. The low density of murres offshore (Briggs et al. 1983) indicates that this habitat may not be important for feeding, however. Common murres are generally piscivorous. The species eaten vary by locality. There is a tendency to switch to invertebrate prey during winter (Krasnow and Sanger, in press).

Common murres are pursuit divers (Ashmole 1971), diving from the surface and pursuing prey underwater. Perhaps because of their abundance and the amount of time which they spend sitting on the water, common murres frequently comprise more than 90% of all birds killed in oil spills (Manuwal 1984).

Cassin's Auklet

Cassin's auklets eat primarily planktonic crustaceans and larval fish (Briggs et al. 1985). Studies of their feeding habits in the eastern North Pacific have been conducted during summer when, according to Briggs et al. (1983), Cassin's auklets feed over the shelf, in thermal fronts bordering upwelled waters. No studies have been conducted during winter when their center of distribution shifts seaward of the shelf break, ie. into an oceanic habitat comparable to that in the proposed lease area.

Rhinoceros Auklet

As for Cassin's auklets, most studies of the feeding habits of rhinoceros auklets have been conducted during summer, when birds are scarce seaward of the shelf (e.g., Vermeer and Westrheim 1984). Little is known of their feeding habits during winter or in habitats resembling the proposed Gorda Ridge Lease Area. Baltz and Morejohn (1977) found that 26 rhinoceros auklets wintering on Monterey Bay had eaten inshore foods, predominantly market squid.

SEABIRDS

Tufted Puffin

Ainley et al. (1985) have summarized the foods brought to tufted puffin chicks at the Farallon Islands over ten summers, 1973-1982. Tufted puffins, foraging predominately over slope waters, caught anchovies, rockfish, and squid. Other studies of feeding habits have been conducted with birds feeding in inshore waters (Cody 1973, Sealy 1973, Vermeer 1979, Hunt et al. 1981, and Krasnow and Sanger, in press).

Horned Puffin

No information is available on the feeding habits of horned puffins in offshore waters of the eastern North Pacific.

GROWTH

Observations Within the Proposed Gorda Ridge Lease Area

No studies on the growth of seabirds have been conducted in the proposed Gorda Ridge Lease Area.

Other Relevant Studies

The young of most seabirds attain adult body weight by the time they fledge. The common murre, which occupies large colonies inshore from the proposed lease area, does not. Murre chicks leave the nest 19-24 days after hatching (Manuwal 1984). At the time of fledging, the weight of the chick is about 16% that of an adult. Unable to forage, each chick is accompanied to sea by an adult, usually a male (D. Varoujean, pers. comm.). Briggs et al. (1983) noted postfledging dispersal of parent-chick pairs by late July each year off central and northern California. Movement was predominantly southward from the colonies, over waters of the continental shelf.

BEHAVIOR

Observations Within the Proposed Gorda Ridge Lease Area

There are no published accounts of the behavior of seabirds in the proposed Gorda Ridge Lease Area.

Other Relevant Studies

Information on the behavior of seabirds, where relevant, is included under other headings in this report.

DATA GAPS

Seabird Densities and Movements at Sea

The area studied by Briggs et al. (1983) overlaps only a small portion of the proposed lease area (Fig. 1) inshore of the Gorda Ridge proper. No systematic time series of observations of the distribution and abundance of seabirds have been conducted in over three quarters of the lease area.

Feeding Habits

There are no published accounts of the feeding habits of seabirds in the proposed lease area.

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APPENDIX 1

Species of seabirds known or thought to occur in the Gorda Ridge Lease Area (Briggs et al. 1983).

Species	Common Name
Diomedea nigripes **	black-footed albatross
D. immutabilis **	Laysan albatross
D. albatrus (endangered) ?	short-tailed albatross
Fulmarus glacialis **	northern fulmar
Puffinus griseus **	sooty shearwater
Oceanodroma furcata **	fork-tailed storm-petrel
O. leucorhoa **	Leach's storm-petrel
Branta canadensis *	Canade goose
B. bernicla *	brant
Anas crecca *	green-winged teal
A. acuta *	pintail
Phalaropus fulicaria **	red phalarope
P. lobatus **	red-necked phalarope
Stercoratius pomarinus **	pomarine jaeger
S. parasiticus *	parasitic jaeger
S. longicaudus **	long-tailed jaeger
Catharacta skua **	south polar skua
Larus californicus **	California gull
L. argentatus **	herring gull
L. occidentalis **	western gull
L. glaucouscens **	glaucous-winged gull
Rissa tridactyla **	black-legged kittiwake
Xema sabini **	Sabine's gull
Sterna paradisaea **	arctic tern
Uria aalge **	common nurre
Ptychoramphus aleuticus **	Cassin's auklet
Cerorhinca monocerata **	rhinoceros auklet
Fratercula cirrhata **	tufted puffin
F. corniculata	horned puffin

* *Known to occur in the Gorda Ridge lease area.
* Thought to occur in the Gorda Ridge lease area.
? Status unknown.